CITY OF LOGAN

WASTEWATER TREATMENT FINAL MASTER PLAN 2015

FINAL DRAFT
October 2015

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CITY OF LOGAN

WASTEWATER TREATMENT FINAL MASTER PLAN 2015

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1.1 INTRODUCTION

The Utah Division of Water Quality (DWQ) has identified Cutler Reservoir as being impaired due to low dissolved oxygen concentrations and excess total phosphorus (see DWQ Cutler Reservoir TMDL, February 2010). A Total Maximum Daily Load (TMDL) study for Cutler Reservoir resulted in limits to the amount of phosphorus that point and non-point source dischargers may contribute to the system in an effort to protect the beneficial uses of the water body. The Cutler Reservoir TMDL was approved by the EPA in February 2010. Subsequently, DWQ has allocated the TMDL to individual point source dischargers, resulting in a limit on the amount of total phosphorus that can be discharged and a compliance schedule for upgrading treatment facilities.

The City of Logan (City) owns and operates a lagoon system that provides wastewater treatment for the City and a number of the surrounding communities. This facility was identified as a point source discharge to Cutler Reservoir, and as such, the City received new limits on total effluent phosphorus as shown in Table 1.1. The current lagoon system is not capable of meeting the total phosphorus limit imposed by the TMDL.

In May of 2012, Carollo Engineers (Carollo) completed a master plan for the City to evaluate treatment alternatives to meet the new total phosphorus limit established by the TMDL. The master plan was submitted to DWQ for review in May 2012. During the course of their review, DWQ determined that Logan’s wastewater discharge permit needed to be modified to include a new chronic ammonia limit. In early 2013, DWQ sent three different letters to the City with information on the proposed new ammonia limits, and explanation as to why ammonia was a late addition to the planning process. See correspondence included in Appendix A and Table 1.2 below. As of August 1, 2015, the limits shown in both Tables 1.1 and 1.2 became part of the City’s discharge permit (Appendix B). Compliance to these new limits is required by January 1, 2021, which provides the City time to construct and optimize a new treatment system.

Table 1.1 Effluent Limits for Phosphorus
Wastewater Treatment Final Master Plan 2015
City of Logan

Season	Phosphorus Mass Limit [1] (log)
May through October	11,487 kg
November through April	12,901 kg

Notes:
(1) Based on Discharge Compliance at 001, by no later than January 1, 2021.

Table 1.2	Effluent Limits for Ammonia Wastewater Treatment Final Master Plan 2015 City of Logan			
Season	**Winter**	**Spring**	**Summer**	**Fall**
New Ammonia Limits*				
Monthly Average	3.0	3.0	1.3	2.6
Daily Maximum	5.0	8.0	6.0	7.0
Previous Ammonia Limits				
Daily Maximum	14.4	11.9	9.1	11.2
*New limits must be met by January 1, 2021.				

Carollo prepared an updated master plan in October 2013 that recommended a new mechanical treatment process for improved phosphorus and ammonia treatment. The cost of that recommended project was the basis for the City's funding package request approved by the DWQ Board in January 2014.

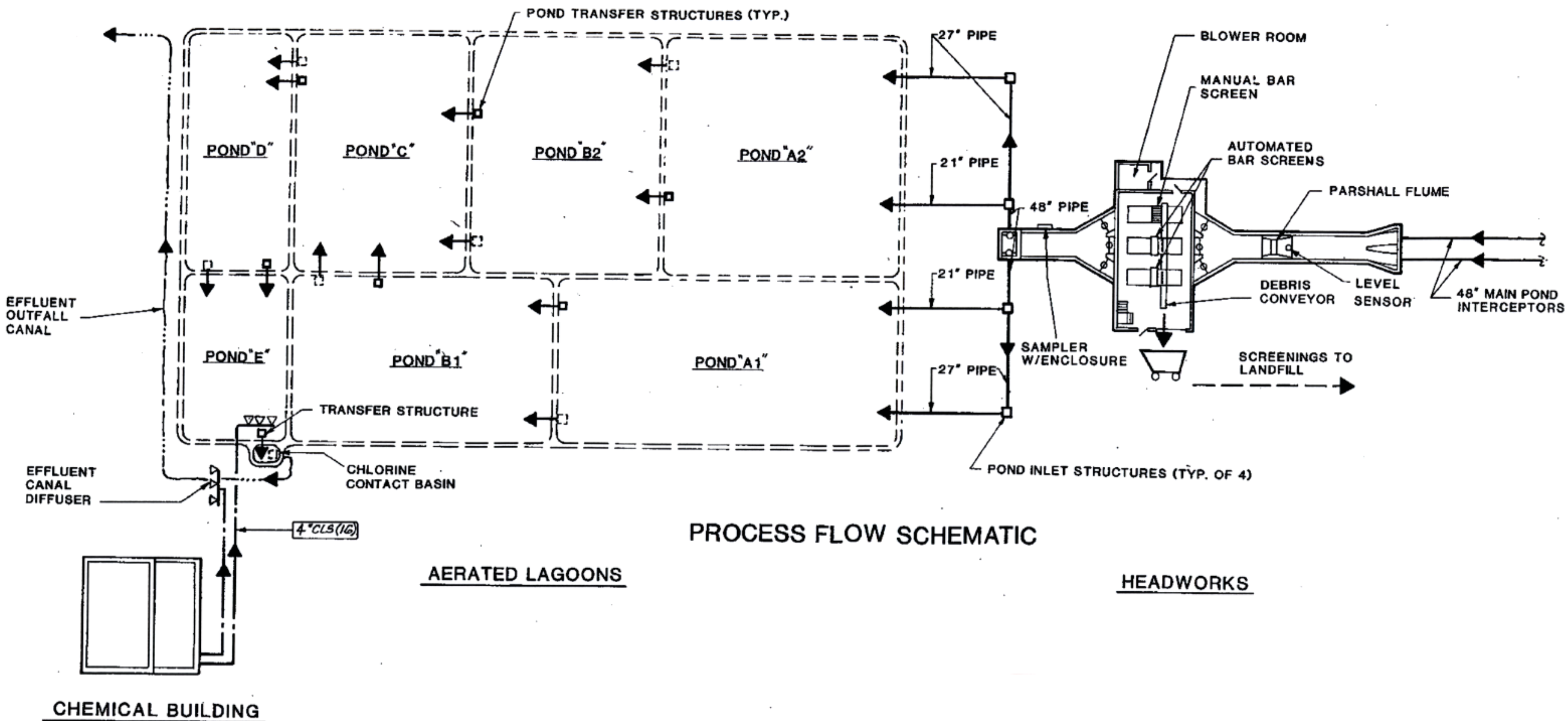
Shortly after the approval of the funding, DWQ allowed the other six cities that have historically participated in Logan's regional facility, Hyde Park, Nibley, North Logan, Providence, River Heights, and Smithfield, time to conduct their own studies evaluating the cost of wastewater treatment. As of August 2015, the City has received confirmation from all six cities that they will participate in the project. Additionally, the City received a new discharge permit from DWQ effective as of August 1, 2015 that includes final effluent numbers and the required project compliance schedule (Appendix B).

The purpose of this wastewater treatment final master plan is to incorporate all funding, permitting, and compliance updates that have occurred since October 2013 into a final planning document for DWQ approval.

1.2 BACKGROUND

The City's lagoon system consists of a series of seven cells for wastewater treatment. In 1987, a mechanical headworks facility and chlorine contact basin were added. Also at that time, all seven cells were equipped with pontoon-mounted surface aerators. In 2002, a series of wetlands were added to try to enhance ammonia removal. Figure 1.1 provides a plan view of the treatment facilities.

During the irrigation season, discharged effluent is used to irrigate fields to the west of the facility. The effluent quality must meet the requirements of Type II Reuse (per DWQ Permit and R317) and the compliance point is just downstream of the chlorination basin (Compliance Point 001). If effluent is not used as irrigation water, it is conveyed to the wetland polishing cells, and then discharged to Cutler Reservoir via Swift Slough. The compliance point is located downstream of the outlet on the wetland cells (Compliance Point 002).



EXISTING FLOW SCHEMATIC WASTEWATER FACILITY PLAN

FIGURE 1.1

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

1.3 POPULATION

The lagoons serve the City of Logan and a number of surrounding cities, including North Logan, Smithfield, Hyde Park, River Heights, Providence, and Nibley. It should be noted that Utah State University is also included in the service area, which has an annual enrollment of approximately 20,000 students. The population from 2000 to 2010 for the City and the aforementioned communities increased significantly based on census data shown in Table 1.3, the average annual growth rate for the service area is approximately two percent. Table 1.3 shows “moderate growth” projections compiled for each community based on census data and other sources as listed. The 2010 service area population was 87,566. Population projections through the year 2040 are included in Table 1.3. The projections shown in Table 1.3 represent an annual growth rate of approximately two percent.

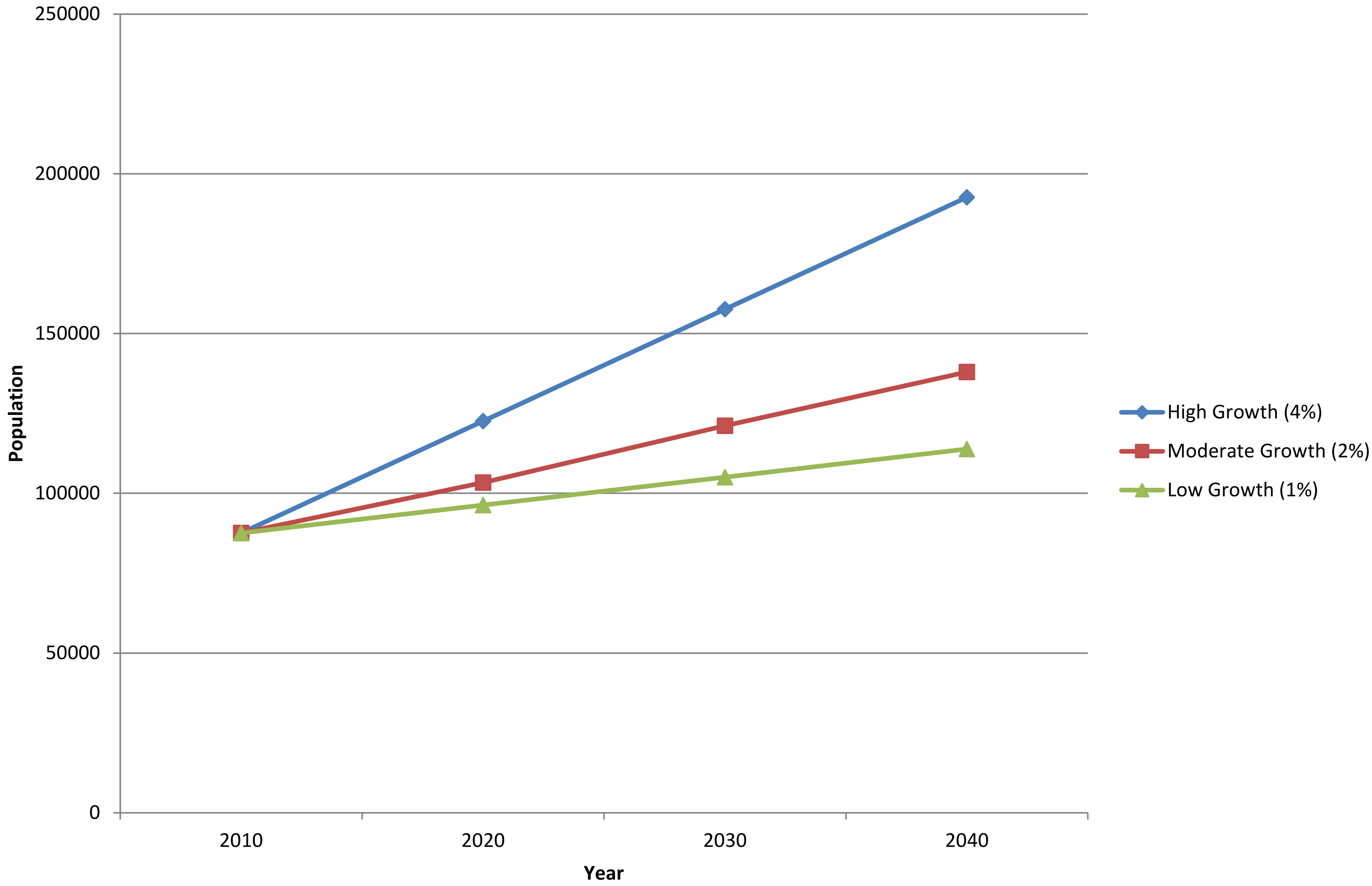
Table 1.3 Population Projections
Wastewater Treatment Final Master Plan 2015
City of Logan

City	2000	2010	2020	2030	2040
Hyde Park	2,955	3,546	4,255	4,393	5,382
Logan	42,670	50,770	57,000	65,000	73,000
Nibley	2,045	5,453	7,671	8,822	9,705
North Logan	6,163	8,269	11,641	14,964	16,708
Providence	4,377	7,075	8,490	10,188	12,226
River Heights	1,496	1,795	2,154	2,477	2,725
Smithfield	7,523	10,658	12,150	15,300	18,250
Totals	**67,229**	**87,566**	**103,361**	**121,144**	**137,996**

Sources: U.S. Census, Governor’s Office of Planning & Budget, Cache Metropolitan Planning Organization.

Figure 1.2 shows a graph of Logan service area population projections including a “high growth” and “low growth” scenario. Table 1.3 represents the moderate growth scenario shown in Figure 1.2.

A pre-treatment program is in place to control industrial loading to the lagoons. It is recommended that the pre-treatment program be reviewed with detailed industrial loading projections if any industries are proposed to discharge to the City’s wastewater collection system. Any proposed industrial loading can readily be expressed in terms of population equivalents for facilities planning. The City of Logan Planning Department indicated that there are not currently any plans for major industries.



LOGAN SERVICE AREA POPULATION PROJECTIONS

FIGURE 1.2

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

1.4 CURRENT AND FUTURE FLOWS AND LOADINGS

1.4.1 Historical Flows and Loadings

The lagoons receive flow from the City's collection system as well as flow from lift stations owned by the other cities. The City provided historical data for flow, organic and nutrient loading from 2007 through 2010. A summary of the most recent influent data is included in Table 1.4. Historical effluent data for discharge 001 and 002 is included in Appendix C.

Table 1.4 Historical Influent Wastewater Characteristics
Wastewater Treatment Final Master Plan 2015
City of Logan

	Average Flow (mgd)	BOD (mg/L)	TSS (mg/L)	NH_3 (mg/L)	TP (mg/L)
2012 Average	12.3	103	113	17	4
2012 Max. Month	16.2	139	179	22	6.3
2012 Max. Day	17.9	194	324	24	7.8
2012 Max. Month Occurrence	July	January	January	January	January
2012 Min. Month	7.9	72	79	12	3.1
2012 Min. Month Occurrence	December	July	July	July	August

The data in Table 1.4 show a significant difference in wastewater strength and flow between the maximum month and minimum month values. These data are inversely correlated in that during high flows, the strength of the wastewater is decreased, and during lower flows, strength goes up. This pattern is thought to be a function of inflow and infiltration (I&I) during the summer months. Given the seasonal difference in wastewater strength, the following design criteria are proposed for the future project as shown in Table 1.5.

Table 1.5 Proposed Wastewater Design Characteristics
Wastewater Treatment Final Master Plan 2015
City of Logan

Winter Wastewater Characteristics	January
BOD	140 mg/L
TSS	180 mg/L
NH3	22 mg/L
TP	6.3 mg/L
Temperature	13 degrees C (55 F)
Summer Wastewater Characteristics	**July**
BOD	100 mg/L
TSS	113 mg/L
NH3	17 mg/L

Table 1.5	Proposed Wastewater Design Characteristics Wastewater Treatment Final Master Plan 2015 City of Logan
TP	4 mg/L
Temperature	18 degrees C (64 F)

1.4.2 Historical Effluent Quality

Average monthly ammonia concentrations from the discharge of the wetlands (002) are shown in Table 1.6. As can be seen in Table 1.6, the wetlands will not be able to achieve the new ammonia discharge limits shown in Table 1.2.

Historical effluent quality data from the lagoons are shown in Figures 1.3, 1.4 and 1.5 for BOD, TSS, and ammonia respectively, along with the permitted limits for each constituent as required by the Utah Pollutant Discharge Elimination System (UPDES) permit. The data shown in these figures is lagoon effluent sampled at discharge 001.

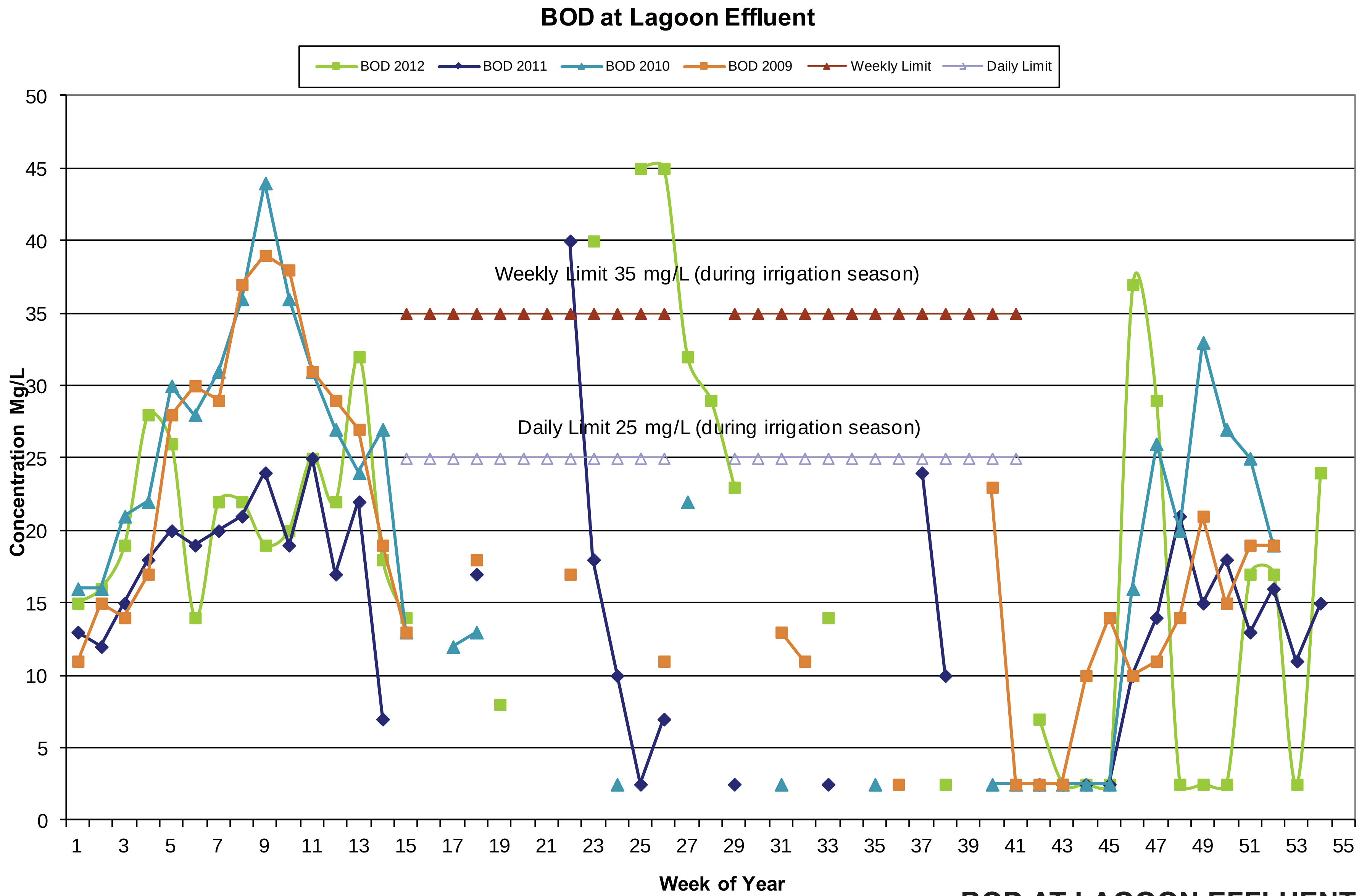
Phosphorus data collected on the lagoon effluent is summarized in Figure 1.6. The current permit requires the City to sample and report the effluent total phosphorus concentration.

The data from Figure 1.6 shows effluent total phosphorus concentrations ranging from 1.5-6 mg/L. The existing lagoon system will not meet the total phosphorus limits of approximately 1.0 mg/L that will be required by the Cutler Reservoir TMDL. The lagoons will also not be able to meet the new ammonia limits.

Table 1.6 Wetland Discharge 002 Average Monthly Ammonia Concentrations
Wastewater Treatment Final Master Plan 2015
City of Logan

	2007 (mg/L)	2008 (mg/L)	2009 (mg/L)	2010 (mg/L)	2011 (mg/L)	2012 (mg/L)	Average (mg/L)
Jan	ND	10.10	8.68	8.83	7.80	8.23	8.73
Feb	11.07	11.30	7.60	5.40	7.78	10.22	8.89
Mar	6.25	11.57	4.22	7.90	2.02	9.13	6.85
Apr	4.96	7.68	5.53	2.38	0.30	8.78	4.94
May	1.13	4.75	5.13	0.30	2.33	1.04	2.45
Jun	ND	1.80	2.65	1.00	3.82	6.93	3.24
Jul	ND	ND	2.17	ND	3.73	5.78	3.89
Aug	ND	ND	ND	ND	ND	4.10	4.10
Sep	ND	2.00	1.05	2.88	1.75	ND	1.92
Oct	0.87	1.80	0.53	0.90	0.88	ND	0.99
Nov	0.95	0.45	0.20	0.18	0.56	ND	0.47
Dec	3.35	1.68	3.22	1.56	4.80	ND	2.92

ND = No Discharge



BOD AT LAGOON EFFLUENT

FIGURE 1.3

LOGAN CITY
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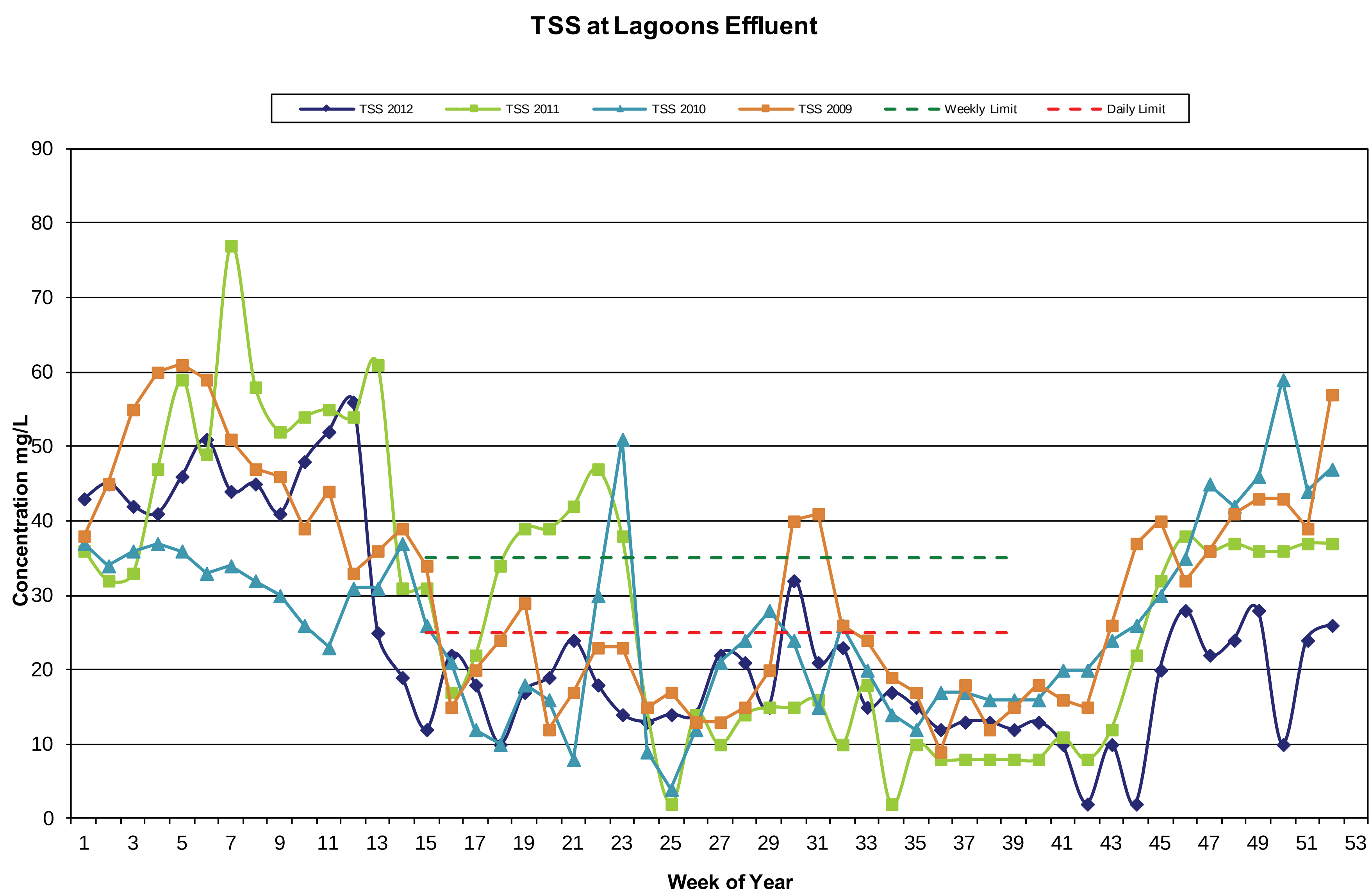
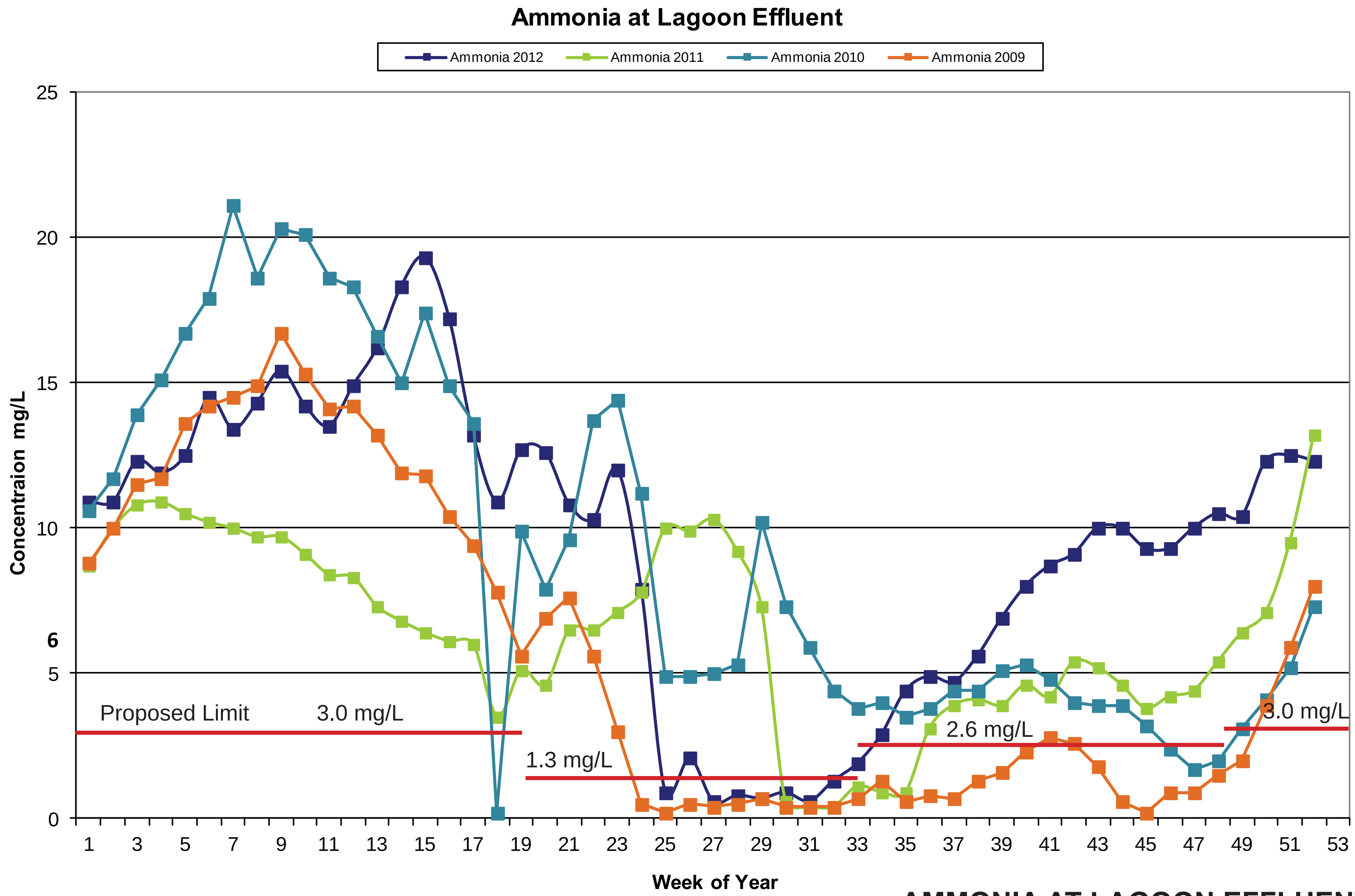
Client\UT\Logan\8621A00\Deliverables\Revised Submittal with Ammonia\Figure 1.3 indd



TSS AT LAGOON EFFLUENT

FIGURE 1.4

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

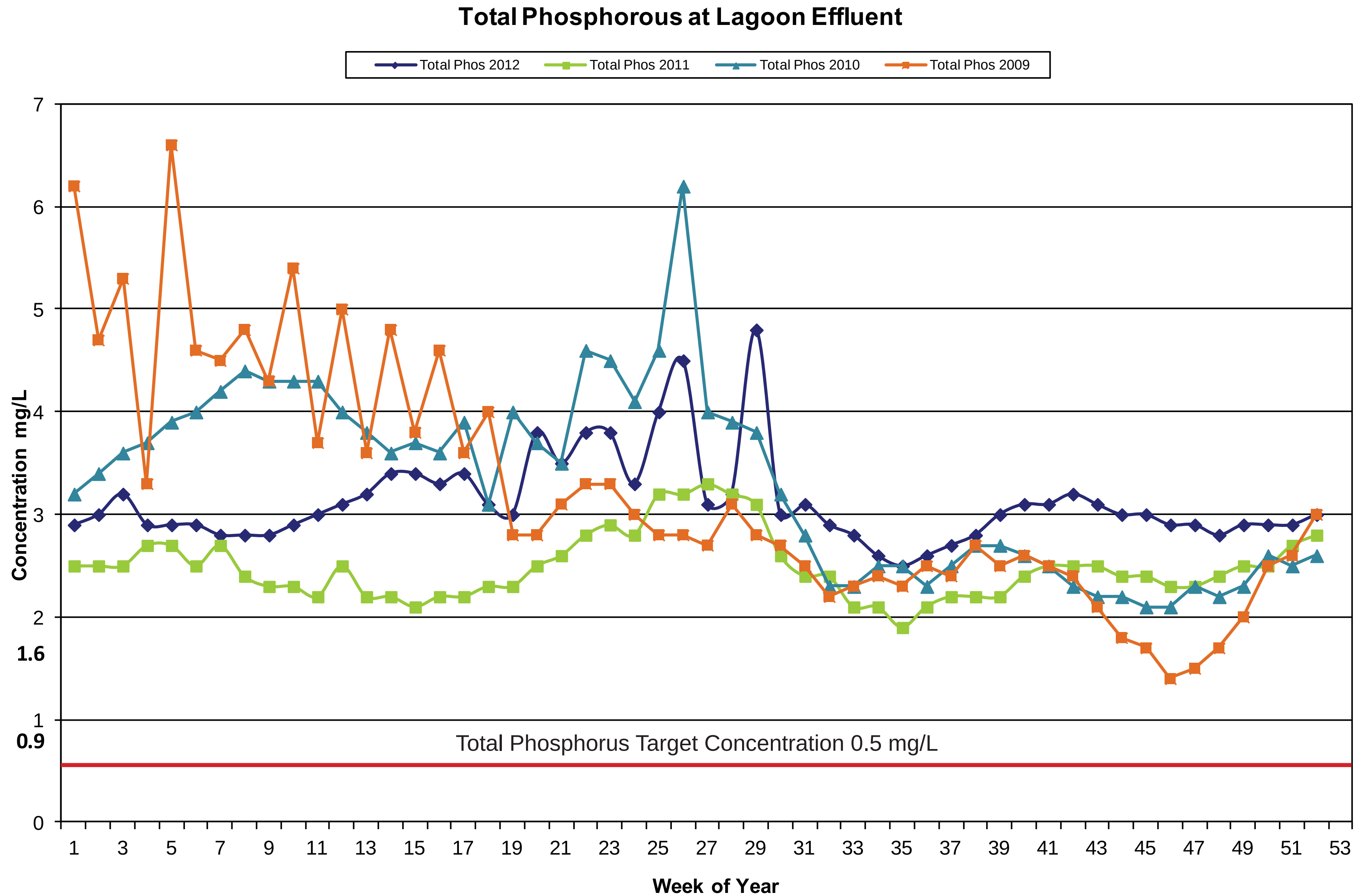


AMMONIA AT LAGOON EFFLUENT

FIGURE 1.5

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

Client\UT\Logan\8621A00\Deliverables\Revised Submittal with Ammonia\Figure 1.5.indd



TOTAL PHOSPHORUS AT LAGOON EFFLUENT

FIGURE 1.6

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

Client\UT\Logan\8621A00\Deliverables\Revised Submittal with Ammonia\Figure 1.6.indd

1.4.3 Projected Wastewater Flows

Projected Wastewater Flows at the Logan Lagoons are presented in Table 1.7. The projected flows were calculated using the population projections from Table 1.3. Wastewater flowrates for existing population in the service area was projected at a rate of 150 gallons per capita per day (gpcd), where all new growth was projected at 100 gpcd. This convention assumes that existing inflow and infiltration (I&I) is part of the 150 gpcd, and that growth will occur at 100 gpcd due to tighter collection system standards and materials.

**Table 1.7 Projected Wastewater Flows
Wastewater Treatment Final Master Plan 2015
City of Logan**

Flow	2010 (mgd)	2020 (mgd)	2030 (mgd)	2040 (mgd)
Annual Average Day	13	15	17	18
Max Month (July) Average Day	17	20	23	24
Max Day(1)	25	30	34	36

Notes:
(1) Maximum day wet weather flows will be equalized using the existing lagoons. This will limit maximum flow to the plant to MMAD Flows (24 mgd in 2040).

1.4.4 Future Discharge Requirements

The current discharge permit includes the following compliance schedule for the new phosphorus and ammonia limits. The resulting project will be significantly larger than the project that would have been required to meet the total phosphorus limit. Therefore, the compliance schedule has been revised to allow for planning, design, and construction of the larger project. The project schedule is discussed in Chapter 4.

1.4.5 Existing Compliance Schedule

The permittee shall complete the listed items (below) by the indicated dates.

- By December 31, 2016 Logan City shall submit detailed construction plans and specifications to DWQ to obtain a construction permit.
- By June 30, 2017 Logan City shall commence construction of approved wastewater treatment upgrades as outlined in the DWQ construction permit.
- By July 31, 2020 Logan City shall complete construction of wastewater treatment upgrades and begin startup and optimization of upgraded wastewater treatment processes.

- By January 1, 2021 Logan City shall achieve compliance with all effluent limits prescribed in UPDES Permit #UT0021920 including all new phosphorus and ammonia effluent limits. The final phosphorus limits from Outfall 002 shall be 4,405 kg/ total phosphorus from May through October and 11,831 kg total phosphorus from November through April. If Logan City decides to abandon the treatment wetlands and move its discharge point to Outfall 001A and Outfall 001B, then the final phosphorus limits from those outfalls shall be a combined total of 11,487 kg from May through October and 12,901 kg from November through April. Final ammonia limits shall be 30 Day Average of 3.0 mg/L in Winter and Spring, 1.3 mg/L in Summer and 2.6 mg/L in Fall. The Daily Maximum shall be 5.0 mg/L in Winter, 8.0 mg/L in Spring, 6.0 mg/L in Summer and 7.0 mg/L in Fall.

TREATMENT AND NUTRIENT REMOVAL ALTERNATIVES

2.1 INTRODUCTION

The purpose of this section is to identify, describe, and evaluate treatment and nutrient removal alternatives for the City of Logan, Utah wastewater treatment facility (WWTF). The alternatives will be evaluated based on treatment objectives, site constraints as well as capital and operating cost which will be evaluated in Chapter 3. Treatment objectives include meeting the proposed effluent limits for BOD, TSS, ammonia, phosphorus, and a future limit for total nitrogen.

2.2 PREVIOUS ALTERNATIVES EVALUATED

The City previously considered treatment alternatives as part of the Master Plan completed in 2007 and 2012. The alternatives considered in previous master plans are presented in Table 2.1. The alternatives were not viable because they failed to meet anticipated permit limits or because of excessive cost and/or complexity. These alternatives will not be evaluated further in this master plan.

Table 2.1 Treatment Alternatives Previously Considered[1]
Wastewater Treatment Final Master Plan 2015
City of Logan

Alternative No.	Description
1	Existing Lagoons with Diffused Air
2	Deeper Lagoons with Existing Aerators
3	Deeper Lagoons with Diffused Air
4	Sequencing Batch Reactors
5	Biological Aerated Filters
6	Membrane Bioreactor

Notes:
(1) From City of Logan WWTP Master Plan 2007 and 2012.

2.3 TREATMENT REQUIREMENTS

As indicated in Chapter 1, the City's discharge permit will include requirements for future phosphorus and ammonia removal. Future discharge from the treatment facility will need to meet the phosphorus limits listed in Table 2.2.

The future phosphorus limit is mass based, so as flows increase, the effluent concentration required to meet the limit will decrease. Based on the maximum month projected flow in 2040, the required effluent concentration would be about 0.69 mg/L total phosphorus.

To be able to reliably meet the phosphorus permit limit it is recommended that the selected process be capable of reliably achieving total phosphorus concentrations of 0.5 mg/L.

Table 2.2	Future Phosphorus Limits Wastewater Treatment Final Master Plan 2015 City of Logan		
Seasons		**Limit (kg)**	**Limit (lb/day)**
Summer	May - Oct	11,487	137.7
Winter	Nov - Apr	12,901	157.2
Year	**Season**	**Approx. Flow (MGD)**	**Concentration (mg/L)**
2010	Summer	15	1.1
	Winter	10	1.9
2020	Summer	17	0.9
	Winter	12	1.6
2030	Summer	20	0.83
	Winter	13	1.4
2040	Summer	24	0.69
	Winter	14	1.3

Notes:
(1) These limits were based in part on maximum day flows not considering recommended wet weather equalization.

New chronic and acute ammonia permit limits have been established by DWQ, and they are listed in Table 2.3. The new treatment process must be capable of meeting these new ammonia limits.

Table 2.3	Proposed Ammonia Limits Wastewater Treatment Final Master Plan 2015 City of Logan			
Season	**Winter**	**Spring**	**Summer**	**Fall**
Expected				
Monthly Average (mg/L)	3.0	3.0	1.3	2.6
Daily Maximum (mg/L)	5.0	8.0	6.0	7.0

In addition to the new ammonia limits, DWQ is proposing new statewide total nitrogen limits. A total nitrogen limit of 10 mg/L has been proposed and the new treatment process must also be capable of meeting this proposed total nitrogen limit.

2.4 TREATMENT ALTERNATIVES

This section will evaluate treatment alternatives to meet the above discharge requirements.

We previously evaluated six different treatment alternatives that are listed in Table 2.1. We will not include these alternatives in the current evaluation.

Four treatment options will be evaluated along with a “no action” alternative. The alternatives that will be evaluated include:

- Bio-Domes and Tertiary Treatment
- 3 Stage Bardenpho Bioreactor
- Algae Treatment
- Conventional Activated Sludge
- No action

Each of these alternatives will be discussed in the following section, and economic and non-economic evaluations are included in Chapter 3.

2.4.1 Alternative 1 – Existing Lagoons with Bio-Domes and Tertiary Treatment

One alternative to continue using the lagoon involves the installation of Bio-Domes to enhance ammonia removal. Bio-Domes are an attached growth biological process. They provide a packing media with surface area for bacteria to grow. Aeration is provided to the Bio-Dome (1 cfm) to keep conditions aerobic. Information about the Bio-Domes is included in Appendix C.

Bio-Domes have limited full-scale installations, which are mostly in small lagoon systems. The biggest concern with the Bio-Domes is ammonia removal in the winter when water temperature in the lagoons is typically one to two degrees Celsius. Nitrifying bacteria slow down when the temperature is cold. Most data shows that nitrification stops at about three to five degrees.

Bio-Dome manufacturers have developed a larger unit called Bio-Shell, however, there are no full-scale installations of the Bio-Shell, so the smaller Bio-Domes will be evaluated for this alternative.

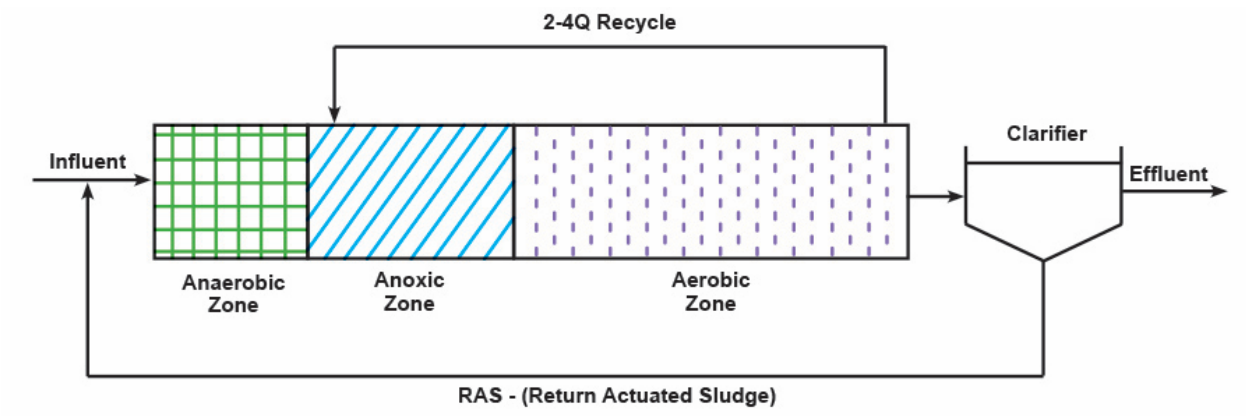
Bio-Dome researchers have limited data that shows that Bio-Domes may be able to achieve low ammonia concentrations in cold-water temperatures. Some of their data included in their proposal shows that the winter ammonia concentration would not be met. Their recommended design criterion is that each Bio-Dome can remove 0.18 pound of ammonia. Based on this criterion, the Logan lagoons would require approximately 18,000 Bio-Domes to remove ammonia at the average design flow of 18 mgd.

Bio-Dome researchers have found that controlling algae is essential to effective operation of the Bio-Domes. This is done by installing a floating cover on the lagoons with the Bio-Domes. A blower building with blowers, air piping, valves, and air hoses to each Bio-Dome is also required.

The Bio-Domes will not remove phosphorus or total nitrogen, so tertiary treatment processes will need to be provided to remove nitrogen and phosphorus. Deep bed denitrifying filters with methanol storage and feed facilities will be required to remove nitrogen, and chemical phosphorus removal facilities including chemical storage and feed equipment and filtration will be required to achieve the total phosphorus limit.

2.4.2 Alternative 2 – 3 Stage Bardenpho Bioreactor Process

The 3 Stage Bardenpho process is a widely used process to biologically remove both nitrogen and phosphorus. The process consists of an anaerobic zone followed by an anoxic zone and an aerobic zone. In the aerobic zone, ammonia is converted to nitrates (NO_3) by nitrifying bacteria. The nitrates are constantly recycled back to the anoxic zone where denitrifying bacteria convert the nitrates to nitrogen gas, which is released into the atmosphere. The initial anaerobic zone promotes the release and subsequent uptake of phosphorus by the bacteria. The following graphic shows a schematic of the 3 stage Bardenpho process.



3 Stage Bardenpho Process Schematic

Clarifiers are used to remove and return the bacteria to the bioreactor. Tertiary filters will be provided to ensure that the total phosphorus limit is achieved. Tertiary filters provide the following benefits:

- Filters remove biological solids that are not captured in the clarifiers. Since the biological solids contain elevated phosphorous concentrations, removal of these solids is critical. Biological solids from a 3 Stage Bardenpho process can contain up to 15 percent phosphorus. Typical solids discharge (TSS) from a secondary clarifier is up to 10 mg/L. Without filtration, this would result in a total phosphorus discharge of 1.5 mg/L plus any orthophosphorus that was not removed. Therefore, filtration is critical to meeting the proposed phosphorus limit.

- Filtration improves the disinfection process by removing solids that can mask bacteria and viruses. Providing tertiary filtration will significantly reduce the cost of disinfection.

- Phosphorus removal could be achieved by adding alum or ferric chloride to the clarifiers. However, this results in recycling chemical to the biological phosphorus removal process, which will inhibit the biological removal of phosphorus. This results in a significant amount of chemical solids in the bioreactor which can reduce the effectiveness of nitrification (ammonia removal), resulting in higher effluent ammonia concentrations. If chemical addition is necessary for polishing, it should ideally be added as a tertiary process before the filters.

2.4.3 Alternative 3 – Algae Treatment

Preliminary research by Utah State University has shown great potential for algae to utilize soluble phosphorus and nitrogen concentrations within the wastewater. Three major areas of research are being conducted at a new research center (Sustainable Waste-to-Bioproducts Engineering Center (SWBEC)), a joint effort between Utah State University and the Logan City Environmental Department: 1) looking at optimally growing algae; 2) harvesting the algae from the treated wastewater; and 3) utilizing the algae to produce valuable biofuels and bioproducts to minimize the cost and operation of the system as well as make the system environmentally sustainable. (For additional information about SWBEC research, see “Sustainable Waste-to-Bioproducts Engineering Center Logan Lagoons Research Summary” in the Appendix).

Algae growth research efforts have included monitoring the current lagoon system over an extended period and testing the growth of algae in suspension and attached growth systems. The suspended growth research on open pond algae raceways has included bench (25 L), pilot (535 L), and large pilot (75,700 L) systems. Extensive research has been conducted on nutrient utilization and operation at each of these scales. The attached growth system, called the rotating algal biofilm reactor (RABR), is a unique system which has been developed through SWBEC and shows significant potential (see photo on the following page). The RABR has demonstrated the capability of growing algae at higher concentrations, which means higher phosphorus and nitrogen removal rates, is capable of being easily implemented into the current wastewater treatment facility, and utilizes a very inexpensive harvesting system. It has also been researched and demonstrated at scale; bench (8 L), pilot (535 L), and large pilot (10,700 L), with a full-scale system being designed and constructed for use starting June, 2012. Currently the most favorable system being looked at is placement of the RABR systems within several of the treatment cells at the wastewater treatment facility. The flow of water would be directed into channels within these treatment cells providing efficient flow through the system. The algae produced on the RABR systems would be harvested and used to produce biofuels and bioproducts, or algae could be blended with food processing wastes and digested for biogas to be used as an alternative energy source (See Appendix, “Summary of Anaerobic Digestion of Algae and Algae Comingled With Food Processing Wastes”, prepared by Conly Hansen, May 9, 2012). The treated water would continue through the treatment plant and pass through a DAF system to remove any remaining algae or other suspended solids.

Logan City, working with Utah State University, has demonstrated that algae can be used to remove nitrogen and phosphorus from wastewater down to low levels. However, the main limitation for using algae is that algae growth is severely limited in the wintertime.

Rotating Algal Biofilm Reactor (RABR) designed by SWBEC is currently being tested at the Logan lagoon facility.

There are two commercial systems that market systems to use algae for nutrient removal. One manufacturer uses a suspended growth algae process, and the other manufacturer uses a fixed growth algae process. Both manufacturers use greenhouses to enclose the process and maintain acceptable temperatures in the winter season. Because of the large area of the greenhouses required and high cost of equipment, this alternative is fairly expensive.

2.4.4 Alternative 4 – Conventional Activated Sludge with Nutrient Removal

Conventional activated sludge systems with nutrient removal are similar to the 3 Stage Bardenpho Bioreactor process. The main difference with the conventional activated sludge is that the aeration volume is reduced, and primary clarifiers are provided to reduce the loading to the aeration basins.

Anaerobic digestion is typically provided to stabilize the waste solids from the primary clarifiers and aeration basins.

2.4.5 Alternative 5 – No Action

The no action alternative assumes that the existing lagoons would continue to be used for BOD, suspended solids, and ammonia removal. Chemical phosphorus with filtration removal would be provided to meet the proposed phosphorus limit.

As can be seen in the data presented in Chapter 1, there are times of the year that the existing lagoons do not meet the ammonia limit. Currently the wetland provides additional treatment for ammonia removal. The goal is to meet all treatment requirements at the discharge from the treatment facilities so that the wetlands are no longer required. To meet this goal, treatment would have to be provided to phase out the use of the lagoons.

In addition, the existing lagoons have high-suspended solids during certain times of the year. Use of the lagoons in place of another biological treatment process would require more filters to handle the increased solids loading.

2.4.6 Anticipated Effluent quality of Alternatives

Alternatives 2, 3, and 4 are all assumed to have similar effluent quality and would meet the new ammonia and phosphorus permit limits. It is anticipated that Alternative 1 would not meet the new ammonia limit in the wintertime, as pilot test data shows times when effluent ammonia is in the 3-10 mg/L range. Alternative 5 (No Action Alternative) would result in failure to meet the new ammonia and phosphorus limits.

2.5 COMMON PROJECT ELEMENTS

The City's WWTF currently consists of influent flow measurement, headworks, and a series of lagoons that are utilized for treatment followed by a chlorine contact basin and effluent outfall canal. New treatment facilities will be implemented that require a number of common project elements as well as evaluation of secondary (biological) treatment alternatives. All the common project elements will apply regardless of the secondary (biological) treatment alternative selected.

The common project elements include the following:

- Headworks Improvements
- Grit Removal Facility
- Disinfection Facility
- Dewatering

2.5.1 Headworks Improvements

The City's existing headworks is a block building that was constructed in the late 1980s. The facility was designed with three influent channels that utilize two Meunier mechanical, front-cleaning screens that remove debris and discharge on to a single belt conveyor that discharges to an interior dumpster. The age of the equipment has resulted in increased maintenance and difficulty in obtaining spare parts. As such, the City desires to replace the existing mechanical screens. If feasible, the City may use the existing belt conveyor with two new mechanical screens and screenings conveyance. The project elements for the headworks improvements entail the following:

- Replace the existing mechanical screens
- Install new isolation stainless steel slide gates as needed
- Replace the manual bar screen with new mechanical screen
- HVAC improvements as needed
- New headworks facility with fine screen and grit removal

2.5.2 Hydraulic Considerations

The existing Parshall flume located upstream of the headworks facilities as well as the influent channels through the headworks building to the pond inlet structure are rated for 19 mgd average daily flow and an ultimate design flow of 37.1 mgd (JMM drawing G-6, 12/87) and this is sufficient for the design flows defined in Chapter 1 through the year 2040. Wet weather flow equalization to mitigate wet weather peak hour flows will be provided using existing lagoon cells A1 and A2 to store peak flows which will then be returned to the plant for treatment.

2.5.3 Design Criteria

The proposed design criteria for the new headworks are presented in Table 2.4.

Table 2.4 Headworks Improvements Design Criteria
Wastewater Treatment Final Master Plan 2015
City of Logan

Parameter	2040 Design Criteria
Mechanical Screen Type	Mechanical Bar
Total Peak Flow, mgd	24
Quantity (Duty + Standby)	3 (2+1)
Peak Flow per screen, mgd (1)	12
Nominal Screen Spacing, inches	1/4
Clean Screen Headloss at Peak flow, inches	12

Notes:
(1) Assume existing lagoons will be used to equalize wet weather maximum day flows.

2.5.4 Grit Removal Facility

The City's wastewater treatment facility (WWTF) was not designed with a means of grit removal. Because grit removal is an important part of minimizing abrasion and clogging of downstream mechanical equipment, a mechanically-induced vortex grit removal facility with associated grit classifier and grit pumps is proposed that will be provided upstream of the influent pump station.

A mechanically induced vortex system utilizes a rotating turbine inside a circular tank to control the velocity inside the circular chamber. The turbine impeller is located at the center of the chamber and above the grit collection hopper. Rotation of the impeller suspends lighter organic material and allows heavier grit to settle. A sloped, conical bottom is recommended to minimize grit accumulation.

Top-mounted, vacuum-primed pumps are proposed to pump grit to inclined grit classifiers equipped with washwater to remove organic material. The washed grit will be discharged to a dumpster for disposal.

Benefits of the mechanically induced vortex grit removal systems are that the headloss is minimal and that multiple reputable equipment manufacturers offer these systems.

2.5.4.1 Hydraulic Considerations

The typical headloss through a mechanically induced vortex grit removal process is less than six inches, which will be accounted for in the design of the influent pump station.

2.5.4.2 Design Criteria

The proposed design criteria for the grit removal facilities are presented in Table 2.5.

Table 2.5 Grit Removal Facility Design Criteria
Wastewater Treatment Final Master Plan 2015
City of Logan

Parameter	2040 Design Criteria
Grit Removal	
Type	Mechanically-induced vortex
Total Peak Flow, mgd (1)	24
Quantity (Duty + Standby)	3 (2+1)
Peak Flow per unit, mgd	12
Nominal Tank Diameter, ft	12
Max Headloss at Peak Flow, inches	6
Nominal Motor HP, each	1.0
Grit Classifiers	
Type	Inclined Conveyor
Quantity (Duty + Standby)	3 (2+1)
Capacity per unit, CY/hr	1.5
Nominal Motor HP, each	0.5
Grit Pumps	
Type	Top-mounted, vacuum-primed
Quantity (Duty+Standby)	3 (2+1)
Design Flow Each, gpm	100
Design TDH, ft	24
Nominal Motor HP, each	1.0

Notes:
(1) Peak Day Value assumed with peak-hour flows shed to lagoons.

2.5.5 Influent Pump Station

All of the treatment options will require influent pumping to provide sufficient head to accommodate headloss through the treatment system. The influent pumps would be located in a wet well after the headworks to minimize wear and plugging by removing rags and grit prior to pumping.

2.5.6 Solids Dewatering

Waste digested solids can be dewatered by using sludge drying beds or by various mechanical dewatering processes, such as centrifuges, belt presses, or screw presses.

The estimated capital cost of dewatering alternatives is shown in Table 2.6

Table 2.6 Solids Dewatering Alternatives
Wastewater Treatment Final Master Plan 2015
City of Logan

Alternative	Estimated Capital Cost
Drying Beds	$9,422,000
Mechanical Dewatering	$6,441,000

Based on the large area of concrete drying beds that would be required and the potential for odors, mechanical dewatering would be more economical and would be recommended.

2.5.7 Disinfection

Disinfection will be a required common element of all treatment alternatives. Disinfection is currently accomplished using chlorine gas. Effluent from the last lagoon treatment cell is dosed with chlorine and conveyed to the chlorine contact basin. The existing chlorination facilities will be 33 years old when the new treatment facility is started up. The existing facilities have lived their useful life and need to be replaced. The new disinfection facilities could be accomplished with chlorine or UV disinfection. If chlorine is used, current safety codes will need to be met including providing a chlorine scrubber to handle potential chlorine gas leaks. Total chlorine residual permit limits can also be a concern for chlorine facilities, and dechlorination facilities are often required.

UV disinfection is a popular alternative to chlorine disinfection and is effective at inactivating pathogens. The UV lamps require electrical power but have a safety advantage over chlorine gas. Many plants are switching to UV disinfection. A lifecycle comparison between the disinfection alternatives of chlorine disinfection and UV disinfection is presented in Table 2.7. The UV system is the lower cost disinfection alternative. UV disinfection is also a safer alternative as the dangers associated with transport, storage, and, handling of chlorine gas, are eliminated.

Table 2.7 Disinfection Cost Comparison Chlorine vs. UV
Wastewater Treatment Final Master Plan 2015
City of Logan

Parameter	Chlorine	UV
Capital Costs	$1,800,000	$1,037,000
Annual O&M	$110,000	$130,000
Lifecycle Cost(1)	$3.3 M	$2.8 M

Notes:
(1) Lifecyle costs based on 20 years and 4% interest.

Based on the results of the lifecycle cost presented above, UV is recommended as the preferred method of disinfection for the upgrade project.

EVALUATION OF ALTERNATIVES

3.1 INTRODUCTION

In this section, the treatment alternatives described in Chapter 2 are evaluated using both economic and non-economic criteria. Results from this evaluation will determine the preferred treatment alternative.

3.2 ECONOMIC EVALUATION

Detailed cost estimates for each alternative have been developed including capital and O&M costs. A summary of the costs are given in this chapter. A copy of the detailed cost estimates is included in Appendix E.

3.2.1 Alternative 1 – Bio-Domes with Tertiary Treatment

Major construction elements of this alternative include the following:

- Sitework for the tertiary treatment facilities.
- New equipment for the existing headworks.
- 18,000 Bio-Domes, 8 million LF of air hose, lagoon cover, blower building and air piping.
- Deep bed sand filters and chemical storage and feed facilities for tertiary denitrification.
- Electrical building and emergency generator.
- Tertiary filters and chemical addition facilities for chemical phosphorus removal.
- Solids dewatering facilities.
- Operations building.

The cost estimate for this alternative is summarized in Table 3.1.

3.2.2 Alternative 2 – 3 Stage Bardenpho Bioreactor

The 3 Stage Bardenpho Bioreactor process would include the following:

- Sitework for new treatment facilities, including earthwork, yard piping, grading, paving and landscaping.
- Construction of a new headworks and grit removal facility.
- Construction of a new influent pump station.
- Six Bioreactors, each with anaerobic, anoxic, and aerobic zones to allow for biological nitrogen and phosphorus removal.
- Six secondary clarifiers with Return Activated Sludge (RAS) pump station.
- Tertiary filters and UV disinfection.
- Solids dewatering facilities.
- Operations building.

The cost estimate for this alternative is summarized in Table 3.2.

Table 3.1 Cost Estimate for Alternative 1 – Bio-Domes with Tertiary Treatment and Dewatering
Wastewater Treatment Final Master Plan 2015
City of Logan

Item	**Total**
Mobilization/Sitework	$10,500,000
Headworks	$ 720,000
Bio-Domes	$93,916,000
Tertiary Nitrogen Removal	$12,640,000
Electrical/SCADA	$12,286,000
Tertiary P Removal/Disinfection Building	$16,743,000
Solids Processing	$ 3,940,000
Operations Building	$ 1,750,000
Subtotal	**$ 152,495,000**
(Contingency (25%)	$ 38,124,000
Escalation to Construction Mid-point	$ 9,150,000
Estimated Total Construction Cost (2016 Dollars)	**$199,769,000**
Engineering, Legal & Admin	$27,968,000
Estimated Total Project Cost (2016 Dollars)	**$227,737,000**
Operations & Maintenance Cost Estimate	
Labor	$ 615,000
Benefits	$ 369,000
Tools/Supplies	$ 120,000
Utilities	$ 278,000
Chemicals	$ 1,500,000
Laboratory	$ 300,000
Subtotal	**$ 3,182,000**
Misc Items (10%)	$ 318,000
Total Estimated New O&M Cost	**$ 3,500,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 5,950,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$21,258,000

3.2.3 Alternative 3 – Algae Treatment

The major construction elements of the alternative are as follows:

- Sitework for algae treatment basins.
- Algae treatment basins, green houses, and treatment equipment.
- Electrical building and emergency generator.
- filtration and disinfection.
- solids dewatering.
- Operations building.

The estimated cost of this alternative is presented in Table 3.3.

AlgEvolve is another algae process that was evaluated. However, it is estimated that this alternative would be more expensive due to the membrane filters that are used for algae separation. The RABR system under development by SWBEC is also a possible algae treatment technology. However, it was not used for cost estimating as the technology is still in the research and development phase.

3.2.4 Alternative 4 – Conventional Activated Sludge

The major construction elements of the alternative are as follows:

- Sitework including earthwork, piping, grading, paving, and landscaping.
- A new headworks with screening and grit removal.
- Primary clarifiers.
- Aeration basins and equipment including air piping and diffusers, mixers, and mixed-liquor return pumps.
- blower building and blower equipment.
- Secondary clarifiers and RAS building.
- Electrical building and electrical work.
- Filtration and UV disinfection.
- Solids processing including WAS thickening, digestion, and dewatering.

Table 3.4 includes the estimated cost for this alternative.

Table 3.2	**Cost Estimate for Alternative 2 – 3 Stage Bardenpho Wastewater Treatment Final Master Plan 2015 City of Logan**
Item	**Total**
Mobilization/Sitework	$ 10,600,000
Headworks	$ 6,210,000
Bioreactors	$ 17,480,000
Clarifiers	$ 6,836,000
Electrical/SCADA	$ 15,080,000
Filtration/Disinfection Building	$ 9,143,000
Solids Processing	$ 3,440,000
Operations Building	$ 1,750,000
Subtotal	**$ 70,539,000**
(Contingency (25%)	$ 17,635,000
Escalation to Construction Mid-point	$ 5,535,000
Estimated Total Construction Cost (2016 Dollars)	**$ 93,709,000**
Construction Management, Legal & Admin	$ 7,914,000
Subtotal – Plant Construction (2016 Dollars)	**$101,623,000**
City Funded Upfront Costs	
Land Acquisition	$ 1,000,000
Engineering	$ 5,000,000
Estimated Preload Construction	$ 4,000,000
Estimated Total Project Cost (2016 Dollars)	**$111,623,000**
Operations & Maintenance Cost Estimate	
Labor	$ 615,000
Benefits	$ 369,000
Tools/Supplies	$ 120,000
Utilities	$ 835,000
Chemicals	$ 100,000
Laboratory	$ 300,000
Subtotal	**$ 2,339,000**
Misc Items (10%)	$ 234,000
Total Estimated New O&M Cost	**$ 2,573,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 5,023,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$ 11,854,000

Table 3.3	**Cost Estimate for Alternative 3 – Algae Treatment Wastewater Treatment Final Master Plan 2015 City of Logan**
Item	**Total**
Mobilization/Sitework	$ 32,000000
Headworks	$ 2,758,000
Algaewheel	$ 91,150,000
Electrical/SCADA	$ 18,500,000
Filtration/Disinfection Building	$ 9,023,000
Solids Processing	$ 3,440,000
Operations Building	$ 1,750,000
	$ 158,621,00
	0
	$ 39,655,000
Subtotal	$11,897,000
(Contingency (25%)	**$ 210,173,00**
Escalation to Construction Mid-point	**0**
Estimated Total Construction Cost (2016 Dollars)	$29,424,000
Engineering, Legal & Admin	**$ 239,597,00**
Estimated Total Project Cost (2016 Dollars)	**0**
Operations & Maintenance Cost Estimate	
Labor	$ 615,000
Benefits	$ 369,000
Tools/Supplies	$ 120,000
Utilities	$ 209,000
Chemicals	$ -
Laboratory	$ 300,000
Subtotal	**$ 1,613,000**
Misc Items (10%)	$ 161,000
Total Estimated New O&M Cost	**$ 1,774,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 4,224,025**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$ 20,329,000

Table 3.4 Cost Estimate for Alternative 4 – Conventional Activated Sludge with Nutrient Removal
Wastewater Treatment Final Master Plan 2015
City of Logan

Item	**Total**
Mobilization/Sitework	$ 13,600,000
Headworks	$ 6,210,000
Primary Clarifiers and Aeration Basins	$ 19,328,000
Clarifiers	$ 6,836,000
Electrical/SCADA	$ 18,685,000
Filtration/Disinfection Building	$ 9,143,000
Solids Processing	$ 20,190,000
Operations Building	$ 1,750,000
	$ 95,742,000
	$ 23,936,000
Subtotal	$ 7,181,000
(Contingency (25%)	**$ 126,859,00**
Escalation to Construction Mid-point	**0**
Estimated Total Construction Cost (2016 Dollars)	$17,760,000
Engineering, Legal & Admin	**$ 144,619,00**
Estimated Total Project Cost (2016 Dollars)	**0**
Operations & Maintenance Cost Estimate	
Labor	$ 665,000
Benefits	$ 399,000
Tools/Supplies	$ 160,000
Utilities	$ 900,000
Chemicals	$ 200,000
Laboratory	$ 350,000
Subtotal	**$ 2,674,000**
Misc Items (10%)	$ 267,000
Total Estimated New O&M Cost	**$ 2,941,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 5,391,400**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$ 15,112,000

3.2.5 Alternative 5 – No Action

The “no action” alternative would continue the use of the lagoons. This alternative would not meet the new phosphorus limits, or the new ammonia limit. Failure to comply with the new permit limits could result in significant fines and potential legal action. Therefore, the “no action” alternative is not feasible.

3.2.6 Lifecycle Cost Evaluation

Table 3.5 provides a summary of the annual O&M and annual lifecycle costs for each alternative. Annual lifecycle costs were calculated annualizing the project cost using a rate of three percent over 20 years. The 3 Stage Bardenpho Bioreactor is the preferred alternative from an economic standpoint as it has the lowest lifecycle.

Table 3.5 Life Cycle Cost Evaluation
Wastewater Treatment Final Master Plan 2015
City of Logan

Alternative	Project Cost (million dollars)	Annual O&M (million dollars)	Annual Life Cycle Cost (million dollars)
Bio-Domes with Tertiary Treatment	$227.7	$5.95	$21.3
3 Stage Bardenpho Bioreactor	$111.6	$5.02	$12.5
Algae Treatment	$239.6	$4.22	$20.3
Conventional Activated Sludge	$144.6	$5.39	$15.1

3.3 NON-ECONOMIC EVALUATION

Criteria used to evaluate the treatment options on a non-economic basis and the associated weighting factors assigned to each are shown in Table 3.6. Weighting factors are assigned based on the relative importance of each criterion. The criteria were ranked for each treatment alternative with a score of 1 to 5. The score was multiplied by the weighting factor to determine the total points. The maximum possible score for any alternative is 100 points. The criteria are described in the following sections, and the results of the evaluation are shown in Table 3.7.

3.3.1 Ease of Operations

This is a measure of the complexity of day-to-day operations for a treatment alternative. The total number of employees and training each requires to conduct daily operations and maintenance are judged. Alternatives that are of lesser complexity, or that are familiar to plant operators, receive the highest score.

Table 3.6	Non-Economic Evaluation Criteria Wastewater Treatment Final Master Plan 2015 City of Logan
Criteria	**Weight**
Ease of Operation/Simplicity	4
Compatibility with Existing Lagoons	2
Process Reliability	5
Effluent Quality	3
Constructability	3
Energy Use/O&M	4
Total	**20**

Table 3.7 Non-Economic Evaluation
Wastewater Treatment Final Master Plan 2015
City of Logan

Category	Weight	Expansion Alternatives							
		Alt No. 1 Bio-Domes		Alt No. 2 Bardenpho		Alt No. 3 Algae-Wheel		Alt No. 4 Conv. AS	
Ease of Operation/Simplicity	4	2	8	5	20	3	12	4	16
Compatibility with Existing Lagoons	2	4	8	3	6	4	8	3	6
Process Reliability	5	1	5	5	25	3	15	4	20
Effluent Quality	3	3	9	5	15	4	12	5	15
Constructability	3	2	6	4	12	2	6	3	9
Energy Use/O&M	3	3	9	4	12	5	15	3	9
Totals	**20**		**45**		**90**		**68**		**75**

3.3.2 Compatibility with Existing Lagoons

This is an evaluation of how well new treatment alternatives make use of the existing lagoons. The existing lagoon system is large and still has value. A treatment system that can utilize the existing system will receive a higher score than those that do not.

3.3.3 Process Reliability

The potential for a treatment alternative to provide consistent and reliable effluent water quality is evaluated in this category. A treatment alternative that has the potential for frequent upsets, or that is difficult to operate in a stable manner receives a lower rating. This is particularly important with regard to treating the proposed phosphorus load limits.

3.3.4 Effluent Quality

This is a measure of the water quality expected from a treatment alternative. Potential to produce a higher quality effluent results in a higher score.

3.3.5 Constructability

This is a measure of the relative ease that the alternative can be implemented, including the overall ease of construction as well as the anticipated impact on existing facilities. Alternatives that include the construction of relatively simple facilities and that do not impact the operation of existing facilities and treatment processes receive a higher score.

3.3.6 Energy Use

Alternatives with lower energy consumption needs are given a higher score than those that require more energy. In addition, alternatives with lower O&M costs receive a higher score.

3.4 RECOMMENDATION

Based on the results of the economic and non-economic alternative evaluations, Alternative 2, the 3-Stage Bardenpho Bioreactor with filtration, is recommended as the treatment alternative of choice. This alternative is less expensive than the other alternatives and provides greater process reliability and ease of operation.

IMPLEMENTATION

4.1 INTRODUCTION

In Chapter 3, Alternative 2, the 3 stage Bardenpho Bioreactor was found to be the preferred treatment alternative. The implementation plan for the recommended alternative is presented in this section. Reuse is also evaluated as a possible alternative to reduce the project cost.

4.2 REUSE

One way to potentially reduce the implementation cost of the selected alternative is to construct a smaller capacity and continue to use the lagoons in parallel with the new treatment facility. For this alternative, 12 mgd capacity of the 3 stage Bardenpho Bioreactor process would be constructed and the lagoons would be used to treat the remainder of the flow. The flow from the lagoons would have to be stored during the winter and used for irrigation in the summertime. To comply with the TMDL, reuse water would have to be applied at agronomic uptake rates.

4.2.1 Reuse Storage Requirements

In order to continue to use the lagoons to treat part of the flow, non-irrigation season storage would need to be provided because the lagoon effluent would not meet the requirements to discharge the water to Cutler Reservoir. Water from the lagoons would have to be stored from October through June each year. Based on a flow of 6.0 mgd through the lagoons, this would amount to 1.64 billion gallons of water that would need to be stored, plus any precipitation. This would equate to 5,027 acre-feet of water, plus precipitation. If the last three cells of the lagoons (Cells C, D and E) were converted to storage, they would provide approximately 590 acre-feet of storage. An additional 4,440 acre-feet would need to be provided outside of the lagoons. If the storage were approximately 10 feet deep, this would require about 522 acres of land to construct the required storage, and accommodate annual precipitation.

4.2.2 Irrigation Requirements

Water from the lagoons would have to be applied at agronomic uptake rates to comply with the TMDL and future DWQ nutrient requirements. The total quantity of water requiring land application would be 2.55 billion gallons (7,826 acre-feet). This water would have an average concentration of 25 mg/L total nitrogen and 3 mg/L total phosphorus. Therefore, the total mass of nutrients to be land applied would be 532,000 pounds of nitrogen and 63,800 pounds of phosphorus.

Based on USDA's crop nutrient uptake data, hay would take up to 13.2 lbs of nitrogen per ton and 1.44 pounds of phosphorus per ton. Alfalfa would take up more nutrients. Nutrient uptake data for hay and alfalfa are shown in Table 4-1 along with the land required for nutrient uptake.

Table 4.1 Nutrient Uptake for Land Application (Hay)
Wastewater Treatment Final Master Plan 2015
City of Logan

	Crop	
	Hay	**Alfalfa**
Nitrogen Uptake Required (lbs)	532,000	532,000
Nitrogen Uptake (lb/ton)	13.2	51.8
Typical Yield (tons/acre)	2.8	3.6
Land Required (acres)	14,400	2,850
Phosphorus Uptake Required (lbs)	63,800	63,800
Phosphorus Uptake (lb/ton)	1.44	5.0
Typical Yield (tons/acre)	2.8	3.6
Land Required (acres)	15,800	3,540

As can be seen in Table 4.1, the land required varies significantly between alfalfa and pasture hay. For both crops, phosphorus uptake controls the acreage required for land application. A minimum of 3,540 acres would be required for land application, assuming alfalfa would be grown.

4.2.3 Feasibility of Reuse

In order to make reuse feasible, the City would have to acquire approximately 4,100 acres. In order to maintain long-term control of the property, the City would need to purchase the land. It could be difficult to acquire the needed land, and the water distribution system would be very expensive and complex if the land is far away from the lagoons or dispersed. The cost of this alternative was estimated to be $180 million (see cost estimate in Appendix F). The cost of this alternative is significantly higher than building the 18 mgd 3 stage Bardenpho Bioreactors with filtration. Therefore, this alternative is not economically feasible. However, the 3 stage Bardeno Bioreactors with filtration will meet Type 1 reuse water quality standards, so water reuse will be possible with the recommend alternative.

Table 4.2 Cost Estimate for Alternative 2 – 3 Stage Bardenpho
Wastewater Treatment Final Master Plan 2015
City of Logan

Item	**Total**
Mobilization/Sitework	$ 10,600,000
Headworks	$ 6,210,000
Bioreactors	$ 17,480,000
Clarifiers	$ 6,836,000
Electrical/SCADA	$ 15,080,000
Filtration/Disinfection Building	$ 9,143,000
Solids Processing	$ 3,440,000
Operations Building	$ 1,750,000
Subtotal	**$ 70,539,000**
(Contingency (25%)	$ 17,635,000
Escalation to Construction Mid-point	$ 5,535,000
Estimated Total Construction Cost (2016 Dollars)	**$ 93,709,000**
Construction Management, Legal & Admin	$ 7,914,000
Subtotal – Plant Construction (2016 Dollars)	**$101,623,000**
City Funded Upfront Costs	
Land Acquisition	$ 1,000,000
Engineering	$ 5,000,000
Estimated Preload Construction	$ 4,000,000
Estimated Total Project Cost (2016 Dollars)	**$111,623,000**
Operations & Maintenance Cost Estimate	
Labor	$ 615,000
Benefits	$ 369,000
Tools/Supplies	$ 120,000
Utilities	$ 835,000
Chemicals	$ 100,000
Laboratory	$ 300,000
Subtotal	**$ 2,339,000**
Misc Items (10%)	$ 234,000
Total Estimated New O&M Cost	**$ 2,573,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 5,023,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$ 11,854,000

4.3 RECOMMENDED PROJECT SUMMARY

The 3 stage Bardenpho Bioreactor process with tertiary filtration is recommended to meet the City's ammonia and phosphorus permit limits. This process will also meet the anticipated future total nitrogen permit limit of 10 mg/L. The project will include a new headworks with grit removal. The secondary treatment process will include six new Bioreactors with anaerobic and anoxic zones to allow for nitrification, denitrification, and biological phosphorus removal. Six clarifiers with Return Activated Sludge (RAS) pumping facility will be provided, and tertiary treatment will include filtration and UV disinfection. The preliminary site plan for the recommended facilities is shown in Figure 4.1. Energy recovery was evaluated previously. It was determined that energy recovery would not be included in the project at this time due to the significant cost required. A copy of the energy recovery evaluation is included in Appendix H. The cost of the recommended alternative is shown in Table 4.2.

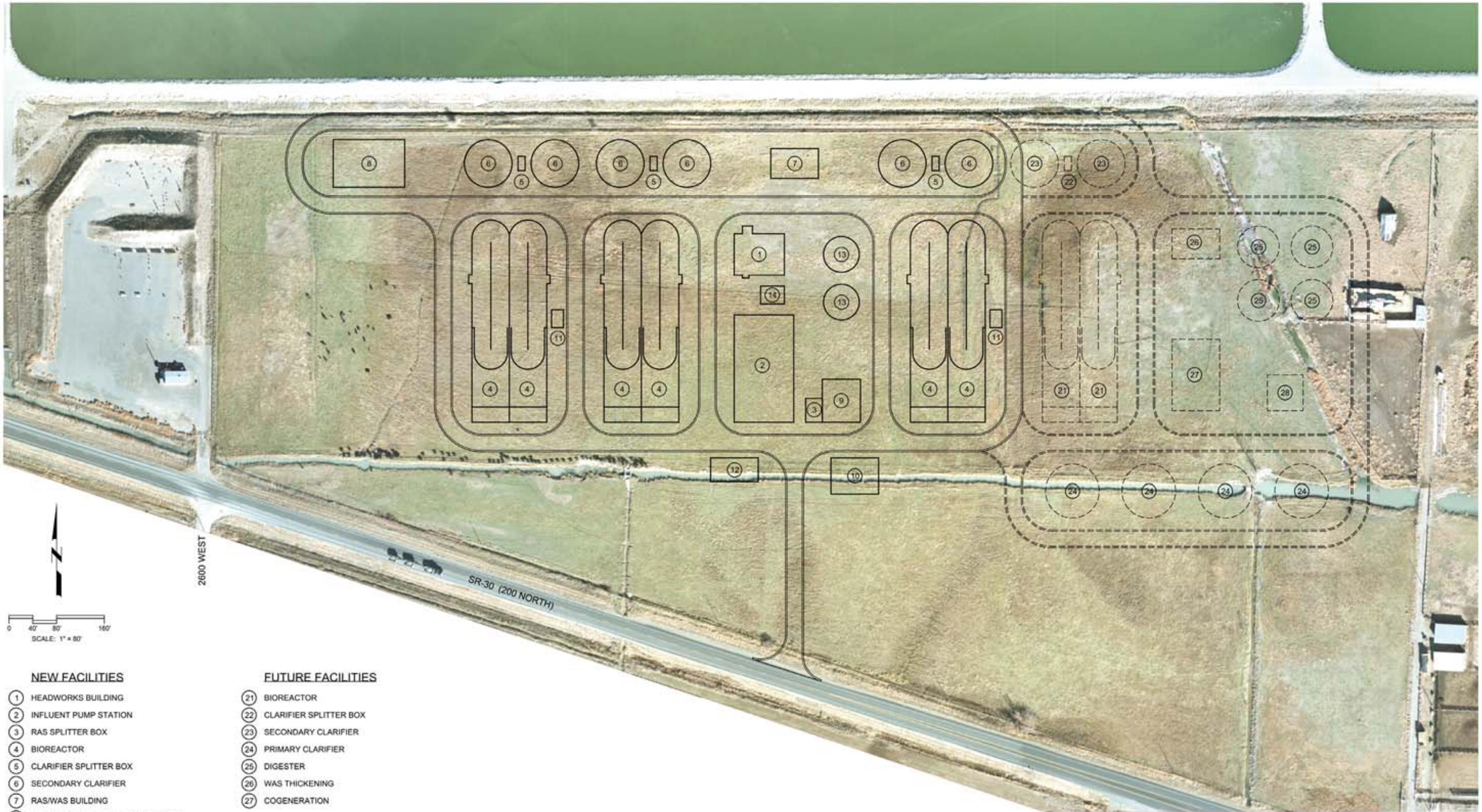
4.3.1 Anti-Degradation Review

The proposed process will meet the proposed water quality limits and will improve the receiving water quality. All of the concentration and mass loadings for water quality parameters will be improved. Table 4.3 summarizes the existing limits and mass loadings and Table 4.4 summarized the proposed limits and mass loadings.

The DWQ Anti-Degradation Review form has been completed and is included in Appendix I.

4.4 IMPLEMENTATION SCHEDULE

The City's existing permit includes a compliance schedule for implementing phosphorus and ammonia removal. This schedule required the City to comply with the new permit limits by January 1, 2021. The anticipated implementation schedule is shown in Table 4.5.



NEW FACILITIES

1. HEADWORKS BUILDING
2. INFLUENT PUMP STATION
3. RAS SPLITTER BOX
4. BIOREACTOR
5. CLARIFIER SPLITTER BOX
6. SECONDARY CLARIFIER
7. RAS/WAS BUILDING
8. TERTIARY TREATMENT / UV BUILDING
9. DEWATERING BUILDING
10. OPERATIONS BUILDING
11. ELECTRICAL BUILDING
12. EMERGENCY GENERATOR BUILDING
13. WAS STORAGE TANKS
14. ODOR CONTROL FACILITY

FUTURE FACILITIES

21. BIOREACTOR
22. CLARIFIER SPLITTER BOX
23. SECONDARY CLARIFIER
24. PRIMARY CLARIFIER
25. DIGESTER
26. WAS THICKENING
27. COGENERATION

CONCEPTUAL SITE PLAN

FIGURE 4.1

LOGAN CITY
WASTEWATER TREATMENT FINAL MASTER PLAN 2015

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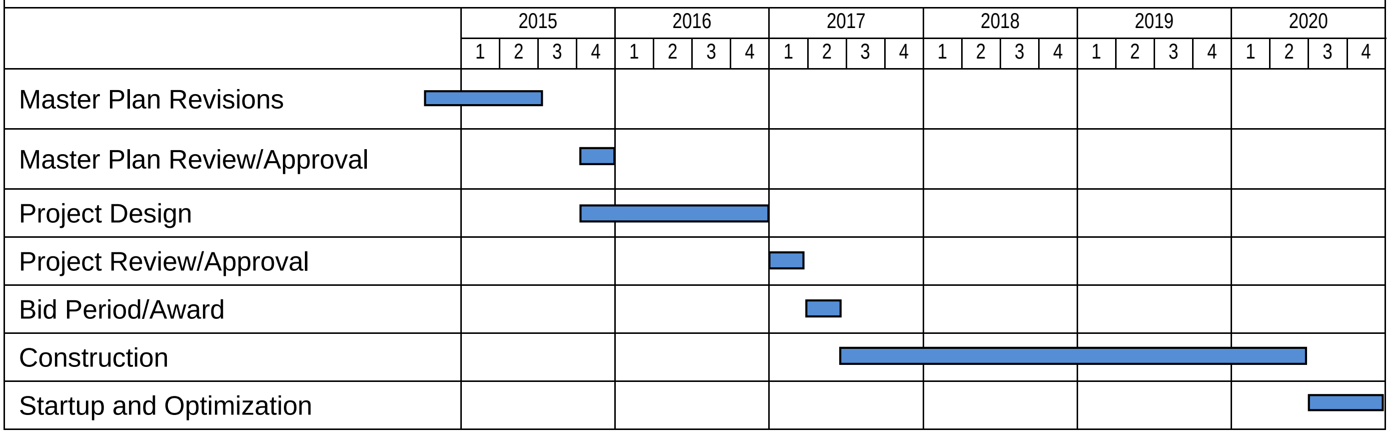
Table 4.3	Existing Limits and Mass Loadings Wastewater Treatment Final Master Plan 2015 City of Logan			
	Season			
Existing Limits	**Summer**	**Fall**	**Winter**	**Spring**
Permitted Flow (mgd)	22.0	21.0	16.0	21.0
Ammonia Daily Max (mg/L)	9.1	11.2	14.4	11.9
Ammonia Loading (lb/day)	1,670	1,960	1,920	2,080
Ammonia – 30 Day Average (mg/L)	No Limit	No Limit	No Limit	No Limit
BOD – 30 Day Average (mg/L	25	25	25	25
BOD – 30 Day Mass Loading (lb/day)	4,590	4,380	3,340	4,380
TSS – 30 Day Average (mg/L)	25	25	25	25
TSS – 30 Day Mass Loading (lb/day)	4,590	4,380	3,340	4,380
Total Phosphorus Mass Loading	No Limit	No Limit	No Limit	No Limit

Table 4.4	Proposed Limits and Mass Loadings Wastewater Treatment Final Master Plan 2015 City of Logan			
	Season			
Proposed Limits	**Summer**	**Fall**	**Winter**	**Spring**
Projected Flow (mgd)	24	18	15	18
Daily Max Ammonia Limit (mg/L)	6.0	7.0	5.0	8.0
Daily Max Ammonia Loading (lb/day)	1,200	1,050	626	1,070
Ammonia – 30 Day Average (mg/L)	1.3	2.6	3.0	3.0
Ammonia – 30 Day Mass Loading (lb/day)	260	390	375	400
Expected BOD – 30 Day Average (mg/L	<10	<10	<10	<10
BOD – 30 Day Mass Loading (lb/day)	2,000	1,500	1,250	1,330
Expected TSS – 30 Day Average (mg/L)	<10	<10	<10	<10
TSS – 30 Day Mass Loading (lb/day)	2,000	1,500	1,250	1,330
Total Phosphorus Mass Loading (lb/day)	138	-	157	-

.

Table 4.5 Implementation Schedule
Wastewater Treatment Final Master Plan 2015
City of Logan



4.5 PUBLIC PARTICIPATION PLAN

The City and the Design Team will take a proactive approach to community involvement. The project has been presented to the City Council multiple times for discussion and public input. The need for the project will be explained and the costs of the project will be discussed.

4.6 FINANCING

The primary source of funding is from the State of Utah's Department of Environmental Quality, Division of Water Quality ("DWQ") in the form of $70 million dollar, low interest loan (0.75%). The City has also secured a $10 million dollar, low interest loan (1.5%) from the State of Utah's Permanent Community Impact Board ("CIB"). The City has increased sewer rates over the past several years in anticipation of this project, and has begun accumulating capital reserve funds. The City has accumulated $21 million in capital reserve funds for this project. The balance of the financing for Logan City's proposed wastewater treatment plant will come in the form of City cash reserves or tax-exempt bonding in the public markets. Table 4.6 on the following page outlines the sources of funds and the associated monthly increase in the sewer treatment fees.

Table 4.5 Treatment Fee Increase Matrix
Wastewater Treatment Final Master Plan 2015
City of Logan

Financing	Amount ($M)	Rate	Term	Estimated Monthly Treatment Fee Increase
DWQ Loan	$70	0.75%	20 Years	$10.01 (1.29% Blended Rate)
CIB Loan	$10	1.5%	20 Years	
Project Bond	$10	4.86%	20 Years	
City Cash on Hand	$21	N/A	N/A	

Appendix A

DWQ COORESPONDENCE

State of Utah
GARY R. HERBERT
Governor
GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

FILE COPY

Document Date 1/31/2013
DWQ-2013-001385

JAN 3 1 2013

Issa Hamud
Environmental Department
Logan City Corporation
450 North 1000 West
Logan UT 84321

Dear Mr. Hamud:

Subject: New Proposed Ammonia Limits for Logan City Lagoons UPDES Permit No. UT0021920

On September 26, 2012, we notified Logan City Corporation as to an anticipated change to the ammonia limits in the Logan City Corporation Wastewater Treatment Plant's UPDES permit. As stated in the previous letter, these changes were necessitated by a rule change required by EPA and adopted by the Water Quality Board in October 2008 which extended the chronic ammonia criteria from 3A and 3B waters to include 3C and 3D waters.

After much discussion and collaboration with Logan City that resulted in incorporating many new data sources, the Division has established ammonia limits in a draft wasteload analysis. The wasteload analysis was conducted for projected effluent flows and quality in 2037, which were provided by Carollo Engineers assuming a hybrid facility with a 12 MGD mechanical treatment plant in combination with the existing lagoons. Note that should the projected effluent flow or quality (temperature, pH, and alkalinity) change appreciably during the planning and engineering process, the limits may need to be revisited and modified. The wasteload established the following effluent limits for Logan's discharge:

Logan Utah Expected Effluent Limits for Ammonia, mg/L

Season:	Winter	Spring	Summer	Fall
Monthly Average	3.0	3.0	1.3	2.6
Daily Maximum	5.0	8.0	6.0	7.0

The complete wasteload analysis is attached to this letter. The WLA is part of the draft permit package and will be subject to a 30 day public comment period to be scheduled in the coming weeks, along with the renewal permit and fact sheet and statement of basis.

We appreciate the efforts that Logan City is undertaking to address the water quality of Cutler Reservoir. If you have any questions regarding this matter, please contact Mr. Lonnie Shull at (801) 536-4394, or via e-mail at lshull@utah.gov.

Sincerely,

Walter L. Baker, P.E.
Director

WLB:NvS:ls:mc

Enclosure: 1. WLA, (DWQ-2013-00-1297)

cc: John Mackey, DWQ (w/o encl)

DWQ-2013-001296

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Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review
TREATMENT PLANT UPGRADE – PHASE 1 TO 2037

Date: **January 10, 2013**

Prepared by: **Nicholas von Stackelberg, P.E.**
Water Quality Management Section

Facility: **Logan Wastewater Treatment Plant, Logan, UT**
UPDES No. UT0021920

Receiving water: **Swift Slough (2B, 3B, 3D, 4)**

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge
This wasteload is for the proposed treatment plant upgrade for phase 1 to 2037. The proposed project involves construction of a mechanical treatment plant with a design capacity of 12 MGD. The remainder of flows would be treated by the existing lagoon system. The existing polishing wetlands would no longer be used for wastewater treatment.

Design data for the treatment facility was provided by Carollo Engineers under contract to Logan City. The design parameters for the discharge are summarized in Table 1 for the year 2037.

Table 1: Discharge in 2037

Duration	Flow (MGD)		pH		Temperature (deg C)	
	Max. Daily	Max. Monthly	Max. Daily	Max. Monthly	Max. Daily	Max. Monthly
Summer (Jun-Aug)	25.4	23.7	8.2	8.1	20.0	19.9
Fall (Sep-Nov)	25.4	20.5	8.2	8.0	14.7	15.4
Winter (Dec-Feb)	35.0	20.3	8.4	8.0	4.7	6.9
Spring (Mar May)	21.3	16.5	8.0	7.8	12.3	12.6

Outfall 001: Unnamed Irrigation Ditch→Swift Slough

Receiving Water

The receiving water for Outfall 001 is an unnamed irrigation ditch that will convey the effluent from the treatment plant to Swift Slough. The beneficial uses for the irrigation ditch are presumed 2B, 3E, and 4 per UAC R317-2-13.9. The irrigation ditch has no background flow during critical conditions.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*
- *Class 3E - Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.*
- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

The unnamed irrigation ditch drains approximately 2.8 miles to Swift Slough. Swift Slough is tributary to Cutler Reservoir. Per UAC R317-2-13.3.a, the designated beneficial uses for Swift Slough (Bear River and tributaries, from Great Salt Lake to Utah-Idaho border) are 2B, 3B, 3D, and 4.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*
- *Class 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*
- *Class 3D - Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*
- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

Typically, the critical flow for the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Flow records from Swift Slough immediately upstream of Outfall 002 were provided by Logan City for the years 2004-2010. Since this is not a long enough flow record to compute the 7Q10 flow, the lowest 7-day average flow while the wetlands were discharging for each season was used (Table 2).

Table 2: Seasonal critical low flow

Season	Background Flow (cfs)	
	Ditch	Swift Slough
Summer	0.0	4.0
Fall	0.0	8.4
Winter	0.0	8.8
Spring	0.0	2.9

TMDL

Cutler Reservoir has an approved TMDL for total phosphorus (TP) (*Middle Bear River and Cutler Reservoir TMDLs, 2010*). The TMDL allocated load for TP from Logan City Wastewater Treatment Plant is 4,405 kg for May through October and 11,831 kg for November through April.

Mixing Zone

The discharge is considered instantaneously fully mixed since the discharge is more than twice the background receiving water flow. Therefore, no mixing zone is allowed.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), BOD5, total phosphorus (TP), total nitrogen (TN), total ammonia (TAM), E. coli, pH, total residual chlorine (TRC), total copper, and total lead as determined in consultation with the UPDES Permit Writer.

Water Quality Modeling

A QUAL2Kw model of the receiving water was built and calibrated. The model was calibrated to synoptic survey data collected in September of 2011 by DWQ staff.

Receiving water quality data was primarily obtained from the synoptic survey conducted for the model calibration from 9/15 to 9/19/2011. The sampling site was on the Swift Slough immediately above the plant discharge. Limited water quality data was obtained from STORET 4905050 Swift Slough below confluence with Logan Lagoons Effluent and STORET 4905070 Swift Slough at 1300 West. The average value was calculated for each constituent in the receiving water.

The calibrated model was used for determining WQBELs. Effluent concentrations were adjusted so that water quality standards were not exceeded at the end of the mixing zone. The calibration model and the wasteload model are available for review by request.

WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC_{50} (lethal concentration, 50%) percent effluent for acute toxicity and the IC_{25} (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC_{50} is typically 100% effluent and does not need to be determined by the WLA.

Table 3: WET Limits

Season	Percent Effluent
Summer	91%
Fall	82%
Winter	81%
Spring	93%

Effluent Limits

The effect of the effluent on the DO in the receiving water was evaluated using the QUAL2Kw model. Due to light and substrate limitation, significant algal growth downstream of the discharge was neither observed nor predicted in the model. Therefore, WQBELs are not required for nitrogen and phosphorus due to algal growth in the Swift Slough. However, as a result of the TMDL for Cutler Reservoir, effluent limits are required for TP. In addition, limits are required for DO to meet instream criteria.

Limits for total residual chlorine were not determined since the proposed treatment plant includes ultraviolet radiation for disinfection.

Table 4: Water Quality Based Effluent Limits

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Ammonia (mg/L)[1]						
Summer	Varies with pH	6.0	1 hour	Varies with pH and temper-ature	1.3	30 days
Fall		7.0			2.6	
Winter		5.0			3.0	
Spring		8.0			3.0	
Min. Dissolved Oxygen (mg/L)	3.0	5.0	Instantaneous	5.5	5.5	30 days
BOD_5 (mg/L)[2]	None	25	7 days	None	35	30 days
1: Ammonia limit due to toxicity requirements.						

QUAL2Kw rates, input and output for DO and nutrient related constituents are summarized in Appendix A.

Simple mixing analysis input and output for conservative constituents are summarized in Appendix B.

Effluent limits for Outfall 001 are summarized in Appendix C.

Models and supporting documentation are available for review upon request.

Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remain below the WQBELs presented in this wasteload.

A Level II Antidegradation Review (ADR) is required for this discharge since the allowable pollutant load will increase with the treatment plant upgrade.

WLA Document: *logan_potw_wla_upgrade_2037_final.docx*
QUAL2Kw Wasteload Model: *logan_potw_wla_upgrade_2037.xlsm*
QUAL2Kw Calibration Model: *logan_q2k_cal_1.3.xlsm*

WASTELOAD ANALYSIS [WLA] Date: 1/9/2013
Appendix A: QUAL2Kw Analysis Results

Discharging Facility:	Logan WWTP		
UPDES No:	UT-0021920		
Permit Flow [MGD]:	25.40	Summer (July-Sept)	Max. Daily
	25.40	Fall (Oct-Dec)	Max. Daily
	35.00	Winter (Jan-Mar)	Max. Daily
	21.30	Spring (Apr-June)	Max. Daily
	23.70	Summer (July-Sept)	Max. Monthly
	20.50	Fall (Oct-Dec)	Max. Monthly
	20.30	Winter (Jan-Mar)	Max. Monthly
	16.50	Spring (Apr-June)	Max. Monthly

Receiving Water:	Swift Slough	
Stream Classification:	2B, 3B, 3D, 4	
Stream Critical Low Flow [cfs]:	3.98	Summer (July-Sept)
	8.40	Fall (Oct-Dec)
	8.82	Winter (Jan-Mar)
	2.88	Spring (Apr-June)

Fully Mixed:	YES
Acute River Width:	100%
Chronic River Width:	100%

Modeling Information

A QUAL2Kw model was used to determine these effluent limits.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis.
Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Headwater/Upstream Information	Summer	Fall	Winter	Spring
Flow (cfs)	4.0	8.4	8.8	2.9
Temperature (deg C)	21.6	12.3	1.5	14.9
Specific Conductance (μmhos)	850	610	533	619
Inorganic Suspended Solids (mg/L)	26.5	26.5	26.5	26.5
Dissolved Oxygen (mg/L)	5.8	9.0	12.1	9.4
$CBOD_5$ (mg/L)	4.4	4.4	4.4	4.4
Organic Nitrogen (mg/L)	0.084	0.084	0.084	0.084
NH4-Nitrogen (mg/L)	0.025	0.025	0.025	0.025
NO3-Nitrogen (mg/L)	0.270	0.270	0.270	0.270
Organic Phosphorus (mg/L)	0.025	0.025	0.025	0.025
Inorganic Ortho-Phosphorus (mg/L)	0.025	0.025	0.025	0.025
Phytoplankton (μg/L)	2.6	2.6	2.6	2.6
Detritus [POM] (mg/L)	3.6	3.6	3.6	3.6
Alkalinity (mg/L)	225	225	225	225
pH	8.1	8.0	8.0	8.2

Discharge Information

Acute	Summer	Fall	Winter	Spring
Flow (cfs)	25.4	25.4	35.0	21.3
Temperature (deg C)	20.0	14.7	4.7	12.3
Specific Conductance (μmhos)	735	735	735	735
Inorganic Suspended Solids (mg/L)	35.7	35.7	35.7	35.7
Dissolved Oxygen (mg/L)	5.0	5.0	5.0	5.0
$CBOD_5$ (mg/L)	35.0	35.0	35.0	35.0
Organic Nitrogen (mg/L)	5.000	5.000	5.000	5.000
NH4-Nitrogen (mg/L)	6.000	7.000	5.000	8.000
NO3-Nitrogen (mg/L)	5.000	5.000	5.000	5.000
Organic Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Inorganic Ortho-Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Phytoplankton (μg/L)	168.000	168.000	168.000	168.000
Detritus [POM] (mg/L)	0.000	0.000	0.000	0.000
Alkalinity (mg/L)	272	272	272	272
pH	8.2	8.2	8.4	8.0

Chronic	Summer	Fall	Winter	Spring
Flow (cfs)	23.7	20.5	20.3	16.5
Temperature (deg C)	19.9	15.4	6.9	12.6
Specific Conductance (μmhos)	735	735	735	735
Inorganic Suspended Solids (mg/L)	35.7	35.7	35.7	35.7
Dissolved Oxygen (mg/L)	5.5	5.5	5.5	5.5
$CBOD_5$ (mg/L)	25.0	25.0	25.0	25.0
Organic Nitrogen (mg/L)	5.000	5.000	5.000	5.000
NH4-Nitrogen (mg/L)	1.300	2.600	3.000	3.000
NO3-Nitrogen (mg/L)	5.000	5.000	5.000	5.000
Organic Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Inorganic Ortho-Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Phytoplankton (μg/L)	168.000	168.000	168.000	168.000
Detritus [POM] (mg/L)	0.000	0.000	0.000	0.000
Alkalinity (mg/L)	272	272	272	272
pH	8.1	8.0	7.9	7.8

All model numerical inputs, intermediate calculations, outputs and graphs are available for review and comment at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitation for Biological Oxygen Demand (BOD_5) based upon Secondary Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD5 limitation as follows:

	Concentration		
Season	Chronic	Acute	
Summer	25.0	35.0	mg/L as CBOD5
Fall	25.0	35.0	mg/L as CBOD5
Winter	25.0	35.0	mg/L as CBOD5
Spring	25.0	35.0	mg/L as CBOD5

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards
In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent DO limitation as follows:

	Dissolved Oxygen		
Season	**Chronic**	**Acute**	
Summer	5.5	5.0	mg/L
Fall	5.5	5.0	mg/L
Winter	5.5	5.0	mg/L
Spring	5.5	5.0	mg/L

Effluent Limitation for Total Phosphorus based upon TMDL
In-stream criteria of downstream segments for Dissolved Oxygen will be met with effluent TP limitation as follows:

	Total Phosphorus	
Season	**Load**	
May - October	4,405	kg
November - April	11,831	kg

Effluent Limitation for Total Ammonia based upon Water Quality Standards
In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

	Total Ammonia		
Season	**Chronic**	**Acute**	
Summer	1.3	6.0	mg/L as N
Fall	2.6	7.0	mg/L as N
Winter	3.0	5.0	mg/L as N
Spring	3.0	8.0	mg/L as N

Summary Comments
The mathematical modeling and best professional judgement indicate that violations of receiving water beneficial uses with their associated water quality standards, including important down-stream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

Coefficients and Other Model Information

Parameter	*Value*	*Units*
Stoichiometry:		
Carbon	40	gC
Nitrogen	7.2	gN
Phosphorus	1	gP
Dry weight	100	gD
Chlorophyll	1	gA
Inorganic suspended solids:		
Settling velocity	2	m/d
Oxygen:		
Reaeration model	Internal	
Temp correction	1.024	
Reaeration wind effect	None	
O2 for carbon oxidation	2.69	gO2/gC
O2 for NH4 nitrification	4.57	gO2/gN
Oxygen inhib model CBOD oxidation	Exponential	
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2
Oxygen inhib model nitrification	Exponential	
Oxygen inhib parameter nitrification	0.60	L/mgO2
Oxygen enhance model denitrification	Exponential	
Oxygen enhance parameter denitrification	0.60	L/mgO2
Oxygen inhib model phyto resp	Exponential	
Oxygen inhib parameter phyto resp	0.60	L/mgO2
Oxygen enhance model bot alg resp	Exponential	
Oxygen enhance parameter bot alg resp	0.60	L/mgO2
Slow CBOD:		
Hydrolysis rate	0	/d
Temp correction	1.047	
Oxidation rate	0.240778	/d
Temp correction	1.047	
Fast CBOD:		
Oxidation rate	10	/d
Temp correction	1.047	
Organic N:		
Hydrolysis	0.2964425	/d
Temp correction	1.07	
Settling velocity	0.147494	m/d
Ammonium:		
Nitrification	0.0772945	/d
Temp correction	1.07	
Nitrate:		
Denitrification	1.8113375	/d
Temp correction	1.07	
Sed denitrification transfer coeff	0.22471	m/d
Temp correction	1.07	
Organic P:		
Hydrolysis	0.1360275	/d
Temp correction	1.07	
Settling velocity	0.11495	m/d
Inorganic P:		
Settling velocity	0.02022	m/d
Sed P oxygen attenuation half sat constant	1.40616	mgO2/L

Phytoplankton:		
Max Growth rate	1.99746	/d
Temp correction	1.07	
Respiration rate	0.49199	/d
Temp correction	1.07	
Death rate	0.97217	/d
Temp correction	1	
Nitrogen half sat constant	22.0366	ugN/L
Phosphorus half sat constant	1.95708	ugP/L
Inorganic carbon half sat constant	1.30E-05	moles/L
Phytoplankton use HCO3- as substrate	Yes	
Light model	Smith	
Light constant	97.3006	langleys/d
Ammonia preference	27.86895	ugN/L
Settling velocity	0.326705	m/d
Bottom Plants:		
Growth model	Zero-order	
Max Growth rate	7.262455	gD/m2/d or /d
Temp correction	1.07	
First-order model carrying capacity	100	gD/m2
Basal respiration rate	0.1455158	/d
Photo-respiration rate parameter	0.39	unitless
Temp correction	1.07	
Excretion rate	0.202475	/d
Temp correction	1.07	
Death rate	3.8662	/d
Temp correction	1.07	
External nitrogen half sat constant	288.016	ugN/L
External phosphorus half sat constant	98.1445	ugP/L
Inorganic carbon half sat constant	1.19E-04	moles/L
Bottom algae use HCO3- as substrate	Yes	
Light model	Half saturation	
Light constant	89.3608	langleys/d
Ammonia preference	21.65055	ugN/L
Subsistence quota for nitrogen	0.5779116	mgN/gD
Subsistence quota for phosphorus	0.1656965	mgP/gD
Maximum uptake rate for nitrogen	636.1775	mgN/gD/d
Maximum uptake rate for phosphorus	136.553	mgP/gD/d
Internal nitrogen half sat ratio	3.4205925	
Internal phosphorus half sat ratio	2.539308	
Nitrogen uptake water column fraction	1	
Phosphorus uptake water column fraction	1	
Detritus (POM):		
Dissolution rate	1.1092505	/d
Temp correction	1.07	
Settling velocity	0.125501	m/d
pH:		
Partial pressure of carbon dioxide	370	ppm

Atmospheric Inputs:	Summer	Fall	Winter	Spring
Max. Air Temperature, F	85.7	45.5	36.9	67.5
Min. Air Temperature, F	57.5	27.9	19.7	43.6
Dew Point, Temp., F	55.7	30.9	22.4	46.2
Wind, ft./sec. @ 21 ft.	5.7	3.5	3.2	5.6
Cloud Cover, %	0.1	0.1	0.1	0.1

Other Inputs:		
Bottom Algae Coverage	100.0%	
Bottom SOD Coverage	100.0%	
Prescribed SOD	0.0	gO2/m2/d

WASTELOAD ANALYSIS [WLA] Date: 1/9/2013

Appendix B: Simple Mixing Analysis for Conservative Constituents

Discharging Facility:	Logan WWTP		
UPDES No:	UT-0021920		
Permit Flow [MGD]:	25.40	Summer (July-Sept)	Max. Daily
	25.40	Fall (Oct-Dec)	Max. Daily
	35.00	Winter (Jan-Mar)	Max. Daily
	21.30	Spring (Apr-June)	Max. Daily
	23.70	Summer (July-Sept)	Max. Monthly
	20.50	Fall (Oct-Dec)	Max. Monthly
	20.30	Winter (Jan-Mar)	Max. Monthly
	16.50	Spring (Apr-June)	Max. Monthly

Receiving Water:	Unnamed Irrigation Ditch		
Stream Classification:	2B, 3E, 4		
Stream Flows [cfs]:	0.0	All Seasons	Critical Low Flow

Downstream Receiving Water:	Swift Slough		
Stream Classification:	2B, 3B, 3D, 4		
Stream Flows [cfs]:	3.98	Summer (Jun-Aug)	Critical Low Flow
	8.40	Fall (Sep-Nov)	
	8.82	Winter (Dec-Feb)	
	2.88	Spring (Mar-May)	

Fully Mixed:	YES
Acute River Width:	100%
Chronic River Width:	100%

Modeling Information

A simple mixing analysis was used to determine these effluent limits.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis. Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Headwater/Upstream Information

	Ditch cfs	Swift Slough cfs
Summer	0.0	4.0
Fall	0.0	8.4
Winter	0.0	8.8
Spring	0.0	2.9

Discharge Information

	Flow MGD	
	Max. Daily	Monthly Ave.
Summer	25.4	23.7
Fall	25.4	20.5
Winter	35.0	20.3
Spring	21.3	16.5

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitations for Protection of Recreation (Class 2B Waters)

No dilution in unnamed irrigation ditch.

Physical Parameter	Maximum Concentration
pH Minimum	6.5
pH Maximum	9.0
Turbidity Increase (NTU)	10.0

Bacteriological	
E. coli (30 Day Geometric Mean)	206 (#/100 mL)
E. coli (Maximum)	668 (#/100 mL)

Effluent Limitations for Protection of Aquatic Wildlife (Class 3B Waters)

Dilution in Swift Slough - summer season flows used.

Physical Parameter	Maximum Concentration
Temperature (deg C)	27
Temperature Change (deg C)	4

Inorganics	Chronic Standard (4 Day Average)	Acute Standard (1 Hour Average)
Parameter	Standard	Standard
Phenol (mg/L)		0.010
Hydrogen Sulfide (Undissociated) [mg/L]		0.002

Dissolved Metals	Chronic Standard (4 Day Average)[1]			Acute Standard (1 Hour Average)[1]		
Parameter	Standard	Background[2]	Limit	Standard	Background[2]	Limit
Aluminum (µg/L)	87.0	58.3	90.1	750.0	58.3	820.0
Arsenic (µg/L)	150.0	100.5	155.4	340.0	100.5	364.2
Cadmium (µg/L)	0.5	0.3	0.5	4.9	0.3	5.4
Chromium VI (µg/L)	11.0	7.4	11.4	16.0	7.4	16.9
Chromium III (µg/L)	157.0	105.2	162.6	1206.7	105.2	1318.2
Copper (µg/L)	19.6	13.1	20.3	31.9	13.1	33.8
Cyanide (µg/L)	22.0	14.7	22.8	5.2	14.7	4.2
Iron (µg/L)				1000.0	670.0	1033.4
Lead (µg/L)	6.7	4.5	7.0	172.3	4.5	189.3
Mercury (µg/L)	0.012	0.008	0.012	2.4	0.0	2.6
Nickel (µg/L)	112.9	75.6	116.9	1016.5	75.6	1111.7
Selenium (µg/L)	4.6	3.1	4.8	18.4	3.1	19.9
Silver (µg/L)				15.6	10.4	16.1
Tributylin (µg/L)	0.072	0.048	0.075	0.46	0.05	0.50
Zinc (µg/L)	256.8	172.0	266.0	254.7	172.0	263.1

1: Based upon a Hardness of 250 mg/l as CaCO3
2: Background concentration assumed 67% of chronic standard

Organics [Pesticides]	**Chronic Standard (4 Day Average)**			**Acute Standard (1 Hour Average)**		
Parameter	**Standard**	**Background[1]**	**Limit**	**Standard**	**Background[1]**	**Limit**
Aldrin (µg/L)				1.5	1.0	1.6
Chlordane (µg/L)	0.0043	0.0029	0.0045	1.2	0.0	1.3
DDT, DDE (µg/L)	0.001	0.001	0.001	0.55	0.00	0.61
Diazinon (µg/L)	0.17	0.11	0.18	0.17	0.11	0.18
Dieldrin (µg/L)	0.0056	0.0038	0.0058	0.24	0.00	0.26
Endosulfan, a & b (µg/L)	0.056	0.038	0.058	0.11	0.04	0.12
Endrin (µg/L)	0.036	0.024	0.037	0.086	0.024	0.092
Heptachlor & H. epoxide (µg/L)	0.0038	0.0025	0.0039	0.26	0.00	0.29
Lindane (µg/L)	0.08	0.05	0.08	1.0	0.1	1.1
Methoxychlor (µg/L)				0.03	0.02	0.03
Mirex (µg/L)				0.001	0.001	0.001
Nonylphenol (µg/L)	6.6	4.4	6.8	28.0	4.4	30.4
Parathion (µg/L)	0.0130	0.0087	0.0135	0.066	0.009	0.072
PCB's (µg/L)	0.014	0.009	0.015			
Pentachlorophenol (µg/L)	15.0	10.1	15.5	19.0	10.1	19.9
Toxephene (µg/L)	0.0002	0.0001	0.0002	0.73	0.00	0.80

1: Background concentration assumed 67% of chronic standard

Radiological	**Maximum Concentration**		
Parameter	**Standard**	**Background[1]**	**Limit**
Gross Alpha (pCi/L)	15	10.1	-12.2

1: Background concentration assumed 67% of chronic standard; TDS is based on observed ambient data

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

No dilution in unnamed irrigation ditch.

	Maximum Concentration	
Parameter	**Standard**	**Limit**
Total Dissolved Solids (mg/L)	1200	1200
Boron (µg/L)	75	75
Arsenic (µg/L)	100	100
Cadmium (µg/L)	10	10
Chromium (µg/L)	100	100
Copper (µg/L)	200	200
Lead (µg/L)	100	100
Selenium (µg/L)	50	50
Gross Alpha (pCi/L)	15	15

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

FEB 0 6 2013

Issa Hamud, P.E.
Environmental Director
Logan City Corporation
450 North 1000 West
Logan City, UT 84321

Dear Mr. Hamud:

Subject: City of Logan Wastewater Treatment Master Plan

The Division of Water Quality (Division) has been working with you and your staff to establish the UPDES discharge permit requirements for Logan's wastewater treatment plant. New permit requirements, specifically for the pollutant ammonia, were anticipated as a result of a recent rule change that affects discharges into Category 3C and 3D waters, including Swift Slough and Cutler Reservoir. The Division has completed its waste load analysis for Logan's discharge as part of the city's permit renewal process and the proposed new effluent limits for ammonia were reported to you under separate cover in a letter from Walt Baker dated January 31, 2013. In summary, the new effluent limits for Logan's discharge will be as follows:

Logan Utah Expected Effluent Limits for Ammonia, mg/L as N

Season:	Winter	Spring	Summer	Fall
Monthly Average	3.0	3.0	1.3	2.6
Daily Maximum	5.0	8.0	6.0	7.0

The Division recognizes that Logan's existing wastewater treatment system will be unable to consistently meet the new ammonia limits without major technology upgrade and capital expenditure. For planning purposes, the new wastewater treatment works must be designed and constructed to be in compliance with the effluent ammonia limits by October 1, 2017, consistent with the compliance date for Logan's total phosphorus discharge.

Logan has submitted a master plan for upgrading its plant; however, the master plan did not address the need for ammonia removal and must be updated. Logan will need to re-evaluate alternatives for upgrading its treatment works in the context of the new ammonia limits. The Division believes that the city will be challenged to consistently meet the ammonia limits for the design waste loadings and the proposed (phased) treatment system alternatives that were presented in the master plan. In updating the master plan, the alternatives evaluated should all be capable of consistently meeting effluent limits. Seasonal flow balances and pollutant mass balances (including return flows and mass loads) demonstrating permit compliance must be completed for all alternatives analyzed and must be submitted as part of the updated master plan.

For any wastewater treatment alternatives involving continued use of the lagoon system, we believe that it will be critical for Logan to have a good understanding of the hydraulic losses that occur across this system. This understanding will be necessary to accurately demonstrate permit (ammonia) compliance for any alternative that blends treated effluent from the lagoons and a new mechanical treatment plant while minimizing the cost for new treatment works. Because of its importance in the development of a cost effective design, the Division requires that Logan conduct a quantitative analysis of seepage losses through the lagoon liner and that the results of this analysis be used in the flow and pollutant mass balances of its designs.

In the master plan alternatives evaluation, the Division will require that at least one wastewater treatment alternative is developed for the full-flow treatment by a mechanical treatment plant. This is necessary as part of our project funding and "affordability" analysis.

Also as part of the updated master plan, a more thorough assessment of the sewage sludge management approach must be developed. We understand that Logan is planning to dispose sewage sludge from its wastewater treatment operations in the existing sewage lagoons. The Division has a number of concerns about this approach, particularly with respect to the potential accumulation of sludge in the lagoons, the facility's ability to treat and/or remove accumulated sludge, nutrient release, and the potential these conditions have for creating permit exceedences and nuisance conditions. To address these concerns, further analysis is needed.

In the updated master plan, Logan must complete an analysis of the proposed sewage sludge disposal operation. The sewage sludge disposal analysis must identify effective alternatives considered and must establish the expected performance and effectiveness, including costs, of the recommended alternative.

In the sewage sludge disposal analysis the city must demonstrate, e.g., by calculation, that the lagoon system is capable of and has sufficient capacity for effective treatment and disposal of the sewage sludge generated throughout the design period. These calculations must address:

1. Loadings on primary cells;
2. Aeration capacity in the primary cells to satisfy the organic loading, including the sewage sludge loading;
3. The solids distribution, accumulation, and carryover potential in the system;
4. Phosphorus release potential and potential impacts on effluent quality (return flows);
5. Ammonification potential and impacts on effluent quality (return flows);
6. Lagoon liner integrity or equivalent groundwater protection analysis;
7. Sewage sludge disposal contingency plans; and
8. Expected life (duration) of lagoon disposal plan.

As with other facilities in Utah disposing sewage sludge in old lagoons, this disposal method will be considered experimental or an "alternative biological process" that must be terminated and replaced if significant public health, environmental, or nuisance problems develop. Sludge levels in the lagoons will be restricted to two feet of sludge blanket thickness. A biosolids management and contingency plan will be required and this plan will be incorporated into the facility's permit.

Additionally, as with wastewater treatment, the Division will require that at least one sewage sludge management alternative is developed for the design flow condition that incorporates mechanical sludge treatment, e.g., as per U.A.C. R317-3-9, Sludge Processing and Disposal. This is necessary as part of our project funding and affordability analysis.

DWQ requests that you update the project wastewater facilities master plan to reflect the comments in this letter and that you then re-submit the master plan for our review and approval. Please submit two (2) copies of the master plan, sealed by a Utah registered engineer. If you have any questions, please contact me at (801) 536-4347 or by email at jkmackey@utah.gov.

Sincerely,

John K. Mackey

John K. Mackey, P. E.
Engineering Section

JKM:JKM:jkm/fb

cc: C. Ashcroft, P.E. Carollo Engineers, 1265 East Fort Union Blvd., Suite 200, Salt Lake City, UT 84047
L. Shull, DWQ UPDES IES
M. Schmitz, DWQ Biosolids Program

DWQ-2013-001383.DOC
FILE: LOGAN 2013/PLANNING/SECTION 3

State of Utah
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GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

MAR 2 8 2013

Bret F. Randall
Attorney at Law
Durham Jones & Pinegar. P.C.
P.O. Box 4050
Salt Lake City, UT 84110

Dear Mr. Randall:

Subject: New Proposed Ammonia Limits, Logan City Wastewater Treatment Plant, UT0021920

In follow up to our meeting of March 20, 2013, I am writing to address questions and concerns that you and Logan City have expressed about the City's proposed Utah Pollutant Discharge Elimination System (UPDES) permit requirements and the City's proposed new treatment works as described in your letter of March 8, 2013. I feel that our meeting was beneficial in that many difficult issues were addressed and a path toward their resolution was identified. Although challenges remain, I appreciate our open discussions and the City's willingness to work with the Division to overcome these challenges, and ultimately to accomplish a successful water quality project.

A major concern of Logan City has been the effects of a new water quality standard for ammonia that applies to the City's UPDES permit. Staff first identified the applicability of the new ammonia standard (for Category 3C receiving streams) to Logan City's discharge in April 2012. We have since discovered that the new standard should have been applied in several of Logan City's previous permits (for Category 3B receiving streams, in this case, Cutler Reservoir). I regret this error and that Logan City began facility planning in October 2010 aware of having to meet the phosphorus limits due to the TMDL but unaware of having to meet a significantly more stringent ammonia limit.

The major ramifications of the new ammonia limits as they apply to Logan City are: (1) implications on the design of the new treatment works that Logan City is planning; (2) the potential costs for altering the proposed treatment works to meet ammonia as well as phosphorus requirements; and (3) the timing requirements for economically meeting these requirements. Many questions have been raised about these ramifications and they have been discussed extensively among my staff and with Logan City's team. Our position and the path forward that was identified during our meeting are outlined below.

The new treatment plant that was recommended in Logan City's April 2012 Master Plan has very good treatment capabilities for removing ammonia and phosphorus. However, with the proposed phased implementation and continued use of the lagoon system to treat a portion of the City's wastewater, several questions remain: is the level of treatment in the proposed initial project phase sufficient to meet the

ammonia limits as well? Can the overall design and operation of the treatment works be optimized to meet these new limits? If so, at what cost? As a path forward, we have asked that Logan City address these technical questions with an analysis that should be part of the Master Plan's detailed analysis of selected alternatives, i.e., for phased alternatives. All alternatives selected for detailed analysis in the Master Plan must be capable of meeting all of Logan City's permit requirements as soon as possible, including ammonia and phosphorus limits. Alternatives that are incapable of meeting the permit limits should be screened out prior to detailed analysis. The "least degrading alternative" must also be considered for the anti-degradation review. We ask that the full treatment works, i.e., without phasing, be considered as an alternative in this regard.

We understand well the high costs of implementing sewerage and treatment works improvements as well as the extreme pressures that these large infrastructure projects have on communities and their limited financial resources. We also recognize that incorporating additional treatment to meet the new ammonia limits will undoubtedly cause these costs to increase. We believe there are a number of opportunities for minimizing these costs, including both technical and financial opportunities. There are many ways that the Division can assist Logan in this regard. As we discussed, until the cost of treatment project is understood, questions of project affordability and financing cannot be fully answered. At this point, it makes sense to hold off from doing a lot of work on the financing component. At the same time, we don't want this critical effort to get stale as we would like to get Logan City's funding request before the Water Quality Board (WQB) in a timely fashion so that we can commit funds to this high priority project. One effort that could be started is completion of a funding application for WQB assistance. The community and financial information requested in the application will help the Division inform the WQB about the funding needs and the priority of this project. If necessary, elements of the funding application can be revised at a later time when there is more certainty about the project scope and cost.

As mentioned above, we are unable to defer compliance with water quality standards. Where we do have flexibility is in the compliance schedule for completion of the new treatment works and bringing it on line. As we discussed in our meeting, we are willing to adjust the compliance schedule if there are defensible reasons why adjustments to the schedule are necessary. Nevertheless, we encourage the City to expeditiously press forward to complete the project planning phase which now must include meeting the stricter ammonia limits. We recognize that unforeseen issues may arise. We wish to work in partnership with the City and will not seek to penalize Logan City by enforcing an unrealistic schedule. By working together diligently to advance the project, to identify problems and possible solutions early, and to maintain good communications, we will succeed in producing a good, cost effective project in a timely manner.

Regarding phosphorus loading in the waste load analysis, the waste load analysis was performed for the case that Outfall 002 (and the wetlands treatment system) would be abandoned, i.e., the point of compliance would be Outfall 001. However, the waste load analysis narrative indicated phosphorus loadings for the opposite case, wherein Outfall 002 would be the point of discharge. We will correct the waste load narrative to reflect the phosphorus loadings of the permit limits for the Outfall 001 discharge. Nevertheless, the calculated effluent limits identified in our January 31, 2013 letter remain the same.

As we go forward, I have asked John Mackey of my staff to act as DWQ's project manager and principal point of contact for the Logan City treatment works project going forward. John will be responsible for coordinating communications within our team and for being the principal point of contact between DWQ and Logan City's team. John will be diligent in this pursuit and I hope that Logan City and its team will feel comfortable in communicating with him regularly regarding water quality aspects of its project. He will be contacting the City soon to coordinate upcoming events. We appreciate your and the City's efforts and commitment toward completion of this important water quality project.

Sincerely,

Walter L. Baker, P.E.
Director

WLB:JKM:jkm:jn

cc: Issa Hamud, P.E., Environmental Director, Logan City Corporation, 450 North 1000 West, Logan City, UT 84321
Kimber Housley, Esq., Logan City
Matt Dugdale, George K. Baum & Company, 15 West South Temple, Suite 1090, Salt lake City, UT 84101
Craig Ashcroft, P.E., Carollo Engineers, 1265 East Fort Union Blvd., Suite 200, Salt Lake City, UT 84047
Amanda Smith, Esq., DEQ

February 14, 2014

RECEIVED
FEB 18 2014
MC
Utah Division of Water Quality

Walt Baker, Director
Department of Environmental Quality
Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Dear Mr. Baker:

In Cache County, 75% of all residents have their sewage treated at the Logan lagoons. These residents are represented in seven cities located in the heart of Cache County including Nibley, Providence, River Heights, Logan, North Logan, Hyde Park, and Smithfield. Of these seven cities, six currently contract with Logan for this service and they represent 43.4% of all residents who rely on the lagoons for their sewage treatment

With the new discharge standards for nitrogen, phosphorous, and ammonia being established by the EPA, it appears likely that the lagoon system will no longer be able to meet the standards thereby requiring the abandonment of the current lagoon system resulting in the need for an alternative method of treatment. It has consistently been the opinion of the six contracting cities that a regional plant is a far better option than having multiple treatment plants scattered throughout the valley serving individual or smaller groups of cities. The benefits to the Division of Water Quality with respect to their role as overseers of a single or regional plant in contrast to multiple plants, has also been well established. In addition, sewer districts with their associated regional plants that have been constructed up and down the Wasatch Front such as South Davis, South Valley, Central Davis have validated the efficiency and effectiveness of sewer districts and regional plants in meeting the treatment needs of cities.

In 2012 when it became apparent the lagoons may fall short of meeting the new discharge standards, commitments were made by Logan City representatives to involve the contracting cities in charting a future path for sewage treatment for the area currently being served by the lagoons. Yet we were kept in the dark, only learning of the completed facility plan study through newspaper articles. Despite a commitment by Logan City officials and staff to consider the formation of a sewer district should Logan City have to abandon their lagoon system in favor of a new mechanical plant, Logan City has recently refused to consider that as a possibility. Despite concerns relative to rates and overhead fees and how those funds are being used, the contracting cities have been denied a voice in determining the overall financial plans for the sewer treatment system.

We recognize as contracting cities under the current system that we are subject to the terms and conditions established by Logan City. It has been their lagoon system and even though our rates have helped pay for many of the improvements over the years, they have been the service provider and the facility owner. As cities, we have acknowledged and accepted this fact. However, with the inevitable abandonment of the Logan lagoon system, we as a united community of mayors representing the contract cities have encouraged the pursuit of a sewer district only to be rebuffed by officials and staff of Logan City.

Failure to consider a sewer district as a means to govern and manage sewage treatment, leaves the six contracting cities with only a "take it or leave it" option. If the Water Quality Board were to fund the new treatment facility on behalf of only Logan City, 45% of the users would be forced to either contract with Logan City without meaningful representation or seek funding to build and operate their own facilities. A meeting recently scheduled between the contracting cities and Logan City to simply discuss the feasibility of a sewer district and to better understand the process that would be required to establish a sewer district was promptly cancelled by Logan City staff upon hearing three of the contracting cities (North Logan, Smithfield, and Hyde Park) were exploring the *possibility* of a separate sewage treatment facility should such a facility become necessary.

Of the six contracting cities, three are located south of Logan and three are located to the north. As a result, each city has invested heavily in the construction of outfall lines, pump stations, and metering stations to transport their sewage to the centrally located sewage lagoons and the proposed site of the new Logan treatment plant. Building individual treatment plants, although an option worth consideration, would result in the abandonment of all or a portion of this infrastructure. In addition, due to the fact Logan geographically separates the six cities into two groups, one north and one south, at least two additional regional plants would need to be funded and built.

As mayors representing six of the seven cities currently using the Logan sewer lagoons, we find ourselves at a crossroads. No one city, including Logan, has a treatment facility capable of meeting the new discharge standards. As a result, we must all start anew. To provide seventy-million dollars ($70,000,000) to one city thereby allowing that one city to build the treatment facility and then dictate ongoing terms to the other six cities would be an injustice. Growth patterns in Cache Valley indicate that soon the population of the six cities will exceed that of Logan City due to the limited amount of land available for growth within Logan City compared to that of the contracting cities. As a result, inevitable future expansion of the new mechanical plant will be required because of non-Logan growth. There is now an opportunity at hand whereby every resident and business may have equal representation and a voice while achieving the goal of constructing one regional sewage treatment facility for all. It speaks to the need for efficiency, reliability, oversight, and economic responsibility.

As representatives of nearly half of all users of the current lagoon system we are united in the belief that a single regional facility has merit and would provide the most beneficial option for sewage treatment for all cities, including Logan City. It remains our desire to pursue the advantages of a sewer district because to do otherwise would be to deny proper representation of all residential and commercial users. We therefore respectfully request the Water Quality Board delay final approval of the funding for a new sewage treatment facility for Logan City, or tie such funding to the formation of a sewer district that will represent all users.

Sincerely,

Lloyd Berentzen
Mayor, North Logan City

Bryan Cox
Mayor, Hyde Park City

Darrell G. Simmons
Mayor, Smithfield

James Brackner
Mayor, River Heights City

Don W. Calderwood
Mayor, Providence City

Shaun Dustin
Mayor, Nibley City

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

JUL 0 7 2015

Mayor Craig Petersen
Logan City
290 North 100 West
Logan, UT 84323

Dear Mayor Petersen:

Subject: Utah Wastewater Project Assistance Program
Logan City, Project #201 – Authorization Letter

On June 24, 2015, the Utah Water Quality Board (the "Board") re-affirmed its January 22, 2014 authorization of a loan in the amount of $70,000,000 to Logan City (the "Applicant") for the construction of a new mechanical wastewater treatment facility (the "Project").

The loan will be secured by a revenue bond issued by the Applicant and purchased by the Board. The retirement period for the bond shall be no more than twenty (20) years from the anticipated Project completion date with an interest rate/hardship grant assessment of three-quarters of a percent (0.75%). The Board will require annual payments on the bond of approximately $3,782,144 (*Exhibit #1)* beginning one year after the loan closing date.

Special Conditions:

1. Logan City must continue to aggressively pursue funding through USDA Rural Development and Community Impact Board (CIB).

2. Logan City must agree to participate annually in the Municipal Wastewater Planning Program (MWPP).

3. As a part of facility planning, Logan City must maintain an updated Water Conservation and Management Plan.

This project is authorized subject to the availability of funds. The financial assistance represented by this authorization may be funded, in whole, or in part, from the proceeds of a federal SRF Capitalization Grant (Title VI CWA, CFDA 66.458) to the State of Utah. Under the SRF Capitalization Grant Program, federal funds are to be made available to the State of Utah by way of authorized draws on a letter of credit over the construction period of the Applicant's project. Therefore, this authorization is expressly subject to the continued availability of federal funds through the SRF Capitalization Grant and the letter of credit related thereto. Neither the Water Quality Board nor the State of Utah shall be bound by this authorization or by any obligation to provide further loan funds to, or purchase any bonds from, the Applicant if the SRF Capitalization Grant funds to which this authorization relates are not awarded or if payments under the federal letter of credit are withheld for any reason.

Based upon the information presented to the Board, the following sources of funding will be available for the construction of the Project:

Funding Source	Cost Share	Percent of Project
WQB Loan	$70,000,000	63%
CIB Loan	10,000,000	9%
Logan City Contribution	31,623,000	28%
Total	$111,623,000	100%

As Applicant of this Project, you will need to complete the following items before the Water Quality Board will purchase your bonds:

1. The State of Utah has assigned William Prater, the State's bond counsel, the responsibility of reviewing all proceedings and documents relating to the sale of bonds to the Board. His address is:

   William Prater, L.L.C.
   P.O. Box 71368
   6925 Union Park Center - Suite 265
   Midvale, Utah 84047
   Telephone: (801) 566-8882
   Fax: (801) 566-8884
   Email: bill@billprater.com

   The Applicant's bond counsel should submit the following items to William Prater at the times indicated below. A copy of the transmittal letter for the items indicated below must also be sent to the Division of Water Quality to document Project progress.

   a. No later than one week prior to the meeting at which the Applicant intends to adopt its Resolution for the issuance of the bonds, a complete copy of the proposed Resolution shall be submitted for review. Appropriate notice should be given to notify the public of the meeting at which the governing board intends to adopt the bond resolution.

   b. No later than two weeks after the adoption of the Resolution, the following items shall be submitted:

      i. A true and complete photocopy of the Resolution as adopted, showing signatures of the appropriate officials of the Applicant on the Resolution and on the Notice of Meeting, Acknowledgment of Notice and Consent, Certificate of Publication, Open Meeting Certificate, and other similar documents relating to the Resolution.

      ii. If applicable, a true and complete photocopy of the minutes, notices, resolutions and other documents relating to the bond election, showing signatures of the appropriate officials.

iii. A true and complete photocopy of the minutes, notices, resolutions and other documents, showing signatures of the appropriate officials, of the proceedings by which the Applicant was created.

iv. A complete copy of the proposed documents to be signed at closing, including (but not necessarily limited to) General Certificate, Signature Identification and Nonlitigation Certificate, Receipt, Arbitrage Certificate (if required), Applicant Attorney's Nonlitigation Certificate, Certificate of the Clerk (or Recorder) as to contents of Bond Transcript File, Escrow Agreement, and the Bond Attorney's Opinion.

v. A copy of the sewer use ordinance and rate structure described in paragraph 3 of this letter.

vi. A copy of the proposed opinion letter of the Applicant's attorney described in paragraph 6 of this letter.

The procedures for bond approval will be substantially the same as required by the Utah Municipal Bond Act as it applies to cities and towns. The opinion of the bond attorney must accompany delivery of the bonds to the Board before bond proceeds will be released.

As a condition to the acceptance by the Board of a non-voted revenue bond, the issuer must (a) publish notice and conduct a public hearing consistent with the requirements of the Utah Local Government Bonding Act, and (b) mail notices to system users in the issuer's service area informing them of the public hearing. In addition to the time and location of the public hearing, notices mailed to system users shall inform them of the issuer's intent to issue a non-voted revenue bond to the Board, shall describe the face amount of the bond, the rate of interest, the repayment schedule, and shall describe Project impacts. User charge rates and connection fees should be included in that notice, and the notice shall state that system users may respond to the issuer in writing or in the public hearing. A copy of all written responses and a certified record of a public hearing shall be forwarded to the Board. If the Board feels that there is significant opposition to the proposed Project, or if required by the Utah Local Government Bonding Act, it may be necessary for the issuer to hold a bond election before the Board's funds will be made available.

At or after the closing, the State's bond counsel will bill the Applicant, and the Applicant must pay those legal fees.

At the time of closing, the Applicant shall pay a Loan Origination Fee equal to 1% of the principal loan amount. If the Applicant decides not to build the Project after the Board has authorized the Project, the Applicant will reimburse all costs accruing after the Project Authorization. The Project Cost and Loan Origination Fee Acceptance Form (*Exhibit #2*) must be signed and returned to the Board within three weeks of the date of this letter.

2. Consistent with requirements of the law and the covenants of applicable bond resolutions, the actual payment of funds by the Board to the Applicant will not take place until the Board has assurance the funds will be used for Project costs and the Project will actually be completed. To assure this, all monies to be expended on the Project shall be placed in an escrow account jointly supervised by the Applicant and the Board. A copy of the proposed escrow agreement shall be submitted to the Board and the State's bond counsel for review. If the Project is completed without using all of the escrowed funds, the Board's share of the unused escrowed

funds will be applied as a prepayment of principal to shorten the bond repayment term. The Applicant will be required to deposit all of its Project funds in the escrow account at the time of the closing of the loan or make other provisions acceptable to the Board to ensure that funds will be available to complete the project. Disbursements from the escrow account will be reviewed and approved by the Division of Water Quality. A disbursement request form must be completed and submitted along with each request.

3. At the time of the adoption of the bond resolution, or within a reasonable time thereafter (but no later than the pre-closing date), the Applicant shall adopt an ordinance or resolution detailing proper use of the system and establishing reasonable sewer use charges and fees and collection enforcement procedures taking into account all relevant factors, including but not limited to the need to generate sewerage revenues sufficient to meet all payment and funding requirements specified in the bond resolution. A Reserve Fund, equivalent to at least one (1) year's installment on the bond and an Emergency Repair and Replacement Fund, equivalent to one-half (1/2) of one year's installment payment, must be accumulated during the first six (6) years of the repayment period. The sewer rate ordinance or resolution must establish rates sufficient to generate no less than the following amounts:

   a. An amount calculated to be sufficient to pay operation and maintenance expense of the system.

   b. $315,179 per month to be placed in a Sinking Fund for the repayment of the obligation ($3,782,144 average per year).

   c. $52,530 per month (for the first six years) to be added to a Reserve Fund until a total of $3,782,144 is accumulated.

   d. $26,265 per month (for the first six years) to be added to an Emergency Repair and Replacement Fund until a total of $1,891,072 is accumulated.

   A copy of the sewer use and user rate ordinances and/or resolutions as adopted shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date. A copy of the sewer use and user rate ordinances and/or resolutions as adopted shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date.

4. At the time of the adoption of the bond resolution, or within a reasonable time thereafter (but no later than the pre-closing date), the Applicant shall execute Interlocal Agreements for provision of wastewater treatment services with the surrounding cities that will contribute wastewater to the Applicant's facility. Copy of the executed Interlocal Agreements shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date.

5. The Applicant's contract with its consulting engineer(s) should include the cost of developing complete bidding and contract documents, performing bidding and construction management services, and preparation of an operations and maintenance manual. The engineering contract must be submitted to the Division of Water Quality for review and approval. This requirement is to assure the Board that adequate and appropriate arrangements are made for completing and inspecting the Project within the guidelines set by the Board.

6. The Applicant must secure a construction permit for the Project from the Board prior to soliciting bids. Final bidding and contract documents should be submitted to the Manager of the Engineering Section, Utah Division of Water Quality, for review.

7. The Applicant's attorney shall certify the following items in writing to the Water Quality Board:

   a. The Applicant is a legal entity as of the date of the loan closing.

   b. The Applicant has valid legal title to the rights-of-way designated and shown on the right-of-way map, including rights-of-way both for the Project to be constructed and the remainder of the existing wastewater system as of the date of the loan closing.

   c. The bidding and contract documents for the construction of the Project have the proper and legal format and are in compliance with the Utah Code Annotated 1953 (Title 34, Chapter 30).

   d. Following review by the Applicant's attorney of the completed and executed construction contract, performance and payment bonds, and evidence of necessary insurance, the Applicant's attorney shall furnish to the Water Quality Board his legal opinion that all of such items are legal and binding and in compliance with the Utah Code.

8. The Applicant shall acquire rights-of-way and easements for construction and ongoing operation and maintenance of the Project facilities. The Applicant, through its engineer, shall furnish its attorney a right-of-way map showing the location of all lagoons, buildings, structures, pipelines, and other pertinent facilities in the Project. The engineer and presiding officer of the Applicant will sign this map.

9. The Applicant must agree to the following requirements of Title VI of the Clean Water Act as applicable throughout the course of the Project:

   a. Submission of a DUNS number to the DWQ within 45 days before loan closing.

   b. Completion of the "MBE/WBE Procurement Annual Report" form for construction services. This should be submitted to the Division of Water Quality two weeks after the end of each reporting period (September 30) during construction.

   c. Include the following certification in the bond resolution:

      "The Issuer agrees, in accepting the proceeds of the Series ____ Bonds, to comply with all applicable state and federal regulations related to the Utah State Revolving Fund administered by the Water Quality Board. These requirements include, but are not limited to, Title VI of the Clean Water Act of 1987, The Single Audit Act of 1996, the Utah Wastewater Loan Program policies and guidelines, the Utah Local Government Bonding Act, the Utah Money Management Act, the Utah Procurement Code and the State of Utah Legal Compliance Audit Guide."

   d. Compliance with Davis-Bacon Act wages:

"Notwithstanding any other provision of law and in a manner consistent with other provisions in this Act, all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to this Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards specified in this section, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code."

e. Compliance with American Iron & Steel (AIS) provisions:

P.L. 113-76, Consolidated Appropriations Act 2014, requires Clean Water State Revolving Loan Fund (CWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public treatment works.

10. The Applicant shall submit a cash drawdown schedule prepared and certified by its consulting engineer that coincides with the rate construction-related Project costs are expected to occur.

11. The Applicant must have an approved Capital Facilities Plan or Engineering Report, as applicable, prior to loan closing.

12. The Applicant is required to submit a plan of operation and an operation and maintenance (O&M) manual according to the following:

    a. Applicants that have not previously operated wastewater facilities of similar magnitude and complexity to the Project are required to submit a plan of operation containing a schedule summarizing appropriate times for essential actions to be taken for facility operation. A draft plan must be submitted to the Division of Water Quality at initiation of construction and approved in final form prior to 50% of construction completion. As a minimum, the plan of operation must include provisions for an operation and maintenance manual, emergency operating and response plan, properly trained management, adequate number and training of operation and maintenance personnel, budget plan for operation and maintenance, operational reports, and start-up procedures.

    b. An operation and maintenance (O&M) manual which provides long-term guidance for efficient facility operation and maintenance must be submitted and approved in draft and final form prior to 50% and 90% completion, respectively.

In order to facilitate the timely completion of the financial assistance requirements outlined in this letter, a pre-closing conference call shall be held to determine all of the outstanding items. The Applicant and its attorney and engineer should submit to the Division of Water Quality all of the items required by the dates agreed to during the pre-closing conference call and the Applicant's bond attorney should submit to the State's bond counsel the items listed in the subsection "b" of paragraph 1 on or before the due date specified therein so that he can review those items prior to closing.

The final closing on the bond may occur once the Division of Water Quality and the State's bond counsel determine that all of the items listed in this letter have been completed and submitted satisfactorily.

If the Applicant fails to reasonably comply with the Project schedule, this Authorization may be withdrawn. If the Applicant received Planning or Design advances from the Board, withdrawal of this Authorization may authorize the Board to seek repayment of the advance(s) on such terms and conditions as it may determine pursuant to Utah Administrative Code R317-101-9 and R317-101-10. . In the event that material changes affect the funding or scope of the project, the Board reserves the right to reconsider its authorization terms.

These requirements will probably not cover all the matters pertaining to your Project. We anticipate that specific questions on matters relating to your Project will arise, and we are confident that a joint cooperative effort can resolve the issues. If you have any questions concerning these requirements, please contact Lisa Nelson (801-536-4348) or Emily Cantón (801-536-4342) of the Division of Water Quality.

Sincerely,

Utah Water Quality Board

Walter L. Baker, P.E.
Executive Secretary

cc: William Prater, Bond Counsel

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File: SRF\Helper City\Administration\Section 1
DWQ-2015-007584

Exhibit 1

Logan City Revenue Bond Repayment Schedule

Principal	$70,000,000
Interest/Hardship Assessment	0.75%
Term	20
Avg Annual Pmt	$3,782,144

Payment Number	Payment Due Date	Principal Due	Principal Payment	Interest Payment	Total Payment
1	1-Jan-19	70,000,000	3,257,000	525,000	3,782,000
2	1-Jan-20	66,743,000	3,282,000	500,573	3,782,573
3	1-Jan-21	63,461,000	3,306,000	475,958	3,781,958
4	1-Jan-22	60,155,000	3,331,000	451,163	3,782,163
5	1-Jan-23	56,824,000	3,356,000	426,180	3,782,180
6	1-Jan-24	53,468,000	3,381,000	401,010	3,782,010
7	1-Jan-25	50,087,000	3,406,000	375,653	3,781,653
8	1-Jan-26	46,681,000	3,432,000	350,108	3,782,108
9	1-Jan-27	43,249,000	3,458,000	324,368	3,782,368
10	1-Jan-28	39,791,000	3,484,000	298,433	3,782,433
11	1-Jan-29	36,307,000	3,510,000	272,303	3,782,303
12	1-Jan-30	32,797,000	3,536,000	245,978	3,781,978
13	1-Jan-31	29,261,000	3,563,000	219,458	3,782,458
14	1-Jan-32	25,698,000	3,589,000	192,735	3,781,735
15	1-Jan-33	22,109,000	3,616,000	165,818	3,781,818
16	1-Jan-34	18,493,000	3,643,000	138,698	3,781,698
17	1-Jan-35	14,850,000	3,671,000	111,375	3,782,375
18	1-Jan-36	11,179,000	3,698,000	83,843	3,781,843
19	1-Jan-37	7,481,000	3,726,000	56,108	3,782,108
20	1-Jan-38	3,755,000	3,755,000	28,163	3,783,163
TOTAL			70,000,000	5,642,918	75,642,918

Note: Loan repayments will start one year after the loan closing date.

EXHIBIT 2

PROJECT COST AND LOAN ORIGINATION FEE ACCEPTANCE FORM
FOR PROJECTS FUNDED THROUGH
THE UTAH STATE REVOLVING FUND PROGRAM

1. Costs of bond document review by the Water Quality Board and its bond attorney will be billed to the Applicant.

2. Costs related to the project such as administrative review, engineering, investigation, and construction supervision by the Water Quality Board (i.e. Division of Water Quality staff) will be paid from the proceeds of the Loan Origination Fee, which is equal to 1% of the principal loan amount.

3. Cost of engineering, investigation, and construction supervision are considered as follows:

   a. If the Water Quality Board denies the project or if the Applicant withdraws prior to the preparation of the feasibility report, normal manpower costs incurred by the Department of Environmental Quality during the preliminary investigation of the potential project will not become a charge to the Applicant.

   b. If the project is authorized by the Water Quality Board, all manpower costs from the beginning of the project will be charged to the project and paid from the proceeds of the Loan Origination Fee.

   c. If the applicant decides not to build the project after the Water Quality Board has authorized the project, all costs accruing after the authorization will be reimbursed by the Applicant to the Board.

ACCEPTANCE:

On behalf of the Applicant, I hereby accept the policy and conditions as enumerated above. Logan City

7/17/15

(Name of Applicant) (Date) (Presiding Official) (Date)

(Secretary) (Date)

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ACCEPTANCE:

On behalf of the Applicant, I hereby accept the policy and conditions as enumerated above.

(Name of Applicant)	(Date)	(Presiding Official)	(Date)
(Secretary)	(Date)		

Appendix A

DWQ COORESPONDENCE

State of Utah
GARY R. HERBERT
Governor
GREG BELL
Lieutenant Governor

Department of
Environmental Quality
Amanda Smith
Executive Director
DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

FILE COPY

JAN 3 1 2013

Issa Hamud
Environmental Department
Logan City Corporation
450 North 1000 West
Logan UT 84321

Dear Mr. Hamud:

Subject: New Proposed Ammonia Limits for Logan City Lagoons UPDES Permit No. UT0021920

On September 26, 2012, we notified Logan City Corporation as to an anticipated change to the ammonia limits in the Logan City Corporation Wastewater Treatment Plant's UPDES permit. As stated in the previous letter, these changes were necessitated by a rule change required by EPA and adopted by the Water Quality Board in October 2008 which extended the chronic ammonia criteria from 3A and 3B waters to include 3C and 3D waters.

After much discussion and collaboration with Logan City that resulted in incorporating many new data sources, the Division has established ammonia limits in a draft wasteload analysis. The wasteload analysis was conducted for projected effluent flows and quality in 2037, which were provided by Carollo Engineers assuming a hybrid facility with a 12 MGD mechanical treatment plant in combination with the existing lagoons. Note that should the projected effluent flow or quality (temperature, pH, and alkalinity) change appreciably during the planning and engineering process, the limits may need to be revisited and modified. The wasteload established the following effluent limits for Logan's discharge:

Logan Utah Expected Effluent Limits for Ammonia, mg/L

Season:	Winter	Spring	Summer	Fall
Monthly Average	3.0	3.0	1.3	2.6
Daily Maximum	5.0	8.0	6.0	7.0

The complete wasteload analysis is attached to this letter. The WLA is part of the draft permit package and will be subject to a 30 day public comment period to be scheduled in the coming weeks, along with the renewal permit and fact sheet and statement of basis.

We appreciate the efforts that Logan City is undertaking to address the water quality of Cutler Reservoir. If you have any questions regarding this matter, please contact Mr. Lonnie Shull at (801) 536-4394, or via e-mail at lshull@utah.gov.

Sincerely,

Walter L. Baker, P.E.
Director

WLB:NvS:ls:mc

Enclosure: 1. WLA, (DWQ-2013-00-1297)

cc: John Mackey, DWQ (w/o encl)

DWQ-2013-001296

FILE COPY

Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review
TREATMENT PLANT UPGRADE – PHASE 1 TO 2037

Date: **January 10, 2013**

Prepared by: **Nicholas von Stackelberg, P.E.**
Water Quality Management Section

Facility: **Logan Wastewater Treatment Plant, Logan, UT**
UPDES No. UT0021920

Receiving water: **Swift Slough (2B, 3B, 3D, 4)**

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge
This wasteload is for the proposed treatment plant upgrade for phase 1 to 2037. The proposed project involves construction of a mechanical treatment plant with a design capacity of 12 MGD. The remainder of flows would be treated by the existing lagoon system. The existing polishing wetlands would no longer be used for wastewater treatment.

Design data for the treatment facility was provided by Carollo Engineers under contract to Logan City. The design parameters for the discharge are summarized in Table 1 for the year 2037.

Table 1: Discharge in 2037

Duration	Flow (MGD)		pH		Temperature (deg C)	
	Max. Daily	Max. Monthly	Max. Daily	Max. Monthly	Max. Daily	Max. Monthly
Summer (Jun-Aug)	25.4	23.7	8.2	8.1	20.0	19.9
Fall (Sep-Nov)	25.4	20.5	8.2	8.0	14.7	15.4
Winter (Dec-Feb)	35.0	20.3	8.4	8.0	4.7	6.9
Spring (Mar May)	21.3	16.5	8.0	7.8	12.3	12.6

Outfall 001: Unnamed Irrigation Ditch→Swift Slough

Receiving Water

The receiving water for Outfall 001 is an unnamed irrigation ditch that will convey the effluent from the treatment plant to Swift Slough. The beneficial uses for the irrigation ditch are presumed 2B, 3E, and 4 per UAC R317-2-13.9. The irrigation ditch has no background flow during critical conditions.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*

- *Class 3E - Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.*

- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

The unnamed irrigation ditch drains approximately 2.8 miles to Swift Slough. Swift Slough is tributary to Cutler Reservoir. Per UAC R317-2-13.3.a, the designated beneficial uses for Swift Slough (Bear River and tributaries, from Great Salt Lake to Utah-Idaho border) are 2B, 3B, 3D, and 4.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*

- *Class 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*

- *Class 3D - Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*

- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

Typically, the critical flow for the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Flow records from Swift Slough immediately upstream of Outfall 002 were provided by Logan City for the years 2004-2010. Since this is not a long enough flow record to compute the 7Q10 flow, the lowest 7-day average flow while the wetlands were discharging for each season was used (Table 2).

Table 2: Seasonal critical low flow

Season	Background Flow (cfs)	
	Ditch	Swift Slough
Summer	0.0	4.0
Fall	0.0	8.4
Winter	0.0	8.8
Spring	0.0	2.9

TMDL

Cutler Reservoir has an approved TMDL for total phosphorus (TP) (*Middle Bear River and Cutler Reservoir TMDLs, 2010*). The TMDL allocated load for TP from Logan City Wastewater Treatment Plant is 4,405 kg for May through October and 11,831 kg for November through April.

Mixing Zone

The discharge is considered instantaneously fully mixed since the discharge is more than twice the background receiving water flow. Therefore, no mixing zone is allowed.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), BOD5, total phosphorus (TP), total nitrogen (TN), total ammonia (TAM), E. coli, pH, total residual chlorine (TRC), total copper, and total lead as determined in consultation with the UPDES Permit Writer.

Water Quality Modeling

A QUAL2Kw model of the receiving water was built and calibrated. The model was calibrated to synoptic survey data collected in September of 2011 by DWQ staff.

Receiving water quality data was primarily obtained from the synoptic survey conducted for the model calibration from 9/15 to 9/19/2011. The sampling site was on the Swift Slough immediately above the plant discharge. Limited water quality data was obtained from STORET 4905050 Swift Slough below confluence with Logan Lagoons Effluent and STORET 4905070 Swift Slough at 1300 West. The average value was calculated for each constituent in the receiving water.

The calibrated model was used for determining WQBELs. Effluent concentrations were adjusted so that water quality standards were not exceeded at the end of the mixing zone. The calibration model and the wasteload model are available for review by request.

WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC_{50} (lethal concentration, 50%) percent effluent for acute toxicity and the IC_{25} (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC_{50} is typically 100% effluent and does not need to be determined by the WLA.

Table 3: WET Limits

Season	Percent Effluent
Summer	91%
Fall	82%
Winter	81%
Spring	93%

Effluent Limits

The effect of the effluent on the DO in the receiving water was evaluated using the QUAL2Kw model. Due to light and substrate limitation, significant algal growth downstream of the discharge was neither observed nor predicted in the model. Therefore, WQBELs are not required for nitrogen and phosphorus due to algal growth in the Swift Slough. However, as a result of the TMDL for Cutler Reservoir, effluent limits are required for TP. In addition, limits are required for DO to meet instream criteria.

Limits for total residual chlorine were not determined since the proposed treatment plant includes ultraviolet radiation for disinfection.

Table 4: Water Quality Based Effluent Limits

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Ammonia (mg/L)[1]						
Summer	Varies with pH	6.0	1 hour	Varies with pH and temper-ature	1.3	30 days
Fall		7.0			2.6	
Winter		5.0			3.0	
Spring		8.0			3.0	
Min. Dissolved Oxygen (mg/L)	3.0	5.0	Instantaneous	5.5	5.5	30 days
BOD_5 (mg/L)[2]	None	25	7 days	None	35	30 days
1: Ammonia limit due to toxicity requirements.						

QUAL2Kw rates, input and output for DO and nutrient related constituents are summarized in Appendix A.

Simple mixing analysis input and output for conservative constituents are summarized in Appendix B.

Effluent limits for Outfall 001 are summarized in Appendix C.

Models and supporting documentation are available for review upon request.

Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remain below the WQBELs presented in this wasteload.

A Level II Antidegradation Review (ADR) is required for this discharge since the allowable pollutant load will increase with the treatment plant upgrade.

WLA Document: *logan_potw_wla_upgrade_2037_final.docx*
QUAL2Kw Wasteload Model: *logan_potw_wla_upgrade_2037.xlsm*
QUAL2Kw Calibration Model: *logan_q2k_cal_1.3.xlsm*

WASTELOAD ANALYSIS [WLA] Date: 1/9/2013
Appendix A: QUAL2Kw Analysis Results

Discharging Facility:	Logan WWTP		
UPDES No:	UT-0021920		
Permit Flow [MGD]:	25.40	Summer (July-Sept)	Max. Daily
	25.40	Fall (Oct-Dec)	Max. Daily
	35.00	Winter (Jan-Mar)	Max. Daily
	21.30	Spring (Apr-June)	Max. Daily
	23.70	Summer (July-Sept)	Max. Monthly
	20.50	Fall (Oct-Dec)	Max. Monthly
	20.30	Winter (Jan-Mar)	Max. Monthly
	16.50	Spring (Apr-June)	Max. Monthly

Receiving Water:	Swift Slough	
Stream Classification:	2B, 3B, 3D, 4	
Stream Critical Low Flow [cfs]:	3.98	Summer (July-Sept)
	8.40	Fall (Oct-Dec)
	8.82	Winter (Jan-Mar)
	2.88	Spring (Apr-June)

Fully Mixed:	YES
Acute River Width:	100%
Chronic River Width:	100%

Modeling Information

A QUAL2Kw model was used to determine these effluent limits.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis.
Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Headwater/Upstream Information	Summer	Fall	Winter	Spring
Flow (cfs)	4.0	8.4	8.8	2.9
Temperature (deg C)	21.6	12.3	1.5	14.9
Specific Conductance (μmhos)	850	610	533	619
Inorganic Suspended Solids (mg/L)	26.5	26.5	26.5	26.5
Dissolved Oxygen (mg/L)	5.8	9.0	12.1	9.4
$CBOD_5$ (mg/L)	4.4	4.4	4.4	4.4
Organic Nitrogen (mg/L)	0.084	0.084	0.084	0.084
NH4-Nitrogen (mg/L)	0.025	0.025	0.025	0.025
NO3-Nitrogen (mg/L)	0.270	0.270	0.270	0.270
Organic Phosphorus (mg/L)	0.025	0.025	0.025	0.025
Inorganic Ortho-Phosphorus (mg/L)	0.025	0.025	0.025	0.025
Phytoplankton (μg/L)	2.6	2.6	2.6	2.6
Detritus [POM] (mg/L)	3.6	3.6	3.6	3.6
Alkalinity (mg/L)	225	225	225	225
pH	8.1	8.0	8.0	8.2

Discharge Information

Acute	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	25.4	25.4	35.0	21.3
Temperature (deg C)	20.0	14.7	4.7	12.3
Specific Conductance (µmhos)	735	735	735	735
Inorganic Suspended Solids (mg/L)	35.7	35.7	35.7	35.7
Dissolved Oxygen (mg/L)	5.0	5.0	5.0	5.0
$CBOD_5$ (mg/L)	35.0	35.0	35.0	35.0
Organic Nitrogen (mg/L)	5.000	5.000	5.000	5.000
NH4-Nitrogen (mg/L)	6.000	7.000	5.000	8.000
NO3-Nitrogen (mg/L)	5.000	5.000	5.000	5.000
Organic Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Inorganic Ortho-Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Phytoplankton (µg/L)	168.000	168.000	168.000	168.000
Detritus [POM] (mg/L)	0.000	0.000	0.000	0.000
Alkalinity (mg/L)	272	272	272	272
pH	8.2	8.2	8.4	8.0

Chronic	**Summer**	**Fall**	**Winter**	**Spring**
Flow (cfs)	23.7	20.5	20.3	16.5
Temperature (deg C)	19.9	15.4	6.9	12.6
Specific Conductance (µmhos)	735	735	735	735
Inorganic Suspended Solids (mg/L)	35.7	35.7	35.7	35.7
Dissolved Oxygen (mg/L)	5.5	5.5	5.5	5.5
$CBOD_5$ (mg/L)	25.0	25.0	25.0	25.0
Organic Nitrogen (mg/L)	5.000	5.000	5.000	5.000
NH4-Nitrogen (mg/L)	1.300	2.600	3.000	3.000
NO3-Nitrogen (mg/L)	5.000	5.000	5.000	5.000
Organic Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Inorganic Ortho-Phosphorus (mg/L)	5.000	5.000	5.000	5.000
Phytoplankton (µg/L)	168.000	168.000	168.000	168.000
Detritus [POM] (mg/L)	0.000	0.000	0.000	0.000
Alkalinity (mg/L)	272	272	272	272
pH	8.1	8.0	7.9	7.8

All model numerical inputs, intermediate calculations, outputs and graphs are available for review and comment at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitation for Biological Oxygen Demand (BOD_5) based upon Secondary Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD5 limitation as follows:

	Concentration		
Season	**Chronic**	**Acute**	
Summer	25.0	35.0	mg/L as CBOD5
Fall	25.0	35.0	mg/L as CBOD5
Winter	25.0	35.0	mg/L as CBOD5
Spring	25.0	35.0	mg/L as CBOD5

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards
In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent DO limitation as follows:

	Dissolved Oxygen		
Season	Chronic	Acute	
Summer	5.5	5.0	mg/L
Fall	5.5	5.0	mg/L
Winter	5.5	5.0	mg/L
Spring	5.5	5.0	mg/L

Effluent Limitation for Total Phosphorus based upon TMDL
In-stream criteria of downstream segments for Dissolved Oxygen will be met with effluent TP limitation as follows:

	Total Phosphorus	
Season	Load	
May - October	4,405	kg
November - April	11,831	kg

Effluent Limitation for Total Ammonia based upon Water Quality Standards
In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

	Total Ammonia		
Season	Chronic	Acute	
Summer	1.3	6.0	mg/L as N
Fall	2.6	7.0	mg/L as N
Winter	3.0	5.0	mg/L as N
Spring	3.0	8.0	mg/L as N

Summary Comments
The mathematical modeling and best professional judgement indicate that violations of receiving water beneficial uses with their associated water quality standards, including important down-stream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

Coefficients and Other Model Information

Parameter	*Value*	*Units*
Stoichiometry:		
Carbon	40	gC
Nitrogen	7.2	gN
Phosphorus	1	gP
Dry weight	100	gD
Chlorophyll	1	gA
Inorganic suspended solids:		
Settling velocity	2	m/d
Oxygen:		
Reaeration model	Internal	
Temp correction	1.024	
Reaeration wind effect	None	
O2 for carbon oxidation	2.69	gO2/gC
O2 for NH4 nitrification	4.57	gO2/gN
Oxygen inhib model CBOD oxidation	Exponential	
Oxygen inhib parameter CBOD oxidation	0.60	L/mgO2
Oxygen inhib model nitrification	Exponential	
Oxygen inhib parameter nitrification	0.60	L/mgO2
Oxygen enhance model denitrification	Exponential	
Oxygen enhance parameter denitrification	0.60	L/mgO2
Oxygen inhib model phyto resp	Exponential	
Oxygen inhib parameter phyto resp	0.60	L/mgO2
Oxygen enhance model bot alg resp	Exponential	
Oxygen enhance parameter bot alg resp	0.60	L/mgO2
Slow CBOD:		
Hydrolysis rate	0	/d
Temp correction	1.047	
Oxidation rate	0.240778	/d
Temp correction	1.047	
Fast CBOD:		
Oxidation rate	10	/d
Temp correction	1.047	
Organic N:		
Hydrolysis	0.2964425	/d
Temp correction	1.07	
Settling velocity	0.147494	m/d
Ammonium:		
Nitrification	0.0772945	/d
Temp correction	1.07	
Nitrate:		
Denitrification	1.8113375	/d
Temp correction	1.07	
Sed denitrification transfer coeff	0.22471	m/d
Temp correction	1.07	
Organic P:		
Hydrolysis	0.1360275	/d
Temp correction	1.07	
Settling velocity	0.11495	m/d
Inorganic P:		
Settling velocity	0.02022	m/d
Sed P oxygen attenuation half sat constant	1.40616	mgO2/L

Phytoplankton:		
Max Growth rate	1.99746	/d
Temp correction	1.07	
Respiration rate	0.49199	/d
Temp correction	1.07	
Death rate	0.97217	/d
Temp correction	1	
Nitrogen half sat constant	22.0366	ugN/L
Phosphorus half sat constant	1.95708	ugP/L
Inorganic carbon half sat constant	1.30E-05	moles/L
Phytoplankton use HCO3- as substrate	Yes	
Light model	Smith	
Light constant	97.3006	langleys/d
Ammonia preference	27.86895	ugN/L
Settling velocity	0.326705	m/d
Bottom Plants:		
Growth model	Zero-order	
Max Growth rate	7.262455	gD/m2/d or /d
Temp correction	1.07	
First-order model carrying capacity	100	gD/m2
Basal respiration rate	0.1455158	/d
Photo-respiration rate parameter	0.39	unitless
Temp correction	1.07	
Excretion rate	0.202475	/d
Temp correction	1.07	
Death rate	3.8662	/d
Temp correction	1.07	
External nitrogen half sat constant	288.016	ugN/L
External phosphorus half sat constant	98.1445	ugP/L
Inorganic carbon half sat constant	1.19E-04	moles/L
Bottom algae use HCO3- as substrate	Yes	
Light model	Half saturation	
Light constant	89.3608	langleys/d
Ammonia preference	21.65055	ugN/L
Subsistence quota for nitrogen	0.5779116	mgN/gD
Subsistence quota for phosphorus	0.1656965	mgP/gD
Maximum uptake rate for nitrogen	636.1775	mgN/gD/d
Maximum uptake rate for phosphorus	136.553	mgP/gD/d
Internal nitrogen half sat ratio	3.4205925	
Internal phosphorus half sat ratio	2.539308	
Nitrogen uptake water column fraction	1	
Phosphorus uptake water column fraction	1	
Detritus (POM):		
Dissolution rate	1.1092505	/d
Temp correction	1.07	
Settling velocity	0.125501	m/d
pH:		
Partial pressure of carbon dioxide	370	ppm

Atmospheric Inputs:	Summer	Fall	Winter	Spring
Max. Air Temperature, F	85.7	45.5	36.9	67.5
Min. Air Temperature, F	57.5	27.9	19.7	43.6
Dew Point, Temp., F	55.7	30.9	22.4	46.2
Wind, ft./sec. @ 21 ft.	5.7	3.5	3.2	5.6
Cloud Cover, %	0.1	0.1	0.1	0.1

Other Inputs:

Bottom Algae Coverage	100.0%	
Bottom SOD Coverage	100.0%	
Prescribed SOD	0.0	gO2/m2/d

WASTELOAD ANALYSIS [WLA]
Appendix B: Simple Mixing Analysis for Conservative Constituents

Date: 1/9/2013

Discharging Facility:	Logan WWTP		
UPDES No:	UT-0021920		
Permit Flow [MGD]:	25.40	Summer (July-Sept)	Max. Daily
	25.40	Fall (Oct-Dec)	Max. Daily
	35.00	Winter (Jan-Mar)	Max. Daily
	21.30	Spring (Apr-June)	Max. Daily
	23.70	Summer (July-Sept)	Max. Monthly
	20.50	Fall (Oct-Dec)	Max. Monthly
	20.30	Winter (Jan-Mar)	Max. Monthly
	16.50	Spring (Apr-June)	Max. Monthly
Receiving Water:	Unnamed Irrigation Ditch		
Stream Classification:	2B, 3E, 4		
Stream Flows [cfs]:	0.0	All Seasons	Critical Low Flow
Downstream Receiving Water:	Swift Slough		
Stream Classification:	2B, 3B, 3D, 4		
Stream Flows [cfs]:	3.98	Summer (Jun-Aug)	Critical Low Flow
	8.40	Fall (Sep-Nov)	
	8.82	Winter (Dec-Feb)	
	2.88	Spring (Mar-May)	
Fully Mixed:	YES		
Acute River Width:	100%		
Chronic River Width:	100%		

Modeling Information

A simple mixing analysis was used to determine these effluent limits.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis. Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Headwater/Upstream Information

	Ditch cfs	Swift Slough cfs
Summer	0.0	4.0
Fall	0.0	8.4
Winter	0.0	8.8
Spring	0.0	2.9

Discharge Information

	Flow MGD Max. Daily	Flow MGD Monthly Ave.
Summer	25.4	23.7
Fall	25.4	20.5
Winter	35.0	20.3
Spring	21.3	16.5

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

Effluent Limitations

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

Effluent Limitations for Protection of Recreation (Class 2B Waters)

No dilution in unnamed irrigation ditch.

Physical Parameter	Maximum Concentration
pH Minimum	6.5
pH Maximum	9.0
Turbidity Increase (NTU)	10.0

Bacteriological	
E. coli (30 Day Geometric Mean)	206 (#/100 mL)
E. coli (Maximum)	668 (#/100 mL)

Effluent Limitations for Protection of Aquatic Wildlife (Class 3B Waters)

Dilution in Swift Slough - summer season flows used.

Physical Parameter	Maximum Concentration
Temperature (deg C)	27
Temperature Change (deg C)	4

Inorganics	Chronic Standard (4 Day Average)	Acute Standard (1 Hour Average)
Parameter	Standard	Standard
Phenol (mg/L)		0.010
Hydrogen Sulfide (Undissociated) [mg/L]		0.002

Dissolved Metals	Chronic Standard (4 Day Average)[1]			Acute Standard (1 Hour Average)[1]		
Parameter	Standard	Background[2]	Limit	Standard	Background[2]	Limit
Aluminum (µg/L)	87.0	58.3	90.1	750.0	58.3	820.0
Arsenic (µg/L)	150.0	100.5	155.4	340.0	100.5	364.2
Cadmium (µg/L)	0.5	0.3	0.5	4.9	0.3	5.4
Chromium VI (µg/L)	11.0	7.4	11.4	16.0	7.4	16.9
Chromium III (µg/L)	157.0	105.2	162.6	1206.7	105.2	1318.2
Copper (µg/L)	19.6	13.1	20.3	31.9	13.1	33.8
Cyanide (µg/L)	22.0	14.7	22.8	5.2	14.7	4.2
Iron (µg/L)				1000.0	670.0	1033.4
Lead (µg/L)	6.7	4.5	7.0	172.3	4.5	189.3
Mercury (µg/L)	0.012	0.008	0.012	2.4	0.0	2.6
Nickel (µg/L)	112.9	75.6	116.9	1016.5	75.6	1111.7
Selenium (µg/L)	4.6	3.1	4.8	18.4	3.1	19.9
Silver (µg/L)				15.6	10.4	16.1
Tributylin (µg/L)	0.072	0.048	0.075	0.46	0.05	0.50
Zinc (µg/L)	256.8	172.0	266.0	254.7	172.0	263.1

1: Based upon a Hardness of 250 mg/l as CaCO3

2: Background concentration assumed 67% of chronic standard

Organics [Pesticides]	Chronic Standard (4 Day Average)			Acute Standard (1 Hour Average)		
Parameter	Standard	Background[1]	Limit	Standard	Background[1]	Limit
Aldrin (µg/L)				1.5	1.0	1.6
Chlordane (µg/L)	0.0043	0.0029	0.0045	1.2	0.0	1.3
DDT, DDE (µg/L)	0.001	0.001	0.001	0.55	0.00	0.61
Diazinon (µg/L)	0.17	0.11	0.18	0.17	0.11	0.18
Dieldrin (µg/L)	0.0056	0.0038	0.0058	0.24	0.00	0.26
Endosulfan, a & b (µg/L)	0.056	0.038	0.058	0.11	0.04	0.12
Endrin (µg/L)	0.036	0.024	0.037	0.086	0.024	0.092
Heptachlor & H. epoxide (µg/L)	0.0038	0.0025	0.0039	0.26	0.00	0.29
Lindane (µg/L)	0.08	0.05	0.08	1.0	0.1	1.1
Methoxychlor (µg/L)				0.03	0.02	0.03
Mirex (µg/L)				0.001	0.001	0.001
Nonylphenol (µg/L)	6.6	4.4	6.8	28.0	4.4	30.4
Parathion (µg/L)	0.0130	0.0087	0.0135	0.066	0.009	0.072
PCB's (µg/L)	0.014	0.009	0.015			
Pentachlorophenol (µg/L)	15.0	10.1	15.5	19.0	10.1	19.9
Toxephene (µg/L)	0.0002	0.0001	0.0002	0.73	0.00	0.80

1: Background concentration assumed 67% of chronic standard

Radiological	Maximum Concentration		
Parameter	Standard	Background[1]	Limit
Gross Alpha (pCi/L)	15	10.1	-12.2

1: Background concentration assumed 67% of chronic standard; TDS is based on observed ambient data

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

No dilution in unnamed irrigation ditch.

	Maximum Concentration	
Parameter	Standard	Limit
Total Dissolved Solids (mg/L)	1200	1200
Boron (µg/L)	75	75
Arsenic (µg/L)	100	100
Cadmium (µg/L)	10	10
Chromium (µg/L)	100	100
Copper (µg/L)	200	200
Lead (µg/L)	100	100
Selenium (µg/L)	50	50
Gross Alpha (pCi/L)	15	15

State of Utah
GARY R. HERBERT
Governor
GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

FEB 0 6 2013

Issa Hamud, P.E.
Environmental Director
Logan City Corporation
450 North 1000 West
Logan City, UT 84321

Dear Mr. Hamud:

Subject: City of Logan Wastewater Treatment Master Plan

The Division of Water Quality (Division) has been working with you and your staff to establish the UPDES discharge permit requirements for Logan's wastewater treatment plant. New permit requirements, specifically for the pollutant ammonia, were anticipated as a result of a recent rule change that affects discharges into Category 3C and 3D waters, including Swift Slough and Cutler Reservoir. The Division has completed its waste load analysis for Logan's discharge as part of the city's permit renewal process and the proposed new effluent limits for ammonia were reported to you under separate cover in a letter from Walt Baker dated January 31, 2013. In summary, the new effluent limits for Logan's discharge will be as follows:

Logan Utah Expected Effluent Limits for Ammonia, mg/L as N

Season:	Winter	Spring	Summer	Fall
Monthly Average	3.0	3.0	1.3	2.6
Daily Maximum	5.0	8.0	6.0	7.0

The Division recognizes that Logan's existing wastewater treatment system will be unable to consistently meet the new ammonia limits without major technology upgrade and capital expenditure. For planning purposes, the new wastewater treatment works must be designed and constructed to be in compliance with the effluent ammonia limits by October 1, 2017, consistent with the compliance date for Logan's total phosphorus discharge.

Logan has submitted a master plan for upgrading its plant; however, the master plan did not address the need for ammonia removal and must be updated. Logan will need to re-evaluate alternatives for upgrading its treatment works in the context of the new ammonia limits. The Division believes that the city will be challenged to consistently meet the ammonia limits for the design waste loadings and the proposed (phased) treatment system alternatives that were presented in the master plan. In updating the master plan, the alternatives evaluated should all be capable of consistently meeting effluent limits. Seasonal flow balances and pollutant mass balances (including return flows and mass loads) demonstrating permit compliance must be completed for all alternatives analyzed and must be submitted as part of the updated master plan.

For any wastewater treatment alternatives involving continued use of the lagoon system, we believe that it will be critical for Logan to have a good understanding of the hydraulic losses that occur across this system. This understanding will be necessary to accurately demonstrate permit (ammonia) compliance for any alternative that blends treated effluent from the lagoons and a new mechanical treatment plant while minimizing the cost for new treatment works. Because of its importance in the development of a cost effective design, the Division requires that Logan conduct a quantitative analysis of seepage losses through the lagoon liner and that the results of this analysis be used in the flow and pollutant mass balances of its designs.

In the master plan alternatives evaluation, the Division will require that at least one wastewater treatment alternative is developed for the full-flow treatment by a mechanical treatment plant. This is necessary as part of our project funding and "affordability" analysis.

Also as part of the updated master plan, a more thorough assessment of the sewage sludge management approach must be developed. We understand that Logan is planning to dispose sewage sludge from its wastewater treatment operations in the existing sewage lagoons. The Division has a number of concerns about this approach, particularly with respect to the potential accumulation of sludge in the lagoons, the facility's ability to treat and/or remove accumulated sludge, nutrient release, and the potential these conditions have for creating permit exceedences and nuisance conditions. To address these concerns, further analysis is needed.

In the updated master plan, Logan must complete an analysis of the proposed sewage sludge disposal operation. The sewage sludge disposal analysis must identify effective alternatives considered and must establish the expected performance and effectiveness, including costs, of the recommended alternative.

In the sewage sludge disposal analysis the city must demonstrate, e.g., by calculation, that the lagoon system is capable of and has sufficient capacity for effective treatment and disposal of the sewage sludge generated throughout the design period. These calculations must address:

1. Loadings on primary cells;
2. Aeration capacity in the primary cells to satisfy the organic loading, including the sewage sludge loading;
3. The solids distribution, accumulation, and carryover potential in the system;
4. Phosphorus release potential and potential impacts on effluent quality (return flows);
5. Ammonification potential and impacts on effluent quality (return flows);
6. Lagoon liner integrity or equivalent groundwater protection analysis;
7. Sewage sludge disposal contingency plans; and
8. Expected life (duration) of lagoon disposal plan.

As with other facilities in Utah disposing sewage sludge in old lagoons, this disposal method will be considered experimental or an "alternative biological process" that must be terminated and replaced if significant public health, environmental, or nuisance problems develop. Sludge levels in the lagoons will be restricted to two feet of sludge blanket thickness. A biosolids management and contingency plan will be required and this plan will be incorporated into the facility's permit.

Additionally, as with wastewater treatment, the Division will require that at least one sewage sludge management alternative is developed for the design flow condition that incorporates mechanical sludge treatment, e.g., as per U.A.C. R317-3-9, Sludge Processing and Disposal. This is necessary as part of our project funding and affordability analysis.

DWQ requests that you update the project wastewater facilities master plan to reflect the comments in this letter and that you then re-submit the master plan for our review and approval. Please submit two (2) copies of the master plan, sealed by a Utah registered engineer. If you have any questions, please contact me at (801) 536-4347 or by email at jkmackey@utah.gov.

Sincerely,

John K. Mackey

John K. Mackey, P. E.
Engineering Section

JKM:JKM:jkm/fb

cc: C. Ashcroft, P.E. Carollo Engineers, 1265 East Fort Union Blvd., Suite 200, Salt Lake City, UT 84047
L. Shull, DWQ UPDES IES
M. Schmitz, DWQ Biosolids Program

DWQ-2013-001383.DOC
FILE: LOGAN 2013/PLANNING/SECTION 3

State of Utah
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GREG BELL
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Department of
Environmental Quality
Amanda Smith
Executive Director
DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

MAR 28 2013

Bret F. Randall
Attorney at Law
Durham Jones & Pinegar. P.C.
P.O. Box 4050
Salt Lake City, UT 84110

Dear Mr. Randall:

Subject: New Proposed Ammonia Limits, Logan City Wastewater Treatment Plant, UT0021920

In follow up to our meeting of March 20, 2013, I am writing to address questions and concerns that you and Logan City have expressed about the City's proposed Utah Pollutant Discharge Elimination System (UPDES) permit requirements and the City's proposed new treatment works as described in your letter of March 8, 2013. I feel that our meeting was beneficial in that many difficult issues were addressed and a path toward their resolution was identified. Although challenges remain, I appreciate our open discussions and the City's willingness to work with the Division to overcome these challenges, and ultimately to accomplish a successful water quality project.

A major concern of Logan City has been the effects of a new water quality standard for ammonia that applies to the City's UPDES permit. Staff first identified the applicability of the new ammonia standard (for Category 3C receiving streams) to Logan City's discharge in April 2012. We have since discovered that the new standard should have been applied in several of Logan City's previous permits (for Category 3B receiving streams, in this case, Cutler Reservoir). I regret this error and that Logan City began facility planning in October 2010 aware of having to meet the phosphorus limits due to the TMDL but unaware of having to meet a significantly more stringent ammonia limit.

The major ramifications of the new ammonia limits as they apply to Logan City are: (1) implications on the design of the new treatment works that Logan City is planning; (2) the potential costs for altering the proposed treatment works to meet ammonia as well as phosphorus requirements; and (3) the timing requirements for economically meeting these requirements. Many questions have been raised about these ramifications and they have been discussed extensively among my staff and with Logan City's team. Our position and the path forward that was identified during our meeting are outlined below.

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www.deq.utah.gov

The new treatment plant that was recommended in Logan City's April 2012 Master Plan has very good treatment capabilities for removing ammonia and phosphorus. However, with the proposed phased implementation and continued use of the lagoon system to treat a portion of the City's wastewater, several questions remain: is the level of treatment in the proposed initial project phase sufficient to meet the

ammonia limits as well? Can the overall design and operation of the treatment works be optimized to meet these new limits? If so, at what cost? As a path forward, we have asked that Logan City address these technical questions with an analysis that should be part of the Master Plan's detailed analysis of selected alternatives, i.e., for phased alternatives. All alternatives selected for detailed analysis in the Master Plan must be capable of meeting all of Logan City's permit requirements as soon as possible, including ammonia and phosphorus limits. Alternatives that are incapable of meeting the permit limits should be screened out prior to detailed analysis. The "least degrading alternative" must also be considered for the anti-degradation review. We ask that the full treatment works, i.e., without phasing, be considered as an alternative in this regard.

We understand well the high costs of implementing sewerage and treatment works improvements as well as the extreme pressures that these large infrastructure projects have on communities and their limited financial resources. We also recognize that incorporating additional treatment to meet the new ammonia limits will undoubtedly cause these costs to increase. We believe there are a number of opportunities for minimizing these costs, including both technical and financial opportunities. There are many ways that the Division can assist Logan in this regard. As we discussed, until the cost of treatment project is understood, questions of project affordability and financing cannot be fully answered. At this point, it makes sense to hold off from doing a lot of work on the financing component. At the same time, we don't want this critical effort to get stale as we would like to get Logan City's funding request before the Water Quality Board (WQB) in a timely fashion so that we can commit funds to this high priority project. One effort that could be started is completion of a funding application for WQB assistance. The community and financial information requested in the application will help the Division inform the WQB about the funding needs and the priority of this project. If necessary, elements of the funding application can be revised at a later time when there is more certainty about the project scope and cost.

As mentioned above, we are unable to defer compliance with water quality standards. Where we do have flexibility is in the compliance schedule for completion of the new treatment works and bringing it on line. As we discussed in our meeting, we are willing to adjust the compliance schedule if there are defensible reasons why adjustments to the schedule are necessary. Nevertheless, we encourage the City to expeditiously press forward to complete the project planning phase which now must include meeting the stricter ammonia limits. We recognize that unforeseen issues may arise. We wish to work in partnership with the City and will not seek to penalize Logan City by enforcing an unrealistic schedule. By working together diligently to advance the project, to identify problems and possible solutions early, and to maintain good communications, we will succeed in producing a good, cost effective project in a timely manner.

Regarding phosphorus loading in the waste load analysis, the waste load analysis was performed for the case that Outfall 002 (and the wetlands treatment system) would be abandoned, i.e., the point of compliance would be Outfall 001. However, the waste load analysis narrative indicated phosphorus loadings for the opposite case, wherein Outfall 002 would be the point of discharge. We will correct the waste load narrative to reflect the phosphorus loadings of the permit limits for the Outfall 001 discharge. Nevertheless, the calculated effluent limits identified in our January 31, 2013 letter remain the same.

As we go forward, I have asked John Mackey of my staff to act as DWQ's project manager and principal point of contact for the Logan City treatment works project going forward. John will be responsible for coordinating communications within our team and for being the principal point of contact between DWQ and Logan City's team. John will be diligent in this pursuit and I hope that Logan City and its team will feel comfortable in communicating with him regularly regarding water quality aspects of its project. He will be contacting the City soon to coordinate upcoming events. We appreciate your and the City's efforts and commitment toward completion of this important water quality project.

Sincerely,

Walter L. Baker, P.E.
Director

WLB:JKM:jkm:jn

cc: Issa Hamud, P.E., Environmental Director, Logan City Corporation, 450 North 1000 West, Logan City, UT 84321
Kimber Housley, Esq., Logan City
Matt Dugdale, George K. Baum & Company, 15 West South Temple, Suite 1090, Salt lake City, UT 84101
Craig Ashcroft, P.E., Carollo Engineers, 1265 East Fort Union Blvd., Suite 200, Salt Lake City, UT 84047
Amanda Smith, Esq., DEQ

February 14, 2014

Walt Baker, Director
Department of Environmental Quality
Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Dear Mr. Baker:

In Cache County, 75% of all residents have their sewage treated at the Logan lagoons. These residents are represented in seven cities located in the heart of Cache County including Nibley, Providence, River Heights, Logan, North Logan, Hyde Park, and Smithfield. Of these seven cities, six currently contract with Logan for this service and they represent 43.4% of all residents who rely on the lagoons for their sewage treatment

With the new discharge standards for nitrogen, phosphorous, and ammonia being established by the EPA, it appears likely that the lagoon system will no longer be able to meet the standards thereby requiring the abandonment of the current lagoon system resulting in the need for an alternative method of treatment. It has consistently been the opinion of the six contracting cities that a regional plant is a far better option than having multiple treatment plants scattered throughout the valley serving individual or smaller groups of cities. The benefits to the Division of Water Quality with respect to their role as overseers of a single or regional plant in contrast to multiple plants, has also been well established. In addition, sewer districts with their associated regional plants that have been constructed up and down the Wasatch Front such as South Davis, South Valley, Central Davis have validated the efficiency and effectiveness of sewer districts and regional plants in meeting the treatment needs of cities.

In 2012 when it became apparent the lagoons may fall short of meeting the new discharge standards, commitments were made by Logan City representatives to involve the contracting cities in charting a future path for sewage treatment for the area currently being served by the lagoons. Yet we were kept in the dark, only learning of the completed facility plan study through newspaper articles. Despite a commitment by Logan City officials and staff to consider the formation of a sewer district should Logan City have to abandon their lagoon system in favor of a new mechanical plant, Logan City has recently refused to consider that as a possibility. Despite concerns relative to rates and overhead fees and how those funds are being used, the contracting cities have been denied a voice in determining the overall financial plans for the sewer treatment system.

We recognize as contracting cities under the current system that we are subject to the terms and conditions established by Logan City. It has been their lagoon system and even though our rates have helped pay for many of the improvements over the years, they have been the service provider and the facility owner. As cities, we have acknowledged and accepted this fact. However, with the inevitable abandonment of the Logan lagoon system, we as a united community of mayors representing the contract cities have encouraged the pursuit of a sewer district only to be rebuffed by officials and staff of Logan City.

Failure to consider a sewer district as a means to govern and manage sewage treatment, leaves the six contracting cities with only a "take it or leave it" option. If the Water Quality Board were to fund the new treatment facility on behalf of only Logan City, 45% of the users would be forced to either contract with Logan City without meaningful representation or seek funding to build and operate their own facilities. A meeting recently scheduled between the contracting cities and Logan City to simply discuss the feasibility of a sewer district and to better understand the process that would be required to establish a sewer district was promptly cancelled by Logan City staff upon hearing three of the contracting cities (North Logan, Smithfield, and Hyde Park) were exploring the *possibility* of a separate sewage treatment facility should such a facility become necessary.

Of the six contracting cities, three are located south of Logan and three are located to the north. As a result, each city has invested heavily in the construction of outfall lines, pump stations, and metering stations to transport their sewage to the centrally located sewage lagoons and the proposed site of the new Logan treatment plant. Building individual treatment plants, although an option worth consideration, would result in the abandonment of all or a portion of this infrastructure. In addition, due to the fact Logan geographically separates the six cities into two groups, one north and one south, at least two additional regional plants would need to be funded and built.

As mayors representing six of the seven cities currently using the Logan sewer lagoons, we find ourselves at a crossroads. No one city, including Logan, has a treatment facility capable of meeting the new discharge standards. As a result, we must all start anew. To provide seventy-million dollars ($70,000,000) to one city thereby allowing that one city to build the treatment facility and then dictate ongoing terms to the other six cities would be an injustice. Growth patterns in Cache Valley indicate that soon the population of the six cities will exceed that of Logan City due to the limited amount of land available for growth within Logan City compared to that of the contracting cities. As a result, inevitable future expansion of the new mechanical plant will be required because of non-Logan growth. There is now an opportunity at hand whereby every resident and business may have equal representation and a voice while achieving the goal of constructing one regional sewage treatment facility for all. It speaks to the need for efficiency, reliability, oversight, and economic responsibility.

As representatives of nearly half of all users of the current lagoon system we are united in the belief that a single regional facility has merit and would provide the most beneficial option for sewage treatment for all cities, including Logan City. It remains our desire to pursue the advantages of a sewer district because to do otherwise would be to deny proper representation of all residential and commercial users. We therefore respectfully request the Water Quality Board delay final approval of the funding for a new sewage treatment facility for Logan City, or tie such funding to the formation of a sewer district that will represent all users.

Sincerely,

Lloyd Berentzen
Mayor, North Logan City

Bryan Cox
Mayor, Hyde Park City

Darrell G. Simmons
Mayor, Smithfield

James Brackner
Mayor, River Heights City

Don W. Calderwood
Mayor, Providence City

Shaun Dustin
Mayor, Nibley City

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

received
7/13/15

JUL 0 7 2015

Mayor Craig Petersen
Logan City
290 North 100 West
Logan, UT 84323

Dear Mayor Petersen:

Subject: Utah Wastewater Project Assistance Program
Logan City, Project #201 – Authorization Letter

On June 24, 2015, the Utah Water Quality Board (the "Board") re-affirmed its January 22, 2014 authorization of a loan in the amount of $70,000,000 to Logan City (the "Applicant") for the construction of a new mechanical wastewater treatment facility (the "Project").

The loan will be secured by a revenue bond issued by the Applicant and purchased by the Board. The retirement period for the bond shall be no more than twenty (20) years from the anticipated Project completion date with an interest rate/hardship grant assessment of three-quarters of a percent (0.75%). The Board will require annual payments on the bond of approximately $3,782,144 (*Exhibit #1)* beginning one year after the loan closing date.

Special Conditions:

1. Logan City must continue to aggressively pursue funding through USDA Rural Development and Community Impact Board (CIB).

2. Logan City must agree to participate annually in the Municipal Wastewater Planning Program (MWPP).

3. As a part of facility planning, Logan City must maintain an updated Water Conservation and Management Plan.

This project is authorized subject to the availability of funds. The financial assistance represented by this authorization may be funded, in whole, or in part, from the proceeds of a federal SRF Capitalization Grant (Title VI CWA, CFDA 66.458) to the State of Utah. Under the SRF Capitalization Grant Program, federal funds are to be made available to the State of Utah by way of authorized draws on a letter of credit over the construction period of the Applicant's project. Therefore, this authorization is expressly subject to the continued availability of federal funds through the SRF Capitalization Grant and the letter of credit related thereto. Neither the Water Quality Board nor the State of Utah shall be bound by this authorization or by any obligation to provide further loan funds to, or purchase any bonds from, the Applicant if the SRF Capitalization Grant funds to which this authorization relates are not awarded or if payments under the federal letter of credit are withheld for any reason.

Based upon the information presented to the Board, the following sources of funding will be available for the construction of the Project:

Funding Source	Cost Share	Percent of Project
WQB Loan	$70,000,000	63%
CIB Loan	10,000,000	9%
Logan City Contribution	31,623,000	28%
Total	$111,623,000	100%

As Applicant of this Project, you will need to complete the following items before the Water Quality Board will purchase your bonds:

1. The State of Utah has assigned William Prater, the State's bond counsel, the responsibility of reviewing all proceedings and documents relating to the sale of bonds to the Board. His address is:

   William Prater, L.L.C.
   P.O. Box 71368
   6925 Union Park Center - Suite 265
   Midvale, Utah 84047
   Telephone: (801) 566-8882
   Fax: (801) 566-8884
   Email: bill@billprater.com

   The Applicant's bond counsel should submit the following items to William Prater at the times indicated below. A copy of the transmittal letter for the items indicated below must also be sent to the Division of Water Quality to document Project progress.

   a. No later than one week prior to the meeting at which the Applicant intends to adopt its Resolution for the issuance of the bonds, a complete copy of the proposed Resolution shall be submitted for review. Appropriate notice should be given to notify the public of the meeting at which the governing board intends to adopt the bond resolution.

   b. No later than two weeks after the adoption of the Resolution, the following items shall be submitted:

      i. A true and complete photocopy of the Resolution as adopted, showing signatures of the appropriate officials of the Applicant on the Resolution and on the Notice of Meeting, Acknowledgment of Notice and Consent, Certificate of Publication, Open Meeting Certificate, and other similar documents relating to the Resolution.

      ii. If applicable, a true and complete photocopy of the minutes, notices, resolutions and other documents relating to the bond election, showing signatures of the appropriate officials.

iii. A true and complete photocopy of the minutes, notices, resolutions and other documents, showing signatures of the appropriate officials, of the proceedings by which the Applicant was created.

iv. A complete copy of the proposed documents to be signed at closing, including (but not necessarily limited to) General Certificate, Signature Identification and Nonlitigation Certificate, Receipt, Arbitrage Certificate (if required), Applicant Attorney's Nonlitigation Certificate, Certificate of the Clerk (or Recorder) as to contents of Bond Transcript File, Escrow Agreement, and the Bond Attorney's Opinion.

v. A copy of the sewer use ordinance and rate structure described in paragraph 3 of this letter.

vi. A copy of the proposed opinion letter of the Applicant's attorney described in paragraph 6 of this letter.

The procedures for bond approval will be substantially the same as required by the Utah Municipal Bond Act as it applies to cities and towns. The opinion of the bond attorney must accompany delivery of the bonds to the Board before bond proceeds will be released.

As a condition to the acceptance by the Board of a non-voted revenue bond, the issuer must (a) publish notice and conduct a public hearing consistent with the requirements of the Utah Local Government Bonding Act, and (b) mail notices to system users in the issuer's service area informing them of the public hearing. In addition to the time and location of the public hearing, notices mailed to system users shall inform them of the issuer's intent to issue a non-voted revenue bond to the Board, shall describe the face amount of the bond, the rate of interest, the repayment schedule, and shall describe Project impacts. User charge rates and connection fees should be included in that notice, and the notice shall state that system users may respond to the issuer in writing or in the public hearing. A copy of all written responses and a certified record of a public hearing shall be forwarded to the Board. If the Board feels that there is significant opposition to the proposed Project, or if required by the Utah Local Government Bonding Act, it may be necessary for the issuer to hold a bond election before the Board's funds will be made available.

At or after the closing, the State's bond counsel will bill the Applicant, and the Applicant must pay those legal fees.

At the time of closing, the Applicant shall pay a Loan Origination Fee equal to 1% of the principal loan amount. If the Applicant decides not to build the Project after the Board has authorized the Project, the Applicant will reimburse all costs accruing after the Project Authorization. The Project Cost and Loan Origination Fee Acceptance Form (*Exhibit #2*) must be signed and returned to the Board within three weeks of the date of this letter.

2. Consistent with requirements of the law and the covenants of applicable bond resolutions, the actual payment of funds by the Board to the Applicant will not take place until the Board has assurance the funds will be used for Project costs and the Project will actually be completed. To assure this, all monies to be expended on the Project shall be placed in an escrow account jointly supervised by the Applicant and the Board. A copy of the proposed escrow agreement shall be submitted to the Board and the State's bond counsel for review. If the Project is completed without using all of the escrowed funds, the Board's share of the unused escrowed

funds will be applied as a prepayment of principal to shorten the bond repayment term. The Applicant will be required to deposit all of its Project funds in the escrow account at the time of the closing of the loan or make other provisions acceptable to the Board to ensure that funds will be available to complete the project. Disbursements from the escrow account will be reviewed and approved by the Division of Water Quality. A disbursement request form must be completed and submitted along with each request.

3. At the time of the adoption of the bond resolution, or within a reasonable time thereafter (but no later than the pre-closing date), the Applicant shall adopt an ordinance or resolution detailing proper use of the system and establishing reasonable sewer use charges and fees and collection enforcement procedures taking into account all relevant factors, including but not limited to the need to generate sewerage revenues sufficient to meet all payment and funding requirements specified in the bond resolution. A Reserve Fund, equivalent to at least one (1) year's installment on the bond and an Emergency Repair and Replacement Fund, equivalent to one-half (1/2) of one year's installment payment, must be accumulated during the first six (6) years of the repayment period. The sewer rate ordinance or resolution must establish rates sufficient to generate no less than the following amounts:

   a. An amount calculated to be sufficient to pay operation and maintenance expense of the system.

   b. $315,179 per month to be placed in a Sinking Fund for the repayment of the obligation ($3,782,144 average per year).

   c. $52,530 per month (for the first six years) to be added to a Reserve Fund until a total of $3,782,144 is accumulated.

   d. $26,265 per month (for the first six years) to be added to an Emergency Repair and Replacement Fund until a total of $1,891,072 is accumulated.

   A copy of the sewer use and user rate ordinances and/or resolutions as adopted shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date. A copy of the sewer use and user rate ordinances and/or resolutions as adopted shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date.

4. At the time of the adoption of the bond resolution, or within a reasonable time thereafter (but no later than the pre-closing date), the Applicant shall execute Interlocal Agreements for provision of wastewater treatment services with the surrounding cities that will contribute wastewater to the Applicant's facility. Copy of the executed Interlocal Agreements shall be submitted to the Water Quality Board and to the State's bond counsel on or before the pre-closing date.

5. The Applicant's contract with its consulting engineer(s) should include the cost of developing complete bidding and contract documents, performing bidding and construction management services, and preparation of an operations and maintenance manual. The engineering contract must be submitted to the Division of Water Quality for review and approval. This requirement is to assure the Board that adequate and appropriate arrangements are made for completing and inspecting the Project within the guidelines set by the Board.

6. The Applicant must secure a construction permit for the Project from the Board prior to soliciting bids. Final bidding and contract documents should be submitted to the Manager of the Engineering Section, Utah Division of Water Quality, for review.

7. The Applicant's attorney shall certify the following items in writing to the Water Quality Board:

    a. The Applicant is a legal entity as of the date of the loan closing.

    b. The Applicant has valid legal title to the rights-of-way designated and shown on the right-of-way map, including rights-of-way both for the Project to be constructed and the remainder of the existing wastewater system as of the date of the loan closing.

    c. The bidding and contract documents for the construction of the Project have the proper and legal format and are in compliance with the Utah Code Annotated 1953 (Title 34, Chapter 30).

    d. Following review by the Applicant's attorney of the completed and executed construction contract, performance and payment bonds, and evidence of necessary insurance, the Applicant's attorney shall furnish to the Water Quality Board his legal opinion that all of such items are legal and binding and in compliance with the Utah Code.

8. The Applicant shall acquire rights-of-way and easements for construction and ongoing operation and maintenance of the Project facilities. The Applicant, through its engineer, shall furnish its attorney a right-of-way map showing the location of all lagoons, buildings, structures, pipelines, and other pertinent facilities in the Project. The engineer and presiding officer of the Applicant will sign this map.

9. The Applicant must agree to the following requirements of Title VI of the Clean Water Act as applicable throughout the course of the Project:

    a. Submission of a DUNS number to the DWQ within 45 days before loan closing.

    b. Completion of the "MBE/WBE Procurement Annual Report" form for construction services. This should be submitted to the Division of Water Quality two weeks after the end of each reporting period (September 30) during construction.

    c. Include the following certification in the bond resolution:

    "The Issuer agrees, in accepting the proceeds of the Series ____ Bonds, to comply with all applicable state and federal regulations related to the Utah State Revolving Fund administered by the Water Quality Board. These requirements include, but are not limited to, Title VI of the Clean Water Act of 1987, The Single Audit Act of 1996, the Utah Wastewater Loan Program policies and guidelines, the Utah Local Government Bonding Act, the Utah Money Management Act, the Utah Procurement Code and the State of Utah Legal Compliance Audit Guide."

    d. Compliance with Davis-Bacon Act wages:

"Notwithstanding any other provision of law and in a manner consistent with other provisions in this Act, all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to this Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards specified in this section, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code."

e. Compliance with American Iron & Steel (AIS) provisions:

P.L. 113-76, Consolidated Appropriations Act 2014, requires Clean Water State Revolving Loan Fund (CWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public treatment works.

10. The Applicant shall submit a cash drawdown schedule prepared and certified by its consulting engineer that coincides with the rate construction-related Project costs are expected to occur.

11. The Applicant must have an approved Capital Facilities Plan or Engineering Report, as applicable, prior to loan closing.

12. The Applicant is required to submit a plan of operation and an operation and maintenance (O&M) manual according to the following:

    a. Applicants that have not previously operated wastewater facilities of similar magnitude and complexity to the Project are required to submit a plan of operation containing a schedule summarizing appropriate times for essential actions to be taken for facility operation. A draft plan must be submitted to the Division of Water Quality at initiation of construction and approved in final form prior to 50% of construction completion. As a minimum, the plan of operation must include provisions for an operation and maintenance manual, emergency operating and response plan, properly trained management, adequate number and training of operation and maintenance personnel, budget plan for operation and maintenance, operational reports, and start-up procedures.

    b. An operation and maintenance (O&M) manual which provides long-term guidance for efficient facility operation and maintenance must be submitted and approved in draft and final form prior to 50% and 90% completion, respectively.

In order to facilitate the timely completion of the financial assistance requirements outlined in this letter, a pre-closing conference call shall be held to determine all of the outstanding items. The Applicant and its attorney and engineer should submit to the Division of Water Quality all of the items required by the dates agreed to during the pre-closing conference call and the Applicant's bond attorney should submit to the State's bond counsel the items listed in the subsection "b" of paragraph 1 on or before the due date specified therein so that he can review those items prior to closing.

The final closing on the bond may occur once the Division of Water Quality and the State's bond counsel determine that all of the items listed in this letter have been completed and submitted satisfactorily.

If the Applicant fails to reasonably comply with the Project schedule, this Authorization may be withdrawn. If the Applicant received Planning or Design advances from the Board, withdrawal of this Authorization may authorize the Board to seek repayment of the advance(s) on such terms and conditions as it may determine pursuant to Utah Administrative Code R317-101-9 and R317-101-10. . In the event that material changes affect the funding or scope of the project, the Board reserves the right to reconsider its authorization terms.

These requirements will probably not cover all the matters pertaining to your Project. We anticipate that specific questions on matters relating to your Project will arise, and we are confident that a joint cooperative effort can resolve the issues. If you have any questions concerning these requirements, please contact Lisa Nelson (801-536-4348) or Emily Cantón (801-536-4342) of the Division of Water Quality.

Sincerely,

Utah Water Quality Board

Walter L. Baker, P.E.
Executive Secretary

cc: William Prater, Bond Counsel

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File: SRF\Helper City\Administration\Section 1
DWQ-2015-007584

Exhibit 1

Logan City Revenue Bond Repayment Schedule

Principal	$70,000,000
Interest/Hardship Assessment	0.75%
Term	20
Avg Annual Pmt	$3,782,144

Payment Number	Payment Due Date	Principal Due	Principal Payment	Interest Payment	Total Payment
1	1-Jan-19	70,000,000	3,257,000	525,000	3,782,000
2	1-Jan-20	66,743,000	3,282,000	500,573	3,782,573
3	1-Jan-21	63,461,000	3,306,000	475,958	3,781,958
4	1-Jan-22	60,155,000	3,331,000	451,163	3,782,163
5	1-Jan-23	56,824,000	3,356,000	426,180	3,782,180
6	1-Jan-24	53,468,000	3,381,000	401,010	3,782,010
7	1-Jan-25	50,087,000	3,406,000	375,653	3,781,653
8	1-Jan-26	46,681,000	3,432,000	350,108	3,782,108
9	1-Jan-27	43,249,000	3,458,000	324,368	3,782,368
10	1-Jan-28	39,791,000	3,484,000	298,433	3,782,433
11	1-Jan-29	36,307,000	3,510,000	272,303	3,782,303
12	1-Jan-30	32,797,000	3,536,000	245,978	3,781,978
13	1-Jan-31	29,261,000	3,563,000	219,458	3,782,458
14	1-Jan-32	25,698,000	3,589,000	192,735	3,781,735
15	1-Jan-33	22,109,000	3,616,000	165,818	3,781,818
16	1-Jan-34	18,493,000	3,643,000	138,698	3,781,698
17	1-Jan-35	14,850,000	3,671,000	111,375	3,782,375
18	1-Jan-36	11,179,000	3,698,000	83,843	3,781,843
19	1-Jan-37	7,481,000	3,726,000	56,108	3,782,108
20	1-Jan-38	3,755,000	3,755,000	28,163	3,783,163
TOTAL			70,000,000	5,642,918	75,642,918

Note: Loan repayments will start one year after the loan closing date.

EXHIBIT 2

PROJECT COST AND LOAN ORIGINATION FEE ACCEPTANCE FORM FOR PROJECTS FUNDED THROUGH THE UTAH STATE REVOLVING FUND PROGRAM

1. Costs of bond document review by the Water Quality Board and its bond attorney will be billed to the Applicant.

2. Costs related to the project such as administrative review, engineering, investigation, and construction supervision by the Water Quality Board (i.e. Division of Water Quality staff) will be paid from the proceeds of the Loan Origination Fee, which is equal to 1% of the principal loan amount.

3. Cost of engineering, investigation, and construction supervision are considered as follows:

   a. If the Water Quality Board denies the project or if the Applicant withdraws prior to the preparation of the feasibility report, normal manpower costs incurred by the Department of Environmental Quality during the preliminary investigation of the potential project will not become a charge to the Applicant.

   b. If the project is authorized by the Water Quality Board, all manpower costs from the beginning of the project will be charged to the project and paid from the proceeds of the Loan Origination Fee.

   c. If the applicant decides not to build the project after the Water Quality Board has authorized the project, all costs accruing after the authorization will be reimbursed by the Applicant to the Board.

ACCEPTANCE:

On behalf of the Applicant, ~~I~~ Logan City hereby accept the policy and conditions as enumerated above.

7/17/15

(Name of Applicant)	(Date)	(Presiding Official)	(Date)

(Secretary)	(Date)

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ACCEPTANCE:

On behalf of the Applicant, I hereby accept the policy and conditions as enumerated above.

(Name of Applicant)	(Date)	(Presiding Official)	(Date)

(Secretary)	(Date)

Appendix B

UPDES PERMIT

State of Utah
GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

JUL 23 2015

CERTIFIED MAIL
(Return Receipt Requested)

Issa Hamud, Environmental Director
Logan City Corporation, Wastewater Treatment Plant
290 North 100 West
Logan City, UT 84321

Dear ~~Mr. Hamud:~~ Issa

Subject: Renewal of UPDES Permit No. UT0021920, Logan City Corporation Wastewater Treatment Plant

Enclosed is the Utah Pollutant Discharge Elimination System (UPDES) Permit No. UT0020192 for your facility as referenced above. This permit was public noticed in the Logan The Herald Journal and also on the Division of Water Quality's website from June 2, 2015 – July 2, 2015. No public comments were received during the public comment period. Therefore, this permit has been re-issued as drafted and is effective August 1, 2015, subject to the right to challenge this decision in accordance with the provisions of *Utah Administrative Code*, Section R317-9. This permit along with the updated Fact Sheet Statement of Basis will also be made available on our website for future reference.

The Utah Division of Water Quality (DWQ) values your feedback, and as the State agency charged with the administration of issuing UPDES permits, we are continuously looking for ways to improve our quality of service to you and remain committed to continually assessing and improving the level and quality of services provided to you. In an effort to improve the State UPDES permitting process, we are asking for your input. Please take a few minutes to comment on the quality of service you received by completing the "Give Feedback to DWQ" form link on DWQ's webpage at www.waterquality.utah.gov. Thank you for assisting us in improving our service to you.

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

AUTHORIZATION TO DISCHARGE UNDER THE

UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM (UPDES)

MAJOR MUNICIPAL PERMIT NO. UT0021920

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

LOGAN CITY CORPORATION WASTEWATER TREATMENT PLANT

is hereby authorized to discharge from its wastewater treatment facility located approximately 2.5 miles west of Logan, Utah, to receiving waters named

SWIFT SLOUGH TO WETLANDS ASSOCIATED WITH THE CUTLER RESERVOIR

in accordance with specific effluent limitations, outfalls, and other conditions set forth herein.

This permit shall become effective on August 1, 2015.

This permit expires at midnight on July 31, 2020.

Signed this JUL 23 2015

Walter L. Baker, P.E.
Director

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

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

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

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

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

10. "Director," means Director of the Utah Water Quality Board.

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

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

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

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

15. Seasons: Summer: June – August
Fall: September – November
Winter: December – February
Spring: March – May

16. "Storm Water," means storm water runoff, snowmelt runoff, and surface runoff and drainage.

Effective immediately, and lasting through the life of this permit, there shall be no chronic toxicity in the discharge as defined in *Part I.A*, and determined by test procedures described in *Part I.D.3* of this permit.

Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfall 001A, Outfall 001B and Outfall 002. Such discharges shall be limited and monitored by the permittee as described in Table 1 below. All parameters shall be monitored at the outfall indicated by the table below.

Table 1. Effluent Limitations Outfall 001A and Outfall 001B *a/ b/*				
Effluent Characteristics	30-day Average	7-day Average	Daily Minimum	Daily Maximum
BOD_5, mg/L	25	35	NA	NA
BOD_5 Minimum % Removal	85	NA	NA	NA
TSS, mg/L	25	35	NA	NA
TSS Minimum % Removal	85	NA	NA	NA
E. coli, no./100mL	126	157	NA	NA
pH, Standard Units	NA	NA	6.5	9.0
Effluent Limitations Outfall 002				
Flow, MGD *c/ d/*				
Summer	NA	NA	NA	22.0
Fall	NA	NA	NA	21.0
Winter	NA	NA	NA	16.0
Spring	NA	NA	NA	21.0
BOD_5, mg/L	25	35	NA	NA
TSS, mg/L	25	35	NA	NA
Ammonia, mg/L				
Summer	NA	NA	NA	9.1
Fall	NA	NA	NA	11.2
Winter	NA	NA	NA	14.4
Spring	NA	NA	NA	11.9
Total Phosphorous, mg/L */e*	NA	NA	NA	Report
Oil & Grease, mg/L */f*	NA	NA	NA	10
Total Copper, µg/L	30.5	NA	NA	51.7
Total Lead, µg/L	18.6	NA	NA	100
pH, Standard Units	NA	NA	6.5	9.0
Dissolved Oxygen, mg/L	NA	NA	$\geq$ 4.0	NA
WET, Chronic Biomonitoring				
Summer	NA	NA	NA	Pass, 100% effluent
Fall	NA	NA	NA	Pass, 67% effluent
Winter	NA	NA	NA	Pass, 58% effluent
Spring	NA	NA	NA	Pass, 75% effluent

NA – Not Applicable

a/ See Definitions, *Part I.A*, for definition of terms.

b/ If a discharge occurs from Outfall 001B, at least one effluent sample must be taken during the time that outfall is discharging.

001A. The flow for 001B shall be reported as the total flow at the junction box minus the flow from Outfall 001A.

d/ Effluent samples for Outfall 001A and Outfall 001B shall be taken at a point after the chlorination basin and before the junction box where the flow is split to the two outfalls. If both outfalls are discharging simultaneously, one sample will suffice and can be reported for both outfalls. If a discharge occurs from Outfall 001B, at least one effluent sample must be taken during the time that outfall is discharging.

e/ Refer to Section IV ***Industrial Pretreatment Program*** for metals sampling requirements.

2. Compliance Schedule. The permittee shall complete the listed items (below) by the indicated dates.

   a. By December 31, 2016 Logan City shall submit detailed construction plans and specifications to DWQ to obtain a construction permit.

   b. By June 30, 2017 Logan City shall commence construction of approved wastewater treatment upgrades as outlined in the DWQ construction permit.

   c. By July 31, 2020 Logan City shall complete construction of wastewater treatment upgrades and begin startup and optimization of upgraded wastewater treatment processes.

   d. By January 1, 2021 Logan City shall achieve compliance with all effluent limits prescribed in UPDES Permit # UT0021920 including all new phosphorus and ammonia effluent limits. The final phosphorus limits from outfall 002 shall be 4,405 kg/ total phosphorus from May through October and 11,831 kg total phosphorus from November through April. If Logan city decides to abandon the treatment wetlands and move its discharge point to Outfall 001A and Outfall 001B, then the final phosphorus limits from those outfalls shall be a combined total of 11,487 kg from May through October and 12,901 kg from November through April. Final ammonia limits shall be 30 Day Average of 3.0 mg/L in Winter and Spring, 1.3 mg/L in Summer and 2.6 mg/L in Fall. The Daily Maximum shall be 5.0 mg/L in Winter, 8.0 mg/L in Spring, 6.0 mg/L in Summer and 7.0 mg/L in Fall.

3. Whole Effluent Toxicity Testing - Chronic Toxicity.
   Beginning on the effective date of the permit, the permittee shall conduct chronic short-term toxicity tests on a grab sample of the final effluent. The sample shall be collected at Outfall 002.

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

The current Utah whole effluent toxicity (WET) policy is in the process of being updated and revised to assure its consistency with the EPA's national and regional WET policy. When the revised WET policy has been finalized and officially adopted, this permit will be reopened and modified to incorporate satisfactory follow-up chronic toxicity language (chronic pattern of toxicity, PTI and/or TIE/TRE, etc.) without a public notice, as warranted and appropriate.

4. Toxicity Reduction Evaluation (TRE).

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

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

a. Phase I - Toxicity Characterization
b. Phase II - Toxicity Identification Procedures
c. Phase III - Toxicity Control Procedures
d. Any other appropriate procedures for toxicity source elimination and control.

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

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

a. Submit an alternative control program for compliance with the numerical requirements.

b. If necessary, provide a modified biomonitoring protocol that compensates for the pollutant(s) being controlled numerically.

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

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

b) Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources which may reasonably be expected to add significant amounts of pollutants to storm water discharges or which may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials, which may be reasonably expected to have the potential as a significant pollutant source. Each plan shall include, at a minimum:

1) Drainage. A site map indicating drainage areas and storm water outfalls. For each area of the facility that generates storm water discharges associated with the waste water treatment related activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow and an identification of the types of pollutants that are likely to be present in storm water discharges associated with the activity. Factors to consider include the toxicity of the pollutant; quantity of chemicals used, produced or discharged; the likelihood of contact with storm water; and history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified. The site map shall include but not be limited to:

(a) Drainage direction and discharge points from all wastewater associated activities including but not limited to grit screen cleaning, bio-solids drying beds and transport, chemical/material loading, unloading and storage areas, vehicle maintenance areas, salt or sand storage areas.

(b) Location of any erosion and sediment control structure or other control measures utilized for reducing pollutants in storm water runoff.

(c) Location of bio-solids drying beds where exposed to precipitation or where the transportation of bio-solids may be spilled onto internal roadways or tracked off site.

(d) Location where grit screen cleaning or other routinely performed industrial activities are located and are exposed to precipitation.

(e) Location of any handling, loading, unloading or storage of chemicals or potential pollutants such as caustics, hydraulic fluids, lubricants, solvents or other petroleum products, or hazardous wastes and where these may be exposed to precipitation.

(f) Locations where any major spills or leaks of toxic or hazardous materials have occurred.

(g) Location of any sand or salt piles.

facility. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls:

(a) Good Housekeeping. All areas that may contribute pollutants to storm waters discharges shall be maintained in a clean, orderly manner. These are practices that would minimize the generation of pollutants at the source or before it would be necessary to employ sediment ponds or other control measures at the discharge outlets. Where applicable, such measures or other equivalent measures would include the following: sweepers and covered storage to minimize dust generation and storm runoff; conservation of vegetation where possible to minimize erosion; sweeping of haul roads, bio-solids access points, and exits to reduce or eliminate off site tracking; sweeping of sand or salt storage areas to minimize entrainment in storm water runoff; collection, removal, and proper disposal of waste oils and other fluids resulting from vehicle and equipment maintenance; other equivalent measures to address identified potential sources of pollution.

7) Preventive Maintenance. A preventive maintenance program shall involve timely inspection and maintenance of storm water management devices (e.g., cleaning oil/water separators, catch basins) as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems.

8) Spill Prevention and Response Procedures. Areas where potential spills that can contribute pollutants to storm water discharges can occur, and their accompanying drainage points, shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures and equipment for cleaning up spills shall be identified in the plan and made available to the appropriate personnel.

9) Inspections. In addition to the comprehensive site evaluation required under paragraph (*Part III.C.1.b.15)* of this section, qualified facility personnel shall be identified to inspect designated equipment and areas of the facility on a periodic basis. The following areas shall be included in all inspections: access roads/rail lines, equipment storage and maintenance areas (both indoor and outdoor areas); fueling; material handling areas, residual treatment, storage, and disposal areas; and wastewater treatment areas. A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections. Records of inspections shall be maintained. The use of a checklist developed by the facility is encouraged.

sources of non-storm water discharges to the storm sewer; and why adequate tests for such storm sewers were not feasible. Non-storm water discharges to waters of the State, which are not, authorized by a *UPDES* permit are unlawful, and must be terminated.

13) Sediment and Erosion Control. The plan shall identify areas, which, due to topography, activities, or other factors, have a high potential for significant soil erosion, and identify structural, vegetative, and/or stabilization measures to be used to limit erosion.

14) Management of Runoff. The plan shall contain a narrative consideration of the appropriateness of traditional storm water management practices (practices other than those which control the generation or source(s) of pollutants) used to divert, infiltrate, reuse, or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges from the site. The plan shall provide that measures that the permittee determines to be reasonable and appropriate shall be implemented and maintained. The potential of various sources at the facility to contribute pollutants to storm water discharges associated with industrial activity *Part III.C.1.b* (Description of Potential Pollutant Sources) of this permit shall be considered when determining reasonable and appropriate measures. Appropriate measures or other equivalent measures may include: vegetative swales and practices, reuse of collected storm water (such as for a process or as an irrigation source), inlet controls (such as oil/water separators), snow management activities, infiltration devices, wet detention/retention devices and discharging storm water through the waste water facility for treatment.

15) Comprehensive Site Compliance Evaluation. Qualified personnel shall conduct site compliance evaluations at appropriate intervals specified in the plan, but in no case less than once a year. Such evaluations shall provide:

(a) Areas contributing to a storm water discharge associated with industrial activity shall be visually inspected for evidence of, or the potential for, pollutants entering the drainage system. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, sediment and erosion control measures, and other structural pollution prevention measures identified in the plan shall be observed to ensure that they are operating correctly. A visual inspection of equipment needed to implement the plan, such as spill response equipment, shall be made.

(b) Based on the results of the evaluation, the description of potential pollutant sources identified in the plan in accordance with *Part III.C.1.b* (Description of Potential Pollutant Sources) of this section and pollution

pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual should carry out the collection and examination of discharges for entire permit term.

b) Visual Storm Water Discharge Examination Reports. Visual examination reports must be maintained onsite in the pollution prevention plan. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

c) Representative Discharge. When Logan City Wastewater Treatment Lagoons has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, the permittee reasonably believes discharge substantially identical effluents, the permittee may collect a sample of effluent of one of such outfalls and report that the observation data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan.

d) Adverse Conditions. When a discharger is unable to collect samples over the course of the visual examination period as a result of adverse climatic conditions, the discharger must document the reason for not performing the visual examination and retain this documentation onsite with the results of the visual examination. Adverse weather conditions, which may prohibit the collection of samples, include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

e) Inactive and Unstaffed Site. When a discharger is unable to conduct visual storm water examinations at an inactive and unstaffed site, the operator of the facility

III. MONITORING, RECORDING & GENERAL REPORTING REQUIREMENTS

A. Representative Sampling.
Samples taken in compliance with the monitoring requirements established under *Part I.D* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Sludge samples shall be collected at a location representative of the quality of sludge immediately prior to the use-disposal practice.

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

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

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

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

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

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

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

   a. A description of the noncompliance and its cause;

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

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

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

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

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

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

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

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

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

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

IV. INDUSTRIAL PRETREATMENT PROGRAM

A. The permittee has been delegated primary responsibility for enforcing against discharges prohibited by *40 CFR 403.5* and applying and enforcing any national Pretreatment Standards established by the United States Environmental Protection Agency in accordance with Section 307 (b) and (c) of *The Clean Water Act (CWA)*, as amended by *The Water Quality Act (WQA), of 1987.*

   The permittee shall implement the Industrial Pretreatment Program in accordance with the legal authorities, policies, and procedures described in the permittee's approved Pretreatment Program submission. Such program commits the permittee to do the following:

   1. Carry out inspection, surveillance, and monitoring procedures which will determine, independent of information supplied by the industrial user, whether the industrial user is in compliance with the pretreatment standards. At a minimum, all significant industrial users shall be inspected and sampled by the permittee at least once per year;

   2. Control through permit, order, or similar means, the contribution to the POTW by each industrial user to ensure compliance with applicable pretreatment standards and requirements;

   3. Require development, as necessary, of compliance schedules by each industrial user for the installation of control technologies to meet applicable pretreatment standards;

   4. Maintain and update industrial user information as necessary, to ensure that all IUs are properly permitted and/or controlled at all times;

   5. Enforce all applicable pretreatment standards and requirements and obtain appropriate remedies for noncompliance by any industrial user;

   6. Annually publish a list of industrial users that were determined to be in significant noncompliance during the previous year. The notice must be published before March 28 of the following year;

   7. Maintain an adequate revenue structure and staffing level for continued implementation of the Pretreatment Program.

   8. Evaluate all significant industrial users at least once every two years to determine if they need to develop a slug prevention plan. If a slug prevention plan is required, the permittee shall insure that the plan contains at least the minimum elements required in *40 CFR 403.8(f)(2)(v);*

administrative structure or operating agreement(s), a significant reduction in monitoring, or a change in the method of funding the program.

6. Other information as may be determined necessary by the Director.

D. Pretreatment standards (*40 CFR 403.5*) specifically prohibit the introduction of the following pollutants into the waste treatment system from any source of non-domestic discharge:

1. Pollutants which create a fire or explosion hazard in the publicly owned treatment works (POTW), including, but not limited to, wastestreams with a closed cup flashpoint of less than 140°F (60°C);

2. Pollutants, which will cause corrosive structural damage to the POTW, but in no case, discharges with a pH lower than 5.0;

3. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference;

4. Any pollutant, including oxygen demanding pollutants (BOD, etc.), released in a discharge at such volume or strength as to cause interference in the POTW;

5. Heat in amounts, which will inhibit biological activity in the POTW, resulting in interference, but in no case, heat in such quantities that the influent to the sewage treatment works exceeds 104°F (40°C);

6. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

7. Pollutants, which result in the presence of toxic gases, vapor, or fumes within the POTW in a quantity that may cause worker health or safety problems;

8. Any trucked or hauled pollutants, except at discharge points designated by the POTW; or

9. Any pollutant that causes pass through or interference at the POTW.

10. Any specific pollutant which exceeds any local limitation established by the POTW in accordance with the requirement of *40 CFR 403.5(c)* and *40 CFR 403.5(d)*.

E. In addition to the general and specific limitations expressed in *Part A and D* of this section, applicable National Categorical Pretreatment Standards must be met by all industrial users of the POTW. These standards are published in the federal regulations at *40 CFR 405* et. seq.

2. In accordance with the requirements of *40 CFR Part 403.5(c)*, the permittee shall determine if there is a need to develop or revise its local limits in order to implement the general and specific prohibitions of *40 CFR Part 403.5 (a)* and *Part 403.5 (b)*. A technical evaluation of the need to develop or revise local limits shall be submitted to the Division within 12 months of the effective date of this permit. This evaluation should be conducted in accordance with the latest revision of the *Utah Model Industrial Pretreatment Program, Section 4, Local Limits*. If a technical evaluation, which may be based on the *Utah Model Industrial Pretreatment Program, Section 4, Local Limits*, reveals that development or revision of local limits is necessary, the permittee shall submit the proposed local limits revision to the Division of Water Quality for approval, and after approval implement the new local limits, within 12 months of the Division's determination that a revision is necessary.

G. Bypass of Treatment Facilities.

1. Bypass Not Exceeding Limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to *paragraph 2 and 3* of this section (*Part V.G*). Return of removed substances, as described in *Part V.F,* to the discharge stream shall not be considered a bypass under the provisions of this paragraph.

2. Notice.

   a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten (10) days before the date of the bypass.

   b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass to the Director as required under *Part II.I, Twenty-four Hour Notice of Noncompliance Reporting.*

3. Prohibition of Bypass.

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

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

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

      (3) The permittee submitted notices as required under paragraph 2 of this section *(Part V.G.2).*

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

VI. GENERAL REQUIREMENTS

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

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

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

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

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

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

more than $10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.

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

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

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

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

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

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

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

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

4. Following the implementation of numerical control(s) of toxicant(s), the Director agrees that a modified biomonitoring protocol is necessary to compensate for those toxicants that are controlled numerically.

5. The TRE reveals other unique conditions or characteristics, which in the opinion of the permit issuing authority justify the incorporation of unanticipated special conditions in the permit.

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

Appendix C

HISTORIC DISCHARGE INFORMATION

BOD/CBOD

	Date	001 BOD	001 COD		Grab 002 BOD	002 COD		Hdworks Influent BOD	HdWorks Influent COD	% Removal
1	1/3/2013	2.5	82		2.5	36		107	247	98%
2	1/9/2013	20	75		12	42		224	347	91%
3	1/16/2013	2.5	82		8	35		87	281	97%
4	1/23/2013	2.5	74		2.5	32		217	522	99%
5	1/30/2013	2.5	84		2.5	40		158	243	98%
	2/6/2013	12	80		2.5	38		115	336	90%
	2/13/2013	20	84		2.5	49		240	267	92%
6	2/20/2013	14	88		2.5	33		156	331	91%
7	2/27/2013	21	89		9	49		192	303	89%
8	3/6/2013	23	92		12	48		142	330	84%
9	3/13/2013	16	93		12	39		80	145	80%
10	3/20/2013	20	102		18	42		81	202	75%
11	3/27/2013	24	128		16	60		149	252	84%
12	4/3/2013	15	148		9	62		145	287	90%
13	4/10/2013	18	138		10	71		136	203	87%
14	4/17/2013	12	82		8	63		207	279	94%
15	4/24/2013		81		8	74		137	396	100%
16	5/1/2013	13	94		7	47		161	282	92%
17	5/8/2013		102		2.5	54		89	214	100%
18	5/15/2013		105		7	62		208	225	100%
19	5/22/2013		117		2.5	67		104	237	100%
20	5/29/2013		124		9	56		145	165	100%
21	6/5/2013	18	122		2.5	56		88	483	80%
22	6/12/2013	2.5	99		2.5	45		76	221	97%
23	6/19/2013	6	94		2.5	48		29	98	79%
24	6/26/2013		93		2.5	56		2.5	199	100%
	7/2/2013	2.5	99					58	233	96%
25	7/10/2013	18	110					56	570	68%
26	7/17/2013		97					77	264	100%
27	7/23/2013		95					114	267	100%
28	7/31/2013		96					119	125	100%
29	8/7/2013	11	90					85	229	87%
30	8/14/2013		73					78	154	100%
31	8/21/2013		92					81	226	100%
32	8/28/2013		88					98	272	100%
#REF!	9/4/2013	2.5	77					86	268	97%
	9/11/2013		89					92	224	100%
#REF!	9/18/2013		71					151	263	100%
#REF!	9/25/2013									#DIV/0!
										#DIV/0!
#REF!										#DIV/0!
#REF!										#DIV/0!
#REF!										#DIV/0!
#REF!										#DIV/0!
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#REF!										#DIV/0!
#REF!										#DIV/0!
#REF!										#DIV/0!
										#DIV/0!
										#DIV/0!
	Yearly Average	12.4375	96		6.730769	50		120	268	
	Max	24	148		18	74		240	570	
	Min	2.5	71		2.5	32		3	98	

% removal

ND = No Discharge

Compliance Sampling

AWAL

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TSS/VS/fTSS

Date	001 TSS	001 VS	001 TSS fixed		Grab 002 TSS	002 VS	002 TSS fixed	Headworks Influent	% Removal
1/3/2013	34	34	0		7	5	2	108	94%
1/9/2013	34	30	4		6	5	1	156	96%
1/16/2013	20	18	2		6	5	1	112	95%
1/23/2013	24	24	0		4	5	0	232	98%
1/30/2013	24	24	0		4	5	0	138	97%
2/6/2013	28	28	0		6	5	1	144	96%
2/13/2013	26	26	0		5	5	0	178	97%
2/20/2013	9	10	0		6	5	1	134	96%
2/27/2013	24	24	0		6	5	1	120	95%
3/6/2013	28	26	2		8	5	3	142	94%
3/13/2013	30	30	0		10	10	0	60	83%
3/20/2013	57	46	11		11	5	6	44	75%
3/27/2013	76	65	11		23	22	1	166	86%
4/3/2013	80	51	29		23	5	18	166	52%
4/10/2013	21	21	0		14	12	2	90	77%
4/17/2013	17	12	5		15	11	4	224	92%
4/24/2013	21	17	4		16	16	0	154	86%
5/1/2013	12	10	2		7	5	2	136	91%
5/8/2013	13	13	0		3.5	5	0	254	95%
5/15/2013	12	12	0		4	5	0	98	88%
5/22/2013	42	35	7		16	5	11	116	64%
5/24/2013	14	14	0						
5/29/2013	18	15	3		2	5	0	102	82%
6/5/2013	16	14	2		2	5	0	86	81%
6/12/2013	11	10	1		5	5	0	42	74%
6/19/2013	5	5	0		5	5	0	48	90%
6/26/2013	7	5	2		3.5	5	0	90	92%
7/2/2013	7	5	2					114	94%
7/10/2013	20	18	2					122	84%
7/17/2013	20	12	8					126	84%
7/23/2013	8	5	3					108	93%
7/31/2013	22	5	17					64	66%
8/7/2013	28	5	23					190	85%
8/14/2013	5	5	0					46	89%
8/21/2013	5	5	0					94	95%
8/28/2013	10	5	5					118	92%
9/4/2013	10	5	0					138	93%
9/11/2013	12	5	7					112	89%
9/18/2013	6	5	1					134	96%
9/25/2013									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!
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									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!
									#DIV/0!

Yearly Average	21.94872	18	4		8.384615	7	2	124	#DIV/0!
Max	80	65	29		23	22	18	254	#DIV/0!
Min	5	5	0		2	5	0	42	#DIV/0!

ND = No Discharge

Compliance Sampling

AWAL

Minimum Detection Limit

NH3

	Date	HW Influent	Grab 001	002
1/5/2011	1/3/2013	19.7	15.9	13
1/12/2011	1/9/2013	18.6	17.1	14.4
1/19/2011	1/16/2013	19.0	17.6	12.6
1/26/2011	1/23/2013	20.5	15.6	4.3
40570	1/30/2013	20.2	17.2	9.8
	2/6/2013	21.7	18.7	10.3
40571	2/13/2013	17.8	18.2	10.2
	2/20/2013	21.8	22.1	12.2
40572	2/27/2013	20.6	17.7	11
40573	3/6/2013	14.9	17.9	3
40574	3/13/2013	9.0	16.5	1
40575	3/20/2013	12.4	13.8	0.6
40576	3/27/2013	20.8	12.9	7
4/4/2012	4/3/2013	19.0	10.9	4.5
4/11/2012	4/10/2013	17.1	9.3	2.4
4/18/2012	4/17/2013	18.2	9.4	0.5
4/25/2012	4/24/2013	19.8	11	0.9
	5/1/2013	22.8	10.1	3.7
41025	5/8/2013	15.3	8.8	3.1
41026	5/15/2013	17.4	8	4.1
41027	5/22/2013	15.7	0.1	2.5
41028	5/29/2013	12.9	0.2	5.5
41029	6/5/2013	15.6	0.2	3
41030	6/12/2013	13.1	0.2	3.9
41031	6/19/2013	6.0	0.2	3.4
41032	6/26/2013	15.1	0.2	1.4
41033	7/2/2013	12.1	0.7	
41034	7/10/2013	15.5	0.2	
41035	7/17/2013	12.5	0.6	
41036	7/23/2013	15.0	1	
41037	7/31/2013	13.5	2	
41038	8/7/2013	17.5	1.7	
41039	8/14/2013	13.2	2.8	
41040	8/21/2013	21.2	4.7	
41041	8/28/2013	21.4	5.1	
41042	9/4/2013	18.4	5.8	
	9/11/2013	20.9	6.5	
41043	9/18/2013	23.0	7.4	
41044	9/25/2013			
41045				
41046				
41047				
41048				
41049				
41050				
41051				
41052				
12/7/2011				
########				
########				
########				
40906				
40907				
40908				
40909				
40910				
40911				
40912				
40913				
40914				
40915				
40916				
40917				
40918				
40919				

Yearly Average	17.1	8.6	5.7
Max	23.0	22.1	14.4
Min	6.0	0.1	0.5

AWAL

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Average Removal Efficiency WL System

Phosphorus

	Ortho phosphate			Total Phosphorus		
Date	HW Influent	001	002	HW Influent	001	002
1/3/2013		3.1	3.5	3.4	3.1	3.4
1/9/2013		2.6	3.8	5.1	3.3	4.1
1/16/2013		2.7	3.6	4.3	3.3	3.8
1/23/2013		2.6	3.1	6.7	3.3	3.3
1/30/2013		2.6	2.8	4.9	3.3	2.9
2/6/2013		2.6	2.8	4.9	3.3	3.1
2/13/2013		2.6	2.8	4.3	3.2	3.0
2/20/2013		2.6	2.8	4.9	3.2	3.1
2/27/2013		2.4	2.6	4.8	3.2	3.0
3/6/2013		2.6	2.5	3.2	2.9	1.9
3/13/2013		2.3	2.7	1.9	2.8	2.0
3/20/2013		2.0	3.0	3.2	2.0	2.1
3/27/2013		1.8	2.3	9.4	2.0	2.6
4/3/2013		2.0	1.9	3.9	3.0	2.4
4/10/2013		1.8	1.9	4.0	2.8	2.5
4/17/2013		2.0	1.8	5.6	2.9	2.3
4/24/2013		2.3	2.2	4.8	2.7	2.7
5/1/2013		2.4	2.7	6.6	2.7	3.0
5/8/2013		2.7	2.9	3.5	2.9	3.0
5/15/2013		2.5	2.7	3.9	2.9	3.1
5/22/2013		1.2	4.1	3.5	2.9	4.3
5/29/2013		3.4	4.0	2.8	3.8	4.0
6/5/2013		3.1	3.3	3.4	3.3	3.5
6/12/2013		3.5	4.2	2.5	3.9	4.4
6/19/2013		3.6	4.2	1.2	4.2	4.6
6/26/2013		3.0	3.2	3.3	3.4	3.6
7/2/2013		3.0		2.8	3.4	
7/10/2013		0.9		3.5	2.9	
7/17/2013		0.6		2.9	2.6	
7/23/2013		1.4		2.9	2.7	
7/31/2013		0.7		2.5	2.4	
8/7/2013		0.7		3.2	2.5	
8/14/2013		2.0		2.3	2.7	
8/21/2013		2.3		6.0	2.7	
8/28/2013		2.6		4.3	2.8	
9/4/2013		2.5		3.9	2.9	
9/11/2013		2.7		4.2	3.2	
9/18/2013		2.8		4.2	3.0	
9/25/2013						
Yearly Average	#DIV/0!	2.3	2.9	4.0	3.0	3.1
Max	0.0	3.6	4.2	9.4	4.2	4.6
Min	0.0	0.6	1.8	1.2	2.0	1.9

No Discharge

Minimum Detection Limit

Copper and Lead

Date	Copper (ug/L)			Lead (ug/L)			FOG (mg/L)			Alkalinity - Total (mg/L)		
	Influent	001	002	Influent	001	002	Influent	001	002	Influent	001	002
1/3/2013	28.8	6.4	2.7	1.8	0.7	0.7	24	2.5				
1/9/2013							31	2.5				
1/16/2013							20	2.5		379	368	411
1/23/2013							36	2.5			373	389
1/30/2013							23	2.5			373	373
2/6/2013							23	2.5			376	369
2/13/2013							29	2.5				
2/20/2013	47.8	11.3	3.4	1.4	0.8	0.6	27	2.5				
2/27/2013							22	2.5				
3/6/2013							23	2.5		394	371	344
3/13/2013							19	2.5				
3/20/2013	32.3	11.2	4.2	1.0	1.0	1	22	2.5				
3/27/2013							23	2.5				
4/3/2013	23.6	11.5	3.2	2.9	1.0	3.2	23	2.5		433	130	228
4/10/2013							15	2.5				
4/17/2013							37	5				
4/24/2013							17	2.5				
5/1/2013							32	6				
5/8/2013	37.5	7.3	1.9	1.9	1.0	0.25	20	5				
5/15/2013							18	2.5				
5/22/2013							71	8				
5/29/2013							11	6				
6/5/2013	29.8	7.6	2.6	1.2	1.0	0.25	19	2.5			371	390
6/12/2013							9	2.5			378	403
6/19/2013							14	2.5			421	419
6/26/2013							16	2.5				
7/2/2013	23.3	6.0		1.2	0.7		16			344	364	
7/10/2013							19	5				
7/17/2013							16	5				
7/23/2013							10	2.5				
7/31/2013							8	2.5				
8/7/2013	27.4	4.9		1.9	0.6		12	2.5				
8/14/2013							11	2.5		444	346	
8/21/2013							16	2.5				
8/28/2013							11	2.5				
9/4/2013	31.8	7.7		2.1	0.9		11	2.5		375	345	
9/11/2013							8	2.5				
9/18/2013							19	2.5				
9/25/2013												
Yearly Average	31.7	8.4	3.1	1.7	0.9	1.06	20.2	3.142857	#DIV/0!	394.8333	351.3333	369.5556
Max	47.8	11.5	4.2	2.9	1.0	3.2	71.0	8	0.0	444	421	419
Min	23.3	4.9	1.9	1.0	0.6	0.25	8.0	2.5	0.0	344	130	228

BOD/CBOD

	Date	001 BOD	001 COD		Grab 002 BOD	002 COD		Hdworks Influent BOD	HdWorks Influent COD	% Removal
1	1/4/2012	15	105		8	51		125	310	88%
2	1/11/2012	16	96		7	49		106	258	85%
3	1/18/2012	19	95		9	52		135	276	86%
4	1/25/2012	28	95		9	53		154	266	82%
5	2/1/2012	26	103		12	57		114	200	77%
	2/8/2012	14	105		10	63		76	236	82%
	2/15/2012	22	107		14	62		104	275	79%
6	2/22/2012	22	103		11	54		71	395	69%
7	2/29/2012	19	98		10	52		88	236	78%
8	3/7/2012	20	111		2.5	48		94	255	79%
9	3/14/2012	25	114		8	54		119	233	79%
10	3/21/2012	22	112		11	58		108	214	80%
11	3/28/2012	32	84		12	53		130	270	75%
12	4/4/2012	18	89		7	48		112	321	84%
13	4/11/2012	14	78		15	40		129	313	89%
14	4/18/2012		83		2.5	22		112	275	100%
15	4/25/2012		148		2.5	44		111	309	100%
16	5/2/2012		107		2.5	34		207	299	100%
17	5/9/2012	8	97		2.5	29		60	392	87%
18	5/16/2012		119		2.5	40		93	144	100%
19	5/23/2012		129		2.5	53		97	183	100%
20	5/30/2012		91		2.5	44		89	175	100%
21	6/6/2012	40	90		2.5	51		72	166	44%
22	6/13/2012		104		2.5	45		57	143	100%
23	6/20/2012	45	107		2.5	37		23	55	-96%
24	6/27/2012	45	100		7	47		2.5	71	-1700%
	6/29/2012	32								#DIV/0!
25	6/29/2012	29								#DIV/0!
26	7/3/2012	23	95		9	65		155	179	85%
27	7/11/2012		87		10	70		71	217	100%
28	7/18/2012		85		9	72		91	174	100%
29	7/25/2012		78		6	49		137	202	100%
30	8/1/2012	14	92		6	48		98	184	86%
31	8/8/2012		73					67	225	100%
32	8/15/2012		104					53	175	100%
#REF!	8/22/2012		64					49	117	100%
	8/30/2012		97					126	197	100%
#REF!	9/5/2012	2.5	57					77	222	97%
#REF!	9/12/2012		64		10	58		90	215	100%
	9/19/2012		62		16	68		49	110	100%
#REF!	9/26/2012		59		2.5	55		102	244	100%
#REF!	10/3/2012	7	60		2.5	49		90	414	92%
#REF!	10/10/2012	2.5	67		2.5	50		81	255	97%
#REF!	10/17/2012	2.5	63		2.5	42		101	307	98%
#REF!	10/24/2012	2.5	56		2.5	42		178	276	99%
#REF!	10/30/2012	37	53		2.5	33		207	313	82%
#REF!	11/7/2012	29	55		2.5	23		159	368	82%
#REF!	11/14/2012	2.5	70		2.5	30		140	253	98%
#REF!	11/20/2012	2.5	70		2.5	30		226	278	99%
#REF!	11/28/2012	2.5	73		2.5	28		161	296	98%
#REF!	12/5/2012	17	71		2.5	29		64	234	73%
#REF!	12/12/2012	17	56		2.5	29		193	285	91%
#REF!	12/18/2012	2.5	69		2.5	36		132	264	98%
#REF!	12/27/2012	24	75		2.5	30		155	241	85%
#REF!										#DIV/0!
#REF!										#DIV/0!
										#DIV/0!
										#DIV/0!
	Yearly Average	18.89189	87		5.925532	46		108	241	
	Max	45	148		16	72		226	414	
	Min	2.5	53		2.5	22		3	55	

% removal

ND = No Discharge

Compliance Sampling

AWAL

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TSS/VS/fTSS

Date	001 TSS	001 VS	001 TSS fixed		Grab 002 TSS	002 VS	002 TSS fixed	Headworks Influent	% Removal
1/4/2012	43	38	5		9	8	1	126	93%
1/11/2012	45	41	4		10	9	1	142	93%
1/18/2012	42	37	5		12	10	2	165	93%
1/25/2012	41	39	2		10	11	0	153	93%
2/1/2012	46	41	5		16	14	2	85	81%
2/8/2012	51	39	12		18	17	1	124	85%
2/15/2012	44	41	3		18	16	2	130	86%
2/22/2012	45	40	5		14	12	2	60	77%
2/29/2012	41	38	3		14	11	3	108	87%
3/7/2012	48	43	5		11	10	1	128	91%
3/14/2012	52	46	6		11	8	3	122	91%
3/21/2012	56	47	9		16	14	2	123	87%
3/28/2012	25	22	3		11	10	1	154	93%
4/4/2012	19	17	2		5	5	0	143	87%
4/11/2012	12	8	4		5	4	1	146	92%
4/18/2012	22	14	8		2	2	0	153	86%
4/25/2012	18	16	2		2	2	0	163	89%
5/2/2012	10	8	2		2	2	0	119	92%
5/9/2012	17	8	9		6	2	4	54	69%
5/16/2012	19	13	6		2	2	0	101	81%
5/23/2012	24	17	7		2	2	0	126	81%
5/30/2012	18	12	6		2	2	0	81	78%
6/6/2012	14	10	4		2	2	0	79	82%
6/13/2012	13	9	4		2	2	0	44	70%
6/20/2012	14	9	5		2	2	0	23	39%
6/27/2012	14	10	4		6	2	4	31	55%
7/3/2012	22	12	10		2	2	0	67	67%
7/11/2012	21	13	8		7	5	2	118	82%
7/18/2012	15	6	9		7	2	5	95	84%
7/25/2012	32	14	18		10	6	4	110	71%
8/1/2012	21	10	11		11	5	6	84	75%
8/8/2012	23	10	13					102	77%
8/15/2012								96	100%
8/17/2012	15	14	1						
8/22/2012	17	5	12					89	81%
8/30/2012	15	4	11					105	86%
9/5/2012	12	5	7					108	89%
9/12/2012	13	7	6		4	2	2	126	90%
9/19/2012	13	8	5		2	2	0	31	58%
9/26/2012	12	5	7		2	2	0	110	89%
10/3/2012	13	10	3		4	2	2	234	94%
10/10/2012	10	7	3		2	2	0	142	93%
10/17/2012	2	2	0		2	2	0	116	98%
10/24/2012	10	4	6		2	2	0	120	92%
10/30/2012	5	5	0		2	2	0	200	98%
11/7/2012	20	14	6		2	2	0	180	89%
11/14/2012	28	18	10		2	2	0	108	74%
11/20/2012	22	22	0		2	2	0	140	99%
11/28/2012	24	21	3		5	2	3	200	98%
12/5/2012	28	26	2		2	2	0	108	98%
12/12/2012	10	20			2	2	0	162	99%
12/18/2012	24	20	4		2	2	0	108	98%
12/27/2012	26	23	3		2	2	0	116	98%
									#DIV/0!
									#DIV/0!
									#DIV/0!

Yearly Average	23.96154	19	6		6	5	1	117	#DIV/0!
Max	56	47	18		18	17	6	234	#DIV/0!
Min	2	2	0		2	2	0	23	#DIV/0!

ND = No Discharge

Compliance Sampling

AWAL

Minimum Detection Limit

NH3

	Date	HW Influent	Grab 001	002
1/5/2011	1/4/2012	17.2	10.9	7.3
1/12/2011	1/11/2012	15.5	10.9	7.9
1/19/2011	1/18/2012	13.1	12.3	9.3
1/26/2011	1/25/2012	12.4	11.9	8.4
40570	2/1/2012	14.3	12.5	9.6
	2/8/2012	16.0	14.5	10.9
40571	2/15/2012	14.7	13.4	9.7
	2/22/2012	14.4	14.3	10.6
40572	2/29/2012	17.2	15.4	10.3
40573	3/7/2012	18.1	14.2	10
40574	3/14/2012	12.1	13.5	8.3
40575	3/21/2012	19.2	14.9	9.2
40576	3/28/2012	18.5	16.2	9
4/4/2012	4/4/2012	18.7	18.3	11.2
4/11/2012	4/11/2012	19.7	19.3	11.4
4/18/2012	4/18/2012	18.5	17.2	7.3
4/25/2012	4/25/2012	20.6	13.2	5.2
	5/2/2012	16.8	10.9	0.6
41025	5/9/2012	13.7	12.7	0.6
41026	5/16/2012	11.7	12.6	0.8
41027	5/23/2012	15.6	10.8	2.6
41028	5/30/2012	9.8	10.3	0.6
41029	6/6/2012	10.5	12	8
41030	6/13/2012	8.0	7.9	7.6
41031	6/20/2012	4.8	0.9	6.9
41032	6/27/2012	6.1	2.1	5.2
41033	7/3/2012	12.6	0.6	6.3
41034	7/11/2012	13.3	0.8	7.3
41035	7/18/2012	9.8	0.7	6.5
41036	7/25/2012	12.6	0.9	3
41037	8/1/2012	11.3	0.6	4.1
41038	8/8/2012	10.2	1.3	
41039	8/15/2012	14.5	1.9	
41040	8/22/2012	15.3	2.9	
41041	8/30/2012	18.0	4.4	
41042	9/5/2012	17.7	4.9	
	9/12/2012	16.8	4.7	4.2
41043	9/19/2012	11.0	5.6	1.7
41044	9/26/2012	21.4	6.9	2.5
	10/3/2012	23.8	8	1
41045	10/10/2012	20.0	8.7	2.8
41046	10/17/2012	22.6	9.1	4
41047	10/24/2012	16.9	10	4.9
41048	10/30/2012	20.4	10	4.4
41049	11/7/2012	23.7	9.3	4.3
41050	11/14/2012	14.3	9.3	4
41051	11/20/2012	21.3	10	4
41052	11/28/2012	25.0	10.5	4.4
12/7/2011	12/5/2012	16.7	10.4	3.5
12/14/2011	12/12/2012	18.0	12.3	5
12/21/2011	12/18/2012	17.6	12.5	5.7
12/28/2011	12/27/2012	17.2	12.3	9.9
40906				
40907				
40908				
40909				
40910				
40911				
40912				
40913				
40914				
40915				
40916				
40917				
40918				
40919				

Yearly Average	15.8	9.5	6.0
Max	25.0	19.3	11.4
Min	4.8	0.6	0.6

AWAL

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Average Removal Efficiency
WL
System

Phosphorus

Date	Ortho phosphate HW Influent	Ortho phosphate 001	Ortho phosphate 002	Total Phosphorus HW Influent	Total Phosphorus 001	Total Phosphorus 002
1/4/2012		2.2	2.8	4.9	2.9	3.1
1/11/2012		2.2	3.1	4.8	3.0	3.4
1/18/2012		2.3	3.4	4.5	3.2	4.1
1/25/2012		2.4	3.3	4.0	2.9	3.6
2/1/2012		2	2.7	3.4	2.9	3.1
2/8/2012		2	2.2	4.2	2.9	2.7
2/15/2012		2	2.2	4.1	2.8	2.8
2/22/2012		2	2.4	4.5	2.8	2.8
2/29/2012		2	2.2	4.0	2.8	2.7
3/7/2012		2.1	2.1	3.8	2.9	2.3
3/14/2012		2.1	2.4	4.4	3.0	2.9
3/21/2012		2.2	2.6	5.0	3.1	3.2
3/28/2012		2.7	3.4	5.3	3.2	3.8
4/4/2012		2.9	3	4.8	3.4	3.3
4/11/2012		2.9	3	4.9	3.4	3.1
4/18/2012		2.4	2.7	5.0	3.3	3.1
4/25/2012		3	3.4	4.8	3.4	3.8
5/2/2012		2	1.8	4.4	3.1	1.9
5/9/2012		2.4	2.7	4.4	3.0	3.1
5/16/2012		3.8	4.7	3.0	3.8	5.2
5/23/2012		2.9	4.4	6.2	3.5	4.6
5/30/2012		3.5	4	2.6	3.8	4.9
6/6/2012		3.7	4.1	3.3	3.8	4.7
6/13/2012		3.2	3.6	1.7	3.3	3.7
6/20/2012		3.6	3.9	1.0	4.0	4.3
6/27/2012		4	4.7	1.3	4.5	5.0
7/3/2012		0.74	6.3	2.6	3.1	6.6
7/11/2012		1	4.7	3.6	3.2	6.7
7/18/2012		3.9	4.5	3.2	4.8	5.2
7/25/2012		0.98	3.8	3.3	3.0	3.9
8/1/2012		1.1	2.5	2.2	3.1	2.7
8/8/2012		1.2		2.7	2.9	
8/15/2012		1.7		2.7	2.8	
8/22/2012		1.1		3.2	2.6	
8/30/2012		0.66		3.2	2.5	
9/5/2012		2.2		4.3	2.6	
9/12/2012		2.4	2.9	4.1	2.7	3.1
9/19/2012		2.4	2.1	3.3	2.8	2.4
9/26/2012		2.5	2.7	3.9	3.0	2.7
10/3/2012		3.1	2.4	5.3	3.1	2.7
10/10/2012		2.8	2.8	4.6	3.1	2.9
10/17/2012		0.08	0.08	4.4	3.2	3.0
10/24/2012		2.7	2.4	3.4	3.1	3.0
10/30/2012		2.7	2.6	4.5	3.0	2.6
11/7/2012		2.6	2.4	5.6	3.0	2.5
11/14/2012		2.3	2.3	3.2	2.9	2.4
11/20/2012		2.4	2	4.8	2.9	2.2
11/28/2012		3.7	2.6	5.3	2.8	2.5
12/5/2012		2.5	2.1	3.5	2.9	2.2
12/12/2012		2.6	2.7	3.6	2.9	2.7
12/18/2012		2.4	2.3	4.5	2.9	2.4
12/27/2012		2.6	2.8	3.2	3.0	2.9
Yearly Average	#DIV/0!	2.3692	2.975111	3.9	3.1	3.4
Max	0.0	4	6.3	6.2	4.8	6.7
Min	0.0	0.08	0.08	1.0	2.5	1.9

No Discharge

Minimum Detection Limit

Copper and Lead

Date	Copper (ug/L) Influent	Copper 001	Copper 002	Lead (ug/L) Influent	Lead 001	Lead 002	FOG (mg/L) Influent	FOG 001	FOG 002
1/4/2012	31.5		3.7	0.8		0.6	18	2.5	
1/11/2012							11	2.5	
1/18/2012							13	5	
1/25/2012							17	2.5	
2/1/2012	26.3	10.1	4.4	0.7	0.7	0.6	11	2.5	
2/8/2012							14	2.5	
2/15/2012							15	2.5	
2/22/2012							23	2.5	
2/29/2012							18	2.5	
3/7/2012	27.9			1.1			22	7	
3/14/2012							12	2.5	
3/21/2012							17	2.5	
3/28/2012							15	2.5	
4/4/2012	27.1	7.5	2.0	0.7	0.25	0.25	16	2.5	
4/11/2012							20	2.5	
4/18/2012							17	2.5	
4/25/2012							19	2.5	
5/2/2012							25	6	
5/9/2012	41.9	11.7	1.0	1.8	1.4	0.25	26	2.5	
5/16/2012							10	2.5	
5/23/2012							19	2.5	
5/30/2012							17	2.5	
6/6/2012	23.1	7.9	1.0	0.8	0.8	0.25	11	2.5	
6/13/2012							7	2.5	
6/20/2012							5	2.5	
6/27/2012							5	2.5	
7/3/2012							13	2.5	
7/11/2012	23.7	4.2	0.5	0.8	0.25	0.25	14	2.5	
7/18/2012							13	2.5	
7/25/2012							12	2.5	
8/1/2012	27.6	4.1	1.3	0.8	0.5	0.25	12	2.5	
8/8/2012							12	2.5	
8/15/2012							21	2.5	
8/22/2012							12	11	
8/30/2012							15	2.5	
9/5/2012							15	2.5	
9/12/2012							18	5	
9/19/2012	42.2	5.9	1.1	1.3	0.9	0.25	22	2.5	
9/26/2012							19	2.5	
10/3/2012	41.6	6.7	1.2	0.9	1	0.25	21	2.5	
10/10/2012							19	2.5	
10/17/2012							23	2.5	
10/24/2012							16	2.5	
10/30/2012							27	2.5	
11/7/2012	45.7	6.5	1.6	1.1	1.1	0.7	22	2.5	
11/14/2012							20	2.5	
11/20/2012							21	2.5	
11/28/2012							32	2.5	
12/5/2012							13	2.5	
12/12/2012	45.0	6.3	2.9	1.7	0.8	0.7	33	2.5	
12/18/2012							19	2.5	
12/27/2012							17	2.5	

Yearly Average	33.8	7.1	1.7	1.1	0.77	0.375	17.1	2.93	#DIV/0!
Max	45.7	11.7	4.4	1.8	1.4	0.7	33.0	11	0.0
Min	23.1	4.1	0.5	0.7	0.25	0.25	5.0	2.5	0.0

	Aluminum (mg/L)			Arsenic (mg/L)			Cadmium (mg/L)		
Date	Influent	001	002	Influent	001	002	Influent	001	002
1/30/2008	0.7		0.1	0.002		0.0027	0.00025		0.00025
6/4/2008	0.4		0.05	0.0027		0.0033	0.00025		0.00025
9/17/2008	0.8		0.05	0.0028		0.0045	0.00025		0.00025
11/25/2008	0.4		0.2	0.0018		0.0039	0.00025		0.00025
3/4/2009	0.9		0.1	0.0034		0.0026	0.00025		0.00025
6/3/2009	0.8		0.2	0.0019		0.0016	0.00025		0.00025
9/16/2009	0.3	0.2		0.0028	0.0026		0.00025	0.00025	
9/25/2009			0.05			0.007			0.00025
12/9/2009	0.5		0.2	0.0016		0.004	0.00025		0.0025
3/10/2010	0.7		0.05	0.0032		0.0023	0.00025		0.00025
6/2/2010	0.3	0.3	0.05	0.0027	0.0021	0.0036	0.00025	0.00025	0.00025
9/10/2010	0.2		0.4	0.0046		0.0028	0.00025		0.00025
12/1/2010	0.8		0.2	0.0021		0.0033	0.00025		0.00025
3/9/2011	0.5		0.025	0.0038		0.0021	0.00025		0.00025
6/8/2011	0.2		0.025	0.0018		0.0027	0.00025		0.00025
7/20/2011			0.3			0.007			0.00025
7/27/2011	0.2			0.0024			0.00025		
12/7/2011	0.2		0.07	0.0016		0.0027	0.00025		0.00025
2/22/2012	0.4		0.025	0.003		0.0021	0.00025		0.00025
5/9/2012	0.5		0.1	0.003		0.0047	0.00025		0.00025
9/19/2012	0.3		0.08	0.0031		0.0095	0.00025		0.0001
12/12/2012	0.3		0.05	0.0033		0.0038	0.0001		0.0001
3/20/2013	0.3		0.05	0.0036		0.0038	0.00025		0.00025
5/8/2013	0.3		0.025	0.0027		0.0066	0.0001		0.0001
8/21/2013	0.2		No Discharge	0.0026		No Discharge	0.0001		No Discharge

Non-Detect	Value reported is 1/2 Mimimum Detection Limit

Date	Chromium (mg/L) Influent	Chromium 001	Chromium 002	Copper (mg/L) Influent	Copper 001	Copper 002	Lead (mg/L) Influent	Lead 001	Lead 002
1/30/2008	0.0038		0.0016	0.041	0.01	0.006	0.0024	0.006	0.001
6/4/2008	0.0024		0.0016	0.031		0.00025	0.001		0.00025
9/17/2008	0.0025		0.0025	0.039	0.007	0.003	0.0024	0.0015	0.0006
11/25/2008	0.0025		0.0025	0.031		0.007	0.0016		0.0014
3/4/2009	0.0047		0.0025	0.047	0.014	0.006	0.0022	0.0013	0.00025
6/3/2009	0.003		0.001	0.0397	0.0036	0.0092	0.003	0.00025	0.0011
9/16/2009	0.0025	0.0025		0.0382	0.0101		0.0025	0.0016	
9/25/2009			0.0025			0.0051			0.00025
12/9/09	0.0025		0.0025	0.0424		0.0047	0.0011		0.0014
3/10/10	0.0025		0.0025	0.044		0.0066	0.0016		0.00025
6/2/10	0.0025	0.0025	0.0025	0.0283	0.0116	0.0034	0.0008	0.0012	0.00025
9/10/2010	0.0025		0.0025	0.049		0.0102	0.0008		0.0013
12/1/10	0.0025		0.0025	0.0431		0.0042	0.0022		0.0012
3/9/11	0.0025		0.0025	0.0413		0.0036	0.0017		0.00025
6/8/11	0.0025		0.0025	0.0201		0.002	0.0007		0.00025
7/20/11			0.0025			0.0044			0.0006
7/27/11	0.0025			0.0214			0.001		
12/7/2011	0.0025		0.0025	0.0708		0.0033	0.0007		0.0006
2/22/12	0.0025		0.0025	0.0415		0.0033	0.0015		0.00025
5/9/12	0.0025		0.0025	0.0419	0.0117	0.001	0.0018	0.0014	0.00025
9/19/12	0.0025		0.0025	0.0422	0.0059	0.0011	0.0013	0.0009	0.00025
12/12/12	0.0025		0.0025	0.045	0.0063	0.0029	0.0017	0.0008	0.0007
3/20/13	0.0028		0.001	0.0323		0.0042	0.001		0.002
5/8/13	0.0025		0.0025	0.0375	0.0073	0.0019	0.0019	0.001	0.00025
8/21/13	0.0025		No Discharge	0.0419	0.0071	No Discharge	0.0009	0.0006	No Discharge

Non-Detect — Value reported is 1/2 Mimimum Detection Limit

	Mercury (ng/L)		
Date	Influent	001	002
3/18/2008	51		10.1
6/4/2008	260		25.1
9/17/2008	200		200
12/10/2008	68		1.3
3/4/2009	82		5.2
6/3/2009	185		2.5
9/16/2009	478	6.4	
12/18/2009	42.8		1.12
3/10/2010	37.1		2.55
6/2/2010	20		0.99
9/10/2010	54		5.85
12/1/2010	9.76		0.62
3/16/2011	42.9		1.19
6/8/2011	3.94		4.6
7/20/2011	9.29		3.3
12/7/2011	17.6		0.13
2/22/2012	48.8		0.13
5/9/2012	12.5		1.6
9/26/2012	69.2		0.8
12/12/2012	1.18		0.13
3/20/2013	7.67		2.59
5/22/2013	31.2		2.08
8/21/2013	60.6		No Discharge

Yearly Average	77.9		12.9
Max	478.0		200.0
Min	1.2		0.1

Non-Detect	Value reported is 1/2 Mimimum Detection Limit

	Cyanide (mg/L)			Molybdenum (mg/L)			Nickel (mg/L)		
Date	Influent	001	002	Influent	001	002	Influent	001	002
1/30/2008	0.001		0.001	0.0021		0.0013	0.0067		0.0129
6/4/2008	0.001		0.001	0.0019		0.0006	0.0047		0.0083
9/17/2008	0.001		0.001	0.0023		0.0013	0.0025		0.0025
11/25/2008	0.001		0.001	0.0015		0.0025	0.0025		0.0025
3/4/2009	0.001		0.001	0.0029		0.0031	0.0085		0.0031
6/3/2009	0.001	0.001	0.001	0.005		0.005	0.0025		0.0025
9/16/2009	0.001	0.001		0.005	0.005		0.0025	0.0025	
9/25/2009			0.001			0.005			0.0025
12/9/2009	0.001		0.001	0.005		0.005	0.008		0.0025
3/10/2010	0.001		0.001	0.005		0.005	0.0025		0.0025
6/2/2010	0.001		0.001	0.005	0.005	0.005	0.0025	0.0025	0.0025
9/10/2010	0.001		0.001	0.005		0.005	0.0025		0.0025
12/1/2010	0.001		0.001	0.005		0.005	0.0025		0.0025
3/9/2011	0.004		0.001	0.005		0.005	0.0025		0.0025
6/8/2011	0.001		0.001	0.005		0.005	0.0025		0.0025
7/20/2011			0.001			0.005			0.0025
7/27/2011	0.001			0.005			0.0025		
12/7/2011	0.003		0.009	0.005		0.005	0.0025		0.0025
2/8/2012			0.001						
2/22/2012	0.001			0.005		0.005	0.0025		0.0025
5/9/2012	0.001		0.001	0.005		0.005	0.0025		0.0025
9/19/2012	0.001		0.001	0.005		0.005	0.0025		0.0025
12/12/2012	0.001		0.001	0.005		0.005	0.0025		0.0025
3/20/2013	0.0025		0.0025	0.001		0.0024	0.0034		0.0071
5/8/2013	0.002	0.002	0.002	0.005		0.005	0.0025		0.005
8/21/2013	0.001		No Discharge	0.005		No Discharge	0.01		No Discharge

Non-Detect

Value reported is 1/2 Mimimum Detection Limit

	Selenium (mg/L)			Silver (mg/L)			Zinc (mg/L)		
Date	Influent	001	002	Influent	001	002	Influent	001	002
1/30/2008	0.0015		0.002	0.0006		0.00025	0.12		0.01
6/4/2008	0.001		0.0009	0.00025		0.00025	0.06		0.005
9/17/2008	0.0015		0.0018	0.0028		0.00025	0.11		0.005
11/25/2008	0.00025		0.00025	0.0008		0.00025	0.07		0.01
3/4/2009	0.0011		0.0007	0.0011		0.00025	0.11		0.02
6/3/2009	0.001		0.0011	0.0025		0.0025	0.08		0.01
9/16/2009	0.0011	0.0011		0.0025	0.0025		0.05	0.005	
9/25/2009			0.0019			0.00025			0.005
12/9/2009	0.0011		0.0009	0.0007		0.00025	0.08		0.01
3/10/2010	0.001		0.0005	0.00025		0.00025	0.11		0.005
6/2/2010	0.0012	0.0011	0.0009	0.00025	0.00025	0.00025	0.04	0.01	0.005
9/10/2010	0.0009		0.0008	0.00025		0.00025	0.07		0.02
12/1/2010	0.001		0.0007	0.0008		0.00025	0.1		0.02
3/9/2011	0.0015		0.001	0.00025		0.00025	0.07		0.02
6/8/2011	0.001		0.0008	0.00025		0.00025	0.03		0.005
7/20/2011			0.0009			0.00025			0.02
7/27/2011	0.001			0.00025			0.05		
12/7/2011	0.0011		0.001	0.00025		0.00025	0.04		0.005
2/22/2012	0.0011		0.0011	0.003		0.00025	0.08		0.005
5/9/2012	0.0014		0.0016	0.00025		0.00025	0.09		0.005
9/19/2012	0.0013		0.0019	0.00025		0.00025	0.08		0.005
12/12/2012	0.0029		0.0026	0.00025		0.00025	0.07		0.01
3/20/2013	0.001		0.001	0.001		0.001	0.081		0.017
5/8/2013	0.0011		0.0009	0.00025		0.00025	0.14		0.01
8/21/2013	0.0008		No Discharge	0.00025		No Discharge	0.09		No Discharge

Non-Detect	Value reported is 1/2 Mimimum Detection Limit

Appendix D

BIO-DOME INFORMATION

Bio-Shell Budgetary Proposal

To: Craig Ashcroft, P.E.
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801-233-2500
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From:

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Director of Sales
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Kraig Johnson, PhD, P.E.
CTO
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Wastewater Compliance Systems, Inc.
Phone: 801-999-8271

&

Jeremy Jensen and Frank Henderson
Independent Sales Representatives
ISI West

Re: Logan, UT Wastewater Lagoon Upgrade

Sep 30, 2013

Craig Ashcroft

From: KRAIG JOHNSON [kraigjoh@msn.com]
Sent: Tuesday, October 01, 2013 7:31 PM
To: Craig Ashcroft
Cc: Taylor Reynolds
Subject: RE: Logan proposal

Craig, for the size units we are recommending for Logan, we don't have any installations. We wouldn't have any installations in the 18 mgd range anyway, as there are no other lagoon systems besides Logan in the US in that flow range. Ideally, these units should be piloted at Logan. We have tried for the last 4 years to get Logan to pilot our units, but rarely were our phone calls even returned. Therefore, at this time we can only offer data from the communities that have been willing to test our technology, and you have the data file for that.

Thanks for your consideration.

Sincerely,

Kraig J.

From: CAshcroft@carollo.com
To: kraigjoh@msn.com
CC: taylor@wcs-utah.com
Date: Tue, 1 Oct 2013 09:52:39 -0700
Subject: RE: Logan proposal

Hi Kraig - Could you send me a reference list of full scale installations of the Bio-shell? I would like a contact name & number and the number of Bio-Shells installed, date installed, and flowrate. Just include Bio-shell installations and not Bio-dome installations.

Thanks,
Craig

Craig Ashcroft, P.E.
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Contents

Executive Summary

Logan, UT received a new NPDES permit for their wastewater lagoons that will require the community to provide year round nitrification. Unfortunately the current lagoon system is unable to meet the new limits and is in need of an upgrade that will allow the community to meet the treatment needs established by the State. Currently, the community is planning on abandoning their existing lagoons to build a mechanical plant. In the event that the citizens of Logan object to the $135 Million cost of the mechanical plant, WCS has put together the following proposal as a much less expensive upgrade alternative.

This updated proposal describes a system that can provide a long term solution for Logan that allows the city to utilize their existing infrastructure in a cost effective and modular manner.

Key Benefits of the Bio-Domes / Bio-Shells

1. The Bio-Shells represent the least expensive treatment upgrade available in terms of both capital expense as well as O&M expense.
2. An upgrade utilizing Bio-Shells will not require new operators with additional training, certification, and or a higher pay grade.
3. The Bio-Shell system is intended to be a modular, expandable, system that is capable of growing with the community over the next 20+ years.
4. The Bio-Shells can be coupled with other, more conventional, technologies to address future phosphorous or Total Nitrogen Limits.
5. Because of the energy efficiency of the Bio-Shells, the proposed system can be considered "green" and will possibly qualify the community for Energy Efficiency grants if any are available through their utility provider.

Background

On August 16th, 2013, Taylor Reynolds and Kraig Johnson of Wastewater Compliance Systems, Inc met with Craig Ashcroft of Carollo Engineering to provide a presentation on the Bio-Dome / Bio-Shell technology that has been developed to increase the treatment capabilities of wastewater lagoons. Also in attendance at the meeting were representatives of Logan, UT and the State of Utah. During the presentation it was expressed that the existing plans were focusing around the idea of abandoning the wastewater lagoons and building a mechanical plant. After the meeting, Craig Ashcroft agreed to include a proposal from WCS in his report to Logan.

Project Goals

The primary goal of this upgrade is to enable Logan to meet all state effluent requirements. The parameters used for the influent and effluent characteristics are described below.

Project Design Parameters

The engineering parameters used to develop this proposal for a complete treatment system are as follows:

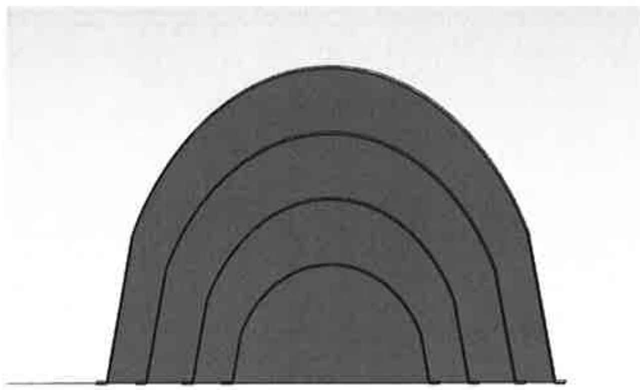
- Effluent BOD limit - 25 mg/
- Effluent TSS Limit - 25 mg/L
- Effluent TP limit @ 18 mgd - 0.92 mg/L
- Effluent NH3 limit (winter season) - 3.0 mg/L
- Effluent NH3 limit (spring season) - 3.0 mg/L
- Effluent NH3 limit (summer season) - 1.3 mg/L
- Effluent NH3 limit (fall season) - 2.6 mg/L
- Effluent DO limit - 5.5 mg/L
- Future TN limit - 10 mg/L

In order to meet the Total Phosphorous Limits, Logan will need to add a chemical precipitation step and possibly a filter. There are a number of lagoons around North America meeting a TP limit of 0.92 mg/L with only chemical precipitation and settling in an existing lagoon cell.

Product Overview

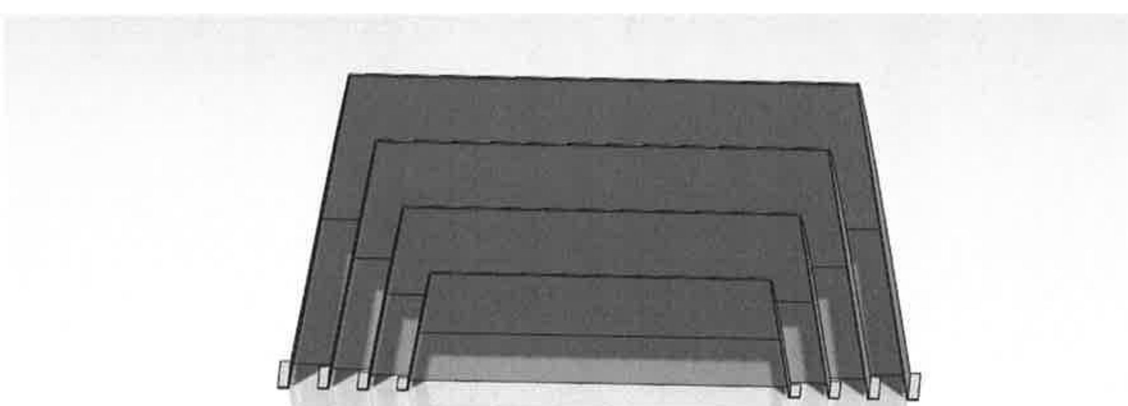
WCS manufactures and sells patented submergible aerated bio-film reactors under the trade names Bio-Dome & Bio-Shell that were developed at the University of Utah to reduce BOD, TSS and NH_4+-N from wastewater streams in a lagoon environment. Because of the large number of units needed for this project, it is recommended that Bio-Shells be used to provide the necessary treatment. The information below provides details regarding traditional Bio-Shells.

The traditional Bio-Shell consists of stacked half pipe sets that contain 10,500 sq-ft of aerated bio-film surface, and is the functional equivalent of 3.5 Bio-Domes. The overall dimensions of the Bio-Shell are 96" long x70" wide x 5' tall (not including the base). Each Bio-Shell is designed to remove 0.63lbs NH_4+-N/Bio-Shell/day, and / or 19.6lbs BOD/Bio-Shell/day.



In order for effective nitrification to occur, BOD levels must first be reduced to a level below 35 mg/L.

Bio-Shells are positioned on the floor of a lagoon for year round, ice-free operation



Logan System

Because the Bio-Shells rely on fixed film, as opposed to suspended growth, they provide reliable nitrification in water temperatures as low as 2°C. Since Logan currently uses a lagoon system for their wastewater treatment, utilizing WCS's Bio-Shells will enable the community to cost-effectively utilize their ***existing*** infrastructure while maintaining compliance with the new permit levels.

Sizing Calculations

Based on the daily loading of the system and the removal rates described above; the total number of Bio-Shells required to ensure Logan stays in compliance with the design criteria of removing the total loading, is 4070. 186 are needed for BOD polishing and 3884 are needed for nitrification. The combined Bio-Shells for BOD and Ammonia removal will also ensure TSS compliance. The sizing calculations are shown on the next page.

Furthermore, it is assumed that because of the robust nature of the fixed film within the Bio-Shells the performance of the Bio-Shells will not decrease appreciably throughout the winter months as long as the water temperatures stay above 2°C, therefore no additional Bio-Shells are necessary in order to ensure winter compliance.

Please Note: The proposed system will allow Logan to achieve an effluent quality that meets the expected permit levels based on current information. In the future as the community grows and loading is increased, additional Bio-Shells can be installed incrementally on an as need basis in order to ensure compliance.

In the event that Logan is given a Total Nitrogen limit, air cycling can be introduced into the treatment regime in order to denitrify as well.

A key feature of the Bio-Shells is their modular nature which allows for seamless growth with the community in order to meet increased populations sizes, loading and even more stringent effluent requirements.

Bio-Shell System

Defined Variables

$BOD_{BS.removal} := 16.1 \frac{lb}{BS \cdot day}$ $Ammonia_{BS.removal} := .63 \frac{lb}{BS \cdot day}$ $TSS_{BS.removal} := 7.56 \frac{lb}{BS \cdot day}$

Project Details

$BOD_{in} := 45 \frac{mg}{L}$ $Ammonia_{in} := 19.3 \frac{mg}{L}$ $TSS_{in} := 70 \frac{mg}{L}$ $Flow := 18MGD$

$BOD_{out} := 25 \frac{mg}{L}$ $Ammonia_{out} := 3 \frac{mg}{L}$ $TSS_{out} := 25 \frac{mg}{L}$ $Conversion := 8.34 \frac{\frac{lb}{MG}}{\frac{mg}{L}}$

BOD Removal Requirements

$Daily_{BOD.removal} := Flow \cdot Conversion \cdot (BOD_{in} - BOD_{out})$

$Daily_{BOD.removal} = 3.002 \times 10^{3} \cdot \frac{lb}{day}$

$BS_{required.BOD} := \frac{Daily_{BOD.removal}}{BOD_{BS.removal}}$

$BS_{required.BOD} = 186$

Ammonia Removal Requirements

$Daily_{ammonia.removal} := Flow \cdot Conversion \cdot (Ammonia_{in} - Ammonia_{out})$

$Daily_{ammonia.removal} = 2.447 \times 10^{3} \cdot \frac{lb}{day}$

$BS_{required.ammonia} := \frac{Daily_{ammonia.removal}}{Ammonia_{BS.removal}}$

$BS_{required.ammonia} = 3884$

Aeration / Power Requirements

The aeration requirement for each Bio-Shell at a depth of 6ft is 3.5 CFM at 7 psig. For the 4070 Bio-Shells required for nitrification, this equates to a requirement of 14,245 CFM. If Logan were to use a Rotary Lobe Positive Displacement Blower, the hp requirements to provide 14,245 CFM at 7 psig would be around 554hp. Additionally, assuming a utility rate of $0.07 / kWhr, the annual utility bill for the proposed nitrification system will be approximately $254,000.

Installation

The installation of a Bio-Shell system occurs in two phases. Phase 1 is the construction of the infrastructure needed to deliver the air from the blower(s) to the Bio-Shells. The exact details of the aeration system are left to the discretion of the design engineer as long as the air manifolds are capable of delivering 3.5CFM to each Bio-Shell. Part 2 of the installation process is the actual placement of the Bio-Shells in the wastewater lagoon. Logan will require the use of a special WCS designed and fabricated barge to install (Labor to be performed by a contractor or Logan UT Employees) the Bio-Shells in the lagoon while it remains fully flooded and operational. Following installation, the barge will become the property of Logan.

Based on previous experience, for a project this size, the cost of installation is between 8 – 15% depending on materials and labor costs.

The Bio-Shells should be installed close to the effluent zone of the lagoon, and arranged in such a fashion as to ensure all water must flow past them. Recommended placement of the Bio-Shells can be seen on page 11.

Miscellaneous Considerations

Sludge Depth

Because the Bio-Shells are installed on a 12" concrete base, a sludge depth of more than 12" will require that the ponds be desludged.

Operator Savings

The continued use of the existing lagoons combined with installation of WCS's Bio-Shells will allow Logan to operate the system with current personnel and avoid the necessity of hiring or upgrading operator certification for a mechanical plant, resulting in significant labor cost savings.

Energy Savings / Rebates

Because of the energy efficiency of WCS's products compared to traditional aeration systems, it is typical for communities to lower their monthly utility bill after implementing the Bio-Shells in their lagoons. Additionally many power companies around the country offer rebate incentives for "energy efficiency" upgrades that could potentially help offset the installation cost. WCS recommends you contact your local power company to see if rebates are available.

Maintenance

Maintenance for the Bio-Shells consists of daily visual inspection to ensure the air is on and flowing through each unit. Yearly cleaning of the air diffusers may be required. This is achieved by injecting a mild acid into the air hose on the shore and blowing it out through the diffusers. A 10 year visual inspection of the Bio-Shells, and a 20 year replacement of the diffusers is recommended. Additionally there is maintenance associated with the blowers per the manufacturer's specifications.

Cost Summary

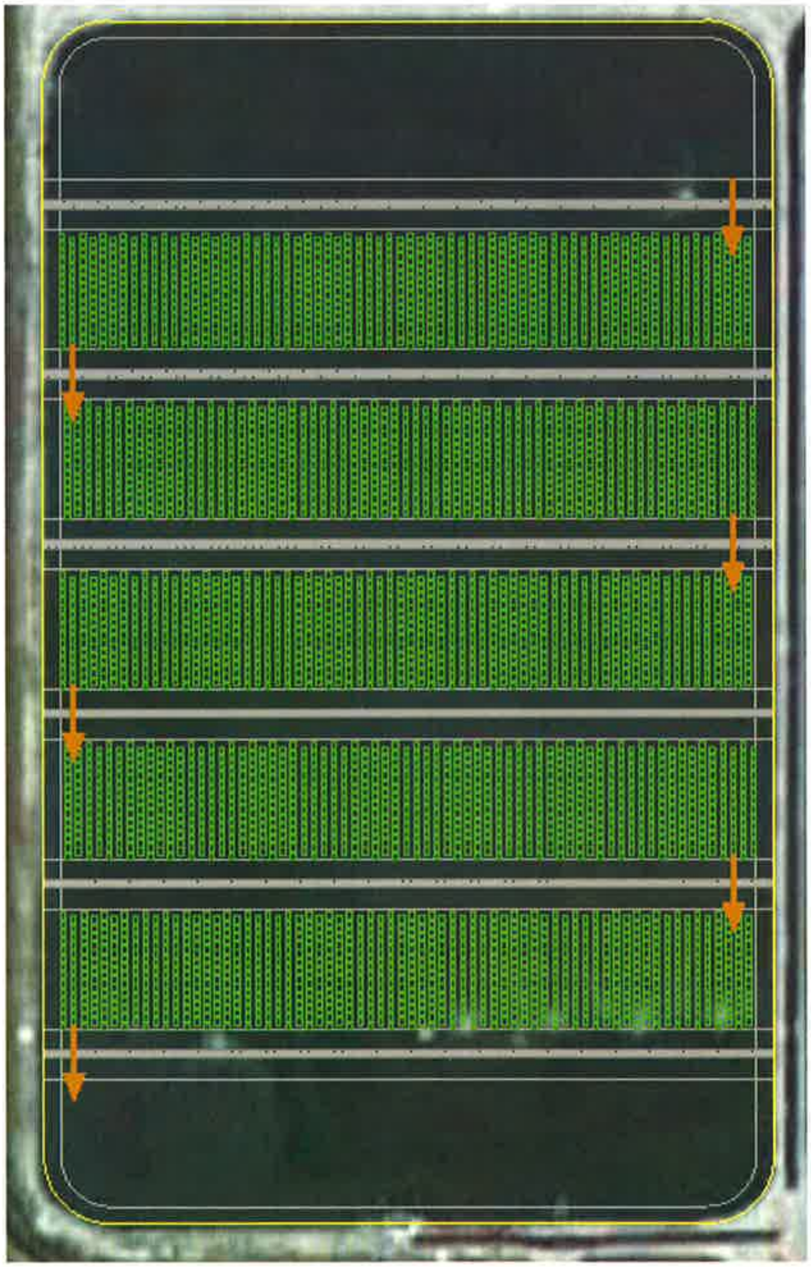
Please note that the cost of the TP removal system has not been included in the costs below. It is WCS' understanding that separate proposals for TP removal have already been received by Carollo Engineering.

Item	Design Flow	
Number of Bio-Shells	4070	
Unit Cost:	$6,500	/ Bio-Shells
Materials / Equipment Costs[1]	$26,455,000	
Estimated Installation Cost[2]	$2,116,400	
Estimated Shipping Cost[3]	$124,771	
Expected System Life (years)	20	
Aeration Requirements	14245	CFM
Estimated Power Requirements[4]	554	hp
Utility Rate	$0.07	/ kWhr
Annual Power Cost[5]	$253,581	
Annual Operations & Maintenance[6]	101750	
System Flow Rate	18,000,000	gal / day
Installed Cost / Gallon Treated	$1.47	
Monthly Installed Cost / Household[7]	$8.57	
Monthly O&M Cost / Household[8]	$0.58	

1. Quoted prices are for Bio-Shells F.O.B Lehi, UT. WCS does not supply hanging curtains or blowers. That equipment must be procured separately. If requested, WCS can provide a quote for the self-sinking rubber air feed hose that runs from shoreline air distribution boxes to each submerged Bio-Shell.
2. This estimate is intended to provide an estimate of the total cost of installation and covers the cost of the blowers, installation of the blowers, air-distribution lines, self sinking rubber hose and placement of the Bio-Shells. It does not include Engineering Fees or Contractor Mark-ups
3. This estimate is based on the assumption that 8 units can be included in each load, and each load will cost approximately $250 to ship from Lehi, UT to Logan, UT.
4. For blower sizing, WCS recommends 3-phase blowers with a variable speed drive, rated at 2x the estimated power consumption rounded up to the nearest available blower size.
5. Based on $0.07USD / kWhr.
6. Based on a $50USD / Bio-Shell for labor and materials to perform an air hose purge every 12 months per the manufacturer's recommendations. Blower maintenance not included as that decision is left to the consulting engineers.
7. Assuming 350 gallons / day / household, and a 5 year amortization.
8. Based on $0.07 USD / kWhr plus annual O&M expenses for 350 gallons / day / household.

Preliminary Proposed Layout

The drawing below shows the 4070 Bio-Shells arranged in Cell E of the Logan Lagoons. With the Bio-Shells only occupying Cell E there is plenty of room for expansion in the future if TN limits are imposed.



Warranty Information

WCS warrants the performance of WCS Bio-Domes & Bio-Shells under the following conditions:

A. **Warranty Guidelines:**
   a. In order to warrant performance, WCS requires:
      i. That a requisite number of *Bio-Domes* or *Bio-Shells* be installed in accordance with the calculated number intended to meet or exceed engineering requirements. This requirement may include contaminant and flow levels that exceed currently expected values. The number of additional *Bio-Domes or Bio-Shells* will be determined exclusively by WCS at the request of the customer.
      ii. That the community and engineering firm allow WCS to review and approve the design and operation of the air delivery system.

The customer must maintain an operating log to confirm proper *Bio-Dome or Bio-Shell* operation and maintenance activities in accordance with WCS provided specifications and operator manuals.

   b. The customer must allow WCS to perform on-site examinations of any under-performing and/or defective *Bio-Domes or Bio-Shells* in order to determine the cause of failure. If any of the exceptions described below are found to be the cause of failure, WCS reserves the right to void the warranty.

B. **Performance Warranty:** WCS offers a 5 year performance warranty. In the event that a warranted system fails to meet the effluent limits established in the final engineering requirements, WCS will provide additional equipment necessary to achieve compliance.
   a. Exceptions:
      i. WCS is not responsible for the lack of performance due to contaminants in the wastewater that impair or kill the microbes growing in the biofilm of the *Bio-Domes or Bio-Shells.*
      ii. WCS will not guarantee performance of blowers and equipment provided by others, or failures due to air delivery system malfunction unless all WCS recommended operating and maintenance procedures are complied with.

C. **Mechanical Warranty:** WCS offers a 5 year, prorated, product warranty on all mechanical components manufactured / assembled by or on behalf of WCS. In the event of a mechanical failure, WCS will repair or replace the defective units / parts.
   a. Exceptions
      i. WCS does not offer any warranty on blowers purchased separately and not provided as part of a WCS contract. Warranty on blowers provided by WCS is limited to the manufacturer's warranty. This exception applies to all blower systems, including off-grid blower units.
      ii. WCS warranty will not cover equipment that is damaged because of improper operation, the lack of proper maintenance, or accidental damage.

D. **Claims:** In the event that *Bio-Domes or Bio-Shells* do not achieve expected performance or experience a mechanical failure, the customer should immediately contact WCS and provide a written report of the problem as well as provide WCS with a copy of all operating and maintenance logs. Provided that customer has met all requirements necessary to qualify for warranty coverage, WCS will provide the customer with repaired or replacement units or additional units in order to achieve performance compliance.

Quality Control/GMPs:

WCS shall ensure that Bio-Shell products meet all Product specifications mutually agreed upon by the parties. Any Products failing to conform to such specifications shall be returned to WCS at WCS's expense. WCS shall be responsible for compliance with present and future applicable statutes, laws, and regulations relating to the design, manufacture and/or quality of the Products (including Good Manufacturing Practices).

Training:

WCS shall provide Logan and its designated project managers with product manuals, training materials, and product literature with respect to the use and installation of the Products

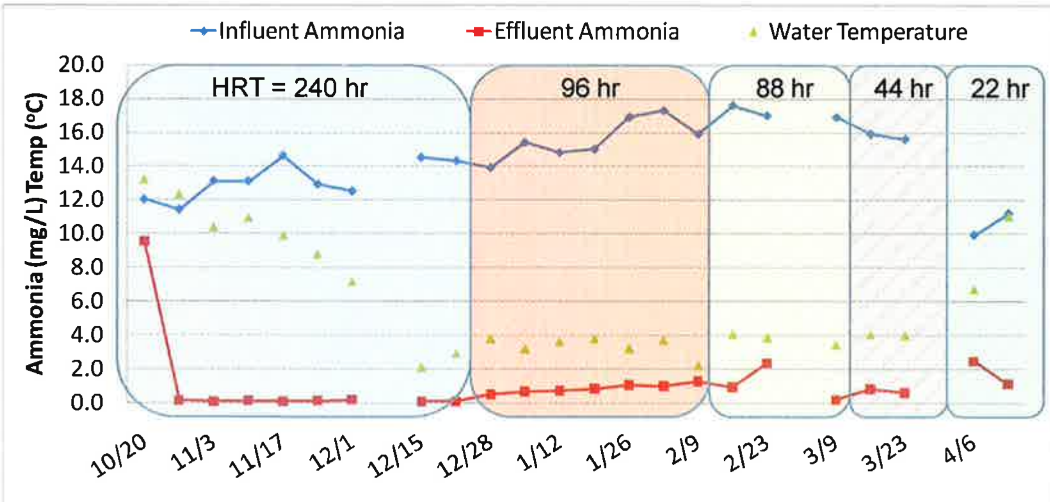
Product Support & Maintenance:

WCS and Logan shall mutually agree upon support and maintenance services in connection with the Project. WCS shall provide mutually agreed upon levels of Product Support and Maintenance.

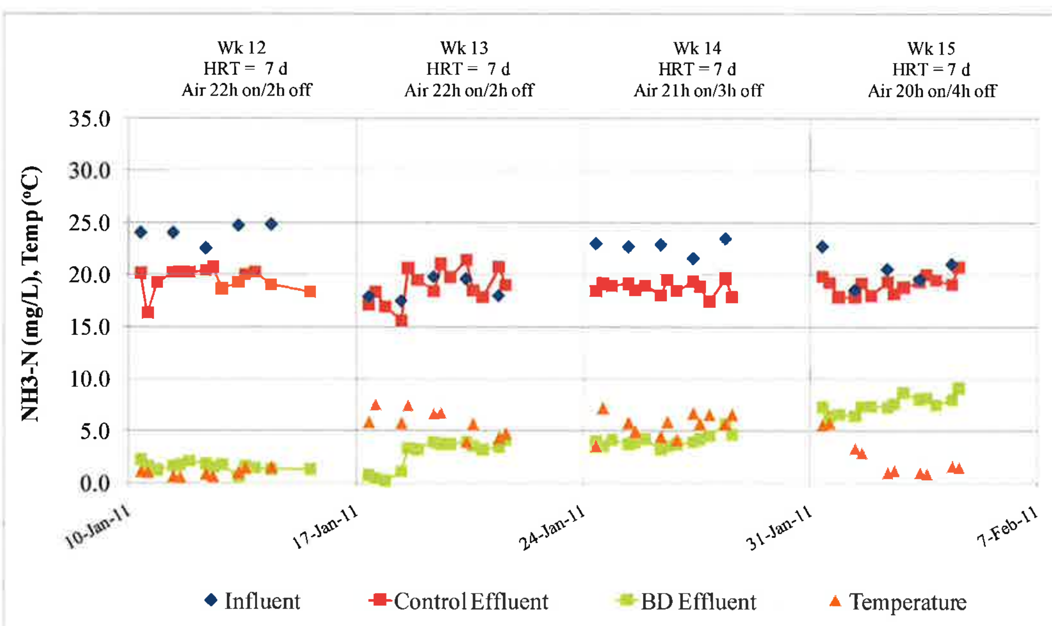
Appendix A

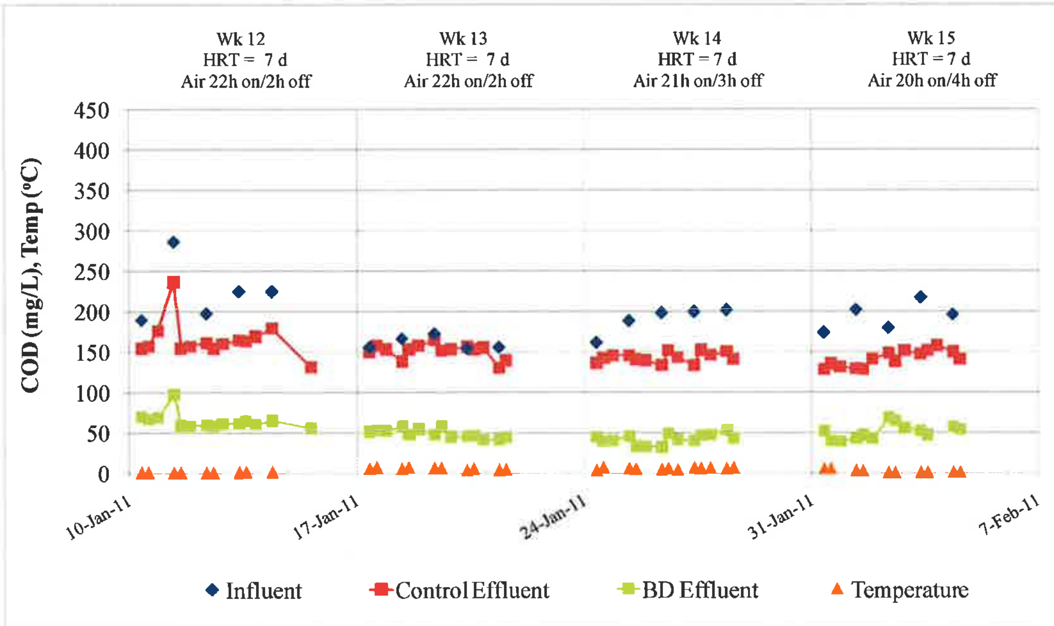
Bio-Dome Performance Examples

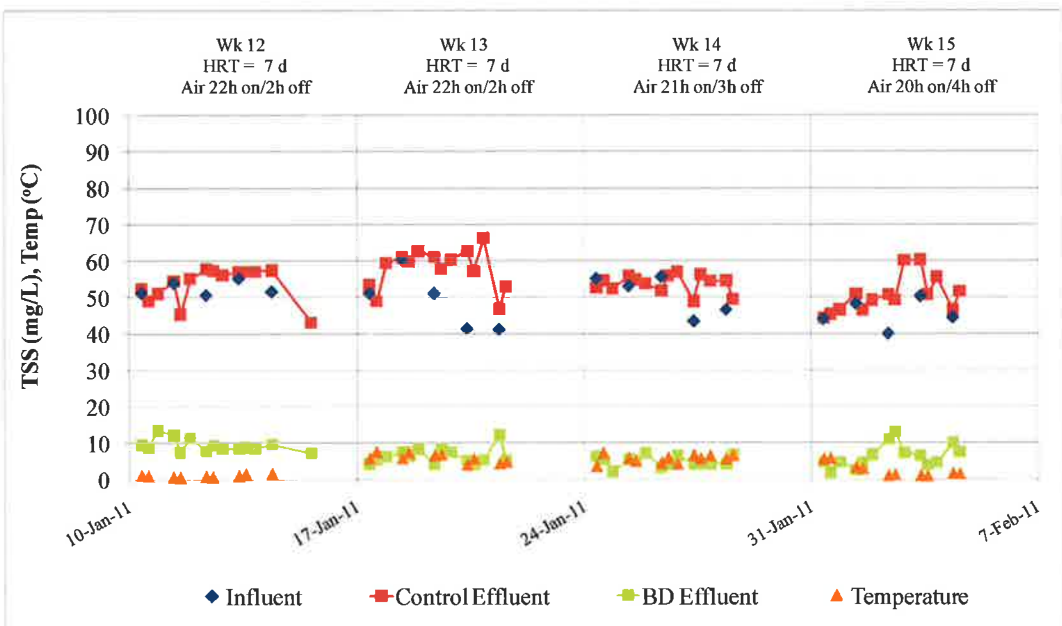
Beginning in October of 2010, WCS provided Gresham WI with a Pilot Unit designed to provide on-site demonstration of the Bio-Dome performance capabilities in cold weather. The pilot unit has been running continuously since then, and the community has taken weekly samples to measure performance. The chart below provides a comparison between the ammonia levels in the influent and effluent of the pilot unit. Also plotted on the graph are the water temperatures measured at the time the samples were collected.



Additionally, beginning in October 2010 and concluding in February 2011, WCS ran a USDA sponsored SBIR Phase I, pilot study in Salt Lake City, UT to evaluate cold weather performance of the Bio-Domes compared to the performance of a typical aeration system. The graphs below shows a sample of the data obtained during the study from January 10, 2011 through February 7, 2011 for Ammonia, COD and TSS. Additional data from the USDA research project, as well as the full USDA report, is available on the WCS website.




Wk 12
HRT = 7 d
Air 22h on/2h off
Wk 13
HRT = 7 d
Air 22h on/2h off
Wk 14
HRT = 7 d
Air 21h on/3h off
Wk 15
HRT = 7 d
Air 20h on/4h off
COD (mg/L), Temp (ºC)
450
400
350
300
250
200
150
100
50
0
10-Jan-11
17-Jan-11
24-Jan-11
31-Jan-11
7-Feb-11
Influent
Control Effluent
BD Effluent
Temperature


Wk 12
HRT = 7 d
Air 22h on/2h off
Wk 13
HRT = 7 d
Air 22h on/2h off
Wk 14
HRT = 7 d
Air 21h on/3h off
Wk 15
HRT = 7 d
Air 20h on/4h off
TSS (mg/L), Temp (ºC)
100
90
80
70
60
50
40
30
20
10
0
10-Jan-11
17-Jan-11
24-Jan-11
31-Jan-11
7-Feb-11
Influent
Control Effluent
BD Effluent
Temperature

Appendix B

Bio-Shell Maintenance Equipment

Given the size of the lagoons and the number of Shells associated with this project, WCS recommends the use of a service barge and service cages to facilitate installation and on-going maintenance. For a project of this size, a barge can be rented. Barges and service cages can be designed for either Bio-Domes or Bio-Shells

The images above show the service barge being used to pull out (left) a Bio-Dome and deliver it to the shore (right) from the Wellsville UT installation as part of an upgrade to the latest and most efficient air distribution hose.

The images below show the use of the service cage. The image on the left shows the service cage being installed on the dome, tipped on its side (center) and inspected and upgraded with the new softened PVC hose (right)

Bio-Dome Performance Review and Design Criteria

20 June 2013

Figure 1 - WCS Mobile Pilot Unit Deployed at Gresham WI

Introduction

In the fall of 2010, Wastewater Compliance Systems, Inc. (WCS) delivered to Gresham WI the first ever Mobile Bio-Dome Pilot Unit so that the community could test the efficacy of the Bio-Domes as a means of reducing the ammonia concentrations in their wastewater lagoons during the winter months. After operating the pilot unit throughout the winter of 2010 – 2011 and commissioning multiple pilot units at various other locations around the country in subsequent years, a number of communities have opted to move forward with a full scale design of a Bio-Dome system to implement in their wastewater lagoons.

WCS has met with the state regulatory agencies of the various communities to review the data obtained from the various pilot studies and to discuss the design criteria used in the full scale design. In those meetings WCS has been asked to provide additional information / data to address the following concerns:

1. Daily removal rates of the Bio-Domes
2. Justification of the extrapolation of the pilot data to a full scale design
3. Recommended design criteria for use in designing a Bio-Dome system

The following document is intended to address these issues as completely as is possible with the data available from both full scale installations as well as numerous pilot studies from multiple locations around the United States. Each pilot has one Bio-Dome in a 1500 gallon tank. Full scale installations described in this report have between 50 and 185 Bio-Domes in-situ. Each Bio-Dome is five feet tall, six feet in diameter at the base, submerged in a minimum of six feet of water column, and has approximately 3,000 ft^2 of internal surface area. Each unit is supplied with roughly one cubic foot per minute (cfm) of low pressure air.

While select data will be shown as part of the body of this document, the complete data sets for all projects discussed will be available in the companion Excel Spreadsheet "WCS Performance Data Compilation"

Daily Removal Rates

BOD Removal

The most comprehensive data available regarding the BOD removal capabilities in full scale operation of the Bio-Domes comes from our Jackpot, Nevada and Plain City, Utah installations. Below we have provided background information for each system along with our analysis of the available data.

Jackpot, NV

In the summer and fall of 2010, the lagoon system at Jackpot received a major overhaul. Among other improvements, the west pond was taken out of service, and the east pond was divided up into three cells. Additionally, at the head of lagoon cells, an Oswald Pit (an upflow anaerobic digester) was installed with the expectation that the Oswald Pit would remove ~80% of the incoming BOD and TSS. Each of the three cells was lined, and 80 Bio-Dome devices (also known as Poo-Gloos) were installed in cell one and cell two. At that time, 50 Bio-Domes were installed in cell one, occupying about half of the cell, and 30 Bio-Domes were installed in cell two, occupying about one-third of the cell. The three cells in the east pond were placed in service in December, 2010.

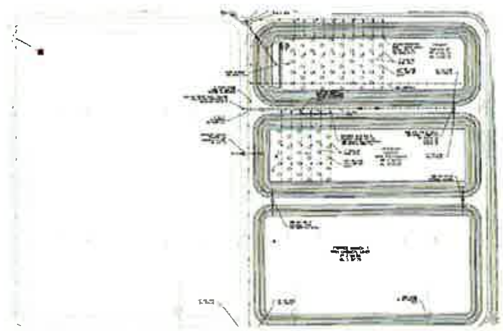


Figure 2 - Original Jackpot Design

After evaluating the performance of the lagoon for a full year, it was decided that either the incoming BOD levels were much higher than anticipated or the Oswald pit was not removing any of the incoming BOD. As such, the Bio-Domes that were intended to provide nitrification, were instead preferentially consuming the BOD and TSS. In February 2012, it was decided by Jackpot to expand the existing Bio-Dome installation (partly because of the ease by which the Bio-Domes can be added after the fact) by adding another 105 units to fully populate cells #1 and #2. The units were built, delivered and installed between May 2012 and June 2012. Performance of the fully upgraded system has been monitored closely. A summary of the BOD removal in cell one is shown in Figure 4. With 60 units in cell one, the removal averaged 4.4 lbs BOD/day per Bio-Dome unit, and with 95 units in cell one, the removal averaged 3.5 lbs BOD/day per unit.

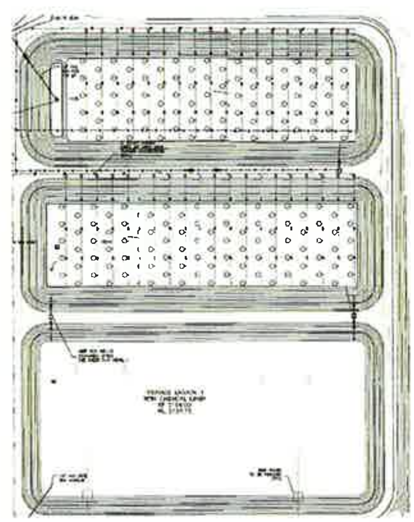


Figure 3 - Current Jackpot Design

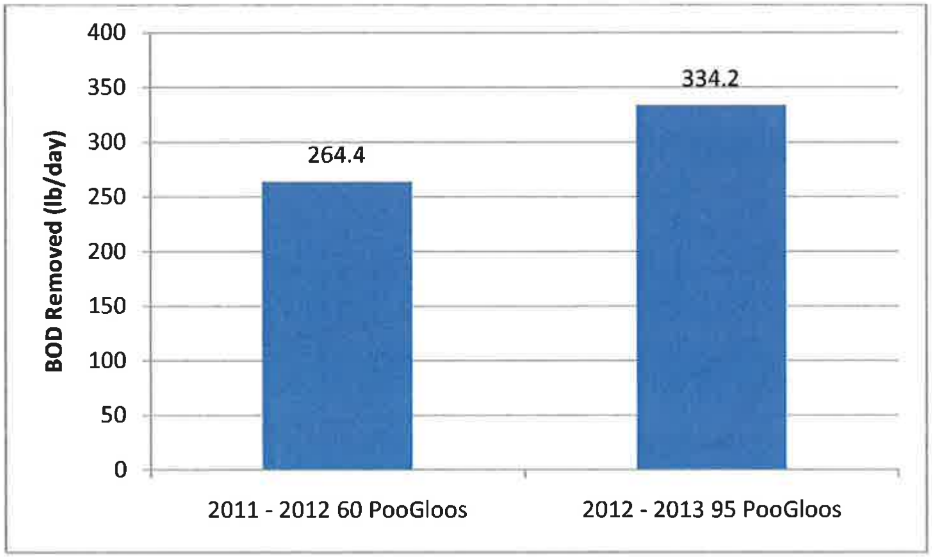


Figure 4 – Jackpot, Nevada Cell One Year-on-year Comparison

Plain City, UT

Plain City Utah is served by a 6 pond lagoon system. This system has worked reliably for decades. Due to community growth, from 2005 through 2007 the effluent from the lagoon system began to exceed regulatory limits for BOD (Biochemical Oxygen Demand) and TSS (Total Suspended Solids). In response to presentations to the City Council 19 Feb and 17 July, 2008 from Dr. Kraig Johnson, Plain City agreed to participate in a Beta test of new wastewater treatment devices called Poo-Gloos™. The design called for 50 Poo-Gloos to be installed in pond #2, along with an air blower and partition curtain to channel the wastewater past the devices. The curtain, blower and Poo-Gloos were installed in November and December. The pond was refilled immediately following the installation, and the Poo-Gloos have been operating from December 2008 till present.

Figure 5 shows the placement of the Poo-Gloos and divider curtain in Pond 2 at Plain City Wastewater Lagoon. From December 2008 to early May 2009, Pond 2 was essentially in a batch reactor mode. On May 13, 2009, all the raw influent water was diverted through Ponds 1-2-3, and flow started to pass Pond 2 and into Pond 3. By mid-June the flow past the 50 Poo-Gloos had reached a steady-state, and could be modeled as a plug flow reactor (PFR). Poo-Gloo performance was then evaluated under PFR mode.

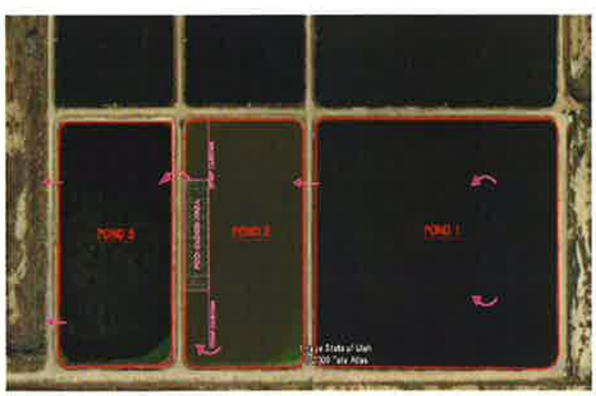


Figure 5 -Layout of sampling locations at Plain City wastewater lagoon

Figure 6 shows the before and after concentrations of BOD from the time period of May 13, 2009 until April 7, 2010.

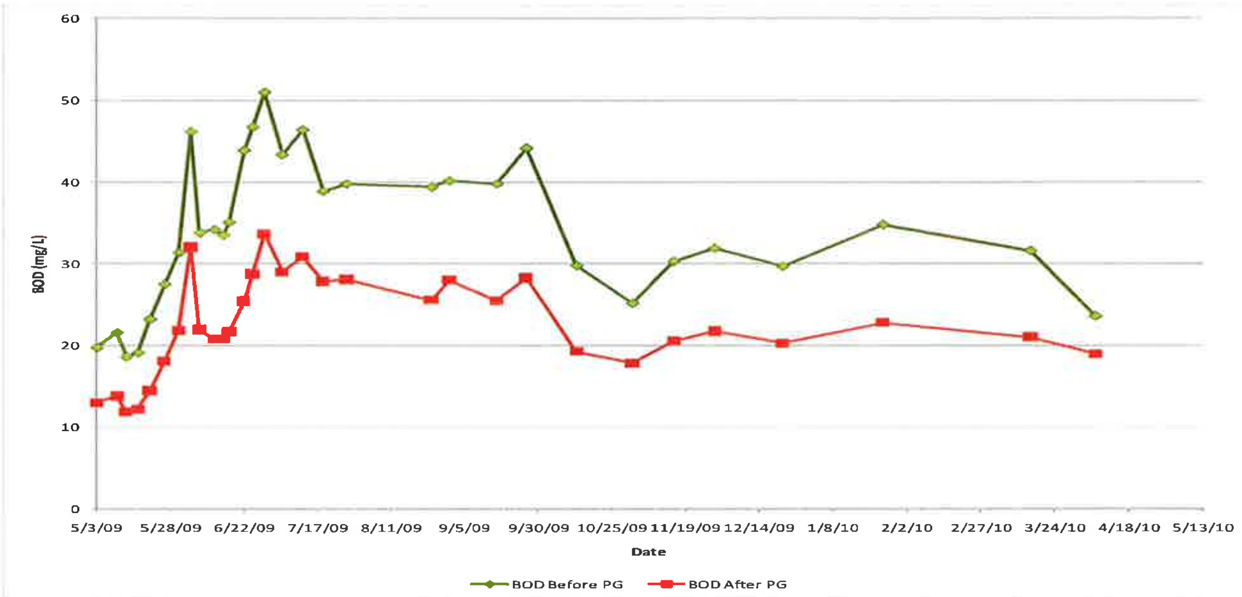


Figure 6 - BOD Concentration sampled just before and just after Poo-Gloo zone.

Plain City Conclusions

In the critical month of June, 2009, all wastewater from the community was flowing through the Poo-Gloo train in Pond 2 at a steady-state condition. Flow was 0.55mgd and removal of BOD concentrations averaged around 15 mg/L. The average BOD load removed for the month was 69 lb BOD/day. This is a removal rate of 1.38 lbs/day per unit. Pond 2 water has high concentrations of algae which makes up the bulk of the TSS and contributes to the BOD. The re-growth rate of the algae between sample points (roughly a 3 day HRT) is not known.

Figure 7 – Plain City Samples Before and After "Poo-Gloo Alley." (Don Weston operates the ponds.)

Ammonia Removal

The majority of our data regarding Ammonia removal rates comes from pilot studies hosted at various locations around the country. The Mobile Pilot Units are designed to be a turn-key pilot demonstration of the Bio-Domes for small communities. The pilot unit, consisting of a 20' cargo container, comes equipped with 1 full-sized Bio-Dome in a 1500 gallon tank, an air compressor with air-flow meter to provide air to the bio-dome, a pump to provide fresh influent, a 4 channel temperature data logger and all of the equipment required to connect the system and operate the Bio-Dome. The drawing below provides a general layout of the equipment in the pilot unit.

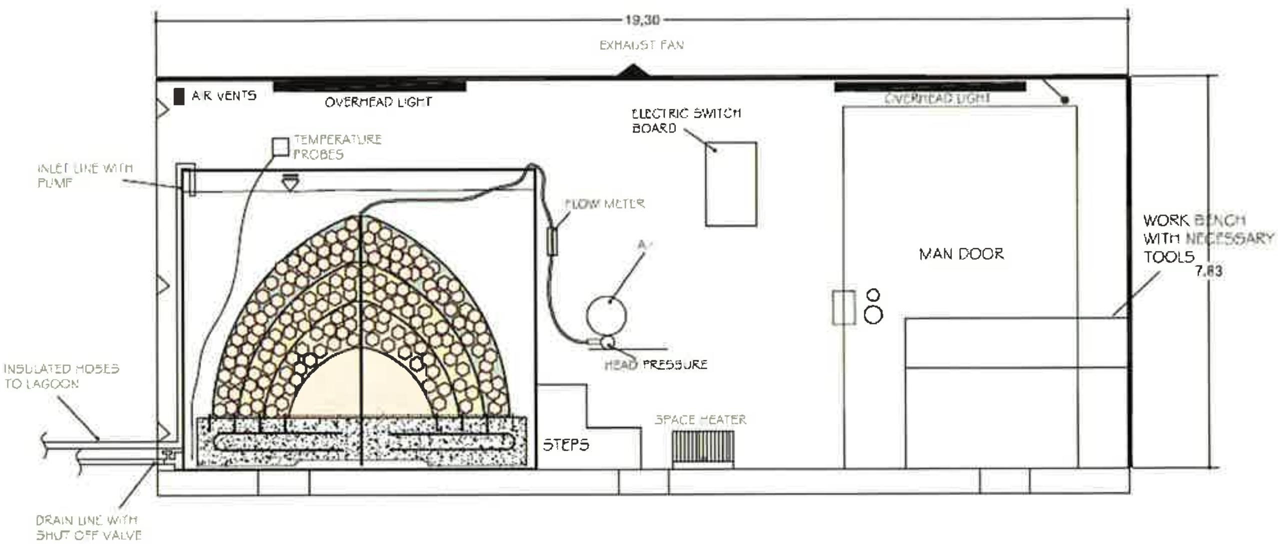


Figure 8 - WCS Mobile Pilot Unit

Gresham, WI

Gresham, WI was the first community to run a mobile pilot test during the winter of 2010 – 2011. The results of the mobile pilot study are shown below in Figures 14 and 15. This pilot was not pushed to a one day HRT, however at a 2 day HRT we did see removal of 0.11 lbs NH_4^+ - N per day in early March.

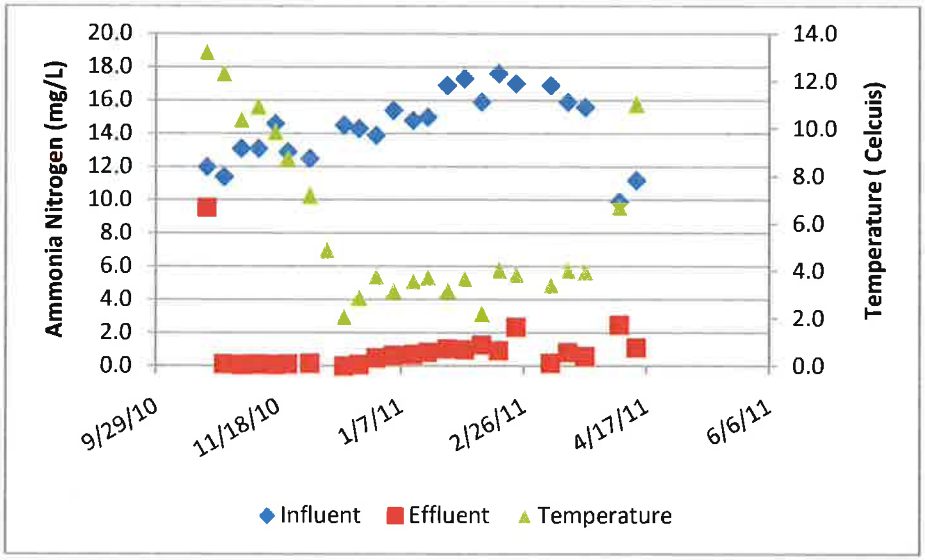


Figure 9 - Concentrations In and Out of the Pilot Unit at Gresham, WI

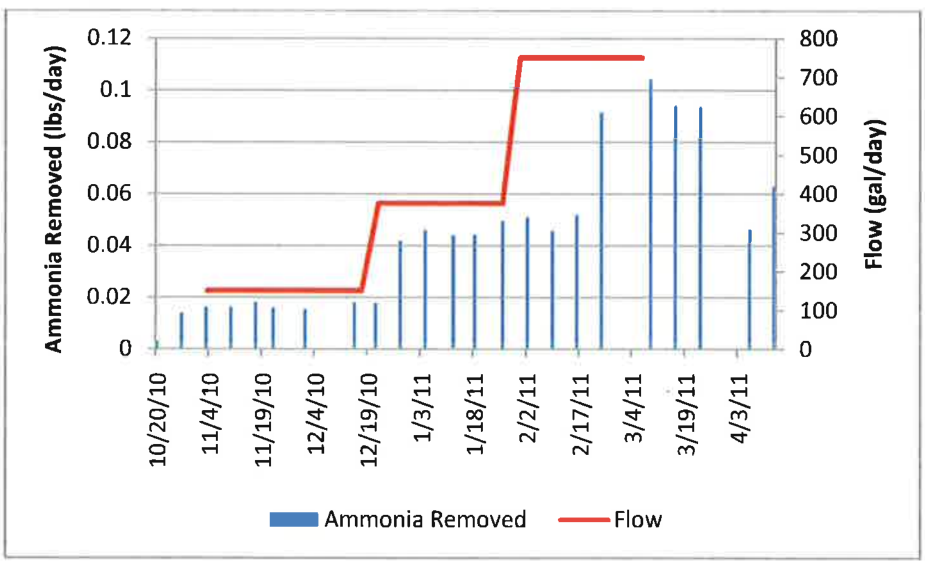


Figure 10 - Loading Diagram for Gresham, WI

Lenox, IA

The WCS Mobile Pilot unit was delivered to Lenox Iowa August, 2011. The pilot unit was managed 100% by the lagoon operator, Quent Dalton. A minimum of three trips per week were made to the pilot unit to ensure everything was operating as it should and samples were collected from the influent and bulk solution (effluent) every Thursday for analysis. The pilot unit was allowed to run for a few weeks before sampling began on the 1st of September 2011. Thereafter sampling occurred every week for the duration of the pilot study. Figure 9 shows the concentrations of ammonia into and out of the pilot tank, and temperature of the water in the tank. Figure 10 shows the ammonia loading and flow rate. Note that at 1500 gallons per day of flow, the HRT is one day. At the highest loading rates, the Bio-Dome removed from 0.11 to 0.18 lbs NH_4^+ - N per day.

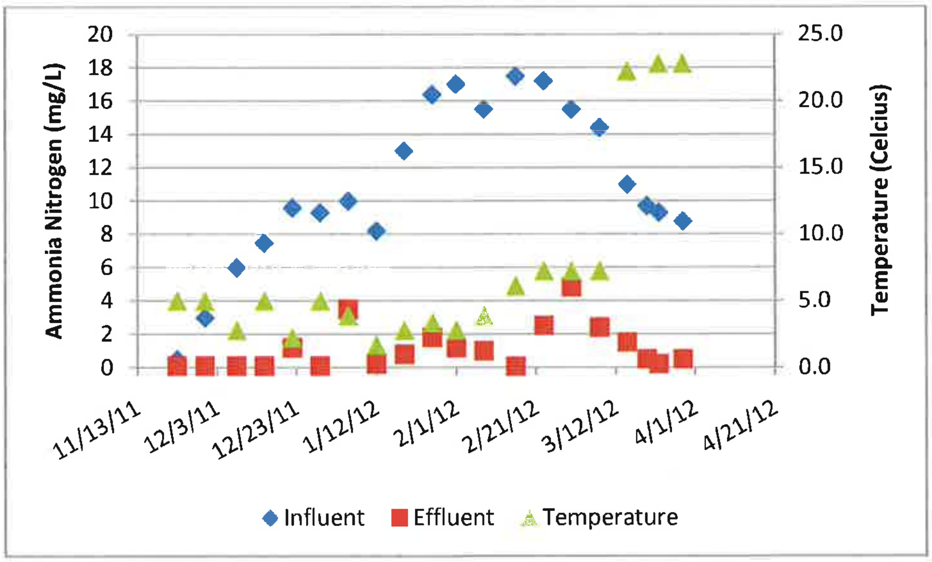


Figure 11 – Concentrations In and Out of the Pilot Unit at Lenox Iowa

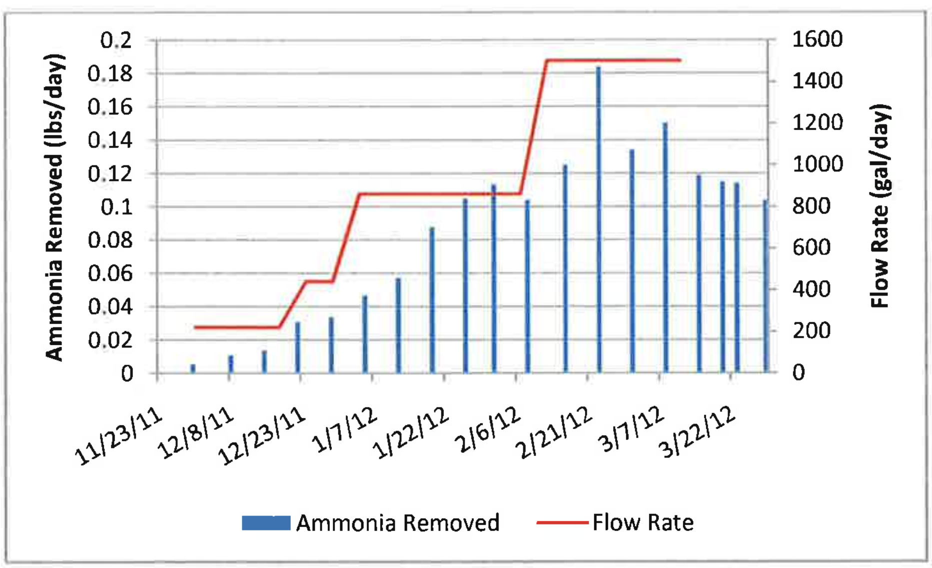


Figure 12 – Loading Diagram for Lenox, Iowa

West Branch, IA

West Branch took receipt of the pilot unit in October 2012 and ran the pilot unit through May 2013. While there were some issues with freezing and power outages (as shown by the gaps in data respectively) West Branch was able to test the Bio-Dome through a much colder winter than that experienced by Lenox, IA in 2012. Note the removal on April 3 in Figures 11 and 12 with ammonia-N removal of 0.14 lbs/day at water temperatures below 6 degrees C.

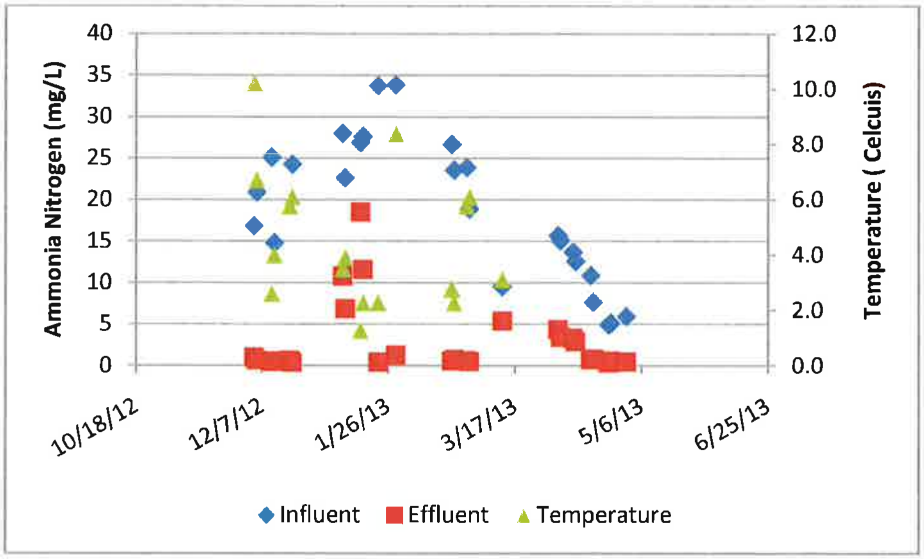


Figure 13 - Concentrations In and Out of the Pilot Unit at West Branch, Iowa

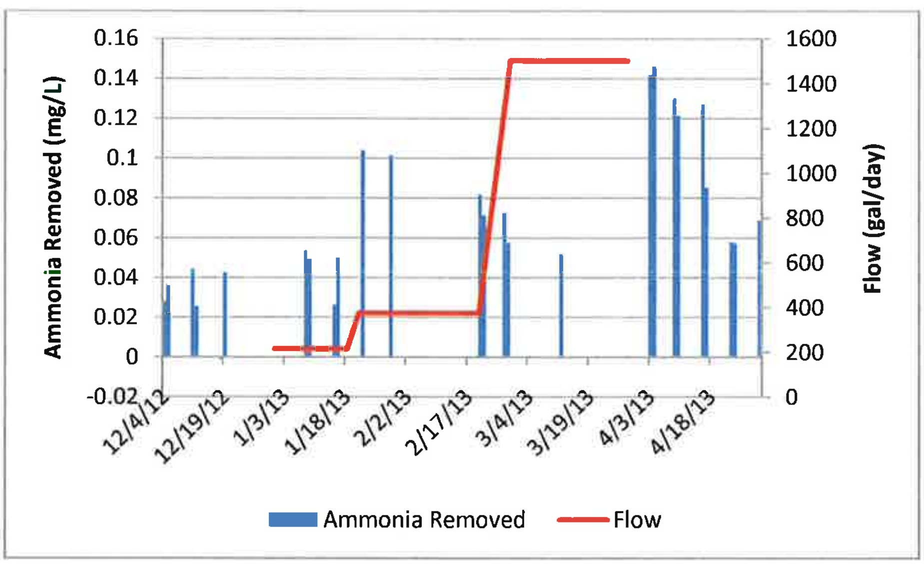


Figure 14 - Loading Diagram for West Branch, Iowa

Laddonia, MO

Laddonia, MO received their mobile pilot unit in January 2013 and had to start operation in sub 4° C water temperatures. Additionally, the pilot unit was spiked with a large dose of bottom sediment sludge from the lagoons to test how the Bio-Dome would perform in the face of the adverse conditions. The results below (Figure 13) show that the bio-film was able to establish itself in mid-winter conditions and by the end of February was consuming essentially all the ammonia coming into the tank. Dilute water coming into the tank (wet early spring 2013) prevented high enough loadings to test the limits of the system to date.

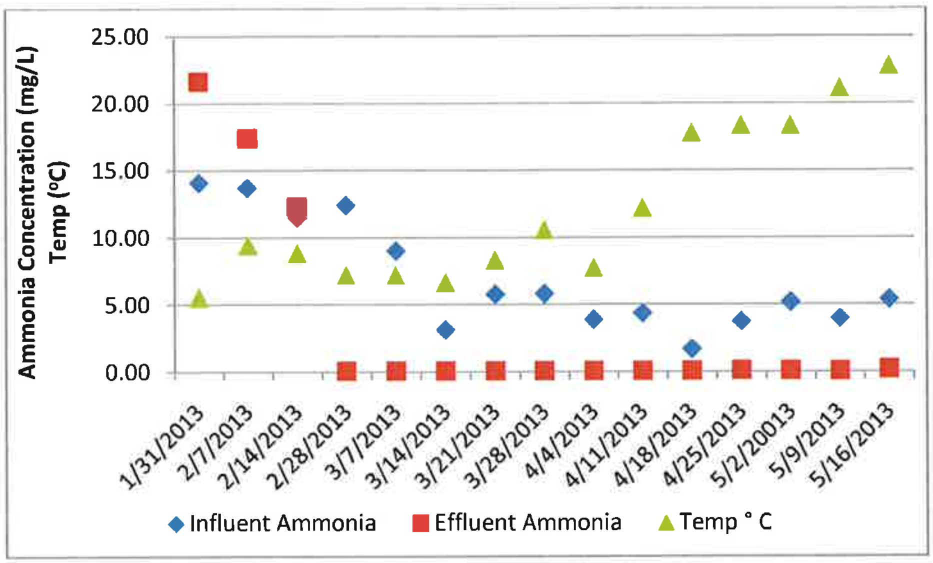


Figure 15 - Concentrations In and Out of the Pilot Unit at Laddonia, MO

Naturita, CO

Naturita, CO received their mobile pilot unit in October 2012 and ran their study throughout the 2012 – 2013 winter. In spite of one event where temperatures dropped so low that the pilot unit froze over, the pilot unit has performed exceptionally well throughout the winter. The results are below. Note the freeze-up effluent spike on 22 January in Figure 16. Figure 17 shows removal rates of between 0.15 and 0.25 lb NH_4^+ - N per day at the highest loading rate.

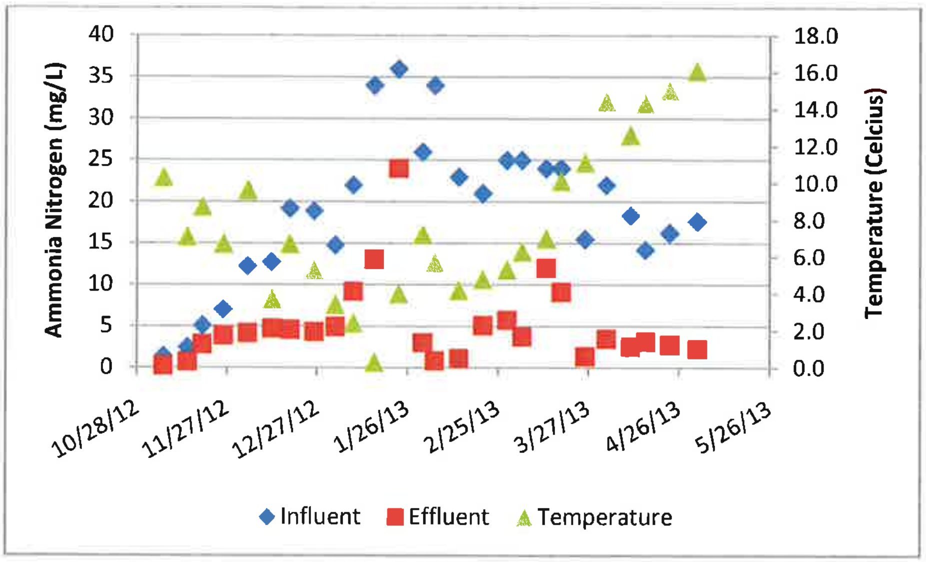


Figure 16 - Concentrations In and Out of the Pilot Unit at Naturita, CO

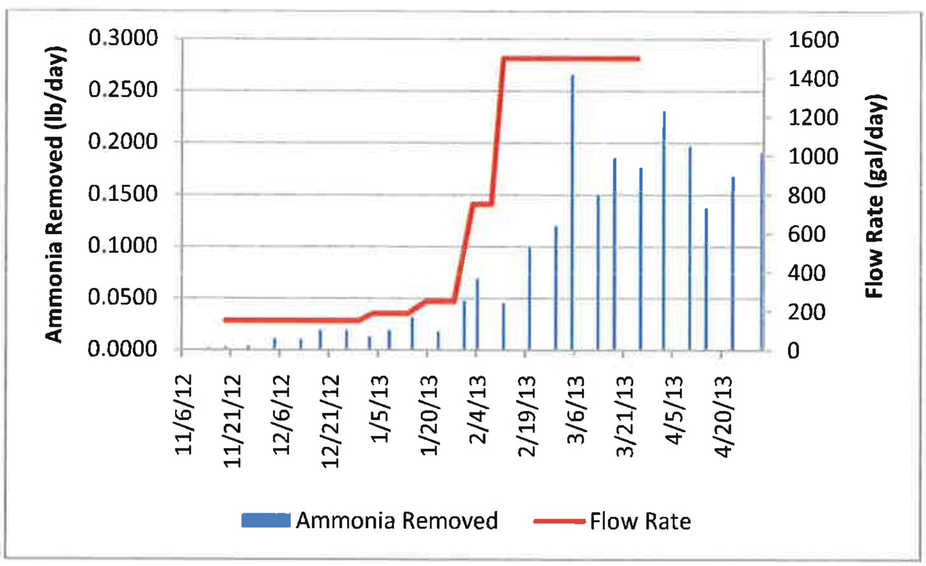


Figure 17 - Loading Diagram for Naturita, CO

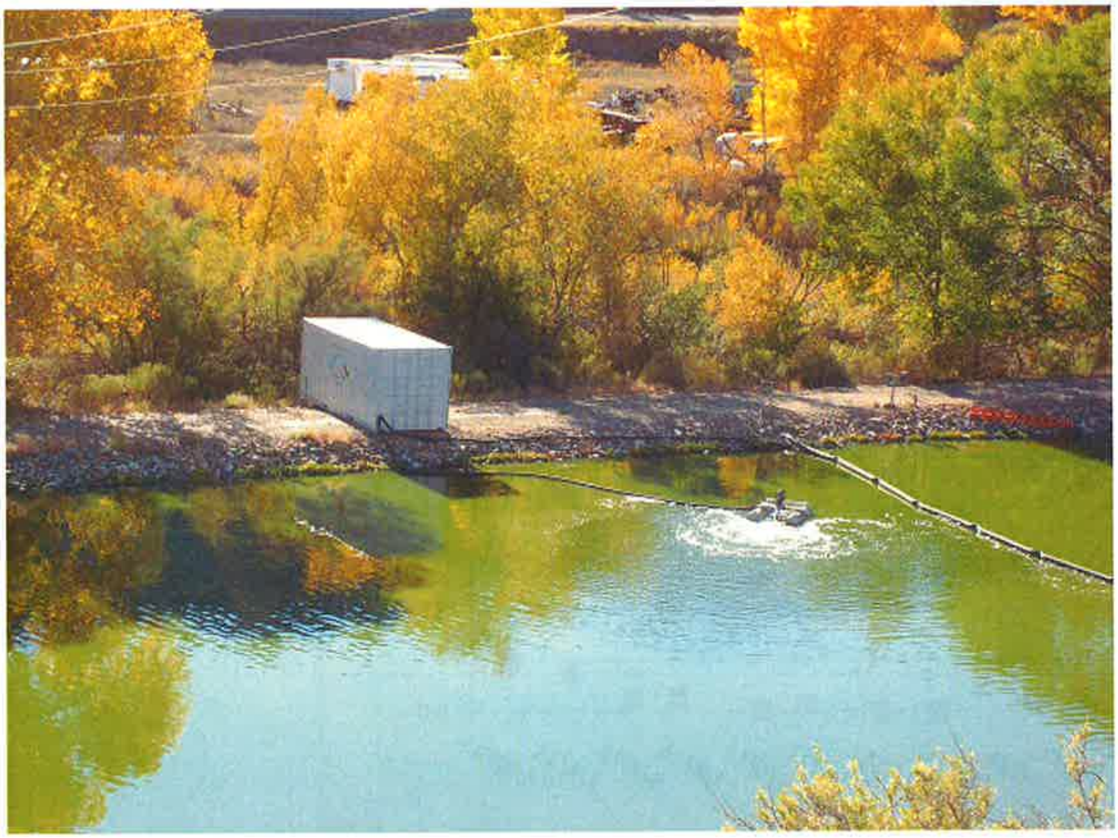


Figure 18 – Pilot Installation at Naturita, CO

Quincy, CA

The Quincy, CA mobile pilot unit was installed in June 2012 and is still running to date (May 2013). Influent concentrations of ammonia never got high enough to test the limits of the removal rates, even at an HRT of one day.

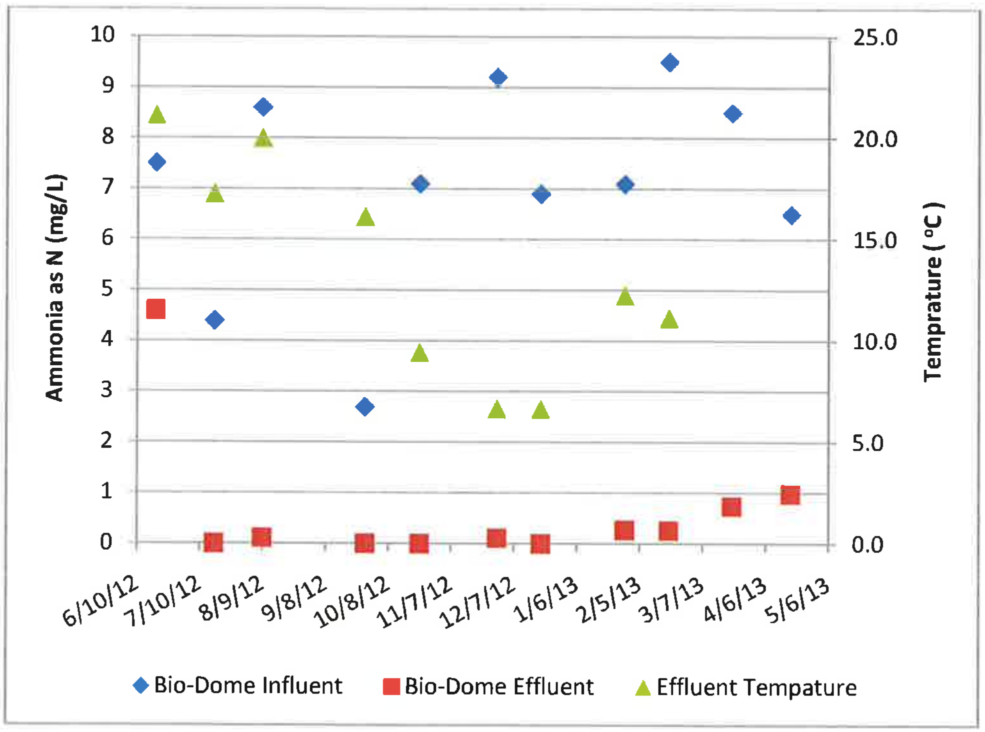


Figure 19 – Concentrations of Ammonia In and Out of the Pilot Unit at Quincy, CA

At the end of March, an air-cycling regimen was introduced with air off 4 hours/on 20 hours each day. The purpose of this was to investigate nitrate removal through enhanced de-nitrification. Figure 20 shows the production of nitrate as the result of biological nitrification. Figure 21 compares the removal of ammonia to the production of nitrate. As expected, with the air off for 4 hours, ammonia levels crept up a bit as capacity was reduced. Nitrate levels, however, dropped from 10 to 6 mg/L as de-nitrification capacity was enhanced.

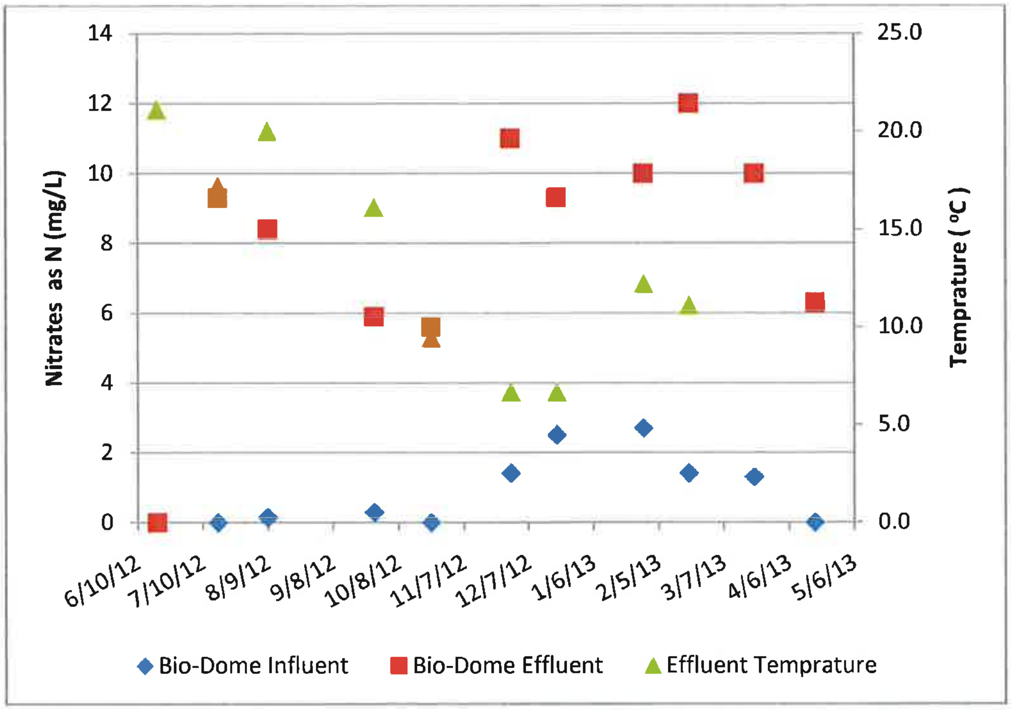


Figure 20 - Concentrations of Nitrate In and Out of the Pilot Unit at Quincy, CA

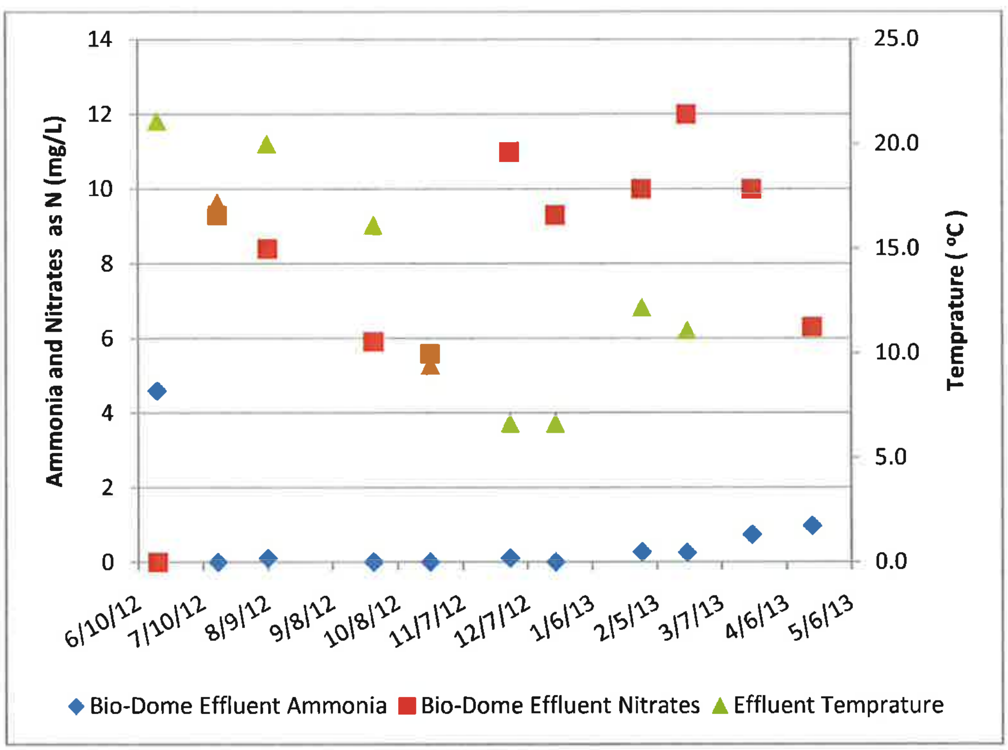


Figure 21 – Comparison of Ammonia and Nitrate in Effluent as a Result of Air Cycling Initiated at the End of March 2013 at Quincy, CA

Jackpot, NV

As previously discussed the lagoon system at Jackpot received a major overhaul in the summer of 2010. Fifty Bio-Domes were installed in cell 1 and 30 in cell 2 in the fall of 2010. In June 2012, more Bio-Domes were added to make a total of 95 in cell 1 and 90 in cell 2. Cell 1 is primarily BOD removal and cell 2 is primarily ammonia removal. System flow rate averages 0.25 mgd. Figure 22 shows the year on year effect of adding the devices to the system. For the 2011-2012 period, the 30 Bio-Domes removed 0.18 lb NH_4^+ - N per day per unit in a 6 ft lagoon. For the 2012-2013 period, 90 Bio-Domes removed 0.12 lb NH_4^+ - N per day per unit. Some of this difference could be attributable to first order reaction kinetics (i.e. the 30 units were working much harder than the 90 units).

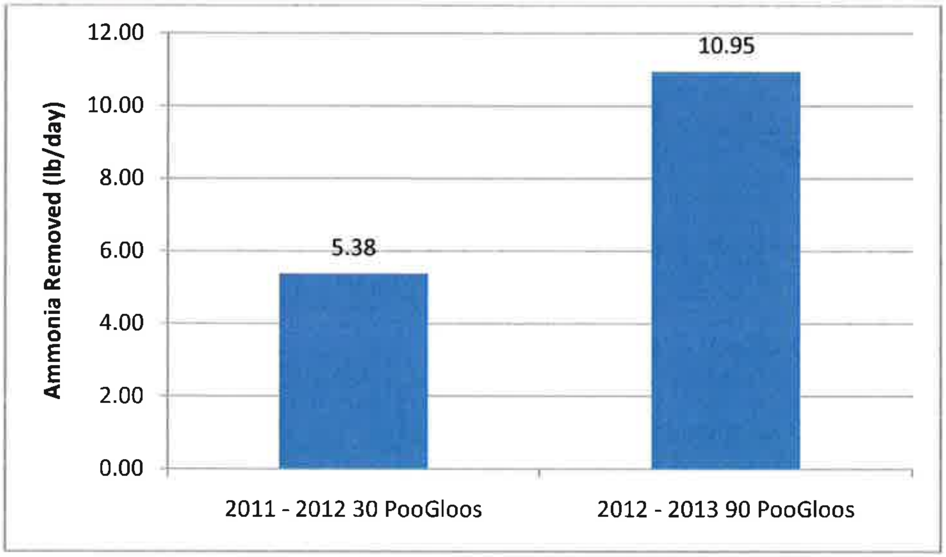


Figure 22 –Cell 2 Removal of Ammonia N, Year on Year Comparison, Jackpot, NV

Figure 23 – Installation of Poo-Gloo Units in Cell 2 in Jackpot, Nevada

Extrapolating Pilot Data to Full Scale Implementation

During the meeting in February 2013, concern was expressed by members of the IDNR regarding the legitimacy of extrapolating the data obtained in the pilot study into a design for a full scale system. WCS believes such an extrapolation is valid based on the following reasons.

Full Scale Unit Used in Testing

In the pilot unit a full scale Bio-Dome is used for all testing purposes. This allows for the performance of the system to be evaluated in terms of lbs removed/ft^2 of aerated surface area as well as lbs removed / unit.

Loading Basis

Each unit, when fully populated with a healthy bio-film / bio-mass has an average demand for BOD, TSS and /or Ammonia. WCS refers to this as the "removal rate" of the unit. Because the full scale system is designed using "removal rate" established in terms of lbs of contaminant removed / day / unit or ft^2, the determination of how many units are necessary is accomplished by matching the total loading of the system with a corresponding removal rate of the Bio-Domes.

Additionally, while each unit consumes a combination of BOD, TSS and / or Ammonia, WCS determines the size of the system based on the assumption that each unit will only consume one of the above mentioned contaminants. Doing so allows for overlap of the units and creates a built in safety margin into the basis for design.

Discussion on Pumping for Pond Turnover

When modeled as an air lift pump, WCS has determined that each Bio-Dome pumps approximately 20 gal/min of wastewater up through each unit. In the case of the pilot unit this equates to a complete turn over every 75 minutes or 20 times / day. In a full scale pond installation, the pilot results can be replicated by placing the units close together and directing the flow of the pond past the cluster of units prior to discharge with hanging curtains or other pond dividers. WCS feels that as long as the proposed system meets a minimum mixing requirement (see *Recommendations for Full Scale Design – Use of Hanging Curtains and Mixing within the Treatment Zone*) the biological demand of each unit will be the predominant driver in the system.

Discussion on Temperature

Fixed-film devices have a proven track record of biological activity at temperatures colder than suspended growth. In the case of nitrifying bacteria, suspended growth removal rates are inhibited below 10 degrees C. Fixed-film nitrifying bacteria can have robust catabolic rates much colder than 10 degrees C. While we have observed nitrification in a scaled pilot study down to 0.4 degrees C, as a practical matter we generally see rapid inhibition below 2 degrees C. In some systems, the temperature below the ice and near the bottom sediments is a few degrees above freezing, and the bottom water is what is pulled up past the bio-film inside the dome.

Recommendations for Full Scale Design

WCS recommends that the following be adopted as the standard for design for all system upgrades that utilize the Bio-Domes or Bio-Shells in the state of Iowa. Any design exceptions should be accompanied by an explanation and co-approval from WCS and the design engineer prior to submittal to the IDNR.

Removal Rates for Loading Calculations

Based on the analysis of the data in the Daily Removal Rates section, WCS recommends that as a basis of design for winter month nitrification a removal rate of **0.18 lbsNH_4^+ - N/Bio-Dome/day** be used.

For BOD removal, WCS recommends that a removal rate of **5 lbs BOD/Bio-Dome/day** be used.

Using the Bio-Domes for Nitrification in Conjunction with Fine Bubble Diffusers

In the event that the community has an existing fine bubble aeration system in place and wishes to continue using it for the purposes of BOD reduction, WCS recommends that:

1. The existing blower is evaluated to determine if it capable of providing sufficient air to both the existing fine bubble aeration system **and** the Bio-Domes. If not, the blower(s) should be replaced with a model capable of meeting the aeration needs of both systems.
2. The existing system should be evaluated to ensure that it is capable of reducing the BOD levels to 30 mg/L or below by the time the wastewater leaves the aeration zone. Failure to do so could result in the nitrification Bio-Domes preferentially consuming the BOD. Such an event would result in sub-standard results with regards to nitrification.

Use of Hanging Curtains and Mixing within the Treatment Zone

The use of hanging curtains should be considered with the Bio-Domes for two reasons.

1. Using hanging curtains to create a serpentine / plug flow path that is populated by the Bio-Domes ensures that there is no short circuiting occurring within the lagoon and provides the longest possible detention time within the wastewater lagoon.
2. The overall volume of the wastewater lagoon should be evaluated relative to the number of Bio-Domes provided and the pumping / mixing action created by each (20 gal/min). In the event that the overall volume of the lagoon is such that the combined pumping of the Bio-Domes does **not** provide a complete turnover of the pond at a rate of 10 to 20 times / day, WCS recommends using a hanging curtain to create a separate / smaller treatment zone within the existing lagoon that allows the Bio-Domes to provide a complete turnover at a rate of 10 to 20 times / day.

Use of Floating Covers Such as Bird Balls Within the Treatment Zone

If the treatment pond where the Bio-Domes are installed has high levels of algae, it is recommended that the treatment zone be covered to reduce light penetration. Bird Balls block 80 % of the light, and other hexagonal floating products can block up to 99% of the light. If a zone of at least 3 days HRT is covered, the algae interference is eliminated and the Bio-Dome surface area will be dominated by nitrifying bacteria.

Unit Spacing Within the Lagoon

If the Bio-Domes are placed in parallel rows and columns, WCS recommends that the Bio-Domes be spaced no further than 9 ft center to center.

If the Bio-Domes are placed in parallel rows and staggered columns, the maximum spacing between domes can be increased to 12 ft center to center.

System Redundancy

WCS does not recommend that there be any additional units installed above and beyond the number determined by WCS and the consulting engineers as part of the design phase.

Aeration Requirements

The aeration requirement for each Bio-Dome is 1 CFM at whatever psi is necessary to overcome the hydro-static head of the wastewater lagoons. Each unit should be connected individually to the shore via a self sinking rubber hose that can be provided by WCS or acquired separately. Typical hose diameters are either 3/8" ID or ½" ID

Furthermore, WCS recommends that whatever blower is selected have at least 2x the desired capacity for air delivery, and should be equipped with a variable speed drive so that the aeration rate can be adjusted to provide the necessary air to the system.

Maintenance Requirements

Communities that implement Bio-Dome systems should plan on the following maintenance program as part of proper operation and care of the Bio-Domes

1. Daily Inspection or every other day at a minimum. WCS requires a daily visual inspection of the Bio-Domes to ensure the air supply is on and that each unit is receiving air.
2. Annually Cleaning. WCs recommends an annual cleaning of the air diffusers within the Bio-Domes. This is accomplished by injecting a mild acid such as acetic acid or even vinegar into the airlines on the shore according to the dosing chart provided by WCS and blowing the liquid out into the pond where it can remove any mineral build up or biological growth that might impair the uniform distribution of the air bubbles leaving the diffusers.
3. 10 year visual inspection. WCS recommends that the Bio-Domes be pulled from the pond at 10 years for the purposes of a visual inspection to ensure there are no major debris obstructing the gaps between the plastic shells that might impair the performance of the unit. The inspection can be accomplished using a service barge provided by WCS or if possible a crane from the shore. At the discretion of the operators, the media within the Bio-Domes can be "cleaned" using a pressure washer but this is not a requirement.
4. 20 year maintenance. At 20 years the air diffuser hoses should be replaced. Instructions for the operation will be provided as part of the operations manual. The air hose replacement will require that the Bio-Domes be removed from the pond and it is WCS's recommendation that the pond be de-sludged at the same time in order to maintain optimal treatment capabilities. After replacing the air hose, the Bio-Domes can be returned to use within the lagoon.

In addition to the maintenance schedule described above, WCS recommends that the community work closely with the manufacturer of the blowers in order to determine the proper maintenance schedule for the blower and that the maintenance schedule be followed closely.

Appendix A: WCS Process Guarantee

WCS includes the following as part of ***every*** proposal. We stand 100% behind our products.

WCS warrants the performance of WCS Bio-Domes under the following conditions:

A. **Warranty Guidelines:**
    a. In order to warranty performance, WCS requires:
        i. That a requisite number of *Bio-Domes* be installed in accordance with the initially calculated number intended to meet the engineering requirements. This requirement will accommodate contaminant levels that exceed the expected values. The number of additional *Bio-Domes* will be determined by WCS at the request of the customer.
        ii. That the community and engineering firm allow WCS to review and approve the air delivery system.

The customer must maintain a maintenance log to confirm that the proper maintenance has been performed on the *Bio-Domes* according to the specifications provided by WCS.

    b. The customer must allow WCS to perform an on-site examination of any under-performing and/or defective *Bio-Domes* in order to determine the cause of system failure. If any of the exceptions described below are found to be the cause of failure, WCS reserves the right to void the warranty.

B. **Performance Warranty:** WCS offers a 5 year performance warranty. In the event that a warranted system fails to meet the effluent limits established in the engineering requirements, WCS will provide the additional equipment necessary to achieve compliance.
    a. Exceptions:
        i. WCS is not responsible for the lack of performance due to contaminants in the wastewater that impair or kill the microbes growing in the biofilm of the *Bio-Domes.*
        ii. WCS will not guarantee performance unless the recommended maintenance procedures are complied with.

C. **Mechanical Warranty:** WCS offers a 5 year, prorated, product warranty on all mechanical components manufactured / assembled by or on behalf of WCS. In the event of a mechanical failure, WCS will repair or replace the defective units / parts.
    a. Exceptions
        i. WCS does not offer any additional warranty on the blowers used to provide air to the *Bio-Domes* beyond what is offered by the manufacturer of the blower. This applies to all blower systems, including off-grid blower units.
        ii. WCS will not cover equipment that is damaged because of improper operation, the lack of proper maintenance, or accidental damage.

D. **Claims:** In the event that the *Bio-Domes* do not achieve expected performance or experience a mechanical failure, the customer should immediately contact WCS and report the problem as well as provide WCS with a copy of its maintenance log. Provided that customer has met all requirements necessary to qualify for warranty coverage, WCS will provide the customer with replacement units or additional units in order to achieve compliance.

Presentation Outline

Objective: Provide a perspective on mobile technology, how agencies are establishing policies, and what is currently being used.

Who cares?

- Mobile technology can help you:
  - do more with less,
  - do better with less
  - facilitate communication,
  - attract the best talent
- Mobile technology creates challenges
  - security (cyberattacks, data integrity, theft/loss)
  - initial cost
  - training/learning curve
  - reliability
  - obselence
- Knowing what to do is not always obvious
  - This presentation will not provide answers, but the perspective may provide some insight to help you find your own answers

1. A history of the mobile world
   a. Computing
      i. Calculations and analysis
   b. Communication
      i. words pictures videos
      ii. social networking (hanging out)
      iii. Documenting
      iv. Researching
      v. Advertising
      vi. Visualization
      vii. Collaboration/community
   c. Entertainment
      i. Games
      ii. Music
      iii. Photography/Videography/Art
   d. Organization
      i. Scheduling
   e. Banking
      i. Paying for stuff
      ii. securing loans

Rural Wastewater Treatment Lagoon Enhancement with Dome Shaped Submerged Bio-film Devices

poo-gloo

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Wastewater Compliance Systems, Inc.
May 9, 2011

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List of Acronyms

ALK: Alkalinity

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

CVWRF: Central Valley Water Reclamation Facility

DO: Dissolved Oxygen

ORP: Oxidation / Reduction Potential

PG: Poo-Gloo

TN: Total Nitrogen

TP: Total Phosphorus

TSS: Total Suspended Solids

USDA: United States Department of Agriculture

SBIR: Small Business Innovative Research Program

Figures

Tables

Acknowledgements

This project was completed with funds from a USDA SBIR Phase I grant.

We would like to thank the reviewers and staff at the SBIR office for seeing the value and application of this research, and the USDA for the funding of this project.

We are also grateful to Reed Fisher, and all the workers at Central Valley Water Reclamation Facility, in Salt Lake City, Utah for supporting us with the necessary facilities to perform this research.

Thanks also to Dr. Otakuye Conroy-Ben and her students in the Department of Civil and Environmental Engineering at the University of Utah for lab and logistical support.

Executive Summary:

WCS, Inc, with funding from a USDA SBIR Phase I grant, ran a pilot study from 25 October 2010 to 17 February, 2011. The purpose of this research project was to show that dome shaped, aerated, submerged biofilm devices are a viable retrofit for existing rural wastewater treatment lagoons. A partitioned pilot scale reactor tank was used to test performance of six dome shaped submerged biofilm devices (called Poo-Gloos) alongside six identical concrete bases with bubble releasing tubes (but without domes). Previous research work has confirmed the ability and effectiveness of Poo-Gloos to remove organics and ammonia nitrogen. In this research, more water quality parameters were tested in order to gain better knowledge of the nitrogen balance and phosphorus balance in the process of wastewater treatment using Poo-Gloos. Air cycling on/off in a plug flow reactor (PFR) mode was conducted to enhance nitrogen removal and phosphorus uptake/release as well as a means of saving energy. This research focused on cold wintertime operations, which is a major concern for most wastewater treatment lagoons at higher latitudes.

Lagoon systems that do not meet discharge requirements in the United States are generally replaced with expensive mechanical treatment plants. There is no equivalent product designed to improve the performance of existing lagoon systems. The low cost of the dome structures should allow inexpensive upgrades of existing lagoons and avoid the expensive replacement with a mechanical plant. The proposed work fulfills public interest by providing lagoon operators with a new, cost effective means to remain in regulatory compliance. Initial commercial deployment is targeted to small rural communities with populations of 500-5,000 that cannot afford to amortize high capital and operating cost of conventional mechanical treatment plants among a few hundred households. Another benefit of our system is that it can be incrementally installed within annual operating budgets to meet community growth and/or compliance objectives, without having to incur long term debt or other major bonding issues. Finally, the technical skills required to service and maintain the modules comfortably match existing lagoon operators in small rural communities.

The purpose of this wintertime study was to compare the performance of six scaled Poo-Gloos (PGs) to a Control in cold temperatures. The test unit is the size of a commercial dumpster and is divided lengthwise into two parallel tanks. One tank holds the six PGs, and the other is a Control that consists of six bubble release tubes only on the bottom of the tank in the same position as the bubble release tubes under the PGs. The same air flow rates and the same wastewater influent flow rates were introduced to both tanks. The experiment ran for 17 weeks. The most interesting results were at the startup (weeks 1 - 4) and at a mature bio-film steady state (weeks 12 - 15). Other weeks were spent adjusting the flow rates to determine optimal Hydraulic Detention Time (HRT), resetting the system, and winterizing the tanks. During weeks 1 – 4 the air was on 24 hours per day. During weeks 12 and 13, the air was cycled on 22/off 2 hours per day. During week 14 the air was cycled on 21/off 3 hours per day and during week 15

the air was cycled on 20/off 4 hours per day. The purpose of this was to promote de-nitrification and phosphorous uptake. The results of the pilot study for the removal of organic carbon (measured as COD), total suspended solids (TSS), ammonium (NH4+), total nitrogen (TN) and total phosphorous (TP) during the startup and steady state weeks are shown below.

COD removal:

At the beginning of week 1, the PG Tank and the Control Tank had similar organic carbon (measured as COD) removal rates. As the biofilm developed on the surfaces of the PGs, the performance began to diverge. By weeks 3 and 4, the Control Tank effluent was around 100 mg/L, whereas the PG Tank effluent was around 50 mg/L. During the steady state weeks 12 – 15, the Control Tank effluent increased to around 150 mg/L, but the PG Tank Effluent remained at 50 mg/L. The presence of the aerated biofilm in the domes removed most of the biologically oxidizable material from the wastewater at winter temperatures.

TSS removal:

Again, performance at the beginning of week 1 for the PG vs Control Tanks was similar for TSS removal. By week 4 the PG Tank was removing almost all the TSS, while the Control Tank effluent was around 20 mg/L. During weeks 12 – 15, the difference was even more dramatic, with the average PG Tank effluent less than 10 mg/L and the Control Tank effluent between 50 to 60 mg/L. The main reason for the difference is that the Control Tank was full of suspended growth, whereas the PG Tank biomass was fixed inside the domes and didn't wash out with the effluent.

Ammonium removal:

Biological nitrification is the desired removal mechanism to get rid of ammonium in wastewater, but for suspended growth, the necessary bacteria are suppressed at cold temperatures. The aerated fixed film biomass inside the domes allows nitrifiers to remain active at temperatures down to near freezing. At the start of the experiment the nitrifying biofilm was not well established, but by week 3, there was a dramatic increase in the removal rate, and by week 4, most of the ammonium was removed from the PG Tank effluent. This occurred despite temperatures less than 10 degrees C. Note that the Control Tank effluent showed no removal during week 3 and a slight removal during week 4.

Because nitrification has a high oxygen demand, cycling aeration off decreases the amount of ammonia removed. This is apparent during the steady state period of weeks 12 to 15 when the air off period was increased from 2 to 3 to 4 hours per day. The stair-step effect on the ammonia concentrations in the PG Tank effluent is apparent. Week 12 shows the strength of the biological dome design with moderate air cycling. At temperatures around 1 to 1.5 degrees C, with influent ammonia at 25 mg/L, the PG Tank effluent was 2 mg/L and the Control Tank effluent was 20 mg/L.

Total Nitrogen removal:

The purpose of air cycling in the Poo-Gloos is to increase the de-nitrification rates. The bacteria that accomplish de-nitrification are suppressed by the presence of oxygen, so the air-off periods allow them to increase their metabolic rate. However, during air-off periods, the metabolic rate of the oxygen dependent nitrifying bacteria is suppressed. The removal of both ammonium and nitrate/nitrite can be accomplished by finding the right balance between the air on and air off periods. Since the Total Nitrogen (TN) value measures ammonium plus nitrate/nitrite (as well as organic N), a minimum value of TN would indicate the optimum air cycling. During weeks 1 – 4 the air was on 24 hours per day and by weeks 3 - 4 the PG Tank effluent TN levels were around 17 to 18 mg/L. For weeks 12 – 15, the air off period was gradually increased from 2 hours off to 4 hours off per day. As the air off period increased, the PG Tank effluent ammonium levels increased 2 to 3 mg/L, but the nitrate/nitrite concentrations dropped 5 to 10 mg/L. The overall effect on TN was that the best removal occurred during week 15, with TN levels of around 14 mg/L. The Control Tank was not responsive to air cycling.

Total Phosphorous uptake/release:

The air cycling during weeks 12 – 15 promoted the uptake of P from the wastewater stream. During this 4 week period, the biofilm in the PGs took up about 20 g of P. During week 16, the air was off for the entire seven days, and the biofilm released 5 g of P. During week 17, the air was turned back on, and the 5 g of P was taken back up by the biofilm. Thus the ability of the bio-film in the Poo-Gloos to uptake P during periods of discharge to a receiving water from a pond, and then release P during periods of diversion of effluent for storage/land application is demonstrated.

Technical Objectives:

Technical Objectives for the Phase I research were:

1. Upgrade pilot plant with 6 new scale Poo-Gloos (outer domes 1.6' radius) and parallel paths for simultaneous control runs.

Progress: Done. See Figures 2 and 3 on page 15.

2. Verify previous work for CBOD and NH_4^+ removal rates while establishing biofilm on new Poo-Gloos.

Progress: Done. Figures 4 through 6 show the carbonaceous oxygen demand removal (as COD), and Figures 11 through 13 show the NH_4^+ removal. Removal rates are discussed in the associated text.

3. Begin a series of controlled runs that vary air cycling times, organic and hydraulic loading rates, and temperature.

Progress: We ran the pilot for 17 weeks to begin to understand the proper HRT and air cycling times to get the system to respond with N removal and P uptake and release. Weekly variations in operational parameters are shown in Table 1.

4. Analyze results and modify factors to optimize N removal through nitrification and de-nitrification.

Progress: We have a good start. The results are shown in Figures 16 – 18 for TN removal in this report. Following the Design of Experiment for Phase II should get us a lot closer to optimization.

5. Analyze results and modify factors to optimize P uptake and release.

Progress: Maximum TP uptake occurred with an HRT of 7 days and an air cycling regime of 22 hours ON/2 hours OFF during January, 2011. See Figures 21 through 23 for details on P uptake and release.

6. Perform statistical analysis on all results to show significant results.

Progress: Paired T-tests were run for each of the constituents measured (TSS, COD, TN, NH_4^+, NO_2^-/NO_3^-, ALK, TP, PO_4^{3-}) comparing influent to PG effluent, influent to Control effluent, and PG effluent to Control effluent. The PG (Poo-Gloo) tank out-performed the Control in almost every category. The results of PG effluent to Control effluent are shown on pages 44, 45 and 46 in this document.

7. Write report, and develop preliminary Operations Manual for full-scale applications.

Progress: This document is the final Phase-I report, and we are working on the Operations Manual.

8. Begin preliminary monitoring of full scale application (35 Poo-Gloos, each 6' diameter at base and 4' high dome) in Wellsville, Utah.

Progress: Wellsville has agreed to add 40 more PGs for a total of 75. The system should be ready to run by July, 2011.

Background:

Overview

This research fit well with the USDA Air, Water and Soils (Topic Area 8.4) research priorities in the area of water conservation and reuse. The proposed technology that was tested consists of submerged bio-domes (nicknamed Poo-Gloos) that reduce the nutrient load of wastewater discharged from rural municipal treatment lagoons, making this water more suitable for discharge or reuse. While the devices researched have shown good performance in the removal of carbonaceous oxygen demand compounds and nitrogen compounds, the specific area of research for this proposal was the uptake and release of phosphorous compounds. Other potential future applications are dairy and feedlot waste lagoons, and reduction in ammonium concentrations to improve the water quality in fish farms.

The Poo-Gloo devices are efficient biological aerators because they put the air directly against the bio-film. In one potential application, the Poo-Gloo installation would use half the power required by pontoon mounted aerators (a competing technology).

Additionally, the Poo-Gloo devices can be manufactured in rural areas in the United States. The concrete base and plastic dome set manufacture and assembly are ideally suited to small facilities already in existence and underutilized. For example, the ABS plastic domes are currently formed at a small plastics shop in Tooele, Utah, population 30,120. The concrete bases are poured and the devices are assembled at an 11 acre farm in Lehi, Utah, and are installed in Wellsville City, population 3260, located in the rural southwest portion of Cache Valley in northern Utah.

This report is for activities funded by a USDA SBIR Phase I award to WCS, Inc in 2010. Kraig Johnson was the PD, and the title of the application was "Rural Wastewater Treatment Lagoon Enhancement with Dome Shaped Submerged Bio-film Devices."

Lagoon systems are the primary form of wastewater treatment for rural communities. In the United States, there are approximately 7000 communities with lagoon systems (EPA 2002). As these communities grow, and as discharge requirements become increasingly stringent, the lagoon systems are often unable to meet the new discharge requirements. To protect the surface waterways in the United States, these requirements mandate reductions in nitrogen (N) and phosphorous (P) compounds (usually referred to as nutrients).

Lagoons can be effective at reducing Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS), provided they are not overloaded. They often fail to remove nutrients, particularly in cold climates. The bacteria that remove N compounds (through nitrification and de-nitrification) are slower growing, and are out-competed by algae and BOD consuming bacteria (heterotrophs). In suspended growth form, they are also inactive at temperatures below 10° C.

Lagoons are also ineffective at removing P compounds, often times due to complicated interactions between aquatic plant growth, benthic cycling and seasonal variations. Beneficial bacteria can take up organic P from the water, and either settle to the bottom or re-release the P in the water column. Some classes of bacteria will uptake excess P and are referred to as Polyphosphate Accumulating Organisms (PAOs).

Bacteria are the workhorses of the environment, breaking down undesirable compounds and making the resulting elements or simpler compounds available for use by other organisms. The proliferation of these beneficial bacteria can be greatly enhanced in an aquatic environment by the addition of colonizable surface area to promote the growth of bio-film. Ideally this surface area will be blocked from the sunlight to prevent algae growth, will provide for the circulation of nutrients past the bio-film, and in the case of aerobic bacteria, lots of air bubbles to oxygenate the bio-film.

The Phase I research covered by this report investigated a novel design to promote the growth of bio-film utilizing submerged Poo-Gloos. These bio-domes are a series of nested concentric plastic domes mounted on a sturdy base and fully submerged. Low pressure air bubbles are introduced around the inner annulus of each dome. The air bubbles must travel up the inside of each dome, contacting the bio-film colonizing the surface with increasing pressure as they move up the curved surface.

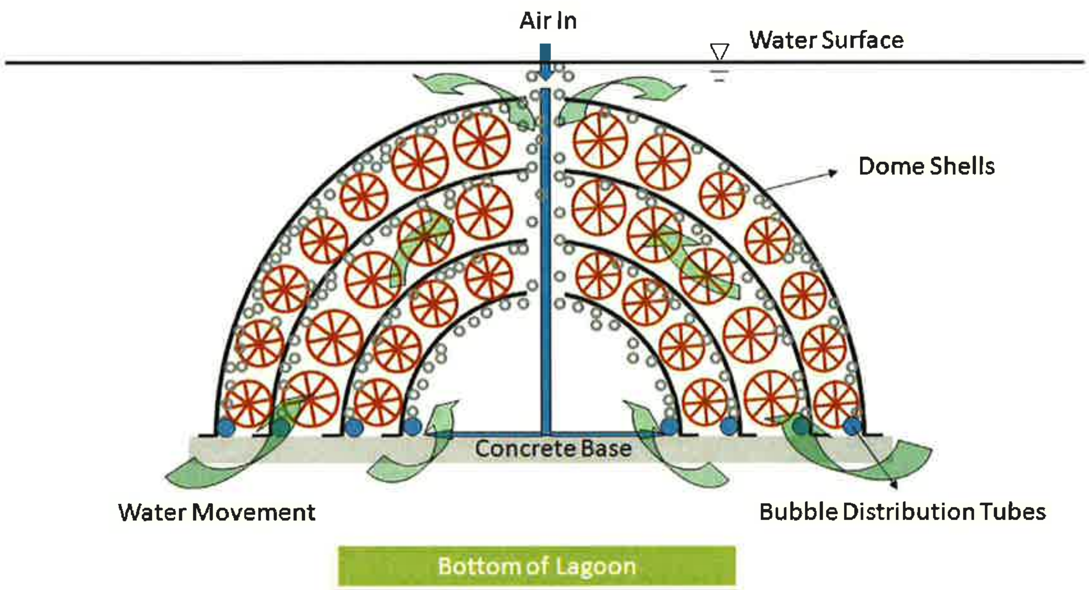


Figure 1: Cross section of a Poo-Gloo with four nested domes + polypropylene pall rings

At the top of each dome, all the air bubbles escape through a hole, dragging water along and expelling it out the top. The combination of oxygenation and micro and macro-mixing of the wastewater at the bio-film surface greatly speeds up the metabolism of the bacteria in the bio-film.

A typical lagoon depth is 6 feet (1.83 m). The Poo-Gloo devices for that depth are about 6 feet (1.83 m) in diameter at the base and 4 feet(1.22 m) high, mounted on a one foot (0.305) tall concrete base for a total height of 5 feet (1.52 m). This allows one foot (0.305 m) of water over the top to keep it fully submerged.

Literature Review

Conventional biological nitrogen removal from wastewater is accomplished by two broad classes of bacteria, the nitrifiers ($NH_4^+ \xrightarrow{Nitrosomonas} NO_2^- \xrightarrow{Nitrobacter} NO_3^-, nitrification$) and the de-nitrifiers ($NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2, denitrification$). It has been extensively studied and well established in activated sludge systems. Nitrification is an aerobic process while de-nitrification requires an anoxic environment. The anaerobic ammonium oxidation (ANAMMOX, $NH_4^+ + NO_2^- \rightarrow N_2 + 2H_2O$) process was first discovered in Dreft, Netherlands about a decade ago and has been studied by numerous researchers, most recently (Schmid et al., 2005; Tsushima, et al., 2007a; Tsushima, et al., 2007b; Kindaichi, et al., 2007; Fernandez, et al., 2008; Szatkowska, et al., 2007; Feng et al., 2008; van der Star, et al., 2007). ANAMMOX gains its attention due to efficiency and cost effectiveness compared with conventional nitrogen removal. However, due to the ANAMMOX slow growth rate with the fastest doubling time reported as 11 days and special sludge seeding needed for a time consuming startup (Schmid et al., 2005), conventional biological removal is still the reliable and manageable process used in current wastewater treatment applications.

Simultaneous nitrification and de-nitrification was detected in activated sludge systems with low DO. It occurs because of different microclimates: de-nitrification can occur in the interior of flocs, while nitrifiers work at the exterior of flocs (Metcalf and Eddy Inc, 2003). Different microclimates exist in fixed bio-film systems. Both nitrifiers and de-nitrifers can live in fixed bio-film and occupy different localized micro-climates. High metabolic rates occur when there is micro-fluidic movement of oxygen (in the case of nitrifiers) and wastewater past the surface area. In the proper symbiotic environments, the removal of nitrogen compounds is complete, with the nitrogen released as harmless N_2 gas. Biological nitrogen removal in fixed film is well documented in the literature. Our own research on this topic with nitrification in submerged bio-film is published in one University of Utah PhD Dissertation and two peer-reviewed journal articles (Choi, 2005, Choi, et al, 2007, Choi et al. 2008.) Other recent references are: Tarre et al, 2007, Terada et al, 2006, Satoh, et al, 2004, and Hibiya, et al, 2003.

Biological phosphorus removal requires alternating anaerobic and aerobic conditions to enrich phosphorus accumulative organisms (PAOs), which release orthophosphate (PO_4^{3-}) during the anaerobic phase and uptake more PO_4^{3-} than released during aerobic phase, therefore removing P from the system (Zeng *et al.*, 2003). Unlike nitrogen, phosphorous cannot escape into the air. PAOs or other organisms will release the phosphorous back into the water, or settle to the bottom as dead cell mass. PAOs are also well documented in the literature, a few recent selected references are: Gu, et al, 2008, Rogalla, et al., 2006, Sriwiriyarat, et al, 2005. Neither de-nitrification nor de-phosphatation can be accomplished without sufficient biodegradable organic compounds, the so-called carbon source (Randall, et al., 1992). In the early research, de-nitrification was considered to interfere with biological phosphorus removal since de-nitrifiers outcompete PAOs for carbon source during the anaerobic process. However, more recent research found that enhanced biological phosphorus removal (EBPR) can occur in the presence of nitrate (Seviour *et al.*, 2003; Oehmen *et al.*, 2005). One of the biggest problems in biological phosphorus removal with activated sludge is management of sludge biomass. Biomass wastes contain excess phosphorus and proper management is required to avoid phosphorus being released and reintroduced to the wastewater (Rich, 1998). Kuba *et al.* (1994) reported that de-nitrifying PAOs produce less sludge, reducing the cost of sludge management. Therefore, simultaneous nitrogen and phosphorus removal is considered a more attractive and economical process (Carvalho, *et al*., 2007; Seviour and McIlroy, 2008).

Martinez and Wilderer (1991) demonstrated lab-scale biological phosphorus removal in a fixed bed bio-film reactor. The reactor filled/ drained and the aerator turned on/off periodically to enrich PAOs in bio-film. After several weeks of operation, the steady-state was reached and phosphorus in dry bio-film turned out to be about 5%.

In a 1994 publication, Gonçalves, et al. showed that a submerged mass of bio-film could perform nitrification, de-nitrification and also biological phosphorous removal. The key was to cycle the air on then off to promote aerobic to anoxic to anaerobic dominance. Phosphorous removal was effected by flushing the bio-film at the end of an extended anaerobic phase. Cycle times were on the order of nine hours on to three hours off using a fixed film upflow filter. Note from the paper that no external carbon source was needed for either de-nitrification or phosphorous uptake and release, due to the long SRT of the biomass in the filter.

In a lagoon environment, phosphorous release could be timed with a diversion of effluent to a holding pond for land application or other phosphorous removal techniques. During the uptake phase, pond effluent could be discharged into the normal receiving water.

Improvement of existing lagoon systems is an overlooked area of engineering design. Addition of baffle curtains to prevent short circuiting, addition of fixed film aeration devices such as the Poo-Gloos, and, theoretically, addition of air cycling in the fixed bio-film and diversion of phosphorous laden effluent away from receiving waters are all operational upgrades that would cost a fraction of the cost of conversion to a mechanical plant. Traditional lagoons are constructed to remove biochemical oxygen demand (BOD), suspended solids, and pathogens. Nutrient removal, defined here as nitrogen compounds such as NH_4^+, NO_3^-, NO_2^- and organic N, as well as phosphorous compounds such as PO_4^{3-} and organic P has been less successful.

Results and Accomplishments:

Overview of the Experiment

The Phase I pilot study ran for 17 weeks from mid-October, 2010 to mid-February, 2011. As described in the Phase I proposal, a pilot tank the size of a commercial roll-off dumpster was constructed so that the six scaled Poo-Gloos would run side-by-side with a Control. Each side was fed the same amount of wastewater and the same amount of air. On the Control side, the bubble tubes were arranged in circular patterns to duplicate the arrangement under the domes on the Poo-Gloo side. The only initial difference between the two was the presence of the plastic domes and plastic packing (high surface area to volume Lanpac material) between the domes. The total surface area including the domes and the packing for the six scaled PGs is approximately 3000 ft^2 (279 m^2).

The 17 week experimental run had three primary variables. They are: a) Wastewater flow rate (and associated constituent loading) into the tanks. Varying the time the pump came on controlled the hydraulic and nutrient loading with a corresponding HRT that varied from 3 days to 9 days. b) Air on/off periods. During the time the air was on, the air flow rate was held constant at around 3 lpm per scaled Poo-Gloo (18 lpm total per side). Air cycling varied from 22 hours ON/2 hours OFF to 19 hours ON/5 hours OFF. Also, twice the air was left off for an entire week to promote the release of stored P. c) Temperature. We allowed the water to follow the weather-induced temperatures, which varied from 12.6 to 0.2 degrees C.

Figure 2: Overview of the dual chamber reactor tank. The Control tank with 6 bubble tube sets is on the left and the PG tank with 6 Poo-Gloos is on the right. (Nearest ones are out of the picture.) The dome structures are about 2.5' (0.762 m) high. Total tank depth is 3' (0.914 m), length is 22' (6.7 m), and overall width is 8' (2.44 m).

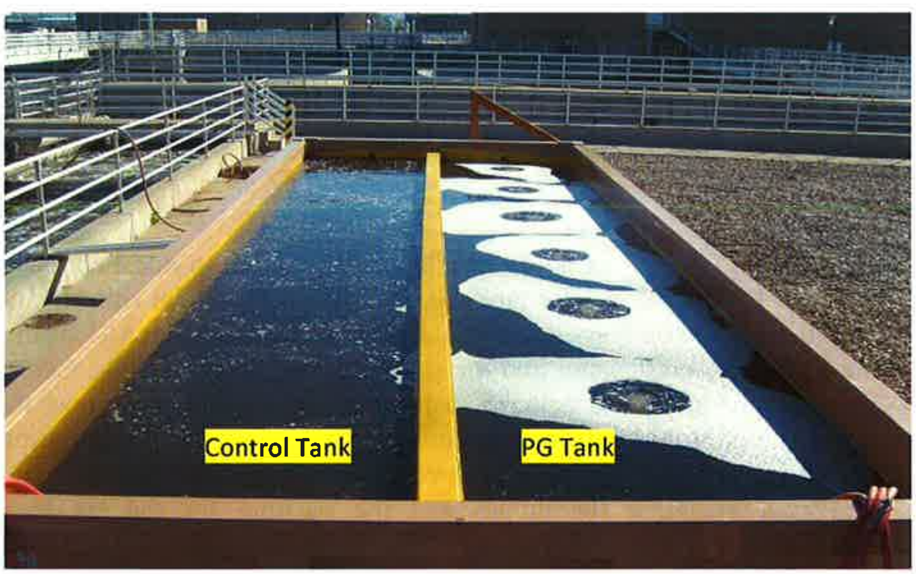


Figure 3: Reactor tanks in operation since mid-October, 2010. Effluent holes are visible at the far end.

We did insulate the tank to more closely mimic an in-ground pond. The concentration of the wastewater pumped from the transfer ditch at CVWRF varied moderately. Comparing effluents of the two side-by-side tanks helped to cancel the influent concentration variations.

The commercial dumpster is divided lengthwise into two parallel tanks, each holding 1650 gallons (6245 liters). The six PGs in the PG tank have an internal structure that provides a total surface area of about 3000 square feet (279 m^2) of colonizable bio-film surface area. The Control tank contains bubble release tubes only. The wastewater was pumped through a flow splitter equally into each tank at one end. At the other end, the effluent spilled out over circular weirs and was returned to the treatment plant downstream of the influent point.

The influent to the tanks was sampled once per day. Values were compared to the lab results at CVWRF for quality control. The PG side and the Control side were each sampled from once to three times per day, depending on the week. During several weeks, lab triplicates were performed for QC and statistical analysis. The standard deviation for the values during those weeks is shown on the associated figures as error bars (± one SD).

Field measurements were taken with a Horiba W-2010 Water Quality Checker. Turbidity, pH, temperature, ORP, DO and conductivity were measured daily, as well as several days where readings were automatically collected every hour. Exiting air bubbles were also checked with an ammonia tube.

At the University of Utah lab, the following parameters were measured: Chemical Oxygen Demand (COD), ionized Ammonia (NH_4^+), Total Suspended Solids (TSS), Nitrate/Nitrite (NO^{3-}/NO^{2-}), Total N (TN), Alkalinity (ALK), Ortho-P (PO_4^{3-}), and Total P (TP). Concentration of P in bio-film samples, and filamentous algae samples was also measured. This monitoring produced a wealth of data, with over 5500 field measurement values, and over 4000 lab measurement values. Most of this data is presented in a series of overview figures. Several weeks are also selected for a closer look. The complete excel file for all field and lab measurements is available on our website (www.wcs-utah.com).

Table 1: Weekly variations in operational parameters

Week	Dates	Inflow Rate (Liters/day)	HRT (days)	Air Cycling Hrs ON/Hrs OFF Each day	Goal	Notes
1	10/25/2010 – 10/29/2010	1938	3	24/0	Establish biofilm	
2-4	11/1/2010-11/19/2010	795	7 – 8	24/0	Allow nitrifying & other bacteria to reach steady-state	Well established by week 4
5-6	11/22/2010 – 12/6/2010	696	9	19/5	Air cycling to promote denitrification & possible P uptake	Minimal de-nitrification, No data for week 6 due to bad weather
7-8	12/6/2010 – 12/17/2010	1181	5 – 6	19/5	Reduce loading, continue to promote de-nit and P uptake	Heavy BOD loading, heterotrophs dominate
9	12/20/2010 – 12/24/2010	0	∞	0/24*	Possible P release	* air pulsed on for 5 min. each 6 hrs. for circulation
10	12/27/2010 – 12/31/2010	0	∞	24/0	Possible P uptake	Air on continuously, release of PO4
11	1/3/2011 – 1/7/2011	863	7	24/0	Return system to steady-state	Insulate tank and winterize feed lines, compressor shed
12-13	1/10/2011 – 1/21/2011	863	7	22/2	Show significant BOD & ammonia removal, possible P uptake	Note huge cold temperature ammonia removal, significant TP uptake.
14	1/24/2011 – 1/28/2011	863	7	21/3	Show significant BOD & ammonia removal, possible P uptake	Significant TP uptake, and possibly some release of PO4.
15	1/31/2011 – 2/4/2011	863	7	20/4	Show significant BOD & ammonia removal, possible P uptake	Consistent removal rates, significant TP uptake from bulk solution into bio-film.
16	2/7/2011 – 2/11/2011	0	∞	0/24	Possible P release	TP in bulk solution increased from 2.4 to 3.2 mg/L
17	2/14/2011 – 2/17/2011	0	∞	24/0	Possible P uptake	TP in bulk solution decreased from 3.2 mg/L to 2.65 mg/L

Analytical Methods

The following analytical methods have been selected to measure the proposed parameters of water quality. (See table 2)

Table 2: Selected analytical methods for water quality analysis

Parameter	Method
COD	HACH TNT 82206 (20 – 1500 mg/L)
TSS	APHA, AWWA, & WPCF. Standard Method with VWR Filters
Ammonia	HACH TNT (0.4 – 50 mg/L)
Total Nitrogen	HACH s-TKN TNT 880 (0 – 16 mg/L)
Nitrites/Nitrates	HACH s-TKN TNT 880 (0 – 16 mg/L)
TKN	HACH s-TKN TNT 880 (0 – 16 mg/L)
Alkalinity	HACH TNT 870 (25 – 400 mg/L)
Total Phosphorus	HACH TNT 844 (0.5 – 5 mg/L PO_4-P)/TNT 845 (2-20 mg/L PO_4-P)
Reactive Orthophosphate	HACH TNT (0 – 5 mg/L PO_4)

Horiba W-2010 was used for field measurements including pH, turbidity, conductivity, DO, temperature and ORP. Drager diffusion tubes (ammonia 20/a-D) were used to measure the concentration of ammonia in the off-gas from both the PG tank and the Control tank.

Collected data is analyzed with Microsoft Office Excel 2007 and also StatEase 8.0.

Modeling the System

Although the side-by-side tanks are approximately 5 times longer than they are wide, based on observations of the system, a Continuous-Flow Stirred Tank Reactor (CFSTR) model works better than a Plug Flow model. One reason for this is a fairly long hydraulic retention time (HRT). The mixing of the water by the rising air bubbles is primarily bottom to top, but within one HRT there was sufficient end-to-end mixing to justify this model. (One aspect of Plug Flow, however, was the amount of filamentous algae growing on the top of each Poo-Gloo. The amount increased proceeding from the influent end to the effluent end.)

Borrowing from Tchobanoglous & Schroeder (1985) on page 270, the CFSTR model equation is:

$$V\frac{dC_{out}}{dt} = QC_{in} - QC_{out} + r_{out}V$$

In the case of Nitrogen, if the influent N is NH_4^+, there is no accumulation due to steady-state inflow and outflow, and the overall reaction r_{out} is removal (i.e. conversion to NO_3^-), the equation becomes:

$$Q[NH_4^+]_{in} - Q[NH_4^+]_{out} = k[NH_4^+]_{out}V$$

If the increase of NO_3^- (NO_2^- concentrations were negligible) is entirely due to nitrification ($NH_4^+ \rightarrow NO_3^-$), then the NO_3^- can be modeled as

$$Q[NO_3^-]_{in} - Q[NO_3^-]_{out} = -k[NH_4^+]_{out}V$$

In the case of P, simplifying assumptions are that the P can be accounted for as Total P. Even if some P in the biomass is converted to PO_4^{3-} (or vice-versa) the P cannot exit the system unless it flows out. Therefore it is non-reactive (for purposes of this model) and accumulates in the system if it is taken up by the biomass or settles. Therefore the equation for P becomes:

$$V\frac{dP_{out}}{dt} = QP_{in} - QP_{out}$$

Based on observations from the PG (Poo-Gloo) tank, the fixed biomass accumulates organic P, and twice released P into the bulk solution. The observations and modeling are explained in the pages that follow.

Analysis by constituent for influent and PG (Poo-Gloo) vs. Control removal

Organic Removal measured as Chemical Oxygen Demand (COD)

Due to ease of measurement with the Hach Colorimetric System, COD was used for the bulk of the dissolved organic oxygen demand values. CVWRF measured BOD for the influent to our pilot tanks, which correlated with our values.

In Figure 4, and in all subsequent similar figures, error bars show ± one S.D. for lab triplicates during selected weeks when triplicates were run.

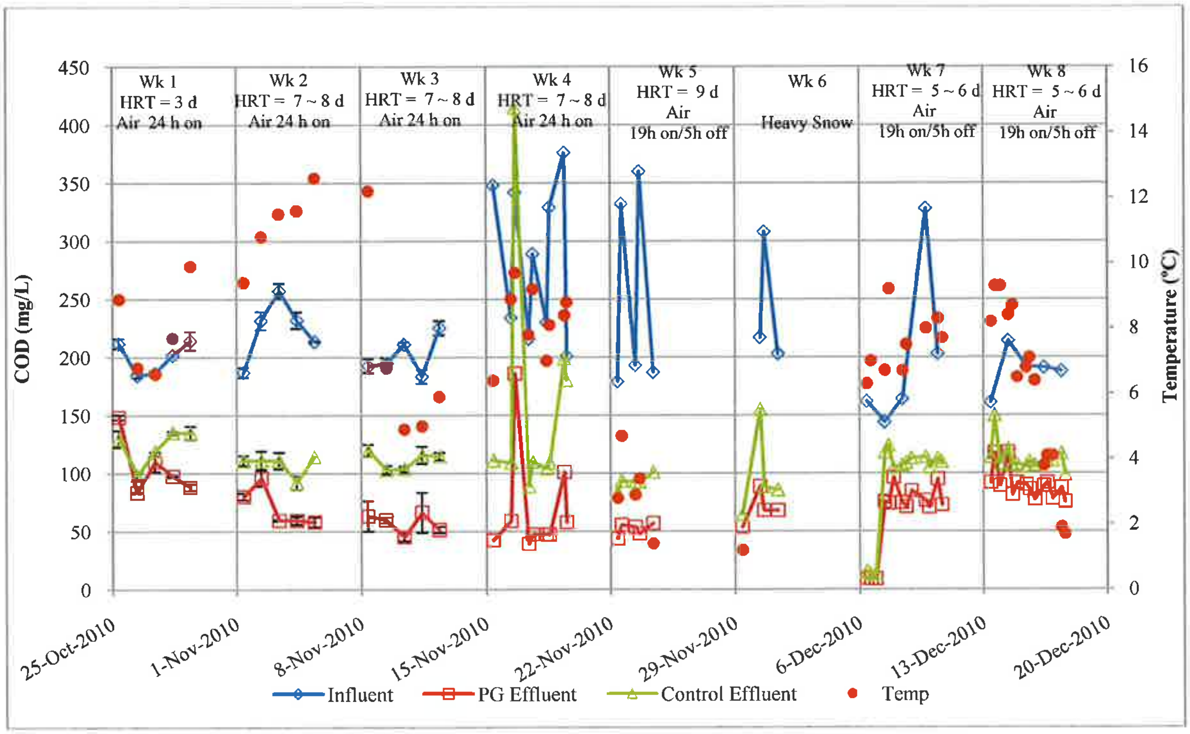


Figure 4: Week 1- 8 of oxygen demand results, measured as COD.

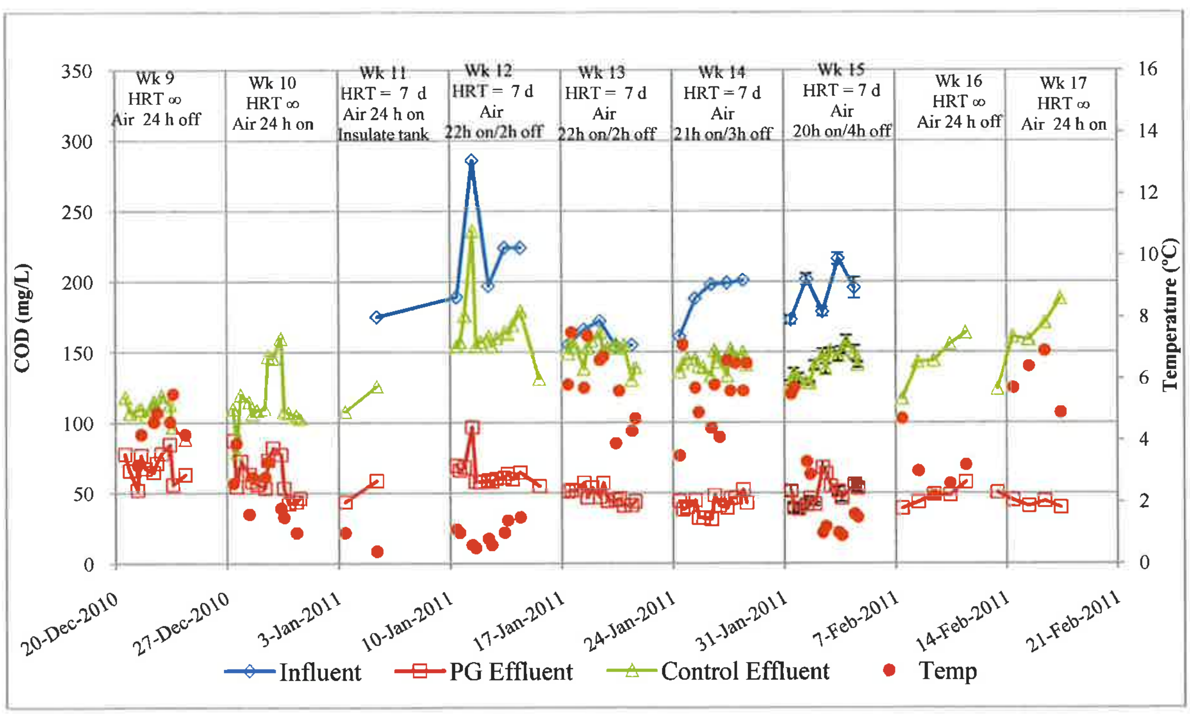


Figure 5: Week 9 - 17 of oxygen demand results, measured as COD.

For dissolved organic removal, the Poo-Gloo Tank (shown in red) outperformed the suspended growth in the Control Tank (shown in green) every week. During the first week at the end of October, the bio-film was still establishing on the interior surfaces. During the runs in November, the influent (shown in blue) averaged around 200 mg/L, Control effluent around 100 mg/L, and PG effluent around 50 mg/L. During the first two weeks of December, the system was deliberately loaded much more heavily with an HRT of 5-6 days, and an air cycling of 5 hours off/19 hours on. This caused the effluent on the PG side to rise to 80 mg/L with a couple of bumps over 100 mg/L. During this period, the PG system was dominated by heterotrophs, and ammonia removal was reduced (more on this in the next section). During the month of January, 2011, the system achieved a steady-state with an HRT of 7 days, and a consistent, impressive COD removal rate at or below 50 mg/L. We assumed that about half of the upstream 3000 ft^2 of biofilm in the PG tank was dominated by heterotrophs removing organic carbon material, and the downstream half was dominated by autotrophs removing ammonium. For organic carbon heterotrophs, removal rates were around 2×10^{-4} lb BOD/ft^2/day. (We also assume in our biological system that delta COD is equivalent to delta BOD.)

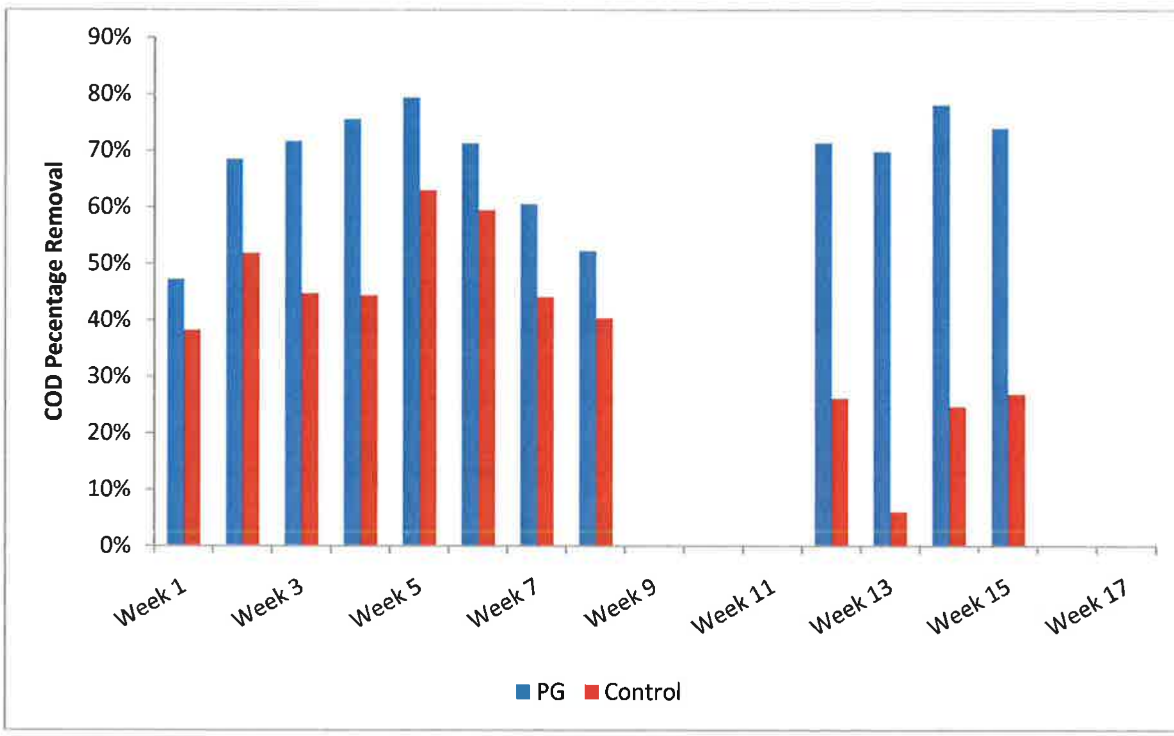


Figure 6: COD percentage removal from influent to effluent, PG vs. Control.

Total Suspended Solids (TSS)

Effluent from the PG side of the tanks was consistently more transparent than the Control side. One reason for this is the biomass in the Control side is suspended, and is washed out with the effluent. Nevertheless, one cannot argue with success, and the effect of the fixed bio-mass in producing a low turbidity effluent is worth mentioning.

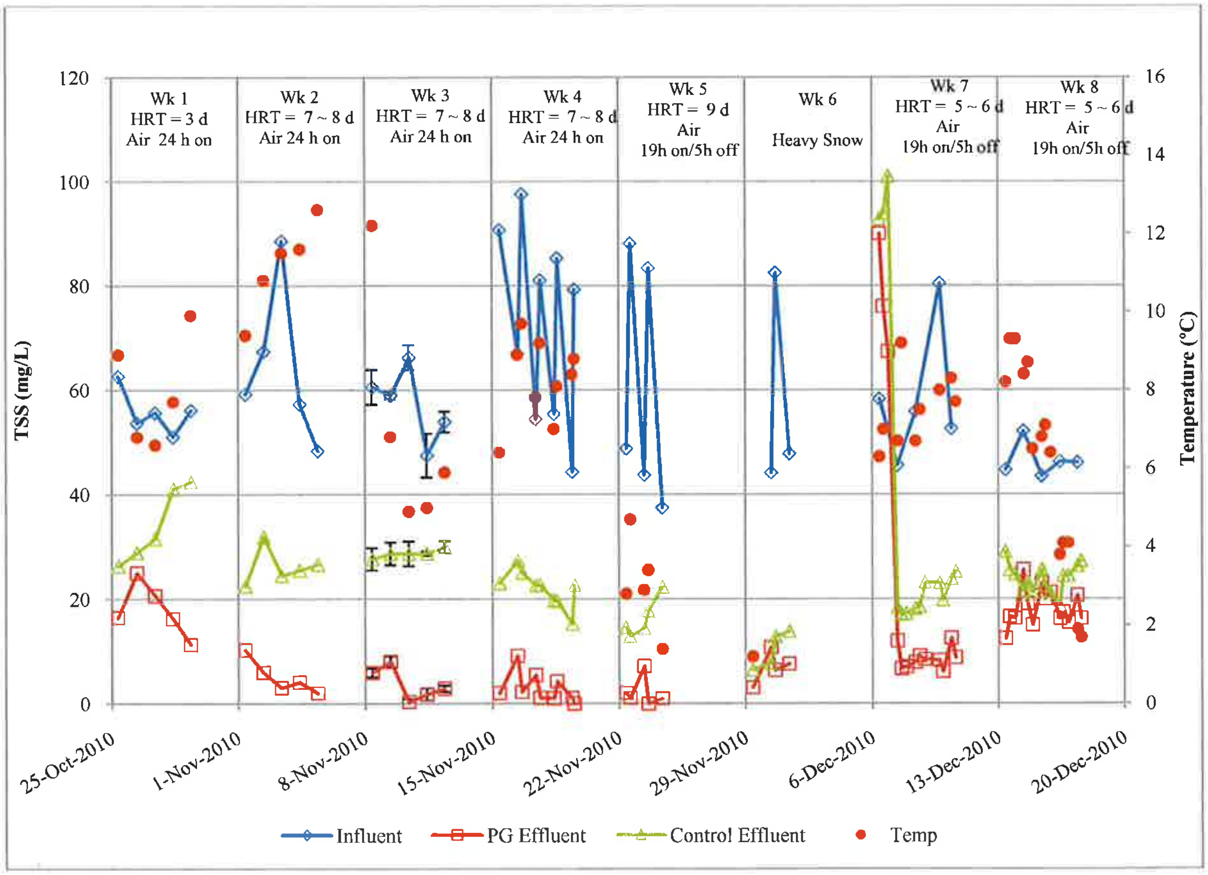


Figure 7: Week 1 - 8 of TSS results.

The steady state period of performance in January, with an HRT of 7 days, clearly demonstrates the benefit of the fixed film PGs. PG tank effluent was less than 10 mg/L, while the Control tank effluent was between 45 and 65 mg/L.

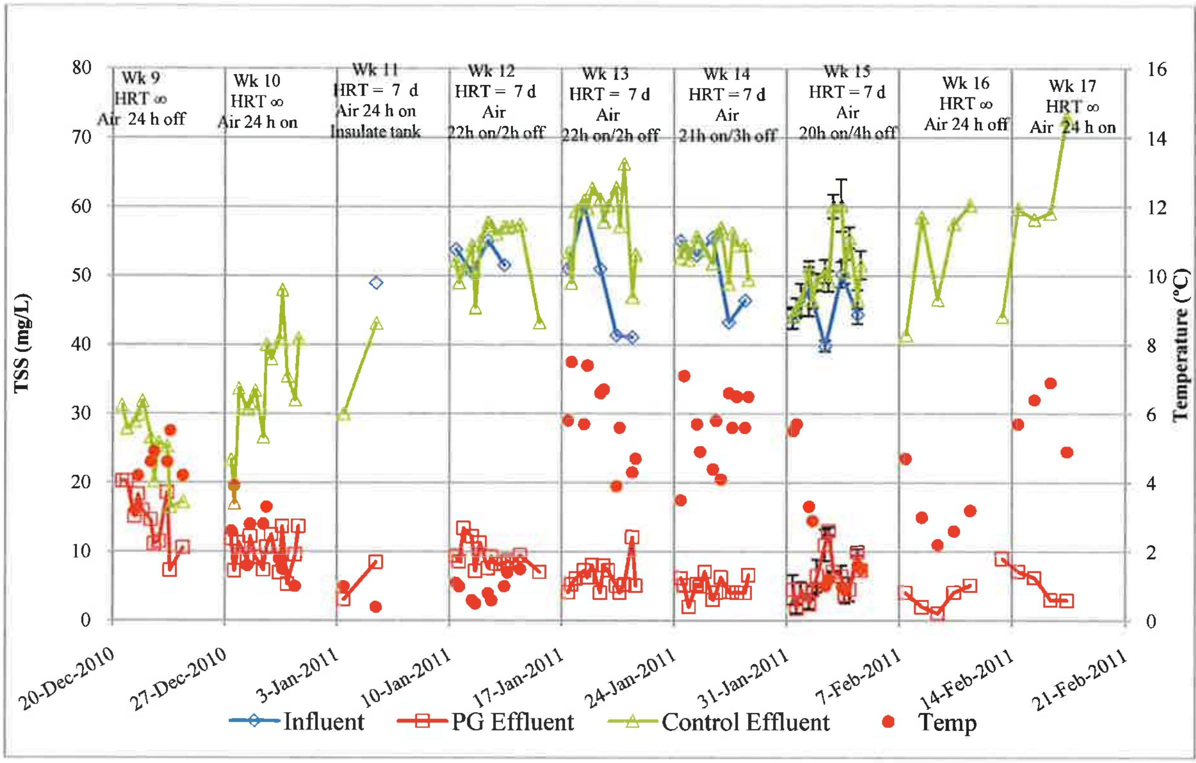


Figure 8: Week 9 – 17 of TSS results.

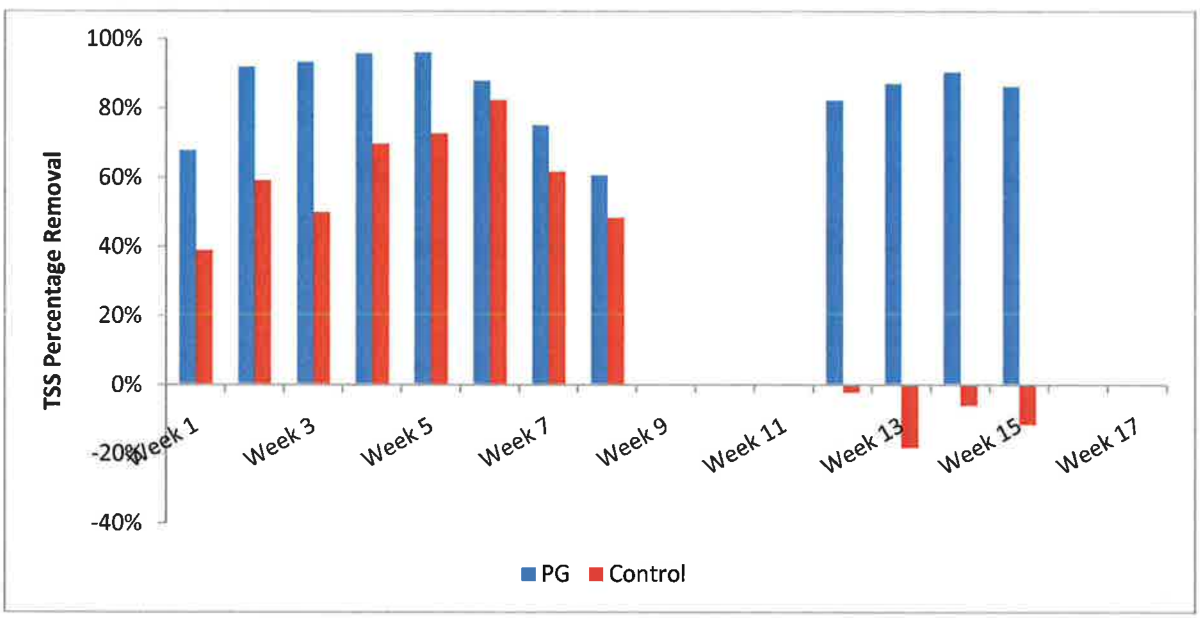


Figure 9: TSS percentage removal from influent to effluent PG vs. Control.

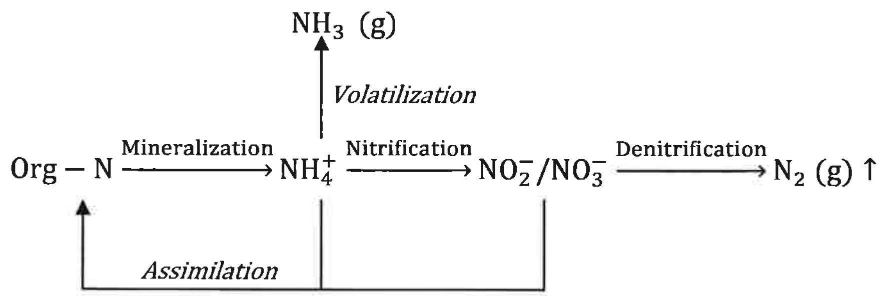
COD and TSS are not mutually exclusive, as the suspended solids do have an oxygen demand. The values are shown together in Table 3.

Table 3: Influent daily loading, PG and Control tank daily removal by week, and 17 week totals for COD and TSS. (Note that an increase is shown as a negative number for the effluent columns.)

	Loading		PG Tank		Control Tank	
	g COD /d	g TSS /d	g COD/d Removed	g TSS/d Removed	g COD/d Removed	g TSS/d Removed
Week 1	1421	397	671	269	543	155
Week 2	1168	334	800	307	606	198
Week 3	1152	328	826	307	515	164
Week 4	1559	398	1178	382	693	278
Week 5	1296	312	1029	300	817	227
Week 6	1221	293	871	258	726	241
Week 7	684	424	415	319	302	262
Week 8	705	173	368	105	285	84
Week 9	0	0	22	18	51	25
Week 10	0	0	61	-2.8	11	-26
Week 11	673	188	477	166	223	48
Week 12	862	202	615	166	226	-4.5
Week 13	477	146	333	127	29	-27
Week 14	516	138	403	125	128	-8.3
Week 15	486	114	359	98	131	-13
Week 16	0	0	-28	-1.6	-71	-28
Week 17	0	0	16	9.0	-96	-43
Total Mass $\sum$ 17 wks (grams)	**85546**	**24131**	**58919**	**20666**	**35824**	**10716**

Nitrogen Removal

Nitrogen appears in the wastewater as inorganic nitrogen (ammonia/ammonium, nitrites and nitrates) and organic nitrogen. The removal of nitrogen in wastewater is a multi-stage process. A simplified nitrogen balance is illustrated as follows.



Organic nitrogen is decomposed to ammonium via mineralization. Ammonium can be oxidized to nitrite and nitrate through nitrification if alkalinity (ALK) is present. Inorganic nitrogen (ammonium, nitrite, and nitrate) can be assimilated by algae or heterotrophic bacteria into organic nitrogen again. Denitrifying bacteria can convert nitrite and nitrate to nitrogen gas (N_2) which is then released to the atmosphere. Un-ionized ammonia (NH_3) in wastewater can get into the air by volatilization. In summary, nitrogen in wastewater can be removed through nitrification/denitrification, volatilization and assimilated into biofilm. The following parameters were measured in the wastewater during this research to determine the removal mechanism and efficiency of nitrogen in our pilot system: ammonia/ammonium, nitrites/nitrates, total nitrogen and alkalinity. Those parameters were measured using HACH TNT or TNT plus methods with HACH DR 3800 spectrophotometer.

Drager diffusion tubes (ammonia 20/a-D) were used to detect any un-ionized ammonia that may have escaped through volatilization. The concentration of un-ionized or ionized ammonia depends on the pH of the system. The pH of the pilot system was around 7 – 8, which means that the NH_3/NH_4^+ speciation is almost entirely in the ionized NH_4^+ form, therefore only minimal amounts would escape into the air. Results are discussed on page 27.

We estimated that there was about 10,000 g biofilm attached onto the interior surfaces of the six PGs in the PG Tank, at steady-state, based on sampling several 10 cm x 10 cm areas. Based on the cell molecular formula of $C_5H_7NO_2$, the biofilm is about 12% N. Therefore, there was about 1200 g nitrogen assimilated into the biofilm. The Total N and ammonia nitrogen that were removed during the entire 17 week run are listed in Table 4. If you assume that all the nitrogen in the Poo-Gloo biofilm came from ammonia nitrogen, then the remainder, about 5000 g of ammonia nitrogen was removed due to nitrification. Note for the 17 week sum, the PGs removed 5 times the ammonia than the Control.

Table 4: Influent daily loading, PG and Control tank daily removal by week, and 17 week total for Nitrogen compounds. (Note that an increase is shown as a negative number for the effluent columns.)

	Loading		PG tank			Control Tank		
	g NH_4^+-N /d	g TN /d	g NH_4^+-N/d Removed	g NO_2^- / NO_3^--N/d Removed	g TN/d Removed	g NH_4^+-N/d Removed	g NO_2^- / NO_3^--N/d Removed	g TN/d Removed
Week 1	151	217	53.0	-7.4	72.5	21.6	0.04	37.6
Week 2	143	182	46.0	-3.6	67.8	20.6	0.9	42.8
Week 3	125	150	97.3	-47.6	48.4	-1.0	0.4	-2.7
Week 4	148	179	143.3	-82.5	90.5	35.9	-0.37	44.4
Week 5	131	167	124.9	-86.8	63.7	13.1	-0.19	35.7
Week 6	116	141	78.9	-56.7	21.8	67.2	-41.1	11.7
Week 7	83	109	25.8	-4.4	34.1	6.5	-1.4	13.8
Week 8	80	92	18.8	-0.42	17.9	9.0	0.7	6.2
Week 9	0	0	2.85	-0.11	7.4	2.4	-0.07	-0.8
Week 10	0	0	12.3	-13.3	0.05	-2.1	-0.02	-4.5
Week 11	62	80	58.5	-61.1	18.4	-15.4	-0.5	7.5
Week 12	92	106	86.4	-55.5	38.2	17.4	0.3	8.0
Week 13	55	74	47.0	-39.0	28.2	-1.0	-0.2	-3.7
Week 14	62	78	51.0	-31.8	36.2	11.0	0.3	8.5
Week 15	51	71	32.6	-14.2	34.8	3.6	0.3	6.5
Week 16	0	0	0.45	No data	1.8	-6.2	No data	-6.6
Week 17	0	0	7.2	No data	8.3	-6.6	No data	-9.2
Total Mass ∑ 17 wks (grams)	**9105**	**11531**	**6205**	**-3532**	**4130**	**1231**	**-287**	**1367**

To be sure that we were not volatilizing ammonia, an ammonia test tube was inserted into the exiting air bubbles over the Poo-Gloo nearest the effluent point and left for a period of several weeks. The yellow material in the tube is designed to change to purple within 24 hours of exposure to volatilized ammonia for a proper reading on the tube scale. Since our tube did not change color after 24 hours, and did not change color even after 3 weeks, it conclusively proved that only minimal amounts were escaping with the air. The pH of our system is in the range of 7 to 8, which means that the NH_3/NH_4^+ speciation is almost entirely in the ionized NH_4^+ form. (Control tank was also tested with similar results.)

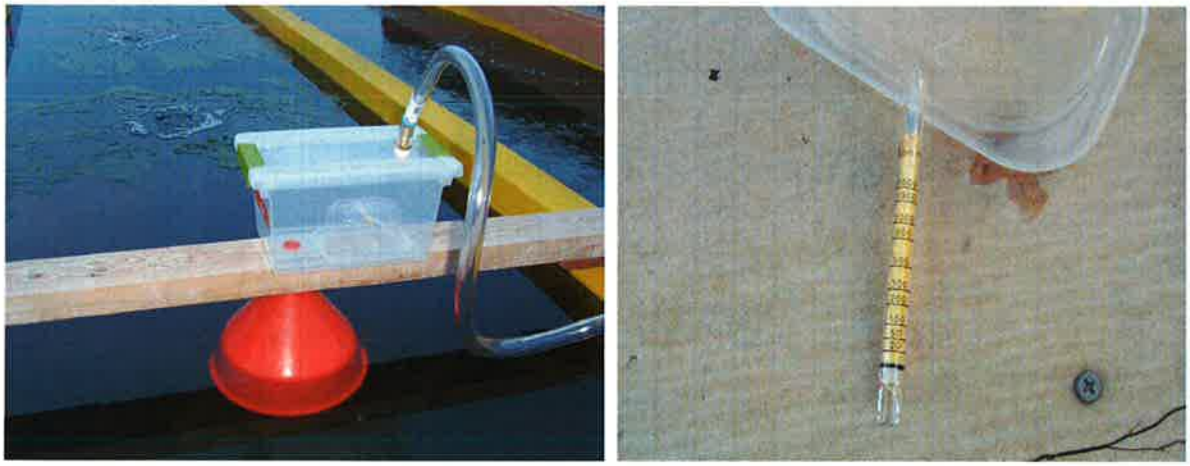


Figure 10: Measurement of volatized ammonia in off-gas. Red funnel test apparatus and close-up of yellow test tube are shown after exposure to escaping air bubbles for 3 weeks to test for the presence of volatized ammonia. Yellow granules would turn purple in the presence of ammonia.

Ammonia (ionized)

Cold weather nitrification is an important aspect of the Poo-Gloo capabilities, and has been explored in previous research. It is worth noting here, though, the terrific nitrification rates at temperatures down to 1 °C.

It took two weeks from startup for the nitrifiers to proliferate in the bio-film. On the third week, the removal rate took off. During weeks 4 and 5 (mid-November), the PG side of the tank took the ammonia level from around 25 mg/L down to 2 mg/L or less. This occurred at the same time the COD levels were reduced from 200+ mg/L to around 50 mg/L. During the weeks in December, the loading rates were increased to the point where the Poo-Gloos were dominated by heterotrophic bacteria consuming the organic carbon material, and the nitrification rates were reduced. By January, with the loading rates reduced, the nitrification returned. Week 12 (mid-January) had among the best removal rates observed from around 24 mg/L in the influent to less than 2 mg/L in the effluent, all at temperatures of 1.5 °C or less. Because nitrification has a high oxygen demand, cycling aeration off decreases the amount of ammonia removed. This is apparent during the steady state period of weeks 12 to 15 when the air off period was increased from 2 to 3 to 4 hours per day. The stair-step effect on the ammonia concentrations in the PG Tank effluent is apparent.

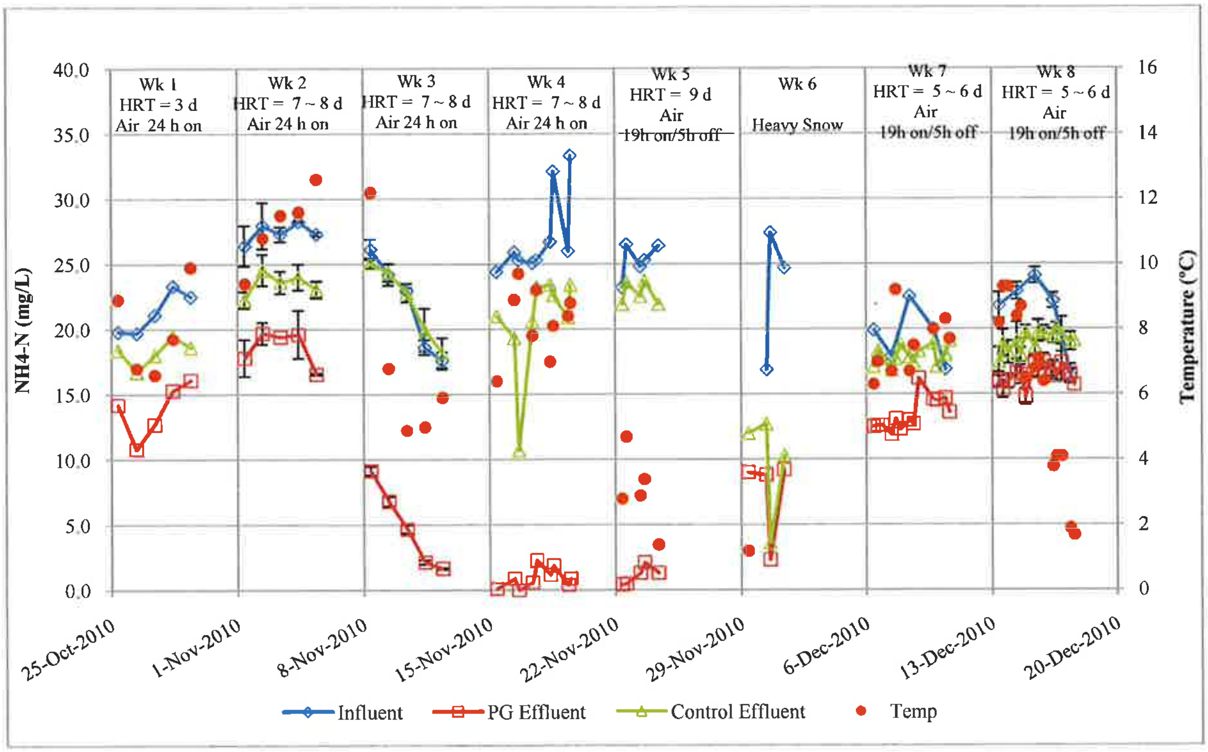


Figure 11: Week 1 - 8 of ammonium results.

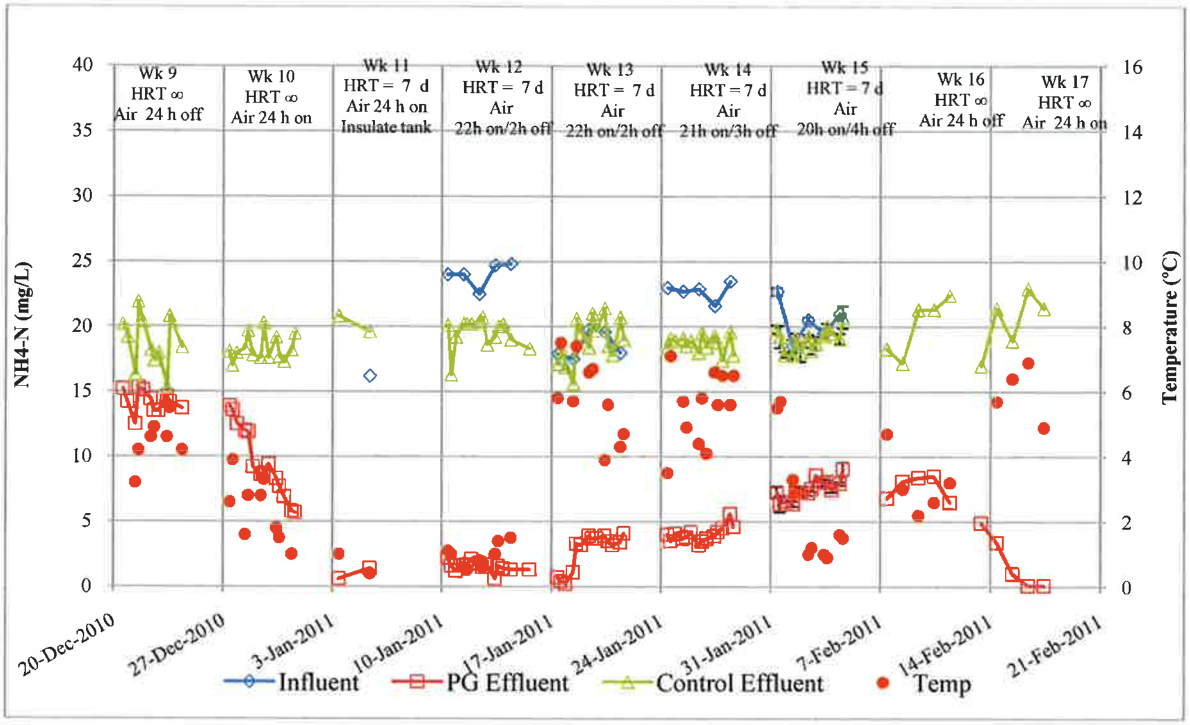


Figure 12: Week 9 - 17 of ammonium results.

If you assume that half of the available bio-film (growing on 1500 ft^2 of surface area) is removing the organic carbon, and half (the other 1500 ft^2) removing the ammonia, then the removal rate is around 6.7×10^{-5} lb NH_4^+-N/ft^2/day.

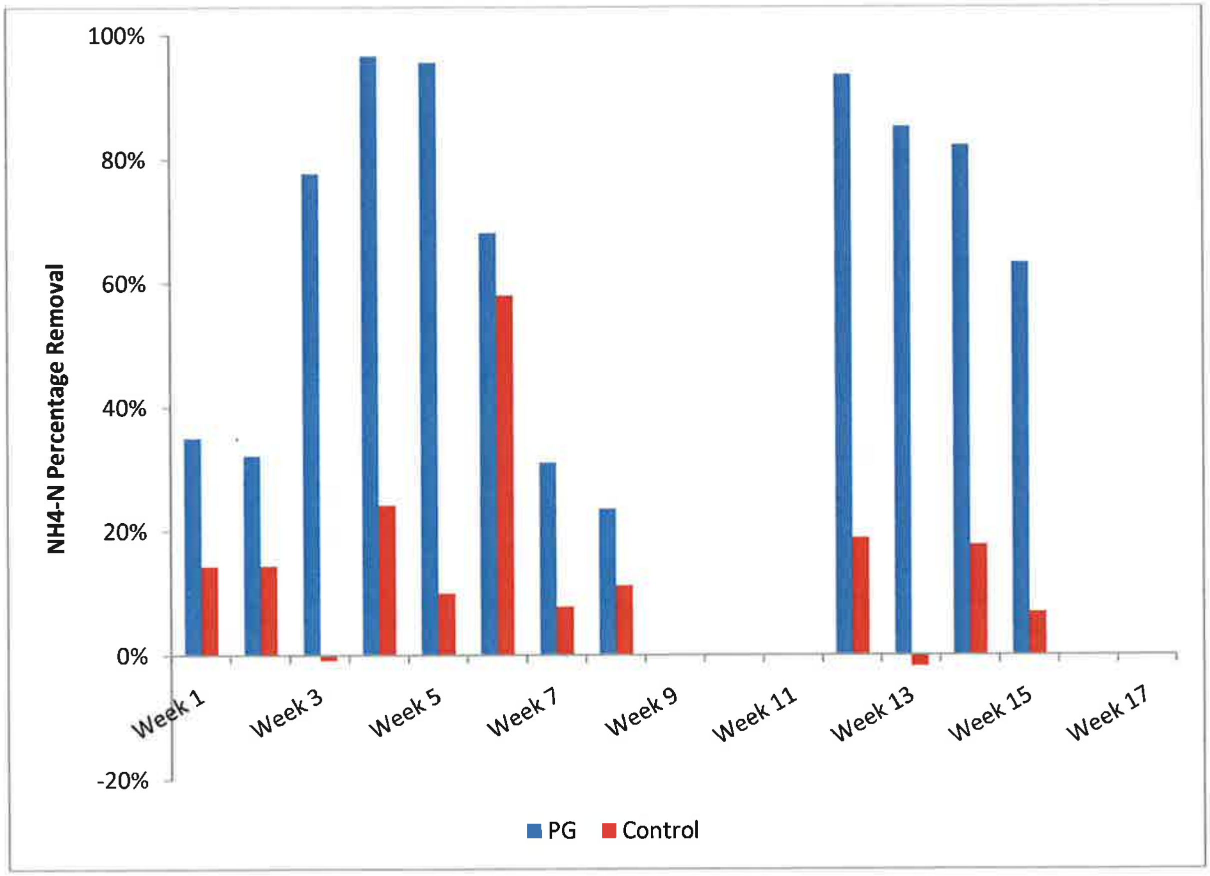


Figure 13: Ammonium percentage removal from influent to effluent, PG tank vs. Control tank

Nitrate/Nitrite and TN

The presence of NO_3^-/NO_2^- in the PG tank is attributed to the products of nitrification. If you compare Figures 14 and 15 to the ammonia removal figures, it is apparent that as the ammonia was removed, the levels of NO_3^-/NO_2^- increased. In previous work, air cycling improved the de-nitrification rates. This effect is less pronounced in this set of runs. One of the reasons is that a carbon source was not directly introduced into the interior of the Poo-Gloos during the air-off period as it was in previous experiments with these devices. This could be added during Phase II experimental runs.

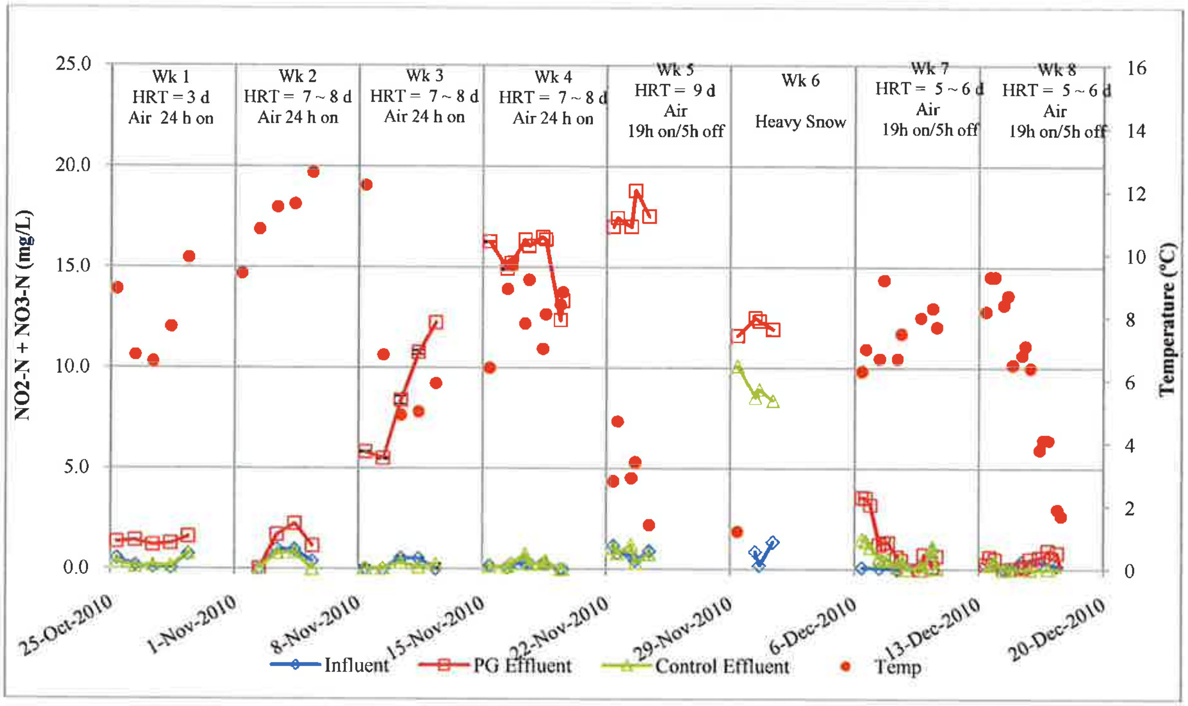


Figure 14: Week 1 - 8 of NO_3^-/NO_2^- results.

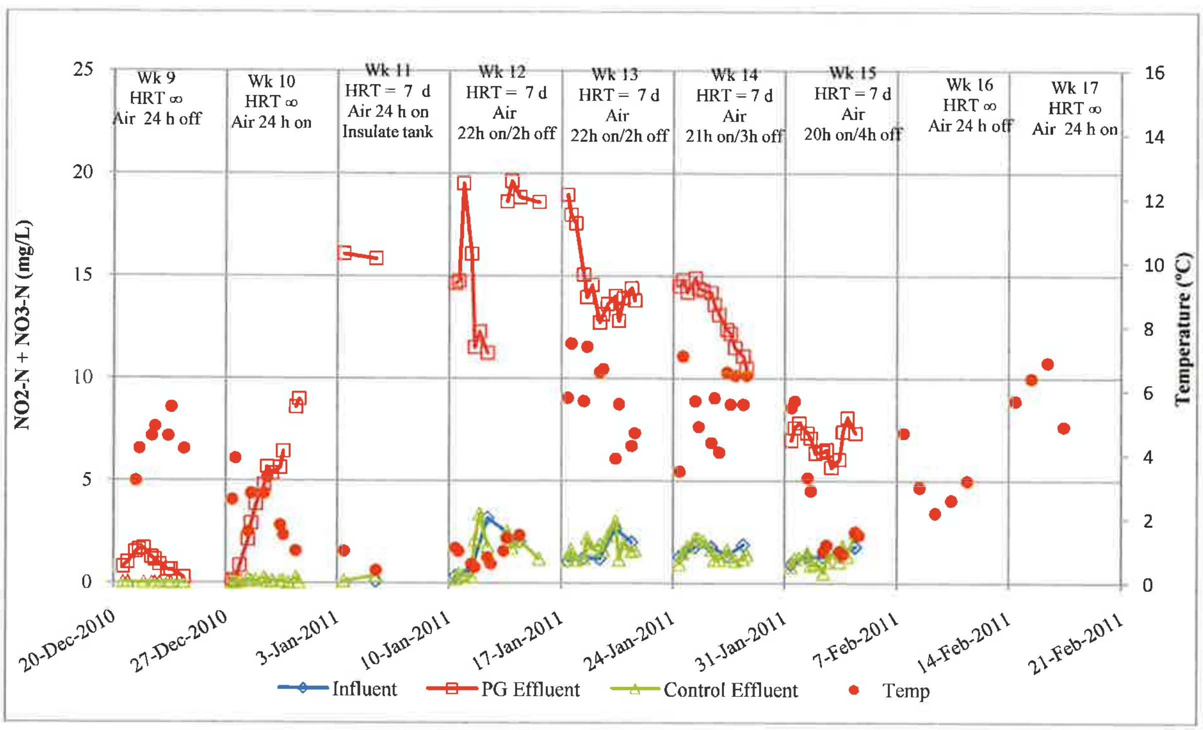


Figure 15: Week 9 – 17 of NO_3^-/NO_2^- results.

Balancing nitrification with de-nitrification should result in an optimal Total Nitrogen removal. Statistical analysis of the TN removal for the entire 17 weeks shows a significant difference between the Control TN removal and the PG TN removal (see Statistical Analysis section). Some of the better results occurred during weeks 13 and 14 (mid to end of January, 2011) when the air was cycled on 22 hrs/off 2 hrs and on 21 hrs/off 3 hrs.

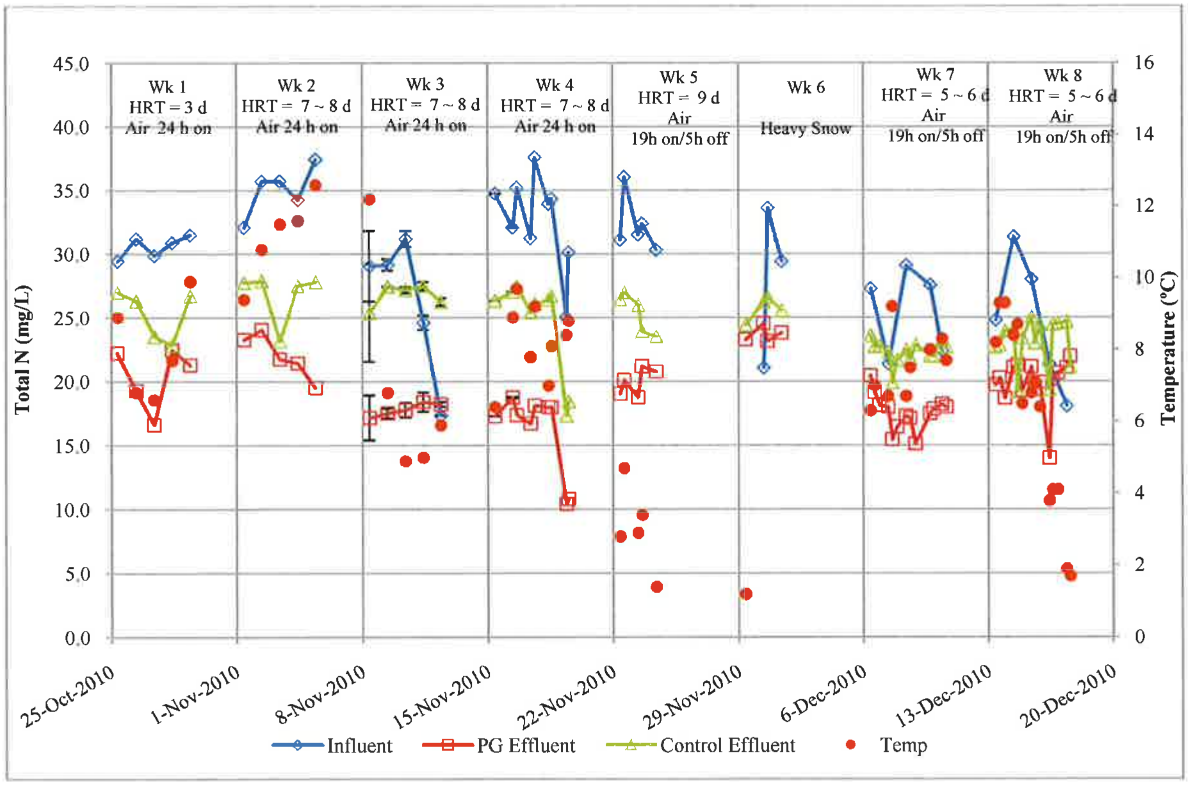


Figure 16: Week 1 – 8 of Total Nitrogen results.

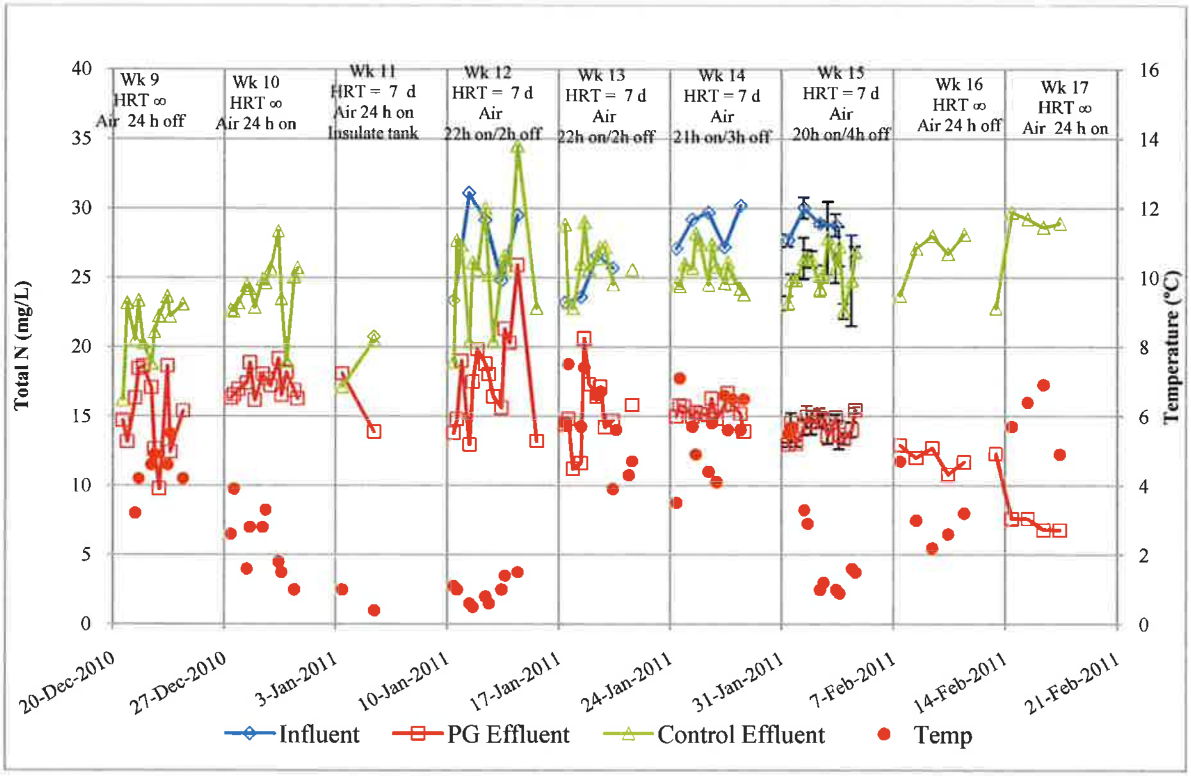


Figure 17: Week 9 – 17 of Total Nitrogen results. Note in weeks 13 to 15 evidence of improved N removal by Poo-Goos due to air cycling.

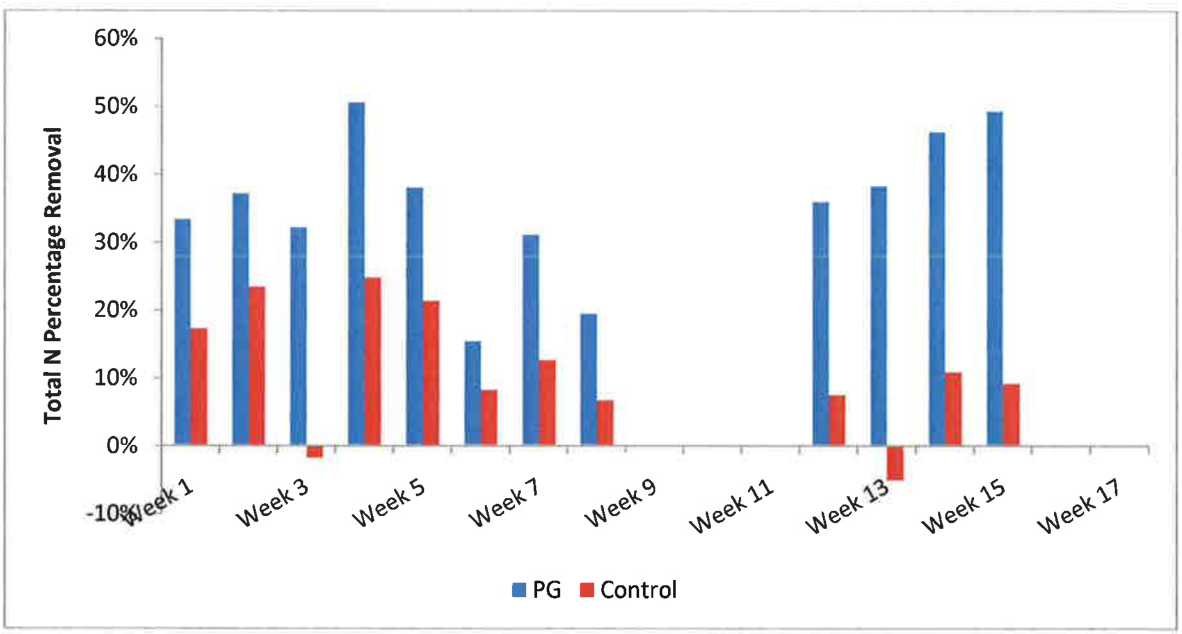


Figure 18: Total Nitrogen percentage removal from influent to effluent, PG vs. Control.

Alkalinity

The alkalinity (ALK) data also shows that the removal of ammonia from the system is mainly due to the action of the nitrifying bacteria in the bio-film. The autotrophic nitrifiers consume ALK and oxygen to oxidize ammonia to nitrate. At the pH of our system (7 -8), the bulk of ALK is in the form of HCO_3^-. The stoichiometric requirements are shown below:

$$55\,NH_4^+ + 76\,O_2 + 109\,HCO_3^- \rightarrow C_5H_7NO_2 + 54\,NO_2^- + 57\,H_2O + 104\,H_2CO_3$$

$$400\,NO_2^- + NH_4^+ + 4\,H_2CO_3 + HCO_3^- + 195\,O_2 \rightarrow C_5H_7NO_2 + 3\,H_2O + 400\,NO_3^-$$

Based on the above equation, about 7.1 mg $CaCO_3$ equivalent alkalinity is consumed in order to oxidize 1 mg NH_4^+-N. We measured 10 weeks of alkalinity to establish the relationship between nitrification and ALK. In the PG tank, total ALK consumed was 28,381 g as CaCO3, while ammonia nitrogen removed was 4117 g. Assuming that all the ammonia remove during this 10 week period was due to nitrification, then the ratio is calculated to be 6.9 (compared to the stoichiometric value of 7.1). In the Control Tank, the ratio was 5.7.

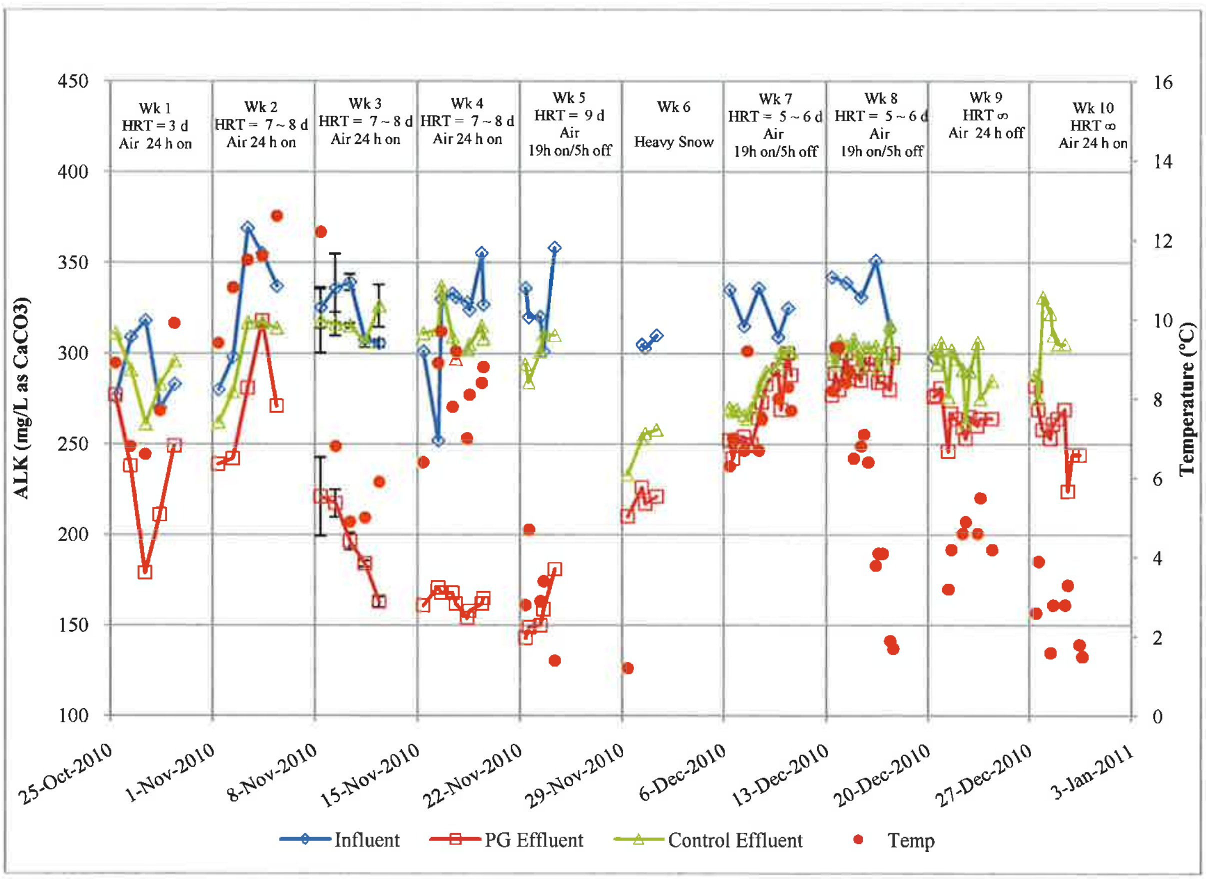


Figure 19: Week 1- 10 of Alkalinity results. ALK tests were discontinued after week 10.

Temperature

It has been reported that nitrification rates have a linear relationship with temperature in the range of 8 – 30 °C. The reported optimum nitrification temperature is 25 – 30 °C. At temperatures below 8 °C, usually there would be no nitrification observed. However, in our system, the operational temperature ranged from just above zero to 15 °C. Nitrification was observed at water temperatures as low as 0.9 °C in the PG Tank. In contrast, there was no significant ammonia removal when temperature was below 10 °C in the Control Tank. During the first three weeks, the biofilm was establishing and by the week 4, the biofilm was well established and reached steady state. During week 4, ammonia removal was as high as 94% in the PG Tank, while it reached only 24% in the Control Tank. During week 15, the temperature was again as low as 0.9 °C. With air cycling of 20 hours on/4 hours off daily, ammonia removal was found to be 63% in the PG Tank and only 7% in the Control Tank.

Figure 20: Wintertime operation - PG tank is on the left, and Control tank is on the right

A statistical correlation of the ammonia, nitrate/nitrite, and alkalinity together with the temperature in the bulk concentration (effluent) is shown below. A very strong correlation exists for the conversion of ammonia N to nitrate/nitrite N with a corresponding consumption of alkalinity with the Poo-Gloos. The Control side did nitrify, but with a much weaker correlation. Most interesting on the PG side for the 17 week run is the slight negative correlation with temperature compared with the positive correlation with temperature on the Control side. The metabolism of the nitrifying fixed-film biomass in the PGs was not affected by temperatures below 10° C (which dominated this run), whereas the suspended growth was affected.

Table 5: Data correlation for nitrification parameters from October, 2010 to February, 2011

Parameter vs. →	Parameter	Correlation
PG Ammonia Concentration vs.	PG Nitrates/Nitrites	- 0.93
PG Ammonia Concentration vs.	PG Alkalinity	0.90
PG Ammonia Removal vs.	Temperature	- 0.13
Control Ammonia Concentration vs.	Control Nitrates/Nitrites	- 0.40
Control Ammonia Concentration vs.	Control Alkalinity	0.44
Control Ammonia Removal vs.	Temperature	0.32

Phosphorus Removal - Total P removal

One of the primary goals of the Phase I research was to determine if the fixed bio-film in the Poo-Gloos will uptake and release P. This was successfully determined to be the case. A look at the difference in Total P across the first 15 weeks shows that the PG Test tank out-performed the Control tank in almost every instance.

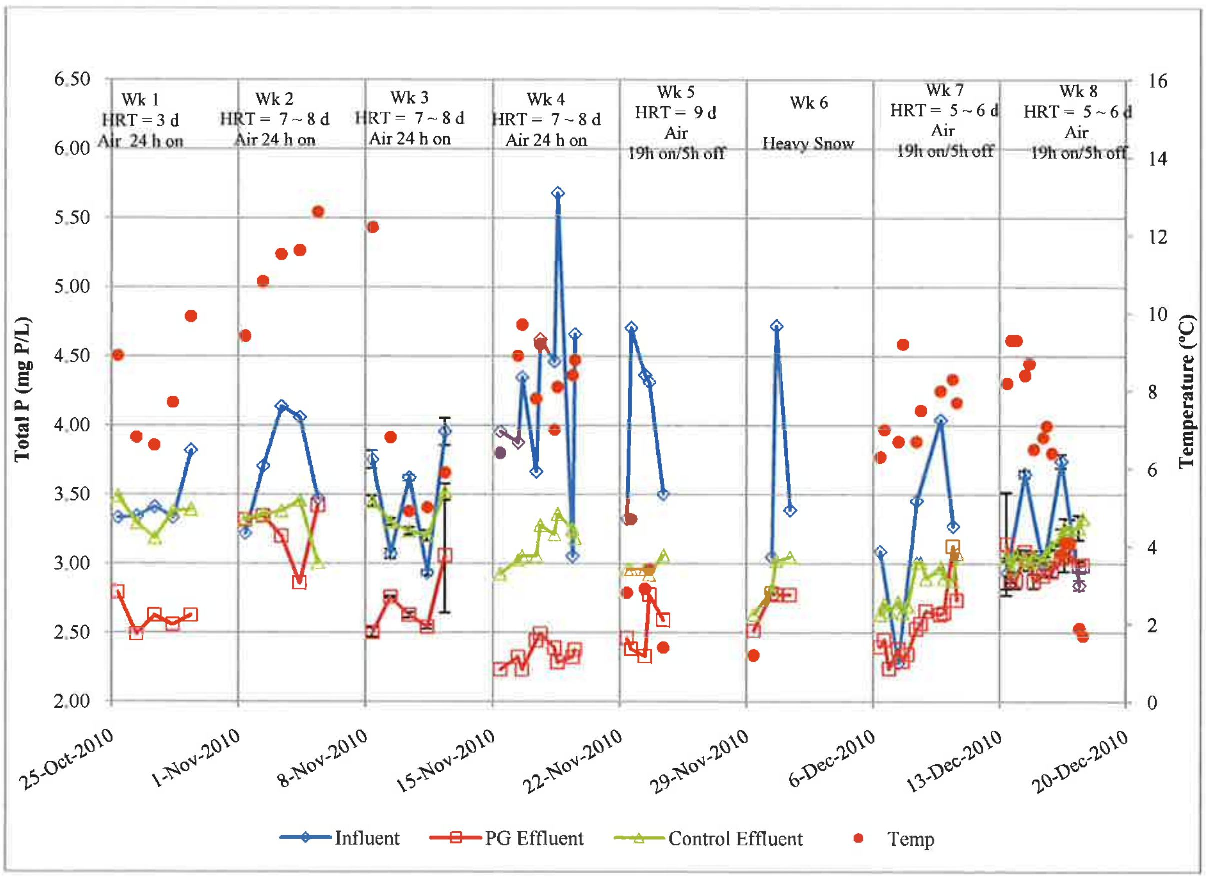


Figure 21: Week 1 – 8 of Total P results.

Figure 21 shows the results from the first 8 weeks. When wastewater was flowing into (and out of) the tanks, the difference between the Influent TP concentration and the Effluent TP (bulk concentration) multiplied by the flow equals the accumulation of P in each tank. Numerically summing the TP accumulation for weeks 1-8 yields a total of 44.2 grams in the PG Test tank side and 24.2 grams in the Control side. (The first several weeks' accumulation must be attributed to the anabolic requirements of initial bacterial colonization of the 280 m^2 on the PG Test tank side as well as side and bottom accumulation on both sides.) Short HRT during weeks 7-8 overloaded the system and less removal was observed.

Figure 22 shows weeks 9 through 17. Influent wastewater was shut off and air was off during week 9, but TP release was not evident. During week 10 the influent remained off and air was on continuously to stabilize the system.

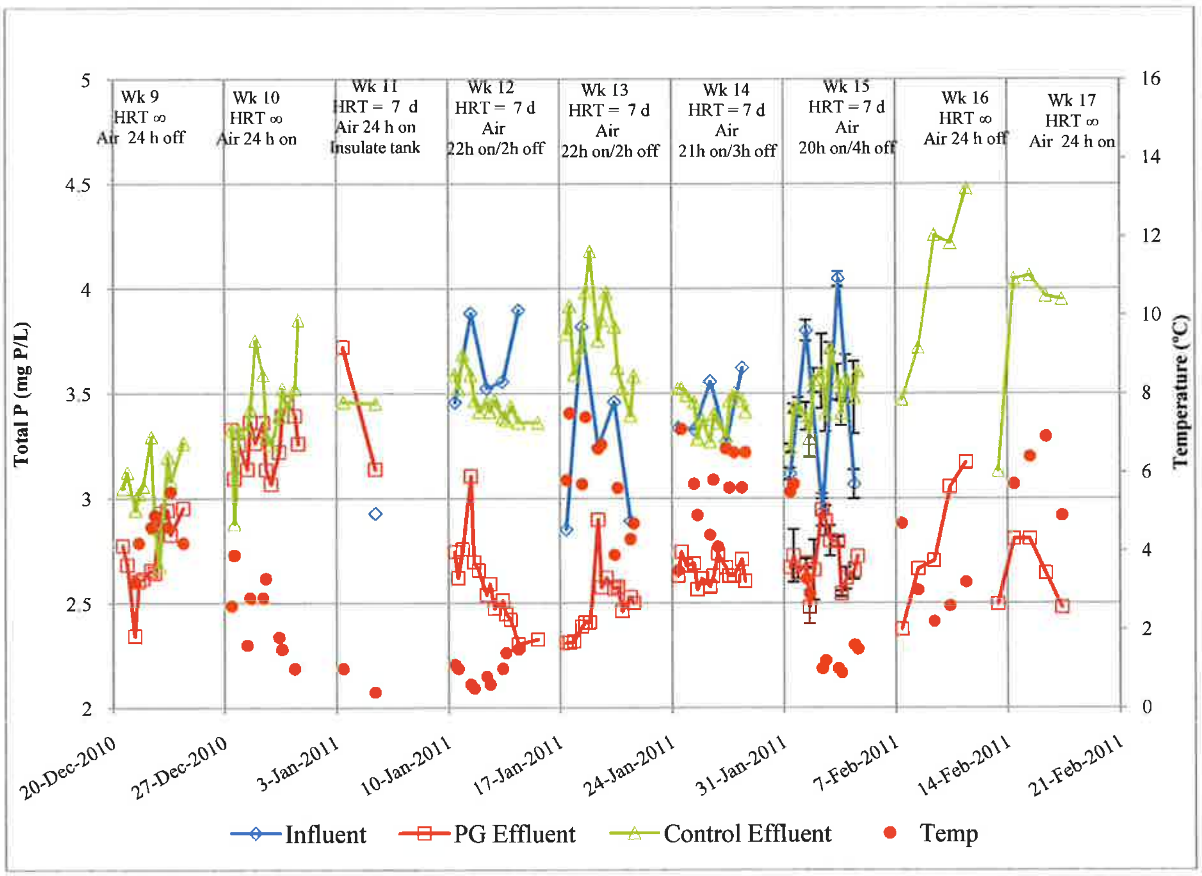


Figure 22: Week 9 - 17 Total P results. P uptake by the bio-film is evident, especially weeks 12 through 15 with air cycling. P release is evident in week 16 with air off.

At the start of week 11 the pump rate for influent was set at 863 L/day for an HRT of 7 days. The week was only partly sampled due to bad weather. During weeks 12 through 15, the HRT remained at 7 days. The air cycling ON/OFF was changed weekly from 24/0 to 22/2 to 21/3 and finally 20/4. This was the most stable period of the 17 week run. During this four week period, the average TP influent concentration was 3.45 mg/L and PG Test effluent was 2.61 mg/L. TP accumulation was 20.3 grams for the PG Test tank and -2.17 for the Control tank (a slight loss, taken to mean the anabolic needs of the bio-mass were satisfied). During week 16, the wastewater influent was shut off and the tanks were in batch mode. The air was also shut off. The release of TP during week 16 is evident in the PG Test tank, climbing from a concentration of 2.4 mg/l to a concentration of 3.2 mg/L in five days. During this five day period, the PG Test tank released a total of 5 grams of P into the 6250 L tank. At the end of week 16 and during week 17, the air was turned back on 24/0, but the influent wastewater flow remained off to observe the effect of turning the air back on. As can be seen for week 17 in Figure 22, the biofilm in the PG Test tank once again took up the 5 grams of TP with the air on. From the data it can be inferred that the biofilm inside the PGs consists of heterotrophs consuming BOD, nitrifiers consuming ammonium, and to a lesser extent, de-nitrifiers. The bio-film is also uptaking and releasing P, although the presence of PAOs is not verified.

It is interesting to note that there was also a release of TP in the Control tank during week 16. The Control tank is dominated by suspended growth, which also responds to air cycling. The uptake and storage of P on the control side was minimal, however, and suspended growth is difficult to maintain in an open lagoon system.

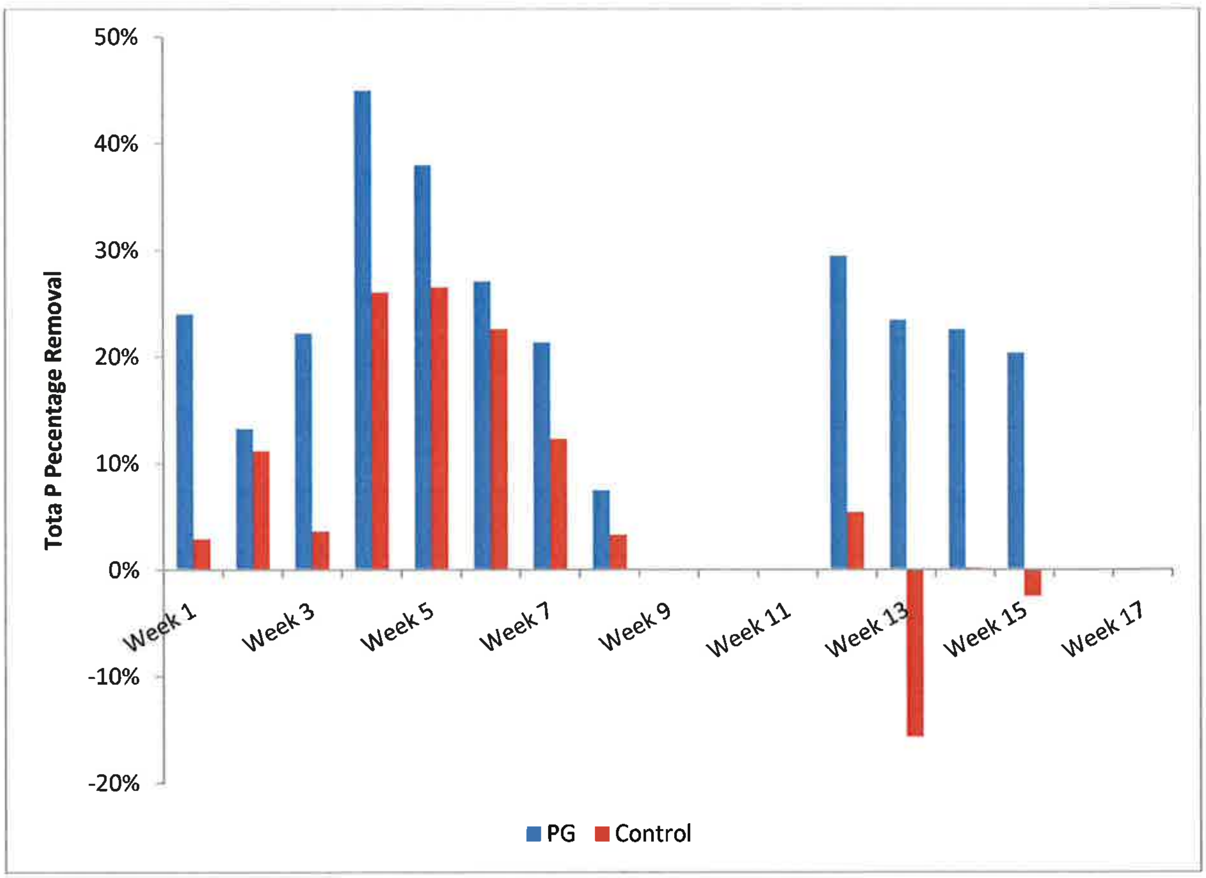


Figure 23: Total Phosphorous percentage removal from influent to effluent, PG vs. Control.

Table 6: Influent daily loading, PG and Control tank daily removal by week, and 17 week totals for Phosphorous compounds. (Note that an increase is shown as a negative number for the effluent columns.)

	Loading		PG Tank		Control Tank	
	g Ortho-P /d	g TP /d	g Ortho-P/d Removed	g TP/d Removed	g Ortho-P/d Removed	g TP/d Removed
Week 1	17	25	3.4	5.9	1.4	0.7
Week 2	14	19	-0.9	2.6	-0.7	2.2
Week 3	14	20	-0.4	4.4	-2.0	0.7
Week 4	17	23	4.0	10.5	2.8	6.1
Week 5	13	21	1.7	8.0	0.4	5.6
Week 6	12	19	-0.2	5.1	-0.7	4.2
Week 7	11	14	0.2	2.9	-0.4	1.7
Week 8	9	12	-0.3	0.9	-0.3	0.4
Week 9	0	0	-0.4	-0.1	-0.3	-0.1
Week 10	0	0	-0.3	0.1	-0.2	-0.8
Week 11	7	11	-3.9	-1.9	-2.6	-2.0
Week 12	10	14	0.7	4.1	0.9	0.8
Week 13	6	10	-0.5	2.3	-0.7	-1.5
Week 14	7	9	0.1	2.1	0.8	0.0
Week 15	6	9	-0.8	1.7	-0.6	-0.2
Week 16	0	0	-0.6	-1.2	-0.6	-1.5
Week 17	0	0	-0.1	0.0	-0.9	-1.2
Total Mass $\sum$ 17 wks (grams)	**986**	**1438**	**12.5**	**331.2**	**-26.7**	**104.5**

Figure 24: Details of PG interior after 17 weeks

Following week 17, one PG was removed from the mid-point of the PG Test tank and taken apart. Biofilm samples were taken from 9 locations inside the domes. The results show that the dry mass of the biofilm covers a colonized surface at 34.6 g/m^2 and the amount of P in the dry mass is 1.4%.

Figure 24 shows photos of the mid-tank PG as it is taken apart, and the biofilm sampling locations. Note striation patterns left by the air bubbles on the inner surface biofilm. Biofilm on the inner surfaces of the domes and on the Lanpac material was about 2 + mm thick. Note also that there is no evidence of clogging. The scrubbed off biofilm seems to land on the outer surface of the next dome under it, then slump off and out the bottom to become part of the bottom sediments.

Weeks 12 to 15 show what is possible for P uptake by the existing biofilm in the six PGs, and week 16 shows what is possible for P release with extended air-off. This is with a biofilm that is 1.4% P, and the presence or absence of specific PAOs is not yet verified.

Phosphorous Removal - Ortho-P

Weeks 7, 8, 9 and 10 provide an interesting look at P uptake and release as PO_4^{3-}. During weeks 7 and 8, the air was cycled 19 hrs on/5 hrs off, and the system was fed 312 gallons (1181 L) per day at an average concentration of 3.23 mg/L. The Total P effluent from the Poo-Gloo side averaged 2.77 mg/L. Total P uptake for this two week (14 day) period was (1181 * (3.23-2.77) * 14) = 7605 mg or 7.6 grams. During week 9, the air was off except for a 5 minute pulse every 6 hours to mix the water. There was also no influent. During week 10, the air was turned on continuously. Influent was still off. Simultaneous to this, there was a significant increase in the Ortho P concentration.

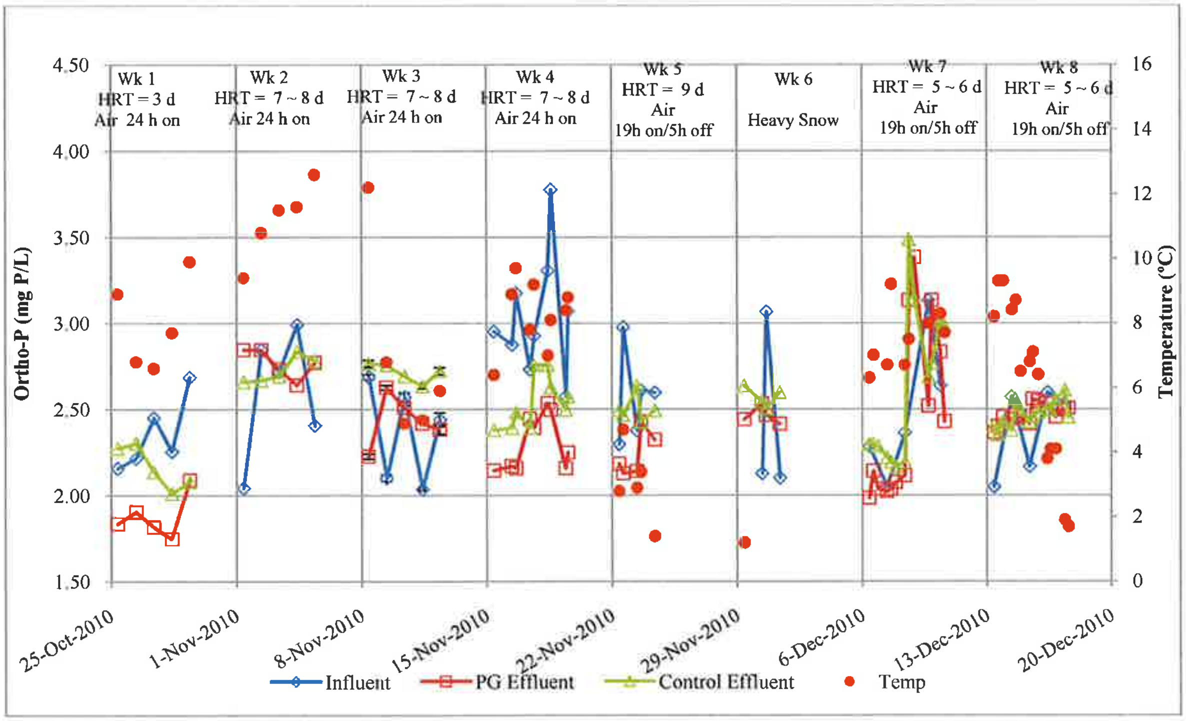


Figure 25: Week 1 – 8 of Ortho P results

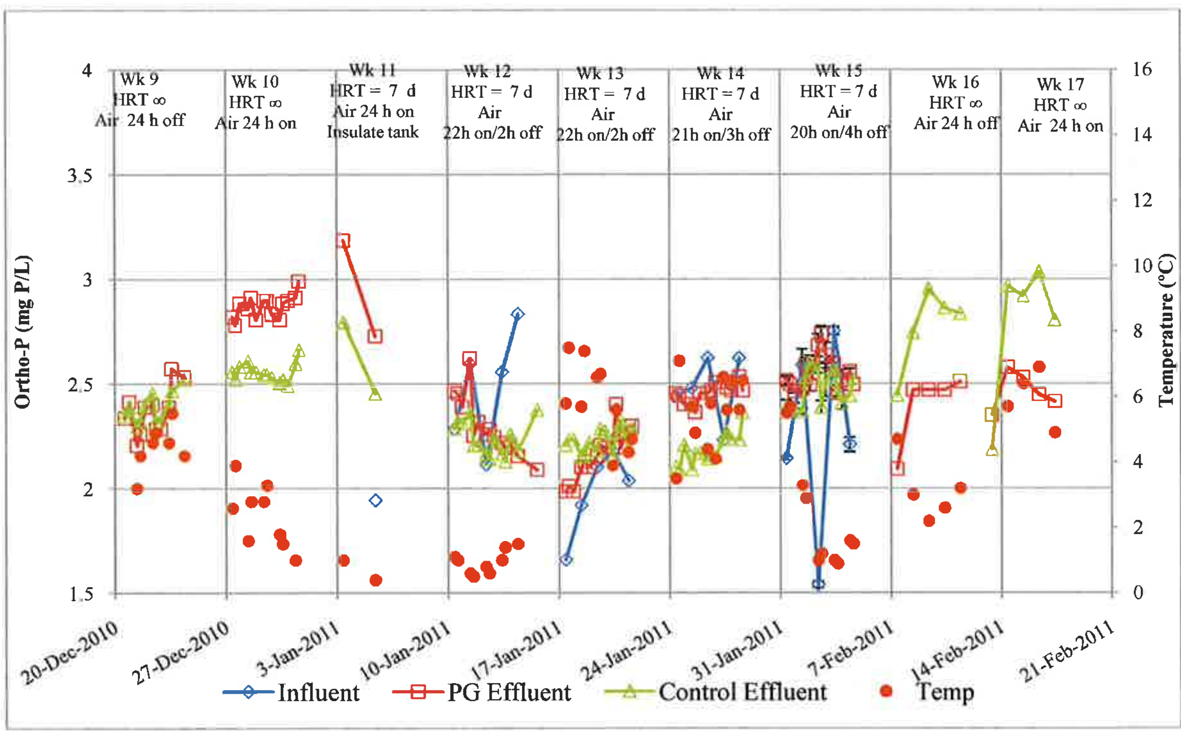


Figure 26: Week 9 – 17 of Ortho-P results.

Taking a closer look at the changes over the 4 week period, and particularly weeks 9 and 10 when the influent was turned off, we see that the bulk concentration of Ortho P in the 1650 gallons (6245 L) increased from an average of 2.36 mg/L during week 9 to an average of 2.87 mg/L during week 10. The total mass of P released was (6245 * (2.87 – 2.36)) = 3185 mg or 3.185 grams. This is about 42 % of the P uptake during weeks 7 and 8 when the influent was on.

A similar smaller release of P was observed during week 14. In the weeks preceding this release, the air cycling was as follows: Week 11, air on 24/ air off 0, week 12, air on 22/air off 2, Week 13 air on 22/air off 2, and in Week 14, air on 21/air off 3. Influent flow was 228 gallons (863 L) per day for an HRT of 7 days for all 4 weeks. As computed previously, the TP accumulation in the PG side was 16.3 grams. The ortho-P average during week 13 was 2.16 mg/L and the average of week 14 was 2.45 mg/L. This is a change in mass in the bulk solution of 1.85 grams.

It is possible that the air off period increasing to 3 hours per day triggered this smaller release. It is also possible that the bio-film in the 3000 square feet of surface area in the six scaled Poo-Gloos reaches a saturation level and releases on its own. Further investigation is warranted.

Algae in the system

In the Poo-Gloo side of the tank, the three PGs closest to the effluent end grew crowns of filamentous algae with HRTs at or above 7 days. The three PGs nearest to the influent had little or none. The amount of filamentous algae in the Control side was minimal. At the effluent end of the PG Test tank side, one could see all the way to the bottom through almost 1 meter of water. The question of the amount of P in the algae was investigated. We harvested all the filamentous algae from the PG closest to the effluent end of the tank, dried it, weighed it, fired a portion of it and measured the P concentration. The dried mass of filamentous algae weighed 23 grams, and was composed of about 1.5% P by dry weight. This is a P mass of 345 mg. A conservative estimate of the total P in the PG Test tank algae would be 23 grams times 3 PGs times 1.5%, or a total P in the algae of about 1 gram. The growth of the filamentous algae at the effluent end was not related to the air cycling. Even if all the P in the algae were suddenly released, it still would not account for the 5 gram increase in TP measured in week 16. In fact, during the air-off weeks, little or no change was noted in the filamentous algae growth.

Figure 27: Side by side PG and Control tanks viewed from effluent end.
Left Side: PG Tank; Right Side: Control Tank

Figure 28: Close up of filamentous algae on PG farthest from the influent point around week 16. Surface of dome is shaggy green.

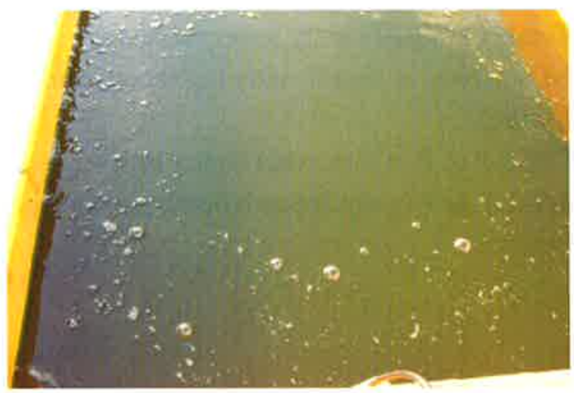


Figure 29: Close up of Control tank at point farthest from influent around week 16. Note turbidity and absence of filamentous algae.

Statistical Analysis

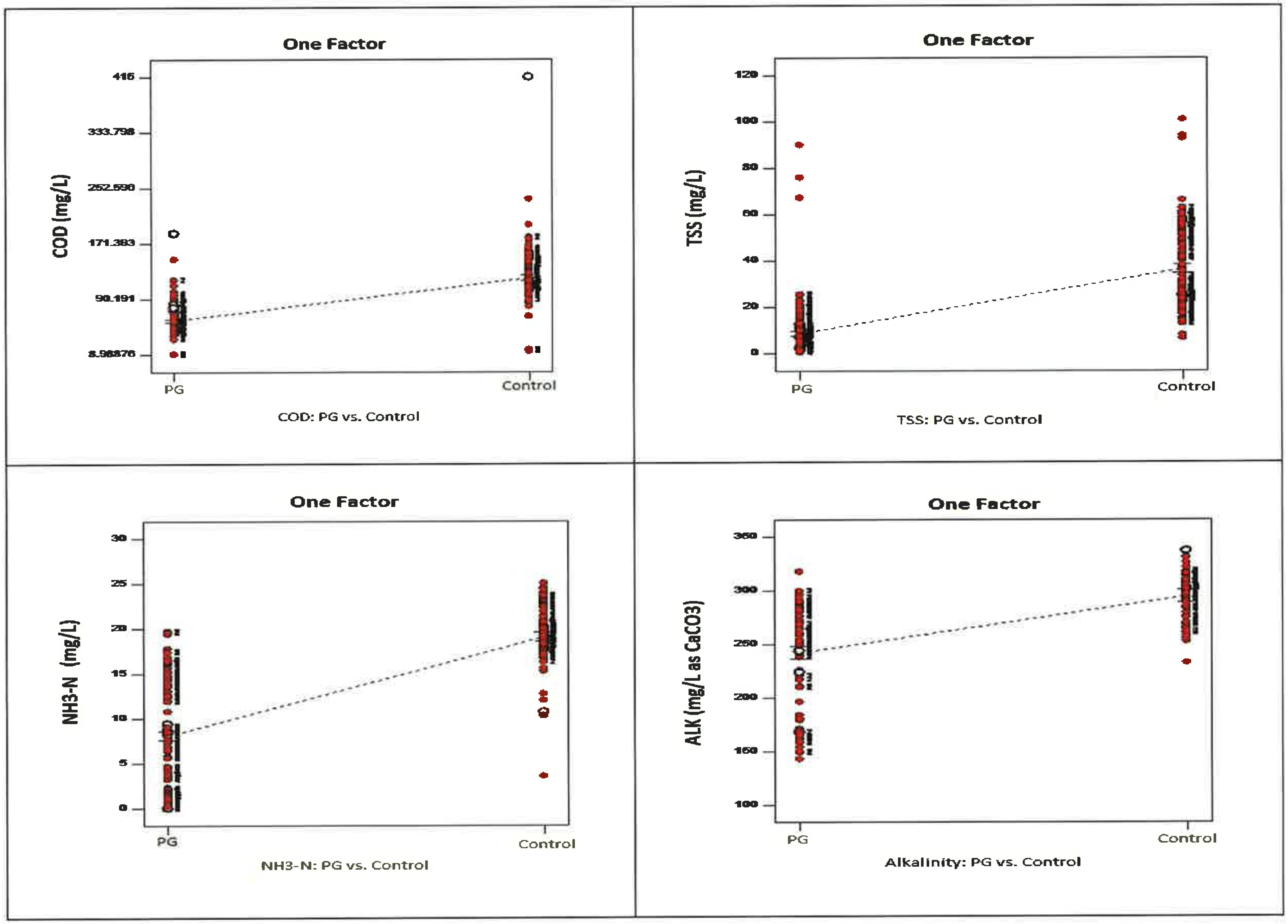
Statistical Anaylsis for the 17 week run, comparing PG effluent to Control effluent

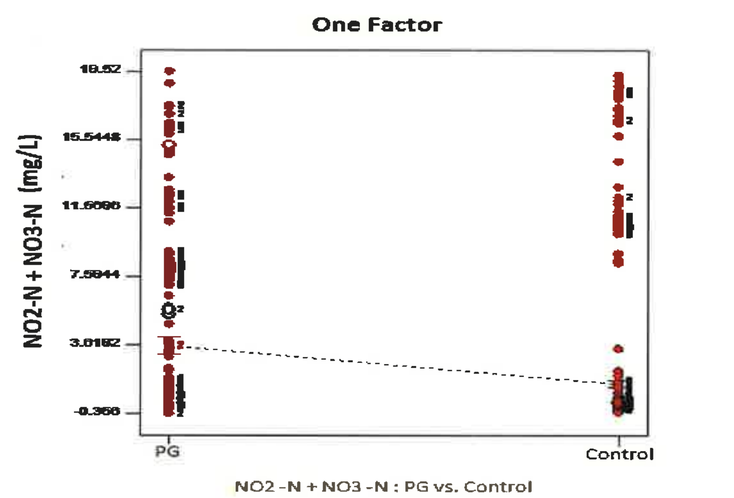
The following is the graphical results of the analysis of the historical data gathered from the WCS - Poo-Gloo (PG) experiment. Analysis was conducted by Design-Expert™ version 8.

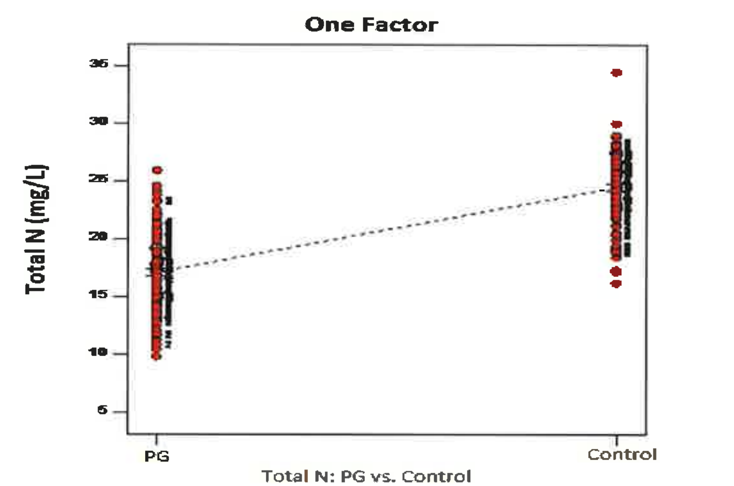
The data was collected on the Influent, Control, and the PG effluent. Because the influent make up, inflow rates, and temperature varied from test to test it is likely some of the variation in the responses were related to these uncontrolled inputs. To compensate for this possible effect, day to day variation was adjusted out of the analysis through blocking. The result becomes a one factor analysis as to whether or not the PG treatment is different than the control treatment.

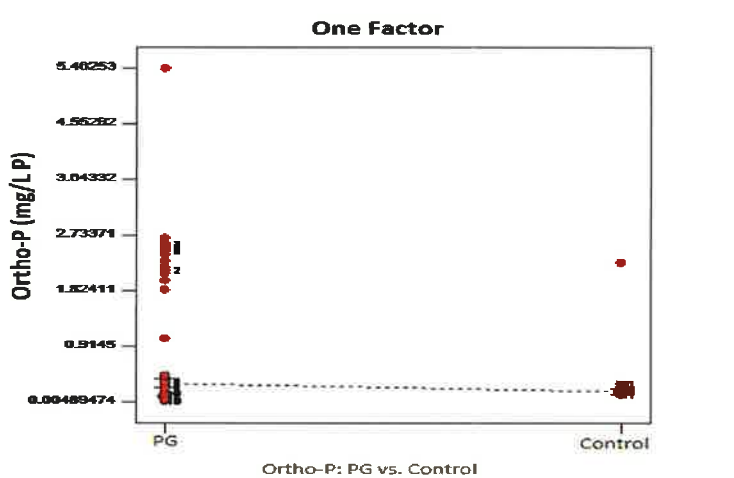
On the graphs the individual observations are displayed along with an estimate of the Least Significant Difference (LSD). When there is a significant ANOVA model, the LSD bars can be compared. If the bounds of two LSD estimates do not overlap (top to bottom) then the means of the treatments are considered significantly different. The results are below:

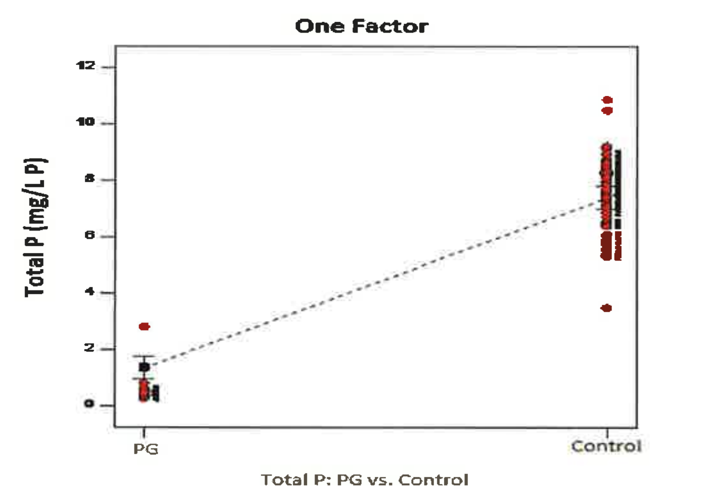
- TSS is significantly lower on average for the PG installation than it is for the Control.
- COD is significantly lower on average for the PG installation than it is for the Control.
- Ammonia is significantly lower on average for the PG installation than it is for the Control.
- ALK is significantly lower on average for the PG installation than it is for the Control.
- Total N is significantly lower on average for the PG installation than it is for the Control.
- $NO_2^- + NO_3^-$ is significantly higher on average for the PG installation than it is for the Control.
- Ortho-P as P is somewhat higher on average for the PG installation than it is for the Control.
- Total P as P is significantly lower on average for the PG installation than it is for the Control.


One Factor
COD (mg/L)
416
333.798
252.590
171.383
90.191
8.98876
PG
Control
COD: PG vs. Control
One Factor
TSS (mg/L)
120
100
80
60
40
20
0
PG
Control
TSS: PG vs. Control
One Factor
NH3-N (mg/L)
30
25
20
15
10
5
0
PG
Control
NH3-N: PG vs. Control
One Factor
ALK (mg/L as CaCO3)
350
300
250
200
150
100
PG
Control
Alkalinity: PG vs. Control


One Factor
NO2-N + NO3-N (mg/L)
18.52
15.5448
11.6698
7.5944
3.0182
-0.366
PG
Control
NO2 -N + NO3 -N : PG vs. Control


One Factor
Total N (mg/L)
35
30
25
20
15
10
5
PG
Control
Total N: PG vs. Control


One Factor
Ortho-P (mg/L P)
5.46253
4.55282
3.64332
2.73371
1.82411
0.9145
0.00489474
PG
Control
Ortho-P: PG vs. Control


One Factor
Total P (mg/L P)
12
10
8
6
4
2
0
PG
Control
Total P: PG vs. Control

Commercialization Plan:

Introduction & Background

Our commercial plan is designed to profitably scale operations and launch new market applications for an existing product to biologically remove phosphorus (P) from municipal wastewater lagoons located in rural areas. Our existing product, called Poo-Gloo, sells for $3,250 each and installation of only a few dozen of the submerged, igloo-shaped, aerated bio-reactors will remove a variety of regulated contaminants from wastewater lagoons.

Since the company's founding in 2008, WCS sold over 200 Poo-Gloos to reduce regulated contaminants of ammonia, nitrogen, and related compounds by supplying each device with *continuous* aeration. Our Phase-I SBIR work confirmed that phosphorus reduction can also occur in the existing product when air is *cycled* on and off at precisely designated intervals. Air cycling for phosphorus removal opens new markets applications, enhances the value of existing devices, and allows municipalities to reduce phosphorus where it is harmful (in lagoon effluent) and make it available where it is valuable (land application for agriculture use).

Phosphorus is a regulated contaminant commonly found in wastewater lagoon effluent that promotes uncontrolled growth of undesirable downstream microbes such as harmful algal blooms. Conventional chemical methods for removing phosphorus involve multi-million dollar mechanical plants that small communities (pop 500-5,000) can seldom afford.

Our patented technology provides an economical means to increase phosphorus-absorbing bio-films using Poo-Gloos as drop-in retrofit devices that can be readily installed into any existing lagoon on an as-needed, incremental basis. The proprietary aeration devices are submersible plastic domes that are concentrically nested to increase bio-film surface area, and provide all requisite conditions to allow beneficial bacterial colonies to flourish. The domes are mounted on a concrete base and each complete unit sits on the lagoon bottom. Poo-Gloos are aerated by means of introducing low pressure compressed air around the circumference of each dome base which then percolates upward to exit a small top hole. As small air bubbles migrate up the inside of each dome, they provide needed oxygen and micro-mixing of nitrogen and phosphorus nutrients with a bacterial bio-film attached to the protected inner wall in a dark environment. The bottom-to-top flow of bubbles creates an airlift effect that circulates entire lagoon contents to prevent stratification and thermoclines that decrease lagoon effectiveness.

Technology Background & Operation

Shallow lagoon systems are one of the most widely deployed, economical means to treat wastewater from municipalities. Lagoons provide an open body of water exposed to sun and wind to facilitate natural reduction of regulated contaminants such as biochemical oxygen demand (BOD), total suspended solids (TSS), and nutrients (ammonia and nitrogen compounds) by means of physical settling and biological breakdown. Beneficial bacteria are the primary workhorses in consuming harmful compounds in a lagoon, and successful systems use diverse colonies of bacteria to work together in balanced, symbiotic communities.

In most lagoons, there is usually enough capacity for physical settling of solid compounds. Often such lagoons lack diversity of beneficial bacteria to consume all types of dissolved compounds, resulting in non-compliant discharge water. What is needed to enhance the performance of lagoon systems is a way to provide a home for the beneficial bacteria to flourish. Such a home has lots of surface area out of the sunlight for the bacteria to colonize, with oxygenating bubbles and water circulating past the bio-film. Our patented Poo-Gloos provide all the requisite conditions described above.

The proprietary technology enables lagoon operators to maintain sufficient symbiotic bacterial colonies in the form of a *fixed bio-film*. Fixed film, compared to conventional suspended growth systems, allows the beneficial bacteria to continue working at 1-2 °C above freezing. Suspended growth systems typically stop working at 10-12 °C. The advantage of a fixed bio-film is an important consideration for high latitude operators who struggle to meet wintertime regulations when lagoon water temperatures are often in the 2-9 °C range.

To flourish, fixed bio-film bacterial colonies require a surface (substrate) to adhere to, a variety of micro-climates, access to abundant oxygen and nitrogen-phosphorous rich nutrients, blocked exposure to sunlight, micro-mixing, and anoxic (non-oxygenated) zones. When all these conditions are met, phosphorus can be removed by adding controlled on/off cycling of air to enhance de-nitrification and phosphorous uptake and release.

From an operational viewpoint, existing Poo-Gloos can be used for phosphorus reduction by simply adding the ability to turn the air supply on and off at precise intervals to create a succession of feast-famine cycles. After the bio-film has been subjected to several cycles, air is left on for a period of time to allow the pre-conditioned bacteria to uptake inordinately high levels of phosphorus, called luxury uptake. Once the bacteria are fully gorged, air is turned off for an extended period to kill the phosphorus-bearing bacteria. Dead phosphorus-laden bacteria slough off Poo-Gloo walls and are flushed through the system and channeled to a holding pond for subsequent land application in lieu of purchasing new fertilizer. The on-off-hold cycling pattern can then be repeated to provide a means for continuous uptake, release, and diversion of phosphorus rich water within a managed lagoon flow system.

Technical Objectives

A primary technical objective for scalable, commercially viable biological phosphorous removal is to achieve 2 lbs/day phosphorus removal per 1 million gallons of treated wastewater flow per day (MGPD). The capacity to biologically remove 2 pounds of phosphorus per 1.0 MGPD opens important competitive cost and operating advantages over conventional chemical precipitation methods used in mechanical plants.

Low operating and maintenance (O&M) cost is another important competitive objective. Poo-Gloos have no moving parts, and air systems are designed to last for 10-15 years before servicing. If electricity cost $0.07/kW-hr, estimated O&M cost for each Poo-Gloo is only $0.12/day. Conventional chemical precipitation methods to remove phosphorus from wastewater streams have an associated O&M cost factor much higher for a comparable flow rate, excluding substantial costs for disposing the large volumes of the unusable sludge that is created in the process.

Another technical objective is to divert phosphorus-rich effluent streams to a holding pond for subsequent land application to increase crop yields in lieu of applying conventional, energy-intensive fertilizer.

Product Attributes & Benefits

Beneficial design and functional advantages of our patented technology provide an economical means to address all lagoon operating requisites for phosphorus removal compared to partial solutions and/or high cost competitive methods.

Furthermore, Poo-Gloos can be *incrementally* installed over several years and paid from operating budgets to exactly meet fluctuating budget and growth needs of a community, shorten sales cycles, and provide an affordable alternative to small and medium sized towns struggling to remain in regulatory compliance. Large mechanical plants are often designed to meet demand 5-10 years in the future, which requires substantial capital financing and interest expense to pay for an under-utilized plant for a number of years until anticipated flows reach full design capacity.

Current Approaches

Non-compliant lagoon operators have several choices: (i) do nothing and risk regulatory fines and penalties, (ii) construct additional lagoons to increase capacity at $1-2 million per lagoon, (iii) purchase $1-4 million floatation aerators with high operating costs, but have limited bottom-to-surface churning action and no bio-film support surfaces to remove phosphorus (iv) migrate to conventional central treatment or packaged plants for $1-10 million capital cost, or (v) purchase a PooGloo retrofit system for $0.1-0.5 million to increase aerated bio-film surface area; increase the capacity, utilization, and bio-efficiency of existing lagoons by 50-100%; and achieve important bottom-to-top water circulation patterns required for phosphorus removal.

Commercial Applications

There are no known, commercially deployed, in-situ products for biological reduction and removal of phosphorus from wastewater lagoons. If our proprietary technology can be successfully scaled, it would represent a new, cost-effective option for lagoon operators seeking to remain in regulatory compliance for phosphorus discharge. Successful results from scaled deployment would position WCS as a leading company to offer innovative new solutions to address the three main problems that prospective clients face regarding cost, compliance, and capacity of lagoon-based systems.

Company Profile

Wastewater Compliance Systems, Inc (WCS) was formed to commercialize technology created at the University of Utah (UU) Center for Wastewater Treatment Technologies. The Company addresses the need of lagoon operators who seek to comply with state and federal environmental regulations by improving efficiency and capacity of existing lagoon systems without dramatically increasing capital or operating costs. Using patented technology exclusively licensed from UU, we assess existing lagoon performance, design-install low maintenance high efficiency submersible fixed film aeration products, and monitor ongoing performance to ensure continuous regulatory compliance using a cost competitive, turnkey blend of products and services.

History & Objectives

WCS was formed in 2008, and ended the year with profitable *beta* sales to two Utah municipalities. In 2009, the Company successfully completed a seed investment round with Park City Angel Network. As part of the investment round, the Company re-incorporated in Delaware and implemented related legal-governance measures to facilitate future institutional investment, if needed. The Company expanded commercial sales of existing products in 2010 with installations at Jackpot, NV and a sole-source federal contract at a National Park . During 2010-11, WCS signed agreements with nine regional manufacturer sales rep agencies that cover most of the US and Canada. WCS currently employs nine full and part time employees.

The Company is pursuing an alliance strategy with outside entities for complete supply chain management and external channels to market. The strategy allows WCS to focus resources on its core competency of innovation and product development while providing a means to build a highly scalable organization and conserve capital.

Core Competencies & Milestones

The Company's core competency is product innovation and creation of intellectual property to build a sustainable competitive advantage. Product innovation, under Dr. Johnson's direction, is pursued internally in concert with sponsored research at the Civil & Environmental Engineering Department at the University of Utah. Since inception in February 2008, the Company subcontracted over $135k of research and technical services to the University of Utah and currently holds exclusive, worldwide license rights to all technology derived from the activity.

Products & Services

The 200 Poo-Gloos that were sold to-date can be retrofitted to remove phosphorus without making any physical changes to the product. All Poo-Gloos reduce regulated contaminants of ammonia, nitrogen, and related compounds by supplying each device with a *continuous* air flow. To add phosphorus removal, the air supply system for existing installations simply needs to be re-configured to provide on-off *cycles* at designated intervals, combined with a means to divert concentrated outflows of phosphorus-rich water to a holding pond for land application. The inexpensive retrofit for air cycling adds value to existing installations, and opens new market opportunities where phosphorus discharge is a problem.

The Company uses a combination of intellectual property, proprietary know-how, and professional engineering services to create a market advantage. We have developed a three part turnkey product-service offering that is intended to deliver seamless, convenient, value to clients in concert with manufacturer rep organizations and locally partnered engineering firms:

- *Evaluate-assess:* Provide professional engineering services to assess unique needs and circumstances of each lagoon environment, and propose custom-fit solutions including number and cost of proprietary dome structures required to achieve client-owner goals by most cost effective means.
- *Design-install:* Design and spec code-compliant solutions that fulfill capacity and efficiency requirements. Install proprietary dome structures and associated aeration systems in lagoons to promote fixed-film bacterial growth, or assist client and/or local contractor installations.
- *Monitor:* Provide systems to monitor and report lagoon performance to ensure continuous compliance with all regulatory codes.

Team

WCS has assembled a complementary team with proven business and technical achievements, skills, and experience including the following:

- *Chairman/CEO – Fred Jaeger:* Senior management, technology marketing, and commercialization experience in many types of industries, disciplines, and business models. Raised over $10 million private equity capital. Founded and bootstrapped five companies, two of which were acquired by publicly traded corporations and balance profitably exited in private M&A transactions. Experienced with early stage company formation and technology commercialization, university spinouts, IP licensing, government contracting, and grants. BS-chemistry, Harvard MBA.
- *VP Research – Kraig Johnson, PhD, PE:* Phase-I PI and co-inventor of patented *Poo-Gloo* technology, Kraig oversees all research and product development activities, including client site analysis and evaluation. Performs targeted pilot studies, conducts field beta tests, handles regulatory approvals, and reviews sales proposals. BS-EE Old Dominion University, MS-Civil & Enviro Engr UC-Berkeley, PhD-Civil & Enviro Engr University of Utah.
- *Director of Sales - Taylor Reynolds:* Experienced in marketing and sales of highly technical products. Taylor increased WCS's online presence, identified new markets, built and managed sales rep relationships, and developed new lead generation strategies. Taylor also brings prior start-up experience that helped another university spinout company raise over $2.5 million. BS-Chemical Engineering, Brigham Young University.
- *Business Development – Lee Saber:* Oversees strategic business relationships, commercial transactions, and intellectual property portfolio to ensure maximum value is achieved from the company's products, technology, and commercial assets. Former corporate finance attorney with Wilson Sonsini Goodrich & Rosati, PC and Howrey, LLP. Worked with numerous private and public companies to create value and navigate complex regulatory and environmental proceedings. A.B. from Bowdoin College & Harvard University; J.D. from the University of Texas School of Law.
- *Research PostDoc – Hua Xu, PhD:* Performs research on effect of aeration cycling to remove nitrogen and phosphorus bearing compounds in wastewater lagoons. Performs laboratory tests and data analysis on field *beta* samples. PhD-Civil & Enviro Engr University of Utah.

- *Project Engineer – Carey Johanson:* Performs client site plans, provides sales support, and assists with installations and regulatory approval. Civil engineering degree from the University of Utah; experienced in land surveying and civil engineering.
- *Board Member & Angel Investor - Al Rafati:* Venture capitalist; former senior executive in nuclear energy industry focusing on strategy and business development for long-term management and disposition of nuclear byproducts. B.S degree in electrical engineering, M.S degree in engineering administration, MBA.
- *Board Member Larry Reaveley PhD:* Co-inventor, Professional Engineer (NM) and VP of Salt Lake City based Reaveley Engineering for 19 years. Departmental Chair of Civil and Environmental Engineering Dept at UU 1993-2006. B.S. and M.S. Civil Engineering Degree from UU, and PhD from University of New Mexico.

Future Vision

WCS has established itself as having the ability to profitably market continuous air flow products to lagoon operators. The ability to add air cycling techniques to existing products for phosphorus remediation will significantly enhance a proven business model. Market & Segments

The wastewater market is broken into three broad segments: individual (primarily rural) septic tanks, small-medium sized municipal lagoons, and large urban mechanical plants. Small towns with populations of 500 – 10,000 make productive use of lagoons, and serve as the Company's primary initial target market.

The estimated number of operating lagoons in the Company's high latitude North American targeted sector (EPA, 2002) for U.S. is 7,000 and 868 in Canada (NRC 2004). The annual addressable market of lagoon operators actively seeking upgrades and renovations for phosphorus and other nutrients at any one time is approximately 25% of the total, or 1,750 US and 220 Canadian lagoons for a total annual target of 1,970 lagoons. WCS projects revenues of $100,000 to $450,000 per lagoon site for the full suite of the Company's product-service line, resulting in a potential annual addressable North American market opportunity of $197-887 million (1,970 US and Canadian sites x $100-$450k/site).

EPA further estimates 4,500 European lagoons, and over 10,000 in China. We expect to serve such international market via licensing and/or value-added reseller models in coming years.

Targeted Customer

Our targeted customers are the 25% (addressable market) of all lagoon operators who are currently out of compliance or near to being a non-compliant operator. Federal and state regulatory agencies maintain publicly available lists of non-compliant lagoon operators within their jurisdiction. Non-compliant operators are highly motivated to find solutions to reduce regulated contaminants, including phosphorus, to avoid fines and possible shutdown of operations.

Competition

Lagoon competitors are generally small-medium sized companies. Large companies like GE-Water and Siemens concentrate on the multi-million mechanical plant sector and don't directly compete in the lagoon market. Competitive lagoon products offer a variety of remediation features including fixed bio-film, aeration, mixing, and air cycling.

Table 7: Marketplace Competition Comparisons

Company – Product	**Fixed Film**	**Aeration**	**Mixing**	**Phosphorus Air Cycling**
Wastewater Compliance Systems – *Poo-Gloos*	X	X	X	X
Aeration Industries – Aire-O2 Bio film.®	X	X	X	
Lemna Technologies Inc – Lemna Polishing Reactor	X	X		
Nelson Environmental – Submerged Attached Growth Reactor.	X	X		
EDI – BioReef and Atlas systems	X	X		
FBC Technologies Inc – Bio^2 Bloc®	X	X		
Meridian Aquatic Technology – Aquamats.®	X			
SolarBee – Various products			X	
Philadelphia Mixing Solutions – Raptor Directional Aerator		X	X	
Airmaster Aerators – Various products		X	X	

Innovative Advantages

The lagoon segment has been technologically under-served for the last two decades, leaving operators with the unsatisfying choices of conversion to expensive mechanical treatment plants, installing inefficient surface aerators and mixers, or constantly adding microbes (bug-in-a-jug) to attempt to increase biological performance. Fixed-film technology provides attractive features for nutrient removal, and performance is directly related to the amount available surface area. The base of each 6ft diameter Poo-Gloo occupies 28 square feet, but creates over 2,800 square feet of available bio-film surface to produce a 100:1 ratio of available bio-film to footprint on the lagoon floor.

Rising bubbles inside each Poo-Gloo drag water along, using an airlift lift principle, which provides critical bottom-to-top water circulation pattern for stagnant bottom layers to ensure total mixing and nutrient exposure to beneficial bio-film microbes. In addition to dramatically increasing remediation efficiency, bottom-to-top circulation patterns create ice-free operation in northern latitudes when warmer water at the bottom of a lagoon gets circulated to the surface.

Poo-Gloos are energy efficient. Each unit requires approximately 1 cubic foot of air per minute (CFM) at a pressure of only 3-5 psi. The energy required to supply that amount of air is 0.1 HP, or approximately $0.12/day if electricity cost $0.07/k-W/hr. Low energy consumption opens off-grid opportunities for wind or solar power operation, and WCS is currently pursuing off-grid sales in remote communities and tribal lands in several western states.

Poo-Gloos economically provide air to existing water bodies. Large mechanical plants provide the needed air and bio-film conditions by expending vast energy and capital cost to pump tons of water per minute over a fixed bio-film surface.

Sales Challenges

Wastewater remediation equipment sales are driven by increasingly tighter regulations. Conservative operators are resistant to adopting new technology unless they feel severe regulatory pain or new product economic-performance characteristics are so compelling that alternative options become obviously non-competitive. To overcome sales hurdles and to shorten sales cycles, WCS has embarked on a vigorous pilot program whereby a Poo-Gloo is placed in a tank housed in a standard 20ft shipping container. These self-contained modules are sent to prospective client jobsites to demonstrate proven performance, build operator confidence, and to gain empirical data, based on unique water chemistry at each site, to engineer a full scale, custom-fit deployment.

Patents & Trademarks

Poo-Gloos are covered under issued US patent #7,008,539 and a USPTO registered trademark. A second PCT patent application was filed December, 2009 that covered additional technology. WCS holds exclusive worldwide license rights to all the above described IP from the University of Utah. Patent rights, together with proprietary know-how and focus on innovation provide a basis to create and maintain a sustainable competitive advantage.

Final Considerations

WCS has established a solid foundation to profitably sell existing products in competitive lagoon markets. The ability to add phosphorus remediation capabilities, by introducing air cycling techniques to existing products, will significantly enhance a proven business model.

A recap of the company operations and markets includes the following factors:

- Large, renewable, motivated, addressable, global market
- Recession resistant – stable performance & economics
- Directly addresses client needs for compliance-cost-capacity
- Effective sales strategy; identify non-compliant operators via public documents
- Incremental sales, shorten sales cycle, use of operating vs capital budgets
- Building scalable supply chain and sales channel via mfrg reps
- Proven IP: issued patent; new applications in pipeline
- Seasoned & diverse team, institutionally investment-ready; if needed

Conclusions:

The 17 week run of the pilot unit, consisting of a set of six scaled Poo-Gloos parallel with a Control was successful in demonstrating cold temperature biological nitrogen removal and phosphorous uptake and release. The Poo-Gloos out-performed the Control in every significant category, and demonstrate the viability of this technology for cold temperature lagoon nutrient removal enhancement.

The optimum HRT for the system was around 7 days. At 5 days or below, the system became overloaded, and above 9 days, the system was underperforming.

The cold temperature organic carbon removal rates were around 2 x 10^{-4} lb BOD/ft^2/day (1 g BOD/m^2/day).

Total Nitrogen removal was achieved through nitrification and de-nitrification. De-nitrification rates were enhanced by cycling the air on 21 hours/off 3 hours each day. The air off period was cycled in the early morning, just before sunrise, to take advantage of the natural DO dip caused by algae. Maximum nitrification rates were achieved when the air was on 24 hours per day, but the combined N removal was improved by air cycling. The nitrogen removal rate for the submerged fixed film devices was on the order of 7 x 10^{-5} lb N/ft^2/day (0.34 g N/m^2/day). This occurred at temperatures of around 5 °C and as low as 0.9 °C.

Daily air cycling also promoted the biological uptake of Total Phosphorous from the wastewater stream. Optimal uptake occurring with air on 22 hours/off 2 hours for this set of runs. For the 4 week period in January, the Poo-Gloos decreased the concentration in the wastewater flow from 3.45 to 2.61 mg/L. The biofilm in the Poo-Gloos released P into the bulk solution after an extended air-off period of 7 days, increasing the concentration from 2.4 to 3.2 mg/L. The P uptake was in the range of the stoichiometric requirements of the bio-film of about 1.4% P. The presence of PAOs was not confirmed, however, the 3000 square feet of bio-film in the 1650 gallon (6245 L) test tank was enough to uptake 20 grams of Total P from the wastewater stream during a 4 week period, and then release 5 grams of Total P during the one week air-off period. The P concentration of the biofilm was on the order of 0.5 g/m^2 at wintertime temperatures of below 5 °C.

Appendices:

- H. Xu, K. Johnson, and Y. Choi. "Air Cycling Enhanced Carbonaceous and Nitrogen Compounds Removal with Pilot Scale Submerged Poo-Gloo^{TM} Dome Sets", Conference Proceeding of Water Environmental Federation (WEF) Impaired Water Symposium, Jan 12 – 13, 2011, Miami, FL. (Forth Coming)
- **www.wcs-utah.com**
- UTES Lead the Way, Kraig Johnson, **Salt Lake Magazine**, April 2011 Volume 22 No. 2, 66.
- Cleanup Crew, **Popular Science Magazine,** May 2011, 14 – 15.

Appendix E

ALGAE PILOT TESTING

Clari-DAF® System
Dissolved Air Flotation Pilot Report

Logan, Utah
Logan Waste Water Treatment Plant
August 25th 2011 ~ November 17th 2011

Operator: Ryan Santelli

Author: Ryan Santelli
Scott Ross

Client: Logan WWTP

Engineer: Carollo Engineering

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1. Executive Summary

In August 2011, Xylem, Inc. was invited to Logan, Utah to perform a 20 day Dissolved Air Flotation (DAF) pilot study at the Logan Waste Water Treatment Plant. The objective of the study was to evaluate the performance of the Leopold Clari-DAF system on the Logan lagoons, and propose a more efficient clarification system to replace the existing process for phosphorus and algae removal.

During the months of August - October, there is a period when the Logan Lagoons experience a large Algae bloom. The Clari-DAF system's onboard raw water Turbidimeter measured up to 50 NTU and the raw water Turbidimeter was on average around 23 NTU. The Leopold Clari-DAF system is currently being evaluated as a clarification process to the existing plant. The Clari-DAF system was selected for the high loading rate/small footprint necessitated by site conditions, and the system's ability to operate very efficiently with various source water qualities.

On August 23, 2011, the Leopold Clari-DAF system pilot trailer was delivered and set up at the Logan Lagoons. The raw water line consisted of roughly 150 feet of 2-inch PVC suction hose that fed directly into the Clari-DAF system pilot trailer. After the influent water went through the clarification process, the DAF clarified water was fed to a discharge hose back into the Lagoons.

Throughout the study period, online monitoring of raw water, Clari-DAF system effluent, pH, flow, and temperature were data logged. In addition, routine samples were collected for total Kjeldahl nitrogen (TKN), total suspended solids (TSS), and total phosphorous removal.

The results from the study were less effective when dosing the Aluminum Sulfate. The ferric chloride provided much better removals. The Clari-DAF system performed extremely well when optimized at a loading rate of 4 gpm/ft^2 It was decided that the Leopold Clari-DAF system loading rate of 4 gpm/ft^2, with a recycle rate of between 15 and 20 percent, and the total flocculation mixing time of 18-22 minutes produced the highest quality system effluent with an average turbidity of **10.1 NTU** when dosing the Aluminum Sulfate and **3.89 NTU** when dosing the Ferric Chloride.

The results obtained during the study confirm that the Clari-DAF system is an effective pretreatment solution for this water source and will produce a high quality effluent.

2. Objectives

The objectives for the Clari-DAF system pilot study were established to meet the needs of the plant. Also, design criteria were gathered for Xylem, Inc. and Carollo Engineers throughout the study. The study's objectives are outlined below:

- Perform with the best Phosphorus and Algae removal
- Evaluate the Clari-DAF system performance at various loading rates.
- Enable Xylem, Inc. to validate the operation of the Clari-DAF system.

3. Methodology

On August 26th, the Leopold Clari-DAF system pilot trailer was set up at the Logan Wastewater Treatment Plant. The source water was fed through roughly 150 feet of 2-inch PVC suction hose that fed directly into the Clari-DAF system pilot trailer before any chemical addition.

The pilot plant is configured with a rapid mix tank followed by two consecutive flocculation cells with hydrofoil style mixers, an automatic chain and flight skimmer, and a level controlled recycle/air saturation system. The Clari-DAF system trailer is also equipped with two one–square foot, fully automated filters. Both of these filters use Leopold's I.M.S.® Cap plus Universal® Type S® Underdrain to support the media. These filters were not utilized during the study.

All instruments were calibrated on power-up, which included chemical feed pumps, turbidimeters, and pH probes. Hach pH 4, 7, and 10 buffer solutions were used to calibrate the pH probes, and Hach 20 NTU formazine solution was made up from stock for calibration of the turbidimeters. A Hach Ice-Pic 1 NTU standardized head unit was used to confirm accuracy.

Online data logging included raw and Clari-DAF system effluent turbidity, pH, and temperature. Online data logging also included the onboard filter's turbidity, loss of head, and flow.

4. Results

The results that the pilot study produced were excellent. The Clari-DAF system operated in an automatic mode with the pilot staff monitoring water quality parameters and making system changes required by the protocol. A summary of the optimized system results while treating the Lagoon water source and a full analysis of the pilot study is given in the subsequent sections of the report.

4.1. Raw Water Quality

Figure 1. Logan Lagoons

Table 1. Raw Water Quality During the Pilot Study.

Raw Water Quality			
Parameter	**Average**	**Min**	**Max**
Turbidity (NTU)	23.4	14.9	49.8
pH	9.6	8.6	9.8
Temperature (°F)	60.5	40.2	73.9

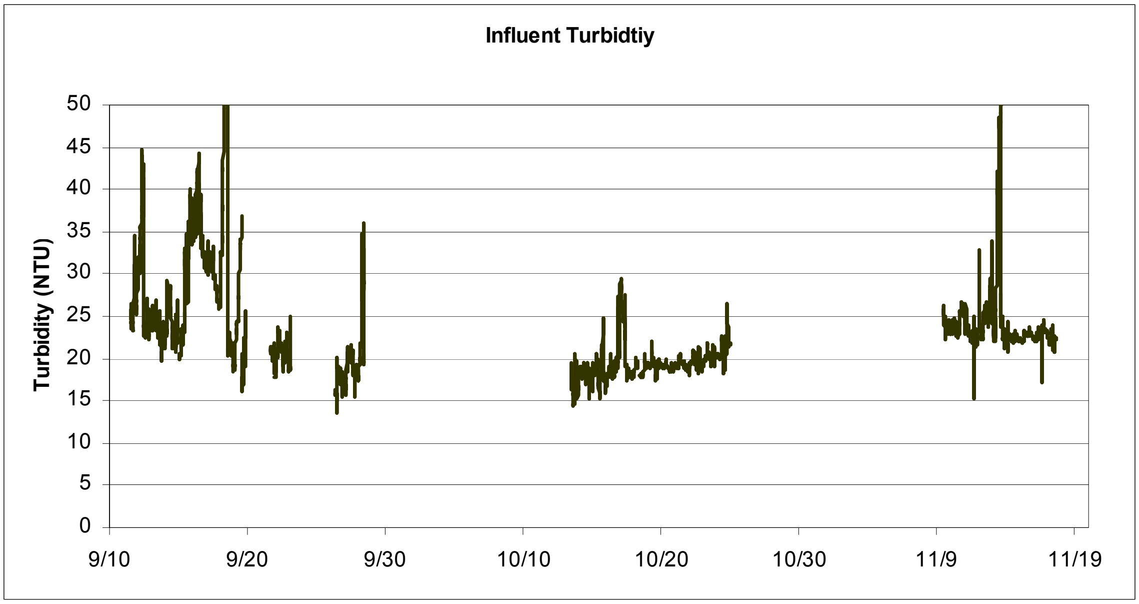

Figure 2. Raw Water Turbidity During the Pilot Study. *

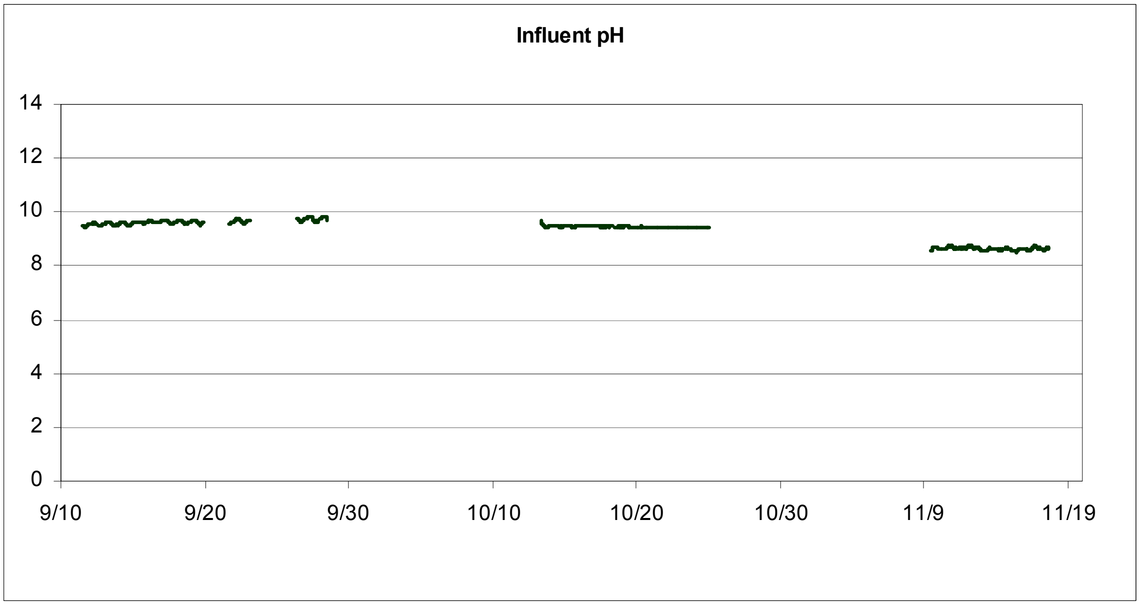

Figure 3. Raw Water pH During the Pilot Study. *

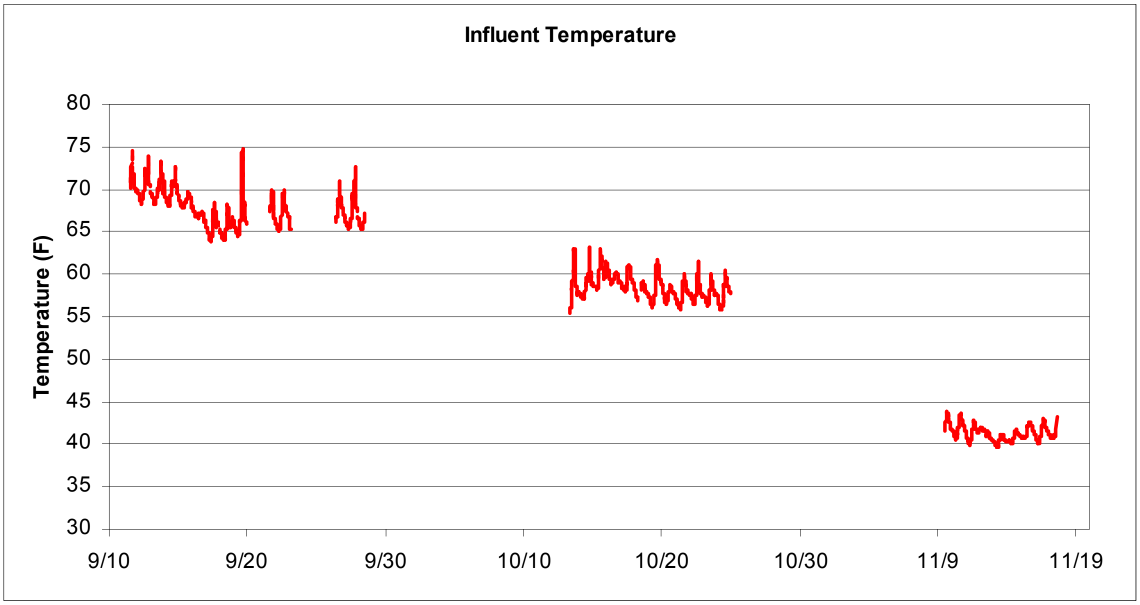

Figure 4. Raw Water Temperature During the Pilot Study. *

* Note: Some spikes and discontinuities in the online data were caused by instrument cleaning and periods of shutdown.

4.2 Dissolved Air Flotation Results

The results of the Clari-DAF system pilot were excellent. Various system loading rates and coagulation chemistries were tested with great success. The results presented in the following sections clearly demonstrate the effectiveness of the Clari-DAF system to maintain a high level of finished water quality.

4.2.1. Clari-DAF System Coagulation

The choice of coagulant can play a critical role in the performance of any clarification process. The Clari-DAF system is a chemical based clarification system and the proper chemical addition is essential for optimal treatment.
The Clari-DAF system was tested with Aluminum Sulfate (alum) at dosages of 40-65 mg/L. Ferric chloride was dosed from 20-45 mg/L. T-Floc, a polyacrylamide was used in combination with alum and ferric chloride at dosages of 15-20 mg/L.
The best turbidity and phosphorus reduction were seen with ferric chloride.

4.2.2. Loading Rate Optimization.

Loading rate is a critical factor in designing a clarification system because it directly affects the full-scale plant's footprint and performance. During the study, the pilot unit was evaluated at Clari-DAF system loading rates between 4 and 8 gpm/ft^2 with varying flocculation mixing times.

Results can be seen below in **Table 2.** The recommended Clari-DAF system loading rate for both treatment schemes is **4 gpm/ft^2.**

Table 2. Loading Rate Optimization.

Clari-DAF Loading Rate (gpm/ft^2 TBA)	Clari-DAF Avg Turbidity (NTU)	Clari-DAF Avg Particles (> 2 um/mL)
4	1.560	11209
6	2.530	12601
8	3.544	13578

4.2.3. Clari-DAF System Parameters

Due to time restrictions on the pilot study, all of the Clari-DAF system's parameters were not able to be optimized. Therefore, proven standard Clari-DAF system parameters were used and provided great results. Below in **Table 3**, all of the additional operation parameters can be seen.

Table 3. Clari-DAF System Operational Parameters at 4 gpm/ft^2 TBA.

Parameter	Value
Total Flocculation Time (min)	18-25
Recycle (% total flow)	15-30
Saturator Pressure (psi)	80

4.2.4. Clari-DAF System Turbidity Removal

Figure 5 presents the turbidity removal performance of the Clari-DAF system for the entire test period. **Figure 6** present the turbidity removal for 9/11-9/29/2011. The Clari-DAF was started with alum only. Later it was run with ferric chloride. **Figure 7** present the turbidity removal for 10/13-10/25/2011. The Clari-DAF was run with ferric chloride and T-Floc for this period. The average turbidity reduction was 80%. **Figure 8** presents the turbidity removal for 11/9-11/17/2011 when the Clari-DAF system was optimized with alum and T-Floc.

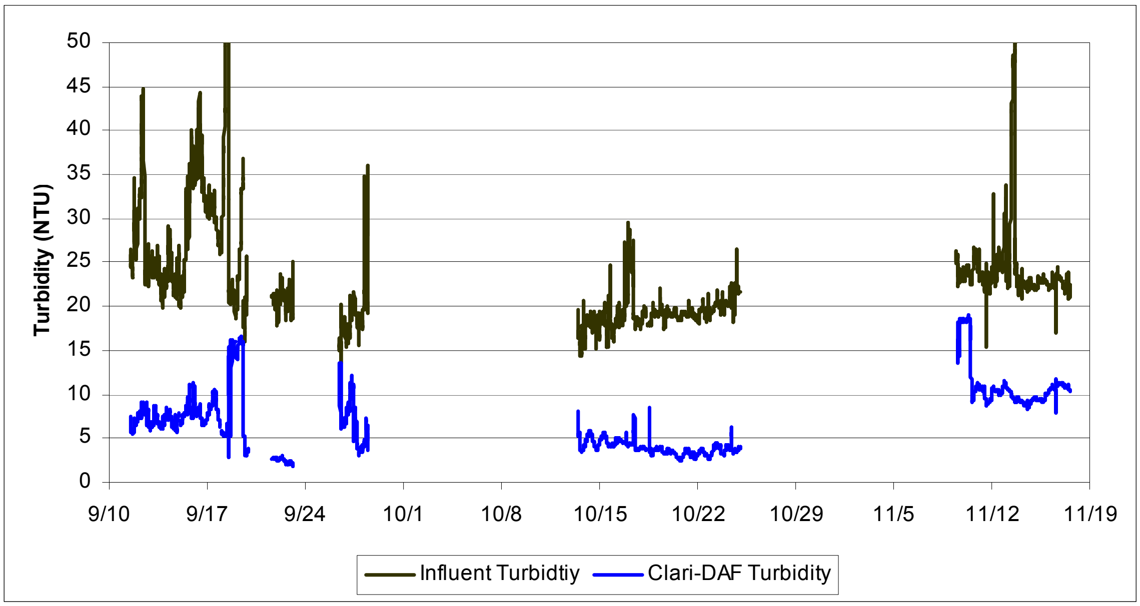

Figure 5. Raw Water and Clari-DAF System Effluent Turbidity. *

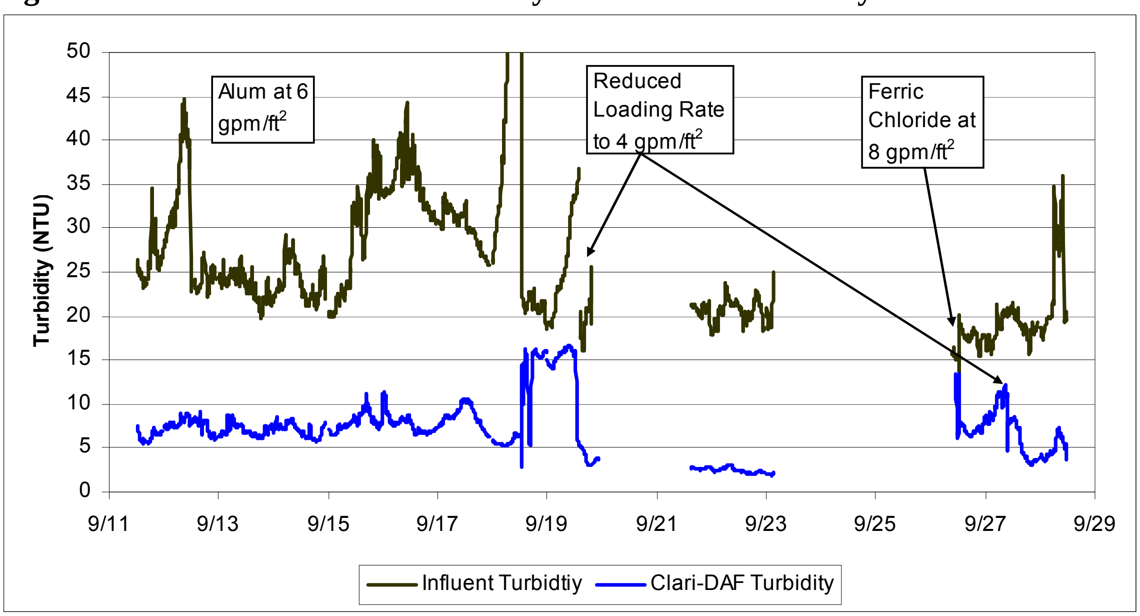

Figure 6. Raw Water and Clari-DAF System Effluent Turbidity 9/11-29/2011. *

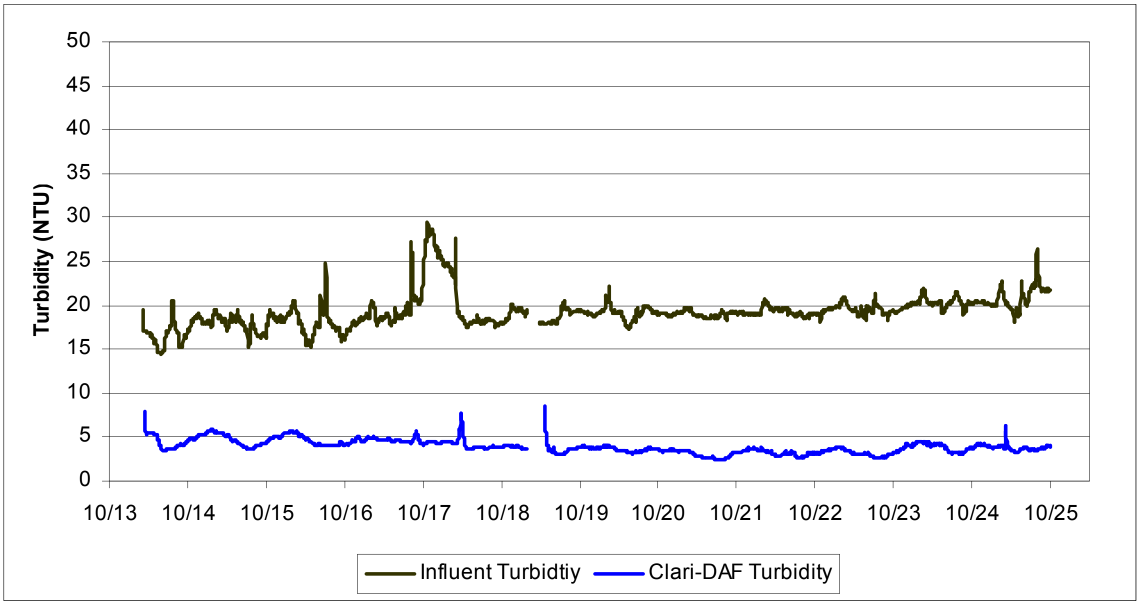

Figure 7. Raw Water and Clari-DAF System Effluent Turbidity Ferric Chloride 4 gpm/ft^2 10/13-25/2011. *

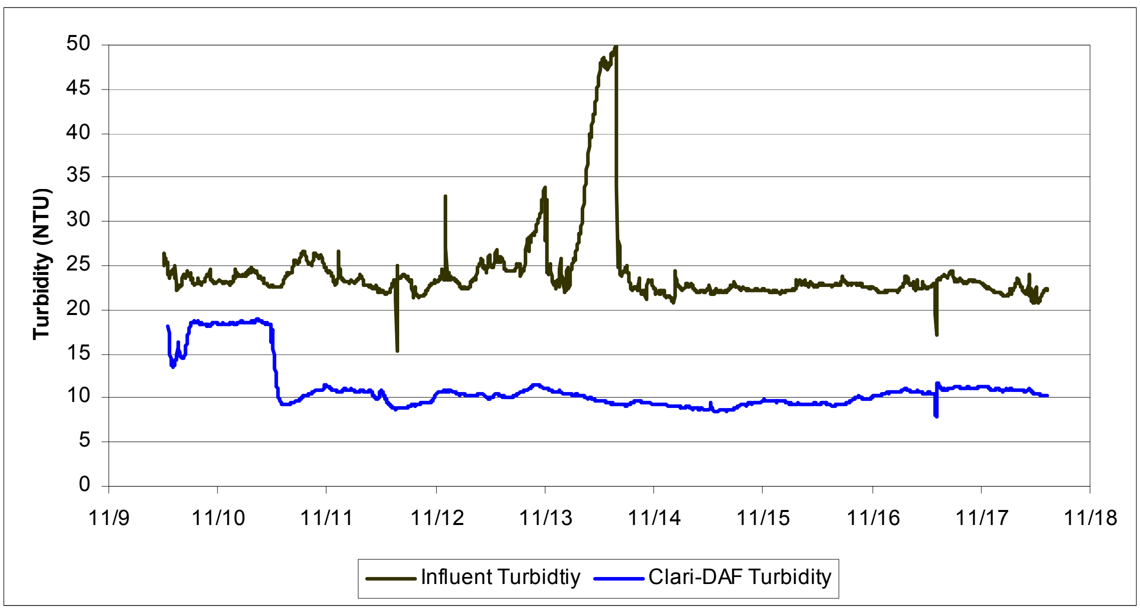

Figure 8. Raw Water and Clari-DAF System Effluent Turbidity Alum 4 gpm/ft^2 11/9-17/2011. *

***** Note: Some spikes and discontinuities in the online data were caused by instrument cleaning and periods of brief shutdown for routine maintenance and holidays.

4.2.5. Clari-DAF System Total Phosphorus Removal

The Clari-DAF removed and average of 56.8% of the Total Phosphorus with alum, and 89.3% with ferric chloride. The results are shown in **Figure 9.**

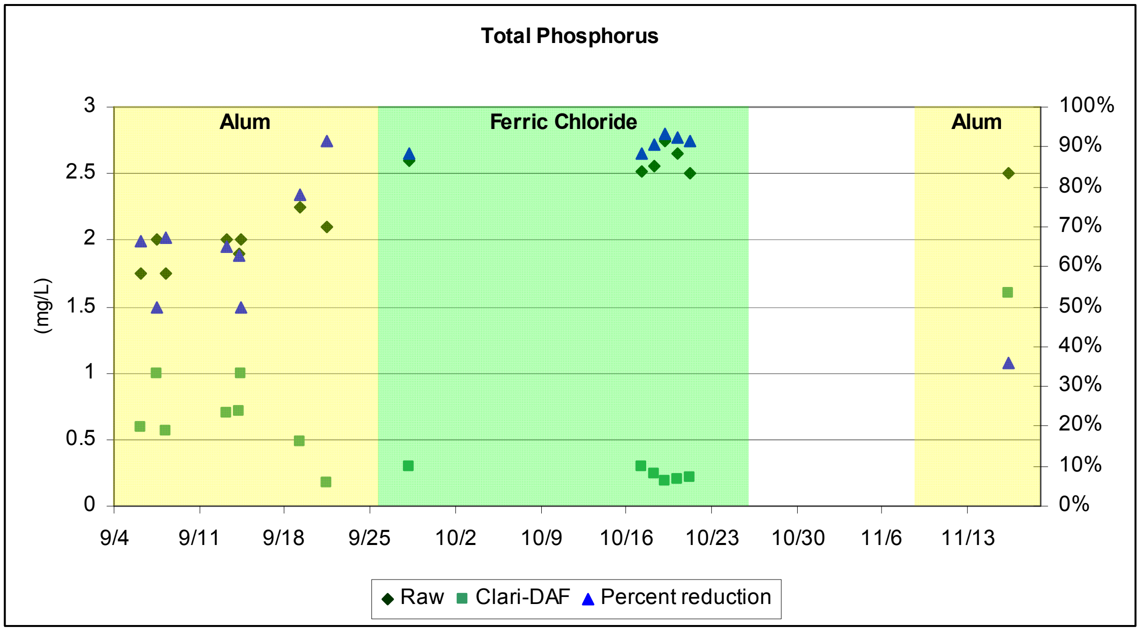

Figure 9. Raw Water and Clari-DAF System Effluent Total Phosphorus.

4.2.6. Clari-DAF System Total Kjeldahl Nitrogen Removal

The Clari-DAF removed and average of 18.4% of the Total Kjeldahl Nitrogen with alum, and 35.9% with ferric chloride. The results are shown in **Figure 10.**

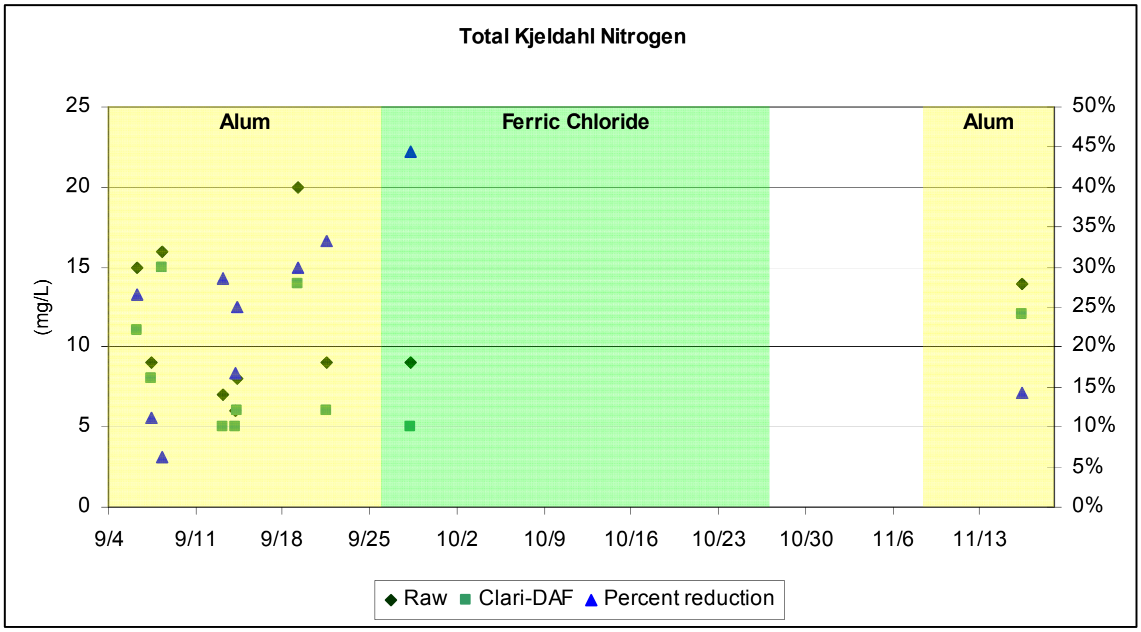

Figure 10. Raw Water and Clari-DAF System Effluent Total Kjeldahl Nitrogen.

4.2.7. Clari-DAF System Total Suspended Solids Removal

The Clari-DAF removed and average of 30% of the Total Suspended Solids with alum, and 63.5% with ferric chloride. The results are shown in **Figure 11.**

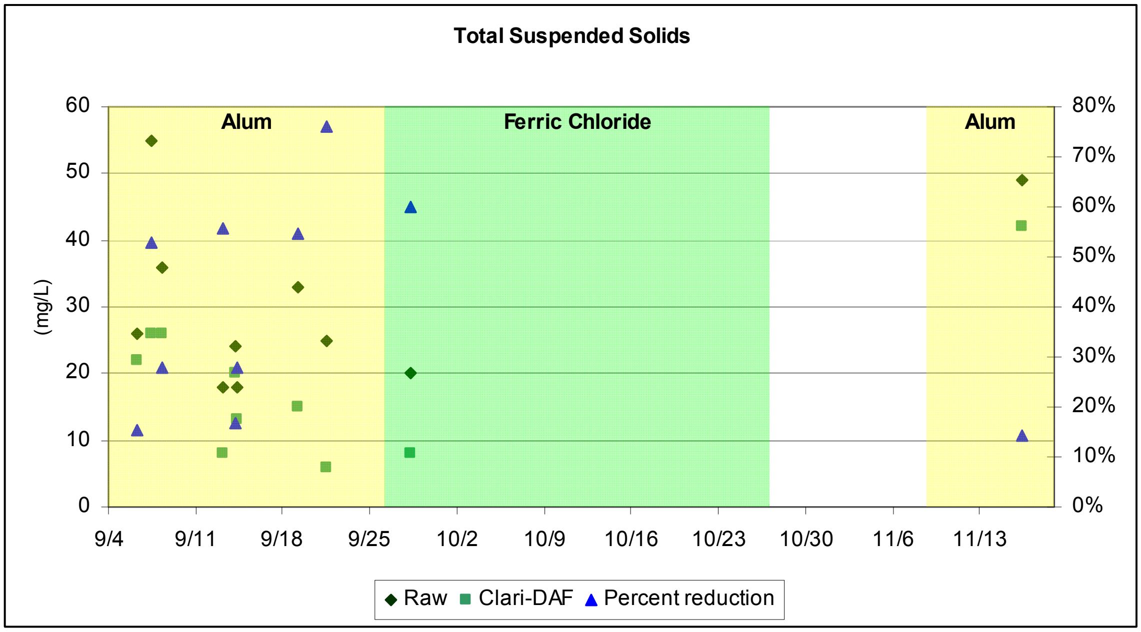

Figure 11. Raw Water and Clari-DAF System Effluent Total Suspended Solids.

4.2.8. Clari-DAF System Sludge

The sludge created by the Clari-DAF system floats to the surface of the tank where it builds up into a sludge blanket, often called "float". This is kept on the surface until it becomes necessary to remove it. The pilot plant uses a chain and flight type mechanical skimmer to pull the float over a curved beach for removal.

Figure 12. Clari-DAF System Sludge Blanket and Skimmer.

5. Conclusions

A study conducted from August 2011 thru November 2011, using the Clari-DAF system (dissolved air flotation) proved to be very effective on the Logan Lagoon water source for the removal of Algae and Phosphorus. The data presented illustrates the performance capability of Leopold's Clari-DAF system. All of the goals of the test were completed and treatment objectives were obtained.

While evaluating chemistries for the Clari-DAF system for conventional filtration pretreatment, two coagulants were tested during the first twenty days of the study; Aluminum Sulfate and Ferric Chloride. While alum did not yield acceptable results, the Ferric provided great results. After the twenty day test period the consulting engineers decided to add a T-Floc flocculent for a ten day study with both coagulants individually. Again the Alum did not perform nearly as well as the Ferric did but it is hard to tell if the T-floc had any effect on the results.

Tests were completed comparing Clari-DAF system loading rates from 4 to 8gpm/ft^2, based on total basin area. The Clari-DAF system's effluent water quality suffered slightly from 4 – 8 gpm/ft^2 even though the effluent turbidity stayed essentially the same. The recommended loading rate for the Clari-DAF system is 4 gpm/ft^2.

The total treatment scheme of Clari-DAF system is flexible and capable of consistently producing excellent finished water quality regardless of the variable raw water quality it was required to treat. The Clari-DAF system was able to withstand brief raw turbidity spikes up to 50+ NTU while still maintaining high quality effluent. When optimized the Clari-DAF system averaged 80% removal of turbidity and 89% of phosphorus.

6. Recommendations

- Based on pilot data, the Clari-DAF system should be designed to operate at the following for both pretreatment scenarios:

Table 4. Clari-DAF System Recommended Design Loading Rates.

Design Loading Rate (gpm/ft^2)	Design Recycle Rate (% of System Flow)	Design Flocculation Time (minutes)
4	15	18-22

CHEMTECH-FORD
LABORATORIES

9/13/2011

Work Order: 1107399

Logan City Wastewater

Attn: Jim Harps

450 North 1000 West

Logan, UT 84321

Client Service Contact: Linda Daniels 801.262.7299

The analyses presented on this report were performed in accordance with the National Environmental Laboratory Accreditation Program (NELAP) unless noted in the comments, flags or case narrative. If the report is to be used for regulatory compliance, it should be presented in its entirety, and not be altered.

Approved By: Dave Gayer, Laboratory Director

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 1107399-01

Name:	**Logan City Wastewater**	***Sample Date:***	9/7/2011 11:00 AM
Sample Site:	Leapold	***Receipt Date:***	9/7/2011 1:34 PM
Comments:	DAF, Influent	***Sampler:***	Erick Griffiths
Sample Matrix:	Wastewater	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	2.0	0.05	mg/L	9/9/2011 11:00	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	9	1	mg/L	9/12/2011 12:00	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	55	10	mg/L	9/8/2011 13:18	JSH	SM 2540 D	CTFID10267	

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 1107399-02

Name:	**Logan City Wastewater**	***Sample Date:***	9/7/2011 11:00 AM
Sample Site:	Leapold	***Receipt Date:***	9/7/2011 1:34 PM
Comments:	DAF, Effluent	***Sampler:***	Erick Griffiths
Sample Matrix:	Wastewater	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	1.0	0.10	mg/L	9/9/2011 11:00	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	8	1	mg/L	9/12/2011 12:00	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	26	4	mg/L	9/8/2011 13:20	JSH	SM 2540 D	CTFID10267	

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Murray, UT 84107
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Certificate of Analysis

Abbreviations

ND = Not detected at the corresponding Minimum Reporting Limit.
1 mg/L = one milligram per liter or 1 mg/Kg = one milligram per kilogram = 1 part per million.
1 ug/L = one microgram per liter or 1 ug/Kg = one microgram per kilogram = 1 part per billion.
1 ng/L = one nanogram per liter or 1 ng/Kg = one nanogram per kilogram = 1 part per trillion.

Flag Descriptions

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

CHEMTECH - FORD, INC.

Analysis Request Form / Chain of Custody

Company: CITY OF LOGAN
Address: 450 NORTH 1000 WEST
City/State/Zip: LOGAN, UT 84321
Phone # : 435-716-9756 Fax # : 435-716-9751
Company Contact: Erick Griffiths
Email: Erick.Griffiths@loganutah.org
Project: DAF

Billing Name: CITY OF LOGAN
Billing Address: 450 NORTH 1000 WEST
LOGAN, UT 84321

7399

Lab ID #	Sample Location	Date	Time	Number of Containers	Sample Type: Grab	Sample Type: Composite	Analysis Requested: Total Phosphorus	TKN	TSS																
01	Leapold Influent	9/7/11	11:00 AM	2	X		X	X	X																
02	Leapold Effluent	9/7/11	11:00 AM	2	X		X	X	X																

Sampled by: (print) Erick Griffiths
Sampled by: (signature) Erick Griffiths

Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:
Erick Griffiths	9-7-11 12pm		9/7/11 11:30
	9/7/11 13:34	David	9/7/11 1334

CHEMTECH-FORD
LABORATORIES

9/22/2011

Work Order: 1107672

Logan City Wastewater

Attn: Jim Harps

450 North 1000 West

Logan, UT 84321

Client Service Contact: Linda Daniels 801.262.7299

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NELAP ACCREDITED TNI LABORATORY

Approved By:

Dave Gayer, Laboratory Director

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 1107672-01

Name:	**Logan City Wastewater**	***Sample Date:***	9/14/2011 9:30 AM
Sample Site:	Influent	***Receipt Date:***	9/14/2011 1:51 PM
Comments:	L DAF	***Sampler:***	Erick Griffiths
Sample Matrix:	Water	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	2.0	0.05	mg/L	9/20/2011 6:30	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	8	1	mg/L	9/21/2011 12:00	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	18	4	mg/L	9/15/2011 13:04	JSH	SM 2540 D	CTFID10267	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 1107672-02

Name:	**Logan City Wastewater**	***Sample Date:***	9/14/2011 9:30 AM
Sample Site:	Effluent	***Receipt Date:***	9/14/2011 1:51 PM
Comments:	L DAF	***Sampler:***	Erick Griffiths
Sample Matrix:	Water	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	1.0	0.10	mg/L	9/20/2011 6:30	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	6	1	mg/L	9/21/2011 12:00	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	13	4	mg/L	9/15/2011 13:06	JSH	SM 2540 D	CTFID10267	

Abbreviations

ND = Not detected at the corresponding Minimum Reporting Limit.
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1 ug/L = one microgram per liter or 1 ug/Kg = one microgram per kilogram = 1 part per billion.
1 ng/L = one nanogram per liter or 1 ng/Kg = one nanogram per kilogram = 1 part per trillion.

Flag Descriptions

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

CHEMTECH - FORD, INC.

Analysis Request Form / Chain of Custody

Company: CITY OF LOGAN
Address: 450 NORTH 1000 WEST
City/State/Zip: LOGAN, UT 84321
Phone # : 435-716-9756 Fax # : 435-716-9751
Company Contact: Erick Griffiths
Email: Erick.Griffiths@loganutah.org
Project: L DAF

Billing Name: CITY OF LOGAN
Billing Address: 450 NORTH 1000 WEST
LOGAN, UT 84321

7672

Lab ID #	Sample Location	Date	Time	Number of Containers	Sample Type: Grab	Sample Type: Composite	Analysis Requested: Total Phosphorus	TKN	TSS
-01	Influent	9/14/11	9:30 AM	2	X		X	X	X
-02	Effluent	9/14/11	9:30 AM	2	X		X	X	X

Sampled by: (print) Erick Griffiths

Sampled by: (signature) [signature]

Relinquished by: (signature) [signature]	Date/Time: 9-14-11 10:47AM	Received by: (signature) [signature]	Date/Time: 9/14/11 11:30
Relinquished by: (signature) [signature]	Date/Time: 9/14/11 1351	Received by: (signature) [signature]	Date/Time: 9.14.11 1351
Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 7672

Delivery Method: (circle one)

UPS FedEX USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / No

Appropriate container/preserve: Yes / No

Temperature 10 C°

Comments:

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01-02	N	867						
2		AP	—						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Bottle Type

Plastic		Glass	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

CHEMTECH-FORD LABORATORIES

Lab ID #: 7399

Sample(s) sealed: Yes / No

Appropriate container/preserve: Yes / No

Temperature 13 C°

Delivery Method: (circle one)

UPS FedEX USPS

Walk-In Courier Chemtech

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01-02	A 1/2							
2		N	867						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type			
Plastic		**Glass**	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

9/29/2011

Work Order: 1107930

Logan City Wastewater

Attn: Jim Harps

450 North 1000 West

Logan, UT 84321

Client Service Contact: Linda Daniels 801.262.7299

The analyses presented on this report were performed in accordance with the National Environmental Laboratory Accreditation Program (NELAP) unless noted in the comments, flags or case narrative. If the report is to be used for regulatory compliance, it should be presented in its entirety, and not be altered.

Approved By:

Dave Gayer, Laboratory Director

Certificate of Analysis

Lab Sample No.: 1107930-01

Name:	**Logan City Wastewater**	***Sample Date:***	9/21/2011 11:15 AM
Sample Site:	Influent	***Receipt Date:***	9/21/2011 1:38 PM
Comments:	L DAF	***Sampler:***	Erick Griffiths
Sample Matrix:	Water	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	2.1	0.05	mg/L	9/27/2011 23:00	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	9	1	mg/L	9/28/2011 10:30	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	25	4	mg/L	9/23/2011 12:07	JSH	SM 2540 D	CTFID10267	

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

Certificate of Analysis

Lab Sample No.: 1107930-02

Name:	**Logan City Wastewater**	***Sample Date:***	9/21/2011 11:15 AM
Sample Site:	Effluent	***Receipt Date:***	9/21/2011 1:38 PM
Comments:	L DAF	***Sampler:***	Erick Griffiths
Sample Matrix:	Water	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Inorganic								
Phosphorus, Total	0.18	0.01	mg/L	9/27/2011 23:00	TSM	SM 4500 PB5E	7723-14-0	
Total Kjeldahl Nitrogen	6	1	mg/L	9/28/2011 10:30	TP	SM 4500 NH3-D	CTFID10234	
Total Suspended Solids (TSS)	6	4	mg/L	9/23/2011 12:09	JSH	SM 2540 D	CTFID10267	

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

Certificate of Analysis

Abbreviations

ND = Not detected at the corresponding Minimum Reporting Limit.
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1 ug/L = one microgram per liter or 1 ug/Kg = one microgram per kilogram = 1 part per billion.
1 ng/L = one nanogram per liter or 1 ng/Kg = one nanogram per kilogram = 1 part per trillion.

Flag Descriptions

CHEMTECH - FORD, INC.

Analysis Request Form / Chain of Custody

Company: CITY OF LOGAN
Address: 450 NORTH 1000 WEST
City/State/Zip: LOGAN, UT 84321
Phone # : 435-716-9756   Fax # : 435-716-9751
Company Contact: Erick Griffiths
Email: Erick.Griffiths@loganutah.org
Project: L DAF

Billing Name: CITY OF LOGAN
Billing Address: 450 NORTH 1000 WEST
LOGAN, UT 84321

7930

Lab ID #	Sample Location	Date	Time	Number of Containers	Sample Type: Grab	Sample Type: Composite	Total Phosphorus	TKN	TSS
01	Influent	9/21/11	11:15 AM	2	X		X	X	X
02	Effluent	9/21/11	11:15 AM	2	X		X	X	X

Sampled by: (print) Erick Griffiths
Sampled by: (signature)

Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:
	9/21/11 11:30		9/21/11 11:30
	9/21/11 13:38		9.21.11 1338

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

CHEMTECH-FORD
LABORATORIES

Lab ID #: ____________________

Delivery Method: (circle one)

UPS FedEX USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / No

Appropriate container/preserve: Yes / No

Temperature 11 **C°**

Comments:

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	AP							
2		N	867						
3	02	AP							
4		N	843						
5									
6									
7									
8									
9									
10									
11									
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18									
19									
20									
21									
22									
23									
24									
25									

Bottle Type

Plastic		Glass	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

February 10, 2012

Preliminary Report of Logan Lagoon IBR Anaerobic Digester

By Conly Hansen

Background

Anaerobic digestion (AD) is an effective way to reduce the volume and mass of many organic waste products. Anaerobic microorganisms convert their organic substrates mostly into biogas; a mixture of primarily methane with carbon dioxide, new cells and a minuscule amount of chemicals such as alcohols. Because of the slow growth of anaerobic bacteria, there is little byproduct from the organics destroyed in the process. Efficient AD is hampered by plant structures resistant to bacterial action, lignin being a main component of this category. Also chemical inhibitors toxic to bacterial activity may retard and suppress AD. Processing methods can overcome many of the barriers of applying AD to certain biomass substrates including algae. The induced bed reactor (IBR) anaerobic digester is a processing method that facilitates rapid and economical AD. Advantages of the process include a high rate, which brings down capital costs for tanks and handling equipment, a small footprint, ease of management and the fact that the IBR can handle relatively large size and abundant solid particles in the influent. The IBR was used in this project to destroy organic matter that otherwise would be treated by municipal liquid or solid waste management systems.

Biogas produced in an anaerobic digester must be cleansed of certain contaminants to facilitate its use for productive purposes such as: combined heat and power (electrical generation), producing compressed natural gas (CNG), production of synthetic diesel or petrol and replacement of natural gas in boilers and heaters. A zeolite based regenerable biogas conditioner was used in this project.

Logan City Project

AD is increasingly being considered around the world for reduction of municipal wastes and production of renewable energy. With this in mind, Logan City helped sponsor an experimental facility at the Logan lagoons that was capable of 1) separating algae from lagoon effluent and feeding it into an IBR anaerobic digester system to make renewable energy, 2) receiving and grinding facilities for receiving, temporarily storing, and processing various organic substrates that otherwise would likely be discharged into the Logan wastewater system or landfill and 3) data acquisition equipment and a small laboratory to analyze effectiveness and economics of AD of the various substrates being tested. The purpose for separating algae from Logan lagoon effluent was to remove phosphorus, which the algae can do, but that leaves algal residue that must be utilized or disposed of.

The purpose of the project was to research and demonstrate AD of algae, dairy waste, various samples of other food processing waste from local food processing plants and various samples of municipal waste in pilot scale IBR digesters and to report effectiveness of the process. Expected benefits were that it would help Logan City determine economics of diverting various organics and making renewable energy and soil conditioner from them. The results of the project can help determine if AD is a viable alternative for handling some of the waste products currently being managed by other means by Logan City.

Two 60 l and two 3,800 l IBR's with controllable temperature and influent feed rate were installed at the Logan lagoons. The system featured data acquisition of pH and temperature (Cole Parmer, Vernon Hills, IL). Feed rate for the 60 l IBR's was automated with timers (Cole Parmer Model # R-94400-62, Vernon Hills, IL) and electrically controlled valves (Ingersoll Rand Model # P251SS-120-A, Dublin, Ireland). The larger IBR's were also automated for control of feed rate using a Campbell Scientific CR 1000 (Campbell Scientific, Logan, UT) with associated valves and pumps, but they were fed manually for the period of these preliminary experiments. Biogas flowrate was monitored for the 60 l IBR's (Alicat, Tucson, AZ). Unfortunately the biogas flowmeters failed for the larger IBR's during the time of the experiment so biogas production is not reported. When it was necessary, incoming wastes were chopped to ≤ 13 mm (0.5 in) with a Master Disposers Inc 3 HP 3 Model 830 (Lancaster, PA) grinder. Waste was pumped into the IBR with a diaphragm pump (Sandpiper 2" SA2, Staffordshire, UK). The temperature was maintained mesophilic (35 – 39 °C) with tank hot water jackets and pH was keep above 6.8 in the digesters, generally never rising above 7.2. Hot water was provided with on-site boilers.

The 60 l digesters were operated in methane forming mode from the first of June - August, 2011. Specific purposes of the preliminary experiments in the 60 L digesters were to: 1) gather more information about anaerobically digesting algae alone and 2) gather data about digesting algae with food waste in an IBR. Ideally, the C:N ratio in AD should be above 20. Algae are generally below 10 and food waste is generally above 20. The hypothesis was that adding food waste would improve biogas production. Experiments started with 100% algae with an HRT of 10 d; after 22 d the HRT was changed to 24 d for 12 d. Following that, 50% dairy waste was mixed with the algae for a 7 d trial and then 20% dairy waste was mixed for the remainder of the preliminary experiments. Following these experiments, the 60 L IBR's had to be used for other purposes.

Two 3,800 l (1000 gal) IBR's were operated during summer and fall of 2010; started again in early summer of 2011 and run until December, 2011. Sludge was pumped from the bottom of the Logan lagoons into the 3,800 l IBR's to get them started. Algae were exclusively digested in one of the 3,800 l digesters (called the west digester). All types of food wastes were digested in the other (east digester) including grocery store organic wastes, bakery byproducts from the Richmond, UT Pepperidge Farms plant and dairy processing waste from the USU dairy processing lab and Schreiber Foods, Logan, UT plant. A relatively small amount of fats, oils and grease (FOG) from local restaurants and general garden wastes were mixed with other substrates and digested in the east IBR. Bakery byproducts consisted of various kinds of cookies, bread, cookie dough and butter and garlic spreads. Dairy waste consisted of cream cheese, whey, out of spec fluid milk, out of spec ice cream mix and yogurt. Grocery waste was typical of that from a major grocery chain, consisting of all types of old fruits and vegetables, flowers, stale bread, and eggs.

Except for algae, the various wastes were not segregated as separate substrates for these preliminary experiments. The larger IBR's were fed manually; daily on weekdays. The 60 L digesters were fed an average of about 4 times/24 hours. The data collected included solids measurements; total and suspended and chemical oxygen demand in and out of the digesters. They were performed according to standard methods [1] Biogas CH_4 percentage was analyzed with an Agilent 6890 GC using an RT-Msieve 5A Plot capillary column (Restek) (Agilent, Santa

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[1] APHA-AWWA-WEF (1992) Standard methods for the examination of water and wastewater, 18th edn. American Public Health Association, Washington, DC

Clara, CA). A zeolite based biogas conditioning system (AD Tec, Provo, UT) removed contaminants from the biogas including H_2S, NH_3 and H_2O that could be harmful to downstream processes.

The amount of substrate added was estimated by visually noting amount of algae pumped in per day from a 1,100 l (300 gal) algae holding container for the larger IBR's and 19 L (5 gal) buckets for the 60 l IBR's.

Results

Grocery Waste

The 3,800 l IBR handled all types of wastes well except for suffering from low pH upon initial addition of food wastes about September 1, 2010. The pH dropped to about 5.0. Approximately 4.5 kg (10 lb) of lime and the same amount of NaOH were added. The rest of the fall (until cold weather in December), pH was above neutral with no pH control added. Only 27-45 kg (60-100 lbs) of mixed waste at 20 – 25% solids mixed with water to about 4 % solids were added each weekday. The mixed food waste added was all that was available; nothing was added on the weekends. A 3,800 l IBR would be expected to handle at least 8 times that amount but the supply came from cooperating grocery stores in the area and that was the amount available at the time. Grinding was the biggest challenge. A Master Disposer (Lancaster, PA) was eventually installed that adequately ground the material, but it added too much water so that the influent was only 2-4% solids; 8-9% is usually preferred. The mixed waste generally produced more methane than we have experienced with manure. This was because a higher percentage of the solids were digested and additionally those types of solids generally produce more gas per mass of solids destroyed. Our preliminary estimate for specific methane production obtained while the biogas flowmeter was working was that > 0.55 l of methane was produced per gm of volatile solids destroyed. This compares to ~0.36 l of methane produced per gm of solids destroyed in animal manure.

Algae

Results of the experiments in the 60 l IBR are summarized in Table 1. It can be seen that the IBR can effectively digest algae and that addition of dairy waste appeared to improve the process. Though no statistics were run on this data, the results are encouraging indicating success digesting algae. These results were verified in the 3,800 l IBR (Table 2). The COD removal efficiency compares favorably with anaerobic digestion of manure that usually has ~50% removal of COD though AD. The high biogas yield with an HRT of 24 d and 100% algae is likely not accurate. It probably reflected the fact that the 24 d HRT experimental trials immediately followed the 10 HRT trials in the same IBR. There was likely a buildup of substrate from the 10 d HRT trials that was slowly broken down. Figure 1 shows that the biogas production for this trial fell off 4 days into the trial. Had the lower production rate been the rate throughout the trial, the biogas yield reported in Table 1 would have been less. However, the 24 d HRT is probably too long for algae as the IBR was able to handle excess substrate throughout the experiment without addition of pH control chemicals. More experimentation would have to done to find the best HRT. The COD removal efficiency particularly when dairy waste was added was very good. Interestingly, the removal efficiency was best when only 20% dairy waste was added compared to 50%. This may mean that too much dairy waste does not help the algae digestion process.

Results of experiments in the 3,800 l IBR's are shown in Table 2. Data taken during the time frame August through November 2011 is reported because: 1) Steady state operation was reached based on consistency of COD and solids removal (Figure 2). 2) Sampling and data analysis was consistently done daily except weekends and included COD, total solids, temperature and pH. 3) Supply of algae to the digester before that time period had been inconsistent because of difficulties separating algae from lagoon water. Dissolved air flotation with aluminum sulfate addition was used to separate the algae. This was not part of our experimental plan and the data on the separation process were not available to report here. However it can be noted that the addition of aluminum sulfate ($Al_2(SO_4)_3$) used to help separate algae did not appear to affect the AD process. It was reported that dosage changed over the time period to optimize algae removal, but the amount of aluminum sulfate added was not known. The operators guessed aluminum sulfate residual in the algae below 100 ppm. COD removal was quite consistent (Figure 2) and appeared to increase a little toward the end of the sampling period. The digester started operation in June, 2011 treating algae, but the algae supply was sporadic until the first of August and remained so through November when the supply was reduced with colder weather. Algal growth in the lagoons diminished with decreasing temperature. This explains why the HRT increased later in the summer (Table 2). The temperature in both IBR's was consistent at 37.2°C (99°F) during the trials and the pH was consistently ≥7.2. This pH is considered optimal and thus pH was believed to not be a factor affecting IBR efficiency. December 1, 2011, the IBR's were shut down again because it was not possible to harvest algae from the lagoon in the extremely cold weather and difficult to grind, store and feed food wastes.

The data in the Tables shows that algae can be anaerobically digested without any additional chemicals or substrates. However when food waste was added, the COD removal increased as was expected. Although the IBR typically handles much more throughput than was available for these experiments, it is noted that COD removal efficiency increased with longer HRT. This may actually be due to the IBR becoming increasingly more acclimated to the algae. Additional experiments would have to run to determine if the longer HRT is beneficial to breakdown of algae. It would be good to conduct more experiments in the larger IBR's digesting mostly algae with 20% added food waste and a much shorter HRT.

February 10, 2012

Table 1. Data taken during June and July, 2011 for 60 l IBR fed algae and dairy waste.

% algae/ % dairy waste	HRT[1] (d)	COD (g/l)		□ COD removal (%)	Solids (g/l)		VSS[2] (g/l)		Biogas produced (l/d)	Biogas yield (l/g of COD loaded)	COD removal efficiency (%)
		in	out		in	out	in	out			
100/0	10	24.7	16.8	~32	21.7	18	7.5	4	34.7	0.23	32.0
100/0	24	24.7	13.6	~45	21.7	13.5	7.5	1.5	22.7	0.37	44.9
50/50	24	62.7	24.2	~61	nm[3]	nm	nm	nm	37.44	0.24	61.4
80/20	24	33.5	8.3	~75	nm	nm	nm	nm	24.5	0.29	75.2

[1]Hydraulic retention time
[2]Volatile suspended solids
[3]Not measured

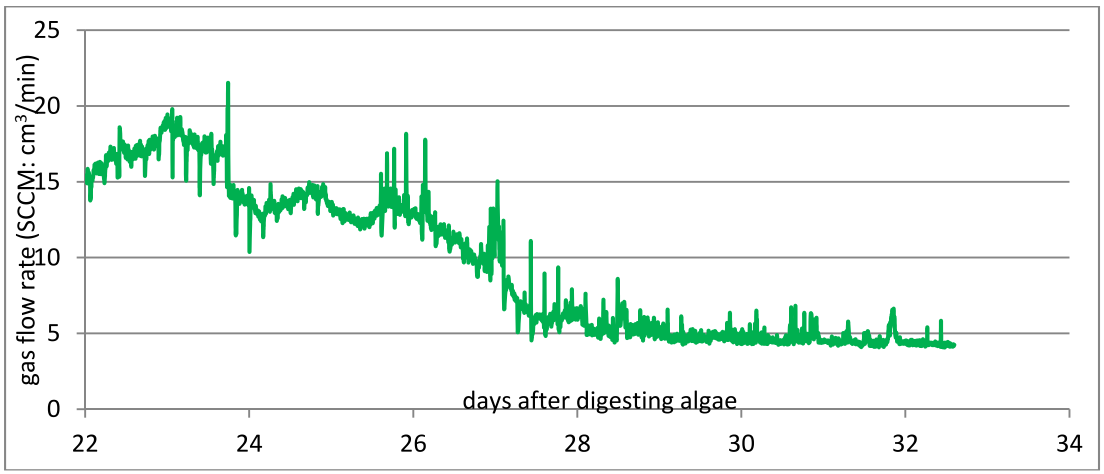

Fig 1 Biogas production at days 22 -33 in the 60 l IBR. The HRT when this data was taken was24 days).

February 10, 2012

Table 2. Data taken during July – December, 2011 for 3,800 l IBR's at Logan lagoons

% algae/ % food waste	Dates of operation	HRT[1] (d)	COD[2] (g/l)		□ COD removal (%)	Solids (g/l)		□ TS removal (%)	Soluble Phosphorus (mg/l)	Total Nitrogen (mg/l)
			in	out		in	out			
100/0	1 Aug – 15 Sept	24.3	16	10.9	~32	16.5	9.9	~40	2.54	182.6
100/0	16 Sept – 1 Dec	38.7	10.9	4.1	~62.5	12.5	5.9	~ 52	1.61	124.5
0/100	9 Aug – 22 Sept	39	27	3.8	~86	ID[3]	ID	-	3.38	140

[1]Hydraulic retention time
[2]Chemical oxygen demand
[3]Insufficient data

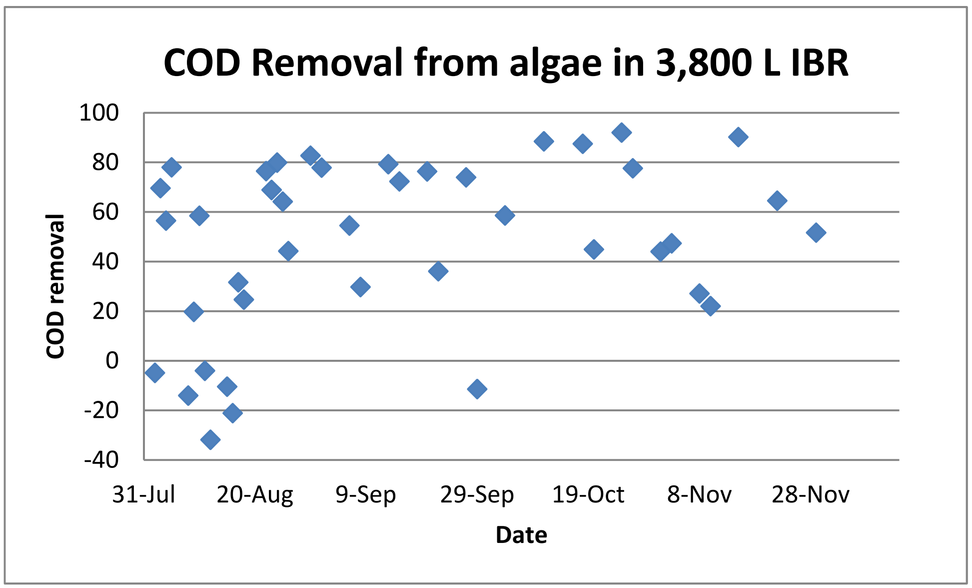

Figure 2. Chemical oxygen demand removal from algae fed to the 3,800 l IBR during the time period August through November, 2011.

Appendix F

COST ESTIMATES

Logan City
Alternative 1 - Bio-Domes with Tertiary Treatment and Dewatering
18 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1.0	$ 7,000,000	$ 7,000,000
Site Preload	CY	100,000	1.0	$ 10	$ 1,000,000
Influent Trunk Line	LF	0	1.0	$ 140	$ -
Headworks					
New Headworks Building	SF	0	1.0	$ 300	$ -
Screening Equipment (Screen and wash press)	EA	3	1.6	$ 150,000	$ 720,000
Grit Removal Equipment	EA	0	1.6	$ 112,000	$ -
Bio-Domes					
Bio-Domes	EA	18,000	1.3	$ 3,000	$ 70,200,000
Air Hose for Bio-Domes	LF	7,920,000	1.3	$ 1	$ 10,296,000
Lagoon Cover	AC	64	1.3	$ 100,000	$ 8,320,000
Blower Building	SF	4,000	1.0	$ 300	$ 1,200,000
Blowers	EA	4	1.6	$ 400,000	$ 2,560,000
Air Piping	LF	3,500	1.6	$ 150	$ 840,000
Air Valves	LS	1	1.0	$ 500,000	$ 500,000
Tertiary Nitrogen Removal					
Deep Bed Sand Filters	SF	12,000	1.0	$ 500	$ 6,000,000
Chemical Storage & Feed Equipment	LS	1	1.6	$ 400,000	$ 640,000
Building	SF	20,000	1.0	$ 300	$ 6,000,000
Emergency Generator					
Electrical Switchgear Building	SF	2,500	1.0	$ 300	$ 750,000
Back-up Generator	EA	1	1.6	$ 350,000	$ 560,000
Tertiary P Removal/Disinfection Building					
Filtration/Disinfection Building	SF	18,000	1.0	$ 350	$ 6,300,000
Solids Contact Clarifiers	EA	4	1.6	$ 750,000	$ 4,800,000
Filter Equipment	EA	6	1.6	$ 450,000	$ 4,320,000
UV Equipment	EA	4	1.6	$ 162,000	$ 1,037,000
Parshall Flume	EA	1	1.6	$ 15,000	$ 24,000
Post Aeration	EA	2	1.6	$ 22,000	$ 70,000
Alum Storage/Feed Equip	LS	1	1.6	$ 75,000	$ 120,000
Utility Water Pumps	EA	3	1.6	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1.0	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1.6	$ 300,000	$ 960,000
Polymer System / Feed Pumps	LS	1	1.0	$ 240,000	$ 240,000
Dredge & Crane	LS	1	1.0	$ 500,000	$ 500,000
Waste Solids Holding Tank	EA	2	1.0	$ 400,000	$ 800,000
Operations Building					
Operations Building	SF	5,000	1.0	$ 250	$ 1,250,000
Process Lab	LS	1	1.0	$ 500,000	$ 500,000
Yard Piping	LS	1	1.0	$ 1,500,000	$ 1,500,000
Landscaping/Sitework/Paving	LS	1	1.0	$ 1,000,000	$ 1,000,000
SCADA System	LS	1	1.0	$ 1,000,000	$ 1,000,000
Electrical/Instrumentation	LS	1	1.0	$ 9,976,330	$ 9,976,000
Subtotal					**$ 152,495,000**
Contingency (25%)					$ 38,124,000
Escallation to Construction Mid-point					$ 9,150,000
Estimated Total Construction Cost (2016 dollars)					**$ 199,769,000**
Engineering, Legal & Admin					$ 27,968,000
Estimated Total Project Cost (2016 dollars)					**$ 227,737,000**

Operations & Maintenance Cost Estimate

Labor	$ 615,000
Benefits	$ 369,000
Tools/supplies	$ 120,000
Utilities	$ 278,000
Chemicals	$ 1,500,000
Laboratory	$ 300,000
Subtotal	$ 3,182,000
Misc Items (10%)	$ 318,000
Total estimated new O&M cost	**$ 3,500,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 5,950,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$21,258,000

Logan City
Alternative 2 - 3 Stage Bardenpho Bioreactor
18 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1.0	$ 3,500,000	$ 3,500,000
Influent Trunk Line	LF	15,000	1.0	$ 140	$ 2,100,000
Headworks					
New Headworks Building	SF	5,000	1.0	$ 300	$ 1,500,000
Screening Equipment (Screen and wash press)	EA	3	1.6	$ 150,000	$ 720,000
Grit Removal Equipment	EA	3	1.6	$ 112,000	$ 538,000
Influent Pump Station/ Equalization	LS	1	1.0	$ 2,300,000	$ 2,300,000
Odor control	LS	1	1.6	$ 450,000	$ 720,000
New Influent Pumps	EA	9	1.6	$ 30,000	$ 432,000
Bioreactors					
Bioreactor Concrete	EA	3	1.0	$ 4,000,000	$ 12,000,000
Bioreactor Aerators & Enclosures	EA	3	1.6	$ 525,000	$ 2,520,000
Bioreactor Mixers, Gates	EA	3	1.6	$ 450,000	$ 2,160,000
Electrical Buildings	EA	2	1.0	$ 400,000	$ 800,000
Clarifiers					
Clarifier with Dome	EA	6	1.0	$ 875,000	$ 5,250,000
Splitter Structure/Scum Pit	EA	3	1.0	$ 150,000	$ 450,000
RAS Building	EA	1	1.0	$ 800,000	$ 800,000
RAS Pumps	EA	6	1.6	$ 30,000	$ 288,000
WAS Pumps	EA	2	1.6	$ 15,000	$ 48,000
Emergency Generator					
Electrical Switchgear Building	SF	3,200	1.0	$ 300	$ 960,000
Back-up Generator	EA	2	1.6	$ 350,000	$ 1,120,000
Filtration/Disinfection Building					
Filtration/Disinfection Building	LS	1	1.0	$ 3,500,000	$ 3,500,000
Filter Equipment	EA	6	1.6	$ 450,000	$ 4,320,000
UV Equipment	EA	4	1.6	$ 162,000	$ 1,037,000
Parshall Flume	EA	1	1.6	$ 15,000	$ 24,000
Post Aeration	EA	2	1.6	$ 22,000	$ 70,000
Alum Storage/Feed Equip	LS	1	1.6	$ 75,000	$ 120,000
Utility Water Pumps	EA	3	1.6	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1.0	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1.6	$ 300,000	$ 960,000
Polymer System / Feed Pumps	LS	1	1.0	$ 240,000	$ 240,000
Waste Solids Holding Tank	EA	2	1.0	$ 400,000	$ 800,000
Operations Building					
Operations Building	SF	5,000	1.0	$ 250	$ 1,250,000
Process Lab	LS	1	1.0	$ 500,000	$ 500,000
Yard Piping	LS	1	1.0	$ 3,000,000	$ 3,000,000
Landscaping/Sitework/Paving	LS	1	1.0	$ 2,000,000	$ 2,000,000
SCADA System	LS	1	1.0	$ 2,000,000	$ 2,000,000
Electrical/Instrumentation	LS	1	1.0	$ 11,000,000	$ 11,000,000
Subtotal					**$ 70,539,000**
Contingency (25%)					$ 17,635,000
Escallation to Construction Mid-point					$ 5,535,000
Estimated Total Construction Cost (2016 dollars)					**$ 93,709,000**
CMS, Legal & Admin					$ 7,914,000
Subtotal - Plant Construction (2016 dollars)					**$ 101,623,000**
City Funded Upfront Costs					
Land Acquisition					$ 1,000,000
Engineering					$ 5,000,000
Site Preload Construction					$ 4,000,000
Estimated Total Project Cost (2016 dollars)					**$ 111,623,000**

Operations & Maintenance Cost Estimate

Labor	$ 615,000
Benefits	$ 369,000
Tools/supplies	$ 120,000
Utilities	$ 835,000
Chemicals	$ 100,000
Laboratory	$ 300,000
Subtotal	$ 2,339,000
Misc Items (10%)	$ 234,000
Total estimated new O&M cost	**$ 2,573,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 5,023,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$11,854,000

Logan City
Alternative 3 - Algae Treatment
18 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1-Jan-1900	$ 7,000,000	$ 7,000,000
Site Work	CY	2,750,000	1-Jan-1900	$ 8	$ 22,000,000
Influent Trunk Line	LF	0	1-Jan-1900	$ 140	$ -
Headworks					
New Headworks Building	SF	5,000	1-Jan-1900	$ 300	$ 1,500,000
Screening Equipment (Screen and wash press)	EA	3	1-Jan-1900	$ 150,000	$ 720,000
Grit Removal Equipment	EA	3	1-Jan-1900	$ 112,000	$ 538,000
Algaewheel					
Primary Clarifiers & Sludge Pump	EA	6	1-Jan-1900	$ 875,000	$ 5,250,000
Algaewheel Concrete/Greenhouse	CY	250,000	1-Jan-1900	$ 250	$ 62,500,000
Algaewheel equipment	LS	1	1-Jan-1900	$ 18,000,000	$ 23,400,000
Emergency Generator					
Electrical Switchgear Building	SF	3,200	1-Jan-1900	$ 300	$ 960,000
Back-up Generator	EA	2	1-Jan-1900	$ 350,000	$ 1,120,000
Filtration/Disinfection Building					
Filtration/Disinfection Building	LS	1	1-Jan-1900	$ 3,500,000	$ 3,500,000
Filter Equipment	EA	6	1-Jan-1900	$ 450,000	$ 4,320,000
UV Equipment	EA	4	1-Jan-1900	$ 162,000	$ 1,037,000
Parshall Flume	EA	1	1-Jan-1900	$ 15,000	$ 24,000
Post Aeration	EA	2	1-Jan-1900	$ 22,000	$ 70,000
Utility Water Pumps	EA	3	1-Jan-1900	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1-Jan-1900	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1-Jan-1900	$ 300,000	$ 960,000
Polymer System / Feed Pumps	LS	1	1-Jan-1900	$ 240,000	$ 240,000
Waste Solids Holding Tank	EA	2	1-Jan-1900	$ 400,000	$ 800,000
Operations Building					
Operations Building	SF	5,000	1-Jan-1900	$ 250	$ 1,250,000
Process Lab	LS	1	1-Jan-1900	$ 500,000	$ 500,000
Yard Piping	LS	1	1-Jan-1900	$ 3,000,000	$ 3,000,000
SCADA System	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
Electrical/Instrumentation	LS	1	1-Jan-1900	$ 14,420,100	$ 14,420,000
Subtotal					**$ 158,621,000**
Contingency (25%)					$ 39,655,000
Escallation to Construction Mid-point					$ 11,897,000
Estimated Total Construction Cost (2016 dollars)					**$ 210,173,000**
Engineering, Legal & Admin					$ 29,424,000
Estimated Total Project Cost (2016 dollars)					**$ 239,597,000**

Operations & Maintenance Cost Estimate

Labor	$ 615,000
Benefits	$ 369,000
Tools/supplies	$ 120,000
Utilities	$ 209,000
Chemicals	$ -
Laboratory	$ 300,000
Subtotal	$ 1,613,000
Misc Items (10%)	$ 161,000
Total estimated new O&M cost	**$ 1,774,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 4,224,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$20,329,000

Logan City
Alternative 4 - Conventinal Activated Sludge with Nutrient Removal
18 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1-Jan-1900	$ 3,500,000	$ 3,500,000
Site Preload	CY	300,000	1-Jan-1900	$ 10	$ 3,000,000
Influent Trunk Line	LF	15,000	1-Jan-1900	$ 140	$ 2,100,000
Headworks					
New Headworks Building	SF	5,000	1-Jan-1900	$ 300	$ 1,500,000
Screening Equipment (Screen and wash press)	EA	3	1-Jan-1900	$ 150,000	$ 720,000
Grit Removal Equipment	EA	3	1-Jan-1900	$ 112,000	$ 538,000
Influent Pump Station/ Equalization	LS	1	1-Jan-1900	$ 2,300,000	$ 2,300,000
Odor control	LS	1	1-Jan-1900	$ 450,000	$ 720,000
New Influent Pumps	EA	9	1-Jan-1900	$ 30,000	$ 432,000
Aeration Basins					
Aeration Basin Concrete	EA	6	1-Jan-1900	$ 1,300,000	$ 7,800,000
Blower Building	SF	6,000	1-Jan-1900	$ 300	$ 1,800,000
Blowers	EA	4	1-Jan-1900	$ 350,000	$ 2,240,000
Air Piping & Valves	LS	6	1-Jan-1900	$ 250,000	$ 2,400,000
Diffusers	EA	6	1-Jan-1900	$ 300,000	$ 2,880,000
Mixers	LS	6	1-Jan-1900	$ 150,000	$ 1,440,000
ML Recycle Pumps	EA	12	1-Jan-1900	$ 40,000	$ 768,000
Clarifiers					
Clarifier with Dome	EA	6	1-Jan-1900	$ 875,000	$ 5,250,000
Splitter Structure/Scum Pit	EA	3	1-Jan-1900	$ 150,000	$ 450,000
RAS Building	EA	1	1-Jan-1900	$ 800,000	$ 800,000
RAS Pumps	EA	6	1-Jan-1900	$ 30,000	$ 288,000
WAS Pumps	EA	2	1-Jan-1900	$ 15,000	$ 48,000
Emergency Generator					
Electrical Switchgear Building	SF	3,200	1-Jan-1900	$ 300	$ 960,000
Back-up Generator	EA	2	1-Jan-1900	$ 350,000	$ 1,120,000
Filtration/Disinfection Building					
Filtration/Disinfection Building	LS	1	1-Jan-1900	$ 3,500,000	$ 3,500,000
Filter Equipment	EA	6	1-Jan-1900	$ 450,000	$ 4,320,000
UV Equipment	EA	4	1-Jan-1900	$ 162,000	$ 1,037,000
Parshall Flume	EA	1	1-Jan-1900	$ 15,000	$ 24,000
Post Aeration	EA	2	1-Jan-1900	$ 22,000	$ 70,000
Alum Storage/Feed Equip	LS	1	1-Jan-1900	$ 75,000	$ 120,000
Utility Water Pumps	EA	3	1-Jan-1900	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1-Jan-1900	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1-Jan-1900	$ 300,000	$ 960,000
Polymer System / Feed Pumps	LS	1	1-Jan-1900	$ 240,000	$ 240,000
Waste Solids Holding Tank	EA	2	1-Jan-1900	$ 400,000	$ 800,000
Primary Clarifiers & Sludge Pump	EA	6	1-Jan-1900	$ 875,000	$ 5,250,000
WAS Thickening	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
Digestion Mechanical Building	LS	1	1-Jan-1900	$ 4,500,000	$ 4,500,000
Digesters with Mixing	EA	4	1-Jan-1900	$ 1,250,000	$ 5,000,000
Operations Building					
Operations Building	SF	5,000	1-Jan-1900	$ 250	$ 1,250,000
Process Lab	LS	1	1-Jan-1900	$ 500,000	$ 500,000
Yard Piping	LS	1	1-Jan-1900	$ 3,000,000	$ 3,000,000
Landscaping/Sitework/Paving	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
SCADA System	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
Electrical/Instrumentation	LS	1	1-Jan-1900	$ 14,604,660	$ 14,605,000
Subtotal					**$ 95,742,000**
Contingency (25%)					$ 23,936,000
Escallation to Construction Mid-point					$ 7,181,000
Estimated Total Construction Cost (2016 dollars)					**$ 126,859,000**
Engineering, Legal & Admin					$ 17,760,000
Estimated Total Project Cost (2016 dollars)					**$ 144,619,000**

Operations & Maintenance Cost Estimate

Labor	$ 665,000
Benefits	$ 399,000
Tools/supplies	$ 160,000
Utilities	$ 900,000
Chemicals	$ 200,000
Laboratory	$ 350,000
Subtotal	$ 2,674,000
Misc Items (10%)	$ 267,000
Total estimated new O&M cost	**$ 2,941,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 5,391,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$15,112,000

Logan City
Hybrid Treatment with Dewatering and Reuse
12 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1.0	$ 2,500,000	$ 2,500,000
Site Preload	CY	300,000	1.0	$ 10	$ 3,000,000
Influent Trunk Line	LF	15,000	1.0	$ 140	$ 2,100,000
Headworks					
New Headworks Building	SF	5,000	1.0	$ 300	$ 1,500,000
Screening Equipment (Screen and wash press)	EA	2	1.6	$ 150,000	$ 480,000
Grit Removal Equipment	EA	2	1.6	$ 112,000	$ 358,000
Influent Pump Station/ Equalization	LS	1	1.0	$ 2,300,000	$ 2,300,000
Odor control	LS	1	1.6	$ 450,000	$ 720,000
New Influent Pumps	EA	6	1.6	$ 30,000	$ 288,000
Bioreactors					
Bioreactor Concrete	EA	2	1.0	$ 4,000,000	$ 8,000,000
Bioreactor Aerators & Enclosures	EA	2	1.6	$ 525,000	$ 1,680,000
Bioreactor Mixers, Gates	EA	2	1.6	$ 450,000	$ 1,440,000
Electrical Buildings	EA	1	1.0	$ 400,000	$ 400,000
Clarifiers					
Clarifier with Dome	EA	4	1.0	$ 875,000	$ 3,500,000
Splitter Structure/Scum Pit	EA	2	1.0	$ 150,000	$ 300,000
RAS Building	EA	1	1.0	$ 800,000	$ 800,000
RAS Pumps	EA	4	1.6	$ 30,000	$ 192,000
WAS Pumps	EA	2	1.6	$ 15,000	$ 48,000
Emergency Generator					
Electrical Switchgear Building	SF	3,200	1.0	$ 300	$ 960,000
Back-up Generator	EA	1	1.6	$ 350,000	$ 560,000
Filtration/Disinfection Building					
Filtration/Disinfection Building	LS	1	1.0	$ 2,500,000	$ 2,500,000
Filter Equipment	EA	4	1.6	$ 450,000	$ 2,880,000
UV Equipment	EA	3	1.6	$ 162,000	$ 778,000
Parshall Flume	EA	1	1.6	$ 15,000	$ 24,000
Post Aeration	EA	2	1.6	$ 22,000	$ 70,000
Alum Storage/Feed Equip	LS	1	1.6	$ 75,000	$ 120,000
Utility Water Pumps	EA	3	1.6	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1.0	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1.6	$ 175,000	$ 560,000
Polymer System / Feed Pumps	LS	1	1.0	$ 150,000	$ 150,000
Waste Solids Holding Tank	EA	1	1.0	$ 400,000	$ 400,000
Operations Building					
Operations Building	SF	5,000	1.0	$ 250	$ 1,250,000
Process Lab	LS	1	1.0	$ 500,000	$ 500,000
Yard Piping	LS	1	1.0	$ 2,000,000	$ 2,000,000
Landscaping/Sitework/Paving	LS	1	1.0	$ 1,500,000	$ 1,500,000
SCADA System	LS	1	1.0	$ 1,500,000	$ 1,500,000
Electrical/Instrumentation	LS	1	1.0	$ 8,436,600	$ 8,437,000
Reuse Facilities					
Storage Reervoir grading	CY	4,356,000	1.0	$ 4.00	$ 17,424,000
Storage Reservoir liner	SF	19,602,000	1.0	$ 0.50	$ 9,801,000
Distribution piping and Pumpstation	LS	1	1.0	$ 10,000,000	$ 10,000,000
Subtotal					**$ 92,532,000**
Contingency (25%)					$ 23,133,000
Estimated Total Construction Cost (2013 dollars)					**$ 115,665,000**
Land Acquisition	acre	4,100	1	$ 10,000	**$ 41,000,000**
Escallation to Construction Mid-point					$ 6,939,900
Engineering, Legal & Admin					$ 16,193,000
Estimated Total Project Cost (2016 dollars)					**$ 179,797,900**

Operations & Maintenance Cost Estimate

Labor	$ 565,000
Benefits	$ 339,000
Tools/supplies	$ 100,000
Utilities	$ 610,000
Chemicals	$ 450,000
Laboratory	$ 250,000
Subtotal	$ 2,314,000
Misc Items (10%)	$ 231,400
Total estimated new O&M cost	**$ 2,545,400**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 4,995,400**

Logan City
3 Stage Bardenpho Bioreactor with Energy Recovery
18 mgd
4-Oct-2013

Capital Costs (2013 dollars)

Item	Unit	Quantity	Installation Multiplier	Unit Price	Total
Mobilization/Demobilization	LS	1	1-Jan-1900	$ 3,500,000	$ 3,500,000
Site Preload	CY	300,000	1-Jan-1900	$ 10	$ 3,000,000
Influent Trunk Line	LF	15,000	1-Jan-1900	$ 140	$ 2,100,000
Headworks					
New Headworks Building	SF	5,000	1-Jan-1900	$ 300	$ 1,500,000
Screening Equipment (Screen and wash press)	EA	3	1-Jan-1900	$ 150,000	$ 720,000
Grit Removal Equipment	EA	3	1-Jan-1900	$ 112,000	$ 538,000
Influent Pump Station/ Equalization	LS	1	1-Jan-1900	$ 2,300,000	$ 2,300,000
Odor control	LS	1	1-Jan-1900	$ 450,000	$ 720,000
New Influent Pumps	EA	9	1-Jan-1900	$ 30,000	$ 432,000
Bioreactors					
Bioreactor Concrete	EA	3	1-Jan-1900	$ 4,000,000	$ 12,000,000
Bioreactor Aerators & Enclosures	EA	3	1-Jan-1900	$ 525,000	$ 2,520,000
Bioreactor Mixers, Gates	EA	3	1-Jan-1900	$ 450,000	$ 2,160,000
Electrical Buildings	EA	2	1-Jan-1900	$ 400,000	$ 800,000
Clarifiers					
Primary & Secondry Clarifiers	EA	12	1-Jan-1900	$ 875,000	$ 10,500,000
Splitter Structure/Scum Pit	EA	3	1-Jan-1900	$ 150,000	$ 450,000
RAS Building	EA	1	1-Jan-1900	$ 800,000	$ 800,000
RAS Pumps	EA	6	1-Jan-1900	$ 30,000	$ 288,000
WAS Pumps	EA	2	1-Jan-1900	$ 15,000	$ 48,000
Emergency Generator					
Electrical Switchgear Building	SF	3,200	1-Jan-1900	$ 300	$ 960,000
Back-up Generator	EA	2	1-Jan-1900	$ 350,000	$ 1,120,000
Filtration/Disinfection Building					
Filtration/Disinfection Building	LS	1	1-Jan-1900	$ 3,500,000	$ 3,500,000
Filter Equipment	EA	6	1-Jan-1900	$ 450,000	$ 4,320,000
UV Equipment	EA	4	1-Jan-1900	$ 162,000	$ 1,037,000
Parshall Flume	EA	1	1-Jan-1900	$ 15,000	$ 24,000
Post Aeration	EA	2	1-Jan-1900	$ 22,000	$ 70,000
Alum Storage/Feed Equip	LS	1	1-Jan-1900	$ 75,000	$ 120,000
Utility Water Pumps	EA	3	1-Jan-1900	$ 15,000	$ 72,000
Solids Processing					
Solids Processing Building	SF	4,800	1-Jan-1900	$ 300	$ 1,440,000
Solids Dewatering Equipment	EA	2	1-Jan-1900	$ 300,000	$ 960,000
Polymer System / Feed Pumps	LS	1	1-Jan-1900	$ 240,000	$ 240,000
Waste Solids Holding Tank	EA	2	1-Jan-1900	$ 400,000	$ 800,000
Energy Recovery					
WAS Thickening	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
Digestion Mechanical Building	LS	1	1-Jan-1900	$ 4,500,000	$ 4,500,000
Digesters with Mixing	EA	4	1-Jan-1900	$ 1,250,000	$ 5,000,000
Digestor Gas Conditioning	LS	1	1-Jan-1900	$ 2,500,000	$ 2,500,000
Cogeneration	LS	1	1-Jan-1900	$ 4,500,000	$ 4,500,000
Operations Building					
Operations Building	SF	5,000	1-Jan-1900	$ 250	$ 1,250,000
Process Lab	LS	1	1-Jan-1900	$ 500,000	$ 500,000
Yard Piping	LS	1	1-Jan-1900	$ 3,000,000	$ 3,000,000
Landscaping/Sitework/Paving	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
SCADA System	LS	1	1-Jan-1900	$ 2,000,000	$ 2,000,000
Electrical/Instrumentation	LS	1	1-Jan-1900	$ 15,532,020	$ 15,532,000
Subtotal					**$ 101,821,000**
Contingency (25%)					$ 25,455,000
Escallation to Construction Mid-point					$ 6,109,000
Estimated Total Construction Cost (2016 dollars)					**$ 127,276,000**
Engineering, Legal & Admin					$ 17,819,000
Estimated Total Project Cost (2016 dollars)					**$ 145,095,000**

Operations & Maintenance Cost Estimate

Labor	$ 715,000
Benefits	$ 429,000
Tools/supplies	$ 160,000
Utilities	$ 455,000
Chemicals	$ 200,000
Laboratory	$ 350,000
Subtotal	$ 2,309,000
Misc Items (10%)	$ 231,000
Total estimated new O&M cost	**$ 2,540,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M cost (2019 dollars)	**$ 4,990,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$14,743,000

Appendix G

ENVIRONMENTAL DATA

A Selective Reconnaissance-Level Survey of Architectural Resources for the Logan Wastewater Treatment Facility Project Logan, Cache, Utah

Prepared for Horrocks Engineers
Pleasant Grove, Utah

By

Peter Steele, M.A. RPA
Project Engineering Consultants, Ltd.
West Jordan, Utah

August 15, 2013

PLPCO Permit #232
Utah Antiquities Project Number U-13-ZP-0596

Abstract

Horrocks Engineers requested that Project Engineering Consultants undertake a selective reconnaissance-level survey of historic architectural resources within a 62.9 acre area of potential effects (APE) related to the Logan Wastewater Treatment Facility in Logan, Cache County, Utah. The results of the survey are presented in this report.

This project's APE for architectural resources consists of a 62.9 acre (25.45 hectare) parcel located between the Logan Wastewater Treatment Facility in the north, 200 North in the south, 2200 West in the east, and 2600 West in the west. The APE also constitutes the survey area, within which a selective reconnaissance-level survey of historic buildings was undertaken.

A total of one property, including two buildings constructed within the historic era (during or before 1963), was identified in the APE. This property, located at approximately 250 North 2300 West, is recommended ineligible for the National Register of Historic Places (NRHP) due to its substantial lack of integrity.

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List of Figures

Appendices

Introduction
Horrocks Engineers requested that Project Engineering Consultants undertake a selective reconnaissance-level survey of historic architectural resources within the area of potential effects (APE) of a 62.9 acre parcel related to the Logan Wastewater Treatment Facility. The results of the survey are presented in this report.

A survey of archaeological resources was also undertaken, the results of which are reported under the title, "*An Archaeological Resources Inventory of the Logan Wastewater Treatment Facility Project, Logan, Cache County, Utah*" (Steele 2013).

Area of Potential Effects and Survey Area
This project's APE for architectural resources consists of a 62.9 acre (25.45 hectare) parcel located between the Logan Wastewater Treatment Facility in the north, 200 North in the south, 2200 West in the east and 2600 West in the west (see Figure 1). The APE also constitutes the survey area, within which a selective reconnaissance-level survey of historic buildings was undertaken (see Figures 2 and 3).

The APE is entirely within the Logan City limits and is owned by Logan City. The area is entirely agricultural and is used for cattle grazing. The Wastewater Treatment Facility lies to the north (see Figure 1).

Previous Research
PEC completed a file search of the project area using Utah Division of State History (UDSH) records on August 2, 2013. No previous projects or previously recorded properties were found within the APE. No properties within the APE are currently listed on the NRHP.

Methods
Peter Steele, PEC Cultural Resource Director, conducted a selective reconnaissance-level historical architecture survey of the APE on August 5, 2013 following State Historic Preservation Office (SHPO) Standard Operating Procedures for Reconnaissance-Level Surveys. The survey was selective in that it omitted buildings estimated or known to have been built after 1963, the cutoff date for consideration under this project. The survey followed UDSH standards. Each property meeting the age standard was photographed using a digital camera at 300 dpi resolution. Notes on the architectural features and attributes as well as any historic outbuildings were taken. Dates were determined by evaluating architectural styles, examining historic photographs and maps, and speaking with property owners. This information will be entered into the UDSH online PreservationPro database after approval of this report.

Figure 1. Typical view of project area, looking northwest.

Historical Context
The first Euroamericans to enter the valley were fur trappers from French, British, and American expeditions in the early 1800s. By the 1820s, the valley was often being used by trappers and was the setting of a rendezvous between trappers and merchants. Permanent settlement by Euroamericans did not take place until 1855 when Mormon settlers under the direction of Brigham Young established a cattle ranch near the Blacksmith Fork River. The ranch was abandoned the next year after a severe winter, but other Mormon settlers entered the valley in the fall of 1856. Logan, along with other settlements, was established in 1859 as increasing numbers of pioneers entered the valley. The city continued to develop and became the principal city and center of Cache Valley (Peterson 1997).

Figure 2. Area of Potential Effects. 1-foot HRO Aerial Photography.

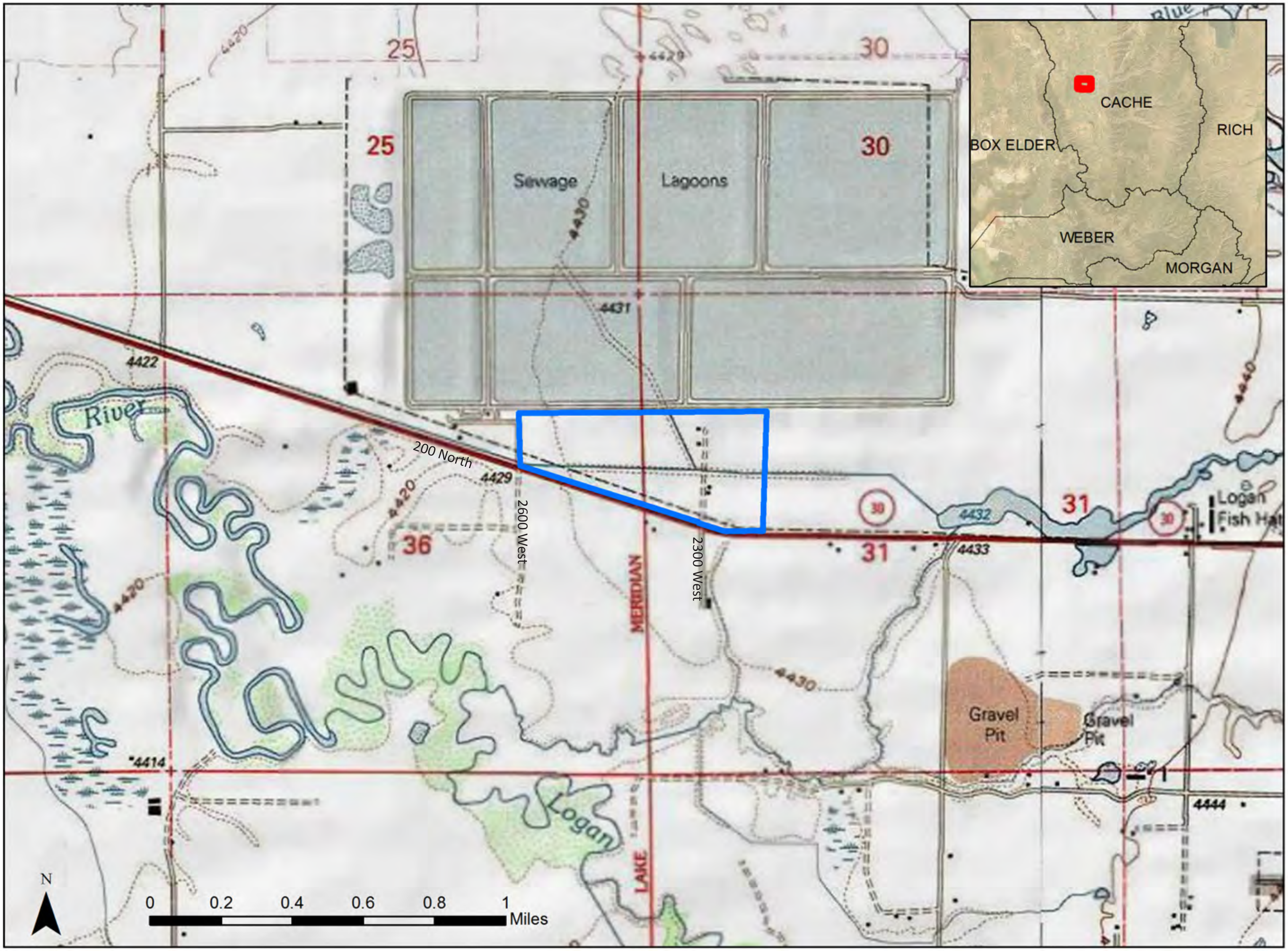


Figure 3. Area of Potential Effects. USGS 7.5' Topographic Maps Wellsville and Logan

Aerial photographs from 1937 show a possible barn north of the canal at 2300 West, and show the Cow Pasture Canal crossing the project area. USGS topographic maps from 1961 and 1962 show structures along 2300 West in the project area, as well as the canal.

Inventory Results and Evaluation

A total of one historic architectural property was identified through the selective reconnaissance-level survey. This property represents mid-twentieth-century, rural, agricultural development. A description of the building and an evaluation of its NRHP eligibility is provided below in the Survey Results section after a description of the criteria used to evaluate the eligibility of the properties.

Sections 36 CFR 800 and 36 CFR 60 (implementing regulations for the National Historic Preservation Act of 1966) and U.C.A. 9-8-404 (state Antiquities Act) establish the criteria under which all cultural resource sites, including historic buildings, are evaluated for eligibility for the NRHP. Sites are evaluated for integrity and significance.

The criteria which are evaluated to examine integrity of an historic property are location, design, setting, materials, workmanship, feeling, and association. There are also four significance criteria as follows. A property may be considered historic if it

A. is associated with events that have made a significant contribution to the broad patterns of our history; OR
B. is associated with the lives of persons significant in our past; OR
C. embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; OR
D. yielded, or may be likely to yield, information important in prehistory or history.

A property must have significance under one of these four criteria, and retain integrity in those areas which are related to its significance to be considered eligible for the NRHP.

Utah-Specific Evaluation Criteria for Buildings

The Historic Preservation Office of the Utah Department of State History has developed an evaluation system to assist in the documentation and evaluation of large numbers of buildings in a reconnaissance survey. Four ratings categories have been defined to determine the degree to which the structures retain integrity. These ratings categories are as follows:

ES. Eligible/Significant: built within the historic period and retains integrity; excellent example of a style or type; unaltered or only minor alterations or additions; individually eligible for the NRHP under criterion C; also includes buildings of known historical significance.

EC. Eligible: built within the historic period and retains integrity; good example of a style or type, but not as well-preserved or well-executed as “ES” buildings; more substantial alterations or additions than “ES” buildings, though overall integrity is retained; eligible for the NRHP as part of a potential historic district or primarily for historical, rather than architectural, reasons (which may not be known at the time of the RLS inventory).

NC. Ineligible: built during the historic period but has had major alterations or additions; no longer retains integrity.

OP. Out-of-Period: built after the historic period.

The Utah-specific evaluation criteria interact with the National Register criteria. A property with a UDSH rating of

ES is likely to be eligible under criteria A and C because it would have a higher degree of integrity or represent a rarer building type within the study area. A property with a UDSH rating of EC is likely to be eligible only under criterion A for association with broad patterns of history.

Because this survey was selective, out-of-period buildings were not recorded, and the rating of "OP" does not apply. Because the buildings within the survey area are mostly from the same time period, a strict standard of integrity was used to judge eligibility for the NRHP. The integrity of a historic building was assessed in the context of the neighborhood, including whether changes are common in the survey area; how well a style is represented in the area; and the degree to which a building has been altered, including changes to fenestration or siding that do not conform to the appearance of fenestration or siding in use in the historic period. Changes to the massing of a structure by altering the roofline, building an addition, or building an attached garage also negatively impact the integrity of a building.

Historic Boundaries

Historical property boundaries must be established to allow for a reasonable assessment of the effect of a project on historic resources. Publications by the National Park Service (Seifert et al. 1997, Southworth 1987) provide guidance on establishing such boundaries with the following recommendations:

- Select boundaries that encompass the entire resource, including both historical and modern additions. Include surrounding land historically associated with the resource that retains integrity and contributes to the property's historic significance.

- Use the legally recorded parcel number or lot lines for urban and suburban properties that retain their historical boundaries and integrity.

- For small rural properties, select boundaries that encompass significant resources, including out buildings and the associated setting.

- For larger rural properties, select boundaries that include fields, forests, and open rangeland that is historically associated with the property and conveys the property's historical setting. The areas must have integrity and contribute to the property's historical significance.

For this APE, the third bulleted item above applies. The area surveyed is part of a rural agricultural area with no defined lot lines. Therefore, the property boundary was drawn to encompass all significant resources.

Survey Results

One property 50 years old or older was documented as part of the reconnaissance-level survey of the Area of Potential Effects. This property, located at approximately 250 North 2300 West, is a one-and-one-half story Agricultural: Other building of unknown use, exhibiting Vernacular style. It is clad in wooden novelty drop siding, and rests on a timber foundation.

Figure 2. Property at 250 North 2300 West, view to northwest.

The interior was at one time clad in plaster and lathe although this has seriously deteriorated. Alterations are primarily due to neglect and include the collapse of a portion of the roof, the removal of windows and doors, and other damage. Although the building appears to be agricultural in nature, it could also have been used as a residence, or for another use. A nearby cattle pen and shed may be associated with this building and are considered a contributing outbuilding. The building has no associations with important events or persons in national, state, or local history. It is not a good example of a style or type, and is unlikely to reveal any information if further investigated. PEC recommends that this building receive an non-contributing UDSH rating, and be considered **Not Eligible** for the NRHP. Appendix A contains maps showing the location of the property.

Summary and Recommendation

The single property recorded is an historical agricultural building representing the World War II to Post-World War II Era.

The property has been substantially modifiied through deterioration of the structure. PEC recommends that it receive a non-contributing UDSH rating and be considered Not Eligible for the NRHP. Because the property is recommended **Not Eligible**, any proposed project would result in a finding of **No Historic Properties Affected** for architectural resources.

References

Peterson, F. Ross
    1997 *A History of Cache County*. Utah State Historical Society, Salt Lake City.

Seifert, Donna, Barbara Little, Beth Savage, and John Sprinkle, Jr.
    1997 *National Register Bulletin 21: Defining Boundaries for National Register Properties.* National Park Service, Washington, D.C.

Southworth, Don
    1987 *Defining Boundaries for National Register Properties*. U.S. Department of the Interior, National Park Service, Washington, D.C.

Steele, Peter
    2013 *An Archaeological Resources Inventory for the Logan Wastewater Treatment Facility Project, Logan, Cache County, Utah.* Project Engineering Consultants, West Jordan, Utah.

Appendix A: Survey Results Maps

Figure A1. Results of Survey.

Appendix B:
Site Forms and Photos

HISTORIC SITE FORM

(3/12)

UTAH OFFICE OF HISTORIC PRESERVATION

For Section 106 Review Only

(This form does not replace the consultation letter or determination of eligibility/finding of effect)

1 IDENTIFICATION

Name of Property/Current Owner: Logan City
Address: Approximately 250 North 2300 West
City, County: Logan, Cache County
Tax Number: 05-057-0001
Legal Description (include acreage):

Twnshp: 12N *Range:* 1E *Section:* 31
Latitude/Longitude:
106 Case #:
Agency Project #:

2 STATUS/USE

Property Category
X *building(s)*
__ *structure*
__ *site*
__ *object*

Evaluation
__ *eligible/contributing*
X *ineligible/non-contributing*
__ *out-of-period*

Use (based on RLS data options)
Original Use: Agricultural
Current Use: Vacant

3 DOCUMENTATION

Photos: Dates
X *CD-Rom/prints:*
__ *historic:*

Drawings and Plans
__ *site sketch map*
__ *other:*

Research Sources (check all sources consulted, whether useful or not)
X *abstract of title*
__ *tax card & photo*
__ *building permit*
X *Sanborn Maps*
__ *other:*

4 ARCHITECTURAL DESCRIPTION (based on RLS data options)

Date of Construction: c. 1950
No. of Stories: 1.5
Building Type: Agricultural: Other
Building Style: Vernacular
Foundation Material: Wood
Wall Material(s): Wooden Novelty Drop Siding
Additions: X *none* __ *minor* __ *major (describe below)*
Alterations: __ *none* __ *minor* X *major (describe below)*
No. of contributing outbuildings and/or structures: 1
No. of non-contributing outbuildings and/or structures: 0

Briefly describe the principal building additions or alterations and their dates, and associated outbuildings and structures.

This property, located at approximately 250 North 2300 West, is one-and-one-half story Agricultural: Other building of unknown use, exhibiting Vernacular style. It is clad in wooden novelty drop siding and rests on a timber foundation. The interior was at one time clad in plaster and lathe although this has now seriously deteriorated. Alterations are primarily due to neglect and include the collapse of a portion of the roof, the removal of windows and doors, and other damage. A nearby cattle pen and shed may be associated with this building and are considered a contributing outbuilding.

5 HISTORY/PROPOSED ACTION

Describe the impending action (e.g., road widening, rehabilitation, alteration, demolition). Additional historical information is optional.

The proposed action may expand the Logan Wastewater Treatment Plant, which could lead to demolition of the building.

Researcher/Organization: Peter Steele/PEC, Inc.

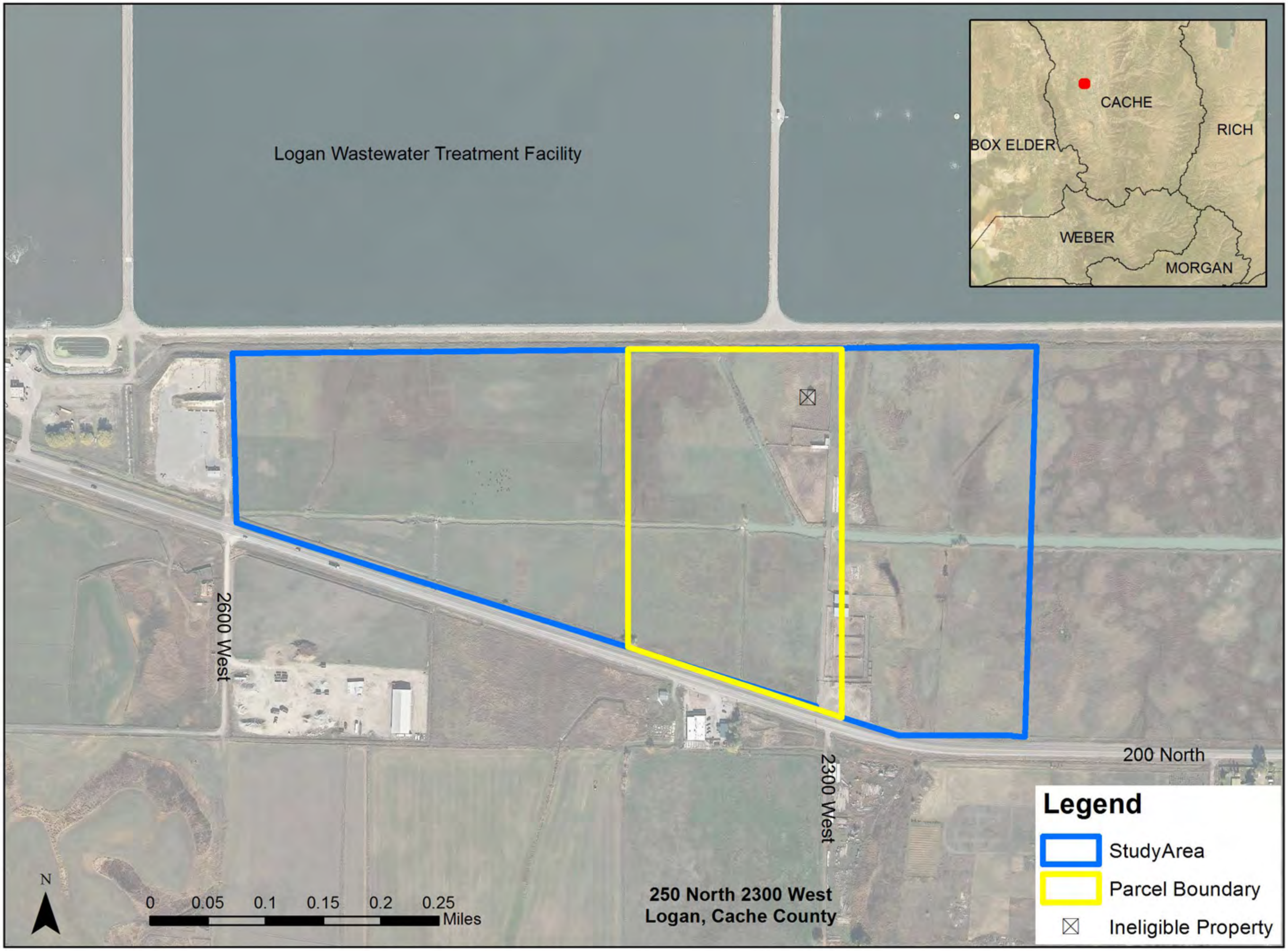
Documentation Date (mo/yr): 7/2013


250 North 2300 West, view to the north.


250 North 2300 West, view to the southeast.


250 North 2300 East - Cattle Sheds, view to northwest.


250 North 2300 East - Cattle Sheds, view to west.



Logan Wastewater Treatment Facility
CACHE
RICH
BOX ELDER
WEBER
MORGAN
2600 West
2300 West
200 North
Legend
StudyArea
Parcel Boundary
Ineligible Property
N
0
0.05
0.1
0.15
0.2
0.25
Miles
250 North 2300 West
Logan, Cache County

COVER PAGE
Must Accompany All Project Reports
Submitted to Utah SHPO

Project Name: Logan Wastewater Facility

State Proj. No.: U13ZP0596

Report Date: 8/14/13

County(ies): Cache

Principal Investigator: Peter Steele

Field Supervisor(s): Peter Steele

Record search completed at what office(s)? PreservationPro

Record search date(s): 8/2/13

Area surveyed - Intensive *(<15 m intervals):* 63 **acres** **Recon/Intuitive** *(>15 m intervals):* 0 **acres**

7.5' Series USGS Map Reference(s): Logan, Wellsville

SITES REPORTED	**COUNT / SMITHSONIAN SITE NUMBERS**	
Archaeological Sites		
Revisits (no inventory form update)	0	
Update (updated IMACS site inventory form attached)	0	
New Recordings (IMACS site inventory form attached)	1	42CA178
Total Count of Archaeological Sites	1	
Historic Structures (USHS 106 site info form attached)	1	
Total National Register Eligible Sites	0	

Checklist of Required Items, attached

1. ☑ **1 Copy of the final report**
2. ☑ **Copy of 7.5' Series USGS map with surveyed/excavated area clearly identified**
3. **Completed IMACS site inventory forms,**
   - ☑ **Parts A and B or C,**
   - ☐ **the IMACS Encoding Form,**
   - ☑ **Site Sketch Map,**
   - ☑ **Photographs, and**
   - ☑ **Copy of the appropriate 7.5' Series USGS map w/ site location marked and Smithsonian site number clearly labeled**
4. ☑ **Completed "Cover Page" accompanying final report and survey materials**

For UDSH office use only

An Archaeological Resource Investigation

of the Logan Wastewater Treatment Facility Project

Logan, Cache County, Utah

Prepared for

Horrocks Engineers

Pleasant Grove, Utah

by

Peter Steele, M.A., RPA

Project Engineering Consultants, Ltd.

West Jordan, Utah

14 August 2013

Utah Antiquities Project No. U-13-ZP-0596

Utah PLPCO Permit No. 232

Abstract

In July 2013, Horrocks Engineers contracted with Project Engineering Consultants (PEC) to conduct a cultural resources inventory of a 62.9 acre (25.45 hectares) parcel between 200 North and the Logan Wastewater Treatment Facility in Logan, Cache County, Utah. The area surveyed consisted of a block of land bordered by the boundary fence for the Treatment Facility in the north, by 200 North in the south, by 2600 West in the west, and by approximately 2200 West in the east. The project area has been disturbed by agricultural use, particularly with cattle grazing and associated structures. The document search and field survey resulted in the observation of one site: 42CA178. Site 42CA178, the Cow Pasture Canal, runs through the center of the parcel from east to west and includes several secondary canals and ditches as well as several features such as diversion structures and culverts. This site has not been previously recorded and was documented as a new site. One isolated occurrence, a ditch without connection to the Cow Pasture Canal or any other ditch or canal, was also recorded. This report contains the results of these investigations.

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Introduction

Project Engineering Consultants (PEC) has been contracted by Horrocks Engineers to prepare the cultural resources documentation needed to obtain a permit for impacts to wetlands south of the Logan Wastewater Treatment Facility. The area of potential effects (APE) pertaining to this project is an irregular parcel containing 62.9 acres (25.45 hectares) (see Figure 1). It lies between the boundary fence of the Treatment facility in the north and 200 North in the south, and between 2600 West in the west and approximately 2200 West in the East (see Figure 2). The project is located in Section 31 of Township 12 North, Range 1 East, and in Section 36 of Township 12 North, Range 1 West. An architectural survey was undertaken and is reported under a separate cover (see *A Selective Reconnaissance-Level Survey of Architectural Resources for the Logan Wastewater Treatment Facility Project*, Steele 2013).

Project Area Setting

The geographic setting for the project area is in the Cache Valley subdivision of the Middle Rocky region (Stokes 1977). Elevations in this location range from approximately 1,351 meters to 1,353 meters (4,432 feet to 4,440 feet) above sea level. The project area is at its highest in the east and descends very gradually to the west. Soils at this location have been somewhat disturbed and compromised through historic agricultural use (see Figure 1). The site showed evidence of recent use as pasture. Vegetation in the project area is made up primarily of grasses and forbs such as redroot pigweed (*Amaranthus retroflexus*), common teasel (*Dipsacus fullonum*), sowthistle (*Sonchus* sp.), and cheatgrass (*Bromus tectorum*), with wetland plants such as common reed (*Phragmites australis*) in wetter areas.

Figure 1. Overview of the project area, view to the northwest.

Historic Context

Relatively little evidence of paleoindian groups using the Cache Valley exists. The Fremont culture may have used the valley up until approximately 1300 AD, and following that period, the valley was used on a seasonal basis by nomadic, primarily Shoshonean, Native American groups. The first Euroamericans to enter the valley were fur trappers from French, British, and American expeditions in the early 1800s. By the 1820s, the valley was often used by fur trappers and was the setting of a rendezvous between trappers and merchants. Permanent settlement by Euroamericans did not take place until 1855 when Mormon settlers under the direction of Brigham Young established a cattle ranch near the Blacksmith Fork River. The ranch was abandoned the next year after a severe winter, but other Mormon settlers entered the valley in the fall of 1856. Logan, along with other settlements, was established in 1859 as increasing numbers of pioneers entered the valley. The city continued to develop and became the principal city and center of Cache Valley (Peterson 1997). Aerial photographs from 1937 show the Cow Pasture Canal and show a possible barn north of the canal at 2300 West. USGS topographic maps of the project area from 1961 and 1962 show structures along 2300 West as well as the canal.

Previous Research

A literature search was conducted August 2, 2013 on the Utah Division of State History's online database, PreservationPro to identify previously documented archaeological sites or areas of historic importance. The literature search found no previously filed cultural resource reports. No sites have been previously recorded. GLO

Figure 2. Project Area, 1-foot Aerial Photography

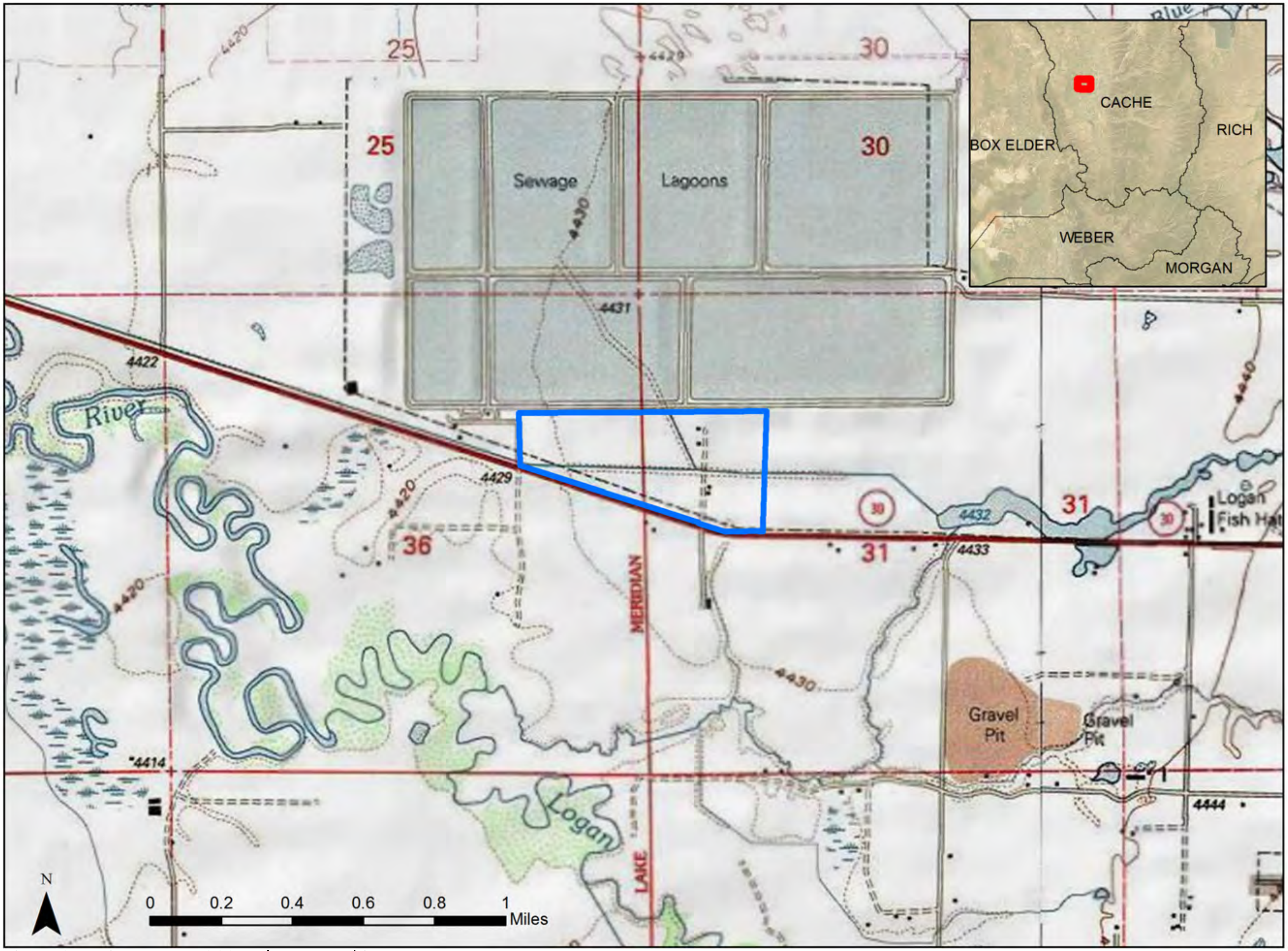


Figure 3. Project Area, USGS 7.5' Topographic Map Magna

plat maps from the Bureau of Land Management were reviewed, with maps from 1856, 1877, and 1908 available for the project area. The 1877 map shows 200 North, labeled as County Road, running near its present alignment. No other features are shown in or near the project area. The USGS 7.5' topographic maps for the Logan (1961) and Wellsville (1962) quadrangles showed 200 North, a dirt road leading to a structure at 2300 East, and Site 42CA178, a canal not named on the topographic map, crossing the project area.

Methods

Peter Steele, PEC Cultural Resources Director, conducted an intensive-level pedestrian inventory of the project area on August 5, 2013 (see Figures 2 and 3). The inventory was conducted according to U.S. Army Corps of Engineers (USACE) guidelines using a 15-meter survey transect throughout the project area (USACE 2011). Topographic maps, aerial photographs, a compass, and a GPS unit were used to confirm location of the survey area and transects. Sites were recorded according to USACE guidelines. Utah Professional Archaeological Council guidance was also considered for linear sites (UPAC 2008). Other cultural resources were recorded as isolated occurrences (IO).

Results

The survey identified one archaeological site in the project area, 42CA178, the Cow Pasture Canal (see map in Appendix A). One isolated occurrence, an earthen ditch with no connection to a larger network, was also identified.

42CA178

Site 42CA178 is the Cow Pasture Canal (see Figure 4). The canal is fed by a set of springs located approximately 1,126 meters (3,700 feet) east-southeast of the portion of the site recorded by this project, near the Logan Fish Hatchery. The canal runs to the west, eventually emptying into Cutler Reservoir near the confluence of the Little Bear and Logan Rivers, for a total distance of approximately 3.35 miles. In the area of the survey, the site includes the main canal, two secondary canals, and four earthen ditches. At one time, a branch of the canal (Canal 2 on the map in Appendix A) ran to the northwest, but the majority of this branch has been demolished or rerouted by construction of the Logan Wastewater Treatment Facility. Another branch is shown on topographic maps running east from the source area, then south along 1000 West. This portion of the site was not examined as part of this project. The canal company (the Logan Cow Pasture Water Company) was incorporated in 1902, and the canal was built shortly thereafter as part of a larger push to irrigate portions of Cache Valley (Cardon n.p.). It runs for approximately 3.34 miles between its source and Cutler Reservoir. The main canal consists of an earthen channel with somewhat irregular, vegetated banks (see Figure 4). It measures approximately 8 meters (26 feet) across at the top east of the diversion into Canal 3 (see Figure 6). West of Canal 3, the site measures 3.5 meters (12 feet) in width. Due to the large amount of water in the canal, the depth and bottom were not ascertained. The canal showed signs of recent dredging, showing that it is currently maintained. Other features of the canal, including two secondary canals, four earthen ditches, and eight irrigation-related features within the canals, are listed below:

Figure 4. Site 42CA178, Main Canal, view to the east.

Canal 2 - An earthen canal measuring 6 meters (20 feet) across the top, 3.5 meters (11.5 feet) across the bottom, and 1.5 meters (5 feet) deep (see Figure 5). It runs northwest from the main canal, with a short offshoot to the west at the fence line.


Figure 5. Site 42CA178, Canal 2, view to the northwest.


Figure 6. Site 42CA178, Canal 3, view to the south.


Figure 7. Site 42CA178, Ditch 3, view to the south.


Figure 8. Site 42CA178, Ditch 4 and Feature 1, view to the south.


Figure 9. Site 42CA178, Ditch 5, view to the southeast.


Figure 10. Site 42CA178, Feature 2, view to the east.


Figure 11. Site 42CA178, Feature 3, view to the east.


Figure 12. Site 42CA178, Feature 4, view to the northwest.


Figure 13. Site 42CA178, Main Canal, Feature 5, view to the west.


Figure 14. Site 42CA178, Feature 6, view to the southwest.


Figure 15. Site 42CA178, Feature 7, view to the north.


Figure 16. Site 42CA178, Feature 8, view to the south.

Canal 3 - An earthen canal measuring 2 meters (6.5 feet) across the top, with an unknown bottom width and depth due to water (see Figure 6). It runs south from the main canal just west of the junction with Canal 2. Water is diverted into the canal by a concrete and board diversion structure (see Feature 3 below).

Ditch 2 - An earthen ditch measuring 1.5 meters (5 feet) across, and 0.33 meters (1 foot) deep. It runs northeast from the main canal, just east of 2300 West.

Ditch 3 - An earthen ditch measuring 1.5 meters (5 feet) across the top, 0.75 meters (2.5 feet) across the bottom and 1 meter (3 feet) deep (see Figure 7). It runs south from a concrete and board diversion structure at approximately 2500 West.

Ditch 4 - An earthen ditch measuring 2.5 meters (8 feet) across the top, 1 meter (3 feet) across the bottom and 0.33 meters (1 foot) deep (see Figure 8). The ditch appears to carry overflow water from the Wastewater Treatment Facility into the main canal, although at the time of survey the ditch was dry.

Ditch 5 - An earthen ditch measuring 1.25 meters (4 feet) across the top, 0.5 meters (1.5 feet) across the bottom, and 0.75 meters (2.5 feet) deep (see Figure 9). It runs southeast from the main canal at 2600 West, paralleling 200 North. It also intersects Ditch 3 near 200 North.

Feature 1 - Feature 1 is the concrete headwall, wingwalls, and drain connecting Ditch 4 to the main canal (see Figure 8). It measures approximately 7 meters (22 feet) in length.

Feature 2 - Feature 2 is the square diversion structure, made of concrete and board, which diverts water from the main canal into Ditch 3 (see Figure 10). It also measures approximately 7 meters (22 feet) in both length and width. The diversion structure also causes a height difference in main canal from east to west, causing a drop off to the west.

Feature 3 - Feature 3 is the diversion structure, made of concrete and board, which diverts water from the main canal into Canal 3 (see Figure 11). The main canal narrows significantly after this feature. The feature measures 4 meters (13 feet) in width and 8 meters (27 feet) in length, and includes a concrete box and concrete wingwalls.

Feature 4 - Feature 4 is a corrugated metal culvert in Canal 3 (see Figure 12). Gravel and dirt have been poured around the culvert in order to create a vehicle crossing. The crossing is approximately 3 meters (10 feet) wide, and appears, from an examination of aerial photography, to have been placed within the last two years.

Feature 5 - Feature 5 is a single corrugated metal culvert carrying a dirt and gravel road (along the alignment of 2300 West) across the main canal (see Figure 13). Dirt and gravel have been placed around the culvert to create the driving surface. The width of the crossing is approximately 8.5 meters (28 feet).

Feature 6 - Feature 6 is a concrete channel of unknown purpose in Canal 2, north of Canal 2's junction with the main canal (see Figure 14). The feature was disturbed by a heavy growth of reeds, but appeared to form a kind of spillway. Measurements could not be taken.

Feature 7 - Feature 7 is a diversion structure made of concrete at the northwest end of Canal 2 (see Figure 15). Water can be channeled either into a narrow ditch paralleling the Wastewater Treatment Facility boundary fence on the south or into a larger ditch north of the fence. The structure measures 8 meters (26 feet) in width.

Feature 8 - Feature 8 is a concrete pipe with a metal cover on the south side of the main canal, east of 2300 West (see Figure 16). Its purpose appears to be to allow water into the adjacent pasture during times of high flow. The diameter of the pipe is approximately 0.33 meters (1 foot).

The Cow Pasture Canal retains good integrity. Maintenance of the canal is in harmony with its historic use and has not altered it to any great degree. The features, the diversions made of concrete and the corrugated metal culvert generally appeared to be in good repair and may be replacements of earlier structures. The canal was a late addition to the Cache Valley irrigation system and uses a small amount of spring water to irrigate approximately 1,800 acres (Kimball 1922). As such, it is not an important contributor to agricultural or other development of Logan or Cache County, and is not associated with other important trends or events in local, regional, or national history. It also has no association with important persons, does not represent a particular style or solve a difficult engineering problem in the area observed, and would not yield important information if excavated. It is recommended that the site be determined **not eligible** for the National Register of Historic Places.

Isolated Occurrence I

Isolated Occurrence I (Figure 17) consists of an earthen ditch running from 200 North, 212 meters (695 feet) east of 2300 West, north and northeast to a modern livestock watering area. The watering area consists of a tractor tire with a water tap creating a small pool. The ditch, which has no apparent connection to any other ditches or canals, may be a result of or an attempt to channel runoff water from this feature. The ditch measures 0.75 meters (2.5 feet) across and 0.33 meters (1 foot) deep.


Figure 17. Isolated Occurrence 1, view to the north.

Conclusion

The literature search conducted for this project identified no previously recorded archaeological sites in or near the project area APE. The intensive-level pedestrian survey noted one previously unrecorded site, 42CA178, as well as one isolated occurrence. PEC recommends that site 42CA178 be considered **not eligible** for the National Register of Historic Places.

Works Cited

Cardon, Wayne R.
Not Published Personal Communication to the Author, August 13, 2013.

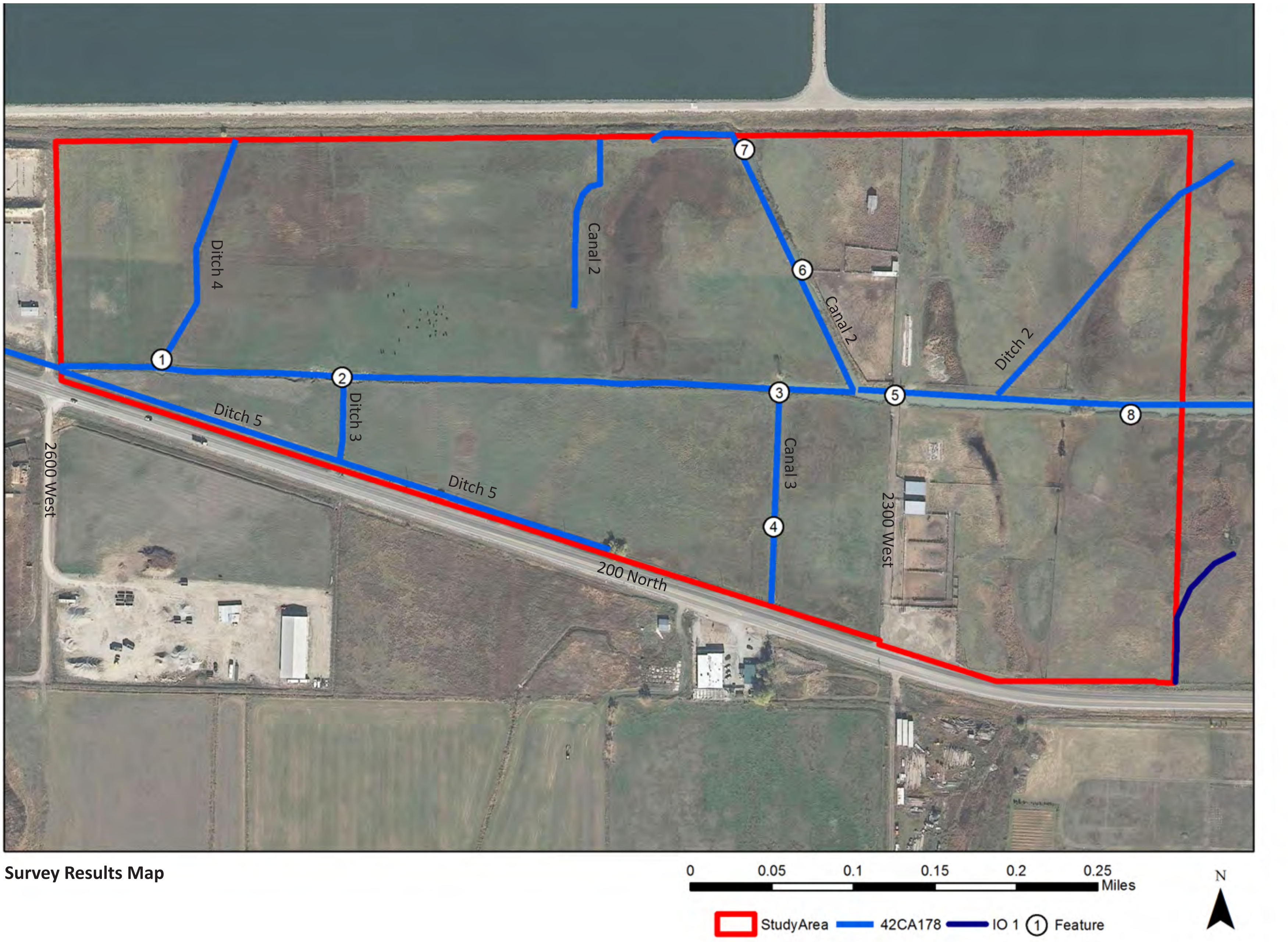
Kimball, James N.
1922 *In the District Court of the First Judicial District of the State of Utah in and for the County of Cache. Utah Power & Light Company vs. Richmond Irrigation Company : Final decree.* First District Court, Logan, Utah.

Peterson, F. Ross
1997 *A History of Cache County*. Utah State Historical Society, Salt Lake City.

United States Army Corps of Engineers (USACE)
2011 "Guidelines for Compliance with Section 106 of the National Historic Preservation Act ." U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Utah Professional Archaeological Council
2008 "Linear Sites: Guidance for Identifying and Recording under Section 106 of the National Historic Preservation Act."

Appendix A:
Survey Results Map



Survey Results Map

Appendix B:
Paleontological Clearance

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Utah Geological Survey

RICHARD G. ALLIS
State Geologist/Division Director

August 6, 2013

Peter Steele
Project Engineering Consultants
986 West 9000 South
West Jordan UT 84088

RE: Paleontological File Search and Recommendations for the Logan Wastewater Treatment Facility Project, Cache County, Utah
U.C.A. 79-3-508 compliance; literature search for paleontological specimens or sites

Dear Peter:

I have conducted a paleontological file search for the Logan Wastewater Treatment Facility Project in response to your email of August 6, 2013.

There are no paleontological localities recorded in our files for this project area. Quaternary and Recent alluvial deposits that are exposed here have a low potential for yielding significant fossil localities (PFYC 1 - 2). Unless fossils are discovered as a result of construction activities, this project should have no impact on paleontological resources.

If you have any questions, please call me at (801) 537-3311.

Sincerely,

Martha Hayden

Martha Hayden
Paleontological Assistant

1594 West North Temple, Suite 3110, PO Box 146100, Salt Lake City, UT 84114-6100
telephone (801) 537-3300 • facsimile (801) 537-3400 • TTY (801) 538-7458 • *geology.utah.gov*

UTAH DNR GEOLOGICAL SURVEY

IMACS SITE FORM

Part A - Administrative Data

INTERMOUNTAIN ANTIQUITIES COMPUTER SYSTEM
Form approved for use by
BLM - Utah, Idaho, Wyoming, Nevada
Division of State History - Utah, Wyoming
USFS - Intermountain Region
NPS - Utah, Wyoming

***1. State No:** 42CA000178
***2. Agency No:**
3. Temp. No: 42CA178

4. State Utah **County:** Cache

5. Project Logan Wastewater Treatment Facility

***6. Report No.** U13ZP0596

***7. Site Name / Property Name** Cow Pasture Canal

8. Class ☐ Prehistoric ☑ Historic ☐ Paleontologic ☐ Ethnographic

9. Site Type Canal

***10. Elevation** 4,440 **ft.**

***11. UTM Grid** 12 426033 **m E** 4621075 **m N**

***12.** NE **of** SE **of** NW **of Section** 31 **T.** 12 N **R.** 1 E

***13. Meridian** Salt Lake

***14. Map Reference** USGS 7.5' Wellsville and Logan

15. Aerial Photo

16. Location and Access

Site as recorded is located north of, and parallel to, 200 North in Logan, Utah between 2300 West and 2600 West. To access, follow gravel road at 2300 West north over fences; site passes under road 600 feet north of 200 West.

***17. Land Owner** Logan City

***18. Federal Administrative Units**

***19. Location of Curated Materials**

20. Site Description

Site 42CA178 is the Cow Pasture Canal. The canal is fed by a set of springs located approximately 1,126 meters (3,700 feet) east-southeast of the portion of the site recorded by this project, near the Logan Fish Hatchery. The canal runs to the west, eventually emptying into Cutler Reservoir near the confluence of the Little Bear and Logan Rivers, for a total distance of approximately 3.35 miles. Within the survey area, the site consists of the main canal, two secondary canal, and four ditches. At one time, a branch of the canal ran to the northwest, but the majority of this branch has been demolished or rerouted by construction of the Logan Wastewater Treatment Facility. Another branch is shown on topographic maps running east from the source area, then south along 1000 West. This portion of the site was not examined by this project. The canal company was incorporated in 1902 and the canal was constructed shortly thereafter as part of a larger push to irrigate portions of Cache Valley. It runs for approximately 3.34 miles between its source and Cutler Reservoir. The Canal consists of an earthen channel with somewhat irregular vegetated banks. It measures approximately 8 meters (26 feet) across at the top east of the diversion into Canal 3. West of Canal 3, the site measures 3.5 meters (12 feet) in width. Due to the large amount of water in the canal, the depth and bottom width were not ascertained. The canal showed signs of recent dredging, showing that it is currently maintained. Other features of the canal are listed below on continuation sheets and include two secondary canals, four earthen ditches, and eight irrigation-related features within the canals.

***21. Site Condition** Excellent

***22. Impact Agents** Canal is maintained, banks are affected by cattle grazing.

***23. National Register Status** Non-Significant

Justify The Cow Pasture Canal retains good integrity. Maintenance of the canal is in harmony with its historic use and has not altered it to any great degree. The features, including the diversion made of concrete and the corrugated metal culvert generally appeared to be in good repair, and may be replacements of earlier structures. The canal was a late addition to the Cache Valley irrigation system and uses a small amount of spring water to irrigate approximately 1,800 acres (Kimball 1922). As such, it is not an important contributor to agricultural or other development of Logan or Cache County, and is not associated with other important trends or events in local, regional, or national history. It also has no association with important persons, does not represent a particular style or solve a difficult engineering problem in the area observed, and would not yield important information if

* Encoded data items

IMACS SITE FORM

Part A - Administrative Data

***1. State No:** 42CA000178

24. Photos Attached

25. Recorded by Peter Steele

***26. Survey Organization** PEC ***28. Survey Date** 05-Aug-2013

27. Assisting Crew Members

List of Attachments

- [ ] Part B
- [x] Part C
- [ ] Rock Art Attachment
- [x] Topo Map
- [x] Site Sketch
- [x] Photos
- [ ] Artifact/Feature Sketch
- [x] Continuation Sheets
- [ ] Other:

Part A - Environmental Data

State No: 42CA000178

***29. Slope** 0 **(Degrees)** 272 **Aspect (Degrees)**

***30. Distance to Permanent Water** 11 **x 100 Meters**

***Type of Water Source** Spring/Seep

Name of Water Source

***31. Geographic Unit** Cache Valley

***32. Topographic Location** *- See Guide for additional information*

Primary Landform Valley

Secondary Landform Plain

Describe Site is located in Cache Valley, near the floodplain of the Logan River.

***33. On-site Depositional Context** Alluvial Plain (canyon, va

Describe Soil is composed primarily of Greenson loam, Airport-Salt Lake complex, Collett silty clay loam, and Logan silty clay loam.

***34. Vegetation**

a. Life Zone

Upper Sonoran

b. Community

Primary On-Site Wetland

Secondary On-Site Grassland

Surrounding Site Grassland

Describe Surrounding site consists primarily of pasture land. Vegetation includes grasses, pigweed, and common teasel. Wetland areas including common reed are also present along the edges of the site.

***35. Miscellaneous Text**

36. Comments/Continuations

Canal 2 - An earthen canal measuring 6 meters (20 feet) across the top, 3.5 meters (11.5 feet) across the bottom, and 1.5 meters (5 feet) deep. It runs northwest from the main canal, with a short offshoot to the west at the fence line.

Canal 3 - An earthen canal measuring 2 meters (6.5 feet) across the top, with an unknown bottom width and depth due to water. It runs south from the main canal just west of the junction with Canal 2. Water is diverted into the canal by a concrete and board diversion structure (see Feature 3 below).

Ditch 2 - An earthen ditch measuring 1.5 meters (5 feet) across, and 0.33 meters (1 foot) deep. It runs northeast from the main canal, just east of 2300 West.

Ditch 3 - An earthen ditch measuring 1.5 meters (5 feet) across the top, 0.75 meters (2.5 feet) across the bottom and 1 meter (3 feet) deep. It runs south from a concrete and board diversion structure at approximately 2500 West.

Ditch 4 - An earthen ditch measuring 2.5 meters (8 feet) across the top, 1 meter (3 feet) across the bottom and 0.33 meters (1 foot) deep. The ditch appears to carry overflow water from the Wastewater Treatment Facility into the main canal, although at the time of survey the ditch was dry.

Ditch 5 - An earthen ditch measuring 1.25 meters (4 feet) across the top, 0.5 meters (1.5 feet) across the bottom, and 0.75 meters (2.5 feet) deep. It runs southeast from the main canal at 2600 West, paralleling 200 North. It also intersects Ditch 3 near 200 North.

* Encoded data items

Part A - Environmental Data

State No: 42CA000178

Feature 1 - Feature 1 is the concrete headwall, wingwalls, and drain connecting Ditch 4 to the main canal. It measures approximately 7 meters (22 feet) in length.

Feature 2 - Feature 2 is the square diversion structure made of concrete and board which diverts water from the main canal into Ditch 3. It also measures approximately 7 meters (22 feet) in both length and width. The diversion structure also causes a height difference in main canal from east to west, causing a drop off to the west.

Feature 3 - Feature 3 is the diversion structure made of concrete and board which diverts water from the main canal into Canal 3. The main canal narrows significantly after this feature. The feature measures 4 meters (13 feet) in width and 8 meters (27 feet) in length, and includes a concrete box and concrete wingwalls.

Feature 4 - Feature 4 is a corrugated metal culvert in Canal 3. Gravel and dirt have been poured around the culvert in order to create a vehicle crossing. The crossing is approximately 3 meters (10 feet) wide, and appears, from an examination of aerial photography, to have been placed within the last two years.

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Feature 6 - Feature 6 is a concrete channel of unknown purpose in Canal 2, north of Canal 2's junction with the main canal. The feature was disturbed by a heavy growth of reeds, but appeared to form a kind of spillway. Measurements could not be taken.

Feature 7 - Feature 7 is a diversion structure made of concrete at the northwest end of Canal 2. Water can be channeled either into a narrow ditch paralleling the Wastewater Treatment Facility boundary fence on the south, or into a larger ditch north of the fence. The structure measures 8 meters (26 feet) in width.

Feature 8 - Feature 8 is a concrete pipe with a metal cover on the south side of the main canal, east of 2300 West. It's purpose appears to be to allow water into the adjacent pasture during times of high flow. The diameter of the pipe is approximately 0.33 meters (1 foot).

Part C - Historic Sites

Site No.(s) 42CA000178

42CA178

1. Site Type Canal

***2. Historic Themes** Farming/Ranching

	CULTURAL AFFILIATION	DATING METHOD	CULTURAL AFFILIATION	DATING METHOD
***3. Culture**	European/American	Documentary Sources		

Describe Site is an early 20th-century irrigation canal constructed by the Cow Pasture Water Company of Logan.

***4. Oldest Date** 1902 **Recent Date** 2013

How Determined Review of aerial photographs, documentary sources, and discussions with water company.

5. Site Dimensions 815 **m X** 8 **m** ***Area** 6,520 **sq. m**

***6. Surface Collection/Metho** None

Sampling Method N/A

***7. Estimated Depth of Cultural Fill** Surface

How Estimated Visual examination.

(If Tested, show location on site map)

***8. Excavation Status** Unexcavated

Testing Method None

***9. Summary of Artifacts and Debris** *(Refer to Guide for additional categories)*

Describe: No artifacts were found associated with the canal.

10. Ceramic Artifacts

Paste	Glaze/Slip	Decoration	Pattern	Vessel Form	Count

a. Estimated Number of Ceramic Trademarks

Describe:

Part C - Historic Sites

Site No.(s) 42CA000178

42CA178

11. Glass

Count	Manufacture	Color	Function	Trademark	Decoration
				0	
				0	
				0	
				0	
				0	
				0	

Describe:

12. Maximum Density - #/sq m (glass and ceramics)

13. Tin Can

Type	Opening	Size	Modified	Label/Mark	Function

Describe:

14. Landscape and Constructed Features (locate on site map)** ***- See Guide for additional categories

Canal		
Ditch		
Irrigation Features		

Describe: Site consists of one main and two secondary canals; four ditches; and eight concrete, metal, and board irrigation features, such as diversion structures.

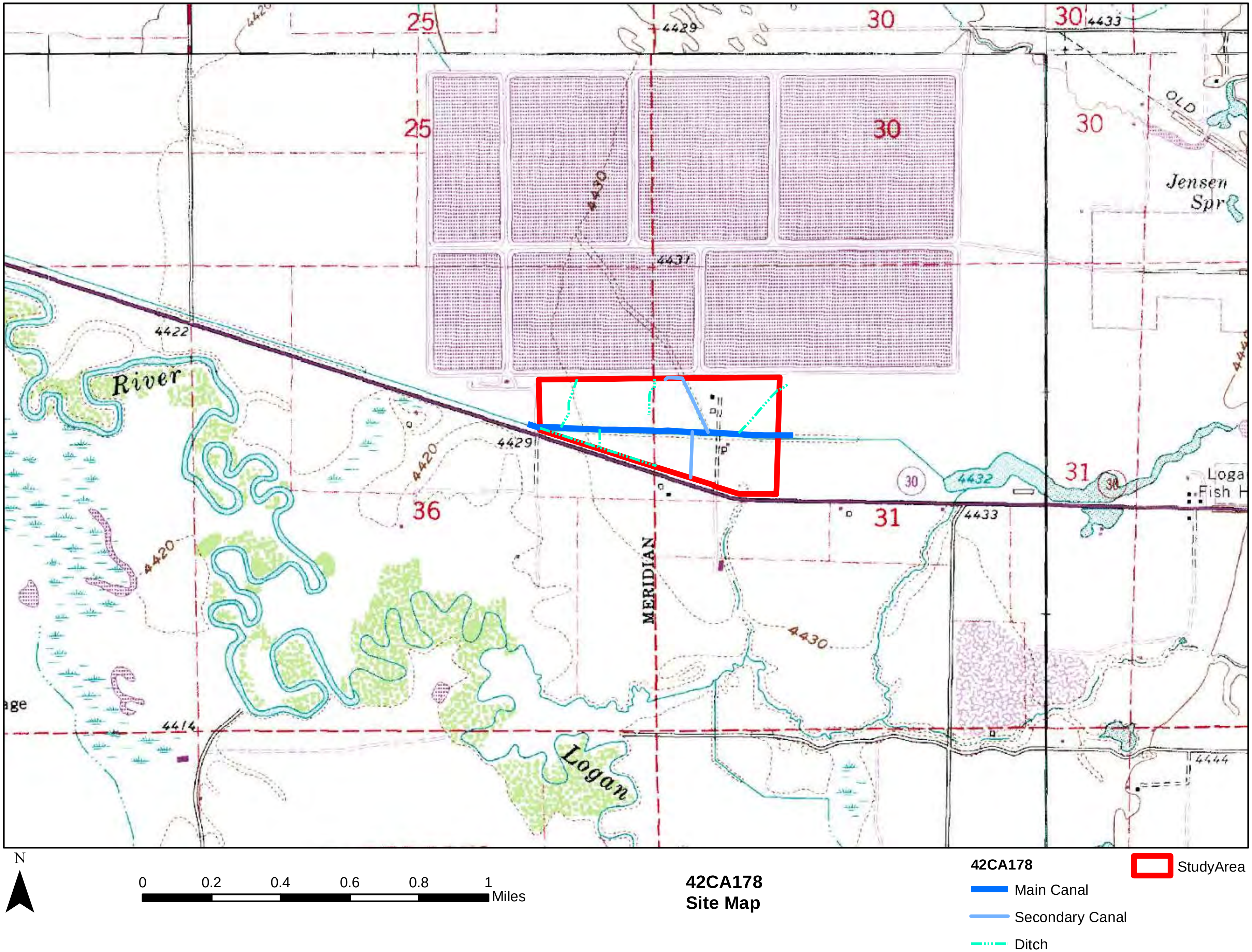
***15. Buildings and Structures (locate on site map)**

Count	Material	Type	Count	Material	Type

Describe:

16. Comments/Continuations - Please make note of any Historic Record searches performed *(County Records, General Land Office, Historic Society, Land Management Agency Records, Oral Histories/Interviews)*

Sources include 1937 Army aerial photography, 1922 court decision in Utah Power & Light v. Richmond Canal Company, and a discussion with Wayne R. Cardon of the Logan Cow Pasture Water Company.



42CA178
Site Map

Logan Wastewater Treatment Facility

Preliminary Wetland Mitigation and Monitoring Plan

August 2015

Applicant/Permittee:
Logan City
153 N 1400 W
Logan, UT 84321
(435) 716-9752
Contact Person: Issa A. Hamud
Issa.Hamud@loganutah.org

Preparer/Consultant:
Horrocks Engineers
2162 W Grove Parkway
Pleasant Grove, UT 84062
(801) 763-5184
Contact Person: Ryan Pitts
ryanp@horrocks.com

HORROCKS
ENGINEERS

Contributors

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Description of Proposed Compensatory Mitigation Project and Proposed Source of Compensatory Mitigation

Logan City is proposing to construct a new addition to an existing wastewater treatment facility and lagoon system in order to meet Environmental Protection Agency (EPA) and Utah Division of Water Quality (DWQ) water quality standards for water discharged from the facility. The existing facility is located at 600 North and 1900 West in Logan, Utah. The new facility will be constructed in the same location directly south of the Logan City sewer lagoons (Section 31, T12N, R1E and Section 36, T12N, R1W)(see Appendix A for site location map). The new facility will impact wetlands and other waters of the U.S. In anticipation of these impacts, Logan City has already created wetlands and is proposing to develop more wetlands at a City-owned wetland mitigation site. The proposed mitigation site is located west of 1900 West, approximately 0.8 miles southeast of the impact site. The City proposes to establish and preserve wetlands in that site to mitigate for wetland impacts associated with the construction of the proposed wastewater treatment facility.

Objectives

This mitigation plan follows the outline established in the 2015 Regional Compensatory Mitigation and Monitoring Guidelines for South Pacific Division USACE, which was developed from the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule, April 10, 2008. According to these documents, it is recommended that projects with impacts greater than 0.5 acre or greater than 300 linear feet of waters of the U.S. use an appropriate functional/conditional assessment method when determining mitigation ratios. Where an approved assessment method is not available (as is the case in Utah), the variables used to determine mitigation ratios need to be addressed. These factors addressing the proposed mitigation site in comparison to the impact site are listed below:

Compensatory Site Location:

The proposed mitigation site is approximately 0.8 mile to the southeast of the project impact site and is in the same watershed. Therefore, a higher mitigation ratio for the mitigation site being outside the project's watershed is not warranted.

Aquatic Resource Area:

Tables 1 through 3 depict the pre- and post-construction conditions at the impact site and the pre- and post-construction conditions at the mitigation site.

Impact Site

Table 1: Pre-Construction Conditions in the Impact Site

Pre-Construction Conditions						
Habitat Type	**Dominant Vegetation**	**Cowardin Classification**	**HGM**	**Hydrology**	**Acres**	**Linear Ft**
Wetland Waters of the U.S.						
Palustrine Emergent Wetland	Rushes, Sedges and Grasses	Palustrine Emergent	Depressional	Temporarily Flooded	21.83*	NA
Non-Wetland Waters of the U.S.						
Irrigation Canal (Cow Pasture Canal)	NA	NA	NA	Intermittent	1.65	2,720

*Approximately 7.05 acres estimated from site visit and aerial imagery

Table 2: Post-Construction Conditions in the Impact Site

Post-Construction Conditions			
Activity Causing the Impacts	**Duration of Impacts**	**Acres**	**Linear Feet**
Wetland Waters of the U.S.			
Location of new Facility	Permanent	10.14	NA
Pipeline Construction	Temporary	2.36*	NA
Non-Wetland Waters of the U.S.			
Location of new Facility	Permanent	0.645	1,794
	Total:	**13.145**	**1,794**

*Estimated from site visit and aerial imagery

Mitigation Site

Table 3: Pre- and Post-Construction Conditions in the Mitigation Site (for Permanent Impacts)

Pre-Construction Conditions	Post-Construction Conditions							
Habitat Type	Habitat Type	Vegetation	Hydrology	Mitigation Method	Acres	Linear Feet	Cowardin	HGM
Wetland Waters of the U.S.								
Freshwater Marsh	Freshwater Marsh	Cattails and Bulrushes	Permanently Flooded	EN	7.38	NA	PEMH	Depress -ional
Open Water	Emergent Wet Meadow	Sedges and Grasses	Saturated	EN	4.818	NA	PEMB	Depress -ional
Non-Wetland Waters of the U.S.								
Irrigation Canal	Irrigation Canal	NA	Intermittent	RE	0.645	1,794	NA	NA
Upland and Buffer Habitats								
Annual Grassland	Native Grassland	Native Grasses	Upland	EN	1.286	NA	NA	NA
				Total	**14.129**	**1,794**		

Table 4: Pre- and Post-Construction Conditions in the Impact Site (for Temporary Impacts)

Pre-Construction Conditions	Post-Construction Conditions							
Habitat Type	Habitat Type	Vegetation	Hydrology	Mitigation Method	Acres	Linear Feet	Cowardin	HGM
Wetland Waters of the U.S.								
Emergent Wetland	Emergent Wetland	Sedges and Grasses	Saturated	RE	2.36	NA	PEMH	Depress -ional
				Total	**2.36**			

Type Conversion:
The wetlands being impacted are classified as palustrine emergent, but they have been heavily grazed and hayed for many years, which has decreased their habitat quality. The type wetland proposed for the mitigation site is also palustrine emergent, which would result in development of in-kind compensatory mitigation.

Risk and Uncertainty of Compensatory Mitigation Success:
A natural source of hydrology is found on the mitigation site and the developed portion of the mitigation site currently able to support desirable hydrophytic vegetation. Given the wetlands the City has already been able to develop on the site, the risk or uncertainty of creating a successful mitigation site is negated.

Temporal Loss:
Since much of the City's previously developed mitigation site already supports high functioning wetland conditions, the delay of project's wetland impact functions being fully replaced will be minimal. The remaining wetlands being created at the mitigation site will be constructed concurrent with the project impacts.

Indirect Impacts:
There are no predictable indirect impacts associated with the construction of the sewer treatment facility. There is also a perceived benefit associated with the project because the project is being implemented to improve water quality in the watershed by replacing a substandard facility and treatment ponds.

Mitigation Site Selection Criteria
Justification for Divergence from Preference Hierarchy
Permittee-responsible mitigation without consideration of a watershed approach was chosen for the following reasons:
- no watershed plan is available for the area;
- the site is in close proximity and in the same watershed as the impacted areas;
- the site is already owned and maintained by Logan City (the applicant/permittee); and,
- the site can be easily deed restricted to prevent future impacts.

Landscape Setting and Position
The proposed mitigation site is located on sloped streamside terraces west of 1900 West near Logan City. The site is located on the western limits of the city in an area that is zoned for community commercial uses. Several community facilities lie within one mile of the proposed mitigation site including the Logan City sewer treatment facility and associated sewer lagoons, the landfill, and a fish hatchery. The site is within one mile of the Logan River and 3.5 miles of Cutler Reservoir and the Little Bear River. An unnamed perennial stream lies to the south and another lies to the west of the mitigation site. The stream serves as a tributary to the Logan River and is separated from the site by an upland buffer that averages 35-40 feet wide.

The site is bordered on the north by a vehicle salvage yard and on the east by 1900 West and the Logan City Landfill. The land immediately to the south and to the west of the site is composed of additional wetland mitigation areas. Beyond those areas the land to the southwest is largely undeveloped and utilized for agricultural purposes.

Site-Specific Information

Ownership Information

The proposed mitigation site is owned and maintained by Logan City and has been set aside specifically for the purpose of providing wetland mitigation. Logan City has owned the site for several years, and ownership and/or designated land use for site is not intended to change in the foreseeable future. The site was selected, in part, due to the ease of deed restricting the property to ensure the future preservation of the compensatory wetlands.

Hydrology Characteristics

As stated above, the proposed mitigation site lies just to the east of a small unnamed stream which serves as a tributary to the Logan River. An upland slope separates the site from the stream and the stream does not provide hydrology for the site. The site is located within a depression that has been excavated to intercept the water table, and as such the primary source of hydrology is ground water. It is also possible that natural springs may provide hydrology for the site, but the presence of such features has not been confirmed. The primary sources of hydrology, the local high water table and any naturally occurring springs, will remain unchanged after mitigation activities.

Soil Characteristics

The soil units occurring within the proposed mitigation site include: Cardon Silty Clay (Cd) and Logan Silty Clay Loam (Lr), and these soils are listed as hydric on the Utah Hydric Soil List. These soils are also similar to the soil units occurring within the impacted areas of the proposed project site.

Existing Habitat Types

A mix of bulrush/cattail and open water create a marsh habitat which is suitable for water fowl (i.e., ducks, geese, gulls). Small to medium sized mammals and other bird species also utilize habitat found within the site.

Threatened and Endangered Species

The following federally-listed ESA species are known to occur in Cache County, Utah:

Table 5: Threatened and Endangered Species in Cache County, Utah

Threatened and Endangered Species in Cache County		
Common Name	**Scientific Name**	**Status**
Maguire Primrose	*Primula maguirei*	Threatened
Ute Ladies' Tresses (ULT)	*Spiranthes diluvialis*	Threatened
Canada Lynx	*Lynx canadensis*	Threatened
Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened
Greater Sage-grouse	*Centrocercus urophasianus*	Candidate
Lease Chub	*Iotichthys phlegethontis*	Candidate

Source: U.S. Fish and Wildlife Service (USFWS)

No critical habitat has been designated within the proposed mitigation site by the USFWS for federally-listed ESA species known to occur in Cache County, Utah. No evidence was observed to suggest that any of the above listed species are found within the site. There are no known occurrences of ULT within the proposed mitigation site. However, prior to mitigation activities a survey will be conducted to identify and locate any ULT potentially occurring therein.

Baseline Information

Characteristics of the Project Impact Site

The impact site is situated on 62.9 acres of relatively level agricultural land that is owned by Logan City. These pastures are leased to farmers and ranchers for grazing and haying. The fields have been flood irrigated over many years to provide enough grazing for livestock. However, heavy agricultural use has prevented the wetland patches within these fields from serving any significant biological, hydrological, and/or aquatic function(s).

A delineation of the impact site was conducted in June 2013. The limits of the impact site delineation included several fields and a stockyard north of 200 North and south of the Logan City sewer lagoons fence. Observations of the project area between the Logan City sewer lagoons fence and the toe of the slope for the sewer lagoons was completed on September 3, 2014. Site inspections were conducted and wetland areas were identified using aerial imagery. Any area containing wetland vegetation was assumed to meet the three wetland parameters. All impacts to those areas are being proposed as needing mitigation as a part of this compensatory mitigation plan (see Appendix B – Impact Site Maps).

Vegetation

Intense grazing and haying has kept vegetation short on the impact site. The presence of livestock likely discourages most wildlife from feeding in, or otherwise utilizing the fields. The fields are composed of a mosaic of non-contiguous wetlands and uplands.

Two plant communities were identified within the impact site: Upland and Palustrine Emergent. The dominant vegetation within the upland community included: meadow fescue (*Festuca pratensis* – FACU), foxtail barley (*Hordeum jubatum* – FAC), saltgrass (*Distichlis spicata* – FAC), Kentucky bluegrass (*Poa pratensis* – FAC), and alkali sacaton (*Sporobolis airoides* – FAC). The dominant vegetation within the palustrine emergent community included: Nebraska sedge (*Carex nebraskensis* – OBL), meadow foxtail *(Alopecurus pratensis* – FACW), seaside arrowgrass (*Triglochin maritima* – OBL), and hardstem bulrush (*Schoenoplectus acutus* – OBL).

Hydrology

Irrigation water from nearby canals is the primary source of hydrology for the wetlands. While the topography of the impact site is generally level, irrigation water that settles in lower lying areas has created patches of wetland. If irrigation water were to remain off, it is likely that the vegetation would transition from wetland to upland species. A clay lens is present throughout the project site and acts as a restrictive layer, confining water within the top 10 inches of soil.

Soil Characteristics

Soils in the impact site were extremely dry, even in areas containing wetland vegetation. A nearly impenetrable barrier has been created by the clay near the soil surface, and soils beneath the lens (>10”) were even drier than those found within the first 10”. As per the United States Geological Survey (USGS) Web Soil Survey, there are three applicable soil units within the project site: Logan Silty Clay Loam (Lr), Greenson Loam Deep Over Clay 0-1% Slopes (GuA), and Collett Silty Clay Loam (Ck). All three soils are listed as hydric on the Utah Hydric Soil List meeting the 2nd hydric soil criterion, which is the least determinate of the four criterion.

<u>Logan Series</u>
The Logan series consists of very deep, poorly drained, slowly permeable soils. These soils formed in alluvium and lake sediments from many kinds of rocks, but dominantly from quartzite, sandstone, and limestone gneiss on flood plains, low smooth undulating lake terraces, and stream terraces. Slopes range from 0 to 3 percent. Flooding frequency is rare, ponding frequency is none, and the depth to water table is 12 inches.

<u>Greenson Series</u>
The Greenson series consists of very deep, somewhat poorly drained or moderately well drained soils that formed in lacustrine deposits derived from limestone, sandstone, and quartzite. Greenson soils are on low lake terraces. Slopes are 0 to 10 percent. Flooding and ponding frequency is none and the depth to water table is 34 inches

<u>Collett Series</u>
The Collett series consists of very deep, somewhat poorly drained soils that formed in lake sediments. The Collett soils are on lake terraces. Slope ranges from 0 to 3 percent. Flooding and ponding frequency is none and the depth to water table is 28 inches.

Characteristics of the Proposed Mitigation Site

A preliminary delineation of the proposed mitigation site was completed on September 3, 2014. During the preliminary delineation, site inspections were conducted and wetland areas were identified using aerial imagery. Any area containing wetland vegetation was assumed to meet the three wetland parameters (see Appendix C – Wetland Mitigation Site Map and Appendix D - Wetland Mitigation Proposed/Existing Conceptual Cross Sections).

Hydrology

The hydrologic regime has been established for the mitigation site. Previous excavations on the site have intercepted the ground water table and the water has been sufficient to support a mix of palustrine emergent marsh and open water. The south polygon has 3.576 acres of open water that will be filled to a level that will support a palustrine emergent wetland.

Soil Characteristics

The soil units occurring within the proposed mitigation site include: Cardon Silty Clay (Cd) and Logan Silty Clay Loam (Lr), and both are listed as hydric on the Utah Hydric Soil List. These soils are also similar to the soil units occurring within the impacted areas of the proposed project site. The soils on the mitigation site have been used for the created wetlands existing on a portion of the mitigation site and they have demonstrated their capacity to retain surface water and support desirable hydrophytic vegetation.

<u>Cardon Series</u>
The Cardon series consists of very deep, somewhat poorly drained soils. The Cardon soils are on lake terraces. Slope ranges from 0 to 3 percent. Flooding and ponding frequency is none and the depth to water table is 28 inches.

Logan Series

The Logan series consists of very deep, poorly drained, slowly permeable soils. These soils formed in alluvium and lake sediments from many kinds of rocks, but dominantly from quartzite, sandstone, and limestone gneiss on flood plains, low smooth undulating lake terraces, and stream terraces. Slopes range from 0 to 3 percent. Flooding frequency is rare, ponding frequency is none, and the depth to water table is 12 inches.

Design Reference Site

Cutler Marsh and the wetlands adjacent to Cutler Reservoir could be used as a design reference site. The size of Cutler Marsh in comparison to the proposed mitigation site makes direct comparisons or reference difficult. However, the diversity of wildlife and flora, the presence of standing water and an associated wetland fringe, and the diverse hydrologic functionality of Cutler Marsh makes it the best and most applicable design reference available.

Geographic Boundaries

The proposed wetland mitigation project will take place within a mitigation site located west of 1900 West, south of the vehicle salvage yard, west of the Logan City Landfill and 1900 West, and east of the unnamed perennial stream. The site is located in S31, T12N, R1E & S6, T11N, R1E.

Construction Methods

The open water on the site will be filled using large earth-moving equipment such as bull dozers, backhoes, and dump trucks to create a palustrine emergent wetland. The areas that contain desirable wetland vegetation will be identified and protected from construction activities. Soil from the impacted site will be used to create wetlands on the mitigation site. Excess soils and materials will be removed from the site.

A person/firm familiar with the wetland mitigation/monitoring plan will supervise all phases of mitigation construction. This person shall have authority to direct equipment operators, and will submit a summary report to the U.S. Army Corps of Engineers documenting construction observations and any problems that arose during construction.

Timing and Sequence

Implementation of the mitigation plan will coincide with the construction of the proposed additions to the Logan City Wastewater Treatment Facility. It is anticipated that work on the mitigation plan will take place during the summer and fall of 2017.

Hydrology Sources

Natural groundwater and water from any naturally occurring springs has been adequate to develop and maintain wetlands over the past few years. These sources will continue to provide sufficient hydrology to maintain the enhanced wetlands. Artificial sources of hydrology will not be required.

Vegetation

Woody Planting

Due to the absence of woody vegetation within the design reference site and current mitigation site, no planting of shrubs and trees is being proposed as part of this mitigation plan.

Seeding Methodology

Topsoil from the impact site will be used as a seed source at the mitigation site. If the site does not revegetate seeding of the mitigation site will occur. Plant species that are native and that thrive in wetland conditions have been selected (see plant lists in Table 5). An upland seed mix has also been selected to be used in reseeding upland buffer zones (see plant list in Table 6). It is proposed that the mitigation site be seeded and panted around the time of the first frost, but prior to the ground freezing or in early spring. Seeding will be broadcast at a rate of 70 to 100 seeds per square foot and greater than 15 pounds of pure, live seed per acre. It is proposed that all seeds for the site be provided by certified seed distributors.

Seed Mixes

Table 6: Wetland Seed Mix

Freshwater Marsh Seed Mix		
Scientific Name	**Common Name**	**Percent of Mix**
Schoenoplectus acutus	Hardstem Bulrush	20
Schoenoplectus americanus	Olney's Threesquare	20
Schoenoplectus tabernaemontani	Softstem Bulrush	10
Carex nebrascensis	Nebraska Sedge	10
Hordeum brachyantherum	Meadow Barley	10
Eleocharis palustric	Creeping Spikerush	10
Distichlis spicata	Inland saltgrass	10
Juncus balticus	Baltic Rush	10
	Total:	100

Table 7: Upland Seed Mix

Upland Seed Mix		
Scientific Name	**Common Name**	**Percent of Mix**
Elymus cinereus	Great Basin Wildrye	25
Pseudoroegneria spicata ssp. spicata	Secar Bluebunch Wheatgrass	25
Elymus laceolatus 'Sodar'	Sodar Wheatgrass	17
Festuca ovia 'Covar'	Sheep Fescue	17
Poa sandbergii	Sandberg Bluegrass	8
Linum perenne	Blue Flax	8
	Total:	100

Invasive Species Control

A corner of the developed mitigation site, which has been set aside as mitigation for another City project, contains common reed (*Phragmites australis*). It is the intent of the City to keep the *Phragmites* confined to this area and control it to prevent its spread. Because *Phragmites* is so pervasive it can be difficult to eradicate. The most effect methodology for *Phragmites* removal includes a combination of aquatic herbicide application and removal of residual material over a period of three or more years. It is proposed that *Phragmites* occurring within the mitigation site be eradicated by spraying effected areas with approved aquatic herbicides (i.e. glyophosate, imazapyr, and/or triclopyr). Care will be taken to prevent the spraying of non-invasive species on the mitigation site by spraying manually when there is no wind present. On site herbicide application will take place during August or September for three consecutive years. The late summer, after *Phragmites* has produced a large seed head, is the most effective time for herbicide use. *Phragmites* decomposes slowly, so it will be necessary to remove residual plant material at least three months after spraying has taken place to allow the herbicide to travel throughout the root systems and rhizomes of the treated plants.

Other undesirable plant species within the site will be eradicated utilizing similar methodology.

Avoidance Measures

Existing wetland areas outside of the proposed enhancement and rehabilitation area will be marked and fenced off with silt fence. Silt fence will also be installed along the unnamed perennial stream to the west of the mitigation site. Photo documentation of this fencing will be completed prior to disturbance.

Any ground-disturbing construction activities that are scheduled to occur during bird breeding and nesting season (March 1 to July 31) will require that ground nest clearings and raptor nest surveys be conducted within seven days prior to any ground disturbing activities.

Controlling Site Access

There are current barriers in place to control unwanted access to the mitigation site. There are deep streams along the western and southern property boundaries and the rest of the mitigation site is fenced with the only access being through a locked gate. No additional site access control measures are proposed.

Determination of Credits

10.14 acres of Palustrine Emergent (depressional-wetland) and 0.645 acres (1,794 linear feet) of irrigation canal will be permanently impacted by the proposed project. It is proposed that 12.198 acres of palustrine emergent wetland and 1.286 acres of upland buffer be established as compensatory mitigation (see Appendix B). The Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (April, 2008) requires a minimum 1:1 mitigation ratio for permittee-responsible mitigation. Logan City proposes to provide 12.198 acres of palustrine emergent wetland equating to a 1.2:1 mitigation ratio. An additional 1.286 acres of deed restricted upland buffer is also proposed (see Table 7).

An additional 2.36 acres of Palustrine Emergent (depressional-wetland) will be temporarily impacted by the proposed project. As mitigation, it is proposed that all 2.36 acres of temporary impacts be fully restored to their pre-construction conditions at the conclusion of projected construction.

To mitigate for the 0.645 acres and 1,794 linear feet of impacts to waters of the U.S., Logan City proposes to reroute the irrigation canal around the new wastewater treatment facility. Approximately 0.645 acres and 1,794 linear feet of open channel canal will be established equating to a 1:1 ratio.

Table 8: Permanent Project Impacts and Proposed Mitigation

Permanent Project Impacts and Proposed Mitigation				
	Impact		**Proposed Mitigation**	
	Acres	Linear Feet	Acres	Linear Feet
Existing Establishment (Palustrine Emergent)	10.14	NA	7.38	NA
New Establishment (Palustrine Emergent)	NA	NA	4.818	NA
Canal	0.645	1,794	0.645	1,794
Upland Buffer	NA	NA	1.286	NA
Total	10.785	1,794	14.129	1,794

Description of Site Protection Instrument

Deed restrictions are required by USACE for wetland mitigation sites as the primary site protection mechanism. A deed restriction, also known as a restrictive covenant, would ensure the continued preservation of the mitigation site by placing specific limitations on the types of allowable activities within the site. These restrictions "run with the land" and would continue with the property regardless of future ownership. Deed restrictions outlined by USACE Sacramento District will be recorded against the mitigation site designating it as wetland mitigation.

Maintenance Plan

The owner of the property will be responsible for annual monitoring and maintenance of the mitigation site. Annual maintenance of the site will primarily consist of litter removal and eradication of noxious and/or invasive species. More frequent maintenance will occur if the mitigation site warrants.

The mitigation site will be monitored twice annually for noxious and invasive species. If any noxious and/or invasive species are present within the mitigation site, efforts to eradicate them from the site will be made. Noxious and/or invasive herbaceous species will be sprayed with an approved aquatic herbicide (i.e. glyophosate, imazapyr, and/or triclopyr). To assure that desirable species are not inadvertently sprayed, all spraying will be done manually and on days where there is no wind present. If any woody species are present that are considered noxious and/or invasive, individuals will be manually cut by chain saw very low to the ground and the stumps sprayed with an approved aquatic herbicide. All remnants and debris of the noxious and/or invasive species will be completely removed from the site and disposed of in a way that will no cause the further propagation and/or spread of the species in another location. No burning of noxious or invasive species is proposed.

Ecological Performance Standards

Success criteria will illustrate that the wetland mitigation site is replacing lost functions and achieving long-term mitigation goals. These criteria will include the establishment of wetland vegetation and hydrology. It is assumed that if the wetland mitigation site meets the hydrology requirements, the soils will begin to demonstrate hydric characteristics. Success criteria consist of the following;

- Saturated soil within 12 inches of soil surface or inundated during the growing season at the end of the 5-year monitoring period.
- Weed species identified on the current version of the Utah State noxious weed list comprise less than, or equal to, 10 percent of the total vegetative cover.
- At least 80 percent of the herbaceous vegetative cover consists of desirable hydrophytic species typically found in similarly positioned nearby wetlands.

Monitoring Requirements

Monitoring Reports

Annual monitoring reports will be prepared and submitted to the U.S. Army Corps of Engineers before November 1st of each year. The reports will be prepared following the outline established in the Regulatory Guidance Letter No. 08-03, Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving Creation, Restoration, and/or Enhancement of Aquatic Resources. These reports will be submitted to the U.S. Army Corps of Engineers until final success criteria have been met for three consecutive years.

To provide a permanent record of the project construction and the completed mitigation work, one complete set of as-build drawings/maps that demonstrate the location and extent of the authorized facility, as well as the location and extent of the completed mitigation work will be submitted to the Army Corps of Engineers. The as-builts will be provided to the Corps of Engineers no later than 60 days after the completion of construction of the authorized facility and the mitigation area.

Long-term Management Plan

The mitigation site is presently owned by Logan City. It is unlikely for sell or transfer of this property to occur in the future. If sell or transfer were to occur during the monitoring period, the Corps would be notified though transfer of ownership forms included with the permit and wetland maintenance and monitoring responsibilities would also transfer to the new property owner. It is planned that the mitigation site will be self-sustaining after the monitoring period through proper implementation of the proposed mitigation plans. USACE developed deed restrictions placed on the mitigation site will hold the new property owner responsible for perpetual maintenance of the property.

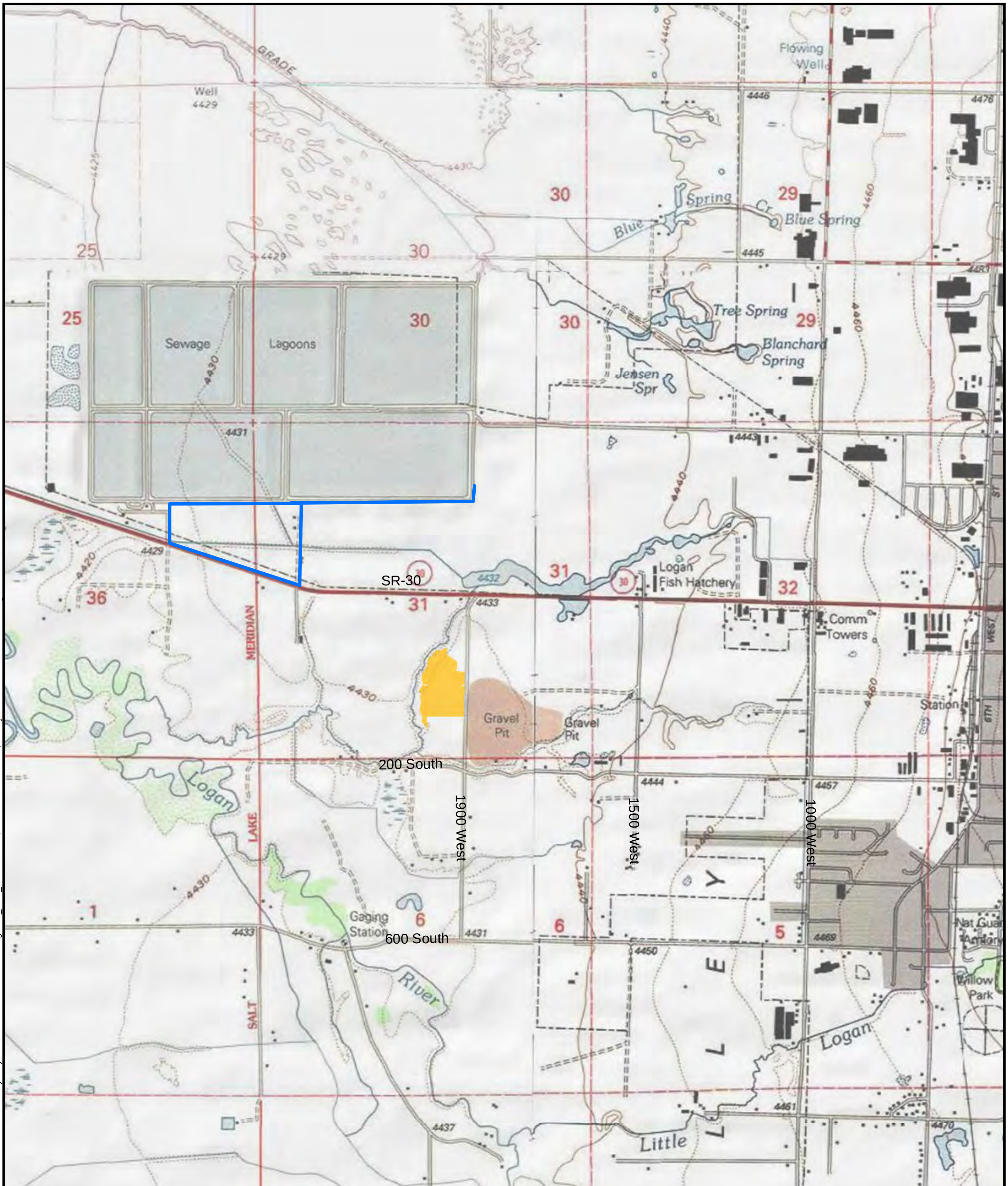
Adaptive Management Plan

In the event the mitigation site fails to meet the performance standards, Logan City will take corrective actions to remedy the situation and coordinate efforts with the Corps. If the mitigation site still fails to meet the success criteria and the site cannot be altered to meet the standards, Logan City will work with the Corps on selecting another site for mitigation.

Financial Assurances

The Final Mitigation Rule states, “In cases where a formal, documented commitment from a government agency is provided, the district engineer may determine that financial assurances are not necessary for that compensatory mitigation project. This flexibility is afforded since government agencies tend to be relatively stable entities, and operate in the public interest.” Logan City recognizes that as a condition of the Department of the Army Permit, they are legally bound to satisfy wetland mitigation requirements. Further, the City recognizes that the failure to complete wetland mitigation obligations will result in a violation of permit conditions. The City has fulfilled its wetland mitigation requirements and will commit to fulfilling its obligation on this mitigation site.

Appendix A - Site Location Map



Impact Site

Mitigation Site

0 1,000 2,000 4,000 Feet

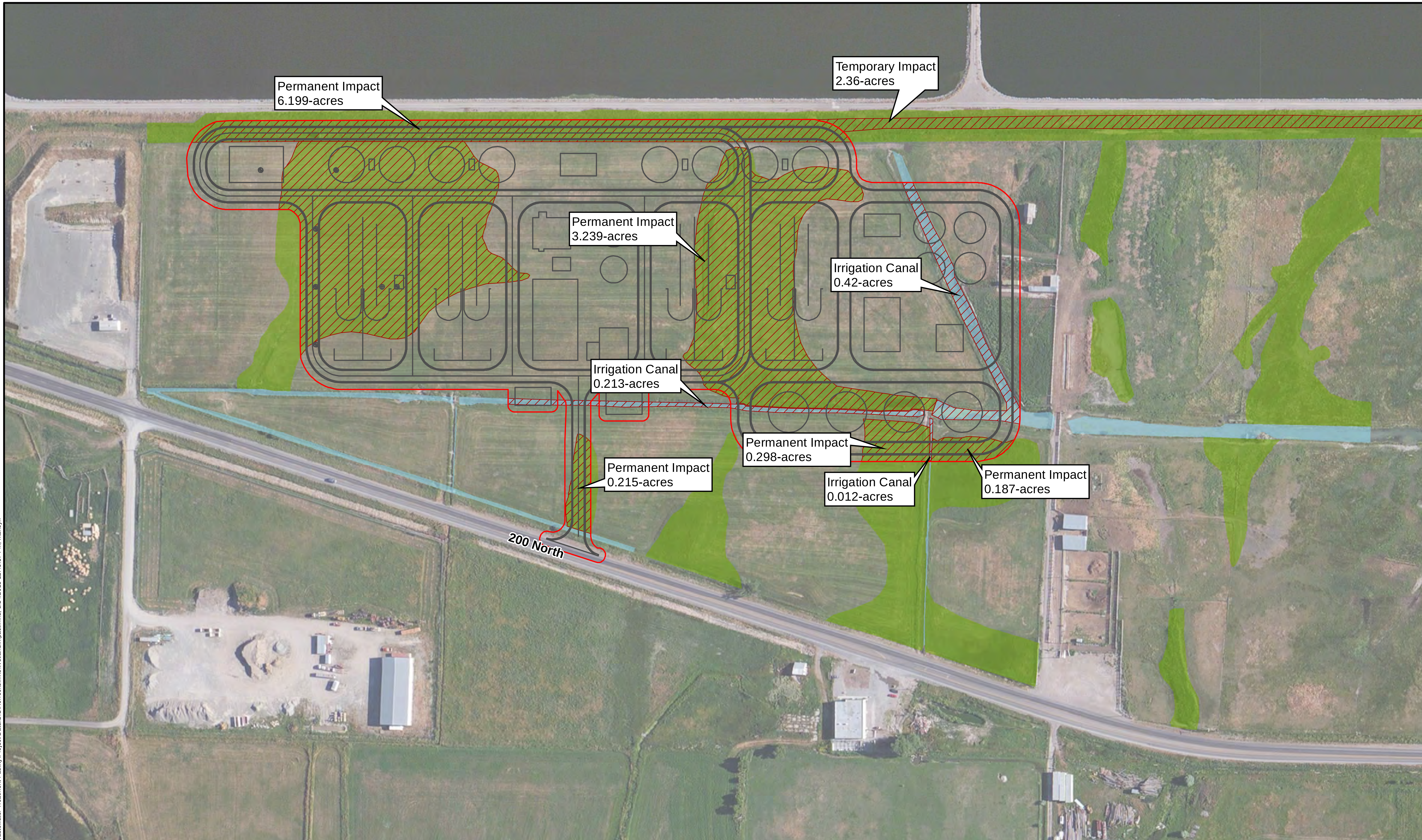
Conceptual Mitigation Plan

Site Location Map

T12N, R1E, Wellsville Quad

O:\2013\PG-021-1306 Logan City Wastewater Treatment Facility\Project Data\GIS\Horrocks\Mxd\Mitigation_Plan_Location.mxd, 6/4/2015 1:04:05 PM, marleyh

Appendix B – Impact Site Maps



New Facility
Facility Buffer
Wetland/Waters of the U.S. Impact
Ditch
PEM Wetland
Water

0 100 200 400 Feet

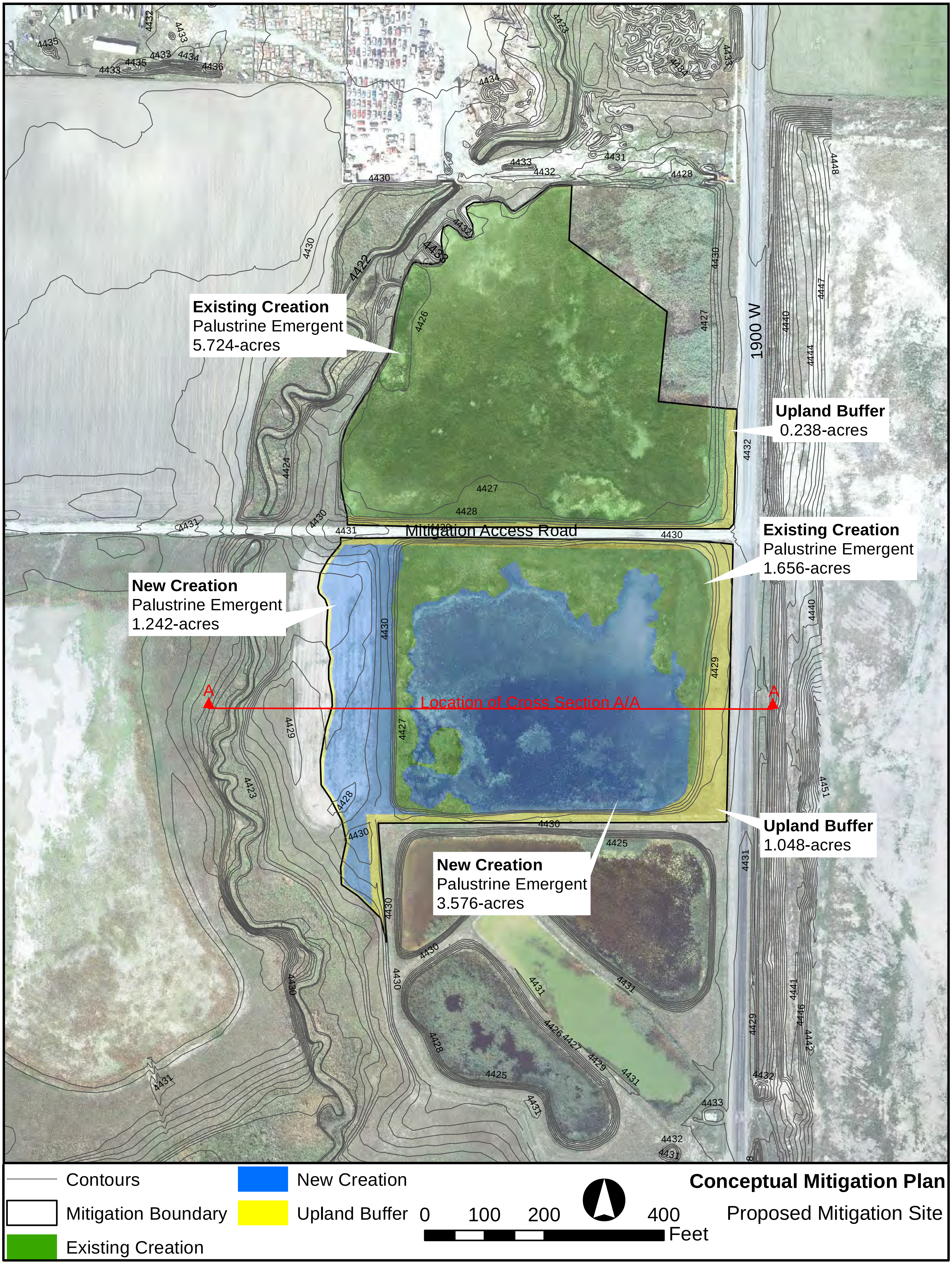
Conceptual Mitigation Plan

Wetland Impact Site 1

O:\2013\PG-021-1306 Logan City Wastewater Treatment Facility\Project Data\GIS\Horrocks\Mxd\WetlandImpact.mxd, 8/14/2015 12:45:37 PM, marleyh

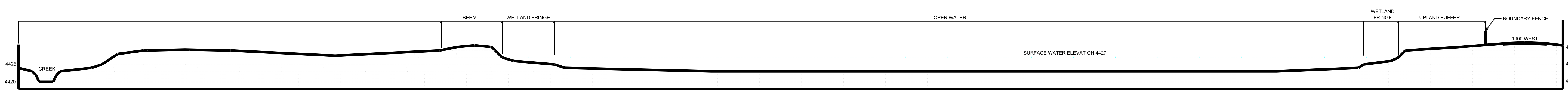

Temporary Impact
2.36-acres
200 North
New Facility
Facility Buffer
Wetland/Waters of the U.S. Impact
Ditch
PEM Wetland
Water
0 100 200 400 Feet
Conceptual Mitigation Plan
Wetland Impact Site 2
O:\!2013\PG-021-1306 Logan City Wastewater Treatment Facility\Project Data\GIS\Horrocks\Mxd\WetlandImpact2.mxd, 6/4/2015 1:08:43 PM, marleyh

Appendix C – Wetland Mitigation Site Map

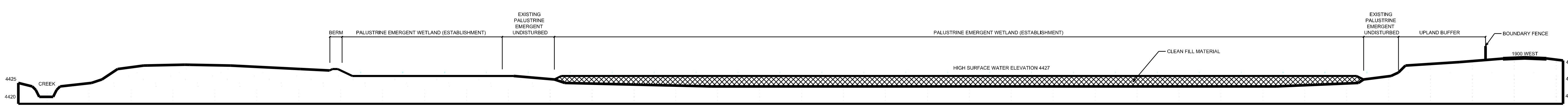


Existing Creation
Palustrine Emergent
5.724-acres
Upland Buffer
0.238-acres
1900 W
Mitigation Access Road
Existing Creation
Palustrine Emergent
1.656-acres
New Creation
Palustrine Emergent
1.242-acres
A
Location of Cross Section A/A
A
Upland Buffer
1.048-acres
New Creation
Palustrine Emergent
3.576-acres
Contours
Mitigation Boundary
Existing Creation
New Creation
Upland Buffer
0 100 200 400
Feet
Conceptual Mitigation Plan
Proposed Mitigation Site

Appendix D –
Wetland Mitigation Proposed/Existing Conceptual Cross Sections



SECTION A/A EXISTING



SECTION A/A PROPOSED

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Phone (801) 748-4044 | Fax (801) 748-4045
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Phase I ESA
Proposed Waste Water Treatment Facility
2300 West Highway 30
Logan, Utah

IGES Job No. 00823-011

September 28, 2012

Prepared for:

Carollo Engineers, Inc.
c/o Craig Ashcroft, P.E.

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APPENDIX

Plates

1.0 INTRODUCTION

This report presents the results of Intermountain GeoEnvironmental Services, Inc. (IGES) Phase I Environmental Site Assessment (Phase I ESA) of the approximately 130-acre site for Logan City's proposed waste water treatment facility at approximately 2300 West on Highway 30 (200 North) in Logan, Utah. The subject site is predominantly vacant and undeveloped with several structures currently on site that are associated with agriculture and animal corrals. A significant portion of the subject site is considered wetlands. In general, the subject property is surrounded in a ¼ mile radius by other land used for similar purposes and water treatment ponds located north of and adjacent to the site. A wetland delineation assessment is not included in the scope of work for this Phase I ESA.

2.0 PURPOSE AND SCOPE

The purpose of this Phase I ESA is to observe and assess, on the basis of readily available information, recognized environmental conditions associated with the present and historical uses of the property and neighboring properties and facilities in the site vicinity (within an approximate ¼-mile radius of the site). A recognized environmental condition is defined by ASTM E 1527-05 as "…the presence or likely presence of any *hazardous substances* or *petroleum products* on a *property* under conditions that indicate an existing release, a past release, or a *material threat* of a release of any *hazardous substances* or *petroleum products* into structures on the *property* or into the ground, ground water, or surface water of the *property*. The term includes *hazardous substances* or *petroleum products* even under conditions in compliance with laws. The term is not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not *recognized environmental conditions*."

This Phase I ESA was performed in general accordance with the standards set forth in ASTM Document E 1527-05, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. The United States Environmental Protection Agency's (EPA) All Appropriate Inquiries (AAI) rule recognizes ASTM E 1527-05 as "*at least as stringent*" and can be used to guide environmental professionals (EP) in satisfying the requirements of AAI. The *user* is defined by ASTM E 1527-05 as "-the party seeking to use this practice to complete an environmental site assessment of the property." AAI describes the *user* as a person or party that is seeking Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) liability protection. The user may include any one of the following: owner or potential owner of the property, tenant or potential tenant of the property, financial lender, property manager, etc.

Under ASTM E 1527-05 and AAI it is understood that the user's responsibilities include the following:

- Search for environmental liens on the property.
- Consider actual or specialized knowledge of the subject property and adjoining properties.
- Consider the relationship of the purchase price to the value of the property if not contaminated.
- Take into consideration known or reasonably ascertainable information regarding the property.
- Provide tract maps if available.

Under ASTM E 1527-05 and AAI it is understood that the EP's responsibilities are to complete the following:

- An environmental inquiry.
- Review historical sources of the property which include existing topographic maps, aerial photographs of the property and previous ESAs.
- Visual inspection of the subject property and adjoining properties or specific areas of the subject property and adjoining properties based on review of available historical sources.
- Interviews with current and past owners, operators, and occupants of the subject property.
- Reviews of federal and state environmental agency databases.

Under ASTM E 1527-05 and AAI it is understood that the following responsibilities are shared by the user and the EP:

- Consider commonly known information about the property.
- Consider the degree of obviousness of contamination.

Specific tasks completed by the EP and the user include the following:

- Consider specialized knowledge and information at the subject property.
- Consider degree of obviousness of contamination at the subject property.

Specific tasks completed by the EP include the following:

- Review and interpretation of available historical aerial photographs showing developments on the subject property and surrounding property since 1953.
- Reconnaissance of the site and area within a ¼-mile radius of the site to make visual observations of surface drainage conditions, water wells, areas of visual contamination and surrounding land use.
- Contact Environmental Data Resources, Inc. (EDR) to search Federal and State environmental database lists within the radial limits as set-forth in ASTM E 1527-05.
    - Additionally, IGES requested EDR to provide a Certified Sanborn® Map Report and aerial photographs which are included in The EDR Aerial Photo Decade Package report; both EDR reports are attached to this report.
- Interviews with current property owners and other government entities as appropriate for an assessment of potential historic recognized environmental conditions associated with the subject property, site vicinity and their respective uses.
- Preparation of this summary report with IGES's findings and recommendations.

This scope of work does not include a wetlands delineation, however, it is our understanding that a wetlands delineation has been recently completed or will be completed by others. The scope of work does not include an assessment of endangered species, asbestos, regulatory compliance, radon, mold, water quality or cultural and historic resources.

Mr. David A. Petersen (IGES) completed the site reconnaissance of the subject property and surrounding properties as well as the aerial photography review, interviews and preparation of this report. Review of the report was completed by Mr. Brett D. Mickelson (IGES).

3.0 SITE DESCRIPTION

3.1 PHYSIOGRAPHY

The majority of the subject property is located in the southern half of the northwestern quarter of Section 31, Township 14 North, Range 1 East and a smaller portion is located in the southeastern portion of the northeast quarter of Section 36, Township 14 North Range 1 West of the Salt Lake Base and Meridian. Topographic map coverage of the site vicinity is provided by the U.S. Geological Survey (USGS), Logan and Wellsville, Utah 7.5 Minute Quadrangles. Based on these topographic maps the subject property is relatively flat. The approximate location of the subject property and surrounding area is shown on the Site Vicinity Map (Plate 1); the general layout of the property is shown on the Site Map (Plate 2).

3.2 GEOLOGIC SETTING

The site is located in Logan, Utah at an elevation of approximately 4,430 feet above sea level in the south central portion of the Cache Valley. Cache Valley is a major intermountain basin located east of the Wasatch fault zone and is flanked on the west by the Wellsville Mountains and on the east by the Bear River Range. This valley represents a deep, sediment-filled structural basin of Cenozoic age located east of the Wasatch fault zone and flanked by uplifted blocks, the Wellsville Mountains on the west, and the Bear River Range on the east (Dover, 1995; Hintze, 1980). Because Cache Valley has active normal faults both on its western and eastern boundaries (McCalpin, 1994), it appears to be the easternmost expression of pronounced Basin and Range extension in northern Utah.

The near-surface geology of the Cache Valley is dominated by sediments, which were deposited within the last 30,000 years by Lake Bonneville (Scott and others, 1983; Hintze, 1993; McCalpin, 1994; Dover, 1995). The lacustrine sediments near the mountain front consist mostly of gravel and sand. As the lake receded, streams began to incise large deltas formed at the mouths of major canyons along the Wellsville Mountains and the Bear River Range, and the eroded material was deposited in shallow lakes and marshes in the basin and in a series of recessional deltas and alluvial fans. Sediments toward the center of the valley are predominately deep-water deposits of clay, silt and fine sand. However, these deep-water deposits are in places covered by a thin post-Bonneville alluvial cover. Most surficial deposits in the Cache Valley were deposited during the Bonneville Lake Cycle that was the last cycle of Lake Bonneville between approximately 32 to 10 ka (thousands of years ago) and in the Holocene (< 10 ka).

3.3 FAULTING

There are no known active faults that pass under or immediately adjacent to the site (McCalpin, 1989, Hecker, 1993). The site is located approximately 4.7 miles west of the mapped location of the Central segment of the East Cache fault zone (McCalpin, 1989). The East Cache fault zone is approximately 48 miles long and forms the boundary between Cache Valley and the Bear River Range. The central segment is one of three main sections of the East Cache fault zone and is approximately 9.6 miles long and extends from Green Canyon southward to Blacksmith Fork Canyon. The site is also located approximately 4.1 miles east of the West Cache fault zone. The most recent surface faulting event along the West Cache fault zone occurred on the Clarkston fault approximately 3,600 to 4,000 years ago (Black and others, 2000).

3.4 HYDROLOGY/HYDROGEOLOGY

As mentioned previously, a significant portion of the subject site appears to be wetland area. Based on the United States Fish & Wildlife Service National Wetland Inventory (http://www.fws.gov/wetlands/Data/Mapper.html) a significant portion of the eastern half of the subject property is mapped as *Freshwater Emergent* with other smaller portions, including on the west half of the subject property, being mapped as *Freshwater Emergent* as well. A freshwater pond is also mapped east of the subject property with what appears to be a manmade canal extending northwest and then west through the subject property. Numerous other drainages, ditches, wetlands and springs are mapped in the general vicinity. The Logan River is mapped within approximately ½-mile of the subject property. No explorations were completed at the site by IGES, however, due to the presence of several wetlands, Logan river and the pond, it is our opinion that groundwater is relatively shallow. Based on our review of documents available at Logan City Department of Environmental Quality and as summarized in Section 10.0, the groundwater gradient is reported to be towards the southwest.

4.0 USER PROVIDED INFORMATION

At the time this report was prepared the user had not completed the provided user questionnaire. Further information regarding the user questionnaire is provided in Section 11.0 of this report.

5.0 SITE RECONNAISSANCE

On September 12, 2012, an experienced geotechnical engineer completed a site reconnaissance of the site; photos taken at that time are included as Plates 3 - 18. At the time of our site reconnaissance the site was largely vacant and undeveloped with only minor structures associated with farming and livestock grazing activities observed on the subject property. The property is relatively flat, and as described previously (Section 3.4), includes a significant portion that is mapped as *Freshwater Emergent* wetlands (http://www.fws.gov/wetlands/Data/Mapper.html). The areas mapped as wetlands include a significant portion of the eastern half of the subject property as well as other smaller portions, including on the west half of the subject property. These areas were observed to have some hydrophilic plants and some of these areas were observed to have several inches of standing water; however, as indicated by the property owner, the site is flood irrigated and it was unclear as to whether this water was a result of flood irrigation or shallow groundwater. The majority of the ground appeared to be covered with grass and various weeds; an unpaved road runs north-south through the center of the subject property. A metal pipe culvert is located beneath the unpaved road at the location of the canal.

Several fenced in areas were observed in the south central portion of the subject property that appeared to have been used as an animal corral with feeding troughs. IGES observed two open structures located north of the southern animal corrals; it appeared that these structures provided some shelter from the weather to animals. A pile of accumulated manure and hay was located in the southern animal corral. Various materials were stored outside of these structures and included wood, brick, metal and wire, as well as some rusty decrepit farming tools and other miscellaneous items and garbage which included plastic, metal and wood.

An animal corral and feeding troughs are also located in the north central portion of the subject property. An old wooden dilapidated house, a wooden storage unit and structures used to provide some shelter to animals are also located in the north central portion of the subject property. Wired string with a mild electric current running through it is used throughout the property to help keep animals in a desired section of the property.

Numerous automobile rubber tires were located on the subject property; some located in random locations while the majority was being used to hold down plastic tarps on top of hay. Overhead power is provided to the site adjacent to the unpaved road and appears to be used for overhead lighting and in some of the storage and animal covering areas.

As mentioned previously, a canal extends through the property from east to west and appears to be manmade; it appears that the source of the canal is at the western end of a natural pond located east of the subject property. The canal extends from the eastern boundary to the western boundary of the subject property and approximately divides the property into northern and southern halves. Several ditches that are oriented perpendicular to the canal are also observed in the northern and southern halves of the subject property; some, but not all of these ditches were filled with water at the time of our site reconnaissance. A ditch was also located on the subject property parallel to the southern boundary near Highway 30 (200 North). Numerous frogs were observed along the banks of the canal on the subject property (Plate 10). The canal has been fitted with gates and other diversion devices to help divert water into various ditches and areas. Soil spoils were observed adjacent to the canal in numerous locations; it appears that they have come from the canal channel.

Irish black cattle were observed grazing in the north western portion of the subject property. What appeared to be a linear pond, or historic canal was located in this area as well. No areas of stressed vegetation were observed.

IGES completed a search for water rights on the subject property at the Utah Division of Water Rights website http://nrwrt1.nr.state.ut.us/wrinfo/query.asp. Three water rights were observed on the subject property each of them are in the name of and/or owned by Eliason Packing Company and are reportedly underground water claims used for stock watering of cattle of other animals. Additionally, the EDR report (EDR, 2012) has listed a fourth water right on the property that is in the name of the United States Geological Survey (USGS). Information for each of these water rights is included in the EDR report in the geocheck section (EDR, 2012). Additionally, two concrete watering basins and at least four to five rubber-tire enclosed watering basins were observed on the subject property. As described in Section 9.2, the property owner indicated that these watering basins are enclosing artesian wells. It appeared that these enclosures include a drain pipe which is used to drain water once it reaches a certain elevation, but it was unclear where the water drained.

6.0 SURROUNDING LAND USE

An experienced geotechnical engineer from IGES performed a reconnaissance of the general site vicinity within an approximate ¼-mile radius of the subject property to observe types of land use within the search area. The subject property is surrounded by other properties with similar uses, however, the majority of the neighboring properties have various different uses. The property located north of and adjacent to the subject property is used by Logan City for the treatment of sewage. Property located east of and adjacent to the subject property is vacant and what appears to be a natural pond is also located east of the subject property. The subject property is bound on the south by Highway 30 (200 North) and much of the property located south of Highway 30 is also vacant, undeveloped and unused. However, a humane society for domestic animals, an auto salvage yard, a property used to store recreation vehicles and boats, a farm property that appears to be storing hay and a rural residential property are also located on the south side of Highway 30 within a ¼-mile of the subject property.

The property is bordered on the west by an older shooting range used for target practice and a property which is used to treat outfall from the sewage ponds. There is a newer public shooting range located west of the area used to treat sewage pond outfall which is located west of the older shooting range. Logan City Landfill is located approximately ¼ of a mile southeast of the subject property. Due to the proximity of the landfill and shallow groundwater, IGES reviewed groundwater sampling and testing reports at the landfill; a summary of our review is included in Section 10.0.

IGES observed portions of the adjacent properties and noted no readily observable environmental concerns.

7.0 PAST SITE LAND USE

7.1 SITE HISTORY

IGES has reviewed and interpreted readily available historical aerial photographs for the site and the immediate site vicinity to observe surface conditions and activities. Aerial photographs obtained from Olympus Aerial Surveys, Inc., EDR and the Automated Geographic Reference Center (AGRC) were reviewed for the years: 1953, 1976, 1981, 1987, 1988, 1993, 1994, 1997, 2001, 2005 and 2011. Based on our aerial photography research, the subject property and surrounding areas are largely used as farming or rangeland. Aerial photographs are included for the years 1953, 1976, 1981, 1987, 1988, 1993, 1997 & 2011 in the *The EDR Aerial Photo Decade Package*, and on Plates 19 and 20.

7.2 AERIAL PHOTOGRAPHS

June 9, 1953

The eastern portion of the subject property appears to be wetland or wetland-like area as evidenced by standing water. Highway 30 (200 North) is observed south of and adjacent to the subject property. The property located south of Highway 30 appears to be property with similar uses as the subject property itself and is largely undeveloped. The subject property is bordered on the east by undeveloped property that appears to be largely similar in nature to that of the subject property; this property includes a pond that appears to be natural and wetland or wetland-like area. What appears to be a manmade canal is observed to extend diagonally northwest out of the pond located east of the subject property. This canal then turns to be oriented east-west and runs through the subject property essentially dividing it into northern and southern halves.

What appears to be a natural drainage, or natural depression is oriented south to north through the center of the subject property. What appears to be a pond or natural depression in an area of shallow ground water is located near the northern boundary in the northwest portion of the subject property.

An unpaved roadway at approximately 2300 West is located immediately west of this drainage, or natural depression, and extends from Highway 30 north to the northern boundary of the subject property and potentially beyond. The canal described previously extends west past the unpaved roadway and includes a small branch that is oriented approximately southeast to northwest and appears to end near the pond or natural depression in the northwest portion of the subject property. The unpaved road bridges over the canal and several other structures are located on the west side of the road and east of the branch of the canal.

A single structure appears to be located southeast of where the unpaved road crosses over the canal. Several other structures are located in the northwest portion of the subject property between the northwest-southeast branch of the canal and the unpaved road. Additionally, a structure is located where the old dilapidated wood home was observed at the time of our site reconnaissance. What appears to be a smaller ditch, branches off of the canal near the eastern portion of the subject property where the canal turns to be oriented east-west. The ditch is oriented southeast to northwest until it is close to the northern boundary of the subject property, there it curves west, and then southwest until it reaches the manmade canal and natural drainage/depression. It appears that some areas in the western portion of the subject property may have been used or are being used for agriculture.

August 25, 1976

Seven ponds that appear to be used in conjunction with water treatments are observed north of and adjacent to the subject property. Structures and development that appear to be part of the water treatment ponds are located west of and adjacent to the subject property. An area of soil disturbance is observed adjacent to the southern boundary of the subject property northeast of the intersection of the unpaved road and Highway 30. No other significant changes were observed since the previous photograph; the quality of this aerial photograph is lower than the previous photograph and some details are less clear.

September 1, 1981

What appears to be animal corrals, are located east of the unpaved roadway and south of the manmade canal where they are currently located as well as in the northern portion of the subject property near the northern boundary and west of the unpaved road close to the dilapidated house.

July 24, 1987

Evidence is seen that sections of the western half of the property are being farmed or plowed. It appears that two storage structures are located immediately north of the animal corrals located in the southern portion of the subject property on the east side of the unpaved road. The natural drainage/depression appears to be wider immediately north and east of the canal and unpaved road respectively. What appear to be less pronounced unpaved roads are observed on the subject property and are in general adjacent to the canal.

June 30, 1988; August 14, 1993; May 24, 1994; October 4, 1997; April 22, 1998; May 24, 2001, July 12, 2005 and August 10, 2011

No significant changes were observed on the subject property or surrounding properties since the previous photograph(s).

8.0 FEDERAL AND STATE AGENCY DOCUMENT REVIEW

IGES staff reviewed the results of the database search of regulatory agencies records to assess the subject property regarding potential environmental conditions. The purpose of the review is to assess whether the subject property, adjacent properties, or other properties within the vicinity have been identified as having environmental problems that might impact the property. Our regulatory review utilized the services of EDR, a firm that specializes in searching databases of Federal and state hazardous waste sites and other related information. A complete list and description of the Federal and state databases are included in the EDR Radius Map Report (EDR, 2012) and is presented in the Appendix. Findings from the databases searched by EDR are contained in the following tables and discussed in the following paragraphs.

8.1 FEDERAL AGENCY DOCUMENT REVIEW

Database Searched	Search Distance (miles)	Total Plotted by EDR
NPL	1	0
Proposed NPL	1	0
Delisted NPL	1	0
NPL Liens	TP	0
CERCLIS	½	0
FEDERAL FACILITY	1	0
CERC-NFRAP	½	0
LIENS2*	TP	0
CORRACTS	1	0
RCRA TSDF	½	0
RCRA Lg. Quan. Gen.	¼	0
RCRA Sm. Quan. Gen.	¼	0
RCRA Conditionally Exempt Sm. Quan. Gen.	¼	0
RCRA Non Generators*	¼	0
ERNS	TP	0
HMIRS*	TP	0
US ENG CONTROLS	½	0
US INST CONTROL	½	0
DOT OPS*	TP	0
US CDL*	TP	0
CDL*	TP	0

Database Searched	Search Distance (miles)	Total Plotted by EDR
FUDS*	1	0
US BROWNFIELDS*	½	0
DOD*	1	0
CONSENT*	1	0
ROD*	1	0
UMTRA*	½	0
ODI*	½	0
DEBRIS REGION 9*	½	0
TRIS*	TP	0
TSCA*	TP	0
FTTS*	TP	0
HIST FTTS*	TP	0
SSTS*	TP	0
ICIS*	TP	0
RADINFO*	TP	0
LUCIS*	½	0
PADS*	TP	0
MLTS*	TP	0
MINES*	¼	0
FINDS*	TP	0
RAATS*	TP	0
FINANCIAL ASSURANCE	TP	0

TP denotes Target Property

* Indicates that these databases have been searched in addition to the standard databases

EDR identified no sites in the federal databases listed above.

8.2 STATE AGENCY DOCUMENT REVIEW

Database Searched	Search Distance (miles)	Total Plotted by EDR
SWF/LF	½	0
LUST	½	0
UST	¼	0
LAST	½	0
AST	¼	0
FEMA UST	¼	0
SPILLS*	TP	0
INST CONTROL	½	0
VCP	½	0
DRYCLEANERS*	¼	0
SCRD DRYCLEANERS*	½	0
BROWNFIELDS	½	0
NPDES*	TP	0
PCB TRANSFORMER	TP	0

TP denotes Target Property
* Indicates that these databases have been searched in addition to the standard databases

EDR identified no sites in the state databases listed above. As is noted above, the search radius for solid waste facilities and landfill sites (SWF/LF) indicates that no facilities were located within a ½-mile radius of the subject property. However, the Logan City Landfill is located at a distance of approximately ¼ to ¾ of a mile away from the subject property. Based on this information, IGES has reviewed groundwater monitoring reports and other documentation for the landfill; a summary of our review is included in Section 10.0.

8.3 TRIBAL RECORDS DOCUMENT REVIEW

Database Searched	Search Distance (miles)	Total Plotted
INDIAN VCP	½	0
INDIAN LUST	½	0
INDIAN UST	¼	0
INDIAN RESERV*	1	0

* Indicates that these databases have been searched in addition to the standard databases

No additional tribal records were researched due to the fact that the subject property is not on or adjacent to tribal property.

8.4 PROPRIETARY RECORDS DOCUMENT REVIEW

Database Searched	Search Distance (miles)	Total Plotted
MANUFACTURED GAS PLANTS	1	0
EDR Historical Auto Stations	¼	0
EDR Historical Cleaners	¼	0

8.5 AREA RADON INFORMATION REVIEW

Our review of the United States Environmental Protection Agency's (USEPA) National Radon Database (http://www.epa.gov/radon/states/utah.html) it appears that the federal EPA radon zone for the subject site is 2. A radon zone of 2 indicates that indoor areas have a moderate potential for elevated radon levels, with a predicted average indoor radon screening level of between 2 to 4 pCi/L (Picocuries/Liter). Radon is a colorless, odorless, tasteless, chemically inert, and naturally occurring radioactive gas. Thorium and uranium are two sources of radon commonly found in soil and rock. Radioactive decay of these elements produces the radioactive gas radon. Radon accumulates in basements and other low levels in homes and other structures.

8.6 ORPHAN SUMMARY

EDR's review identified 20 sites that were not mapped due to inaccurate or incomplete addresses, or due to the site location being restricted. IGES' review indicates that all of these sites appear to be located outside of ASTM's recommended search radii.

9.0 AGENCY/PREVIOUS OWNER CONTACTS

IGES conducted telephone inquiries of city offices and current land users for information regarding hazardous waste/material spills or other incidents within or near the site vicinity which may have potentially impacted the soils and/or groundwater, and which may present a potential environmental impairment to the subject property.

9.1 CURRENT LAND OWNER – ELIASON PACKAGING COMPANY

IGES interviewed Jeff Eliason of Eliason Packaging Company, the current owner of the subject property. Mr. Eliason indicated that Eliason Packaging Company has owned the property since the 1940s or earlier with ownership being held by family members. He indicated that it has always been used for growing hay and grazing cattle. He indicated that the eastern portion of the property has typically been used for grazing cattle and the western portion has been used for growing hay. He indicated that the old house in the north central portion of the subject property has typically been used for storage. He indicated that the property has been flood irrigated with water from the Logan Canal Company and that several artesian wells exist on the property. Mr. Eliason indicated that fuel was never stored on property. He also indicated that nothing was buried on the property.

9.2 FIRE DEPARTMENT

IGES contacted the Logan City Fire Department to inquire regarding any available records of hazmat calls. Logan City Fire Department reported that they have no records of hazmat calls at the subject property.

9.3 LOGAN CITY ENVIRONMENTAL DEPARTMENT

IGES completed limited inquiries with Carl Francis, Landfill Manager for the Logan City Landfill. Mr. Francis indicated that the Logan City Landfill is participating in a voluntary corrective action program, as indicated in Section 10.0. He indicated that an offsite collection system is used to collect leachate that has come from the landfill. The leachate is pumped into a lined pond where it is allowed to evaporate. After a period of time, the leachate is pumped into two un-lined evaporative ponds.

10.0 DOCUMENT REVIEW

As mentioned previously, an IGES employee reviewed documents available for the Logan City Landfill; these documents include the groundwater monitoring reports for the two previous years (2010 and 2011) as well as the landfill quarterly reports for 2011 and 2012 and the spill, prevention, control and countermeasure (SPCC) plan for the landfill.

10.1 GROUNDWATER MONITORING REPORTS

Kleinfelder produced the groundwater monitoring reports for the Logan City Landfill for the years reviewed by IGES. Based on information included in these reports, it appears that the groundwater elevation of the shallowest aquifer at the site is approximately 3 to 4 feet below the existing site grade. IGES' review of the groundwater monitoring reports indicated that the groundwater gradient at the site of the landfill is to the west-southwest. Both the 2010 and 2011 groundwater monitoring reports indicate that the findings during the respective years are in general consistent with the findings of previous years. These reports indicate that concentration of several metals were reported to be above the method detection limits (MDL) but that none of them were above the solid waste ground water protection standard (SWGWPS) except for arsenic. Additional studies have been completed by Kleinfelder and Utah State University (USU) to determine if arsenic in the up gradient groundwater may be impacted by naturally occurring arsenic sources or another source in the area. In a 2009 report, Kleinfelder and USU conclude that arsenic is naturally occurring and can be mobilized into the groundwater. Based on the 2010 and 2011 groundwater monitoring reports, it appears that volatile organic compounds (VOC) are present in the groundwater, however, they are not observed at levels that exceed the SWGWPSs. Since approximately 2009 or prior, Logan City Landfill has been participating in a voluntary corrective action program. The purpose of the corrective action program is to collect leachate that has migrated offsite through the groundwater. Mr. Francis with the Logan City Landfill provided additional information on the voluntary corrective action program (Section 9.3).

10.2 QUARTERLY INSPECTION REPORTS

IGES reviewed quarterly inspection reports for the landfill for 2011 and 2012. IGES observed that for these time periods, no adverse findings or observations were made in these reports with one exception. On September 27, 2011, a relatively low level of methane was observed beyond the limits of the landfill.

10.3 SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

IGES completed a brief review of the SPCC plan that was on file with Logan City's Environmental Department. It appears that there are 15 documented oil storage containers on site. The plan calls for an update every 5 years or when changes are made. The SPCC plan appears to be complete and include the minimum required information; the plan was updated in February 2011.

11.0 DATA GAPS

No aerial photographs taken prior to the year 1953 were available for our review. In the 1953 photograph the subject property was undeveloped farm and rangeland with wetland or wetland-like areas. It further appears that the majority of the neighboring properties were also being used for similar purposes. In general, the use of the subject property appears to have been relatively unchanged from 1952 through the present. It is IGES' opinion that the time prior to the 1953 photograph is not a significant data gap.

A data gap of approximately 23 years between photographs for the years 1953 and 1976 exists. We observed no significant changes during this time period; an area of soil disturbance was observed in the 1976 photo, but this appears to be the result of increased traffic. The property continued to be used for agricultural purposes. It is our opinion that this gap in aerial photos is not a significant data gap.

As stated in Section 6.0 (Surrounding Land Use), the majority of the property within the immediate vicinity of the subject property consists of undeveloped properties that are in general currently used for farming or range land and other uses which include rifle ranges, waste water treatment and an auto salvage yard. No readily observable environmental conditions were observed on adjacent properties. There is a potential that areas not subject to our observations may pose an environmental concern. It is our opinion that there are no more data gaps associated with this Phase I ESA.

As stated in Section 4.0, the user did not complete a user questionnaire for the site. Based on the information collected and summarized in other sections of this report, it is our opinion that this is considered an insignificant data gap since no other information presented in this report suggests a potential recognized environmental condition.

IGES has attempted to indicate and assess recognized data gaps; however, it is possible that some data gaps have not been identified. IGES cannot warranty or guarantee that no hazardous substances have been released on the subject property and adjacent properties.

12.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the data and information obtained as part of our scope of work, IGES observed and recommends the following:

1.) The subject property has existed as an undeveloped lot since prior to 1953 and is still undeveloped.
2.) Housekeeping at the site was good.
3.) The historic use of the property is farming of hay and grazing for livestock.
4.) The subject property as it exists today was not listed in any of the ASTM and AAI recommended databases searched by EDR. No adjacent properties were listed in any of the ASTM and AAI recommended databases searched by EDR.

Based on observations made as part of this Phase I ESA and the information contained herein, it is our opinion that there are no obvious recognized environmental conditions on the subject property and that there are no existing environmental conditions on adjacent properties that pose an immediate threat to the subject property.

IGES has no further recommendations at this time. If there are any further questions or concerns regarding this Phase I ESA, please do not hesitate to contact us at (801) 748-4044.

13.0 LIMITATIONS

The information in this report relates only to the referenced property and should not be extrapolated or construed to apply to any other site or property whatsoever. Furthermore, the information presented in this report has been developed, in confidence, at the request of the client. The information regarding the subject property is intended for use in the client's deliberations concerning the property. The information, recommendations and conclusions provided herein apply only to the subject property as it existed during our site reconnaissance. Should site use or conditions change, the information, conclusions and recommendations herein may no longer apply. As stated in the ASTM E 1527-05 standard, this Phase I ESA report has a shelf life of 1 year. Furthermore, in accordance with the current standard of care, certain components of the report will need to be updated if acquisition of the property by the *user* occurs greater than 180 days from completion of this report. If acquisition of this land occurs greater than 1 year from the completion of this report, in accordance with the current standard of care, the *user* should complete a new Phase I ESA.

We declare that to the best of our professional knowledge and belief we meet the definition of *Environmental Professional* as defined in §312.10 of 40 CFR (Code of Federal Regulations) 312 and we have the specific qualifications based on education, training, and experience to assess a *property* of the nature, history, and setting of the subject *property*. We have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

IGES has performed the investigation described in this report within the bounds described in our proposal. It has been prepared with the usual care and thoroughness of the consulting profession. We offer no warranty with respect to the information contained in this report. Specifically, no representations regarding the marketability of the property or its suitability for any particular use are made, and none should be inferred based solely on this report. This report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings of this investigation.

Finally, a Phase I Environmental Site Assessment such as the one reported herein, cannot eliminate all of the environmental risks associated with a property. IGES has pursued those avenues of investigation, which, based on the scope of work, the readily available data, and our experience, seemed prudent. Obviously, no definitive representations can be made with respect to those site attributes not subject to view or directly sampled for this investigation (e.g., ground and surface water quality, air quality, etc.). Additionally, the following areas have not been assessed: wetlands, health and safety, ecological resources, air quality, endangered species, asbestos, regulatory compliance, radon, mold, water quality, areas with archeological significance, cultural resources or historic resources. Also, no definitive opinions or conclusions can be made relating to periods for which no information is available, i.e. *data gaps*; no warranty or guarantee can be made. Interviews completed by IGES with current and past property owners, current and past property occupants, the *user*, city and state representatives etc. were completed in accordance with ASTM E 1527-05. However, IGES cannot be liable for and cannot verify the truthfulness, completeness, or content of the interviewee's responses. IGES offers no warranty or guarantee regarding their responses. IGES contacted EDR to complete the records review for databases maintained by the state and federal government. If these databases are not complete, IGES cannot be responsible for deficiencies in these databases and offers no warranty or guarantee as to their completeness.

The *user* should be aware that completing this Phase I ESA in accordance with ASTM E 1527-05 and AAI does not guarantee CERCLA liability protection throughout ownership of the property. The *user* should be aware that AAI describes continuing obligations that the *user* should be aware of and comply with if it is desirable to maintain CERCLA liability protection; the *user* should review EPA's AAI and become familiar with what the continuing obligations are. It is our opinion that we have acted prudently in assessing the high-risk elements of the property.

Respectfully submitted,
IGES, Inc.

LICENSED PROFESSIONAL ENGINEER
DAVID A. PETERSEN
4859918
9·28·12
STATE OF UTAH

David A. Petersen, P.E.
Project Engineer

Reviewed by,

Brett D. Mickelson, P.E.
Principal

14.0 REFERENCES

Aerial photographs available from Automated Geographic Reference Center include: August 10, 2011.

Aerial photographs available from Olympus Aerial Surveys, Inc. include: June 30, 1988; May 24, 1994; April 22, 1998; May 24, 2001; and July 12, 2005.

Black, B.D., Giraud, R.E., Mayes, B.H., 2000, Paleoseismic investigation of the Clarksville, Junction Hills, and Wellsville faults, West Cache fault zone, Cache County, Utah. Utah Geological Survey Special Study 98, 23 p.

Dover, J.H., 1995, Geologic map of the Logan 30' x 60' Quadrangle, Cache and Rich Counties, Utah, and Lincoln and Uinta Counties, Wyoming. US Geological Survey Miscellaneous Investigations Series Map I-2210, scale 1:100,000.

Environmental Data Resources, Inc., Logan Phase I ESA, 2400 West 200 North, Logan, UT 84321, Inquiry Number: 3407549.2s, September 11, 2012, The EDR Radius Map™ Report with GeoCheck®.

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Hintze, L.F. 1993, Geologic History of Utah, Brigham Young University Studies, Special Publication 7, 202p.

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McCalpin, J.P., 1994, Neotectonic deformation along the East Cache fault zone, Cache County, Utah: Utah Geological Survey, Special Study 83, 37 p.

Scott, W.E., McCoy, W.D., Shorba, R.R., and Meyer, R., 1983, Reinterpretation of the exposed record of the last two cycles of Lake Bonneville, western United States: Quaternary Research, v.20, p. 261-285.

United States Geological Survey, Logan, Utah, Quadrangle Map 7.5 Minute Series.

United States Geological Survey, Wellsville, Utah, Quadrangle Map 7.5 Minute Series.

15.0 QUALIFICATIONS

David A. Petersen, P.E.

Title	Project Engineer
Academic Background	B.S., Geological Engineering, University of Utah (2001) A.S., Physical Science, Salt Lake Community College (1998)
Registration	Professional Engineer – Utah (2005) Professional Engineer – Wyoming (2011)
Expertise	Phase I ESAs, Phase II ESAs, Transaction Screen Process ESAs.
Professional Affiliation	Association of Environmental and Engineering Geologists (AEG)

Summary of Experience

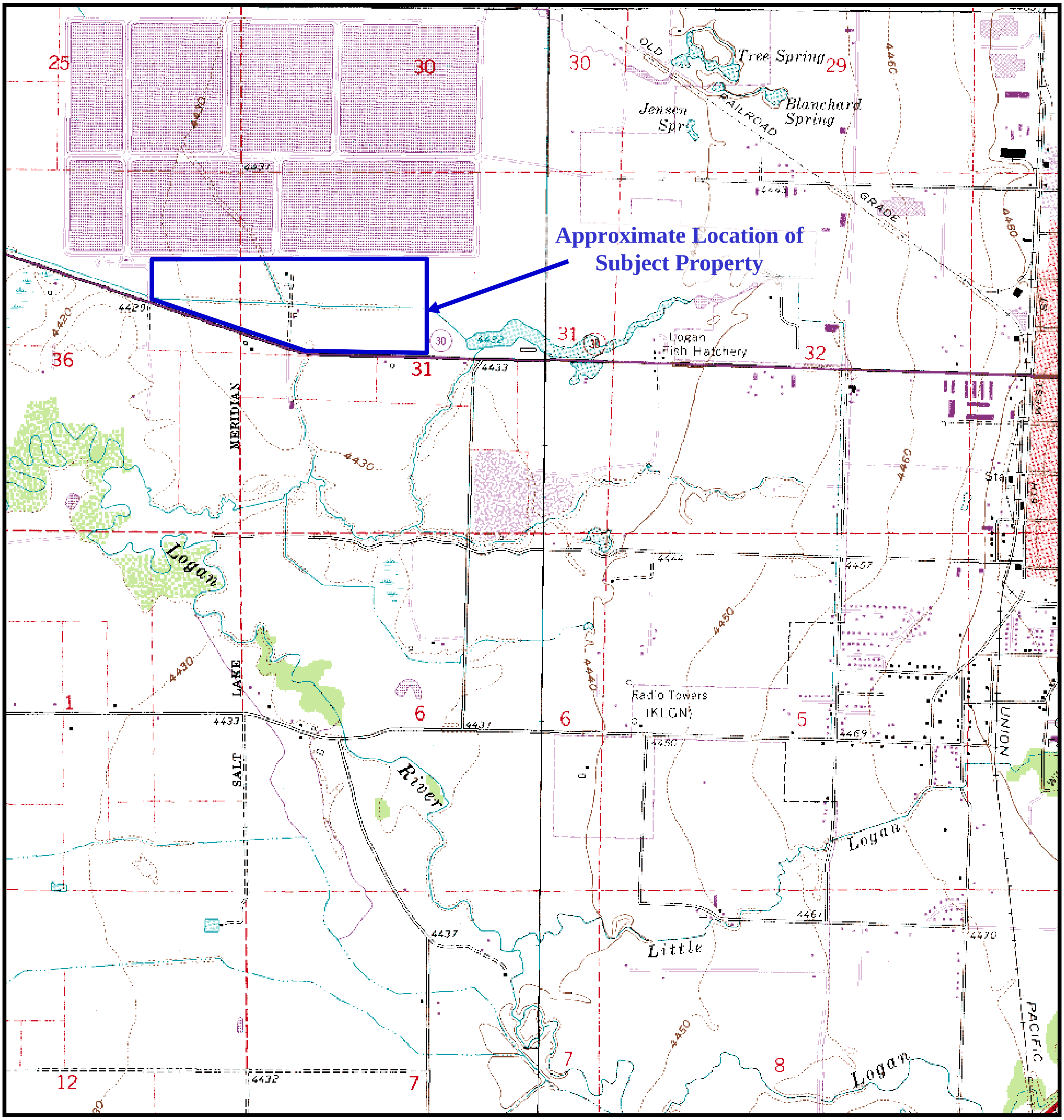
Responsible for conducting numerous Transaction Screen Process ESAs, Phase I ESAs, and Phase II ESAs over the past 6 years. Research included reviewing historical records, databases, conducting interviews with current and past land owners, interviews with land occupants, interviews with appropriate city, county, and state officials, reviewing aerial photography, and performing a site reconnaissance for each site. Listed below are several properties worked on.

- Phase I ESA American Fork.
- Phase I ESA in Bluffdale, Utah.
- Staff engineer responsible for completing a Phase I ESA on six separate properties for the Jordan Valley Water Conservancy District (JVWCD). The properties were in South Jordan, West Jordan, Kaysville, and Clinton, Utah. These sites that range in size from less than one acre to tens of acres were being considered by the JVWCD to purchase as easements.
- Phase I ESA on a 500-acre property in Cedar City, Utah for the State of Utah Trust Lands.
- Phase I ESA on a 4-acre nursery property in Centerville, Utah.
- Phase I ESA on an 18.5-acre property in West Jordan, Utah for a proposed subdivision.
- Phase I ESAs on several properties for proposed restaurant locations for McDonald's. These include properties in Syracuse, Clinton, and Roy, Utah.
- Phase I ESA for a 9,000 s.f. warehouse building on a 0.4-acre parcel of land in West Valley City, Utah.
- Completed Phase I ESAs for proposed Walmart Distribution Center locations in Payson, Tooele, and Grantsville, Utah. Completed Phase II ESA for proposed distribution center in Tooele.
- Phase I ESA for proposed commercial development in Draper, Utah.
- Phase I ESA and Phase II ESA for new warehouse in Layton, Utah.
- Phase I ESA for office property in Brigham City, Utah.
- Phase II ESA for a proposed buried drinking water storage tank in Layton, Utah.
- Phase I ESA for a proposed restaurant and strip mall development in Midvale, Utah.

- Phase I ESA for proposed commercial development in Farmington, Utah.
- Phase I ESA for a proposed restaurant in Sandy, Utah.
- Phase I ESA for proposed water treatment plant expansion in Ogden, Utah.
- Phase I ESA for a proposed development in Bountiful, Utah. A department store existed on the property at the time of the investigation.
- 3 Phase I ESAs for Weber Basin Water Conservancy District.
- Phase I ESA for an existing gas station in Murray, Utah.
- Phase I ESA for a proposed residential subdivision in Heber City, Utah.
- Phase I ESA for proposed mixed-use development in Draper, Utah.
- Phase I ESA for proposed mixed-use development in Pleasant Grove, Utah.
- Phase I ESA for proposed subdivision in Highland, Utah.
- 2 Phase I ESAs in Herriman, Utah.
- Phase I ESA for proposed 128-acre commercial development by Jordanelle Reservoir, Utah.
- Phase I ESA for 158-acre property in Heber, Utah.
- Phase I ESA for 3-acre property in Salem, Utah.
- Phase I ESA for McDonald's restaurant in Draper, Utah.
- Phase I ESAs for Existing or Proposed Charter School Sites in Santaquin, Pleasant Grove, Springville, Salt Lake City, and Nibley, Utah.

APPENDIX

PLATES



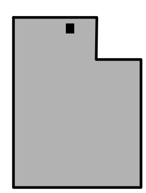
BASE MAPS:
East: LOGAN, UTAH
U.S.G.S. 7.5 MINUTE QUADRANGLE

West: WELLSVILLE, UTAH
U.S.G.S. 7.5 MINUTE QUADRANGLE

0' 1000' 2000'

SCALE 1:24,000

Contour Interval is 10 feet



MAP LOCATION

N

IGES®

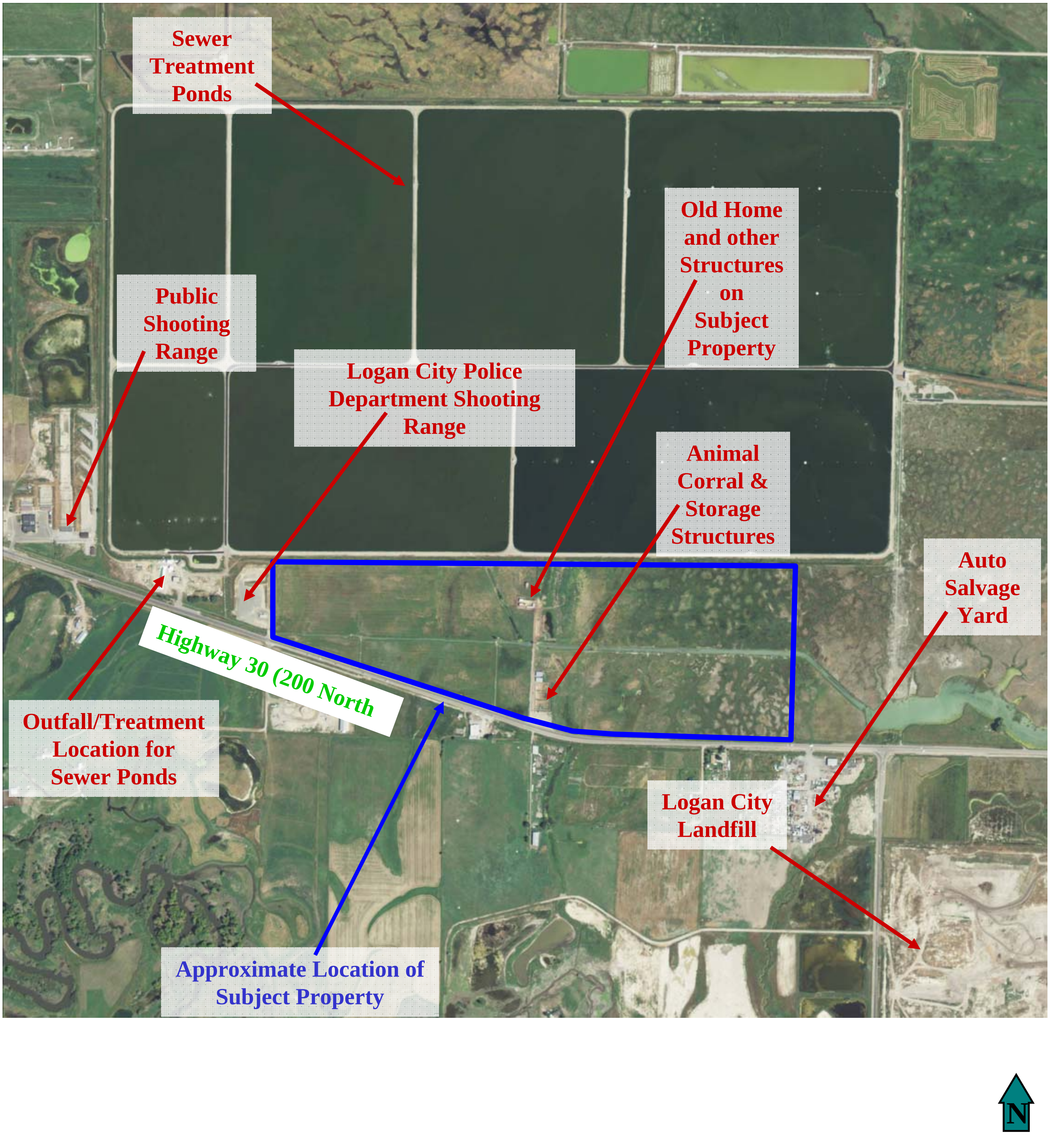
Project Number – 00823-001

Phase I ESA
Proposed Waste Water Treatment Facility
2300 West Highway 30
Logan, Utah

SITE VICINITY MAP

Plate

1



IGES®

Project Number – 00823-011

Phase I ESA
Proposed Waste Water Treatment Facility
2300 West Highway 30
Logan, Utah

Background Photo:
AGRC – August 10, 2011

SITE MAP

Plate

2

Looking north at the subject property from near the center of the southern boundary.

Looking north at the southern animal corral on the subject property near the center of the southern boundary of the subject property.

Looking north along the western portion of the southern animal corral located in the south central portion of the subject property.

One of several water tanks filled with artesian wells on the subject property. This is one of two located in the southern animal corral.

Looking at a structure used to provide shelter from the weather to animals near the southern animal corral.

Plumbing associated with one of the artesian wells providing water to one of the water tanks in the southern animal corral.

Looking northwest from near the center of the subject property.

Looking east between two structures used to provide shelter from the weather to animals near the southern animal corral located in the south central portion of the subject property.

Looking southwest across the subject property from near the center of the subject property.

Looking west along the canal from near the center of the subject property.

Looking east along the canal from near the center of the subject property. One of several artesian wells enclosed in a large rubber tire located on the subject property is seen in the foreground.

Looking southeast from near the center of the subject property.

Looking south along a ditch near the western central portion of the subject property.

Looking northwest from near the western central portion of the subject property.

Looking west across the subject property from near the central western portion of the subject property.

One of numerous frogs located near the canal on the subject property.

Looking northwest across the subject property from near the western boundary of the subject property.

Looking east along the southern boundary of the subject property from near the southwest corner of the subject property.

Looking at a storage shed and covering over the animal feeding area adjacent to the northern animal corral near the north central portion of the subject property.

Looking at a covering over the animal feeding area and storage of hay bales adjacent to the northern animal coral near the north central portion of the subject property.

Looking north to northwest at an old, dilapidated, abandoned wooden home on the subject property near the central portion of the northern boundary of the subject property.

Looking east across the subject property from near the north central portion of the subject property.

Looking southeast to east across the subject property from near the central portion of the northern boundary of the subject property at livestock currently grazing on the subject property.

Looking at an area of ground near the center of the northern boundary of the subject property that appears to have been disturbed by animals.

Looking southeast across the subject property from near the east central portion of the subject property.

Looking at an area in the northeastern portion of the subject property that has either been recently flood irrigated or has shallow groundwater

Looking north to northeast across the subject property from the northeastern portion of the subject property. Another artesian well with a rubber-tire enclosure is seen above the center of the photograph.

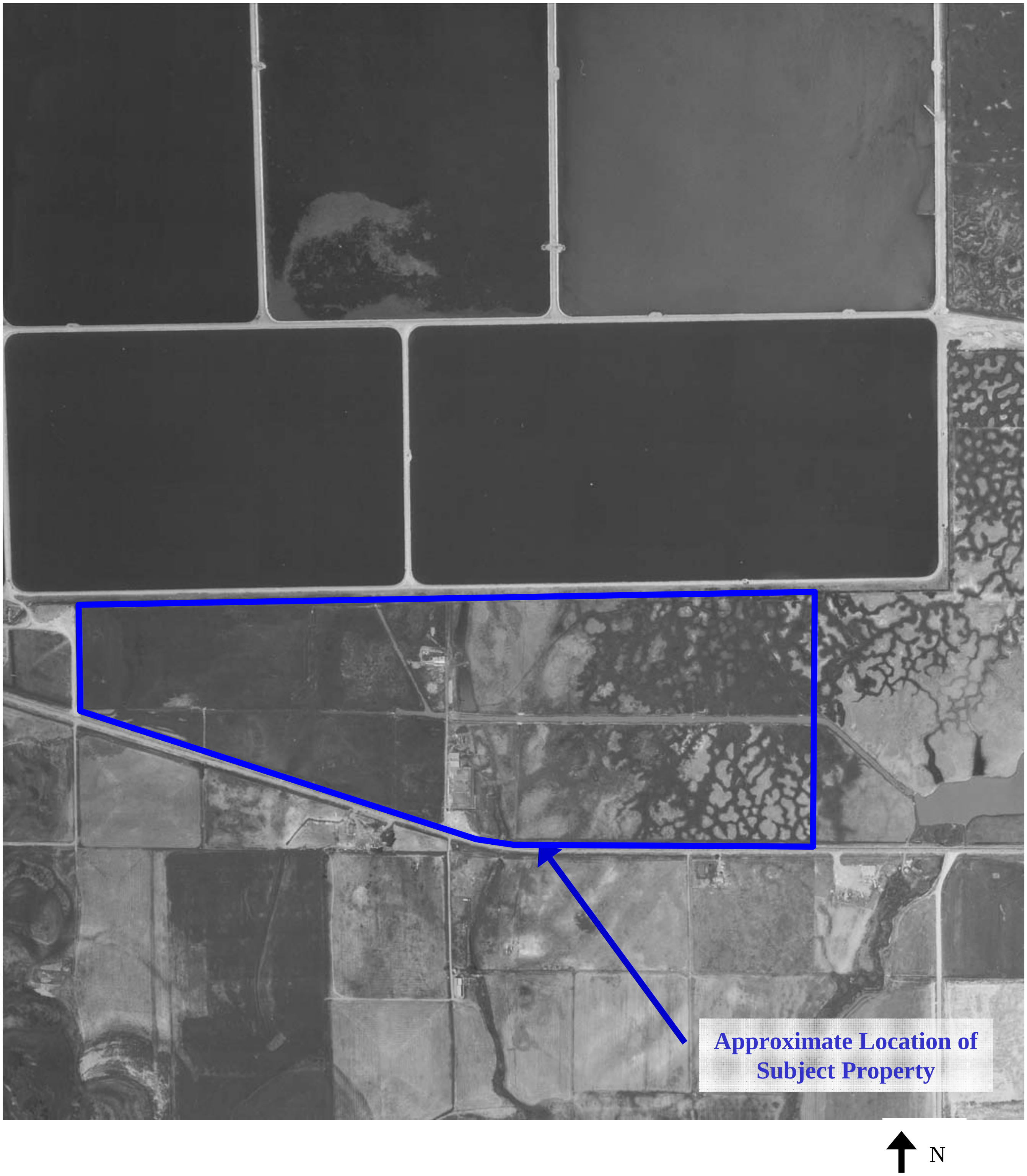
Looking east across the subject property from the northeastern portion of the subject property along the canal.

Looking northeast across the subject property from the northeastern portion of the subject property. Another artesian well with a rubber-tire enclosure is seen above in the center of the photograph.

Looking at some soil spoils near the canal banks in the eastern portion of the subject property. It appears that the spoils have been excavated or removed from the canal.

Looking southeast across the subject property from the southeastern portion of the subject property.

Looking southeast to east across the subject property from the southeastern portion of the subject property.



IGES®

Project Number – 00823-011

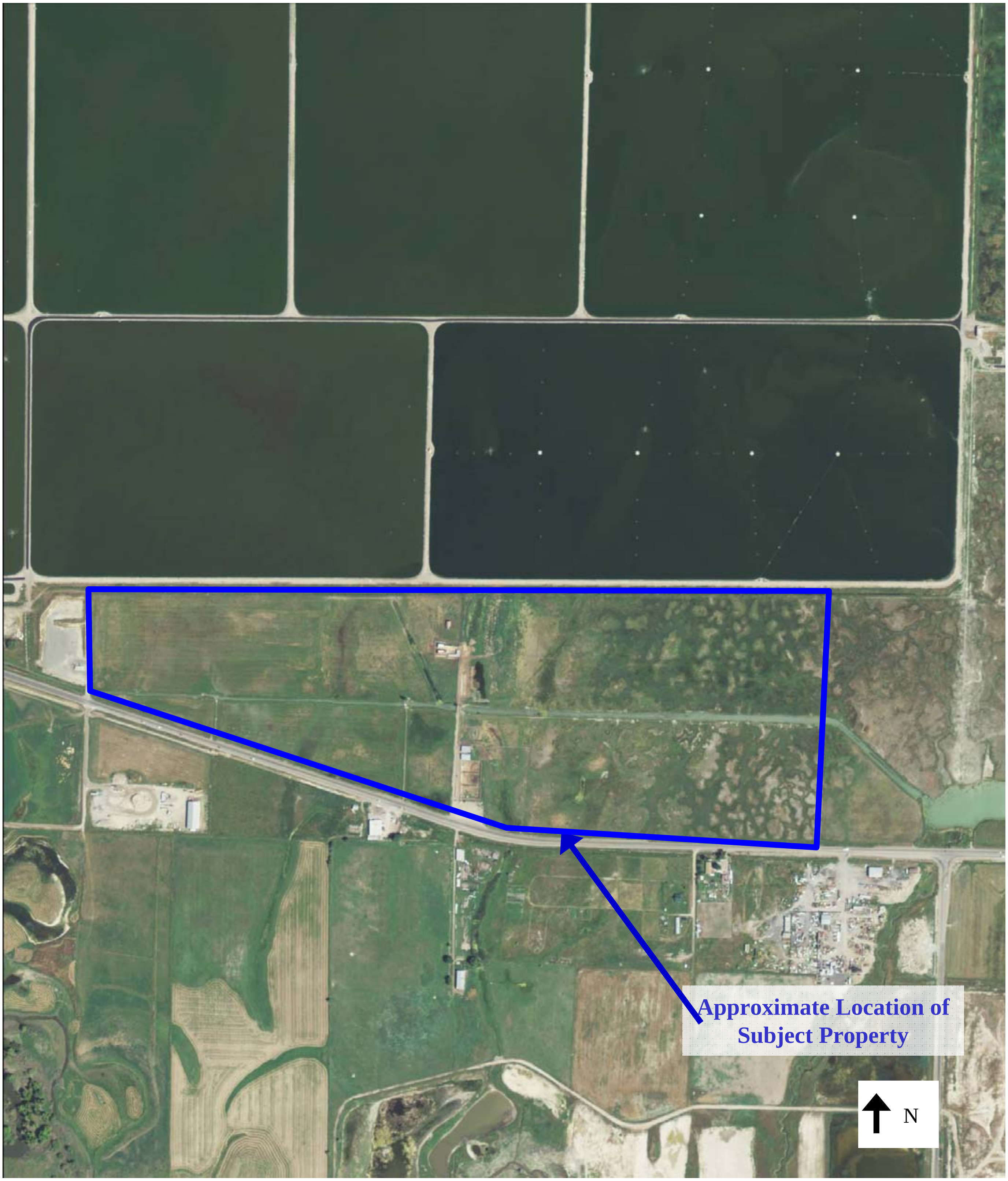
Phase I ESA
Proposed Waste Water Treatment Facility
2300 West Highway 30
Logan, Utah

Date of Aerial Photography:
June 30, 1988

AERIAL PHOTOGRAPHY

Plate

19



IGES®

Project Number – 00823-011

Phase I ESA
Proposed Waste Water Treatment Facility
2300 West Highway 30
Logan, Utah

Date of Aerial Photography:
August 10, 2011

AERIAL PHOTOGRAPHY

Plate

20

EDR Report

Logan Phase I ESA
2400 West 200 North
Logan, UT 84321

Inquiry Number: 3407549.2s
September 11, 2012

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

2400 WEST 200 NORTH
LOGAN, UT 84321

COORDINATES

Latitude (North):	41.7379000 - 41˚ 44' 16.44''
Longitude (West):	111.8883000 - 111˚ 53' 17.88''
Universal Tranverse Mercator:	Zone 12
UTM X (Meters):	426129.6
UTM Y (Meters):	4620844.5
Elevation:	4432 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	41111-F8 WELLSVILLE, UT
Most Recent Revision:	1986
North Map:	41111-G8 NEWTON, UT
Most Recent Revision:	1986
East Map:	41111-F7 LOGAN, UT
Most Recent Revision:	1986

AERIAL PHOTOGRAPHY IN THIS REPORT

Photo Year:	2009
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 7 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
LOGAN OUTFALL DISINFECTION FACILI 2400 WEST & SR 30 LOGAN, UT 84323	FINDS	N/A

EXECUTIVE SUMMARY

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - - - - - - National Priority List
Proposed NPL - - - - - - Proposed National Priority List Sites
NPL LIENS - - - - - - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - - - - - - National Priority List Deletions

Federal CERCLIS list

CERCLIS - - - - - - Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY - - - - - - Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP - - - - - - CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS - - - - - - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - - - - - - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG - - - - - - RCRA - Large Quantity Generators
RCRA-SQG - - - - - - RCRA - Small Quantity Generators
RCRA-CESQG - - - - - - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS - - - - - - Engineering Controls Sites List
US INST CONTROL - - - - - - Sites with Institutional Controls

Federal ERNS list

ERNS - - - - - - Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS - - - - - - This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

EXECUTIVE SUMMARY

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - - - - List of Landfills

State and tribal leaking storage tank lists

LUST - - - - Sites with Leaking Underground Storage Tanks
LAST - - - - Leaking Aboveground Storage Tank Sites
INDIAN LUST - - - - Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST - - - - List of Sites with Underground Storage Tanks
AST - - - - Listing of Aboveground Storage Tanks
INDIAN UST - - - - Underground Storage Tanks on Indian Land
FEMA UST - - - - Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL - - - - Sites with Institutional Controls

State and tribal voluntary cleanup sites

VCP - - - - Voluntary Cleanup Sites List
INDIAN VCP - - - - Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS - - - - Brownfields Assessment Sites Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 - - - - Torres Martinez Reservation Illegal Dump Site Locations
ODI - - - - Open Dump Inventory
INDIAN ODI - - - - Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL - - - - Clandestine Drug Labs
CDL - - - - Methamphetamine Contaminated Properties Listing
US HIST CDL - - - - National Clandestine Laboratory Register

Local Land Records

LIENS 2 - - - - CERCLA Lien Information
LUCIS - - - - Land Use Control Information System

Records of Emergency Release Reports

HMIRS - - - - Hazardous Materials Information Reporting System

EXECUTIVE SUMMARY

SPILLS	Spills Data

Other Ascertainable Records

RCRA-NonGen	RCRA - Non Generators
DOT OPS	Incident and Accident Data
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
RAATS	RCRA Administrative Action Tracking System
UIC	UIC Site Location Listing
DRYCLEANERS	Registered Drycleaners
NPDES	Permitted Facilities Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
FUDS	Formerly Used Defense Sites
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
PRP	Potentially Responsible Parties
2020 COR ACTION	2020 Corrective Action Program List
FINANCIAL ASSURANCE	Financial Assurance Information Listing
PCB TRANSFORMER	PCB Transformer Registration Database
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

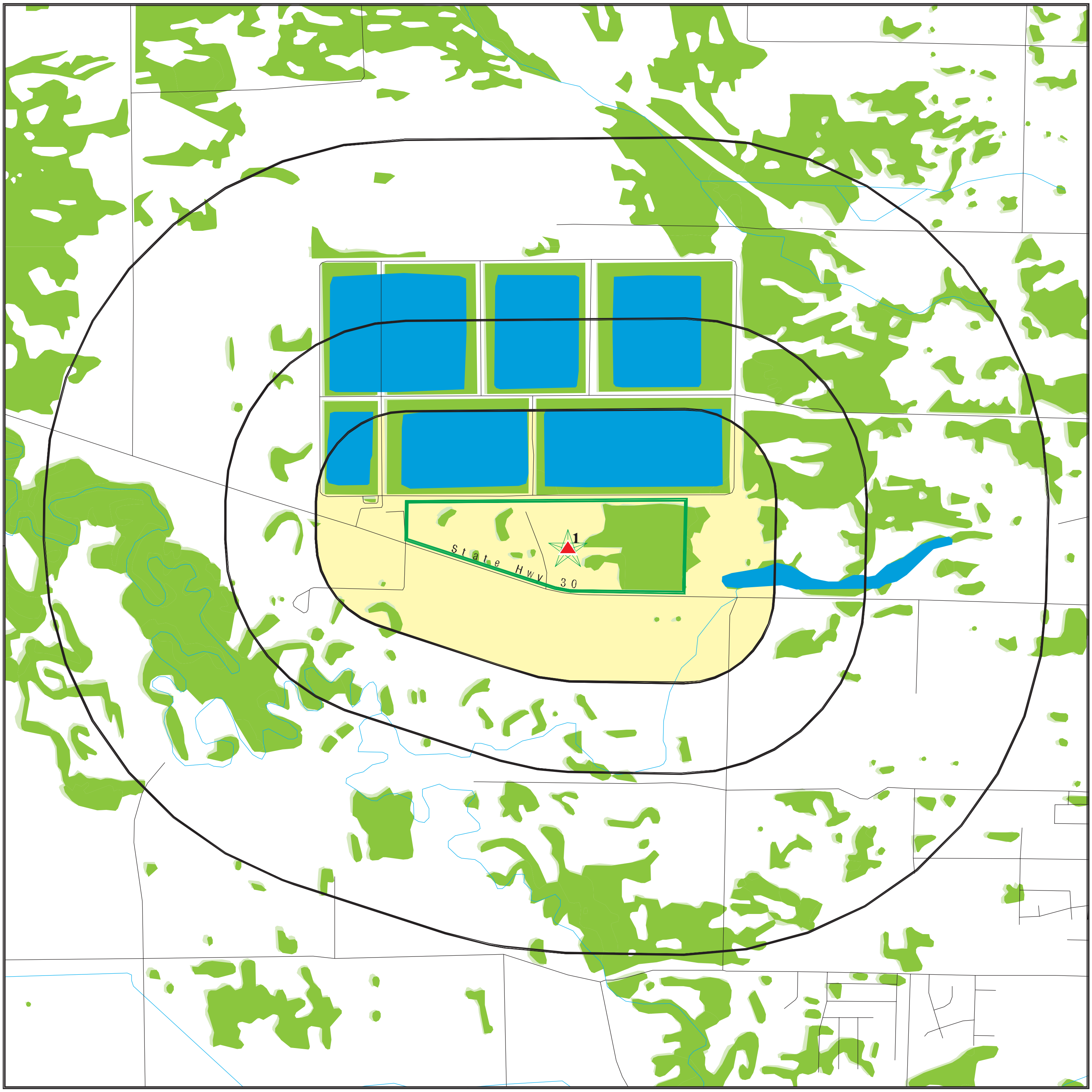
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 20 records.

Site Name	Database(s)
UDOT # 145 LOGAN SUMMIT	LUST,UST,FINANCIAL ASSURANCE 1
MAVERIK #181	LUST,UST,FINANCIAL ASSURANCE 1
FRONTIER SCIENTIFIC, INC.	FINDS,RCRA-LQG
	ERNS
CITY OF LOGAN SEWER DEPARTMENT	FINDS
LOGAN COACH INC.	FINDS
UDOT STATION #145 LOGAN SUMMIT	FINDS
LOGAN CANYON HIGHWAY	FINDS
LOGAN CITY PARKING	FINDS
LOGAN AIRPORT HANGER C-1	FINDS
CITY OF LOGAN HYDRO PLANT #1	FINDS
CITY OF LOGAN HYDRO PLANT #2	FINDS
LOGAN CITY	FINDS
RUPP’S TRUCKING AND EXCAVATION FOR	FINDS
THE SPRINGS AT LOGAN RIVER PHASE I	FINDS
MAPLE VALLEY APTS. PHASE 2	NPDES
LOGAN COACH INC	NPDES
LOGAN GATEWAY PAD A,B,C	NPDES
SIERRA PARK PHASE 1	NPDES
LOGAN AIRPORT HANGAR C-1	FINANCIAL ASSURANCE 1

OVERVIEW MAP - 3407549.2s



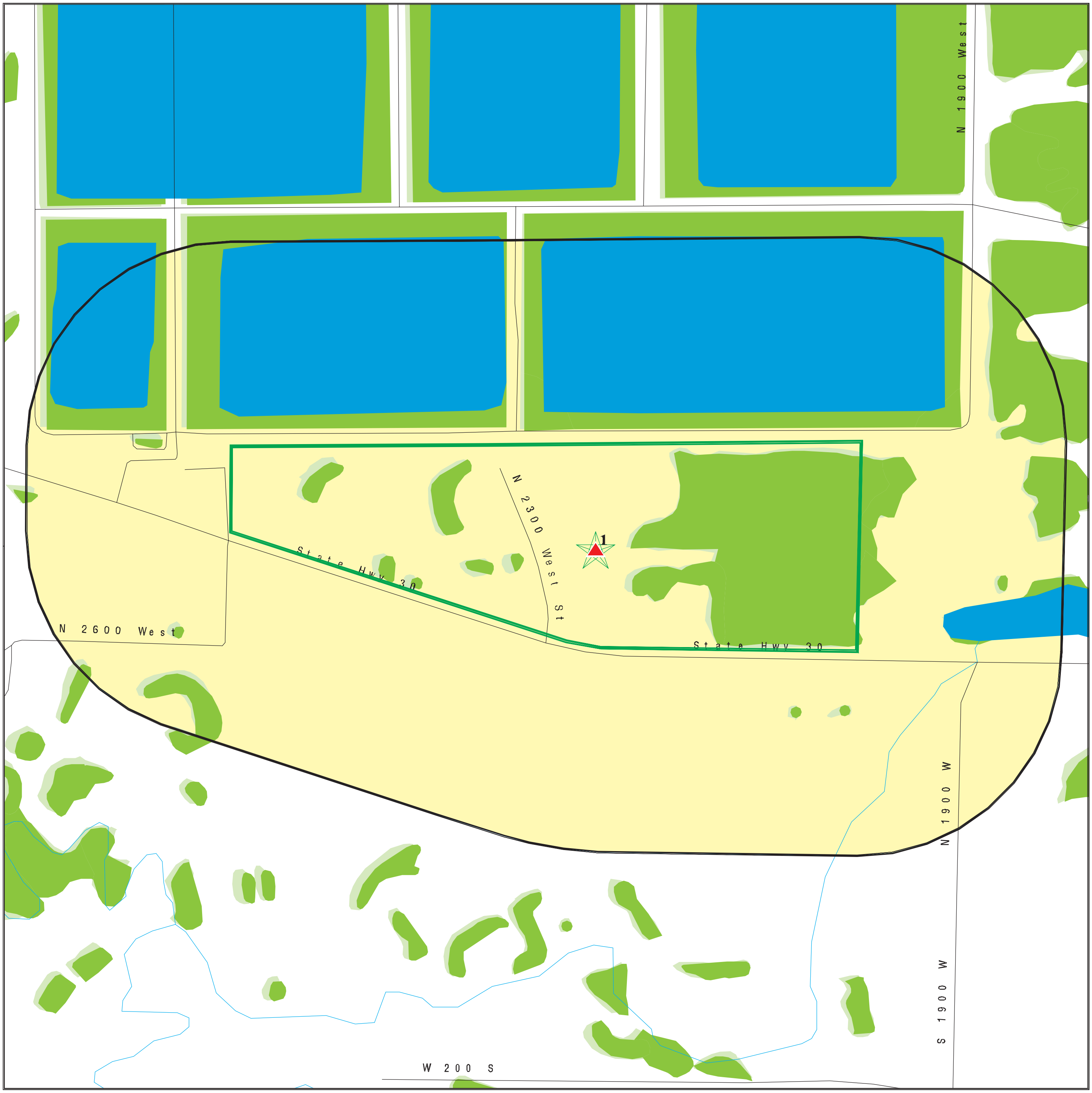
Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
National Priority List Sites
Dept. Defense Sites

Indian Reservations BIA
Oil & Gas pipelines from USGS
National Wetland Inventory
State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Logan Phase I ESA	CLIENT:	IGES
ADDRESS:	2400 West 200 North Logan UT 84321	CONTACT:	David Petersen
		INQUIRY #:	3407549.2s
LAT/LONG:	41.7379 / 111.8883	DATE:	September 11, 2012 12:06 pm

DETAIL MAP - 3407549.2s



0 1/8 1/4 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines from USGS
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Logan Phase I ESA	CLIENT: IGES
ADDRESS: 2400 West 200 North	CONTACT: David Petersen
Logan UT 84321	INQUIRY #: 3407549.2s
LAT/LONG: 41.7379 / 111.8883	DATE: September 11, 2012 12:06 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	1.000		0	0	0	0	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen	0.250		0	0	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP	1	NR	NR	NR	NR	NR	1
RAATS	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
FUDS	TP		NR	NR	NR	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
FINANCIAL ASSURANCE	TP		NR	NR	NR	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
Manufactured Gas Plants	1.000		0	0	0	0	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
1 Target Property	**LOGAN OUTFALL DISINFECTION FACILITY 2400 WEST & SR 30 LOGAN, UT 84323**	**FINDS**	**1012073861 N/A**
Actual: 4432 ft.			

FINDS:

Registry ID: 110000720104

Environmental Interest/Information System

US EPA Risk Management Plan (RMP) database stores the risk management plans reported by companies that handle, manufacture, use, or store certain flammable or toxic substances, as required under section 112(r) of the Clean Air Act (CAA).

Count: 20 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
LOGAN	1004789104	FRONTIER SCIENTIFIC, INC.	689 WEST 200 SOUTH	84321	FINDS,RCRA-LQG
LOGAN	1005827873	LOGAN CANYON HIGHWAY	LOGAN CANYON	84321	FINDS
LOGAN	1005849546	LOGAN AIRPORT HANGER C-1	LOGAN AIRPORT	84321	FINDS
LOGAN	1005849867	CITY OF LOGAN HYDRO PLANT #1	2 MILES UP LOGAN CANYON ON HWY	84321	FINDS
LOGAN	1005849870	CITY OF LOGAN HYDRO PLANT #2	MOUTH OF LOGAN CANYON ON HWY 8	84321	FINDS
LOGAN	1005850763	LOGAN CITY PARKING	LOGAN CITY PARKING	84321	FINDS
LOGAN	1005856343	UDOT STATION #145 LOGAN SUMMIT	HWY 89 AT 402 S MILE POST	84321	FINDS
LOGAN	1007841338	LOGAN CITY	SITE INFORMATION RESTRICTED	84321	FINDS
LOGAN	1009457101	CITY OF LOGAN SEWER DEPARTMENT	400 WEST, 140 N TO 180 N SEWER	84321	FINDS
LOGAN	1010031456	RUPP'S TRUCKING AND EXCAVATION FOR	1100 WEST STREET: TO 1800 S TO	84321	FINDS
LOGAN	1010351168	LOGAN COACH INC.	800 NORTH 870 WEST	84321	FINDS
LOGAN	1011446423	THE SPRINGS AT LOGAN RIVER PHASE I	1778 SOUTH 1200 WEST	84321	FINDS
LOGAN	99628879		US 89 AT LOGAN CANYON AT MM 38		ERNS
LOGAN	S107868976	LOGAN COACH INC	800 NORTH 870 WEST	84321	NPDES
	S108955011	LOGAN AIRPORT HANGAR C-1	LOGAN AIRPORT	84321	FINANCIAL ASSURANCE 1
LOGAN	S111070213	MAPLE VALLEY APTS. PHASE 2	1593 NORTH 400 WEST	84321	NPDES
NIBLEY	S111070527	SIERRA PARK PHASE 1	1200 WEST 2350 SOUTH	84321	NPDES
LOGAN	S111280982	LOGAN GATEWAY PAD A,B,C	100 WEST HWY -89-91	84321	NPDES
	U000557311	MAVERIK #181	1190 S HWY 165	84332	LUST,UST,FINANCIAL ASSURANCE
	U004137880	UDOT # 145 LOGAN SUMMIT	11871 N HWY 89 AT MP 489.6	84321	LUST,UST,FINANCIAL ASSURANCE

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/10/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 5

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/30/2012
Date Data Arrived at EDR: 04/05/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/30/2012
Date Data Arrived at EDR: 04/05/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 12/27/2011
Date Data Arrived at EDR: 02/27/2012
Date Made Active in Reports: 03/12/2012
Number of Days to Update: 14

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 08/28/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 12/10/2010
Date Data Arrived at EDR: 01/11/2011
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 36

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 12/28/2011
Date Data Arrived at EDR: 02/27/2012
Date Made Active in Reports: 03/12/2012
Number of Days to Update: 14

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 08/28/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 08/19/2011	Source: EPA
Date Data Arrived at EDR: 08/31/2011	Telephone: 800-424-9346
Date Made Active in Reports: 01/10/2012	Last EDR Contact: 08/07/2012
Number of Days to Update: 132	Next Scheduled EDR Contact: 11/26/2012
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/15/2012	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/04/2012	Telephone: 303-312-6149
Date Made Active in Reports: 05/15/2012	Last EDR Contact: 08/16/2012
Number of Days to Update: 41	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/15/2012	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/04/2012	Telephone: 303-312-6149
Date Made Active in Reports: 05/15/2012	Last EDR Contact: 08/16/2012
Number of Days to Update: 41	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/15/2012	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/04/2012	Telephone: 303-312-6149
Date Made Active in Reports: 05/15/2012	Last EDR Contact: 08/16/2012
Number of Days to Update: 41	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/15/2012	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/04/2012	Telephone: 303-312-6149
Date Made Active in Reports: 05/15/2012	Last EDR Contact: 08/16/2012
Number of Days to Update: 41	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/30/2011
Date Data Arrived at EDR: 12/30/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 11

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 09/05/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/30/2011
Date Data Arrived at EDR: 12/30/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 11

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 09/05/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 04/02/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 72

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Department of Environmental Quality
Telephone: 801-536-4100
Last EDR Contact: 08/03/2012
Next Scheduled EDR Contact: 11/19/2012
Data Release Frequency: N/A

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: List of Landfills

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 06/01/2011
Date Data Arrived at EDR: 08/31/2011
Date Made Active in Reports: 09/14/2011
Number of Days to Update: 14

Source: Department of Environmental Quality
Telephone: 801-538-6170
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Semi-Annually

State and tribal leaking storage tank lists

LUST: Sites with Leaking Underground Storage Tanks
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/23/2012
Date Data Arrived at EDR: 04/27/2012
Date Made Active in Reports: 06/01/2012
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 801-536-4115
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/05/2012
Data Release Frequency: Quarterly

LAST: Leaking Aboveground Storage Tank Sites
A listing of leaking aboveground storage tank locations.

Date of Government Version: 06/19/2012
Date Data Arrived at EDR: 06/21/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 32

Source: Department of Environmental Quality
Telephone: 801-536-4141
Last EDR Contact: 09/06/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 62

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/03/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Semi-Annually

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 02/07/2012
Date Data Arrived at EDR: 02/17/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 88

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 25

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/26/2012
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 05/25/2012
Date Data Arrived at EDR: 05/25/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 05/07/2012
Date Data Arrived at EDR: 05/08/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 63

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: List of Sites with Underground Storage Tanks
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 04/23/2012
Date Data Arrived at EDR: 04/27/2012
Date Made Active in Reports: 05/31/2012
Number of Days to Update: 34

Source: Department of Environmental Quality
Telephone: 801-536-4115
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/05/2012
Data Release Frequency: Quarterly

AST: Listing of Aboveground Storage Tanks
Aboveground storage tank site locations.

Date of Government Version: 06/19/2012
Date Data Arrived at EDR: 06/21/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 32

Source: Department of Environmental Quality
Telephone: 801-536-4100
Last EDR Contact: 09/06/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 02/07/2012
Date Data Arrived at EDR: 02/17/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 88

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/28/2012
Date Data Arrived at EDR: 02/29/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 76

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/02/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 75

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/03/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 25

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 05/07/2012
Date Data Arrived at EDR: 05/08/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 69

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 11/28/2011
Date Data Arrived at EDR: 11/29/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 42

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 07/26/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/12/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Sites with Institutional Controls

Sites included on the Brownfields Sites listing that have institutional controls in place.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 06/01/2012
Number of Days to Update: 23

Source: Department of Environmental Quality
Telephone: 801-536-4100
Last EDR Contact: 08/09/2012
Next Scheduled EDR Contact: 11/19/2012
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 02/17/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 42

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Voluntary Cleanup Sites List

The purpose of the program is to encourage the voluntary cleanup of sites where there has been a contaminant release threatening public health and the environment, thereby removing the stigma attached to these sites which blocks economic redevelopment. Voluntary cleanup of these sites will hopefully result in clearing the pathway for returning these properties to beneficial use.

Date of Government Version: 06/07/2012
Date Data Arrived at EDR: 06/08/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 45

Source: Department of Environmental Quality
Telephone: 801-536-4100
Last EDR Contact: 08/30/2012
Next Scheduled EDR Contact: 12/03/2012
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Assessment Sites

A Brownfields site means real property, the expansion, redevelopment or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant, controlled substance or petroleum product.

Date of Government Version: 06/07/2012
Date Data Arrived at EDR: 06/08/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 45

Source: Department of Environmental Quality
Telephone: 801-536-4100
Last EDR Contact: 08/30/2012
Next Scheduled EDR Contact: 12/03/2012
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/27/2011
Date Data Arrived at EDR: 06/27/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/25/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/03/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 08/03/2012
Next Scheduled EDR Contact: 11/19/2012
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 03/16/2012
Date Data Arrived at EDR: 06/12/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 34

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 09/05/2012
Next Scheduled EDR Contact: 12/17/2012
Data Release Frequency: Quarterly

CDL: Methamphetamine Contaminated Properties Listing

Utah Administrative Rule 19-6-901 Illegal Drug Operations Site Reporting and Decontamination Act requires local health departments to maintain a list of properties believed to be contaminated by the illegal manufacture of drugs. The following properties were reported to the Salt Lake Valley Health Department by a complaint or report from a law enforcement agency and the Department has determined that reasonable evidence exists that the property is contaminated.

Date of Government Version: 04/26/2012
Date Data Arrived at EDR: 05/31/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 53

Source: Salt Lake Valley Health Department
Telephone: 801-468-2750
Last EDR Contact: 08/29/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/16/2012
Date Data Arrived at EDR: 03/26/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 80

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 07/27/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005	Source: Department of the Navy
Date Data Arrived at EDR: 12/11/2006	Telephone: 843-820-7326
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 05/21/2012
Number of Days to Update: 31	Next Scheduled EDR Contact: 09/03/2012
	Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/01/2012	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 04/03/2012	Telephone: 202-366-4555
Date Made Active in Reports: 06/14/2012	Last EDR Contact: 07/02/2012
Number of Days to Update: 72	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Annually

SPILLS: Spills Data
Incidents reported to the Division of Environmental Response and Remediation

Date of Government Version: 04/16/2012	Source: Department of Environmental Quality
Date Data Arrived at EDR: 04/17/2012	Telephone: 801-536-4100
Date Made Active in Reports: 05/03/2012	Last EDR Contact: 07/13/2012
Number of Days to Update: 16	Next Scheduled EDR Contact: 10/29/2012
	Data Release Frequency: Semi-Annually

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/15/2012	Source: Environmental Protection Agency
Date Data Arrived at EDR: 04/04/2012	Telephone: 303-312-6149
Date Made Active in Reports: 05/15/2012	Last EDR Contact: 08/16/2012
Number of Days to Update: 41	Next Scheduled EDR Contact: 10/15/2012
	Data Release Frequency: Varies

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/29/2011	Source: Department of Transporation, Office of Pipeline Safety
Date Data Arrived at EDR: 08/09/2011	Telephone: 202-366-4595
Date Made Active in Reports: 11/11/2011	Last EDR Contact: 08/07/2012
Number of Days to Update: 94	Next Scheduled EDR Contact: 11/19/2012
	Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 07/19/2012
Number of Days to Update: 62	Next Scheduled EDR Contact: 10/29/2012
	Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 09/10/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/01/2011
Date Data Arrived at EDR: 01/25/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 36

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 06/27/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 02/27/2012
Date Data Arrived at EDR: 03/14/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 92

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 06/13/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 08/28/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 09/08/2011
Date Made Active in Reports: 09/29/2011
Number of Days to Update: 21

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 09/04/2012
Next Scheduled EDR Contact: 12/17/2012
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 09/01/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 131

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 08/31/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/29/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/22/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/22/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 07/27/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 06/21/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/10/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 98

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/21/2011
Date Data Arrived at EDR: 07/15/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 60

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 09/05/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/10/2012
Date Data Arrived at EDR: 01/12/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 49

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/11/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 10/23/2011
Date Data Arrived at EDR: 12/13/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 79

Source: EPA
Telephone: (303) 312-6312
Last EDR Contact: 06/12/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 03/01/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 62

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 08/31/2012
Next Scheduled EDR Contact: 12/10/2012
Data Release Frequency: Biennially

UIC: UIC Site Location Listing

A listing of underground injection control wells.

Date of Government Version: 06/05/2012
Date Data Arrived at EDR: 06/06/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 47

Source: Department of Natural Resources
Telephone: 801-538-5329
Last EDR Contact: 09/06/2012
Next Scheduled EDR Contact: 12/17/2012
Data Release Frequency: Quarterly

DRYCLEANERS: Registered Drycleaners

A listing of registered drycleaners.

Date of Government Version: 03/31/2012
Date Data Arrived at EDR: 04/27/2012
Date Made Active in Reports: 06/01/2012
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 801-536-4437
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 11/05/2012
Data Release Frequency: Varies

NPDES: Permitted Facilities Listing

A listing of Division of Water Quality permits.

Date of Government Version: 06/24/2012
Date Data Arrived at EDR: 06/29/2012
Date Made Active in Reports: 07/27/2012
Number of Days to Update: 28

Source: Department of Environmental Quality
Telephone: 801-538-6146
Last EDR Contact: 06/18/2012
Next Scheduled EDR Contact: 10/01/2012
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 11/05/2012
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 05/24/2012
Date Data Arrived at EDR: 06/05/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 9

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 08/14/2012
Next Scheduled EDR Contact: 12/03/2012
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

Formerly used defense sites.

Date of Government Version: 06/29/2009
Date Data Arrived at EDR: 02/03/2012
Date Made Active in Reports: 03/06/2012
Number of Days to Update: 32

Source: Utah AGRC
Telephone: 801-538-3665
Last EDR Contact: 07/31/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 02/27/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Quarterly

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: N/A

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 08/03/2012
Next Scheduled EDR Contact: 11/12/2012
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 03/31/2012
Date Data Arrived at EDR: 05/17/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 28

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 08/07/2012
Next Scheduled EDR Contact: 11/26/2012
Data Release Frequency: Quarterly

FINANCIAL ASSURANCE 2: Financial Assurance Information Listing

Financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay

Date of Government Version: 06/19/2012
Date Data Arrived at EDR: 06/21/2012
Date Made Active in Reports: 07/23/2012
Number of Days to Update: 32

Source: Department of Environmental Quality
Telephone: 801-536-4141
Last EDR Contact: 09/06/2012
Next Scheduled EDR Contact: 12/24/2012
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/12/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Varies

FINANCIAL ASSURANCE 1: Financial Assurance Information Listing

Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 04/11/2012
Date Data Arrived at EDR: 04/17/2012
Date Made Active in Reports: 05/01/2012
Number of Days to Update: 14

Source: Department of Environmental Quality
Telephone: 801-538-6794
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 08/16/2012
Next Scheduled EDR Contact: 11/26/2012
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 07/16/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 05/01/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 36

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 08/09/2012
Next Scheduled EDR Contact: 11/19/2012
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 04/27/2012
Date Made Active in Reports: 06/05/2012
Number of Days to Update: 39

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 07/19/2012
Next Scheduled EDR Contact: 11/05/2012
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/15/2011
Number of Days to Update: 27

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 07/16/2012
Next Scheduled EDR Contact: 10/01/2012
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Provider List
Source: Department of Health
Telephone: 801-538-9299

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands in Utah
Source: Automated Geographic Reference Center
Telephone: 801-537-9201

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

LOGAN PHASE I ESA
2400 WEST 200 NORTH
LOGAN, UT 84321

TARGET PROPERTY COORDINATES

Latitude (North):	41.7379 - 41˚ 44’ 16.44’’
Longitude (West):	111.8883 - 111˚ 53’ 17.88’’
Universal Tranverse Mercator:	Zone 12
UTM X (Meters):	426129.6
UTM Y (Meters):	4620844.5
Elevation:	4432 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	41111-F8 WELLSVILLE, UT
Most Recent Revision:	1986
North Map:	41111-G8 NEWTON, UT
Most Recent Revision:	1986
East Map:	41111-F7 LOGAN, UT
Most Recent Revision:	1986

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

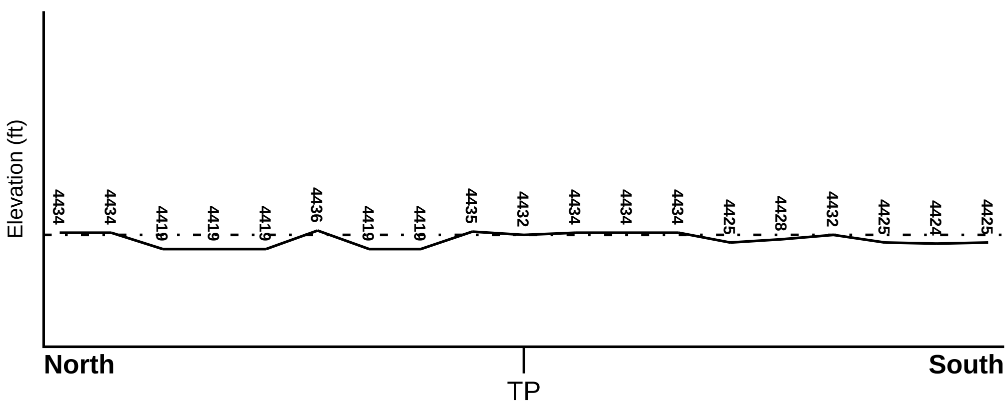
TOPOGRAPHIC INFORMATION

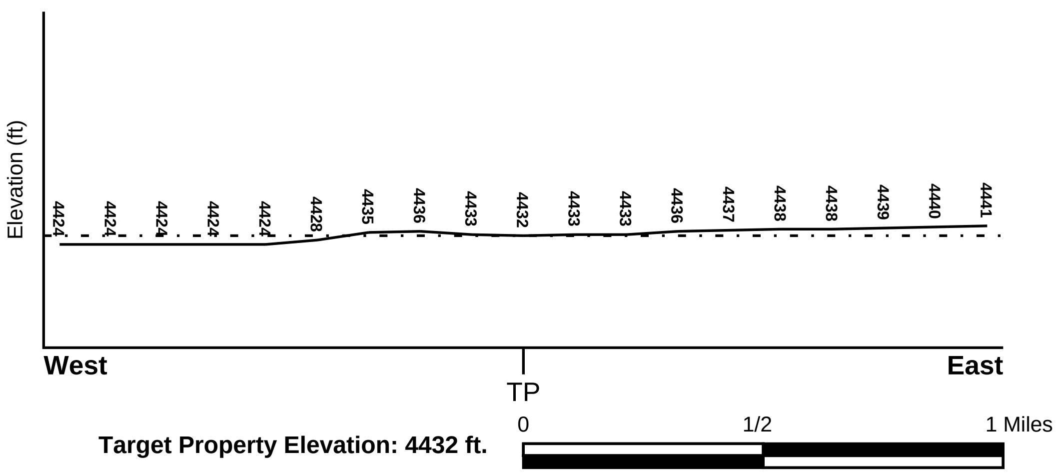
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General North

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 4432 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
CACHE, UT	Not Available

Flood Plain Panel at Target Property: Not Reported

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
WELLSVILLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

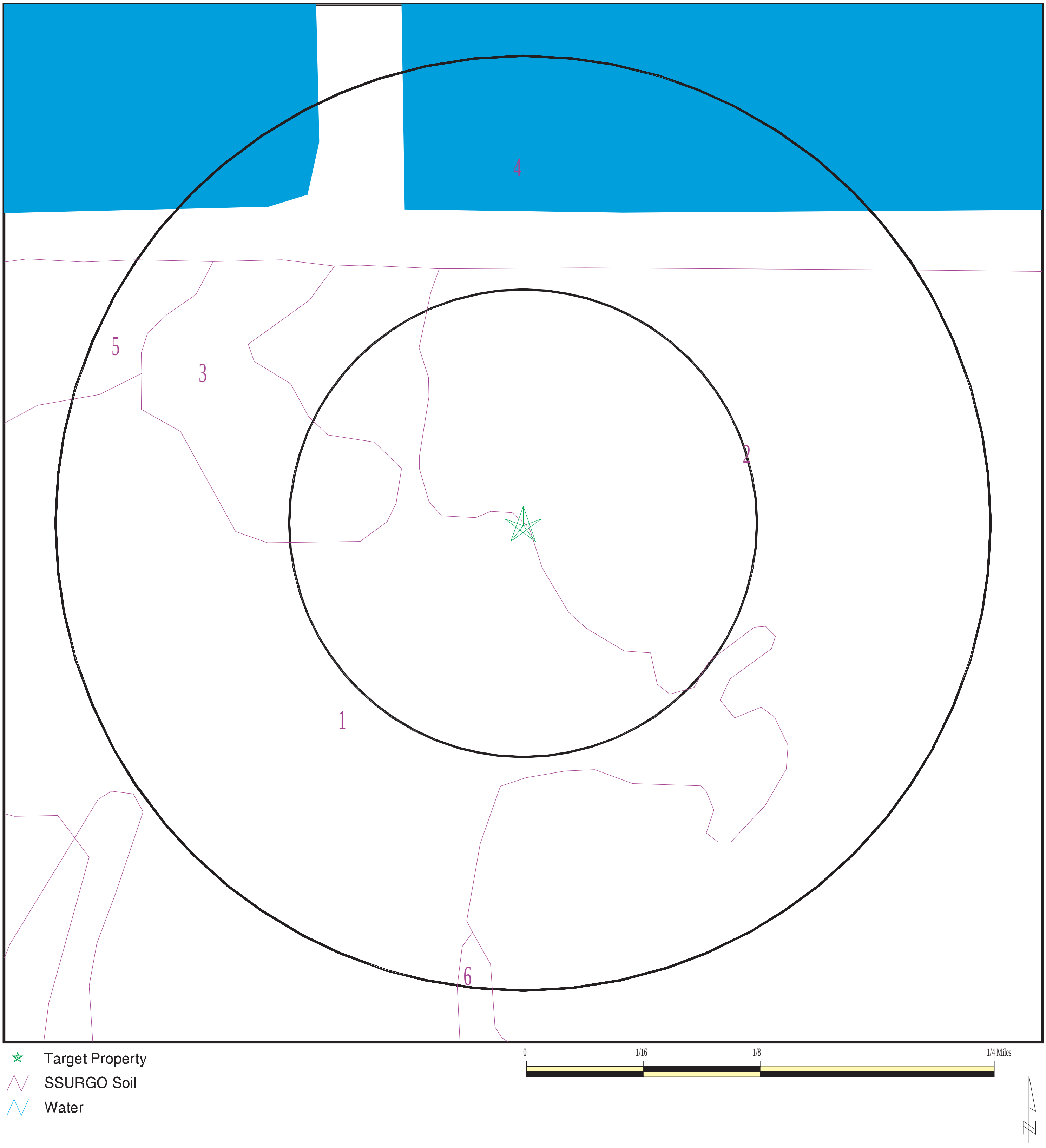
Era: Cenozoic
System: Quaternary
Series: Quaternary
Code: Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 3407549.2s



SITE NAME: Logan Phase I ESA ADDRESS: 2400 West 200 North Logan UT 84321 LAT/LONG: 41.7379 / 111.8883	CLIENT: IGES CONTACT: David Petersen INQUIRY #: 3407549.2s DATE: September 11, 2012 12:06 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Greenson

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 84 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
2	7 inches	16 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	16 inches	22 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
4	22 inches	38 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
5	38 inches	51 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
6	51 inches	72 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9

Soil Map ID: 2

Soil Component Name: Airport

Soil Surface Texture: silt loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 31 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	3 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
2	3 inches	11 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
3	11 inches	16 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
4	16 inches	25 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
5	25 inches	59 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9

Soil Map ID: 3

Soil Component Name: Logan

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 50 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	12 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 0	Max: 9 Min: 7.4

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	12 inches	25 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 0	Max: 9 Min: 7.4
3	25 inches	44 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 0	Max: 9 Min: 7.4
4	44 inches	59 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 0	Max: 9 Min: 7.4

Soil Map ID: 4

Soil Component Name: Miscellaneous water

Soil Surface Texture: silty clay loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class:
Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

Soil Map ID: 5

Soil Component Name: Collett

Soil Surface Texture: silty clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 69 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4
2	7 inches	11 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4
3	11 inches	16 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4
4	24 inches	33 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4
5	33 inches	59 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
6	16 inches	24 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.4

Soil Map ID: 6

Soil Component Name: Greenson

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat poorly drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 114 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	7 inches	16 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
3	16 inches	22 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
4	22 inches	38 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
5	38 inches	51 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
6	51 inches	72 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	USGS3044309	1/8 - 1/4 Mile ESE
C6	USGS3044284	1/8 - 1/4 Mile South
B9	USGS3044303	1/8 - 1/4 Mile WSW
D11	USGS3044283	1/8 - 1/4 Mile SSE
E18	USGS3044286	1/4 - 1/2 Mile ESE
J32	USGS3044288	1/2 - 1 Mile ESE
J33	USGS3044289	1/2 - 1 Mile ESE
K35	USGS3044267	1/2 - 1 Mile South
51	USGS3044277	1/2 - 1 Mile WSW
N59	USGS3044260	1/2 - 1 Mile SSE
P63	USGS3044268	1/2 - 1 Mile SE
66	USGS3044145	1/2 - 1 Mile West
P67	USGS3044266	1/2 - 1 Mile SE
P70	USGS3044265	1/2 - 1 Mile SE
R80	USGS3044300	1/2 - 1 Mile East
R81	USGS3044299	1/2 - 1 Mile East
R82	USGS3044298	1/2 - 1 Mile East
U87	USGS3044158	1/2 - 1 Mile WNW
R99	USGS3044302	1/2 - 1 Mile East
R101	USGS3044297	1/2 - 1 Mile East
Y103	USGS3044317	1/2 - 1 Mile West
Y104	USGS3044142	1/2 - 1 Mile West
X108	USGS3044305	1/2 - 1 Mile East
X109	USGS3044304	1/2 - 1 Mile East
W110	USGS3044301	1/2 - 1 Mile East
W112	USGS3044292	1/2 - 1 Mile East
W113	USGS3044296	1/2 - 1 Mile East
W114	USGS3044294	1/2 - 1 Mile East
W115	USGS3044295	1/2 - 1 Mile East
W116	USGS3044293	1/2 - 1 Mile East
W117	USGS3044287	1/2 - 1 Mile East
X119	USGS3044311	1/2 - 1 Mile East
X120	USGS3044308	1/2 - 1 Mile East

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

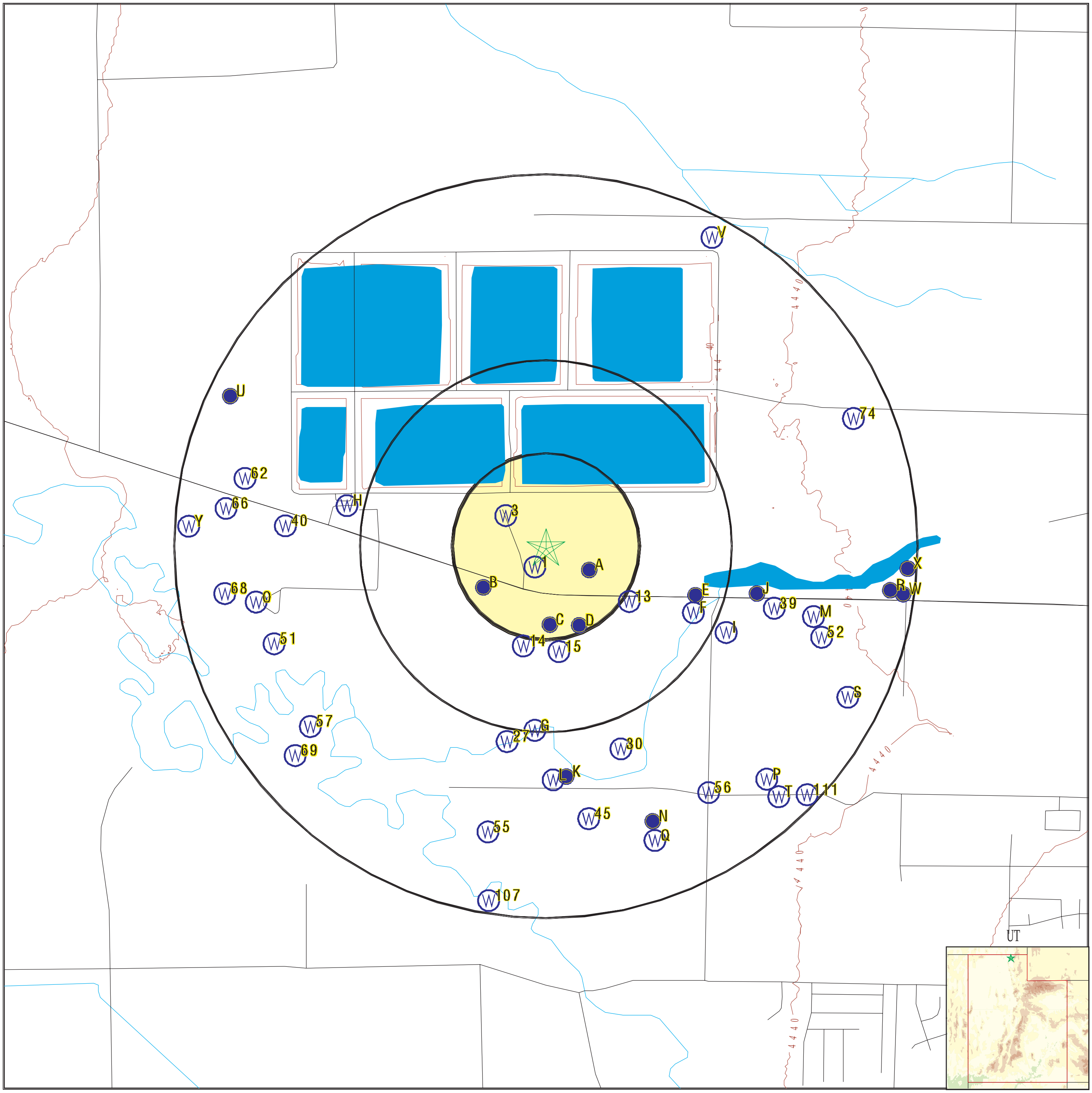
MAP ID	WELL ID	LOCATION FROM TP
1	UT6000000149466	0 - 1/8 Mile SSW
3	UT6000000149551	1/8 - 1/4 Mile NW
A4	UT6000000149454	1/8 - 1/4 Mile ESE
B5	UT6000000149432	1/8 - 1/4 Mile SW
C7	UT6000000149366	1/8 - 1/4 Mile South
C8	UT6000000149365	1/8 - 1/4 Mile South
B10	UT6000000149434	1/8 - 1/4 Mile WSW
D12	UT6000000149358	1/8 - 1/4 Mile SSE
13	UT6000000149395	1/4 - 1/2 Mile ESE
14	UT6000000149312	1/4 - 1/2 Mile SSW
15	UT6000000149308	1/4 - 1/2 Mile South
E16	UT6000000149444	1/4 - 1/2 Mile ESE
F17	UT6000000149382	1/4 - 1/2 Mile ESE
F19	UT6000000149387	1/4 - 1/2 Mile ESE
G20	UT6000000149223	1/4 - 1/2 Mile South
G21	UT6000000149224	1/4 - 1/2 Mile South
G22	UT6000000149208	1/2 - 1 Mile South
G23	UT6000000149209	1/2 - 1 Mile South
H24	UT6000000149569	1/2 - 1 Mile WNW
H25	UT6000000149570	1/2 - 1 Mile WNW
I26	UT6000000149325	1/2 - 1 Mile ESE
27	UT6000000149207	1/2 - 1 Mile South
I28	UT6000000149346	1/2 - 1 Mile ESE
J29	UT6000000149451	1/2 - 1 Mile East
30	UT6000000149203	1/2 - 1 Mile SSE
H31	UT6000000149583	1/2 - 1 Mile WNW
K34	UT6000000149187	1/2 - 1 Mile South
L36	UT6000000149179	1/2 - 1 Mile South
L37	UT6000000149180	1/2 - 1 Mile South
K38	UT6000000149177	1/2 - 1 Mile South
39	UT6000000149390	1/2 - 1 Mile ESE
40	UT6000000149537	1/2 - 1 Mile West
M41	UT6000000149385	1/2 - 1 Mile ESE
M42	UT6000000149386	1/2 - 1 Mile ESE
M43	UT6000000149379	1/2 - 1 Mile ESE
M44	UT6000000149380	1/2 - 1 Mile ESE
45	UT6000000149116	1/2 - 1 Mile South
M46	UT6000000149374	1/2 - 1 Mile ESE
N47	UT6000000149124	1/2 - 1 Mile SSE
N48	UT6000000149125	1/2 - 1 Mile SSE
M49	UT6000000149372	1/2 - 1 Mile ESE
O50	UT6000000149399	1/2 - 1 Mile West
52	UT6000000149322	1/2 - 1 Mile ESE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
N53	UT6000000149118	1/2 - 1 Mile SSE
N54	UT6000000149119	1/2 - 1 Mile SSE
55	UT6000000149090	1/2 - 1 Mile SSW
56	UT6000000149151	1/2 - 1 Mile SSE
57	UT6000000149216	1/2 - 1 Mile SW
O58	UT6000000149394	1/2 - 1 Mile West
N60	UT6000000149087	1/2 - 1 Mile SSE
N61	UT6000000149088	1/2 - 1 Mile SSE
62	UT6000000149624	1/2 - 1 Mile WNW
Q64	UT6000000149080	1/2 - 1 Mile SSE
Q65	UT6000000149081	1/2 - 1 Mile SSE
68	UT6000000149407	1/2 - 1 Mile West
69	UT6000000149196	1/2 - 1 Mile SW
R71	UT6000000149429	1/2 - 1 Mile East
R72	UT6000000149424	1/2 - 1 Mile East
R73	UT6000000149408	1/2 - 1 Mile East
74	UT6000000149719	1/2 - 1 Mile ENE
S75	UT6000000149261	1/2 - 1 Mile ESE
R76	UT6000000149425	1/2 - 1 Mile East
S77	UT6000000149269	1/2 - 1 Mile ESE
T78	UT6000000149139	1/2 - 1 Mile SE
T79	UT6000000149140	1/2 - 1 Mile SE
R83	UT6000000149453	1/2 - 1 Mile East
R84	UT6000000149439	1/2 - 1 Mile East
R85	UT6000000149442	1/2 - 1 Mile East
R86	UT6000000149427	1/2 - 1 Mile East
R88	UT6000000149428	1/2 - 1 Mile East
U89	UT6000000149750	1/2 - 1 Mile WNW
R90	UT6000000149449	1/2 - 1 Mile East
V91	UT6000000149905	1/2 - 1 Mile NNE
V92	UT6000000149906	1/2 - 1 Mile NNE
V93	UT6000000149907	1/2 - 1 Mile NNE
R94	UT6000000149411	1/2 - 1 Mile East
R95	UT6000000149416	1/2 - 1 Mile East
R96	UT6000000149417	1/2 - 1 Mile East
R97	UT6000000149406	1/2 - 1 Mile East
R98	UT6000000149398	1/2 - 1 Mile East
W100	UT6000000149389	1/2 - 1 Mile East
X102	UT6000000149455	1/2 - 1 Mile East
W105	UT6000000149437	1/2 - 1 Mile East
R106	UT6000000149403	1/2 - 1 Mile East
107	UT6000000148955	1/2 - 1 Mile South
111	UT6000000149143	1/2 - 1 Mile SE
W118	UT6000000149431	1/2 - 1 Mile East

PHYSICAL SETTING SOURCE MAP - 3407549.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

0 1/4 1/2 1 Miles

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Oil, gas or related wells

SITE NAME: Logan Phase I ESA ADDRESS: 2400 West 200 North Logan UT 84321 LAT/LONG: 41.7379 / 111.8883	CLIENT: IGES CONTACT: David Petersen INQUIRY #: 3407549.2s DATE: September 11, 2012 12:06 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **SSW** **0 - 1/8 Mile** **Higher**	**UT WELLS**	**UT6000000149466**

Water Right Num:	25-4315	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19640000		
Uses:	Stockwatering		
Cubic ft/sec:	.1		
Acre ft:	0		
Location:	N380 E840 W4 31 12N 1E SL		
Well Id:	0		
First Owner:	ELIASON PACKING COMPANY C/O MAX D. ELIASON		
Supply Source:	Underground Water Well		

A2 **ESE** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS3044309**

Agency cd:	USGS	Site no:	414414111530701
Site name:	(A-12- 1)31bdc- 1		
Latitude:	414414	EDR Site id:	USGS3044309
Longitude:	1115307	Dec lat:	41.73715223
Dec lon:	-111.88605612	Coor meth:	M
Coor accr:	F	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSENWS31 T12N R01E S
Location map:	WELLSVILLE	Map scale:	24000
Altitude:	4432		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	20		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	1934
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	198	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	464920300		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
3 **NW** **1/8 - 1/4 Mile** **Higher**	**UT WELLS**	**UT6000000149551**

Water Right Num:	25-2364	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	18980000		
Uses:	Stockwatering		
Cubic ft/sec:	.016		
Acre ft:	0		
Location:	S1535 E470 NW 31 12N 1E SL		
Well Id:	0		
First Owner:	ELIASON PACKING COMPANY		
Supply Source:	Underground Water Well		

A4 **ESE** **1/8 - 1/4 Mile** **Higher**	**UT WELLS**	**UT6000000149454**

Water Right Num:	25-2323	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19340500		
Uses:	Stockwatering		
Cubic ft/sec:	.022		
Acre ft:	0		
Location:	N270 E1615 W4 31 12N 1E SL		
Well Id:	0		
First Owner:	ELIASON PACKING COMPANY		
Supply Source:	Underground Water Well		

B5 **SW** **1/8 - 1/4 Mile** **Higher**	**UT WELLS**	**UT6000000149432**

Water Right Num:	25-2826	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19290000		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.111		
Acre ft:	0		
Location:	N90 E290 W4 31 12N 1E SL		
Well Id:	0		
First Owner:	CACHE HUMANE SOCIETY		
Supply Source:	Underground Water Well		

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
C6 **South** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS3044284**

Agency cd:	USGS	Site no:	414406111531501
Site name:	(A-12- 1)31cba- 1		
Latitude:	414406	EDR Site id:	USGS3044284
Longitude:	1115315	Dec lat:	41.73493004
Dec lon:	-111.88827838	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NENWSWS31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4432.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	192707
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	190	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1967-08-23	Ground water data end date:	1967-08-23
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-08-23	-34.00	

	Database	EDR ID Number
C7 **South** **1/8 - 1/4 Mile** **Higher**	**UT WELLS**	**UT6000000149366**

Water Right Num:	25-2489	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	Not Reported		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	3.532		
Location:	N2199 E1071 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	BRENT F. AND ANNETTE T. BRYNER		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
C8 **South** **1/8 - 1/4 Mile** **Higher**	**UT WELLS**	**UT6000000149365**

Water Right Num:	25-5656	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19270700		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.049		
Acre ft:	0		
Location:	N2190 E1000 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	MARGIE ANN BECKSTEAD		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
B9 **WSW** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS3044303**

Agency cd:	USGS	Site no:	414411111532801
Site name:	(A-12- 1)31bcc- 1		
Latitude:	414411	EDR Site id:	USGS3044303
Longitude:	1115328	Dec lat:	41.73631886
Dec lon:	-111.89188961	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSWNWS31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4431.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1929
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	72.0	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1967-11-01	Ground water data end date:	1967-11-01
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-11-01	-12.00	

B10
WSW
1/8 - 1/4 Mile
Higher

UT WELLS **UT6000000149434**

Water Right Num:	25-2825	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19000000		
Uses:	Other, Stockwatering		
Cubic ft/sec:	.056		
Acre ft:	0		
Location:	N105 E15 W4 31 12N 1E SL		
Well Id:	0		
First Owner:	CACHE HUMANE SOCIETY		
Supply Source:	Underground Water Well		

D11
SSE
1/8 - 1/4 Mile
Higher

FED USGS **USGS3044283**

Agency cd:	USGS	Site no:	414406111531001
Site name:	(A-12- 1)31cab- 1		
Latitude:	414406	EDR Site id:	USGS3044283
Longitude:	1115310	Dec lat:	41.73493006
Dec lon:	-111.88688945	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNESWS31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4431.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	192707
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	190	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00

Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1962-04-00	Ground water data end date:	1962-04-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1962-04	-31.00	

D12
SSE
1/8 - 1/4 Mile
Higher

UT WELLS **UT6000000149358**

Water Right Num:	25-2489	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	Not Reported		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	3.532		
Location:	N2157 E1515 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	BRENT F. AND ANNETTE T. BRYNER		
Supply Source:	Underground Water Well		

13
ESE
1/4 - 1/2 Mile
Higher

UT WELLS **UT6000000149395**

Water Right Num:	25-6018	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19730727		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	N2525 E2140 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	JUAN C. AND FERNANDO REYES		
Supply Source:	Underground Water Well		

14
SSW
1/4 - 1/2 Mile
Higher

UT WELLS **UT6000000149312**

Water Right Num:	25-5695	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19340000		
Uses:	Stockwatering		
Cubic ft/sec:	.002		
Acre ft:	0		
Location:	N1910 E630 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ASHTON BECKSTEAD		
Supply Source:	Underground Water Well		

15
South
1/4 - 1/2 Mile
Higher

UT WELLS **UT6000000149308**

Water Right Num:	25-2667	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	18800000		
Uses:	Stockwatering		
Cubic ft/sec:	.022		
Acre ft:	0		
Location:	N1825 E1135 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ASHTON BECKSTEAD		
Supply Source:	Underground Water Well		

E16
ESE
1/4 - 1/2 Mile
Higher

UT WELLS **UT6000000149444**

Water Right Num:	25-5980	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19790628		
Uses:	Irrigation		
Cubic ft/sec:	5.05		
Acre ft:	0		
Location:	N155 W2185 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	LOGAN COW PASTURE WATER COMPANY		
Supply Source:	Underground Water Well		

F17
ESE
1/4 - 1/2 Mile
Higher

UT WELLS **UT6000000149382**

Water Right Num:	25-4773	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19670828		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.152		
Acre ft:	0		
Location:	N2340 W2300 SE 31 12N 1E SL		
Well Id:	0		
First Owner:	MICHAEL K. AND CHERYL ANN BENNETT		
Supply Source:	Underground Water Well		

E18
ESE
1/4 - 1/2 Mile
Higher

FED USGS USGS3044286

Agency cd:	USGS	Site no:	414408111524701
Site name:	(A-12- 1)31dbb- 1		
Latitude:	414408	EDR Site id:	USGS3044286
Longitude:	1115247	Dec lat:	41.73548567
Dec lon:	-111.88050039	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSES31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4430.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	196411
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	171	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1967-03-06	Ground water data end date:	1967-03-06
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-03-06	-36.00	

Map ID Direction Distance Elevation	Database	EDR ID Number
F19 **ESE** **1/4 - 1/2 Mile** **Higher**	**UT WELLS**	**UT6000000149387**

Water Right Num:	25-4198	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19640601		
Uses:	Stockwatering		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	N2385 E455 S4 31 12N 1E SL		
Well Id:	0		
First Owner:	MICHAEL K. AND CHERYL ANN BENNETT		
Supply Source:	Underground Water Well		

G20 **South** **1/4 - 1/2 Mile** **Lower**	**UT WELLS**	**UT6000000149223**

Water Right Num:	25-2348	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19090000		
Uses:	Stockwatering		
Cubic ft/sec:	.067		
Acre ft:	0		
Location:	N835 E955 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ASHTON BECKSTEAD		
Supply Source:	Underground Water Well		

G21 **South** **1/4 - 1/2 Mile** **Lower**	**UT WELLS**	**UT6000000149224**

Water Right Num:	25-5694	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19020000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.067		
Acre ft:	0		
Location:	N840 E620 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ASHTON BECKSTEAD		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation				Database	EDR ID Number
G22 **South** **1/2 - 1 Mile** **Higher**				**UT WELLS**	**UT6000000149208**

Water Right Num:	25-2347	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	19090000		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	1.23		
Location:	N583 E775 SW 31 12N 1E SL		
Well Id:	432235		
First Owner:	BRET A. AND JENNY L. ALDER		
Supply Source:	Underground Water Wells		

G23 **South** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149209**

Water Right Num:	25-5578	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	19340000		
Uses:	Irrigation		
Cubic ft/sec:	0		
Acre ft:	.5		
Location:	N583 E775 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	BRET A. AND JENNY L. ALDER		
Supply Source:	Underground Water Wells		

H24 **WNW** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149569**

Water Right Num:	25-10733	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19090101		
Uses:	Irrigation		
Cubic ft/sec:	.243		
Acre ft:	0		
Location:	S1405 W1675 NE 36 12N 1W SL		
Well Id:	0		
First Owner:	LOGAN COW PASTURE WATER COMPANY		
Supply Source:	Underground Water Tile Drain		

Map ID Direction Distance Elevation		Database	EDR ID Number
H25 **WNW** **1/2 - 1 Mile** **Lower**		**UT WELLS**	**UT6000000149570**

Water Right Num:	25-2970	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	1909		
Uses:	Irrigation		
Cubic ft/sec:	18.757		
Acre ft:	0		
Location:	S1405 W1675 NE 36 12N 1W SL		
Well Id:	0		
First Owner:	LOGAN COW PASTURE WATER COMPANY		
Supply Source:	Underground Water Tile Drain		

I26 **ESE** **1/2 - 1 Mile** **Higher**		**UT WELLS**	**UT6000000149325**

Water Right Num:	25-7107	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Permanently lapsed		
Priority Date:	19761029		
Uses:	Not Reported		
Cubic ft/sec:	.25		
Acre ft:	0		
Location:	S600 W1840 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	CACHE COUNTY CORPORATION		
Supply Source:	Underground Water Well		

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27 **South** **1/2 - 1 Mile** **Lower**		**UT WELLS**	**UT6000000149207**

Water Right Num:	25-5693	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.011		
Acre ft:	0		
Location:	N555 E385 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ASHTON BECKSTEAD		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
I28 **ESE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149346**

Water Right Num:	25-7924	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19790410		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.056		
Acre ft:	0		
Location:	N2110 W1700 NE 06 11N 1E SL		
Well Id:	0		
First Owner:	GRANT W. POTTER		
Supply Source:	Underground Water Well		

	Database	EDR ID Number
J29 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149451**

Water Right Num:	25-2962	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19050000		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.018		
Acre ft:	0		
Location:	N200 W1390 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	ERNEST DEAN		
Supply Source:	Underground Water Well		

	Database	EDR ID Number
30 **SSE** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149203**

Water Right Num:	25-7302	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Permanently lapsed		
Priority Date:	19770310		
Uses:	Domestic, Irrigation, Other, Stockwatering		
Cubic ft/sec:	1		
Acre ft:	0		
Location:	N435 E2000 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	HOWARD B. PETERSON		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
H31 **WNW** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149583**

Water Right Num:	25-8559	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19840316		
Uses:	Other		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	S1300 W2000 NE 36 12N 1W SL		
Well Id:	8706		
First Owner:	LOGAN CITY CORPORATION		
Supply Source:	Underground Water Well		

J32 **ESE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044288**

Agency cd:	USGS	Site no:	414409111523501
Site name:	(A-12- 1)31dab- 1		
Latitude:	414409	EDR Site id:	USGS3044288
Longitude:	1115235	Dec lat:	41.73576348
Dec lon:	-111.87716697	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNESES31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4433.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	191408
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	VALLEY FILL		
Well depth:	132	Hole depth:	Not Reported
Source of depth data:	owner		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1960-10-25
Water quality data end date:	1962-08-31	Water quality data count:	3
Ground water data begin date:	1936-10-13	Ground water data end date:	1969-12-04
Ground water data count:	112		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Ground-water levels, Number of Measurements: 112

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1969-12-04	-30.70		1969-07-01	-32.4	
1969-06-02	-30.0		1969-05-06	-30.5	
1969-04-01	-31.1		1969-03-03	-31.3	
1969-02-04	-31.9		1969-01-06	-32.3	
1968-12-03	-33.1		1968-11-06	-33.0	
1968-10-01	-32.3		1968-09-03	-31.8	
1968-08-06	-30.8		1968-07-05	-30.5	
1968-06-04	-30.9		1968-05-07	-31.4	
1968-04-01	-31.5		1968-03-04	-31.0	
1968-02-12	-31.7		1968-01-11	-32.3	
1967-12-06	-32.35		1967-11-08	-29.3	
1967-10-06	-31.2		1967-09-06	-25.9	
1966-12-20	-29.3		1966-03-17	-31.0	
1965-12-15	-33.1		1965-03-31	-31.4	
1964-12-17	-31.2		1964-03-12	-29.4	
1963-12-04	-30.8		1963-03-06	-31.0	
1962-12-19	-32.3		1962-01-08	-32.2	
1961-04-11	-32.6		1960-10-25	-33.1	
1960-03-29	-32.8		1959-12-22	-33.6	
1959-03-24	-34.7		1958-12-03	-37.3	
1958-03-19	-35.9		1957-12-05	-38.0	
1957-03-27	-35.7		1956-04-03	-36.3	
1955-12-13	-35.9		1955-04-08	-35.3	
1954-12-07	-35.2		1954-04-13	-36.1	
1953-03-30	-38.1		1952-10-23	-42.4	
1952-04-14	-36.5		1951-10-31	-40.0	
1951-03-28	-37.9		1950-12-15	-39.7	
1950-03-30	-36.8		1949-12-08	-38.2	
1949-08-08	-36.7		1949-03-28	-34.4	
1947-12-30	-36.9		1947-04-01	-37.1	
1946-12-10	-38.3		1946-03-20	-35.8	
1945-12-06	-37.3		1945-03-01	-35.1	
1944-12-19	-35.7		1944-04-13	-35.1	
1943-12-04	-35.8		1943-04-22	-33.7	
1943-04-15	-33.5		1943-04-06	-33.4	
1943-03-06	-34.5		1942-12-29	-33.2	
1942-08-22	-29.5		1942-04-02	-33.5	
1942-03-04	-34.0		1942-03-03	-34.3	
1942-01-28	-34.1		1942-01-19	-34.0	
1941-12-16	-34.0		1941-12-12	-34.0	
1941-12-10	-33.9		1941-10-07	-29.8	
1941-04-04	-34.7		1941-03-13	-35.1	
1941-03-11	-35.0		1940-12-17	-32.0	
1940-06-25	-27.9		1940-05-01	-35.3	
1940-04-01	-35.9		1940-03-09	-36.0	
1940-02-06	-35.7		1939-12-28	-36.3	
1939-09-30	-35.0		1939-08-08	-32.9	
1939-05-31	-34.0		1939-04-05	-36.4	
1939-02-07	-37.7		1938-12-10	-38.6	
1938-10-13	-33.5		1938-08-19	-32.5	
1938-06-24	-32.3		1938-04-19	-37.1	
1938-02-09	-38.55		1937-12-15	-38.7	
1937-11-03	-33.1		1937-09-30	-27.4	
1937-08-06	-31.6		1937-05-13	-33.1	
1937-03-12	-33.6		1937-01-18	-34.0	

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1936-12-14	-34.2		1936-10-13	-32.0	

J33
ESE
1/2 - 1 Mile
Higher

FED USGS USGS3044289

Agency cd:	USGS	Site no:	414409111523502
Site name:	(A-12- 1)31dab- 2		
Latitude:	414409	EDR Site id:	USGS3044289
Longitude:	1115235	Dec lat:	41.73576348
Dec lon:	-111.87716697	Coor meth:	M
Coor accr:	T	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNESES31 T12N R01E S
Location map:	WELLSVILLE	Map scale:	24000
Altitude:	4430.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	197602
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	VALLEY FILL		
Well depth:	Not Reported	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	464920300		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1990-03-01
Water quality data end date:	1991-03-07	Water quality data count:	6
Ground water data begin date:	1977-03-09	Ground water data end date:	2005-03-01
Ground water data count:	52		

Ground-water levels, Number of Measurements: 52

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2005-03-01	-30.50		2005-01-07	-30.40	
2004-11-16	-30.50		2004-10-07	-28.25	
2004-08-26	-26.75		2004-06-02	-30.17	
2004-04-16	-30.25		2004-03-03	-29.25	
2003-12-04	-28.58		2003-10-21	-28.75	
2003-09-10	-27.75		2003-03-20	-29.50	
2001-03-08	-32.08		2000-03-01	-34.42	
1999-03-19	-35.58		1998-03-12	-34.00	
1997-03-13	-35.17		1996-03-14	-34.58	
1995-03-08	-33.4		1994-03-08	-31.7	
1993-03-17	-30.90		1992-03-10	-27.30	

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1991-03-07	-26.8		1991-01-16	-26.00	
1990-11-28	-28.60		1990-10-29	-31.00	
1990-04-27	-32.60		1990-03-01	-33.20	
1989-09-19	-35.50		1989-03-15	-32.40	
1988-09-23	-33.80		1988-03-03	-37.80	
1987-03-10	-37.80		1986-03-11	-37.70	
1985-09-19	-38.20		1985-03-04	-39.80	
1984-09-07	-43.60		1984-03-02	-39.80	
1983-08-31	-47.10		1983-03-02	-39.30	
1982-09-08	-42.80		1982-03-08	-35.60	
1981-09-17	-33.60		1981-03-02	-38.10	
1980-09-17	-39.30		1980-03-10	-36.40	
1979-09-20	-34.50		1979-03-12	-37.10	
1978-09-20	-38.10		1978-03-09	-36.00	
1977-09-29	-36.20		1977-03-09	-38.40	

K34
South
1/2 - 1 Mile
Lower

UT WELLS **UT6000000149187**

Water Right Num:	25-8517	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19830713		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	N160 E1380 SW 31 12N 1E SL		
Well Id:	0		
First Owner:	ROBERT C. AND CATHY E. CROSSFIELD		
Supply Source:	Underground Water Well		

K35
South
1/2 - 1 Mile
Higher

FED USGS **USGS3044267**

Agency cd:	USGS	Site no:	414344111531301
Site name:	(A-12- 1)31ccd- 1		
Latitude:	414344	EDR Site id:	USGS3044267
Longitude:	1115313	Dec lat:	41.72881909
Dec lon:	-111.88772275	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SESWSWS31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4430.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1909
Date inventoried:	Not Reported	Mean greenwich time offset:	MST

Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	180	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1968-08-07	Ground water data end date:	1968-08-07
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1968-08-07	-17.00	

L36
South
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149179**

Water Right Num:	25-2347	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	19090000		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	1.23		
Location:	N4 E1034 SW 31 12N 1E SL		
Well Id:	22869		
First Owner:	BRET A. AND JENNY L. ALDER		
Supply Source:	Underground Water Wells		

L37
South
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149180**

Water Right Num:	25-5578	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water Claim: Certificated		
Priority Date:	19340000		
Uses:	Irrigation		
Cubic ft/sec:	0		
Acre ft:	.5		
Location:	N4 E1034 SW 31 12N 1E SL		
Well Id:	22869		
First Owner:	BRET A. AND JENNY L. ALDER		
Supply Source:	Underground Water Wells		

Map ID
Direction
Distance
Elevation

Database | EDR ID Number

K38
South
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149177**

Water Right Num:	25-10569	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Approved		
Status:	Appl to Appropriate: Approved		
Priority Date:	20060109		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	1.73		
Location:	S20 E1190 NW 06 11N 1E SL		
Well Id:	35632		
First Owner:	JASON LAIRD		
Supply Source:	Underground Water Well		

39
ESE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149390**

Water Right Num:	25-2463	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19140000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.401		
Acre ft:	0		
Location:	S230 W1070 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	GLACUS GREGORY MERRILL		
Supply Source:	Underground Water Well		

40
West
1/2 - 1 Mile
Lower

UT WELLS **UT6000000149537**

Water Right Num:	25-2745	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19290800		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.011		
Acre ft:	0		
Location:	S1710 E2600 NW 36 12N 1W SL		
Well Id:	0		
First Owner:	JOSEPH E. NIEDERHAUSER		
Supply Source:	Underground Water Well		

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

M41
ESE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149385**

Water Right Num:	25-2410	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.134		
Acre ft:	0		
Location:	S297 W565 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	HARRY I. WILLMORE		
Supply Source:	Underground Water Well		

M42
ESE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149386**

Water Right Num:	25-5687	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.134		
Acre ft:	0		
Location:	S297 W565 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	DEWAIN BERGER		
Supply Source:	Underground Water Well		

M43
ESE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149379**

Water Right Num:	25-2409	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.2		
Acre ft:	0		
Location:	S350 W565 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	HARRY I. WILLMORE		
Supply Source:	Underground Water Well		

Map ID
Direction
Distance
Elevation

Database | EDR ID Number

M44
ESE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149380**

Water Right Num:	25-5686	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.2		
Acre ft:	0		
Location:	S350 W565 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	DEWAIN BERGER		
Supply Source:	Underground Water Well		

45
South
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149116**

Water Right Num:	25-2910	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	18800000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.111		
Acre ft:	0		
Location:	S548 W1115 N4 06 11N 1E SL		
Well Id:	0		
First Owner:	GRANT AND LYNETTE POTTER		
Supply Source:	Underground Water Well		

M46
ESE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149374**

Water Right Num:	25-2941	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.045		
Acre ft:	0		
Location:	S390 W435 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	CORPORATION OF THE PRESIDING BISHOP OF THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS		
Supply Source:	Underground Water Well		

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

N47
SSE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149124**

Water Right Num:	25-2345	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19120000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	0		
Location:	S425 E2450 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Well		

N48
SSE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149125**

Water Right Num:	25-2341	Exchange:	a21759
Type of right:	Underground		
Status of App:	Approved		
Status:	Appl to Appropriate: Approved		
Priority Date:	19971215		
Uses:	Domestic, Irrigation, Other, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	36.34		
Location:	S425 E2450 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Wells (4)		

M49
ESE
1/2 - 1 Mile
Higher | **UT WELLS** | **UT6000000149372**

Water Right Num:	25-2411	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19160000		
Uses:	Irrigation		
Cubic ft/sec:	.096		
Acre ft:	0		
Location:	S445 W385 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	HARRY I. WILLMORE		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation		Database	EDR ID Number
O50 **West** **1/2 - 1 Mile** **Lower**		**UT WELLS**	**UT6000000149399**

Water Right Num:	25-9329	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19930621		
Uses:	Domestic, Irrigation		
Cubic ft/sec:	.013		
Acre ft:	1.37		
Location:	S2748 E2262 NW 36 12N 1W SL		
Well Id:	13126		
First Owner:	HEBER J. LUNDBERG		
Supply Source:	Underground Water Well		

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51 **WSW** **1/2 - 1 Mile** **Lower**		**FED USGS**	**USGS3044277**

Agency cd:	USGS	Site no:	414403111540601
Site name:	(B-12- 1)36cbc- 1		
Latitude:	414403	EDR Site id:	USGS3044277
Longitude:	1115406	Dec lat:	41.73409657
Dec lon:	-111.90244543	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWNWSWS36 T12N R01W S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4420.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	1918
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	175	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1968-10-02	Ground water data end date:	1968-10-02
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1968-10-02	-11.00	

52
ESE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149322**

Water Right Num:	25-5688	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19340000		
Uses:	Stockwatering		
Cubic ft/sec:	.2		
Acre ft:	0		
Location:	S650 W400 E4 31 12N 1E SL		
Well Id:	0		
First Owner:	DEWAIN BERGER		
Supply Source:	Underground Water Well		

N53
SSE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149118**

Water Right Num:	25-2343	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19120000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.111		
Acre ft:	0		
Location:	S540 E2440 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	ALAN J. & SANDRA C. ALDER		
Supply Source:	Underground Water Well		

N54
SSE
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149119**

Water Right Num:	25-2341	Exchange:	a21759
Type of right:	Underground		
Status of App:	Approved		
Status:	Appl to Appropriate: Approved		
Priority Date:	19971215		
Uses:	Domestic, Irrigation, Other, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	36.34		
Location:	S540 E2440 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Wells (4)		

Map ID / Direction / Distance / Elevation	Database	EDR ID Number
55 **SSW** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149090**

Water Right Num:	25-10393	Exchange:	a28494
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Permanently lapsed		
Priority Date:	20031210		
Uses:	Domestic, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	.73		
Location:	S725 E100 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	JACK L. AND TRUDY BROWN		
Supply Source:	Underground Water Wells (2)		

Map ID / Direction / Distance / Elevation	Database	EDR ID Number
56 **SSE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149151**

Water Right Num:	25-10883	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Unapproved		
Status:	Appl to Appropriate: unapproved		
Priority Date:	20080617		
Uses:	Municipal, Other		
Cubic ft/sec:	18		
Acre ft:	13031.4		
Location:	S191 W2055 NE 06 11N 1E SL		
Well Id:	0		
First Owner:	CACHE COUNTY CORPORATION		
Supply Source:	Underground Water Wells		

Map ID / Direction / Distance / Elevation	Database	EDR ID Number
57 **SW** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149216**

Water Right Num:	25-2622	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19200000		
Uses:	Irrigation, Other, Stockwatering		
Cubic ft/sec:	.2		
Acre ft:	0		
Location:	N760 E250 S4 36 12N 1W SL		
Well Id:	0		
First Owner:	JODIE R. AND JEANETTE HARRIS		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
O58 **West** **1/2 - 1 Mile** **Lower**	**UT WELLS**	**UT6000000149394**

Water Right Num:	25-4589	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	WUC		
Priority Date:	19350000		
Uses:	Stockwatering		
Cubic ft/sec:	.002		
Acre ft:	0		
Location:	S185 E2075 W4 36 12N 1W SL		
Well Id:	13126		
First Owner:	HEBER J. LUNDBERG		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
N59 **SSE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044260**

Agency cd:	USGS	Site no:	414337111525501
Site name:	(A-11- 1) 6bad- 1		
Latitude:	414337	EDR Site id:	USGS3044260
Longitude:	1115255	Dec lat:	41.72687475
Dec lon:	-111.88272259	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SENENWS06 T11N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4430.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1912
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	180	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation			Database	EDR ID Number
N60 **SSE** **1/2 - 1 Mile** **Higher**			**UT WELLS**	**UT6000000149087**

Water Right Num:	25-2342	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19120000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.223		
Acre ft:	0		
Location:	S770 E2435 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	ALAN J. & SANDRA C. ALDER		
Supply Source:	Underground Water Well		

N61 **SSE** **1/2 - 1 Mile** **Higher**			**UT WELLS**	**UT6000000149088**

Water Right Num:	25-2341	Exchange:	a21759
Type of right:	Underground		
Status of App:	Approved		
Status:	Appl to Appropriate: Approved		
Priority Date:	19971215		
Uses:	Domestic, Irrigation, Other, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	36.34		
Location:	S770 E2435 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Wells (4)		

62 **WNW** **1/2 - 1 Mile** **Lower**			**UT WELLS**	**UT6000000149624**

Water Right Num:	25-8987	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19930805		
Uses:	Irrigation, Other		
Cubic ft/sec:	.015		
Acre ft:	.6		
Location:	S999 W597 N4 36 12N 1W SL		
Well Id:	28337		
First Owner:	CACHE COUNTY CORPORATION		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation		Database	EDR ID Number
P63 **SE** **1/2 - 1 Mile** **Lower**		**FED USGS**	**USGS3044268**

Agency cd:	USGS	Site no:	414345111523501
Site name:	(A-12- 1)31ddc- 1		
Latitude:	414345	EDR Site id:	USGS3044268
Longitude:	1115235	Dec lat:	41.72909698
Dec lon:	-111.8771669	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSESES31 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4429.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1910
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	100	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1966-08-23	Ground water data end date:	1966-08-23
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1966-08-23		

Note: The site was flowing, but the head could not be measured without additional equipment.

Q64 **SSE** **1/2 - 1 Mile** **Higher**		**UT WELLS**	**UT6000000149080**

Water Right Num:	25-2341	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19120000		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.178		
Acre ft:	0		
Location:	S870 E2470 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Well		

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
Q65 **SSE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149081**

Water Right Num:	25-2341	Exchange:	a21759
Type of right:	Underground		
Status of App:	Approved		
Status:	Appl to Appropriate: Approved		
Priority Date:	19971215		
Uses:	Domestic, Irrigation, Other, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	36.34		
Location:	S870 E2470 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	GERALD J. AND SANDRA C. ALDER		
Supply Source:	Underground Water Wells (4)		

	Database	EDR ID Number
66 **West** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS3044145**

Agency cd:	USGS	Site no:	414422111541501
Site name:	(B-12- 1)36bdb- 1		
Latitude:	414422	EDR Site id:	USGS3044145
Longitude:	1115415	Dec lat:	41.73937418
Dec lon:	-111.90494555	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWSENWS 36T 12 NR 1 W
Location map:	WELLSVILLE, UT	Map scale:	24000
Altitude:	4425.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	19920212
Date inventoried:	19920212	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Unconfined single aquifer		
Aquifer:	Not Reported		
Well depth:	30.0	Hole depth:	34.5
Source of depth data:	reporting agency (generally USGS)		
Project number:	474920300		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1992-03-02	Ground water data end date:	1992-03-02
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1992-03-02	8.81	

P67
SE
1/2 - 1 Mile
Lower

FED USGS USGS3044266

Agency cd:	USGS	Site no:	414344111523301
Site name:	(A-11- 1) 6aab- 1		
Latitude:	414344	EDR Site id:	USGS3044266
Longitude:	1115233	Dec lat:	41.72881922
Dec lon:	-111.87661133	Coor meth:	M
Coor accr:	F	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNENES06 T11N R01E S
Location map:	WELLSVILLE	Map scale:	24000
Altitude:	4430.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	19850805
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	230.	Hole depth:	230.
Source of depth data:	logs		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1989-08-15
Water quality data end date:	1989-08-15	Water quality data count:	1
Ground water data begin date:	0000-00-00	Ground water data end date:	0000-00-00
Ground water data count:	0		

Ground-water levels, Number of Measurements: 0

68
West
1/2 - 1 Mile
Lower

UT WELLS UT6000000149407

Water Right Num:	25-4438	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Diligence Claim		
Priority Date:	19340000		
Uses:	Stockwatering		
Cubic ft/sec:	.002		
Acre ft:	0		
Location:	S20 E1720 W4 36 12N 1W SL		
Well Id:	0		
First Owner:	HEBER J. LUNDBERG		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation		Database	EDR ID Number
69 SW 1/2 - 1 Mile Lower		**UT WELLS**	**UT6000000149196**

Water Right Num:	25-5015	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19200000		
Uses:	Irrigation, Other, Stockwatering		
Cubic ft/sec:	.223		
Acre ft:	0		
Location:	N350 E30 S4 36 12N 1W SL		
Well Id:	0		
First Owner:	JODIE R. AND JEANETTE HARRIS		
Supply Source:	Underground Water Well		

		Database	EDR ID Number
P70 SE 1/2 - 1 Mile Lower		**FED USGS**	**USGS3044265**

Agency cd:	USGS	Site no:	414343111523301
Site name:	(A-11- 1) 6aab- 2		
Latitude:	414343	EDR Site id:	USGS3044265
Longitude:	1115233	Dec lat:	41.72854144
Dec lon:	-111.87661132	Coor meth:	M
Coor accr:	F	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NENENES06 T11N R01E S
Location map:	WELLSVILLE	Map scale:	24000
Altitude:	4430.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	80.	Hole depth:	80.
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
R71 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149429**

Water Right Num:	25-3083	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19491109		
Uses:	Other		
Cubic ft/sec:	.8		
Acre ft:	0		
Location:	N30 E370 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R72 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149424**

Water Right Num:	25-3083	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19491109		
Uses:	Other		
Cubic ft/sec:	.8		
Acre ft:	0		
Location:	S5 E370 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R73 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149408**

Water Right Num:	25-2846	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19300000		
Uses:	Other		
Cubic ft/sec:	.334		
Acre ft:	0		
Location:	S30 E370 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
74 **ENE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149719**

Water Right Num:	25-5973	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Diligence Claim		
Priority Date:	19340000		
Uses:	Irrigation		
Cubic ft/sec:	1		
Acre ft:	0		
Location:	S195 E110 NW 32 12N 1E SL		
Well Id:	0		
First Owner:	LOGAN COW PASTURE WATER COMPANY		
Supply Source:	Underground Water Drain		

Map ID Direction Distance Elevation	Database	EDR ID Number
S75 **ESE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149261**

Water Right Num:	25-6849	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Permanently lapsed		
Priority Date:	19760416		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.5		
Acre ft:	0		
Location:	N1125 W120 SE 31 12N 1E SL		
Well Id:	0		
First Owner:	HEBER T. HARDMAN		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
R76 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149425**

Water Right Num:	25-2849	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19280000		
Uses:	Other		
Cubic ft/sec:	.334		
Acre ft:	0		
Location:	S2 E460 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
S77 **ESE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149269**

Water Right Num:	25-5698	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Diligence Claim		
Priority Date:	19340000		
Uses:	Irrigation		
Cubic ft/sec:	.178		
Acre ft:	0		
Location:	N1160 W10 SE 31 12N 1E SL		
Well Id:	0		
First Owner:	LOUISE R. RICH		
Supply Source:	Underground Water Well		

T78 **SE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149139**

Water Right Num:	25-7901	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19790222		
Uses:	Domestic, Irrigation, Stockwatering		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	S260 W1060 NE 06 11N 1E SL		
Well Id:	0		
First Owner:	WILLIAM WORLEY		
Supply Source:	Underground Water Well		

T79 **SE** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149140**

Water Right Num:	25-8704	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19850822		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.005		
Acre ft:	0		
Location:	S260 W1060 NE 06 11N 1E SL		
Well Id:	0		
First Owner:	WILLIAM WORLEY		
Supply Source:	Underground Water Well (Existing)		

Map ID Direction Distance Elevation	Database	EDR ID Number
R80 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044300**

Agency cd:	USGS	Site no:	414410111521103
Site name:	(A-12- 1)32cbb-14		
Latitude:	414410	EDR Site id:	USGS3044300
Longitude:	1115211	Dec lat:	41.73604133
Dec lon:	-111.87050012	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4437.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1930
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	108	Hole depth:	108
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
R81 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044299**

Agency cd:	USGS	Site no:	414410111521102
Site name:	(A-12- 1)32cbb- 2		
Latitude:	414410	EDR Site id:	USGS3044299
Longitude:	1115211	Dec lat:	41.73604133
Dec lon:	-111.87050012	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported

Altitude:	4437.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	101	Hole depth:	101
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1967-11-01	Ground water data end date:	1967-11-01
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-11-01	-11.00	

R82
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044298**

Agency cd:	USGS	Site no:	414410111521101
Site name:	(A-12- 1)32cbb- 1		
Latitude:	414410	EDR Site id:	USGS3044298
Longitude:	1115211	Dec lat:	41.73604133
Dec lon:	-111.87050012	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4437.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19391128
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	107	Hole depth:	107
Source of depth data:	owner		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00

Peak flow data count:	0	Water quality data begin date:	1961-06-01
Water quality data end date:	1963-02-06	Water quality data count:	4
Ground water data begin date:	1967-11-01	Ground water data end date:	1967-11-01
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-11-01	-11.00	

R83
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149453**

Water Right Num:	25-3262	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19551010		
Uses:	Other		
Cubic ft/sec:	3.47		
Acre ft:	0		
Location:	N235 E607 W4 32 12N 1E SL		
Well Id:	35588		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R84
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149439**

Water Right Num:	25-3262	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19551010		
Uses:	Other		
Cubic ft/sec:	3.47		
Acre ft:	0		
Location:	N81 E595 W4 32 12N 1E SL		
Well Id:	35587		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R85
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149442**

Water Right Num:	25-3262	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19551010		
Uses:	Other		
Cubic ft/sec:	3.47		
Acre ft:	0		
Location:	N106 E598 W4 32 12N 1E SL		
Well Id:	35586		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R86
East
1/2 - 1 Mile
Higher

UT WELLS UT6000000149427

Water Right Num:	25-3078	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19371018		
Uses:	Other		
Cubic ft/sec:	.29		
Acre ft:	0		
Location:	N15 E595 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

U87
WNW
1/2 - 1 Mile
Lower

FED USGS USGS3044158

Agency cd:	USGS	Site no:	414438111541401
Site name:	(B-12- 1)25cdc- 1		
Latitude:	414438	EDR Site id:	USGS3044158
Longitude:	1115414	Dec lat:	41.74381852
Dec lon:	-111.90466782	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSESWS25 T12N R01W S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4424.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19470718
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	186	Hole depth:	Not Reported
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00

Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1968-11-08	Ground water data end date:	1968-11-08
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1968-11-08	-30.00	

R88
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149428**

Water Right Num:	25-2850	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19290000		
Uses:	Other		
Cubic ft/sec:	.39		
Acre ft:	0		
Location:	N15 E615 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

U89
WNW
1/2 - 1 Mile
Lower

UT WELLS **UT6000000149750**

Water Right Num:	25-3152	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: No proof required		
Priority Date:	19470623		
Uses:	Stockwatering		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	N150 W810 S4 25 12N 1W SL		
Well Id:	0		
First Owner:	CHESTER R. KUNZLER		
Supply Source:	Underground Water Well		

R90
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149449**

Water Right Num:	25-2432	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19320700		
Uses:	Irrigation, Other		
Cubic ft/sec:	.156		
Acre ft:	0		
Location:	N160 E640 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

V91
NNE
1/2 - 1 Mile
Higher

UT WELLS UT6000000149905

Water Right Num:	25-5848	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Decree		
Priority Date:	18600501		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	20		
Acre ft:	0		
Location:	S300 W1880 E4 30 12N 1E SL		
Well Id:	0		
First Owner:	EDWIN GOSSNER		
Supply Source:	Underground Water Drain		

V92
NNE
1/2 - 1 Mile
Higher

UT WELLS UT6000000149906

Water Right Num:	25-5849	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Decree		
Priority Date:	18800501		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	20		
Acre ft:	0		
Location:	S300 W1880 E4 30 12N 1E SL		
Well Id:	0		
First Owner:	EDWIN GOSSNER		
Supply Source:	Underground Water Drain		

V93
NNE
1/2 - 1 Mile
Higher

UT WELLS UT6000000149907

Water Right Num:	25-5858	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Decree		
Priority Date:	18600501		
Uses:	Irrigation		
Cubic ft/sec:	20		
Acre ft:	0		
Location:	S300 W1880 E4 30 12N 1E SL		
Well Id:	0		
First Owner:	OSCAR WENNERGREN		
Supply Source:	Underground Water Drain		

R94
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149411**

Water Right Num:	25-2851	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	18950000		
Uses:	Other		
Cubic ft/sec:	.056		
Acre ft:	0		
Location:	S26 E640 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R95
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149416**

Water Right Num:	25-2847	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19280000		
Uses:	Other		
Cubic ft/sec:	.497		
Acre ft:	0		
Location:	S17 E642 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R96
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149417**

Water Right Num:	25-2847	Exchange:	a22484
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Withdrawn		
Priority Date:	19980715		
Uses:	Other		
Cubic ft/sec:	.497		
Acre ft:	0		
Location:	S17 E642 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R97
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149406**

Water Right Num:	25-2848	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19290000		
Uses:	Other		
Cubic ft/sec:	.557		
Acre ft:	0		
Location:	S40 E645 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R98
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149398**

Water Right Num:	25-2845	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	19300000		
Uses:	Irrigation, Other		
Cubic ft/sec:	.228		
Acre ft:	0		
Location:	S130 E645 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

R99
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044302**

Agency cd:	USGS	Site no:	414411111520902
Site name:	(A-12- 1)32bcc- 4		
Latitude:	414411	EDR Site id:	USGS3044302
Longitude:	1115209	Dec lat:	41.7363191
Dec lon:	-111.86994455	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1959
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	112	Hole depth:	112
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1959-07-00	Ground water data end date:	1959-07-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1959-07	-6.00	

W100
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149389**

Water Right Num:	25-3190	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Certificated		
Priority Date:	19511116		
Uses:	Other		
Cubic ft/sec:	.48		
Acre ft:	0		
Location:	S260 E650 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
R101 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044297**

Agency cd:	USGS	Site no:	414410111520901
Site name:	(A-12- 1)32cbb- 8		
Latitude:	414410	EDR Site id:	USGS3044297
Longitude:	1115209	Dec lat:	41.73604133
Dec lon:	-111.86994455	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1928
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	112	Hole depth:	112
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
X102 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149455**

Water Right Num:	25-3262	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19551010		
Uses:	Other		
Cubic ft/sec:	3.47		
Acre ft:	0		
Location:	N241 E750 W4 32 12N 1E SL		
Well Id:	35589		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
Y103 **West** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS3044317**

Agency cd:	USGS	Site no:	414419111542201
Site name:	(B-12- 1)36bca- 1		
Latitude:	414419	EDR Site id:	USGS3044317
Longitude:	1115422	Dec lat:	41.73854085
Dec lon:	-111.90689004	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NESWNWS36 T 12 NR 1 W
Location map:	WELLSVILLE, UT	Map scale:	24000
Altitude:	4425.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	005		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	19910910
Date inventoried:	19920213	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Confined multiple aquifers		
Aquifer:	Not Reported		
Well depth:	715.	Hole depth:	1000.
Source of depth data:	driller		
Project number:	474920300		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1992-03-02	Ground water data end date:	1992-03-02
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1992-03-02	-49.13	

Y104 **West** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS3044142**

Agency cd:	USGS	Site no:	414420111542201
Site name:	(B-12- 1)36bca- 2		
Latitude:	414420	EDR Site id:	USGS3044142
Longitude:	1115422	Dec lat:	41.73881862
Dec lon:	-111.90689005	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NESWNWS36 T 12 NR 1 W
Location map:	WELLSVILLE, UT	Map scale:	24000
Altitude:	4425.		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Valley flat		
Site type:	Ground-water other than Spring	Date construction:	19920114
Date inventoried:	19920213	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Confined multiple aquifers		
Aquifer:	Not Reported		
Well depth:	986.	Hole depth:	1015.
Source of depth data:	driller		
Project number:	474920300		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1992-01-24	Ground water data end date:	1992-01-24
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1992-01-24	-57.5	

W105
East
1/2 - 1 Mile
Higher

UT WELLS UT6000000149437

Water Right Num:	25-2847	Exchange:	a22484
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Withdrawn		
Priority Date:	19980715		
Uses:	Other		
Cubic ft/sec:	.497		
Acre ft:	0		
Location:	N70 E750 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Wells		

Map ID Direction Distance Elevation	Database	EDR ID Number
R106 **East** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000149403**

Water Right Num:	25-3118	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19400417		
Uses:	Domestic, Irrigation, Other		
Cubic ft/sec:	.015		
Acre ft:	0		
Location:	S50 E735 W4 32 12N 1E SL		
Well Id:	0		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
107 **South** **1/2 - 1 Mile** **Higher**	**UT WELLS**	**UT6000000148955**

Water Right Num:	25-10393	Exchange:	a28494
Type of right:	Underground		
Status of App:	Terminated		
Status:	Appl to Appropriate: Permanently lapsed		
Priority Date:	20031210		
Uses:	Domestic, Stockwatering		
Cubic ft/sec:	0		
Acre ft:	.73		
Location:	S1700 E100 NW 06 11N 1E SL		
Well Id:	0		
First Owner:	JACK L. AND TRUDY BROWN		
Supply Source:	Underground Water Wells (2)		

Map ID Direction Distance Elevation	Database	EDR ID Number
X108 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044305**

Agency cd:	USGS	Site no:	414413111520801
Site name:	(A-12- 1)32bcc- 2		
Latitude:	414413	EDR Site id:	USGS3044305
Longitude:	1115208	Dec lat:	41.73687465
Dec lon:	-111.86966677	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported

Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19590812
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	206	Hole depth:	206
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1959-08-12	Ground water data end date:	1959-08-12
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1959-08-12	-12.00	

X109
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044304**

Agency cd:	USGS	Site no:	414412111520801
Site name:	(A-12- 1)32bcc- 1		
Latitude:	414412	EDR Site id:	USGS3044304
Longitude:	1115208	Dec lat:	41.73659688
Dec lon:	-111.86966677	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1932
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	115	Hole depth:	115
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported

Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

W110
East
1/2 - 1 Mile
Higher

FED USGS USGS3044301

Agency cd:	USGS	Site no:	414411111520801
Site name:	(A-12- 1)32bcc- 3		
Latitude:	414411	EDR Site id:	USGS3044301
Longitude:	1115208	Dec lat:	41.73631911
Dec lon:	-111.86966677	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SWSWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19590619
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	115	Hole depth:	115
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1959-06-19	Ground water data end date:	1959-06-19
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1959-06-19	-6.00	

111
SE
1/2 - 1 Mile
Higher

UT WELLS UT6000000149143

Water Right Num:	25-2541	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Underground Water claim		
Priority Date:	1900		
Uses:	Irrigation, Stockwatering		
Cubic ft/sec:	.089		
Acre ft:	9.68		
Location:	S240 E1990 N4 06 11N 1E SL		
Well Id:	0		
First Owner:	OLIVER B. WORLEY		
Supply Source:	Underground Water Well		

W112
East
1/2 - 1 Mile
Higher

FED USGS USGS3044292

Agency cd:	USGS	Site no:	414410111520801
Site name:	(A-12- 1)32cbb- 3		
Latitude:	414410	EDR Site id:	USGS3044292
Longitude:	1115208	Dec lat:	41.73604134
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1928
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	112	Hole depth:	112
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

W113
East
1/2 - 1 Mile
Higher

FED USGS USGS3044296

Agency cd:	USGS	Site no:	414410111520805
Site name:	(A-12- 1)32cbb-13		
Latitude:	414410	EDR Site id:	USGS3044296
Longitude:	1115208	Dec lat:	41.73604134
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1930
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	139	Hole depth:	139
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

W114
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044294**

Agency cd:	USGS	Site no:	414410111520803
Site name:	(A-12- 1)32cbb- 5		
Latitude:	414410	EDR Site id:	USGS3044294
Longitude:	1115208	Dec lat:	41.73604134
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1929
Date inventoried:	Not Reported	Mean greenwich time offset:	MST

Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	111	Hole depth:	111
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

W115
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044295**

Agency cd:	USGS	Site no:	414410111520804
Site name:	(A-12- 1)32cbb- 7		
Latitude:	414410	EDR Site id:	USGS3044295
Longitude:	1115208	Dec lat:	41.73604134
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1938
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	150	Hole depth:	150
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1938-05-00	Ground water data end date:	1938-05-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1938-05	-22.00	

W116
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044293**

Agency cd:	USGS	Site no:	414410111520802
Site name:	(A-12- 1)32cbb- 4		
Latitude:	414410	EDR Site id:	USGS3044293
Longitude:	1115208	Dec lat:	41.73604134
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4439.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1929
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	108	Hole depth:	108
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

W117
East
1/2 - 1 Mile
Higher

FED USGS **USGS3044287**

Agency cd:	USGS	Site no:	414409111520801
Site name:	(A-12- 1)32cbb-12		
Latitude:	414409	EDR Site id:	USGS3044287
Longitude:	1115208	Dec lat:	41.73576357
Dec lon:	-111.86966676	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	NWNWSWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4437.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1944
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	106	Hole depth:	106
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1944-05-00	Ground water data end date:	1944-05-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1944-05	-22.00	

W118
East
1/2 - 1 Mile
Higher

UT WELLS **UT6000000149431**

Water Right Num:	25-3262	Exchange:	Not Reported
Type of right:	Underground		
Status of App:	Perfected		
Status:	Appl to Appropriate: Water users claim signed		
Priority Date:	19551010		
Uses:	Other		
Cubic ft/sec:	3.47		
Acre ft:	0		
Location:	N30 E834 W4 32 12N 1E SL		
Well Id:	31603		
First Owner:	STATE OF UTAH DIVISION OF WILDLIFE RESOURCES		
Supply Source:	Underground Water Well		

Map ID Direction Distance Elevation	Database	EDR ID Number
X119 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044311**

Agency cd:	USGS	Site no:	414416111520601
Site name:	(A-12- 1)32bcd- 2		
Latitude:	414416	EDR Site id:	USGS3044311
Longitude:	1115206	Dec lat:	41.73770797
Dec lon:	-111.86911121	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SESWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported
Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1961
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	265	Hole depth:	265
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	Not Reported	Daily flow data begin date:	Not Reported
Daily flow data end date:	Not Reported	Daily flow data count:	Not Reported
Peak flow data begin date:	Not Reported	Peak flow data end date:	Not Reported
Peak flow data count:	Not Reported	Water quality data begin date:	Not Reported
Water quality data end date:	Not Reported	Water quality data count:	Not Reported
Ground water data begin date:	Not Reported	Ground water data end date:	Not Reported
Ground water data count:	Not Reported		

Ground-water levels, Number of Measurements: 0

X120 **East** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3044308**

Agency cd:	USGS	Site no:	414414111520601
Site name:	(A-12- 1)32bcd- 3		
Latitude:	414414	EDR Site id:	USGS3044308
Longitude:	1115206	Dec lat:	41.73715243
Dec lon:	-111.8691112	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	49
State:	49	County:	005
Country:	US	Land net:	SESWNWS32 T12N R01E S
Location map:	Not Reported	Map scale:	Not Reported

Altitude:	4438.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	5.		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Little BearLogan. Idaho, Utah. Area = 928 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	1959
Date inventoried:	Not Reported	Mean greenwich time offset:	MST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	200	Hole depth:	200
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1959-09-00	Ground water data end date:	1959-09-00
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1959-09	-12.00	

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: UT Radon

Radon Test Results

Zipcode	Maximum	Average	Num Tests	Test Term
84321	5.9	2.7	12	Long Term
84321	82.4	5.3	263	Short Term

Federal EPA Radon Zone for CACHE County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for CACHE COUNTY, UT

Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.300 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5’ Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands in Utah
Source: Automated Geographic Reference Center
Telephone: 801-537-9201

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Rights Database
Source: Department of Natural Resources, Division of Water Rights
Telephone: 801-538-7408

OTHER STATE DATABASE INFORMATION

Utah Oil, Gas and Mining Database
Source: Department of Natural Resources
Telephone: 801-538-5340
The Well Data file contains one record of basic information for each well in the Utah Division of Oil, Gas and Mining database.

RADON

State Database: UT Radon
Source: Department of Environmental Quality
Telephone: 801-536-4250
Test Results by Zip Code

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

Logan Phase I ESA
2400 West 200 North
Logan, UT 84321

Inquiry Number: 3407549.4
September 10, 2012

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

9/10/12

Site Name:
Logan Phase I ESA
2400 West 200 North
Logan, UT 84321

EDR Inquiry # 3407549.4

Client Name:
IGES
4153 South Commerce Drive
Salt Lake City, UT 84107

Contact: David Petersen

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by IGES were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name:	Logan Phase I ESA
Address:	2400 West 200 North
City, State, Zip:	Logan, UT 84321
Cross Street:	
P.O. #	00823-011
Project:	Logan Phase I ESA
Certification #	E6DB-4420-B5BC

Sanborn® Library search results
Certification # E6DB-4420-B5BC

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Logan Phase I ESA
2400 West 200 North
Logan, UT 84321

Inquiry Number: 3407549.3
September 12, 2012

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography September 12, 2012

Target Property:

2400 West 200 North

Logan, UT 84321

Year	***Scale***	***Details***	***Source***
1953	Aerial Photograph. Scale: 1"=1000'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: June 09, 1953	EDR
1976	Aerial Photograph. Scale: 1"=1000'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: August 25, 1976	EDR
1981	Aerial Photograph. Scale: 1"=1000'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: September 01, 1981	EDR
1987	Aerial Photograph. Scale: 1"=750'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: July 24, 1987	EDR
1993	Aerial Photograph. Scale: 1"=750'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: August 14, 1993	EDR
1997	Aerial Photograph. Scale: 1"=750'	Panel #: 41111-F8, Wellsville, UT;/Flight Date: October 04, 1997	EDR

INQUIRY #: 3407549.3

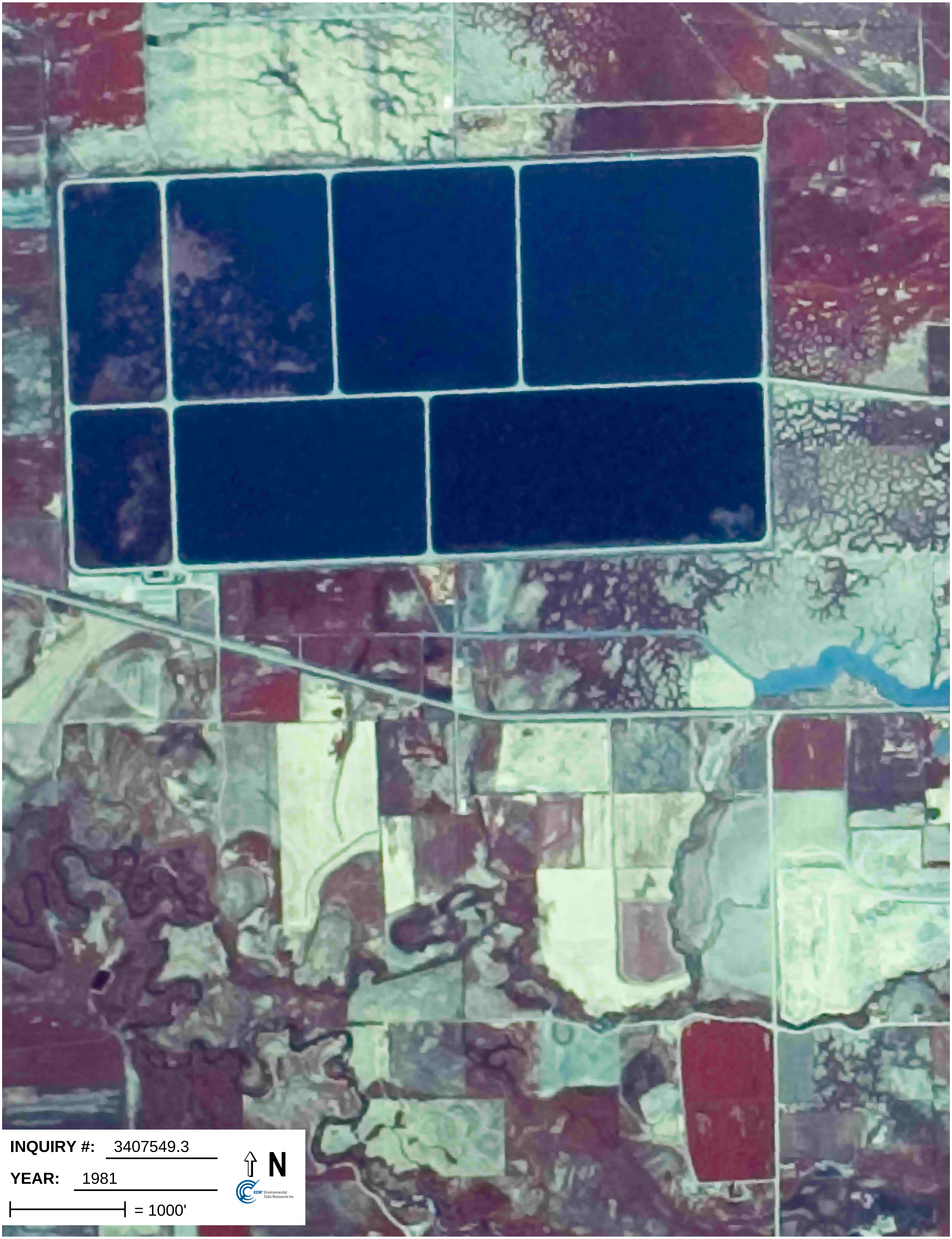
YEAR: 1953

= 1000'

N

EDR Environmental Data Resources Inc

INQUIRY #: 3407549.3
YEAR: 1976
= 1000'
N
EDR Environmental Data Resources Inc



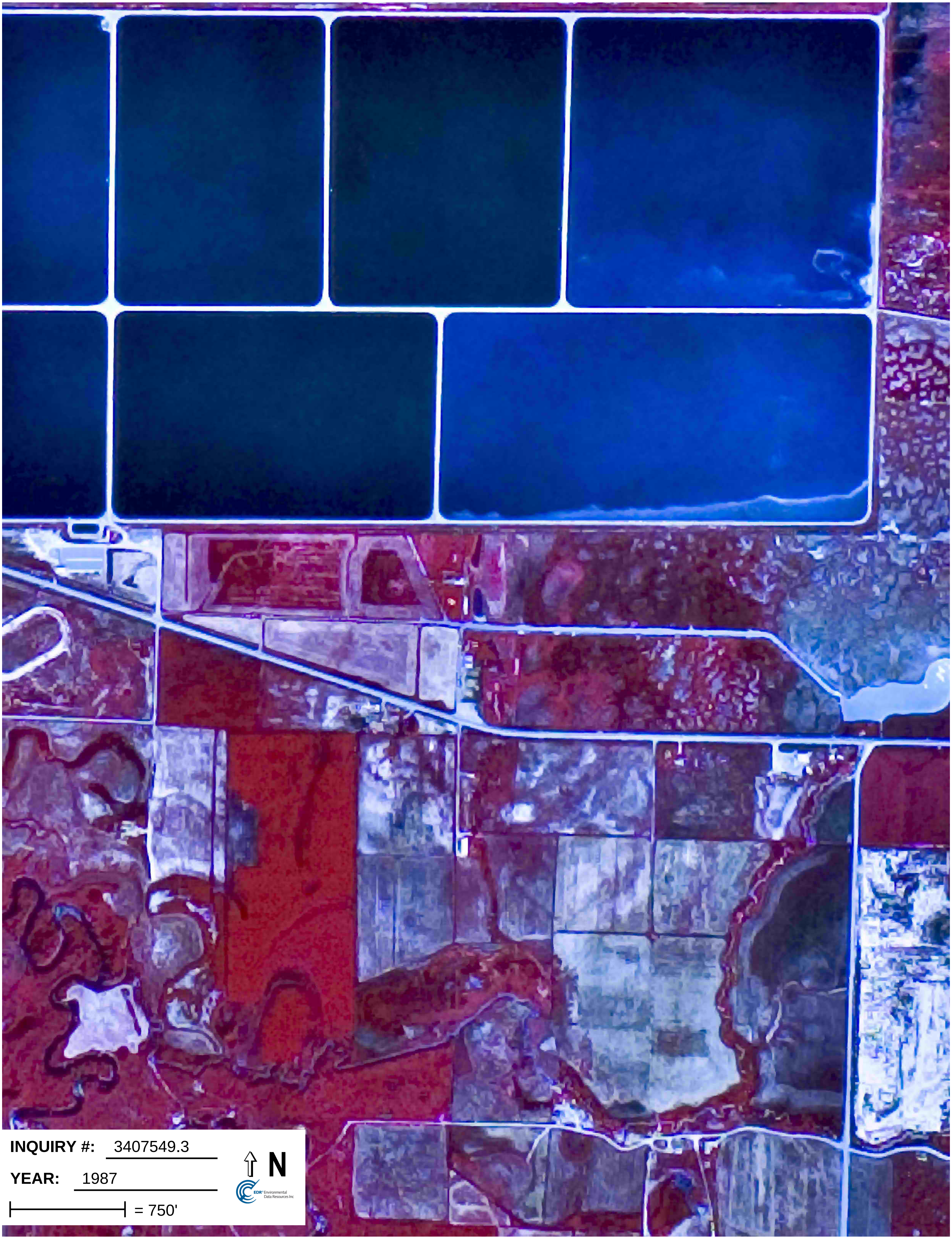
INQUIRY #: 3407549.3

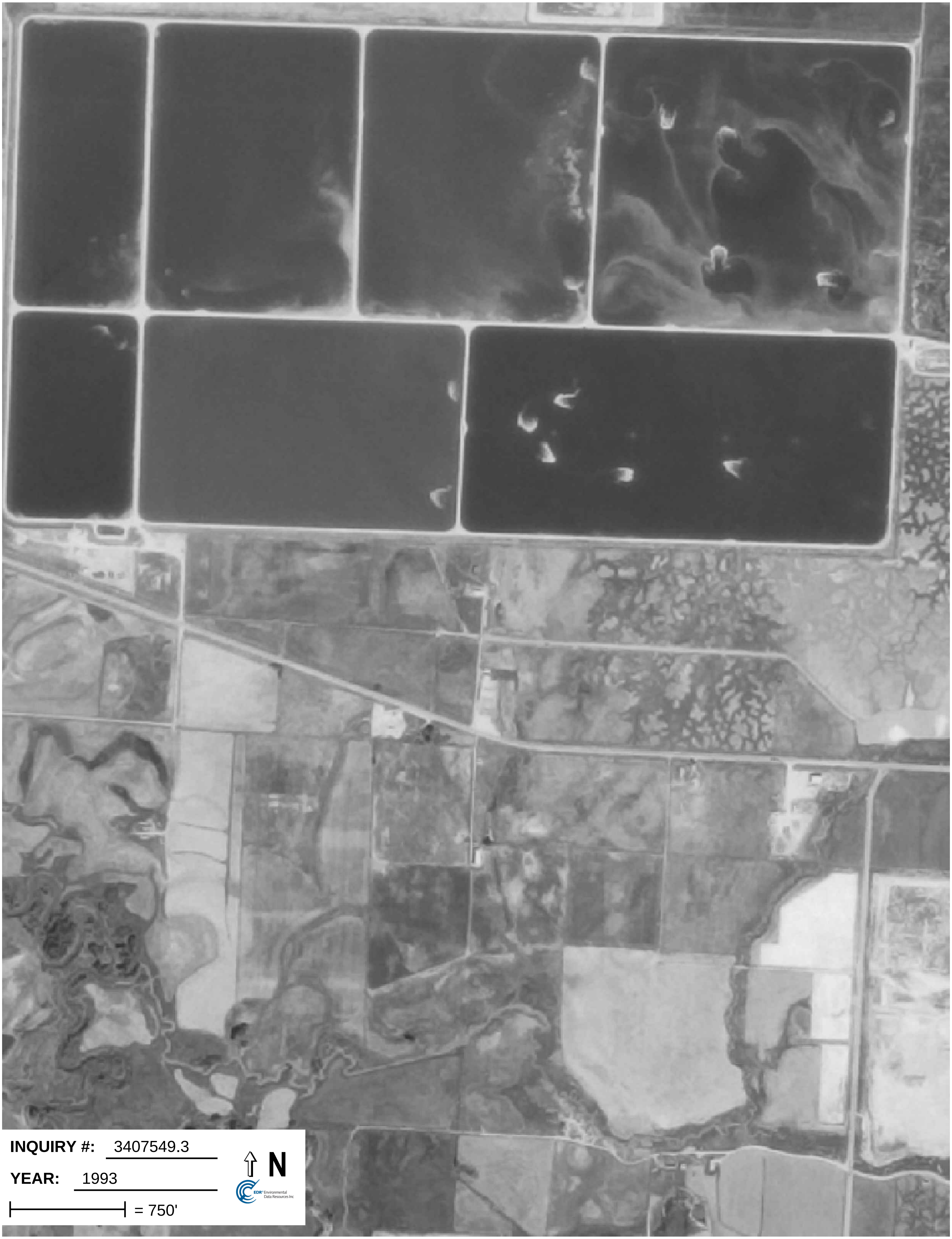
YEAR: 1981

= 1000'

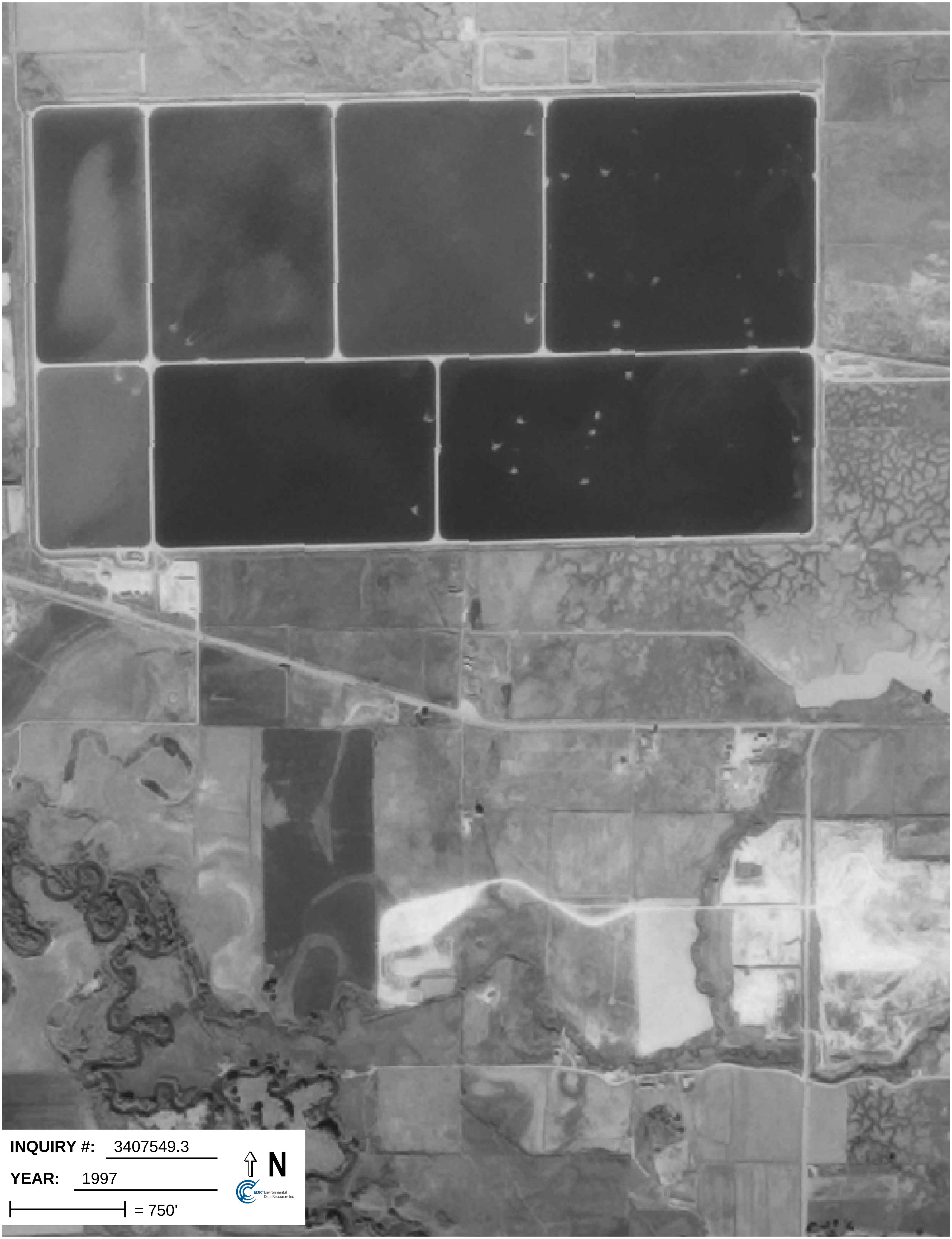
N

EDR Environmental Data Resources Inc


INQUIRY #: 3407549.3
YEAR: 1987
= 750'
N
EDR Environmental Data Resources Inc



INQUIRY #: 3407549.3
YEAR: 1993
= 750'
N
EDR Environmental Data Resources Inc



INQUIRY #: 3407549.3

YEAR: 1997

= 750'

N

User Questionnaire

ENERGY RECOVERY

INTRODUCTION

Wastewater treatment plants are capable of recovering energy from waste solids using anaerobic digestion and cogeneration. There are new cogeneration technologies developing such as fuel cells which greatly reduce air emissions compared to conventional engine generators. This chapter will evaluate energy recovery options for Logan's wastewater treatment facility.

DIGESTION

Anaerobic digestion is used to stabilize waste solids and generate methane, which can be used for combined heat and power generation. Anticipated design criteria for anaerobic digesters are included in Table 4.1. To prevent hydraulically overloading the digesters, waste activated sludge is required.

Table 4.1 Anaerobic Digester Criteria
Wastewater Treatment Master Plan Update 2013
City of Logan

Projected Design Population	120,000
Digester Volume Per Capita	4 cf
Digester Volume (cf)	480,000
Estimated Gas Production Per Capita	1.0 cf
Estimated Gas Production	120,000 cf/day

Industrial Waste Co-Digestion Considerations

The City is considering supplementing the anaerobic digestion process with industrial organic wastes. Waste streams that are high in fats, oils, grease, and organic content have successfully been utilized by WWTPs to increase gas yields and renewable energy from the anaerobic digestion process. It should be noted that many organic wastes contain a higher volatile solids content, which will result in increased gas and energy yields with many of these wastes reporting 3 to 5 times the yields of primary wastewater sludge. Potential sources of wastes that could be utilized for co-digestion within Cache Valley include restaurants, food processing, cheese manufacturers and agricultural wastes. A waste receiving station and processing facilities would be required at a location near the digesters.

Estimated Algae Gas Production

The City is considering co-digestion of algae, which is produced in the WWTP lagoons. Carollo recently completed an evaluation of co-digestion of algae for a wastewater facility in Waco, Texas. The study entailed chemical characterization of algae as well as evaluating the effect of thermal conditioning on the biodegradability of algae in anaerobic digestion. For this study it was determined that pretreating the algae at a temperature of 230 deg F was required to break down material and increase gas production during anaerobic digestion. A comparison of primary municipal wastewater sludge and pretreated algae characteristics is presented in Table 4.2 for consideration.

Table 4.2 Primary Sludge and Pretreated Algae Characteristics
Wastewater Treatment Master Plan Update 2013
City of Logan

Parameter	Primary Sludge [1]	Algae Pretreated at 230^{o} F [1]
Volatile Solids, % of total solids	77	30
Total COD, g/L	108.6	1.5
Soluble COD, g/L	2.8	0.3
COD, g/g VS	1.94	0.86
VFAs, g COD/L	1.5	ND
Ammonia-N, mg/L	191	ND
TKN, mg/L	4,255	107
Total P, mg/L	2,377	27
Carbohydrates, % of VS	13	10
Lipids, % of VS	20	20
Proteins, % of VS	45	39
TKN, % of VS	7.6	63
TP, % of VS	4.2	16

Notes:
[1] Results from Waco, Texas algae characterization April, 2011
ND = Not Detected
COD = Chemical Oxygen Demand
TKN = Total Kjeldahl Nitrogen
TP = Total Phosphorus
VFAs = Volatile Fatty Acids
VS = Volatile Solids

It should be noted that the algae species from the Waco, Texas project were predominantly cyanobacteria or ‘blue-green’ algae. The City has completed some pilot testing of algae digestion. Results of the pilot testing are included in Appendix D.

FUEL TREATMENT

To prevent fouling of the equipment, digester gas must be scrubbed in a fuel treatment system to remove moisture, siloxanes, and hydrogen sulfide (H_2S). Siloxanes are cyclic organic silicon monomers used in the manufacturer of personal hygiene, health care and industrial silicon products, and are typically found in digester gas at varying levels. The combustion of digester gas that contains siloxanes can result in deposits of silica residue on equipment surfaces, which impairs performance and increases maintenance.

There are two commercial methods commonly employed to remove siloxanes from digester gas: (1) adsorption of the siloxanes onto activated carbon and (2) desiccant and refrigeration/condensation technologies. The formation of H_2S can typically be prevented by adding iron salts to the anaerobic digesters influent or plant influent. Alternatively, H_2S can be removed by several methods, which include water scrubbing or the use of adsorptive media such as iron sponge or Sulfatreat.

Fuel treatment is required for all cogeneration technologies presented in this evaluation. The level of fuel treatment required depends on the amount of contaminants in the digester gas and the downstream cogeneration technology. Fuel cells and microturbines require more robust fuel treatment systems. Siloxanes must be removed at a higher rate and the treatment system must include redundant equipment. H_2S is not as harmful to reciprocating engines and microturbines as fuel cell technologies. However, the presence of H_2S can significantly impact the economics associated with removing siloxanes.

COGENERATION TECHNOLOGIES

The size of cogeneration equipment was estimated based on the 2040 design population of approximately 120,000.

Various power generation technologies are available to produce electricity from digester gas. The most common technologies are internal combustion engines and reciprocating engines. Microturbines have recently gained popularity due to their small footprint, modular form, and ability to run economically in small applications. Larger combustion turbines are available for use with digester gas, but are rarely used due to the size of this type of equipment. Emerging technologies such as fuel cells are becoming popular due to their high efficiency, availability, and ability to meet strict air quality regulations.

An economic evaluation of conventional reciprocating gas engines, microturbines, and fuel cells was conducted. The following section summarizes each of the technologies considered.

Conventional Reciprocating Engines

Reciprocating internal combustion engines are machines in which pistons move back and forth in cylinders to create rotations in the connecting shaft. The rotation is used to drive a generator resulting in the creation of electricity. Reciprocating engine technology was developed more than 100 years ago and was the first fossil fuel-driven distributed generators used. Spark and compression ignition engines have gained universal acceptance in nearly every sector of the economy. Reciprocating engines can be found in applications ranging from fractional horsepower units to large utility base load electric power plants.

The cooling water and exhaust heat from reciprocating engines can be recovered in heat exchangers and used to heat digesters and/or facility hot water heating. There are several lean burn reciprocating engine suppliers with biogas-operating experience including Waukesha, Caterpillar, and Jenbacher (GE). These engines typically convert approximately 34 percent (as a percentage of fuel input energy) to electrical output and 42 percent to recoverable engine cooling water and exhaust heat. Therefore, the total overall efficiency of these reciprocating engines is approximately 76 percent. The engines are lean-burn, spark-ignited, turbo-charged, inter-cooled, clean-burning gas engines and have extensive digester gas burning experience. A potential disadvantage of reciprocating engines is that they produce the most air emissions of the technologies considered.

Microturbines

Microturbines are essentially small gas turbines operating at very high speed to produce power and heat. Currently, there are several commercial manufacturers offering microturbine power generating units. However, only two manufacturers, Ingersoll Rand and Capstone, have experience utilizing digester gas as a fuel source.

The Ingersoll Rand module has been optimized to provide a complete, factory-assembled system. Capstone sells only the microturbine units, which are subsequently packaged with compression and waste heat recovery ancillary equipment by third-party integration companies.

Capstone only offers 30 and 70-kW units, which are too small for the City’s application. Consequently, Capstone was not considered as part of this evaluation. Ingersoll Rand offers 70-kW and 250-kW units. Over 100 Ingersoll Rand units have been installed which operate on natural gas and biogas. Several dozen of the 70-kW units and two of the 250-kW units operate on biogas. The 250-kW units are in operation on a medium-BTU gas at an oil and gas producer in Grand Isle, Louisiana. In addition, eight 250-kW units have recently been sold for medium-BTU gas applications in the United States and China.

Based on anticipated needs for the City’s WWTP, the Ingersoll Rand 250-kW units were used as the basis for evaluation in this study. The Ingersoll Rand microturbines typically convert 29 percent of fuel input energy to electrical output and 29 percent to recoverable exhaust heat, for a total overall efficiency of approximately 58 percent. Microturbines have the smallest footprint of all of the evaluated technologies requiring less space than engines and fuel cells with the same power output. It should also be noted that microturbines are an extremely clean technology with low air emissions.

Fuel Cells

Fuel cells utilize the hydrogen present in the methane-rich digester gas as a fuel source in an electrochemical process. The process converts hydrogen and oxygen to water while generating electricity.

The fuel cells evaluated typically convert, as a percentage of fuel input, 47 percent to electrical output, and 22 percent to recoverable exhaust heat, for a total overall efficiency of approximately 69 percent.

Two known fuel cell manufacturers were considered for large-scale power generation - United Technologies Corporation (UTC) and Fuel Cell Energy (FCE). Both manufacturers have provided fuel cells for applications utilizing digester gas. However, only FCE has units currently in operation. Many of these units operating on biogas are located in California. FCE utilizes a more efficient fuel cell technology than UTC, providing 47 percent fuel-to-electricity efficiency versus UTC's 37 to 40 percent. Due to the higher efficiencies and additional experience utilizing digester gas, only FCE units were considered as part of this evaluation. FCE produces three unit sizes: 300 kW, 1,400 kW, and 2,800 kW.

Permitting fuel cells is typically less onerous than obtaining air permits for engines and microturbines due to the fuel cell's extremely low emissions. As an electrochemical process, fuel cells produce significantly less pollutant byproducts than combustion technologies. Fuel cells have approximately 1/30th the emissions generated by a microturbine and 1/100th the emissions generated by engine-generators.

Figure 5.1 presents photographs of each of the cogeneration technologies.

Alternative Benefit Comparison

A summary of the advantages and disadvantages for the no cogeneration versus the three-cogeneration technologies is presented in Table 4.3.

ECONOMIC ANALYSIS

An economic analysis for the Logan City WWTP was completed in order to evaluate the cogeneration technologies considered. Estimated capital costs for the three cogeneration alternatives are summarized in Table 4.4.

Economic and Non-Economic Ranking Analysis

Fuel cells are more efficient than other cogeneration technologies, thus generating more power from the same amount of gas. As a result, Alternative 3 will maximize the incentive payments. Fuel cells also generate the lowest amount of emissions (compared to microturbines and engines) and will significantly reduce the City's emission of NO_x and CO. Consequently, utilizing fuel cell technology will significantly reduce the plant's overall greenhouse gas footprint.

800 kW Caterpillar Digester Gas-Fueled Cogeneration System,
Sunnyvale, CA WWTP

250 kW Ingersoll Rand Microturbine,
Lancaster, CA Landfill

1 MW Fuel Cell Energy Fuel Cell
Riverside, CA WWTP

COGENERATION APPLICATIONS

FIGURE 4.1

LOGAN CITY WWTP
COGENERATION FEASIBILITY STUDY

Table 4.3 Alternative Benefit Comparison
Wastewater Treatment Master Plan Update 2013
City of Logan

Alternative	Advantages	Disadvantages
Alternative 1 - Gas Engine Generator	Proven technology utilizing biogas for over 40 years	Requires dedicated building for sound and weather protection Complex equipment Frequent operator attention required for operations and maintenance Requires fuel treatment
Alternative 2 - Microturbine	Proven technology Simple O&M Simple design Low capital cost Low emissions	Lowest efficiency Requires fuel treatment
Alternative 3 - Fuel Cell Generator Unit	Ultra low emissions Highest efficiency Low operator attention for operations and maintenance	High capital costs High O&M costs Requires extensive fuel treatment Relatively new technology

Table 4.4 Summary of Estimated Capital Costs for Cogeneration
Wastewater Treatment Master Plan Update 2013
City of Logan

Alternative	Estimated Capital Cost
Alternative 1 - 500 kW Engine Generator	$6,366,000
Alternative 2 - 500 kW Microturbine	$4,929,000
Alternative 3 - 600 kW Fuel Cell	$5,421,000

Table 4.5 on the following page ranks the cogeneration alternatives utilizing weighted economic and non-economic criteria. As indicated by the Total Weighted Score, Alternative 3 (Fuel Cell Cogeneration System) offers the greatest benefits and is the recommended alternative, if cogeneration is desired in the future.

IMPLEMENTATION COST AND RECOMMENDATION

The cost of implementing energy recovery using fuel cells in conjunction with the preferred treatment option, the 3 Stage Bardenpho bioreactor, is shown in Table 4.6. A copy of the detailed cost estimate is included in Appendix E. Based on the high cost to implement energy recovery, it is recommended that energy recovery not be implemented at this time. Space on the treatment plant site can be reserved so that energy recovery could be implemented in the future.

Table 4.5 Cogeneration Alternatives - Ranking Matrix
Wastewater Treatment Master Plan Update 2013
City of Logan

Ranking Criteria		**Present Worth of Life Cycle Cost[(1)]**	**Protection Against Energy Price Volatility**	**Reliability**	**O&M Complexity**	**Air Quality Emissions**	**Proven Biogas Cogeneration Technology**	**Footprint**	**Efficient Use of Resources**	**Total Weighted Score[(1)]**	**Ranking**
Weighting Factor[(2)]		**5**	**3**	**4**	**4**	**3**	**4**	**3**	**5**	--	--
Project Alternative	**Description**										
Alternative 1	Engine Generator With Heat Recovery	4	4	2	3	2	5	2	3	99	3
Alternative 2	Microturbines With Heat Recovery	4	3	3	4	3	4	3	3	106	2
Alternative 3	Fuel Cell With Heat Recovery	5	4	4	5	5	4	2	5	135	1

Notes:
(1) Total Weighted Score equals the sum of each criteria's weighted factor multiplied by its individual ranking for each respective alternative.
(2) Weighting Factors: 5 - More Important, 1 - Less Important
(3) Alternative Ranking (Typical for All Alternatives and All Criteria): 5 - Most Desirable/Beneficial, 1 - Least Desirable/Beneficial.

Table 4.6 Cost Estimate for Implementation of Energy Recovery
Wastewater Treatment Master Plan Update 2013
City of Logan

Item	**Total**
Mobilization/Sitework	$ 13,600,000
Headworks	$ 6,210,000
Bioreactors	$ 17,480,000
Primary and Secondary Clarifiers	$ 12,086,000
Electrical/SCADA	$ 19,612,000
Filtration/Disinfection Building	$ 9,143,000
Solids Processing and Energy Recovery	$ 21,940,000
Operations Building	$ 1,750,000
Subtotal	**$101,821,000**
(Contingency (25%)	$ 25,455,000
Escalation to Construction Mid-point	$ 6,109,000
Estimated Total Construction Cost (2016 Dollars)	**$127,276,000**
Engineering, Legal & Admin	$ 17,819,000
Estimated Total Project Cost (2016 Dollars)	**$145,095,000**
Operations & Maintenance Cost Estimate	
Labor	$ 715,000
Benefits	$ 429,000
Tools/Supplies	$ 160,000
Utilities	$ 455,000
Chemicals	$ 200,000
Laboratory	$ 350,000
Subtotal	**$ 2,309,000**
Misc Items (10%)	$ 231,000
Total Estimated New O&M Cost	**$ 2,540,000**
Existing O&M Cost	$ 1,750,000
Existing Debt Service	$ 700,000
Total Estimated Annual O&M Cost	**$ 4,990,000**
Annual Lifecycle Cost (capital cost annualized for 20 years at 3%)	$ 14,743,000

ANTIDEGRADATION REVIEW FORM
UTAH DIVISION OF WATER QUALITY

Instructions

The objective of antidegradation rules and policies is to protect existing high quality waters and set forth a process for determining where and how much degradation is allowable for socially and/or economically important reasons. In accordance with Utah Administrative Code (UAC R317-2-3), an antidegradation review (ADR) is a permit requirement for any project that will increase the level of pollutants in waters of the state. The rule outlines requirements for both Level I and Level II ADRs, as well as public comment procedures. This review form is intended to assist the applicant and Division of Water Quality (DWQ) staff in complying with the rule but is not a substitute for the complete rule in R317-2-3.5. Additional details can be found in the *Utah Antidegradation Implementation Guidance* and relevant sections of the guidance are cited in this review form.

ADRs should be among the first steps of an application for a UPDES permit because the review helps establish treatment expectations. The level of effort and amount of information required for the ADR depends on the nature of the project and the characteristics of the receiving water. To avoid unnecessary delays in permit issuance, the Division of Water Quality (DWQ) recommends that the process be initiated at least one year prior to the date a final approved permit is required.

DWQ will determine if the project will impair beneficial uses (Level I ADR) using information provided by the applicant and whether a Level II ADR is required. The applicant is responsible for conducting the Level II ADR. For the permit to be approved, the Level II ADR must document that all feasible measures have been undertaken to minimize pollution for socially, environmentally or economically beneficial projects resulting in an increase in pollution to waters of the state.

For permits requiring a Level II ADR, this antidegradation form must be completed and approved by DWQ before any UPDES permit can be issued. Typically, the ADR form is completed in an iterative manner in consultation with DWQ. The applicant should first complete the statement of social, environmental and economic importance (SEEI) in Part C and determine the parameters of concern (POC) in Part D. Once the POCs are agreed upon by DWQ, the alternatives analysis and selection of preferred alternative in Part E can be conducted based on minimizing degradation resulting from discharge of the POCs. Once the applicant and DWQ agree upon the preferred alternative, the review is considered complete, and the form must be signed, dated, and submitted to DWQ.

For additional clarification on the antidegradation review process and procedures, please contact Nicholas von Stackelberg (801-536-4374) or Jeff Ostermiller (801-536-4370).

Antidegradation Review Form

Part A: Applicant Information

Facility Name: Logan City Wastewater Treatment Facility

Facility Owner: Logan City

Facility Location: 450 North 1000 West, Logan, Utah 84321

Form Prepared By: Carollo Engineers

Outfall Number: 001

Receiving Water: Swift Slough

What Are the Designated Uses of the Receiving Water (R317-2-6)?
Domestic Water Supply: None
Recreation: 2B - Secondary Contact
Aquatic Life: 3B - Warm Water Aquatic Life
Agricultural Water Supply: 4
Great Salt Lake: None

Category of Receiving Water (R317-2-3.2, -3.3, and -3.4): Category 3

UPDES Permit Number (if applicable): UT0021920

Effluent Flow Reviewed: 24 mgd
Typically, this should be the maximum daily discharge at the design capacity of the facility. Exceptions should be noted.

<u>What is the application for? (check all that apply)</u>

☐ A UPDES permit for a new facility, project, or outfall.

☒ A UPDES permit renewal with an expansion or modification of an existing wastewater treatment works.

☒ A UPDES permit renewal requiring limits for a pollutant not covered by the previous permit and/or an increase to existing permit limits.

☐ A UPDES permit renewal with no changes in facility operations.

Part B. Is a Level II ADR required?

This section of the form is intended to help applicants determine if a Level II ADR is required for specific permitted activities. In addition, the Executive Secretary may require a Level II ADR for an activity with the potential for major impact on the quality of waters of the state (R317-2-3.5a.1).

B1. The receiving water or downstream water is a Class 1C drinking water source.

☐ **Yes** A Level II ADR is required (Proceed to Part C of the Form)

☒ **No** (Proceed to Part B2 of the Form)

B2. The UPDES permit is new <u>or</u> is being renewed and the proposed effluent concentration and loading limits are higher than the concentration and loading limits in the previous permit and any previous antidegradation review(s).

☐ **Yes** (Proceed to Part B3 of the Form)

☒ **No** No Level II ADR is required and there is <u>no need to proceed further with review questions</u>.

B3. Will any pollutants use assimilative capacity of the receiving water, i.e. do the pollutant concentrations in the effluent exceed those in the receiving waters at critical conditions? For most pollutants, effluent concentrations that are higher than the ambient concentrations require an antidegradation review? For a few pollutants such as dissolved oxygen, an antidegradation review is required if the effluent concentrations are less than the ambient concentrations in the receiving water. (Section 3.3.3 of Implementation Guidance)

☒ **Yes** (Proceed to Part B4 of the Form)

☐ **No** No Level II ADR is required and there is <u>no need to proceed further with review questions</u>.

B4. Are water quality impacts of the proposed project temporary <u>and</u> limited (Section 3.3.4 of Implementation Guidance)? Proposed projects that will have temporary and limited effects on water quality can be exempted from a Level II ADR.

☐ **Yes** Identify the reasons used to justify this determination in Part B4.1 and proceed to Part G. No Level II ADR is required.

☒ **No** A Level II ADR is required (Proceed to Part C)

B4.1 Complete this question only if the applicant is requesting a Level II review exclusion for temporary <u>and</u> limited projects (see R317-2-3.5(b)(3) and R317-2-3.5(b)(4)). For projects requesting a temporary and limited exclusion please indicate the factor(s) used to justify this determination (check all that apply and provide details as appropriate) (Section 3.3.4 of Implementation Guidance):

☐ Water quality impacts will be temporary and related exclusively to sediment or turbidity and fish spawning will not be impaired.

Factors to be considered in determining whether water quality impacts will be temporary and limited:

a) The length of time during which water quality will be lowered: ☐
b) The percent change in ambient concentrations of pollutants: ☐
c) Pollutants affected: ☐
d) Likelihood for long-term water quality benefits: ☐
e) Potential for any residual long-term influences on existing uses: ☐
f) Impairment of fish spawning, survival and development of aquatic fauna excluding fish removal efforts: ☐

Additional justification, as needed: ☐

Level II ADR

Part C, D, E, and F of the form constitute the Level II ADR Review. The applicant must provide as much detail as necessary for DWQ to perform the antidegradation review. Questions are provided for the convenience of applicants; however, for more complex permits it may be more effective to provide the required information in a separate report. Applicants that prefer a separate report should record the report name here and proceed to Part G of the form.

Optional Report Name: *City of Logan Wastewater Treatment Master Plan Update 2013*

Part C. Is the degradation from the project socially and economically necessary to accommodate important social or economic development in the area in which the waters are located?

The applicant must provide as much detail as necessary for DWQ to concur that the project is socially and economically necessary when answering the questions in this section. More information is available in Section 6.2 of the Implementation Guidance.

C1. Describe the social and economic benefits that would be realized through the proposed project, including the number and nature of jobs created and anticipated tax revenues.

Logan City, USU and the surrounding communities are avital part of the State economy.

C2. Describe any environmental benefits to be realized through implementation of the proposed project.

The proposed project will meet the water quality standards established by the Cutler Reservoir TMDL for total phosphorus, and will meet the proposed limits for ammonia and total nitrogen.

C3. Describe any social and economic losses that may result from the project, including impacts to recreation or commercial development.

project will impose a heavy finacial burden on local residents and will require monthly sewer rates higher than 1.4% MAGI

C4. Summarize any supporting information from the affected communities on preserving assimilative capacity to support future growth and development.

C5. Please describe any structures or equipment associated with the project that will be placed within or adjacent to the receiving water.

none

Part D. Identify and rank (from increasing to decreasing potential threat to designated uses) the parameters of concern. *Parameters of concern are parameters in the effluent at concentrations greater than ambient concentrations in the receiving water. The applicant is responsible for identifying parameter concentrations in the effluent and DWQ will provide parameter concentrations for the receiving water. More information is available in Section 3.3.3 of the Implementation Guidance.*

Parameters of Concern:

Rank	Pollutant	Ambient Concentration	Effluent Concentration
1	Ammonia		6 mg/L
2	TP		3 mg/L
3	TN		20-25 mg/L
4	BOD5		6 mg/L
5	TSS		8 mg/L

Pollutants Evaluated that are not Considered Parameters of Concern:

Pollutant	Ambient Concentration	Effluent Concentration	Justification

Part E. Alternative Analysis Requirements of a Level II Antidegradation Review.

Level II ADRs require the applicant to determine whether there are feasible less-degrading alternatives to the proposed project. More information is available in Section 5.5 and 5.6 of the Implementation Guidance.

E1. The UPDES permit is being renewed without any changes to flow or concentrations. Alternative treatment and discharge options including changes to operations and maintenance were considered and compared to the current processes. No economically feasible treatment or discharge alternatives were identified that were not previously considered for any previous antidegradation review(s).

☐ **Yes** (Proceed to Part F)

☒ **No or Does Not Apply** (Proceed to E2)

E2. Attach as an appendix to this form a report that describes the following factors for all alternative treatment options (see 1) a technical description of the treatment process, including construction costs and continued operation and maintenance expenses, 2) the mass and concentration of discharge constituents, and 3) a description of the reliability of the system, including the frequency where recurring operation and maintenance may lead to temporary increases in discharged pollutants. Most of this information is typically available from a Facility Plan, if available.

Report Name: *City of Logan Wastewater Treatment Master Plan Update 2013*

E3. Describe the proposed method and cost of the baseline treatment alternative. The baseline treatment alternative is the minimum treatment required to meet water quality based effluent limits (WQBEL) as determined by the preliminary or final wasteload analysis (WLA) and any secondary or categorical effluent limits.

18 mgd 3 stage Bardenpho Bioreactor with Filtration

$111,000,000

E4. Were any of the following alternatives feasible and affordable?

Alternative	Feasible	Reason Not Feasible/Affordable
Pollutant Trading	No	not feasible for magnitued of pollutants to be removed
Water Recycling/Reuse	No	Not affordable
Land Application	No	Not affordable
Connection to Other Facilities	No	No other facilites with 18 mgd of spare capacity
Upgrade to Existing Facility	No	not affordable - see Bio-Dome alternative
Total Containment	No	not feasible
Improved O&M of Existing Systems	No	not able to meet permit limits
Seasonal or Controlled Discharge	No	not affordable
New Construction	Yes	proposed for preferred alternative
No Discharge	No	not feasible

E5. From the applicant's perspective, what is the preferred treatment option?

18 mgd 3 Stage Bardenpho Bioreactor with Filtration

E6. Is the preferred option also the least polluting feasible alternative?

☒ **Yes**

☐ **No**

If no, what were less degrading feasible alternative(s)? ☐

If no, provide a summary of the justification for not selecting the least polluting feasible alternative and if appropriate, provide a more detailed justification as an attachment.

☐

Part F. Optional Information

F1. Does the applicant want to conduct optional public review(s) in addition to the mandatory public review? Level II ADRs are public noticed for a thirty day comment period. More information is available in Section 3.7.1 of the Implementation Guidance.

☒ **No**

☐ **Yes**

F2. Does the project include an optional mitigation plan to compensate for the proposed water quality degradation?

☒ **No**

☐ **Yes**

Report Name: ☐

Part G. Certification of Antidegradation Review

G1. Applicant Certification

The form should be signed by the same responsible person who signed the accompanying permit application or certification.

Based on my inquiry of the person(s) who manage the system or those persons directly responsible for gathering the information, the information in this form and associated documents is, to the best of my knowledge and belief, true, accurate, and complete.

Print Name: CRAIG ASHCROFT

Signature: Craig Ashcroft

Date: 10/3/13

G2. DWQ Approval

To the best of my knowledge, the ADR was conducted in accordance with the rules and regulations outlined in UAC R-317-2-3.

Water Quality Management Section

Print Name: ________________

Signature: ________________

Date: ________________

Appendix J

MEETING MINUTES

LOGAN CITY UNITED IN SERVICE
ESTABLISHED 1866

MUNICIPAL COUNCIL
290 North 100 West
Logan UT 84321

MEETING NOTICE – COUNCIL WORKSHOP
Tuesday, June 25, 2013 – 5:30 p.m.

PUBLIC NOTICE is hereby given that the Logan Municipal Council will meet in a Council Workshop in the **Logan City Hall Conference Room, 290 North 100 West,** Logan, Utah 84321 at **5:30 p.m.** on **Tuesday, June 25, 2013.**

5:30 p.m. 1. Call to Order

2. **ACTION ITEM:**
   A. **PUBLIC HEARING - Budget Adjustment FY 2012-2013 appropriating:** $450,000 to cover unanticipated medical costs in the Health Management Fund – **<u>Resolution 13-48</u>**

3. Presentation: Wastewater Treatment Improvement Project

4. Questions or Comments

7:30 p.m. 5. Adjourn

On Friday, June 21, 2013, at 5:00 p.m. a copy of the foregoing notice was posted in conspicuous view in the front foyer of Logan City Hall, Logan, Utah. A copy of this notice was faxed to the Herald Journal. The Agenda was also posted on the Logan City website at www.loganutah.org and the State Public Meeting Notice website at http://pmn.utah.gov.

DATED THIS 21st OF JUNE 2013 *Teresa Harris, City Recorder*

Council Member's may participate in the meeting via telephonic communication. If a Council Member does participate via telephonic communication, the Council Member will be on speakerphone. The speakerphone will be amplified so that the other Council Members and all other persons present in the Council Chambers will be able to hear all discussions.

In compliance with the American with Disabilities Act, individuals needing special accommodations or assistance during this meeting shall notify Teresa Harris, City Recorder, at 435-716-9002, at least 24 hours prior to the meeting.

Logan Municipal Council Meetings are televised live as a public service on Channel 17

Minutes of the meeting of the Logan Municipal Council convened in a workshop session Tuesday, June 25, 2013 at 5:30 p.m. in the Logan City Hall Conference Room, 290 North 100 West, Logan, Utah. Chairman Holly Daines conducting.

Council members present at the beginning of the meeting: Chairman Holly Daines, Vice Chairman Tom Jensen, Councilmember Karl B. Ward, Councilmember Herm Olsen and Councilmember Dean W. Quayle. Administration present: Mayor Randy Watts, Public Works Director Mark Nielsen, Environmental Director Issa Hamud, Finance Director Richard Anderson. Staff Present: Wastewater/Permits & Analysis Manager Jim Harps, Environmental Engineer (EIT) Alexandra Rasband, and Conservation Coordinator Emily Malik.

CALL TO ORDER.

Meeting Agenda. Chairman Daines announced there will be one public hearing tonight prior to the workshop item.

ACTION ITEMS.

PUBLIC HEARING – Budget Adjustment FY 2012-2013 appropriating: $450,000 to cover unanticipated medical costs in the Health Management Fund **– Resolution 13-48.**

In accordance with Utah State law and Logan City budgeting practices, Logan City is holding a public hearing this evening to discuss the appropriation of funds to cover unanticipated medical costs in the Health Management Fund.

Chairman Daines asked council for questions. There were none.

Chairman Daines opened the meeting to a public hearing.

There were no public comments and Chairman Daines closed the public hearing. Chairman Daines asked for a motion.

ACTION. Motion by Councilmember Quayle seconded by Vice Chariman Jensen to adopt resolution 13-48 as presented. Motion carried unanimously.

INTRODUCTIONS.

Mayor Watts said that this is such a huge discussion that he had expected there to be a greater turnout this evening. Mayor Watts continued on to introduce the evening's presenters. Presenting are: Walt Baker from the State of Utah Department of Water Quality, Matt Dugdale the project financial advisor from the company George K. Baum & Company, Craig Ashcroft from Corlolo, our consulting Engineer, and Ron Simms from Utah State University, an algae research expert, and representing the Water Quality Board. Mayor Watts turned the time over to the presenters.

PRESENTATIONS.

(Slides for each presentation are included with the minutes)

Walt Baker, director of Utah Department of Water Quality (UDWQ) began with a presentation titled “A Perfect Storm”.

Mr. Baker’s presentation began by outlining water quality standards, what the standards are designed to protect, defined beneficial uses of waterways, and defined nutrient pollution as primarily phosphorous and nitrogen and total dissolved oxygen as a major problem in several of Utah’s waterways. Logan City’s wastewater treatment lagoons discharge into Cutler Reservoir and, according to a TMDL study completed in 2008, this discharge is impairing the intended uses of Cutler Reservoir.

Councilman Olson asked what TMDL stands for. Mr. Baker stated it stands for Total Maximum Daily Load. Utah Department of Water Quality is required by the EPA to be below certain limits when a waterway is not meeting its intended uses (such as Cutler Reservoir). Utah Department of Water Quality performed a TMDL for this area and the results indicated that the UDWQ is obligated to take action to try to repair the waterway.

Mr. Baker used graphs and charges and continue to discuss the existing conditions regarding nutrient pollution in Cutler Reservoir and how frequently Logan City’s wastewater treatment plant is in violation of the current discharge standards for phosphorous pollution according to the TMDL. Mr. Baker said that the TMDL showed UDWQ that they needed to attempt to correct the problem. Originally, the UDWQ proposed a moderate and adaptive approach to restore Cutler Reservoir. Logan City’s compliance plan based on the TMDL study went into effect in February 10, 2011 and we were set to be in compliance by October 1, 2017. Compliance would be achieved with the following standards: Meet total phosphorus loading requirement of 4,405 kg - May through October and 11,831 kg – November through April.

Councilmember Jensen asked why November through April has higher limits. Mr. Baker replied that it has to do with flows, background flows, temperature, ph, the amount of wastewater being discharged and different variables that go into targets we need to hit. Summer need to ratchet down the loadings because there is less algae during the summer.

Mr. Baker indicated that the Utah Department of Water Quality had switched gears during this time to take a look at setting state standard to avoid doing multiple TMDLs within the state. Mr. Baker indicated that a state-wide cost estimate for implementing programs to reduce nutrient pollution would be an average of approximately $3.70 per month per household. The take home message was that if we upgrade technology, we will significantly reduce nutrient pollution within the state.

Mr. Baker indicated that because of the work on the statewide nutrient pollution standard, they overlooked an ammonia standard that went into effect in 2008. As a result, this was not addressed in Logan City's permitting process, master plan process, and in 2011 it was found that while Logan City had an acute ammonia standard, they had failed to address the chronic ammonia standard. When Logan City's permit was renewed in 2011, we were severely out of compliance with the new, very tight, chronic ammonia standards. Mr. Baker showed graphs detailing the standards and Logan City's wastewater treatment plant. Mr. Baker asserts that Logan City's sewage lagoons and wetland system do not allow us to come into compliance with the requirements. Mr. Baker indicated that while Mr. Dugale will speak more about various financing approaches, but it has been estimated that it will cost $125 million to address our nutrient pollution concerns. The state is all in to help Logan City along with the Water Quality Board, Rural Development Funds, and the Community Impact Board.

Mr. Baker's stressed that the purpose of the presentation was to make everyone aware of how Logan City got to this point with their wastewater compliance issues.

Councilmember Olsen asked if the cost of the project would be $125 million total. Mr. Baker replied that he was correct and that the costs would be discussed more by Mr. Dugale as there are some unknowns, but that is pretty close.

Councilmember Quayle asked if money coming from the Water Quality Board is a zero interest loan or a grant. Walt replied that it will not be grant money, but it will be zero interest loan money instead. Logan City would most likely not be grant eligible.

Councilmember Quale asked why it took four years to get at the ammonia level. Mr. Baker stated that there were other bit standards on the plate and their focus was distracted. They do not open permits to see what the effect of a new standard is on a permit prior to it being renewed and in Logan City's case that was 2011. However, Mr. Baker stated, it would not have made a difference. It has bought Logan some time, but an important takeaway is that they made a mistake not applying the ammonia standard to Logan standards in 2008 and before. Error was on their part, not ours. They should have notified us.

Chairman Daines asked how we know that the standards will not change again. "You shoot at one target and the target moves. If we spend all of this money on the treatment plant, how can we guarantee we won't be faced with upgrades and such down the line?" Mr. Baker said that UDWQ is giving assurances that there will be a 10 year window of being held harmless on certain criteria. There are no assurances that EPA will not change other criteria. However we can set up that a phosphorous will be held for 10 years. The ammonia standard is trickier. Logan City should rely on their engineer to have a plant designed that can adapt to be able to remove pollutants that come up. There are a host of pollutants that are not regulated now. We suspect there will be standards in the future. Build an adaptable facility that will take you 20 years into the future.

Mayor Watts said that Holly brings up a good point and we continue to talk about the lagoons and that technology has gone by the wayside but we want to move ahead to try to use what we have already created with the wetlands. Mr. Baker indicated that Logan City can use wetlands for stormwater and other uses and that it was not a throwaway investment. Mr. Baker indicated that Logan City is changing and will have to be prepared to keep up with demands of an increasing population. Several cities within Cache County have had to upgrade their wastewater treatment facilities, we are no different.

Mr. Baker concluded his presentation and turned the time over to Issa Hamud.

Mr. Hamud addressed the steps that we need to take in the future with this project. He said that we need to create a master plan that meets ammonia standards and we need to do that by January 2014. All planning is flexible until we sign for the loans, but we need to submit applications for funding as soon as possible and would like consent tonight from Council to move forward with the site assessment plans so that we can move forward with the loan process. Mr. Hamud indicated that we are doing some site assessments currently and there has been some land purchasing as well. We need to do all of these things concurrently so that we can build immediately when the plans and loans are approved so we can complete the facility by 2017 or close to that date. Corolo will give you the information that we have collected about the new treatment facility and funding and potential rate increases. We need to do this quickly because of market conditions. The information that Corolo will present was reviewed by Logan City's Water Board and Ron Simms will share their perspective with you.

Mr. Hamud turned the time over to Ron Simms.

Mr. Simms is speaking on behalf of the Logan Water Board. Logan Water Board supports the request by Logan City for financial aid from the Department of Environmental Quality to make improvements to upgrade the Logan City Wastewater Treatment Plant to meet requirements for nitrogen and phosphorous. Mr. Simms added that the testing of tech from USU using algae is not complete. Test results to date indicate that algae technology or "resource out of place" can meet the standards for nitrogen and phosphorous in the summer months. He noted that more testing is needed to evaluate performance in fall, winter, and spring. USU would like to continue to work with Logan City to evaluate performance in the next two years. Algae can to take care of the ammonia also. There will be more information as we develop the testing and Utah State University's plan is to continue to work with the Division of Environmental Quality, Logan City and Corolo to develop this technology to have additional options in the future.

Mayor Watts mentioned that he knows Ron and this has been a long and laborious process. We have met with people in Washington DC about this research and it has the potential to be big, especially the biofules aspect of the algae research. This also has the potential to help more than one city across the US. Mayor Watts would like to see Ron and USU continue in looking at this "nutrient/nuisance out of place" because it has the potential to really help clean our water. That is why we have pursued trying to get support across the country and it has been worth it.

Councilmember Olson asked Mr. Simms to please clarify that for the summer months, the algae project would satisfy requirements for nitrogen and phosphorous, but ammonia too? Mr. Simms replied that they are meeting ammonia standards too. The algae are prolific in the summer, but we don't know about other seasons. Mr. Simms indicated that we need two more years and longevity in this study.

Councilmember Olson asked are we wasting money to build the plant. Mr. Simms said no because we can work together and integrate the technologies if necessary.

Councilmember Ward stated that we have a deadline given to us, but we also have promising alternative biotechnology to deal with a problem outside of having mechanical treatment facilities. Councilmember Ward asked Mr. Baker if that creates enough mitigation to the deadlines to make it worthwhile to wait a year or two to see if it will be effective and applicable across the country. This could change, a great deal, how we deal with wastewater as a human population. Simply, is this not promising enough that it is worthwhile to give another couple of years? Mr. Baker indicated that the compliance schedule will have to be modified in any event as when it was created we going down the road to comply with TMDL and now the ammonia has come into which is the driver now because ammonia is more stringent and others will be met with that control. Mr. Baker said that UDEQ doesn't dictate to Logan City what technology they have to use, but there is still some uncertainty with using a biological approach to solve the problem entirely. For example, lagoon is biotreatment, but there is little we can do to effect treatment at our lagoons now. Mechanical plant will give us more flexibility in the future.

Mr. Ashcroft has worked with Mr. Simms and looked at other treatment in the winter time in the past and will talk about it a little bit in his presentation.

An audience member indicated that it is worrisome that there is only one option on the table. We do not know what the next cost/step is incrementally if we wanted to go more strict in our requirement. Mr. Ashcroft replied that there were several options available. This has been a process of elimination and we have narrowed things down and when the ammonia came into the picture, we evaluated things all over again.

Craig Ashcroft from Corolo introduced himself and began his presentation by saying that much of the beginning of his presentation was addressed by Mr. Baker including the need for the project and the limits that may be coming in the future such as Nitrogen or Total Organic Nitrogen and this treatment plant would have the ability to meet these standards. Mr. Baker also discussed the compliance schedule.

Mr. Ashcroft showed a slide that indicated the total Total phosphorous at Lagoon Effluent along with 2040 limits.

Chairman Daines asked if the limits are a guaranteed number? Mr. Ashcroft indicated it was established in the TMDL. It could be revised; there is no guarantee that they will not be changed in the future and that we should take comfort that we can go lower than current numbers with a future treatment plant.

Councilmember Quayle asked if that was based on existing technology. Mr. Ashcroft said yes.

Councilmember Olson asked if the highest spiking numbers were in the summertime. Mr. Ashcroft said yes, there are spikes in the wintertime as well, but also in the summer months.

Councilmember Ward asked an educational technical question: How do these limits get set in the first place. Who sets them and what criteria makes them decide that it needs to be different than it is. Mr. Ashcroft replied that these criteria are set through the TMDL study. Mr. Baker added that it is a long process that looked at several sources of phosphorous and cut up the total pie to determine the sources.

Mr. Hamud asked what other areas are doing. Mr. Ashcroft indicated that there is one plant at Snyderville Basin in the Park City Area. They are meeting the 0.1 limit. Hyrum is meeting the limits with their mechanical plant.

Councilmember Olson asked if that was also true for Richmond and Wellsville plants. Mr. Hamud said that Richmond is meeting and Wellsville isn't. Wellsville has a lagoon system and they do not discharge in the summer so they have a different biotechnology system.

Chairman Daines asked if we could store water and stagger our discharge like Wellsville does while we look more at the algae technology. Mr. Hamud replied that we cannot hold in the winter. We can in the summer maybe because the farmers use nearly 100% of our discharge for irrigation, but having the farmers use our water for irrigation is part of the problem.

Councilmember Quayle asked that if we meet the TMDL, will our meeting limits satisfy the problems with cutler or will there still be other problems. Mr. Hamud said that the algae concentration may not change in the short term, but it may help in the long term. There is also sediment that will have to be taken care of in the future. Ours plant has a higher limit because there are so many conditions of cutler are different than other water bodies.

Mr. Ashcroft continued his presentation to talk about ammonia effluent and existing limits and the various approaches that have been discussed to help us meet our nutrient pollution limits. Originally, a hybrid treatment plant was discussed, but it was found that it would be difficult to make work during the winter time and it would require greenhouses or additional mechanical treatment to remove algae from the liquid stream which brought the cost of the hybrid plant to higher than a simple treatment facility. Nearly double the cost. We can add components of algae treatment in the future, but it is cost prohibitive to start with them. So he has come up with three alternatives that are different from this option.

The first option to meet ammonia limits and ability to meet future total nitrogen limits would also provide dewatering for waste solids. Some water would go to lagoons to store water during the winter time and use that water for irrigation during the summer time. All water in lagoons would go to irrigation in the future with this option.

Councilmember Quayle asked about how algae research fits with this option. Mr. Ashcroft replied that if Mr. Simms research is feasible, then the lagoons remain.

Mayor Watts commented that with this option you have irrigation or discharge and they are separate.

Chairman Daines asked if thy water is acceptable for irrigation? Mr. Ashcroft replied that it is the same as is used right now.

Chairman Daines asked if it ended up further contaminating things? Mr. Ashcroft indicated that irrigation water will still count against our limits, but we will have to treat for lower in treatment plant to make up for what is being discharged for irrigation. So what goes into cutler will be clean.

Mr. Ashcoft presented the final option of a full mechanical treatment plant and eliminating the lagoons or using them solely as a research laboratory. We would have sufficient capacity in mechanical plant to treat all of our water. All water discharged would meet all of the water quality standards.

Mayor Watts commented that the lagoons could be more than a lab, but also the biofuel farm for energy production too.

Mr. Ashcroft presented a second option that is the same as a mechanical plant but add an energy recovery plant. That is digesters, cogen plants, and other such technology. This is an option that can be added on with the alage in the future but for the cost may not be feasible right now.

Vice Chairman Jensen asked if the energy recovery system productive enough to offset the production.

Councilperson Olson indicated he thought it was a wash which Mr. Ashcroft confirmed. He continued to say that Logan City would be better of to delay the energy recovery portion of a plant because technology is rapidly changing in this area and the costs will most likely be lower in the future.

Mr. Ashcroft showed pictures of Park City's treatment plant and offered a tour if anyone would like to see it. This is a similar process as what they are proposing for Logan City. They are well below a potential state standard and easily meeting ammonia standards. There is flexibility in a mechanical plant

Councilmember Quayle asked what their gallons per day were in Park City? Mr. Ashcroft replied 5 million gallons per day.

Councilmember Quayle asked if they have the agriculture and industry like Logan City. Mr. Ashcroft 5 million gallons per day. Mr. Ashcoft indicated that they have their own challenges such as golf courses and high fertilizer levels.

Mr. Ashcroft continued with slides addressing the cost of the three plant options.

Option 1 is 75-80 million dollars capital costs. Option 2 is 100-110 million dollars capital costs. Option 3 is $140 to 150 million dollars in capital costs.

Chairman Daines asked if the slides were in the book that was presented to Council. Mr. Hamud said yes, but this slide has been updated because of changes in the estimate. The slide on the screen of 100-110 million dollars is correct.

An audience member asked if 12 million gallons is today's numbers or future numbers. Mr. Ashcroft replied that 18 million gallons is projected to accommodate grown 20 years into the future.

Another audience member asked how easy it is to add onto the treatment plant. Mr. Ashcroft indicated that it is fairly easy because these treatment plants take a module approach.

Another audience member asked if the placement of the plant allowed for this expansion. Mr. Ashcroft replied that land has been purchased and we lay it out to be expandable.

Mayor Watts asked that when you look at the entire geography of the Bear River, and all it travels through, how bad is it by the time it gets to us and we discharge it. Mr. Baker indicated that the DWQ takes a holistic approach to water quality . . . Utah, Idaho, and Wyoming are involved in this watershed and work together, and the TMDL drove this information, but really, ammonia is trumping the TMDL. It is the pollutant of concern, but we get a "two for".

Chairman Daines asked if Idaho also implementing treatments? Mr. Baker indicated that Idaho is employing TMDLs and so is Wyoming.

Councilmember Ward asked what differential is there between before the water gets to our treatment facility and after, what's the differential, are we a significant contributor? Is it somewhat marginal or minimal? Mr. Baker indicated that it is significant.

Councilmember Ward asked if the water is better before it gets to us then. Mr. Baker indicated that he doesn't have that information with him but the Cutler is a choke point for what we need to do regionally before we restore it. He can get us the information what it looks like before and after it hits our area.

Chairman Daines indicated that she thought it would be significant to know.

Mayor Watts said that the Bear River is amazing and we are all trying to do the best we can and we hope that everyone is a player in betterment of water for three states.

Mr. Baker said that he sits down twice a year to talk about nothing but the Bear River and how we are integrating our approach and that is what is happening.

Vice Chairman Jensen indicated that we have a growth of population and that is not going to change a whole lot. Is there some way to reduce the total flow through some sustainability methods, low flow methods, we know some years ago contractors discharged into sewer system, but is there some way to get it to reduce the cost. Mr. Hamud replied that it is possible; in Logan we have a lot of infiltration from ground water into the old sewer line systems. The Island and other places where we have open joint pipes. He said that we can save a lot of money and reduce the flow and there will be a lot of basements inundated with water also.

Mr. Hamud suggested that we base applications on the second option. We can always adjust in the future. There are challenges with option 1 with odor. Mr. Hamud said that we have opportunities in the current market to get really great low interest rate and we should move forward to move ahead with applications and get a final consent before we sign on the dotted line. The applications are prioritized by application date and we want to be a priority on the list.

The time is turned to Matt Dugale.

Mr. Dugale presented two slides regarding financing options for this project. He indicated that much on the financing end depends on variables such as end cost and interest rates, but he has done his best to estimate in today's market and potential lenders. Mr. Dugale used a modeling tool to use to look at historical revenues and expenses in sewer fund, so we can determine net revenues and current debt payments, the two outstanding bond payments, and what revenues are left over after those two items to make sure that we can make our payments. Matt indicates that we would need to do a fee increase.

The funding sources are as follows:

State $50 million 0% interest for 30 years
USDA $20 million at 2.75% interest 40 years
CIB $5 million at 1.5% interst over 20 years
City $20 million at 4.34% interst over 30 years (plus $15 million in city cash)

Mr. Dugale indicated that we need to consider where rates will be in the future and add as much cash as we can now. He then presented a Matrix trying to capture a lot of variables to determine what it will cost our residents. We have discussed the potential for a 7 to 12 dollar increase per household. As we go forward we will refine these numbers. This again is today's best guess, it will change as we move forward.

Councilmember Ward asked if Mr. Dugale's assumptions were a blended rate is a weighted average of financing components. Mr. Dugale indicated that was correct.

Councilmember Olson asked if he understood correctly that the probable increase is $12? Mr. Dugale said yes, it is between 7 and 12 dollars.

Councilmember Quayle asked if that covered operation costs also. Mr. Dugale indicated that it did include those costs and it will be adjusted as the plans become more refined.

Councilmember Quale stated that the scary part is what if something else happens.

Mayor Watts said that this is paramount with everything this city is dealing with, we have to make sure that we backfill this project with the revenue needed to meet the bond, so that we don't weaken ourselves with bond ratings and continue to be proactive for everything else that happens, that is huge. It is nice to have you [Mr. Dugale] on board because the other things don't go away either.

Mayor Watts wanted to specifically make mention that he was hoping for a crowd tonight because there are other cities involved in this and they aren't here tonight and there isn't anything bigger on their plates than this and to not have them here is troublesome to him.

Vice Councilman Jensen asked if we notified the other towns. Mr. Hamud indicated that we presented this to their councils and some of the mayors showed up and they have seen the charts. Logan city rates will still be equivalent to what the other cities are paying today or less. We are paying $29 and with $12 that is $41 per month. Most other cities are at this rate or more. We still have reasonable rates and we have increased in the past with the knowledge that this project will be on our plates, and we will probably borrow less than indicated because we have put money away. We have anticipated increase and hopefully with low interest rates we can keep the cost down.

Mr. Dugale said that when packaging with other agencies it can sometimes be difficult, but there is great communication between the different entities. Hopefully requirements will be harmonious in this case and we won't have three task masters.

Mr. Dugale finished his presentation

Mayor Watts asked Mr. Hamud if there is anything else that we need to cover and Mr. Hamud indicated that there is nothing else, he just needs Council approval to move forward to obtain loans and will bring it back to them when we have more information for them to make a decision.

Richard Anderson added that this is the biggest project ever in his tenure with Logan City and, hopefully, biggest we will face in the near future. This will put stress on our bond rating, but we do not have alternatives. He says that option1 is too small, option 2 is just right and option 3 is speculative.

Chairman Daines asked if we be able to bond if we had another project we needed to bond for. Mr. Anderson said that it would be difficult without a significant rate increase, but only within this fund. Other funds are still okay and have significant reserves.

Councilmember Ward wanted to know, in case it is asked of him, what the consequence is if we say forget it EPA, we don't care what you think, we are doing nothing. Not saying it is a reasonable alternative, but to be able to answer the question. Mr. Baker said that this is a state standard and the EPA is involved in elements of this, but this is a state standard. We would be violating water quality law. There is a state statute. The consequence is enforcement action, meaning court orders, lawsuits, basically someone would adjudicate. Things can go as far as to shut down housing loans, etc. . There could be court orders, lawsuit, someone would adjudicate. They can shut down He is not an attorney, but there isn't a lot of experience.

Vice Chairman Jensen asked if there is an option to wait for two more years to go along with Mr. Simms opportunity. Mr. Baker replied that the city will have to make the decision of what is prudent. Algae can be a component of the solution, but it is not the only solution. Mr. Simms agreed, it is a long term study and still a study.

Mayor Watts indicated that he asked Mr. Ashcroft how long the construction project will take once we are shovel ready and this is a three year construction project. There are not many projects that are three year construction. This is after site loading (1.5) years so it is really a five year project. We are trying to get the design and begin loading by 2014 to try to meet the deadlines.

Vice Chairman Jensen asked when the new rates would go into effect. Mr. Hamud thinks 2015 when we are closing the loans.

Mayor Watts indicated that they have sat with the EPA and asked for time. The big hurdle with the algae projects is the winter and that was when we were talking about the TMDL only. Mayor appreciates everyone that is here and the people from the State that take the time to be here. This is so huge, there is nothing as huge as this entails now and in the future. We need to make sure that as we move into this we don't leave anything unturned and keep the city healthy.

Chairman Daines motioned all in favor of pursuing second option and beginning application process all in favor. Motion passed unanimously. Councilmember Olson noted that he would like us to keep moving forward with the algae studies too. Meeting adjourned 7:33 pm.

ADJOURN.

There being no further business to come before the council, meeting adjourned at 7:33 p.m.

Emily Malik, Conservation Coordinator

Minutes of the meeting of the Logan Municipal Council convened in regular session on Tuesday, February 19, 2013 at 5:30 p.m. in the Logan City Municipal Council Chamber, 290 North 100 West, Logan, Utah. Chairman Holly H. Daines conducting.

Council members present at the beginning of the meeting: Chairman Holly H. Daines, Vice Chairman Tom Jensen, Councilmember Karl B. Ward and Councilmember Dean W. Quayle. Administration present: Mayor Randy Watts, Public Works Director Mark Nielsen, City Attorney Kymber Housley, Finance Director Richard Anderson and City Recorder Teresa Harris. Excused: Councilmember Herm Olsen.

OPENING CEREMONY.

Council Member Dean Quayle gave the opening thought/prayer and led the audience in the pledge of allegiance.

Chairman Daines welcomed those present. There were approximately 8 citizens in the audience at the beginning of the meeting.

Meeting Minutes. Minutes of the council meeting from February 5, 2013 were reviewed and approved with no changes.

Meeting Agenda. Chairman Daines announced there are no public hearings scheduled for tonight's council meeting.

Meeting Schedule. Chairman Daines announced that regular council meetings would be held the first and third Tuesdays of the month at 5:30 p.m. The next regular council meeting is Tuesday, March 5, 2013.

QUESTIONS AND COMMENTS FOR MAYOR AND COUNCIL.

Logan resident Tony Nielson, 1393 Boxwood Circle. Mr. Nielson said commendation should be given to those in the City who organize and attend the neighborhood council meetings and he thanked them for their hard work. He also said snow removal is a property issue and property owners should take care of their own property both residential and business owners. He feels if property owners don't clean their sidewalks a fine should be imposed. He also talked about the bus stops on 1000 West and said all of the stops are closed because there is only one lane of traffic and the bus cannot stop anywhere. He suggested an alternative route for the bus to go around the construction zone. He said there are a lot of people that work in this area and asked the Council to consider an alternative route so they can still ride the bus.

Councilmember Quayle offered to contact Transit Director Todd Beutler regarding the 1000 West bus stops. He also said at the last council meeting it was suggested that crossing guards and the parking authority could help in reporting areas where snow removal is needed on sidewalks. He asked Police Chief Gary Jensen for an update on this suggestion.

Chief Jensen responded that the problem in asking the crossing guards to monitor snow removal is it would take them away from what they are doing and they need to be watching traffic and children as they cross the street. The parking authority could be involved as well as on duty police officers.

Chairman Daines suggested the parking authority could keep a small notebook and could write down problem areas where snow is observed on the sidewalk. They could give this information to someone at the police department who could keep a record of the problem areas. She also stated that on a yearly basis the fire department sends out a reminder on weed abatement and suggested this same process be used for snow removal on sidewalks. She suggested coming up with a letter, especially for businesses owners reminding them to clear their sidewalks.

Councilmember Jensen said he recently drove in the area of 600 East and after three weeks, there are still properties that have not cleared the snow on the sidewalk. He said with our digital age, he suggested a location on the Logan City website where people can put an address where snow needs to be cleared on the sidewalk and alert people that it's a problem.

MAYOR/ STAFF REPORTS.

North Valley Landfill Report – Issa Hamud, Logan City Environmental Director.

Issa Hamud, Logan City Environmental Department Director addressed the Council regarding the North Valley Landfill. He said a permit was issued from the State of Utah last week and we are now legally allowed to use the landfill. There are still a few issues that need to be addressed before garbage can be taken to this location. This is 530 acres and is on the boarder of Idaho. Out of the 530 acres there are 329 acres allocated for landfill use and a permit was issued. He intends to use at least 133 acres and a design has been submitted for this property. There will be two entrances to the landfill property. The next step is to apply for a conditional use permit and he currently has all the information to meet the requirements for the permit. The property has been zoned by Cache County as a landfill. The focus will be access to the property and the costs involved. The four options will be presented to Cache County and they will make the decision on the route the garbage trucks will take to the new landfill which will also determine the cost. There has been a concern about the Martin Harris Pageant that is held in this area every other year for a 10-day time period. Crews will work around the pageant so it will not cause any disruptions.

Mr. Hamud said the road will be a hard surface and these will be less than 15 trucks per day traveling along this road. No trucks will go through neighborhoods unless the road goes through Clarkston Town. The route next to the Clarkston Cemetery is an option.

Mr. Hamud also gave an update on the Waste Water Treatment and the phosphorus requirement that was mandated by the EPA three years ago. Comments came back from the State of Utah that indicated in addition to the phosphorus requirements, the State also want us to comply with ammonia limits which are more stringent than what we are currently discharging. Our current limit is 11 and the State wants us to cut back to 1 which would require Logan City to build a full mechanical treatment plant. Logan City is currently evaluating the options and how we respond to this request. The phosphorus requirement is statewide and is something the City was aware of and is working on. The ammonia issue is somewhat concerning and is based on a law that the Water Quality Board adopted in 2008 even though our permit was received in 2011 and nothing was previously mentioned regarding ammonia. We will comply with the ammonia requirement by the year 2040.

Mayor Watts added that because of the size of the lagoons we need to in the process continue using the lagoons. Half of the lagoons will continue as they have been working and by the year 2040 unless we get help, then we will at that time be a total treatment plant which is very costly.

Mr. Hamud said if we were to comply with the ammonia and phosphorus requirement and with the full flow of waste water we are receiving and with growth, it would be approximately 20 million gallons per day by the time we are in true compliance. The cost would be approximately $100 million and the question is do we borrow and build it all at once or build in steps. We are under a strict timetable and we need to present a plan to the State of Utah based on this timetable.

Chairman Daines recognized a local scout group that was in attendance at tonight's meeting.

COUNCIL BUSINESS.

Chairman Daines announced as a follow-up to our recent trails presentation that Russ Akina did two weeks ago, a public meeting has been scheduled on Thursday, March 28 to gather citizen input on the trails masterplan. This meeting will be held at City Hall in the main conference room. The public is invited to attend as well as neighborhood council chairs and all those who are interested.

ACTION ITEMS.

No action items scheduled at tonight's council meeting.

WORKSHOP ITEMS.

Budget Adjustment FY 2012-2013 appropriating: $6,823 for additional grant expenses for reimbursement on the Logan River Golf Course project; $15,001 to cover utility costs for the Willow Park Zoo for the remainder of Fiscal year 2013; $140,700 for betterments on the canal project including irrigation line, flow meters, slide gate and 1500 North restoration costs; $16,200 Class C Funding for a change order for additional modeling and analysis of one-way couplet alternatives (Restricted Class C Reserves) – Resolution 13-11 – Richard Anderson, Logan City Finance Director.

Finance Director Richard Anderson explained the proposed budget adjustments:

$6,823 – This is an increase in the grant we received from the federal government for the Logan River Flood Project. This is a budgetary adjustment reimbursing us for the costs.

$15,001 – This amount is for the Willow Park Zoo and as part of the transfer arrangement the City was paying the utilities going forward. For the current year the remaining cost will be $15,001 and will be transferred from the Zoo to the Parks and Recreation budget.

$140,700 – This amount is for the canal project betterments and is coming from reserves in our storm water fund.

$16,200 – This amount is for a study of one-way couplets and is coming from Class C Funds.

Councilmember Jensen said that he requested an expansion in the study for one-way couplets and felt that more information should be given to the neighborhood and the downtown so the council can make a better decision on what to do.

The proposed resolution will be an action item and public hearing at the March 5, 2013 council meeting.

Consideration of a proposed Boundary Adjustment with Logan/North Logan – Mayor Randy Watts and Kirk Jensen, Logan City Economic Development Director.

The cities of Logan and North Logan began discussing potential boundary realignment along North Main Street about three years ago. The discussion was initiated by then, North Logan Mayor Cary Watkins and continued between Logan City and Mayor Lloyd Berentzen, along with members of both administrations and Councilmember Dean Quayle. Resulting from these discussions and negotiations, a parcel exchange proposal, has been informally consented to by the North Logan City Council and Administration. The intent is to workshop the proposal at tonight's meeting and should the Council consent to move forward, both council's would then simultaneously draft resolutions for their respective cities calling for realignment. Noticing and public hearings would then follow. Logan City would net a loss of 146 acres having a total assessed property value of $2.5 million, while gaining approximately $13k in tax revenue annually, based upon current revenue streams. There are obviously certain infrastructure challenges, as there would be even without realignment. The value of this proposition, from the Logan standpoint, is primarily the enhanced development potential of land fronting Main Street, given the resulting land depth within a single municipality off of this highway. Further, the boundary realignment along Main Street simplifies the number of transitions from one city to the other, from three down to one. Also, much needed sidewalk improvements along West 1800 North could be installed without an interlocal agreement. (Handouts consisting of the Current Alignment, Proposed New Boundaries, Comparison Summary and Proposed Map of the Parcel Exchange were distributed to the council members).

Logan City Economic Development Director Kirk Jensen referred to the Proposed Map of the Parcel Exchange and indicated this would involve 48 different parcels consisting of 20 businesses and a few residential properties for a total of 200 acres are involved in the transaction, North Logan would net an increase of 146 acres, representing $2.5 million dollars in real property value. Logan City would gain a net increase of tax revenue of $13,000 per year. The primary reasons for the parcel exchange would be the increased potential for development with greater land depth of the properties facing Main Street. Also, simplification of the transitions and the infrastructure issue on 1800 North in Logan where there is a lot of multifamily property, and adjusting the boundaries would alleviate the safety concerns of those walking to Main Street.

Logan City Attorney Kymber Housley said under the law, all that is required is three weeks of published notice for three consecutive weeks and the notice published on the State Website. Individual notice to the property owners is not required but the Council can choose to notice each property owner.

Chairman Daines said she would like each property owner to be notified with a letter letting them know when the public hearing will be held and give them any information regarding the boundary adjustment.

Mayor Watts said for future business growth, the question is what can Logan do to incentivize a business and the problem has been the boundary issues with North Logan. He feels the boundary adjustment is business friendly and helps both Logan and North Logan to reach their potential.

Councilmember Quayle asked about property taxes and money that goes to the Logan City School District.

Mr. Housley responded the school boundaries will not change with this boundary adjustment. There might be a slight change in property taxes but is not like taking property from the unincorporated County that has no municipal tax going to a City. We are changing from one municipality to another and if anything, it will be a fractional amount. North Logan and Logan know their tax rate and this information will be available at the upcoming public hearing.

Councilmember Quayle asked about infrastructure issues between Logan and North Logan.

Logan City Public Works Director Mark Nielsen said the plan for utilities is that overtime both cities will work to separate the utilities between the two cities. Snow removal will also be worked out with North Logan and Logan.

Councilmember Jensen said he is complimentary of cleaning up the boundary issues and feels this is a very positive step forward.

Councilmember Ward said he is concerned that Logan is giving up the potential for future commercial development. Most of what Logan is gaining is facing Main Street now and is already developed, there isn't much behind it. The remainder is all residential and Logan has a fairly narrow corridor, 1900 and 2000 North is all we have for commercial development and is something we should consider.

Mayor Watts said the concern has always been frontage and completing this boundary adjustment will straighten the boundary line. There is the potential for a future Economic Development Area along the corridor going to 2500 North.

Chairman Daines complimented Mayor Watts and Kirk Jensen on their negotiations with North Logan and feels we have a good, workable plan on the table.

Councilmember Ward said he would like to look at the boundary issue longer and in more depth. He referred to the area of 2500 North and North Logan development on both sides of the road, but then we run into the issue of depth size. He asked if it makes more sense to run the boundary line down 2200 North?

Chairman Daines suggested that Councilmember Ward meet with Kirk Jensen separately to review the map and look at other options prior to the March 5 council meeting and public hearing.

Mayor Watts complimented Councilmember Dean Quayle for taking the initiative to arrange a meeting and work towards an agreement with North Logan.

Councilmember Ward stated that he's in agreement to go forward with the boundary adjustment and public hearing.

Mr. Housley said the process for the boundary adjustment moving forward is that both council's need to pass a resolution in support, noticing process and then a protest. To stop the boundary adjustment through the protest period would require 15% of value and 25% of the land mass of the proposed area that is being changed. If there is not sufficient protest the Council's would pass an ordinance adopting the new boundaries and then it would be sent to the Lt. Governor's Office.

This will be an action item at the March 5, 2013 council meeting.

Consideration of a proposed ordinance amending Section 8.16.300 and enacting 8.16.740 of the Logan Municipal Code regarding Vehicle Air Brakes in Neighborhood Residential Zones – Ordinance 13-09 – Kymber Housley, Logan City Attorney.

Mr. Housley suggested that the wording on the ordinance be changed from **Vehicle Air Brakes to Vehicle Engine Brakes**. He said it would be best to have a "blanket ordinance" regarding Vehicle Engine Brakes that would cover any area in Logan City and signs would be posted where there is a need. The only area the council has a concern with at this time is the stretch along 600 South and 1000 West. If this ordinance is adopted and because 1000 West is a UDOT road, a copy of the adopted ordinance will be sent to UDOT with a request that signs be made for this area. If UDOT approves, they will install the signs and bill Logan City.

Chairman Daines said she received an email from business owner Tony Nielsen and he said there is also a concern regarding vehicle engine brakes along 600 West in the area of BATC and Fast Forward Charter School. She likes the way the ordinance is drafted so if there are other areas in Logan City, the council can consider future requests without going through the process of another ordinance being written.

The proposed ordinance will be an action item and public hearing at the March 5, 2013 council meeting.

Consideration of a proposed ordinance amending Sections 10.52.050(B) and repealing 10.52.290(E)-(F) of the Logan Municipal Code regarding Vehicle Impounding – Ordinance 13-10 – Sgt. Jeff Simmons, Logan City Police Department.

Mr. Housley stated the proposed amendment is to make changes in the fee structure to be consistent with the fees that have already been adopted and then removing **Section E. Impound of Vehicles** because it has already been covered in another section of the Municipal Code.

The proposed ordinance will be an action item and public hearing at the March 5, 2013 council meeting.

OTHER CONSIDERATIONS.

There were no additional items of consideration from the council.

ADJOURN.

There being no further business to come before the Council, meeting adjourned at 6:30 p.m.

Teresa Harris, City Recorder

Minutes of the meeting of the Logan Municipal Council convened in regular session on Tuesday, March 6, 2012 at 5:30 p.m. in the Logan City Municipal Council Chamber, 290 North 100 West, Logan, Utah. Chairman Dean Quayle conducting.

Council members present at the beginning of the meeting: Chairman Dean Quayle, Vice Chairman Holly Daines, Karl B. Ward, Herm Olsen and Tom Jensen (present electronically by telephone). Administration present: Mayor Randy Watts, City Attorney Kymber Housley, Finance Director Richard Anderson and City Recorder Teresa Harris.

OPENING CEREMONY

Pastor Paul Heins from the First Presbyterian Church gave the opening thought, prayer and led the audience in the pledge of allegiance

Chairman Quayle welcomed those present. There were approximately 24 citizens in the audience at the beginning of the meeting.

Meeting Minutes. Minutes of the Council meeting from February 21, 2012 were reviewed and approved with minor changes.

Meeting Agenda. Chairman Quayle announced at tonight's meeting there would be three public hearings.

Meeting Schedule. Chairman Quayle announced that regular council meetings would be held the first and third Tuesdays of the month at 5:30 p.m. The next regular council meeting is Tuesday, March 20, 2012.

QUESTIONS AND COMMENTS FOR MAYOR AND COUNCIL.

Attorney Nathan Hult addressed the Council regarding an appeal of park strip reclamation. He represents appellants Gutke Hult Properties (Law Offices), St. John's Episcopal Church, Citrus and Sage, Sunrise Cyclery and Le Nonne's all of which are located in the area of 110 North 100 East. He distributed a summary of arguments in support of a request for the City Council appeal hearing. He highlighted Logan City Resolution 08-24 that approved "Supporting Park Strip Regulation and Enforcement" on May 13, 2008. He feels the plan does not designate what a park strip is exactly. The appellants feel this is public parking and not private. They believe that these facts and issues are sufficient for the City Council to conclude that an exception could be justified and it should therefore grant them an appeal hearing.

Dr. Myron Guymon addressed the Council. His business is located at 191 North 200 East. He appeals for a hearing on the nature that he has anywhere from 60 to 80 patients, most of which are adolescents coming into his business each day and not having off street parking is a safety concern. He feels the parking was there as a contingency when the building was built and the parking has been in place for over 50 years. He has maintained the building and does not want his patients crossing 100 East. He respectfully requests a hearing.

Councilmember Olsen stated there might not be enough interest on the Council for a hearing but he is sympathetic to these parking concerns and there is a historical component that he feels is worth reviewing.

MAYOR/ STAFF REPORTS.

Board Appointments – Mayor Randy Watts.

Mayor Watts asked the Council for ratification of Fred Duersch and Doug Raymond to serve on the Board of Adjustment (reappointments) which are five year terms.

ACTION. Motion by Councilmember Daines seconded by Councilmember Ward to approve ratification of Fred Duersch and Doug Raymond as presented. Motion carried by roll call vote.
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

Mayor Watts asked the Council for ratification of Clair Griffin to serve on the Board of Adjustment (new appointment) which is a five year term.

ACTION. Motion by Councilmember Daines seconded by Councilmember Ward to approve ratification of Clair Griffin as presented. Motion carried by roll call vote.
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

Gang Officer of the Year Award – Chief Gary Jensen.

Logan City Police Chief Gary Jensen recognized Detective Denny Bird who recently received the Utah State Gang Officer of the Year Award. Detective Bird is a NOVA Officer in the Logan City Elementary Schools.

Canal Update – Mark Nielsen.

Public Works Director Mark Nielsen gave an update on the canal. He stated the canal project is underway and Cache County has selected a project management consultant to start the planning process. They are currently working on a request for proposal for a design engineer for the canal facilities. The consultant will be ready May 1, 2012. The project team will design the facilities from May 1 to October 1 and start the construction process of box culverts and piping from the Logan River in the Logan Canyon to 1500 North. The current intended schedule is that most of the construction will be completed during the winter of 2012 and 2013. The entire project is projected to be completed in the

Spring of 2014. The 1500 North pipeline will come down the street from the bridge at Deer Crest and will go along the Logan/North Logan boundary to the lower canal. The Council will need to decide if there should be any diversions from the canal to help with power generation. The Council also will also need to make a decision regarding storm water on the upper canal. Mr. Nielsen will meet with the Mayor and Council on these two issues. Regarding the homes on Canyon Road, Logan City is working to acquire these homes and have currently purchased six homes, two that are scheduled for closing next week and another under contract. There are five more that are interested in selling and there are some that will choose not to sell.

Councilmember Olsen said the canal project involves the effort from various agencies, he asked Mr. Nielsen if this is still in the best interest for Logan City to go in this direction.

Mr. Nielsen responded this is the best course and he would not change the decision that has been made regarding the canal project.

Sewer Phosphate/Algae Project Update – Issa Hamud.

Environmental Director Issa Hamud gave an update on the Sewer Phosphate/Algae Project. He said the State mandated that Logan City comply with certain requirements. The plan is very specific to what needs to be accomplished during the seven year compliance time period and also includes a timeline of what needs to be accomplished. This project has been underway for the past three years and we are working with USU to make the algae project successful. There are challenges and the goal is to present a plan to the City Council in April or May 2012 on how the algae program will work. Studies have been done on the growth of algae and have also looked into harvesting algae from the lagoons. Also studied are ways we can actually process the algae in terms of production for bio fuels. The challenges are that we cannot make changes in the lagoons and we have to make side pilot projects to perfect the technology. Logan City is working with what has been removed from the lagoon rather than the fresh product. This project will require a lot of money, he and Mayor Watts have traveled to Washington DC twice to request funding for this project.

Councilmember Olsen said he received a letter from Senator Mike Lee congratulating him on his reelection. He sent a letter back to Senator Lee asking for assistance in funding this project.

COUNCIL BUSINESS.

No council business at this time.

ACTION ITEMS.

PUBLIC HEARING - Budget Adjustment FY 2011-12: $61,882 for State funds received for alcohol enforcement for FY 2012; $109,398 for funds received from FEMA for Riverbank Restoration at the Logan River Golf Course – <u>Resolution 12-20.</u>

Chairman Quayle opened the meeting to a public hearing.

There was no public comment and the hearing was closed.

ACTION. Motion by Councilmember Ward seconded by Councilmember Daines to **approve Res. 12-20** as presented. Motion carried by roll call vote.
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

PUBLIC HEARING - Consideration of a proposed amendment to Section 5.04 of the Logan Municipal Code regarding Special Events, Itinerant or Transient Merchants, Mobile Food Vendor Licenses and Public Dance Halls/Cabarets – Ordinance 12-17.

Chairman Quayle opened the meeting to a public hearing.

There was no public comment and the hearing was closed.

Councilmember Ward stated in Section 5.04.050 Paragraph A he appreciates the language because it gives flexibility. In Section 5.20.040 Paragraph C it states that the applicant provide a valid driver's license which he feels should happen because they are driving a mobile vehicle. In Section 5.20.050 Paragraph D it refers to a flashing yellow beacon and the time period going go until 10:00 p.m. and he asked if this will be a problem.

Community Development Director Mike DeSimone stated the reason for the flashing yellow beacon is for safety so people can see the vehicle. Regarding the hours of operation, latitude can be approved if there is a special event.

Councilmember Daines asked about Section 5.20.050 Paragraph C regarding inspections and who would do the inspections.

Mr. DeSimone responded this is to make sure the vehicle is appropriately signed and in good working order. The inspection is done by the Community Development Department.

City Attorney Kymber Housley said Logan City is not doing a safety inspection defined by the State of Utah and he is not concerned about liability. The vehicle will need to comply with the requirements that are in the ordinance such as flashing lights, working signals, headlights, etc.

Councilmember Jensen asked about a background check and is there a consequence or limit if someone is not granted a permit because of their background check. He also referred to Section 5.20.060 Paragraph E; he suggested that in addition to the statement to "Be fully self-contained with respect to gas and water" that "waste" to added to this Paragraph.

Mr. Housley responded if there is a criminal background on an applicant and we don't feel comfortable licensing the applicant, they can challenge the decision. We will look at each applicant individually. He also said there was a suggestion to add the ability to extend hours for mobile food vendors and asked if the Council wants to add this to the ordinance.

Chairman Quayle responded yes, they would like to make the addition to extend the hours.

ACTION. Motion by Councilmember Ward seconded by Councilmember Jensen to **adopt Ord. 12-17** as amended. Motion carried by roll call vote.
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

PUBLIC HEARING - Consideration of a proposed rezone of approximately 30 acres of the intersection located at 1200 East and 1400 North (Gravel Pit) – Ordinance 12-18.

Chairman Quayle opened the meeting to a public hearing.

Citizen Tony Nelson addressed the Council he lives at the corner of 1400 North 1400 East. He represents the Pat Hancey family and their request that the proposed area is rezoned back to single family. They also requested the small triangle behind the Foothill Mart/Shell Gas station on 1400 North be changed from Mixed Use back to Commercial. They feel that Logan needs more single family housing and they would like to develop this property with single family homes.

Jack Peterson addressed the Council regarding the proposed rezone. He and others in this area give their full support to the recommendation from the Planning Commission, staff and owners of the property to be rezoned back to the way it was. They support changing the property back to Residential Eastside and also support the change back to Commercial Zoning of the smaller piece of property. They appreciate the owners desire to make this happen and highly recommend the Council approve this rezone.

Chairman Quayle closed the public hearing.

ACTION. Motion by Councilmember Olsen seconded by Councilmember Ward to **adopt Ord. 12-18** as presented. Motion carried by roll call vote.
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

WORKSHOP ITEM.

Downtown Specific Plan – The Specific Plan will guide development, transportation enhancements, and provides market and economic recommendations for the City of Logan and the Logan Downtown Downtown Alliance. More information can be found at http://www.loganutah.org/CommunityDevelopment/DTLSP/index.cfm - Mike DeSimone.

Community Development Director Mike DeSimone stated the Downtown Logan Specific Plan guides the future development, transportation enhancements, and recommended market and economic restructuring for the City of Logan and the Logan Downtown Alliance over the next 40 years. This Specific Plan describes a vision for the Downtown and the necessary actions to achieve that vision, and provides the blueprint for the future development of the downtown area.

The Downtown Logan Specific Plan adopts the National Trust's "Main Street Approach" in its methodology and incorporates the approach's four principles, Design, Economic Restructuring, Promotion and Organization into the overall plan framework.

The Downtown Specific Plan is consistent with the Logan General Plan, the Land Development Code, the visioning plan "The Future of Downtown Logan". and the Historic District Design Standards.

Councilmember Daines said regarding the Wayfinding system she asked if money will be set aside for the signage. She feels this might need to be phased in for key locations and recommended that we start putting funding toward this project.

Finance Director Richard Anderson responded at this time we are looking at flat budgets so the best way to fund is reprioritizing funding.

Councilmember Olsen asked about the description of "traffic calming" on key retail streets.

Mr. DeSimone responded "traffic calming" is a method to try and slow traffic down and move traffic along efficiently.

Chairman Quayle asked Logan Downtown Manager Gary Saxton if the Downtown Alliance and the downtown merchants have bought into this plan.

Mr. Saxton responded there is a lot of information in the Specific Plan and they are working to prioritize what they can do first and what is the most beneficial. They are meeting with property owners regarding facade improvements and way finding. They are also looking for ways to improve shopping in the downtown. They are also encouraging private investment to help with the progress. He would like to dispel some of the perceptions that the City isn't supportive of the downtown and wants to have a good solid partnership between Logan City and the downtown.

Chairman Quayle asked are more people supporting the Downtown Alliance.

Mr. Saxton responded when he started as the Downtown Manager, there were 42 property owners that were involved in the Downtown Alliance and now there are 160 that are supporting the Downtown Alliance. He said the Council's approval of the Downtown Specific Plan will give validation to what they are trying to accomplish in the downtown.

Mayor Watts stated there have been great improvements in the downtown such as coach lighting and parking improvements. He feels with improvements being made we are getting positive responses from the downtown and we are going in the right direction.

Councilmember Jensen stated that he was part of the downtown design committee. He feels the Specific Plan is critical and the downtown will strengthen the surrounding neighborhoods if we have an exciting downtown. He feels the Downtown Specific Plan is a working document and the plan is flexible. We need to integrate a transition zone between single family housing to higher density housing.

Mr. Anderson said regarding wayfinding, funding could come from multiple sources such as the Redevelopment Agency, CDBG and other funding sources including the general fund. We can phase this in and over time and allocate funding.

OTHER CONSIDERATIONS.

No other considerations were discussed.

RECESS TO MEETING OF LOGAN REDEVELOPMENT AGENCY.

WORKSHOP ITEM:

PUBLIC HEARING - Consideration of a resolution approving Agency Assistance in Neighborhood Nonprofit Housing Corporation's "Welcome Home – Own in Logan" Program – Resolution 12-19 RDA.

Chairman Quayle opened the meeting to a public hearing.

There was no public comment and the hearing was closed.

Councilmember Ward feels the *Welcome Home Program* is very important and the Council needs to seriously consider this interim funding. He feels this is something we should have as a priority and is a long term benefit to our community.

Councilmember Daines stated the funding comes from Redevelopment Agency funds that have to be applied specifically to housing projects.

Mayor Watts feels the *Welcome Home Program* is a "jewel" in bringing back vitality to our community.

ACTION. Motion by Councilmember Olsen seconded by Councilmember Daines to **approve Res. 12-19 RDA** as presented. Motion carried unanimously
Ward: yes
Daines: yes
Quayle: yes
Olsen: yes
Jensen: yes

ADJOURN.

There being no further business to come before the Council, meeting adjourned at 6:55 p.m.

Teresa Harris, City Recorder

Minutes of the meeting of the Logan Municipal Council convened in regular session on Tuesday, September 18, 2012 at 5:30 p.m. in the Logan City Municipal Council Chamber, 290 North 100 West, Logan, Utah. Chairman Dean Quayle conducting.

Council members present at the beginning of the meeting: Chairman Dean Quayle, Vice Chairman Holly Daines, Councilmember Herm Olsen, Councilmember Karl B. Ward and Councilmember Tom Jensen. Administration present: Mayor Randy Watts, City Attorney Kymber Housley, Finance Director Richard Anderson and Deputy City Recorder Sylvia Tibbitts. Excused: City Recorder Teresa Harris

OPENING CEREMONY.

Chairman Quayle called the meeting to order and welcomed those present. Sgt May from the Utah National Guard 142nd Military Intelligence Battalion performed the opening ceremony. He introduced himself with a short history of his service, gave a thought and led the audience in the pledge of allegiance.

Chairman Quayle welcomed those present. There were approximately 33 citizens in the audience at the beginning of the meeting.

Meeting Minutes. Minutes of the council meeting from September 4, 2012 were reviewed and approved with minor changes.

Meeting Agenda. Chairman Quayle announced at tonight's meeting there would be two public hearings. Councilmembers Daines and Olsen asked that 2 items be added to the council agenda regarding a report of the Utah League of Cities and Towns meetings, and apartment owners' compliance with ordinances. Holly moved to adopt the council agenda. Tom seconded the motion. The motion carried.

Meeting Schedule. Chairman Quayle announced that regular council meetings would be held the first and third Tuesdays of the month at 5:30 p.m. The next regular council meeting is Tuesday, October 2, 2012.

QUESTIONS AND COMMENTS FOR MAYOR AND COUNCIL.

David Welch, a resident who lives on the east bench of Logan City near Dry Canyon, spoke of the Canyon Winds and recreational fires from people who live above them. The smoke from these fires interferes with the evening activities of those who live below them on a regular basis. He reported that recreational fires are exempted from fire laws as per the fire chief. He indicated there are no ordinances, laws or statutes presented in the International Fire Code which Logan has adopted that regulate exempted fires, smoke or noxious odors as in this situation. He encouraged the council to consider an ordinance regulating recreational fires for homeowners in situations like what he and his neighbors are presently facing. Fire Chief Jeff Peterson and City Attorney Kymber Housley replied that this is basically a policy decision the council would need to decide and how involved they want to be. Kymber said the City could pass an ordinance, prohibiting recreational fires, but the question is whether we want to. His concern is it could impact so many other people who are not in this particular type of situation and it would have unintended consequences. It seems that this is a unique scenario involving canyon winds. There is a challenge with this matter. Councilmember Ward asked if the issue could be addressed on a case by case basis through the nuisance ordinance. Attorney Housley replied he is hesitant to craft regulation of these types of activities. Open pit recreational fires are presently allowed and we would need to have subjective criteria for when it is allowed. Councilmember Olsen added a premise for limitations and restrictions could be imposed on yellow or red burn days. Councilmember Jensen asked Mr. Welch if the involved neighbor has been approached. Mr. Welch responded they have attempted to reason with the neighbor on several occasions, however they have not had any cooperation from him. Mr. Welch noted that their intent is not to prohibit recreational fires, but to prevent the nuisances that come from them.

Leo Erickson, a resident of Logan City who lives next to Mr. Welch reported he has done fairly extensive research as to what other cities in Utah are doing in this case. Sandy City has taken the two first bullets of the International Code and added a nuisance part and the authority to ask the person who created the fire to extinguish it. It also has a paragraph saying neighbors should try to work together. It also states that if there is going to be a big fire, to let the neighborhood know. If the fire becomes too bad, the neighbors could call the city. Basically, the only relief he and his neighbors have is when the individual involved goes on vacation. He is concerned that these fires are a real detriment and a nuisance to the neighborhood. Mr. Housley added that to be exempt, dry wood must be used so as not to create excessive smoke and the City can regulate that. Additionally, there are civil remedies available to those private property owners affected in the neighborhood. Councilmember Ward advocated the City should look at what remedies do exist. Councilmember Daines advised looking at language other cities have used. There might be some refinement there. Fire Chief Peterson reported he has asked the Fire Marshall what was being burned at this residence, to which he was told it looked like green waste materials at the time the Fire Marshall observed it.

Bill Bower, a Logan City resident, said that in his neighborhood on any given day people in his neighborhood could have a fireplace going or other legal fires at the same time. He is not in favor of more regulation by the City and doesn't feel a regulating ordinance is needed for this. He feels the root problem is not the smoke, but the attitude of the property owner doing with his property whatever he wants.

Chairman Quayle closed this portion of the meeting.

MAYOR/ STAFF REPORTS.

Presentation: Branding Cache Valley – Kirk Jensen.

Economic Development Kirk Jensen provided a background and context to the need for this venture which began about 2 years ago when the vice president for ventures and strategic economic development for Utah State's Innovation Campus wrote to the Cache Chamber of Commerce asserting that Cache Valley did not have a cohesive branding strategy for Cache Valley to market outwards to high tech companies such as Salt Lake has and other parts of the country. Those who serve the Cache Chamber of Commerce realized what was being said and agreed that there is not presently a single branding strategy to bring business into the valley that seeks to cultivate business coming into the valley. Through Mr. Jensen, the Chamber has hired Mark Hurst as the consultant for the branding initiative. Mr. Jensen spoke of Mr. Hurst's accolades including the "Life Elevated" campaign that Utah has. The whole effort for Mr. Hurst and his team is determine what the essence of Cache Valley is. Mr. Jensen pointed out to the Council that this is not an effort to ask for any money, it is merely for informational purposes. He turned the time over to Mr. Hurst to give a presentation to expose the Council to their branding effort. Mr. Hurst spoke of his personal relativity to Cache Valley. In branding Cache Valley, he strove to determine what the essence of Cache Valley stands for and how it resonates with an audience over time in attracting tourists and jobs. He visited with some council members, nearly 50 businessmen in Cache Valley, and nearly 50 people in the Salt Lake valley in his research. The most regular answer he received was "cheese" and "cows". He figures there will be 30,000 more people in this valley before the next census. It is important to have new jobs to keep our educated workforce here. There needs to be an outreach to our local market as well as on a national basis. His firm has produced a 50 page evaluation report that is available through Mr. Jensen. He pointed out that the slide presentation he prepared summarized the evaluation report. He said the object is to create jobs and connect to the vitality of the wired world. Never leverage our heritage, but never let it hold us back. The object is to take our perceived negatives and turn them into our greatest strengths.

He gave a slide based presentation entitled "Cache Valley – On The Edge", that could be produced in video form. Additionally, he shared hypothetical ad possibilities for national journals. He also shared some print ad possibilities he has developed.

Chairman Quayle asked what the next step might be. Mr. Hurst deferred the question to Mr. Jensen, adding that he envisions a local campaign to procure funding to produce the video and other advertisement. The next step would be a timetable, budgeting, and strategic planning.

Algae Harvesting Project – Issa Hamud.

Chairman Quayle reported the council has visited the sewer lagoons and observed that the first unit is in place to begin harvesting algae.

Mr. Hamud gave a general overview of the improvement project for wastewater treatment. The City is currently working with the State for additional funding. After, he will report back to the Council. Also, they are still negotiation for property for expansion. Mr. Hamud added that he is working with the State of Utah for additional funding to expand the project. They are also purchasing additional property for staging purposes.

This project involves experimenting with the use of algae that is ongoing with USU for treating wastewater. It is the size of 1500 gallons. Councilmember Olsen reported that there will be a presentation Thursday at 4:00 pm and a tour of the facility at the sewer lagoons. USU continues to perfect some technologies they are researching that hopefully the City can utilize and participate in. Mayor Watts spoke of how the City is going to continue to treat wastewater and how we need to meet the demand to reduce the phosphorous levels.

Mayor Watts added that there are many projects going on in the valley and this project could become the biggest single issue in the future as far as dollars. They are trying really hard to make this stay within a parameter of 20 years with much less than $200 million for a total treatment plant. The algae grows on the lagoons and it is huge in its magnitude. There is too much phosphorus in it. This is a matter of handling wastewater. This project is going into production to help meet the mandate that is coming in a few years to reduce the phosphorus level.

Chairman Quayle asked what the byproducts of the algae drying are. Mr. Hamud said that the algae can be dried and oil extracted from it for biodiesel production, or it can be processed to produce ethanol, beutenol and methanol to be used for other purposes. They can also digest it and produce methane gas from the digester and it can be used for fuelling our trucks or generation of power.

Chairman Quayle thanked Mr. Hamud for his report.

COUNCIL BUSINESS.

Gossner Foods Recognition – Chairman Dean Quayle.

Chairman Quayle read a statement he had prepared in honor of Gossner's Foods. Gossner's has been on its present location since 1966. Chairman Quayle spoke of the accolades and contributions of Gossner's Cheese. He commended Gossner's for their efforts and business practices. Councilmember Ward spoke to the great impact in employment and benefits to the community. Mayor Watts added his admiration for Delores Wheeler and the Gossner family for hanging onto the business and helping to keep farmers afloat during the hard times to keep their product coming in. He recognized and thanked Delores for what her father and the Gossner's family has contributed in this valley.

Councilmember Daines gave a brief report of the Utah League of Cities and Towns league meetings held in Salt Lake City last week. She distributed to the council members a list of several of the 2012 ULCT resolutions and issues they will be focusing on when the legislature meets in January. She advised the council members that now is the time to contact the League if they have any input. She spoke of the workshop that made specific suggestions in making government more transparent for the citizens.

Councilmember Jensen added that he was impressed with reports at the League meetings of small communities doing wonderful things.

Councilmember Olsen spoke of the damaging component to neighborhoods when apartment owners will fill up their apartments with 4, 5 and 6 students in violation of zoning ordinances and if perhaps a neighbor discloses the violation, the owner cleans up the place for a few months and when nobody is looking, violates again. His anxiety is that we don't have the money to hire several new enforcers to go out into the neighborhoods. We only have the monies to respond only to complaints. He asked what it would take to change ordinances in terms of penalties to send messages to apartment owners that there are limits and restrictions. If there are apartment owner who regularly violate ordinances, we may want to craft some rather severe penalties to force those owners to pay attention so there is a financial incentive to comply. Councilmember Daines said perhaps the problem is with single family residential owners who overload their houses with students. Councilmember Olsen agreed. This is what he suggests the council revisit. Attorney Housley advocated inviting Jim Geier from Neighborhood Improvement attend a council meeting to report as to what they are presently doing. He felt the program only works when neighbors participate in such ways as taking down license numbers on vehicles where possible violations occur. He added that the City does prosecute and go after the violating property owners and succeeds in these efforts. He is not aware of a single occupancy case that the City has lost. Civil penalties are charged, however, criminal action can be taken on repeat offenders. Attorney Housley said the City might want to focus on getting the word out to the neighbors to encourage them to get involved and do the reporting and the City will follow up.

Councilmember Olsen advocated having Jim Geier invited to attend a future council meeting as well as the neighborhood chairs to share a collective sense of what they are dealing with. Kymber added that it will give the City an opportunity to identify the issues. He spoke of the various types of occupancy violations and some fit into the nuisance category or disorderly house, rather than an occupancy violation.

Councilmember Olsen advocated sending notice to neighborhood chairs to invite them to bring input on this subject. Councilmember Daines noted that the neighborhood chairs are currently on the agenda for the second council meeting in October to present some suggestions they have, not related to occupancy, however, they will be here and can give some input as to the occupancy issues. Councilmember Olsen need to let them know the council would like to address this issue with them as well. Councilmember Daines is the liaison for the neighborhood chairs, and she offered to give them the information and the invitation. Councilmember Jensen would like this viewed as an opportunity to strengthen the fabric of the neighborhoods in a coordinated effort. Attorney Housley admonished the council to come up with suggestions as to how to get the word out.

ACTION ITEMS.

PUBLIC HEARING - Budget Adjustment FY 2012-13 appropriating: $21,071 for contributions from the Logan School District for the replacement of the tennis court $3,900,000 for the NRCS Logan River Dredging Project; $549 for the awarded EMS Grant to be used for certification, training, and continuing medical education for the Communication Center – Resolution 12-62.

Chairman Quayle opened the meeting to a public hearing.

There were no comments and Chairman Quayle closed the public hearing.

ACTION. Motion by Councilmember Ward seconded by Councilmember Olsen to **approve Res. 12-62** as presented. Motion carried unanimously.

PUBLIC HEARING – Consideration of a proposed resolution specifying the preferred intersection improvements for the 200 East Project from 450 North to 1250 North – Resolution 12-64.

Chairman Quayle opened the meeting to a public hearing.

Alex (?), a Logan Resident lives near the Transit Center. He reported that he and his daughter have nearly been hit at 500 North and 200 East. He said nobody stops for the stop signs now. He feels that if a roundabout is put in, the situation will only get worse. He encouraged the council to think about the children and the future. He wonders what is so important about the roundabout. Chairman Quayle asked him if he had a better solution for this intersection. Alex said he would like to see a street light placed at this intersection. He has called the police previously with concerns and complaints and feels he is getting little response.

Ann Geary from the Board of Education reported the Board applauds the council's decision to put in an intersection with lights on 1000 North and 200 East. She encouraged the council to look at obtaining crossing guards there even with a street light and on 900 North 200 East. She added that the Board also applauded the planned island in front of the Middle School eliminating left hand turns coming out of the school area and reducing hazardous situations there. Councilmember Olsen reported the width of the crosswalk at 900 North would be 3 feet rather than 8 feet. Chairman Quayle asked Ann about parent-specific drop-offs on 200 East. Ann replied they are encouraging parents as to where to safely drop their children off, however the Board is still working with a consulting firm on a solution.

Councilmember Olsen asked Ann if the Board has arrived at any conclusion with regard to the roundabout on 500 North 200 East. Ann reported they have looked at the studies and are uncomfortable in giving an opinion based on the information they received as it pertains to a double roundabout as opposed to a single roundabout that is planned.

Logan Resident (?) is against the roundabout. She feels a roundabout will tie up the traffic. She said all of the traffic line up will have to stop on 400 North anyway and on the roundabout as well. A whole block of cars can be put through that intersection with one stop light cycle.

Carl Strucki, a Logan resident who lives on 200 East suggested banning all on street parking on 200 East from Thanksgiving to April. He suggested a one-way road on 200 East and 200 West. He also advocated for no additional entrances on the west side 200 East. He agreed the roundabout on 1000 North won't work. He can barely get onto the street with the street light now.

Mary Godfrey, a Logan resident spoke. She is legally blind and uses a white cane when she is out and about. She uses the bus system to get around. In having a roundabout on 500 North and 200 East, she is concerned that the traffic might not see her. She presently crosses the street where there is a light or stop signs to get to the Transit Center. She doesn't feel safe crossing in a roundabout even with flashing lights. She encouraged the council to reconsider the roundabout at this intersection.

Chairperson Quayle asked Mark Nielsen to comment on options at this intersection. Mr. Nielsen reported that all options are available, however, he has a concern with a signal at 500 North and 200 East. Two signals a block apart are not going to work 20 years from now. As far as safety, stop signs are where drivers yield the best, however, they do choke up traffic and may require putting in a signs in the future. Councilmember Olsen asked about the timing of the one-way couplet study. Mr. Nielsen replied the study would be finished before any construction is done on this project. If the study chooses 200 East as a one-way road, it would affect any plans for the roundabout. As to Ms. Geary's comments, Mr. Nielsen said the median on 900 North is 2 feet wide as proposed. It eliminates left turns out of the drop off for busses, however, it preserves the parking on the East side of 200 East. It will not create a safe haven for students in the median. The school zone flashing lights will remain in place if crossing guards are placed there.

Police Chief Gary Jensen reported to a request from the council pertaining to the costs of crossing guards. Each crossing guard is about $4,000 per year and that is just dollars. The other problem is getting people to apply for the job as the hours and seasonal challenges deter many from applying. It is already an ongoing problem for the Police Department to fill the crossing guard positions they already have.

Annette Pearson, a Logan resident, is concerned about the 500 North roundabout. Her primary concern is for safety, rather than traffic control at the 3 major intersections involved on 200 East particularly 500 North. Her biggest concern particularly is for the safety of the elementary school children moving about. She advocated using the roundabout money for other items such as enforcement of pedestrian safety or potholes and leaving the 4-way stop there as it is.

Sabrina Cropper a Logan resident, advocated for use of crossing guards for safety of students. She also feels a light would be the best resolution at 500 North 200 East. As a bicyclist, she is concerned that at 500 North 200 East, drivers would fail to see a bicyclist and pull into the roundabout without yielding because they are looking for a car, not a bicyclist or a pedestrian.

Bill Bower at 990 North 200 East said a lot of traffic comes up 1000 North and with the USU residential development further up the street, there will be more traffic. He has seen people going the wrong way in the roundabout on 1800 North and 200 East. Safety of the public and pedestrians should be foremost. He expressed his concerns for police enforcement as it pertains to pedestrians and vehicles.

Marilyn Griffin, a Logan resident, spoke about roundabouts. She lives at 600 North 200 East and sees traffic back-ups often. She has to make adjustments to get onto 200 East from her home depending on the time of day. She feels that drivers can make adjustments in traveling this area during certain times of the day by utilizing other roads. She is aware of some near misses on 200 East between 500 North and 1000 North, but no accidents. If there is a roundabout, the pedestrian crossings need to be well marked, not only with paint. She suggested stamped, colored concrete in the crosswalks. The crosswalks need to be visible before vehicles reach the intersection. She spoke about the possibility of raised crosswalks. She appreciated the council and administration considerations and involvements.

Conley Thompson, a Logan resident, had a question pertaining to the culdesac he lives in on 870 North and the raised median. He doesn't favor a left hand turn only onto 200 East from this culdesac. Mark Nielsen confirmed there would be only a left hand turn in the current plans. He feels that if the City is fixing a problem between 500 North and 600 North, they will create the same problem from 800 North to 1000 North as it pertains to neighborhood qualities. He feels the answer is not to create a traffic corridor on 200 East.

Rachael Rasmussen, a Logan resident has a daughter and son-in-law who are disabled. They have no choice but to use the transit system to get around. She feels that a roundabout with flashing lights on 500 North 200 East would confuse them. She is concerned that this scenario would also be confusing to many disabled riders of the Transit System.

Crystal Burningham, a Logan resident showed a photograph she took of 2 handicapped individuals who live on 200 East who were utilizing a motorized cart and a wagon for their transportation. She thanked the Council for listening to the residents' concerns who live along the 200 East Corridor and resolving to keep a traffic signal at 1000 North 200 East. She wanted to clarify that single lane roundabouts are safer for car to car contact, however, they are not safer for bicyclists, handicapped individuals and car to person contact. She thanked the Council for their help. She advocated for tabling of the roundabout decision on 500 North 200 East until more information on this matter can be obtained.

Janice Morris, a Logan resident stated that traffic near the middle school and 500 North on 200 East is a terrible problem. She already has difficulty getting out of her driveway due to traffic before and after school. She is concerned with students bailing out of busses right into the streets on this corridor and at the Transit Center. She advocated for a crossing guard on 900 North. She would like to see the school zone extended to the Transit Center. She appreciated the Council for putting a street light in at 1000 North and responding to the citizens.

Councilmember Ward voiced concern with the resolution as presented with the roundabout on 500 North and 200 East. He questioned the information as it pertains to pedestrian safety in a roundabout. Councilmember Daines suggested tabling the 500 North roundabout decision until the one-way couplet study comes in and complete the rest of the design. Mark Nielsen said that is possible, however, it will delay the project. However, the whole plan will change if the one-way is put in. Some property purchases are already made at the involved intersections. Any additional properties needed have been identified. Councilmember Olsen asked the JUB engineer present about the study of the roundabouts and informational guides. JUB reported a roundabout for a pedestrian would be safer than a signal. Also, a roundabout would create fewer contact points for pedestrians than a 4-way stop.

Mark Nielsen reported that according to the NCHP 572, bicyclists have larger dangers in roundabouts. Other vehicles don't seem to see the bicycles as a vehicle taking the entire lane. The JUB engineer added that single roundabouts seem to be safer for bicyclists than double roundabouts.

Councilmember Ward asked Crystal Burningham about the study she read regarding safety for the disabled at roundabouts. She replied that nationwide, improvements are not being put in for the visually impaired and disabled according to the study. Also, in her research, she found reports indicating there were more bicycle accidents at roundabouts than other types of intersections.

Chairman Quayle closed the public hearing.

Councilmember Ward inquired as to construction delays if 500 North was tabled. Mark Nielsen indicated the delay would be approximately one year as the couplet study would not be finished until the first of next year. He would not like to begin any construction in the autumn. Also, the project needs to be bid at one time. Councilmember Jensen indicated he would be in favor of moving ahead with the 500 North roundabout. Chairman Olsen agreed, however, he is not concerned to wait until the couplet study is complete. Councilmember Ward would like to see additional research as it pertains to handicapped people and possible dangers involving them with a roundabout. He would like to have a month. Councilmember Jensen agreed.

Councilmember Olsen reiterated the motion presently before the council is to accept including items 1, 2 and 3 of the proposed resolution due to the paramount safety issues still up in the air. He is in favor of this motion. Councilmember Jensen would like to table the discussion about 500 North 200 East for further discussion.

ACTION. Motion by Councilmember Daines to accept items 1, 2 and 3 while deferring item 4 for discussion at the 2nd Council Meeting in October to obtain further research information seconded by Councilmember Olsen to **approve Res. 12-64** as amended. Motion carried unanimously.

WORKSHOP ITEM.

Budget Adjustment FY 2012-13 appropriating: \$130,073 for the 21st Century Grant; \$400,000 for the County Road Tax Grant (Public Works Grants); \$3,100,000 for the County Road Tax Grant (Public Works Class C) – Resolution 12-63 – Richard Anderson.

Finance Director, Richard Anderson clarified to the members of the council that the \$400,000 was coming from Class C Road Funds and the \$3,100,00 is coming from the County Road Tax Grant.

This will be a public hearing and action item at the October 2, 2012 council meeting.

OTHER CONSIDERATIONS.

There were no other considerations stated.

ADJOURN.

There being no further business to come before the Council, meeting adjourned at 8:05 p.m.

Sylvia Tibbitts, Deputy City Recorder