Great Salt Lake Minerals Corporation
Ogden, Utah

LEVEL II ANTI-DEGRADATION REVIEW
UPDES PERMIT MODIFICATION – ADDITION OF STEAM GENERATING PLANT

SEPTEMBER 2012

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Introduction

Great Salt Lake Minerals Corporation (GSLM) has been operating on the shores of the Great Salt Lake near Ogden, Utah since about 1970. The primary product produced by GSLM is potassium sulfate (K_2SO_4), a fertilizer commonly known as sulfate of potash. Sulfate of potash (SOP) is the most effective fertilizer for supplying vital potassium and sulfur nutrition for high crop yields and constant quality in agriculture products. Unlike other potassium sources, SOP contains virtually no chloride which can cause crop damage. GSLM also produces 2 types of salt products – sodium chloride (NaCl) and magnesium chloride ($MgCl_2$).

GSLM uses the sun as its primary energy source to naturally produce SOP. The SOP is produced by drawing brine from Gunnison Bay of the Great Salt Lake. The brine is diverted into solar evaporation ponds which are used to precipitate potassium salts. The sun provides the majority of the energy used to evaporate the water and produce SOP. However, additional heat in the form of steam is required to convert the potassium salts into the final SOP product. PacifiCorp, through its Little Mountain Power Plant, provides GSLM with the required steam to produce the final SOP product (in addition to supplying steam to GSLM's Magnesium Chloride Production Facility).

PacifiCorp has informed GSLM that it shall abandon the Little Mountain Power Plant rather than replace its aging equipment, and therefore shall no longer supply steam to GSLM. Thus, GSLM needs to construct and operate its own steam generation plant to continue its operations and the production of SOP (and magnesium chloride). The proposed steam generation plant replaces 40-year-old, less efficient equipment that was owned and operated by PacifiCorp.

GSLM is purchasing two (2) boilers each having a heat input capacity of 110 mmBtu/hr and an output capacity of 90,000 lb/hr steam. Both boilers will be fired with clean-burning natural gas. A discharge permit application has been submitted to the State of Utah Division of Water Quality (UDWQ). The permit application is for the wastewater generated from water pretreatment and the boiler operations.

In any boiler operation, pretreatment of the water supply source prior to input into the boiler is critical; this prevents adverse mechanical/thermal & maintenance issues to the boiler. Such is the case with the GSLM boilers and the water supply source. The water shall be supplied from the Weber Basin Water Conservancy District. This culinary-quality supply water shall undergo a 3-stage pretreatment prior to input into the boilers. The 3 stages shall be: water softening, carbon filtration, and reverse osmosis (RO). These 3 stages shall collectively provide demineralization, solids removal, and purification of the water. After input of the pretreated source water into the boiler, the boiler recycle/condensate stream shall be treated with conventional boiler treatment materials for scale control and corrosion inhibition.

A portion of the proposed water discharge will come from backwashing the water softener and the carbon filters. Also the RO system is anticipated to have about a 10% reject rate and this flow will be combined with the backwash water. This water will normally be consumed in the SOP production process when the SOP plant is operating.

Following pretreatment, the water will then be used in the boilers to generate the steam. A portion of the boiler water will be continually bled off to control the concentration of salts that will build up in the boiler system. This water is referred to as blowdown water. In addition to the trace elements from the source water, the blowdown water is expected to contain trace amounts of the ingredients from the scaling controls and corrosion inhibitors. These ingredients include: sodium bisulfite corrosion inhibitor, sodium hydroxide buffering agent, and a polymeric dispersant with molybdate tracer – all of which are aqueous solutions and water soluble.

The peak discharge flow from water supply pretreatment and boiler operations is estimated to be 90,000 gals/day (0.09 MGD); the average discharge flow is estimated to be 53,000 gals/day (0.05 MGD). This discharge shall be to the facility's existing drainage ditch leading to Outfall 001. The facility's existing average effluent flow to Outfall 001 is 3.8 MGD (from CY2011 UPDES data). Thus, the daily flow contribution from the water supply pre-treatment and boiler operations shall be approximately 2% of the facility's existing effluent flow. Outfall 001 is located within the Bear River Bay of the Great Salt Lake.

GSLM will own and operate the new steam generation plant. The new steam generation plant is essential to the company's continued operations as the GSLM facility ...

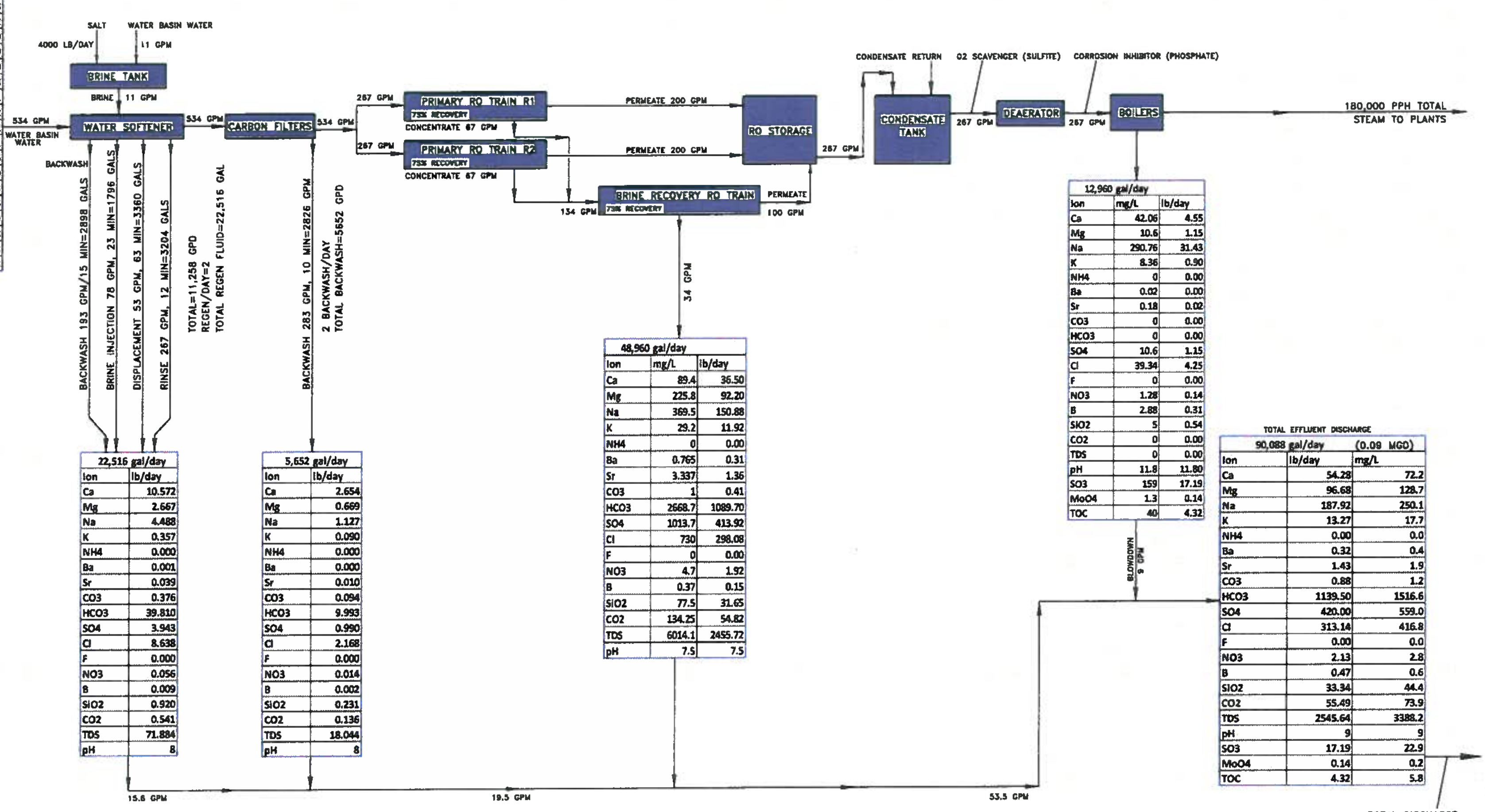
- keeps hundreds of Utah citizens employed,
- generates millions of dollars for Utah's economy,
- generates ~$7 million/year in royalty payments to Utah,
- exports ~$40 million in SOP, thereby helping with the country's trade deficit,
- provides a beneficial fertilizer and soil nutrient for USA farmers,
- provides a useful product for controlling dust from unpaved roads and construction sites, and
- provides a valuable product for maintaining winter roadway safety.

This Level II Anti-Degradation Review evaluates the social and economic impact that alternatives to a discharge from the steam generation plant would have upon the Great Salt Lake and surrounding community.

The flow sheet shown in Figure 1 shows the water quality entering the steam generation plant and boiler system along with the different treatment processes. This is the maximum flow and all the reject water is assumed to be discharged.

The flow sheet shown in Figure 2 is the average flow for the steam generation plant and boiler system. None of the water is assumed to be put back into the process in this flow sheet. This would be the average under the assumption of discharging all the treatment water. However, this is not the intended operation because most of the time, the water from the softeners, carbon filters, and brine recovery RO train will be used as process water.

COMPASS MINERALS
OGDEN, UTAH
BOILER-RO SYSTEM SCHEMATIC
PEAK WASTEWATER FLOW



Ion	mg/L
Ca	56.3
Mg	14.2
Na	23.9
K	1.9
NH4	0
Ba	0.0048
Sr	0.21
CO3	2
HCO3	212
SO4	21
Cl	46
F	0
NO3	0.3
Ba	0.05
SiO2	4.9
CO2	2.88
TDS	382.8
pH	8

22,516 gal/day	
Ion	lb/day
Ca	10.572
Mg	2.667
Na	4.488
K	0.357
NH4	0.000
Ba	0.001
Sr	0.039
CO3	0.376
HCO3	39.810
SO4	3.943
Cl	8.638
F	0.000
NO3	0.056
B	0.009
SiO2	0.920
CO2	0.541
TDS	71.884
pH	8

5,652 gal/day	
Ion	lb/day
Ca	2.654
Mg	0.669
Na	1.127
K	0.090
NH4	0.000
Ba	0.000
Sr	0.010
CO3	0.094
HCO3	9.993
SO4	0.990
Cl	2.168
F	0.000
NO3	0.014
B	0.002
SiO2	0.231
CO2	0.136
TDS	18.044
pH	8

48,960 gal/day		
Ion	mg/L	lb/day
Ca	89.4	36.50
Mg	225.8	92.20
Na	369.5	150.88
K	29.2	11.92
NH4	0	0.00
Ba	0.765	0.31
Sr	3.337	1.36
CO3	1	0.41
HCO3	2668.7	1089.70
SO4	1013.7	413.92
Cl	730	298.08
F	0	0.00
NO3	4.7	1.92
B	0.37	0.15
SiO2	77.5	31.65
CO2	134.25	54.82
TDS	6014.1	2455.72
pH	7.5	7.5

12,960 gal/day		
Ion	mg/L	lb/day
Ca	42.06	4.55
Mg	10.6	1.15
Na	290.76	31.43
K	8.36	0.90
NH4	0	0.00
Ba	0.02	0.00
Sr	0.18	0.02
CO3	0	0.00
HCO3	0	0.00
SO4	10.6	1.15
Cl	39.34	4.25
F	0	0.00
NO3	1.28	0.14
B	2.88	0.31
SiO2	5	0.54
CO2	0	0.00
TDS	0	0.00
pH	11.8	11.80
SO3	159	17.19
MoO4	1.3	0.14
TOC	40	4.32

TOTAL EFFLUENT DISCHARGE

90,088 gal/day		(0.09 MGD)
Ion	lb/day	mg/L
Ca	54.28	72.2
Mg	96.68	128.7
Na	187.92	250.1
K	13.27	17.7
NH4	0.00	0.0
Ba	0.32	0.4
Sr	1.43	1.9
CO3	0.88	1.2
HCO3	1139.50	1516.6
SO4	420.00	559.0
Cl	313.14	416.8
F	0.00	0.0
NO3	2.13	2.8
B	0.47	0.6
SiO2	33.34	44.4
CO2	55.49	73.9
TDS	2545.64	3388.2
pH	9	9
SO3	17.19	22.9
MoO4	0.14	0.2
TOC	4.32	5.8

ORIGINAL				
NO	DATE	DESIGN	DRAWN	CHECKED
B	04/10/12	B2	J3W	SR
REVISIONS				

Compass Minerals, Ogden, Utah

Boiler-RO System Schematic
PEAK WASTEWATER FLOW

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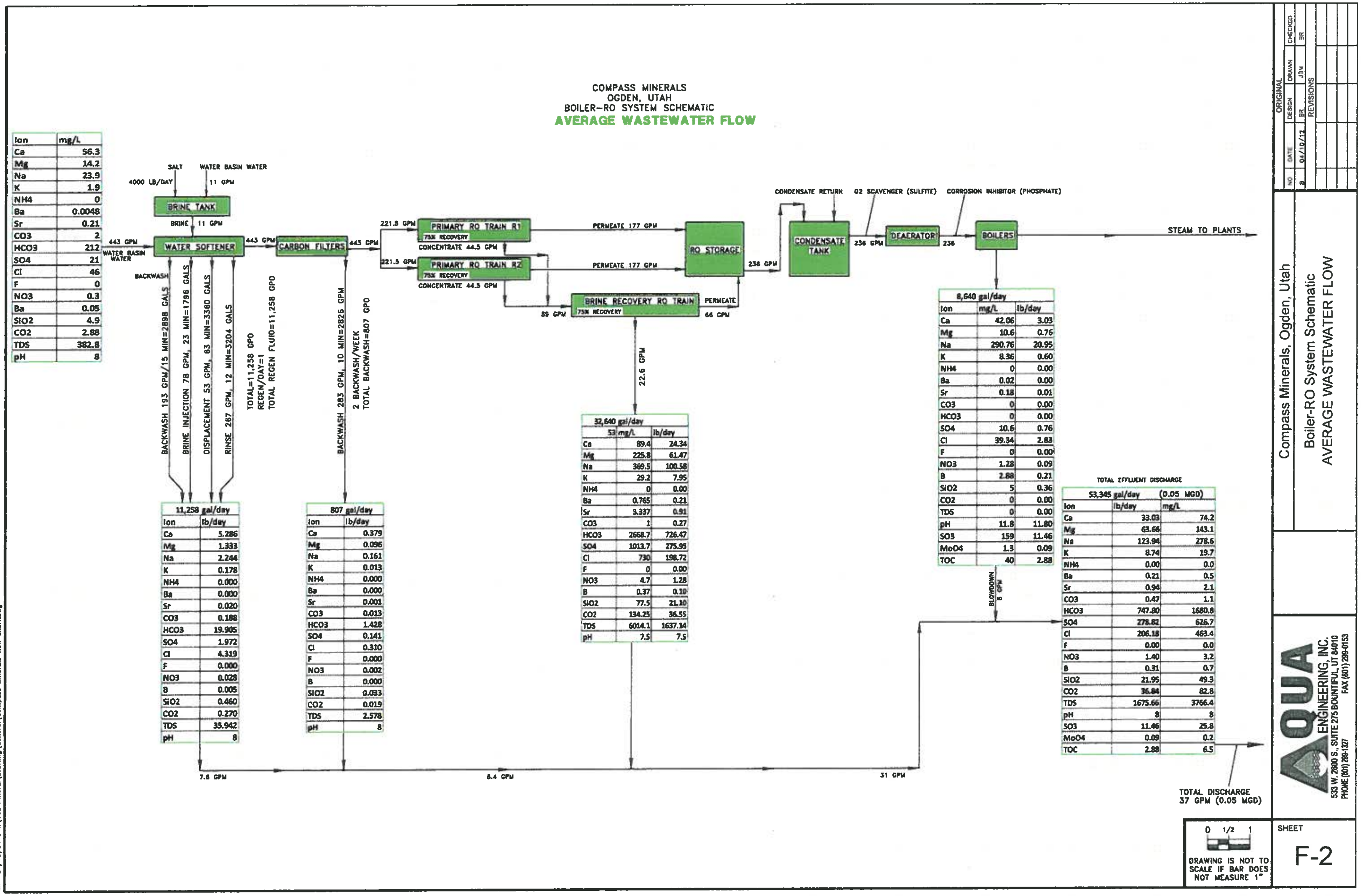
0 1/2 1
DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"

SHEET F-1



Ion	mg/L
Ca	56.3
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NH4	0
Ba	0.0048
Sr	0.21
CO3	2
HCO3	212
SO4	21
Cl	46
F	0
NO3	0.3
Ba	0.05
SiO2	4.9
CO2	2.88
TDS	382.8
pH	8

11,258 gal/day	
Ion	lb/day
Ca	5.286
Mg	1.333
Na	2.244
K	0.178
NH4	0.000
Ba	0.000
Sr	0.020
CO3	0.188
HCO3	19.905
SO4	1.972
Cl	4.319
F	0.000
NO3	0.028
B	0.005
SiO2	0.460
CO2	0.270
TDS	35.942
pH	8

807 gal/day	
Ion	lb/day
Ca	0.379
Mg	0.096
Na	0.161
K	0.013
NH4	0.000
Ba	0.000
Sr	0.001
CO3	0.013
HCO3	1.428
SO4	0.141
Cl	0.310
F	0.000
NO3	0.002
B	0.000
SiO2	0.033
CO2	0.019
TDS	2.578
pH	8

32,640 gal/day		
	53 mg/L	lb/day
Ca	89.4	24.34
Mg	225.8	61.47
Na	369.5	100.58
K	29.2	7.95
NH4	0	0.00
Ba	0.765	0.21
Sr	3.337	0.91
CO3	1	0.27
HCO3	2668.7	726.47
SO4	1013.7	275.95
Cl	730	198.72
F	0	0.00
NO3	4.7	1.28
B	0.37	0.10
SiO2	77.5	21.10
CO2	134.25	36.55
TDS	6014.1	1637.14
pH	7.5	7.5

8,640 gal/day		
Ion	mg/L	lb/day
Ca	42.06	3.03
Mg	10.6	0.76
Na	290.76	20.95
K	8.36	0.60
NH4	0	0.00
Ba	0.02	0.00
Sr	0.18	0.01
CO3	0	0.00
HCO3	0	0.00
SO4	10.6	0.76
Cl	39.34	2.83
F	0	0.00
NO3	1.28	0.09
B	2.88	0.21
SiO2	5	0.36
CO2	0	0.00
TDS	0	0.00
pH	11.8	11.80
SO3	159	11.46
MoO4	1.3	0.09
TOC	40	2.88

TOTAL EFFLUENT DISCHARGE

53,345 gal/day		(0.05 MGD)
Ion	lb/day	mg/L
Ca	33.03	74.2
Mg	63.66	143.1
Na	123.94	278.6
K	8.74	19.7
NH4	0.00	0.0
Ba	0.21	0.5
Sr	0.94	2.1
CO3	0.47	1.1
HCO3	747.80	1680.8
SO4	278.82	626.7
Cl	206.18	463.4
F	0.00	0.0
NO3	1.40	3.2
B	0.31	0.7
SiO2	21.95	49.3
CO2	36.84	82.8
TDS	1675.66	3766.4
pH	8	8
SO3	11.46	25.8
MoO4	0.09	0.2
TOC	2.88	6.5

Great Salt Lake Water Quality Use Designations

The State of Utah has five water classes assigned to water bodies within the state. The five different classifications are as follows:

Class 1 – Protected for use as a raw water source for domestic water systems.
Class 2 – Protected for recreational use and aesthetics.
Class 3 – Protected for use by aquatic wildlife.
Class 4 – Protected for agricultural uses including irrigation of crops and stock watering.
Class 5 – The Great Salt Lake

The Great Salt Lake is unique and has its own separate classification. The only numerical standard assigned to water quality in the Great Salt Lake is for selenium. This standard is only applicable in the Gilbert Bay area of the Lake and GSLM's discharge is not located in Gilbert Bay, but in Bear River Bay. Bear River Bay is classified as Class 5C water. The beneficial use of Class 5C water is:

- *Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.*

There are no numeric standards associated with water quality requirements in the Bear River Bay. However, the water must still be protective for the intended use. There is also a narrative standard that is intended to protect the water body from pollution. The narrative standard is as follows:

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

The effluent from the steam generation plant and boiler system will not interfere with or adversely impact the existing uses of the Great Salt Lake as defined above.

Effluent Limitations

The dissolved solids in the potable water supply will be concentrated in the boiler process prior to discharge. Also, it has been estimated that corrosion and scaling inhibitors will add 22.9 ppm of SO_3 and 0.2 ppm for MoO_4 to the 0.09 MGD maximum flow rate of the boiler water discharge. The boiler water discharge will be combined and with the existing 3.8 MGD average water discharge through GSLM's Outfall 001. This combination and mixing will reduce these concentrations to 0.54 ppm SO_3 and 0.005 ppm MoO_4 prior to discharging into the Great Salt Lake.

Because there are no numerical standards on the Bear River Bay in the Great Salt Lake, a possible consideration for regulating the discharge from the steam generation plant would be to look at the Categorical Pretreatment standards. The closest applicable effluent guideline or New Source Performance Standard (NSPS) that would be similar to the boiler operation/steam generating activity is codified in 40 CFR Part 423 – Steam Electric Power Generating Point Source Category. This category is applicable to discharges from facilities engaged in the generation of electricity for distribution and sale through a process that combusts a fossil fuel in conjunction with a thermal cycle using a water/steam system as the thermodynamic medium. GSLM would simply combust natural gas in a boiler for purposes of generating steam; nothing beyond this.

New sources subject to 40 CFR 423 would have to comply with the performance standards and effluent limits codified in Part 423.15; those regulated parameters or pollutants are pH, oil & grease, TSS, and total residual chlorine. In addition several pollutants are added to the list based on best professional judgment from DWQ. The parameters and limits are shown in Table 1 below.

Table 1

Parameter	Effluent Limitations			
	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum
Oil & Grease, mg/l	NA	NA	NA	10.0
pH Standard Units	NA	NA	6.5	9.0
Total Suspended Solids mg/L	25.0	NA	NA	100.0
Total Residual Chlorine mg/L	0.2	NA	NA	0.5
Total Dissolved Oxygen mg/L	NA	NA	4.5	NA
Chromium, Total mg/L	0.2	NA	NA	0.2
Zinc, Total mg/L	1.0	NA	NA	1.0

Pollutants of Concern

The Level I ADR looked at potential pollutants that could cause an effect on the Great Salt Lake. Because there are no numerical water quality standards background levels were used for comparison. The majority of the metals that are in the source water will not be concentrated up enough to exceed the existing background levels in the lake. However, there are some metals that will be concentrated higher than background and there are chemicals that will be added as part of the water treatment process. In addition, the blowdown water from the boilers will be warmer than ambient temperature when it enters the ditch going to Outfall 001. The chemicals that will be added have the potential to change the following parameters.

pH – a caustic will be used to adjust the pH in the water treatment process. However, the discharge will remain in the range defined in Table 1.

Dissolved Oxygen (DO) – an oxygen scavenger will be added to the water treatment process to protect the boilers. This has the potential to reduce the DO in the effluent from the water treatment system.

Chemical Oxygen Demand (COD) – The oxygen scavenger will increase chemical oxygen demand. This is why the DO is going to be lowered. Both COD and DO will both be treated with the re-aeration process.

Temperature – The wastewater from boiler blowdown will be hotter than ambient temperature. The hot blowdown wastewater (about 6 gpm) is combined with the unheated wastewater (about 31 gpm). This combined flow will then traverse the 2-mile long ditch which feeds Outfall 001. The temperature should be ambient at the point the water enters Bear River Bay.

Molybdate / molybdenum – part of the water treatment chemistry will include adding molybdate which is used as a tracer to determine when the boiler will need to be blown down. Molybdenum is not in the water quality sampling data in the Bear River Bay. However, because it is being added in the system it is included as part of this Level II ADR.

Metals – several metals are going to be increased above the existing background levels as determined in the Level I review. They are:

- Barium
- Calcium
- Copper
- Iron
- Lead
- Selenium
- Zinc

All the metals listed above are in the source water that is being treated for the boiler water. The boiler feed-water purification process concentrates the metal salts that are already in the source water. The reason they are listed is because their concentration exceeds the background level in the lake. However, all the source water is from the basin and not imported from another basin. Therefore, the mass loading from this process is the same as if it naturally entered the lake.

A Level II ADR is required for each pollutant of concern. However, with the above mentioned pollutants each of the different alternatives are essentially the same so all the potential pollutants are being evaluated in this report.

Baseline Treatment Alternative

This treatment alternative will meet the permit limits and protect water quality standards. The proposed discharge will flow into the existing drainage ditch that eventually reaches Outfall 001. The cost associated with the transmission of the steam plant discharge to the existing drainage ditch and then to Outfall 001 line is shown in Table 2 below. In addition to the outfall line, a re-aeration structure will be required prior to discharge. This structure will add additional oxygen to the effluent to bring the dissolved oxygen to an acceptable level. Furthermore, the re-aeration of the wastewater will satisfy any remaining chemical oxygen demand caused from adding the oxygen scavenger to the process water.

Table 2

Item	Quantity	Units	Unit Cost	Total
8-inch PVC Gravity Pipe	650	Ft	$ 30.00	$ 19,500.00
Railroad Jack and Boar	120	Ft	$ 130.00	$ 15,600.00
Aeration System	1	ea	$ 27,000.00	$ 27,000.00
Subtotal				$ 62,100.00
25% Contingency				$ 15,525.00
Engineering				$ 7,452.00
Construction Management				$ 7,452.00
Total				**$ 92,529.00**

The cost associated with the proposed discharge is approximately $100,000. This proposal and selected alternative will be the basis of comparison for all the potential less-degrading alternatives. Using this alternative will protect the beneficial use for the Bear River Bay and meet all water quality standards for the Great Salt Lake. In addition this will meet the anticipated permit limits.

Reasonable Less-degrading Alternatives

The anti-degradation criteria require a review of alternatives to allow the discharge into waters of the State. The following are suggested alternatives to be evaluated based on the anti-degradation criteria.

- Innovative or alternative treatment options
- More effective treatment options or higher treatment levels
- Connection to other wastewater treatment facilities
- Process changes or product or raw material substitution
- Seasonal or controlled discharge options to minimize discharging during critical water quality periods
- Pollutant trading
- Water conservation
- Water recycle and reuse
- Alternative discharge locations or alternative receiving waters
- Land application
- Total containment
- Improved operation and maintenance of existing treatment systems
- Other appropriate alternatives

Innovative or Alternative Treatment Options

There are no innovative or alternative treatment options for this waste stream.

More Effective Treatment Options or Higher Treatment Levels

A zero liquid discharge (ZLD) system was considered for treating the boiler blowdown portion of the wastewater. (Please see section titled "Other Appropriate Alternatives" for more discussion of this option.) However, the wastewater generated from the water purification process would still need to be discharged into the Bear River Bay, making this option ineffective.

Connection to Other Wastewater Treatment Facilities

This option includes connecting the new source discharge to existing wastewater treatment facilities that may have different discharge limits and that will facilitate the discharge of the new source. The closest publicly-owned treatment works (POTW) is the Central Weber POTW. Figure 3 below is a Google Earth image of the area. Assuming one follows existing right-of-ways, a line connection of about 15.6 miles (82,400 feet) long would be needed to get to the POTW. This system would also require a pump station because the POTW cannot be reached with a gravity pipe.

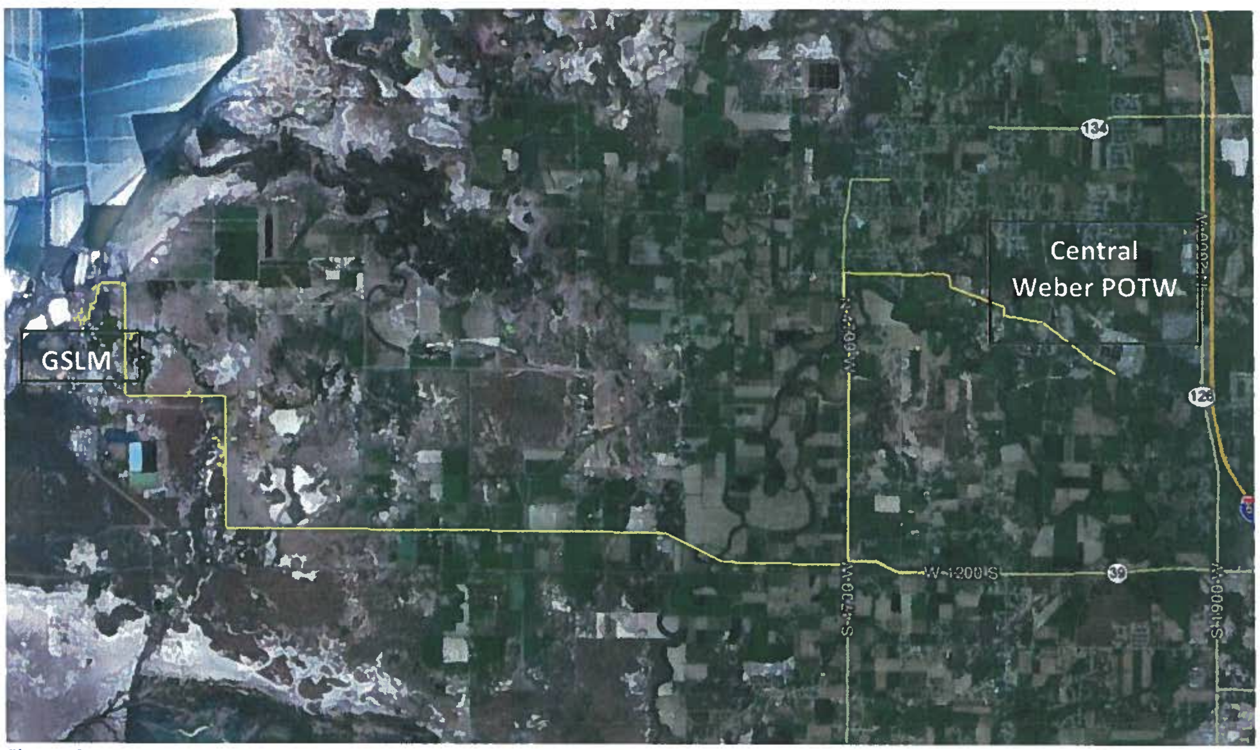

Figure 3

The cost estimate for installing a pipeline to the POTW is shown in Table 3 below. As summarized, the cost for installing such a line would be approximately $2.64 million.

Table 3

Item	Quantity	Units	Unit Cost	Total
4-inch HDPE Pipe	82400	Ft	$ 20.00	$ 1,648,000.00
Pump Station	1	Lump	$ 80,000.00	$ 80,000.00
Subtotal				$ 1,728,000.00
25% Contingency				$ 432,000.00
Environmental Assessment				$ 200,000.00
Engineering				$ 138,240.00
Construction Management				$ 138,240.00
Total				**$ 2,636,480.00**

The difficulty with sending this water to the treatment facility is that this wastewater doesn't contain any pollutants for which the POTW is designed to treat. If this water were to be sent to the POTW, it would receive little if any treatment, with the majority of the salts just passing through the POTW. The Central Weber POTW discharges into a canal that flows into the Great Salt Lake. By pumping the waste water to the POTW it would cost about $2.64 million with no net difference to the Great Salt Lake. Therefore, this alternative is not effective.

Process Changes or Product or Raw Material Substitution

The process change or product or raw material substitution alternative includes altering the process or changing the product or raw material used in the steam generation plant. Portions of this alternative have been determined to be feasible and other portions are not practicable. The reasons are as follows:

1. The boilers at the Little Mountain Power Plant are 40+ years-old while the new GSLM boilers will be manufactured and equipped with the contemporary technological advancements and controls. As a result, it is expected that the air emissions will be reduced significantly. The water discharges will also be significantly reduced in terms of total discharge flow. However, because the total discharge is reduced the concentration of the background salts will be increased. Therefore, the improved boilers will be used. This portion of the alternative is an option and has been implemented into the design of the facility.
2. The needed product of the boiler process is steam. There is no other product that will make this feasible.
3. The raw material for this process is water. The only available water for this area is provided by Weber Basin Water Conservancy District. No other water source is available. Thus, this portion of the alternative is not an option.
4. One of the key constituents in the boiler treatment materials for corrosion/scale control contains a molybdate tracer. There is no beneficial use associated with the Great Salt Lake that molybdenum/molybdate is known to inhibit.

The potential to change process or raw product is fairly limited and any of the above-mentioned changes will not significantly change water quality.

Seasonal or Controlled Discharge Options to Minimize Discharging During Critical Water Quality Periods

The alternative for seasonal or controlled discharge options to minimize discharging during critical water quality periods involves discharging during certain seasons or during certain periods depending on the water quality. The discharging restrictions will be due to the water quality of the discharging stream. This alternative was determined to be ineffective due to the following factor: the receiving water of the discharge is the Great Salt Lake. There are no seasonal limits; therefore, discharging seasonally would provide no environmental benefit.

Pollutant Trading

The pollutant trading alternative would require a regulated pollutant that could be identified. Because the Great Salt Lake has no numerical criteria in this region, there is no trading program in place. Therefore, pollutant trading is not an option.

Water Conservation

The new boilers and water pretreatment system are much more efficient than what are currently being used by PacifiCorp. Given the efficiency of the new steam generation plant with respect to water use, the mass loading of dissolved solids is the same with less water for dilution; hence the concentration of the dissolved solids is higher. The new boilers will conserve water compared to the boilers that were being used, and are the best available at this time.

Water Recycle and Reuse

The current plan is to recycle the water when possible. The water from the water softener, carbon filters and the reject water from the RO system will be consumed in the SOP production process when possible. However, this water can only be used for limited purposes and if the SOP process is not operating, then the water cannot be recycled. The boiler blowdown water cannot be used in the SOP process.

Alternative Discharge Locations or Alternative Receiving Waters

The discharge location or alternative receiving waters option includes changing the discharge location to a different or alternative receiving water. The peak discharge flow from water supply pretreatment and boiler operations is estimated to be 90,000 gals/day (0.09 MGD); the average discharge flow is estimated to be 53,000 gals/day (0.05 MGD). This discharge shall be to the facility's existing drainage ditch leading to Outfall 001. The facility shall have the capability to sample and monitor the discharge from water supply pretreatment and boiler operations prior to the confluence with the outfall drainage ditch. The facility's existing average effluent flow to Outfall 001 is 3.8 MGD (from CY2011 UPDES data).

Thus, the daily flow contribution from the water supply pretreatment and boiler operations shall be approximately 2% of the facility's existing effluent flow. Furthermore, the Great Salt Lake is a terminal surface water body so it would not matter what other receiving water was selected to discharge into – it would eventually flow into the Great Salt Lake. This alternative would not make a difference in the water quality.

Land Application

Applying the wastewater stream on land for irrigation purposes is the primary disposal method for land application. The TDS level in the wastewater is estimated to be about 3800 mg/l. This is higher than most vegetation can tolerate. Therefore, land application is not a reasonable alternative for wastewater disposal. In addition, land application would require winter storage because the vegetation in the region does not grow year-round.

Total Containment

Creating a total evaporation pond is a potential option. The pond would need to be sized to evaporate the design flow. A mass balance is shown in Table 4 below. The rainfall and evaporation data were obtained from the State Engineers consumptive use publication for the CORINNE station. Based on the mass balance the minimum required pond size would be approximately 33 acres.

Table 4

Storage area required	1,437,486	sq. ft		Square Pond Size	1,199	ft	Storage area	33.0	acres
Starting Depth	0								
Month	**Influent (gal/day)**	**Days / Month**	**Influent (gal/month)**	**Average Monthly Rainfall (in/month)**	**Average Monthly Evaporation (in/month)**	**Net Precipitation Monthly (in/month)**	**Net Precipitation Monthly (gal/month)**	**Net Change in Pond Depth**	**Total Depth of Pond**
Jan	54,000	31	1,674,000	1.42	0.7	0.72	645,144	0.22	0.2
Feb	54,000	28	1,512,000	1.56	1.1	0.46	412,175	0.18	0.4
Mar	54,000	31	1,674,000	1.54	1.88	-0.34	-304,651	0.13	0.5
Apr	54,000	30	1,620,000	1.79	3.36	-1.57	-1,406,771	0.02	0.5
May	54,000	31	1,674,000	1.91	5.07	-3.16	-2,831,463	-0.11	0.4
Jun	54,000	30	1,620,000	1.34	5.93	-4.59	-4,112,790	-0.23	0.2
Jul	54,000	31	1,674,000	0.77	6.65	-5.88	-5,268,672	-0.33	0.0
Aug	54,000	31	1,674,000	0.89	6.3	-5.41	-4,847,537	-0.30	0.0
Sep	54,000	30	1,620,000	1.63	4.55	-2.92	-2,616,415	-0.09	0.0
Oct	54,000	31	1,674,000	1.65	2.67	-1.02	-913,953	0.07	0.1
Nov	54,000	30	1,620,000	1.59	1.29	0.30	268,810	0.18	0.2
Dec	54,000	31	1,674,000	1.55	0.72	0.83	743,707	0.22	0.5

The cost to construct an evaporation pond is based on a dike that is 5-feet high, with a 10-foot top and 3:1 slopes on each side. This would allow the pond depth to reach 3-feet deep with 2-feet of freeboard. This depth would allow for annual variations in evaporation and rainfall. It is assumed that the site of a pond would need to be grubbed and the pond dikes could be constructed from the material removed from the bottom of the pond once the grubbing was done. It was assumed that a 60-ml HDPE liner would be placed over a small sand bed. Table 5 below is an estimate of the cost to construct an evaporation pond.

Table 5

Item	Quantity	Units	Unit Cost	Total
Site Preparation	53240	Cu Yd	$ 6.00	$ 319,440.00
Excavation For Dike Placement	26700	Cu Yd	$ 10.00	$ 267,000.00
Dike Placement	26700	Cu Yd	$ 10.00	$ 267,000.00
Sand Liner Bedding	1437500	Sq Ft	$ 0.25	$ 359,375.00
Pond Liner / Installation	1437500	Sq Ft	$ 1.00	$ 1,437,500.00
Subtotal				$ 2,650,315.00
25% Contingency				$ 662,578.75
Permitting Costs				$ 100,000.00
Engineering				$ 212,025.20
Construction Management				$ 212,025.20
Total				**$ 3,836,944.15**

It is also assumed that because of the size of the pond there will be substantial permitting costs as required by other State jurisdictional agencies. This alternative is not feasible because it will cost about 3.85 Million dollars and large pond that would be required.

Improved Operation and Maintenance of Existing Treatment Systems

There is not an existing treatment system so this option is unavailable for further examination.

Other Appropriate Alternatives

GE Power & Water has proposed a Mobile Demineralization Trailer to remove the minerals from the boiler blowdown water. This trailer's treatment system would have the ability to return water to be used as boiler make-up water. The trailers would be removed and regenerated off-site at a service center. This process would take the minerals from the source water and then recover them at some other location. Prior to actual use the boiler system would need to be installed and provide water for analysis. The annual cost for trailer rental and regeneration is shown in Table 6 below.

Table 6

Item	Quantity	Units	Unit Cost	Total
Trailer Rental	12	Trailers/Year	$ 7,000.00	$ 84,000.00
Trailer Exchange	12	Trailers/Year	$ 10,500.00	$ 126,000.00
Total				$ 210,000.00

This alternative will only treat the boiler blowdown water so the water from the softener, carbon filter, and the RO reject water would still need to be discharged into Bear River Bay when the SOP process is not operating. This alternative is not feasible because of the operating cost and the inability to treat all of the waste water streams.

Alternative Analysis Summary

There are many different alternatives that are required to be evaluated based on the requirements of a Level II anti-degradation review. Many of the required alternatives are not feasible because of the type of wastewater that is being produced from the RO system. None of the less degrading alternatives are feasible for this project compared to the base line alternative. The baseline alternative will protect the uses in the Bear River Bay area of the Great Salt Lake. A summary of the different alternatives is listed in Table 7.

Table 7

Treatment Alternative	Cost
Baseline Treatment Alternative	$ 100,000
Innovative or Alternative Treatment Options	NA*
More Effective Treatment Options or Higher Treatment Levels	NA*
Connection to Other Wastewater Treatment Facilities	$ 2,600,000
Process Changes or Product or Raw Material Substitution	NA*
Seasonal or Controlled Discharge Options to Minimize Discharging During Critical Water Quality Periods	NA*
Pollutant Trading	NA*
Water Conservation	NA*
Water Recycle and Reuse	NA*
Alternative Discharge Locations or Alternative Receiving Waters	NA*
Land Application	NA*
Total Containment	$ 3,850,000
Improved Operation and Maintenance of Existing Treatment Systems	NA*
Other Appropriate Alternatives **	$ 210,000

NA* This alternative was determined to be Not Applicable for the wastewater treatment requirements
**This alternative will only treat the 6 gpm from the boiler blowdown and will not treat the 31 gpm wastewater flow from boiler feed-water purification.

Economic and Social Importance

The anti-degradation criteria specify an evaluation of the economic and social importance of the project. The new steam generation plant is required for the GSLM facility to continue operating. As part of this review, the following factors will be addressed:

- Employment (i.e., increasing, maintaining, or avoiding a reduction in employment)
- Increased production
- Improved community tax base
- Housing
- Correction of an environmental or public health problem
- Other information that may be necessary to determine the social and economic importance of the proposed surface water discharge.

Employment

The direct economic and social benefit of GSLM's steam generation plant is new, local employment for 20 mechanics and laborers during installation, and four additional full-time employees at Great Salt Lake Minerals in maintenance and engineering for ongoing operations. The project represents a direct investment of $7 million, including $4.5 million with Utah companies for manufacturing, engineering and installation.

But of far greater importance, the project is essential for the continued operation of GSLM, which cannot produce SOP specialty fertilizer or magnesium chloride road treatment products without the steam and treated water that the project will provide. GSLM employs 350 people in Ogden, plus typically 80 full-time on-site contractors; these jobs would disappear if the steam generation plant project does not proceed. The jobs affected include drivers, heavy equipment operators, engineers, sales, mechanics, and administration. GSLM contributes $65 million per year to the Utah economy in payroll, local purchases and other spending, including $2 million each year in state and local taxes, and more than $7 million to the state each year in royalties. Like the jobs, these contributions to the local and state economy would disappear without this project.

Increased Production

The proposed project will not increase production at the existing facility. The new steam generation plant is replacing equipment that was owned and operated by PacifiCorp. Because PacifiCorp's facility is being decommissioned the steam is no longer available. This process is required to sustain the existing production of SOP at GSLM.

Improved Community Tax Base

This is an existing facility that is not expanding. GSLM is installing boilers that replace existing boilers that have been owned and operated by PacifiCorp. This will not improve the community tax base. However, without the boilers, GSLM will be unable to operate, which would substantially reduce the tax base. GLSM contributes $65 million per year to the Utah economy in payroll, local purchases and other spending. Each year GSLM pays $2 million in state and local taxes, and more than $7 million is collected by the state as royalties.

Housing

This project will allow all the existing employees to keep their existing jobs. Therefore, it is assumed that they can continue to provide housing for their families and themselves. Because this is not a new facility or an expansion of the existing facility it is not anticipated to significantly increase the demand for housing.

Correction of an Environmental or Public Health Problem

There are no current environmental or public health problems that this project is addressing.

Other information that may be necessary to determine the social and economic importance of the proposed surface water discharge

Beyond the direct contributions to the Utah economy, GSLM's continued operation benefits the entire country by increasing the supply of fruit, vegetables, nuts and other wholesome food crops. Here is how: GSLM is the only domestic source of SOP. GSLM's SOP is an organic specialty fertilizer that is an essential all-natural nutrient which increases yield-per-acre for America's growers of fruits, vegetables and other high-value food crops with perennial root systems. This is because, unlike commodity potassium fertilizers commonly used on seed crops like wheat or corn, SOP has virtually no chloride, which can damage roots and impede yield. The steam produced by the boilers is essential for converting the raw potassium salts harvested from GSLM's solar evaporation ponds into SOP fertilizer.

Also, the steam generated by the boilers is essential for the production and delivery of magnesium chloride, an all-natural brine product that GSLM provides to public works departments and highway departments throughout the western U.S. for roadway deicing in winter weather conditions. Magnesium chloride keeps drivers safe and the economy moving in the coldest winter weather when salt is not sufficient for deicing. It also is used for dust control on dirt roads in the summer, reducing air pollution in rural and forest areas.

In addition to its direct and indirect economic impact, GSLM is an active participant in community activities. For example, for several years GSLM has been the largest corporate donor to the Joyce Hansen Hall Community Services Food Bank in Ogden, the biggest food bank in Northern Utah; this and other social activities would disappear along with GSLM jobs without the new steam generation plant.

Social and Economic Summary

There are no social or economic losses from the project, which replaces existing equipment providing exactly the same services. In fact, the state-of-the-art new boiler and new water treatment equipment are cleaner, more efficient and more reliable than the older equipment being replaced. There is no impact to the Great Salt Lake compared to existing operations, and de minimis impact overall, if any, as the water discharged into the Lake following treatment will meet all Clean Water Act standards. There is no impact on social or recreation opportunities or on other potential commercial development, as the project is entirely on GSLM's property that is not available to the public.

CONCLUSION

GSLM concludes the economic costs and social impacts of alternatives to discharging waste waters from the steam generation plant into the Great Salt Lake are not warranted, particularly given the absence of potential environmental harm from the discharge. The new steam generation plant and its proposed discharge maintains the favorable economic and social impact to the Great Salt Lake and surrounding community.