MEMORANDUM

TO: David Anderson, Engineering Manager, Twin Falls Regional Office
Bill Allred, Regional Administrator, Twin Falls Regional Office

FROM: Paul Wakagawa, Technical Engineer 1
Wastewater Program Office

DATE: **February 27, 2013**

SUBJECT: **Staff Analysis for Draft Reuse Permit I-050-03 (Industrial Wastewater)—The Amalgamated Sugar Company LLC (TASCO), Mini-Cassia Facility**

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1. Purpose

The purpose of this memorandum is to satisfy the requirements of the "Recycled Water Rules" (IDAPA 58.01.17.400.05) for issuing Reuse Permits. This memorandum addresses draft Reuse Permit I-050-03 (previous permit LA-000050-02 [TASCO 1995]) for the industrial wastewater treatment and reuse system owned and operated by The Amalgamated Sugar Company (TASCO), Mini-Cassia facility. The principal facts and basis for the requirements and conditions specified in the draft Reuse Permit provided in this document. Sections of the permit application referred to in this staff analysis can be accessed at www.deq.idaho.gov/media/957322-tasco_paul_ww_reuse_permit_application_0710.pdf.

2. Project Description

TASCO operates a sugar beet processing facility located approximately 1.5 miles northeast of Paul, Idaho (Figure 1 and Figure 2). The processing facility is located in Township 9 South, Range 23 East, Section 27, and land application fields are located in Township 9 South, Range 23 East, Sections 21, 22, 25, 26, and 27. The processing facility is located northeast of the intersection of 100 South Road and 500 West Road.

Two types of wastewater are generated by the facility: process wastewater and condensate wastewater. The process and condensate wastewater systems are interconnected but are normally segregated in various lagoons and ponds to allow separate application.

The process wastewater consists of multiple sources including the flume system, mud ponds, coal fly ash system, flue gas scrubber water from pulp driers, factory floor and roof drains, storm water, and boiler blowdown. The process wastewater is treated in three aerated ponds (flume excess pond, 22 million gallon (MG) capacity, west lagoon, 20 MG capacity, and east lagoon, 22 MG capacity) to reduce chemical oxygen demand (COD), total dissolved solids (TDS), and nonvolatile dissolved solids (NVDS) prior to land application.

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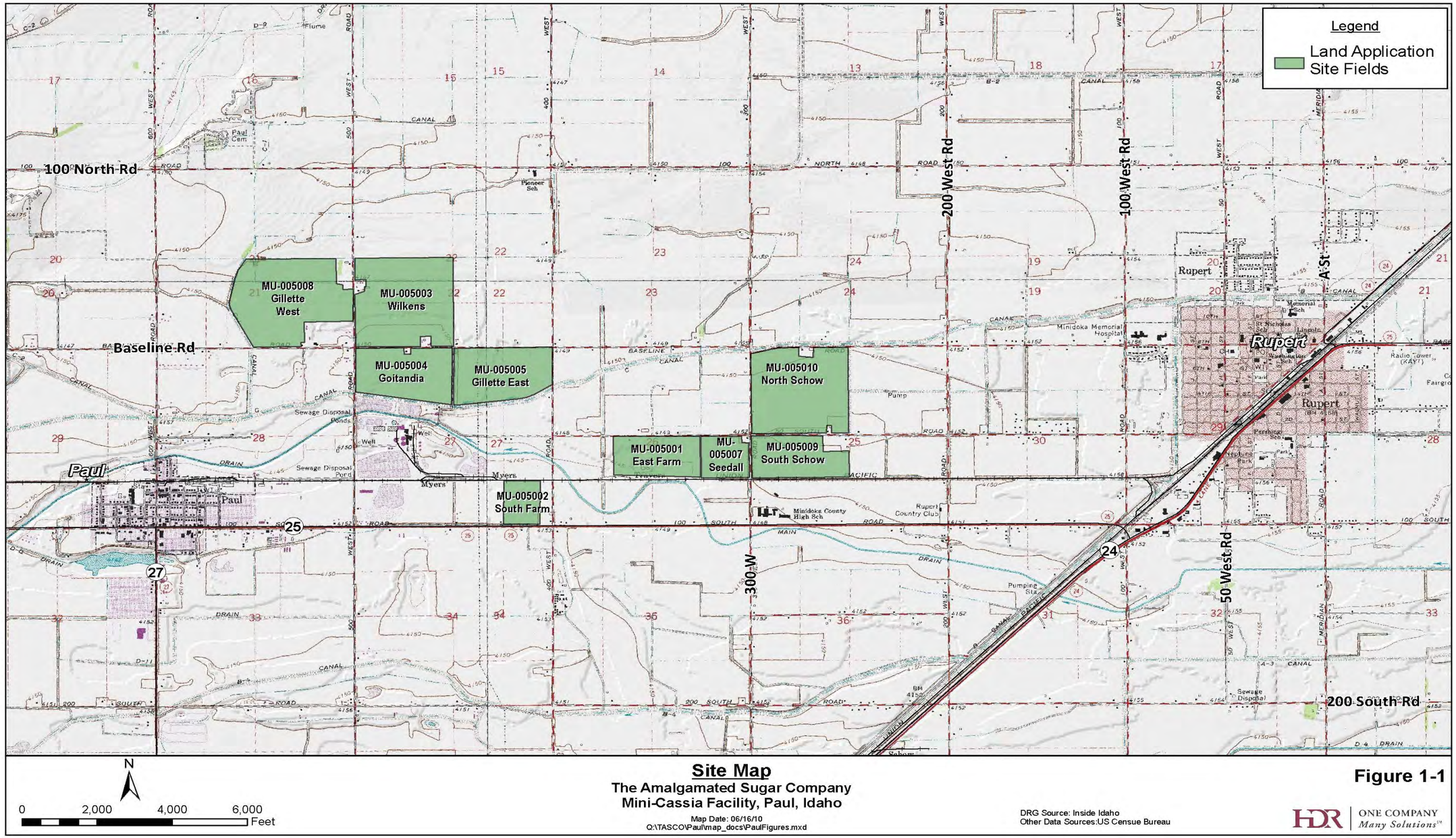

Figure 1. The Amalgamated Sugar Company site map.

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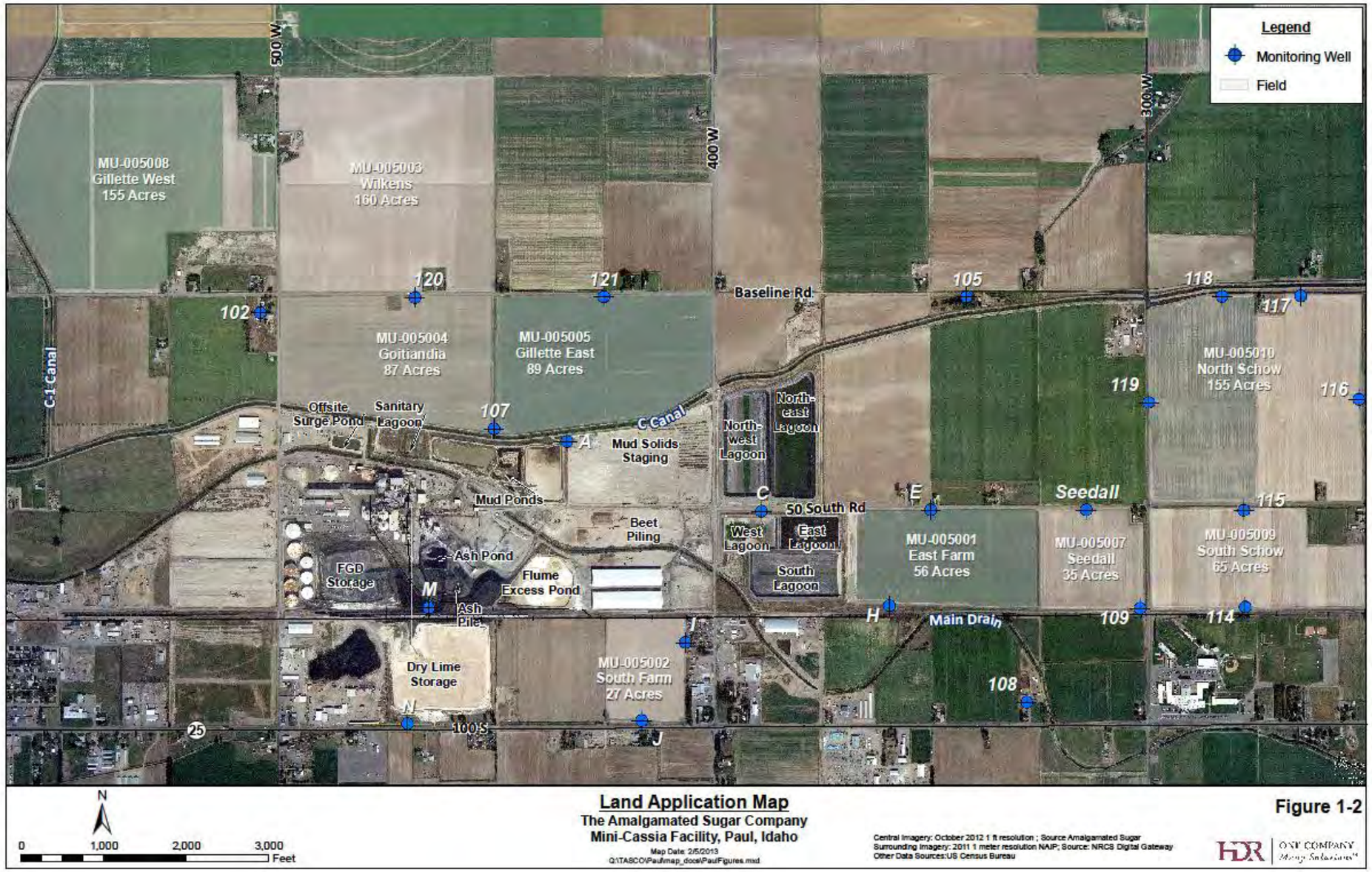

Figure 2. The Amalgamated Sugar Company land application map.

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Condensate wastewater originates from the moisture contained in the sugar beets and is generated by evaporative and condensing equipment while concentrating the sugar. The condensate is normally stored in four lagoons: off-site lagoon (2 MG capacity), northwest lagoon (73 MG capacity), northeast lagoon (81 MG capacity), and south lagoon (66 MG capacity). The condensate wastewater is low in COD and TDS and is not treated prior to land application.

The current permitted area for agricultural production is 833 acres. These land application fields are split into two categories, on-site and off-site.

The on-site fields are owned and managed by TASCO and consist of seven fields totaling 518 acres. These fields are irrigated using hand- and wheel-line sprinkler systems and receive both types of wastewater. The off-site system currently consists of two fields totaling 315 acres. The off-site fields are owned by private owners, and TASCO has agreements with the owners to apply condensate wastewater. Wastewater is applied by center pivot and wheel and hand lines. A third off-site field (Fisk/Blacker) is included in the current permit, but the field has not been used since 1998, and TASCO requests this field be removed from the new Reuse Permit.

In April 2011, TASCO submitted a proposal to apply process wastewater to the dry lime storage area as a pilot/demonstration study for a 2-year period. DEQ approved the plan on June 15, 2011, and TASCO started application on June 17, 2011. Results of the pilot/demonstration indicated this application process was effective as a total evaporation system and did not pose an unacceptable risk to ground water quality. The lime storage area will be added to the Reuse Permit as a new management unit. Hydraulic management units are shown in Table 1.

Table 1. TASCO management units.

Field	Field Type	Management Unit Number	Acres	Irrigation Type	Notes
East	On-site	MU-005001	56	Hand/wheel lines	—
South	On-site	MU-005002	27	Hand/wheel lines	—
Wilkins	Off-site	MU-005003	160	Hand/wheel lines	—
Goitiandia	On-site	MU-005004	87	Hand/wheel lines	Permitted as on-site in fall 2006
Gillette East	On-site	MU-005005	89	Hand/wheel lines	Permitted as on-site in fall 2006
Fisk/Blacker	Off-site	MU-005006	80	Wheel lines	No longer used
Seedall	On-site	MU-005007	35	Hand/wheel lines	—
Gillette West	Off-site	MU-005008	155	Center pivot Hand/wheel lines	—
South Schow	On-site	MU-005009	65	Hand/wheel lines	—
North Schow	On-site	MU-005010	155	Hand/wheel lines	—
Lime Storage Area	On-site	MU-005011	23	Hand lines	Evaporative system

The average volume of wastewater applied from 1995 through 2011 was 94.08 MG per reporting year, consisting of 17.67 MG of process wastewater and 76.41 MG of condensate wastewater. The average amount of wastewater applied during the growing season (April 1 to October 31)

was approximately 45% of the total and during the non-growing season (November 1 to March 31) was 55% of the total.

3. Summary of Events

The original land application permit, LA-000050-01, was issued on June 13, 1989. The current permit, LA-000050-02, was issued July 5, 1995. TASCO submitted permit renewal application materials in April/May 2000. The Idaho Department of Environmental Quality (DEQ) issued a preliminary draft permit in 2003, but a final permit was not issued. TASCO operates under permit LA-000050-02 and various permit modifications that are summarized in Table 2.

Table 2. LA-000050-02 permit modifications, dates, and descriptions.

Permit Modification	Date	Description
Appendix B	11/27/1996	Allowed the use of additional land for application at low *de minimis* rates and added Gillette West (management unit [MU]-005008, 155 acres) for condensate wastewater application.
Appendix B	4/15/1997	Administrative changes
Appendix C	12/10/1999	Allowed application of condensate wastewater on the North and South Schow fields (MU-005010 and MU-005009) during the 1999–2000 non-growing season.
Appendix C	11/1/2000	Allowed application of condensate wastewater on the North and South Schow fields (MU-005010 and MU-005009) during the 2000–2001 non-growing season.
Appendix E	1/10/2002	Allowed application of condensate wastewater on the North and South Schow fields (MU-005010 and MU-005009) during the 2001–2002 non-growing season.
Appendix F	9/20/2002	Allowed non-growing season application of condensate wastewater on the North and South Schow fields (MU-005010 and MU-005009).
Appendix D	11/30/2006	Removed the total wastewater hydraulic limit and permitted Goitiandia (MU-005004) and East Gillette (MU-005005) as on-site fields allowing year-round application of process and condensate wastewater.

In July 2009, DEQ requested TASCO submit an updated permit renewal application. The permit application was received on July 1, 2010, and updated environmental monitoring data were provided in September 2010. This staff analysis is based on these application materials and the TASCO 2010 and 2011 annual reports to provide current information and data for analysis (TASCO 2011a; 2012).

4. Discussion

Section 4.1 describes the typical sugar beet processing time frames that generate the process and condensate wastewater.

Section 4.2 provides a description of the physical characteristics of the site (soils, surface waters, wastewater storage ponds, and regional and local ground water hydrology).

Section 4.3 includes an analysis of the wastewater quantity and quality data, wastewater and supplemental irrigation water hydraulic loading rates, constituent loading rates, and ground water and soil monitoring data.

Section 4.4 provides information on process wastewater application on the lime storage area.

Since permit LA-000050-02 was issued in 1995, TASCO has made various changes to the processing facilities, wastewater systems, and the land used for application. These changes have significantly impacted the quantity and quality of wastewater and the hydraulic and constituent loading rates over the past 17 years. The changes were taken into consideration in the data analysis and in the recommendations made about permit requirements and conditions. A summary of the major changes is shown in Table 3.

Table 3. Summary of TASCO processing, wastewater systems, and land application changes.

Date	Change/Modification	Impact on Wastewater Reuse System
November 1996	Gillette West (155 acres) added as an off-site field.	Increased area for condensate wastewater application. Provided the ability to reduce wastewater hydraulic loading rates.
1997, 1999, and 2003	Added aerators to flume excess pond.	Increased biological treatment of process wastewater. Reduced chemical oxygen demand and nonvolatile dissolved solid concentrations in applied wastewater.
1998	South lagoon constructed (41 million gallon [MG] capacity).	Increased storage capacity for condensate wastewater and provided flexibility for managing condensate wastewater recycling and application.
1998	Dry beet handling.	Reduced mud/organic material to the mud pond system.
1999	Started condensate wastewater application on the North and South Schow fields (220 acres). TASCO purchased these properties in 1998.	Increased area for condensate wastewater application and reduced wastewater hydraulic loading rates.
2002	South lagoon storage capacity increased from 41 MG to 66 MG capacity.	Increased flexibility for managing condensate wastewater application.
2002–2003	TASCO purchased Goitiandia (87 acres) and Gillette East (89 acres) fields.	Allowed these fields to be permitted as *on-site* management units in 2006 allowing application of process wastewater in addition to condensate wastewater. Provided flexibility in managing wastewater application.
2004	Flue gas desulphurization installed to reduce sulfur oxide air emissions.	FGD for boilers is closed loop with no wastewater to reuse. Pulp drier scrubbers use the flume water system as the water source and discharge scrubber water back into the flume water system.
2007	North lagoon constructed (81 MG capacity).	Provided flexibility for managing condensate wastewater application.
2007	Dry lime handling system installed.	Eliminated wastewater in the lime pond system and reduced ground water impacts from the pond seepage.
2008–2009	Flume system improvements (hydroseparators and belt presses).	Additional solids removal reduced the load to the mud ponds.
2011	Northwest lagoon constructed (73 MG)	Provided flexibility for managing condensate wastewater
2011	Application of process wastewater on lime storage area.	Two-year trial started June 2011. This practice will provide an additional area for process wastewater application.

4.1 Sugar Beet Processing Time Frames

Sugar beet harvest typically starts in September and continues into November. Processing sugar beets starts shortly after harvest begins. Beets waiting to be processed are stored on site and at various off-site locations.

At the plant, sugar beets are washed and conveyed in the flume system. The washed sugar beets are sliced and placed in diffusers containing hot water to extract sugar creating *raw juice*. The raw juice is sent to a purification process where hydrated lime and carbon dioxide are added to remove impurities such as waxes, fats, and gums. After this purification process, the juice is filtered to create *thin juice*. The thin juice is sent to evaporators to create *thick juice,* which is sent to the sugar production section of the plant where wet sugar and molasses are produced. Excess thick juice is sent to storage for later processing. The wet sugar is sent to granulators to produce the final sugar product, and molasses is sent to storage.

Processing sugar beets generally runs from September through March and is called the *beet campaign*. Process wastewater generated during this period is delivered to the flume excess pond, west lagoon, or east lagoon. The process wastewater is normally treated in these aerated lagoons through July prior to land application.

Following the beet campaign, the thick juice from storage is processed and is called the *juice run*. The juice run typically occurs from March through June and has historically averaged 110 days. Condensate wastewater is generated throughout the beet campaign and is normally stored in the northwest, northeast, or south lagoon prior to land application. Some of the condensate generated during the beet campaign is reused in the juice run for evaporator supply and also for plant water supply which reduces well water usage.

Following the juice run, the plant is shut down for maintenance for approximately 60 days in July and August.

4.2 Site Physical Characteristics

4.2.1 Soils

Soils information in the Natural Resource Conservation Service (NRCS) *Soil Survey of the Minidoka Area, Idaho* was used to characterize the soils in the land application fields (NRCS 2004). Section 4.2 of the permit application provided a narrative summary of the soil types and characteristics, mapping of the soil types in Figure 4.3, and a summary of soil characteristics in Table 4-6. Figure 4-3 and Table 4-6 are provided in Appendix A.

The predominant soil types are loams, sandy loams, and fine sandy loams with less than 2% slope. The soil types are classified as very deep with a potential rooting depth of 60 inches or more. Soil available water holding capacity (AWC) for the soil types present are shown in Table 4-6 of the permit application (Appendix A). Reuse Permits allow non-growing season application of wastewater based on the soil's ability to hold moisture in the soil column until it can be used during the following growing season. Soil AWC is a key factor in determining this allowance.

4.2.2 Surface Waters

4.2.2.1 Main Drain

The Main Drain is an agricultural drain operated by the Minidoka Irrigation District. The surface water flows to the west through the TASCO Mini-Cassia facility (Figure 1) and continues to flow to the southwest, discharging into the Snake River. Any seepage that may occur from the Main Drain would recharge the shallow ground water system.

4.2.2.2 C Canal

The C Canal is an irrigation supply canal originating from Lake Walcott on the Snake River. It flows west through the TASCO Mini-Cassia facility and supplies supplemental irrigation water for the agricultural fields. It is located north of the Main Drain and flows along the north side of the mud ponds and north lagoon. Any seepage that may occur from the C Canal would recharge the shallow ground water system.

The water quality data for the C Canal is shown in Table 4.

Table 4. C Canal water quality.

Surface Water	COD (mg/L)	Nitrate (mg/L)	TKN (mg/L)	Ammonia (mg/L)	Total Phosphorus (mg/L)	TDS (mg/L)	NVDS (mg/L)
C Canal	18	ND	2.04	ND	0.63	241	157

Notes: Average of 2009 to 2012 sample results; chemical oxygen demand (COD); milligram per liter (mg/L); total Kjeldahl nitrogen (TKN); total dissolved solids (TDS); nonvolatile dissolved solids (NVDS); not detected (ND). Previous data from 1996 averaged 217 mg/L NVDS (two samples)

4.2.2.3 C1 Canal

The C1 Canal is a branch off the C Canal that is located approximately one-half mile west of the plant. The C1 Canal borders the west side of off-site field Gillette West (MU-005008).

4.2.3 Wastewater Ponds

The wastewater ponds are described in the following sections. Some ponds may change service depending on capacity requirements for the various types of wastewater in a given year.

4.2.3.1 Mud Ponds

The mud ponds consist of three interconnected ponds that receive residual solids and water removed from the flume system (pond data from permit application, Table 2-1 [Appendix B]). The mud ponds have a capacity of approximately 4 MG and have a surface area of 15 acres. The mud ponds were seepage rate tested in 2011, and the measured rate was 0.0117 inches per day. The settled mud is periodically removed and dried in the area located to the east of the ponds

called the Manning property. The calculated seepage volume using 0.0117 inches per day, 15-acre surface area, and a 300-day wetted period is 1.4 MG per year (53 acre-inches).

4.2.3.2 Flume Excess Pond

The flume excess pond receives process wastewater generated during the beet campaign and juice run, and supernatant from the mud and fly ash ponds at the end of the processing season. The flume excess pond has an operating minimum of 10 MG and maximum fill of 22 MG. The surface area is 9 acres, and it contains wastewater year-round. The last reported seepage test was in 1995, and the result was 0.06 inches per day. The calculated seepage volume using 0.06 inches per day, 9-acre surface area, and a 365-day wetted period is 5 MG. The pond has ten 75 horsepower surface aerators for a total aeration capacity of 750 horsepower. Process wastewater in the flume excess pond is normally treated through July prior to land application.

4.2.3.3 West and East Lagoons

The west lagoon receives process wastewater and has seven 50 horsepower surface aerators (total aeration capacity of 350 horsepower). The lagoon has a storage capacity of 20 MG, a surface area of 5.2 acres, and a measured seepage rate of 0.01 inches per day. The calculated annual seepage volume using a 240-day wetted period is 0.3 MG. Process wastewater is normally treated through July prior to land application.

The east lagoon receives process wastewater and has a storage capacity of 22 MG, a surface area of 5.2 acres, and a measured seepage rate of 0.125 inches per day. The calculated annual seepage volume using a 240-day wetted period is 4.2 MG. In 2012, a new treatment process called the Blue Frog System (www.bluefrogsystem.com) developed by Absolute Aeration was being evaluated.

The northwest, northeast, and south lagoons are normally used to store condensate wastewater. The storage capacities are northwest lagoon—73 MG, northeast lagoon—81 MG, and south lagoon—66 MG. The northwest lagoon was installed in 2011 and will be seepage rate tested in 2013. Surface areas are northeast lagoon—19.0 acres, northwest lagoon—18.0 acres, and south lagoon—13.25 acres. The last seepage rate test results were northeast lagoon—0.052 inches per day (2007) and south lagoon—0.0008 inches per day (2011). The typical wetted period is 330 days (northeast lagoon) and 100 days (south lagoon) resulting in a calculated seepage volume of 8.9 and 0.0 MG.

4.2.3.4 Sanitary Lagoon

The sanitary lagoon receives sewage from the TASCO Mini-Cassia facility. This lagoon was seepage rate tested in September 2011, and the result was 0.0129 inches per day. The lagoon has a surface area of 2 acres and a capacity of 3 MG. The calculated annual seepage volume is 0.3 MG. The lagoon operates as a no discharge/evaporative system.

4.2.3.5 Fly Ash Pond

Fly ash from coal-fired boilers is slurried and discharged into the fly ash pond for solids settling. Water from the fly ash pond is pumped to one of the aerated ponds at the end of the processing season. The last reported seepage rate in 1995 was 0.126 inches per day. The pond has a surface area of 3 acres, capacity of 2 MG, and a wetted period of 268 days per year. The calculated seepage volume is 3.7 MG per year. The TASCO Twin Falls facility (permit LA-000049-03, issued November 5, 2011 [TASCO 2011b]) contains a compliance activity to characterize the coal ash wastewater at that facility. Monitoring of the fly ash pond wastewater transferred to the process wastewater system will be included in the TASCO Mini-Cassia Reuse Permit.

4.2.3.6 Condensate Surge Pond

The condensate surge pond receives condensate wastewater and is used to supply pumps that deliver condensate to the land application fields. The last reported seepage rate in 1995 was 0.01 inches per day. It has a storage capacity of 2 MG and a surface area of 1.0 acres. The calculated seepage volume using a 330-day wetted period is 0.3 MG.

4.2.3.7 Summary

A summary of lagoon information is shown in Table 5. The total estimated seepage from the various ponds is approximately 23 MG per year. The TASCO Twin Falls facility has similar wastewater treatment and storage ponds and accompanying seepage volumes. Permit LA-000049-03 (TASCO-Twin Falls facility) contains compliance activities to determine if the actual or predicted impact from pond seepage is in compliance with the “Ground Water Quality Rule” (IDAPA 58.01.11) and the surface water quality requirements in the “Water Quality Standards” (IDAPA 58.01.02). If the impacts are not in compliance, a plan to address the noncompliance is required. A similar assessment and plan is recommended for the TASCO Mini-Cassia Reuse Permit.

Table 5. Lagoon information.

Serial Number	Description	Capacity (million gallons)	Surface Area (Acres)	Last Seepage Test	Seepage Rate (inches/day)	Notes
LG-05001	Condensate surge pond	2	1	1995	0.01	Condensate
LG-05002	Sanitary lagoon	3	2	2011	0.0129	Total evaporation system, no discharge
LG-05003	Mud ponds (three ponds operated in series)	4	15	2007	0.0117	Bentonite added after periodic mud removal
LG-05004	Fly ash pond	2	3	1995	0.126	Coal fly ash settling pond
LG-05005	Flume excess pond	9	22	1995	0.06	Process wastewater, aerated
LG-05006	Northwest lagoon	73	NA			Condensate, installed 2011, seepage rate test planned for 2013
LG-05007	Northeast lagoon	81	19	2007	0.052	Condensate
LG-05008	West lagoon	20	5.2	1995	0.01	Process wastewater, aerated
LG-05009	East lagoon	22	5.2	2005	0.125	Process wastewater, aerated
LG-05010	South lagoon	66	13.25	2011	0.0008	Condensate

4.2.4 Regional and Local Ground Water Hydrology

Section 4.3 of the permit application provides a description of the regional and site hydrogeology. The regional hydrogeology consists of surface deposits of unconsolidated clay, silt, sand, and gravel to a depth of 30–35 feet. Underlying these surface sediments are alternating sequences of sediments and basalt to a depth of approximately 800 feet. Surface sediments become shallower to the north. Approximately 10 miles north of the facility, basalt occurs at the land surface.

The TASCO facility and land application fields are located on the southern rim of the eastern Snake River Plain, which is a sole-source aquifer. The surface sediments have a depth of 30-35 feet and are underlain by a continuous clay layer. The layer acts as a confining unit between the shallow alluvial aquifer and deeper regional aquifer. The depth to ground water in monitoring wells varied from 4 feet to 29 feet (1998 to 2009 data), with an average depth of 12 feet. In general, the ground water level is the highest at the end of the irrigation season in the fall and lowest before irrigation starts in the spring. The average saturated thickness of the alluvial aquifer is estimated to be approximately 23 feet.

The shallow ground water flows predominantly to the north with localized northeast and northwest vectors. Groundwater contour maps are provided in Figures 4-4 and 4-5 of the permit application (Appendix A). The deeper regional basalt aquifer flows generally to the west at a

depth of 150 to 300 feet (ISDA Ground Water Technical Report #8 (www.agri.state.id.us/Categories/Environment/water/waterPDF/gwreports/minidoka1.pdf). Table 4-9 of the permit application provides shallow aquifer properties (specific capacity, transmissivity, hydraulic conductivity, ground water velocity, and Darcy velocity) for four areas at the site (East Farm, South Farm, South Schow, and North Schow) (Appendix A). A summary is shown in Table 6.

Table 6. Permit application summary for shallow aquifer properties.

Area	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)	Hydraulic Conductivity (feet/day)	Ground Water Velocity (feet/day)	Ground Water Velocity (feet/year)	Travel Time for 1 mile (years)
East Farm	17	24,860	145	0.6	220	24
South Farm	6	9,291	54	0.2	75	75
South Schow	33	50,000	291	2.3	840	6
North Schow	57	84,800	493	3.9	1,420	12

Notes: gallons per minute per foot (gpm/ft); gallons per day per foot (gpd/ft).

These aquifer properties are based on well testing done in 1991 for the East and South Farm wells and in 1999 for the North and South Schow fields. Using these data, the time for ground water to travel 1 mile varies from 6 years to 75 years. Translating this to a specific field, for example, the east field is approximately one-quarter mile across in the direction of ground water flow, and it would take approximately 6 years for ground water to travel from the south edge of the field to the north edge. The South Farm is also approximately one-quarter mile across in the direction of ground water flow, and it would take approximately 18 years for ground water to travel this distance. DEQ recommends aquifer properties be provided for the following fields that are not characterized: MU-05004, Goitiandia; MU-05005, East Gillette; and MU-05007, Seedall.

Pursuant to guidance provided in DEQ's *Policy for Addressing Degraded Ground Water Quality Areas*, a statewide list of significantly degraded areas with nitrate was developed (DEQ 2000). In 2002, DEQ, in cooperation with the Idaho Ground Water Monitoring Technical Committee (GWMTC) published a ranking of 25 nitrate priority areas (NPAs), where elevated levels of nitrate have been found in ground water. The 2008 rankings can be found in the *2008 Nitrate Priority Area Delineation and Ranking Process* report (DEQ 2008) at www.deq.idaho.gov/media/471611-ranking_2008.pdf.

The TASCO Mini-Cassia facility is located in NPA 12. DEQ (2008) Appendix 12 provides mapping and ground water nitrate levels for the Mini-Cassia NPA. Of the wells in this NPA, 41% have nitrate levels greater than 5 milligrams per liter (mg/L), and 8% are 10 mg/L or higher. The 2012 DEQ NPA update did not result in any changes to this NPA.

4.3 Wastewater Quantity and Quality, Wastewater and Supplemental Irrigation Water Hydraulic Loading Rates, Constituent Loading Rates, and Soil and Ground Water Monitoring Data

4.3.1 Wastewater Quantity and Quality

The average volume of wastewater applied for the 1995 through 2011 reporting years is 94.08 MG. Process wastewater averaged 17.67 MG (18.8% of total), and condensate wastewater averaged 76.41 MG (81.2% of total). Table 7 and Figure 3 show the wastewater applied from 1995 through 2011.

Table 7. The Amalgamated Sugar Company Mini-Cassia wastewater applied (1995–2011).

Reporting Period	Process Wastewater (million gallons)	Condensate Wastewater (million gallons)	Total (million gallons)
1995–1996	18.80	50.01	68.81
1996–1997	15.85	53.27	69.12
1997–1998	17.13	49.47	66.60
1998–1999	22.07	30.73	52.80
1999–2000	20.40	37.90	58.30
2000–2001	13.31	79.49	92.80
2001–2002	14.20	84.40	98.60
2002–2003	17.53	81.02	98.55
2003–2004	9.20	85.72	94.92
2004–2005	12.40	87.80	100.20
2005–2006	0.00	114.50	114.50
2006–2007	25.01	84.18	109.19
2007–2008	12.12	111.63	123.75
2008–2009	32.98	70.88	103.86
2009–2010	5.30	102.42	107.72
2010–2011	46.42	99.10	145.52
Average	17.67	76.41	94.08

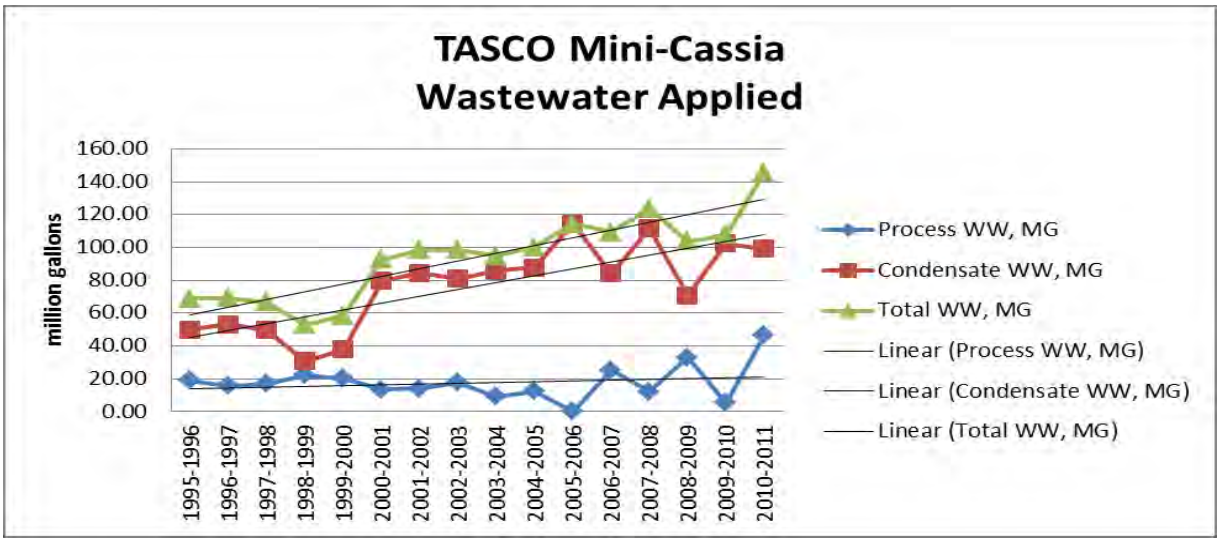

Figure 3. The Amalgamated Sugar Company Mini-Cassia wastewater applied (1995–2011).

Linear trend lines show the amount of process and condensate wastewater both increasing since permit LA-000050-02 was issued in 1995. Based on the linear trend line, process wastewater volume has increased from approximately 15 MG to 20 MG per year from 1995 to 2011, and condensate wastewater increased from 45 MG to 108 MG per year. TASCO Mini-Cassia is near the beet processing limit in their air quality permit (3.5 million tons per year), which will limit future increases in the wastewater generation. Process wastewater quality is shown in Table 8 and Figure 4, Figure 5, and Figure 6.

Table 8. Process wastewater quality (1995–2011).

Campaign Year	COD (mg/L)	Ammonia (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	NVDS (mg/L)
1995–1996	494	3.5	28.5	1.91	931
1996–1997	408	41.2	66.8	1.42	1,355
1997–1998	657	1.1	24.8	1.21	1,282
1998–1999	4,630	15.2	125.0	7.80	2,320
1999–2000	1,026	46.0	82.4	2.29	1,087
2000–2001	1,454	12.3	68.9	1.72	2,227
2001–2002	753	40.7	66.1	0.93	998
2002–2003	1,210	11.0	0.4	11.50	1,460
2003–2004	640	10.5	65.4	3.11	4,318
2004–2005	562	29.7	48.5	1.94	2,433
2005–2006	No process wastewater applied				
2006–2007	477	12.5	48.4	3.17	2,475
2007–2008	268	3.8	29.8	1.94	1,450
2008–2009	457	9.8	27.9	2.44	1,395
2009–2010	2,510	0.5	34.9	8.57	3,880
2010–2011	3,077	22.1	53.1	3.30	1,376
Average	1,241	17.3	51.4	3.55	1,932

Notes: chemical oxygen demand (COD); milligrams per liter (mg/L); total Kjeldahl nitrogen (TKN); nonvolatile dissolved solids (NVDS)

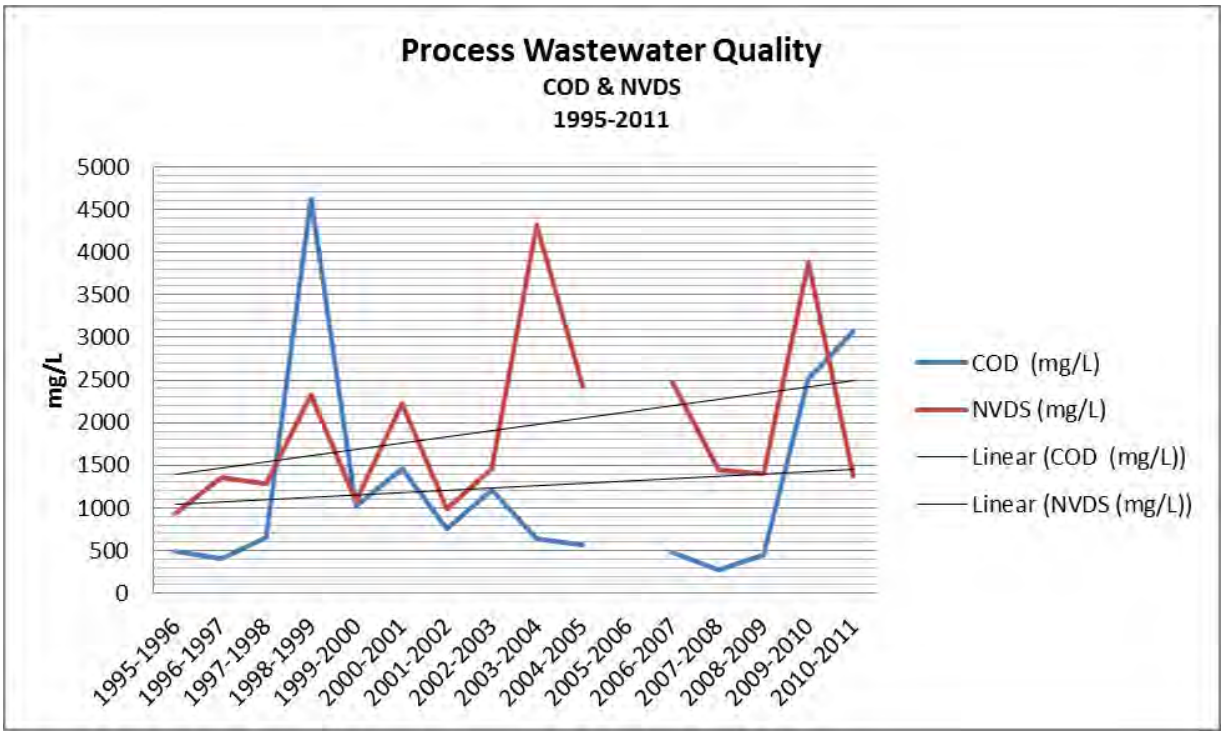

Figure 4. Process wastewater quality, chemical oxygen demand, and nonvolatile dissolved solids (1995–2011).

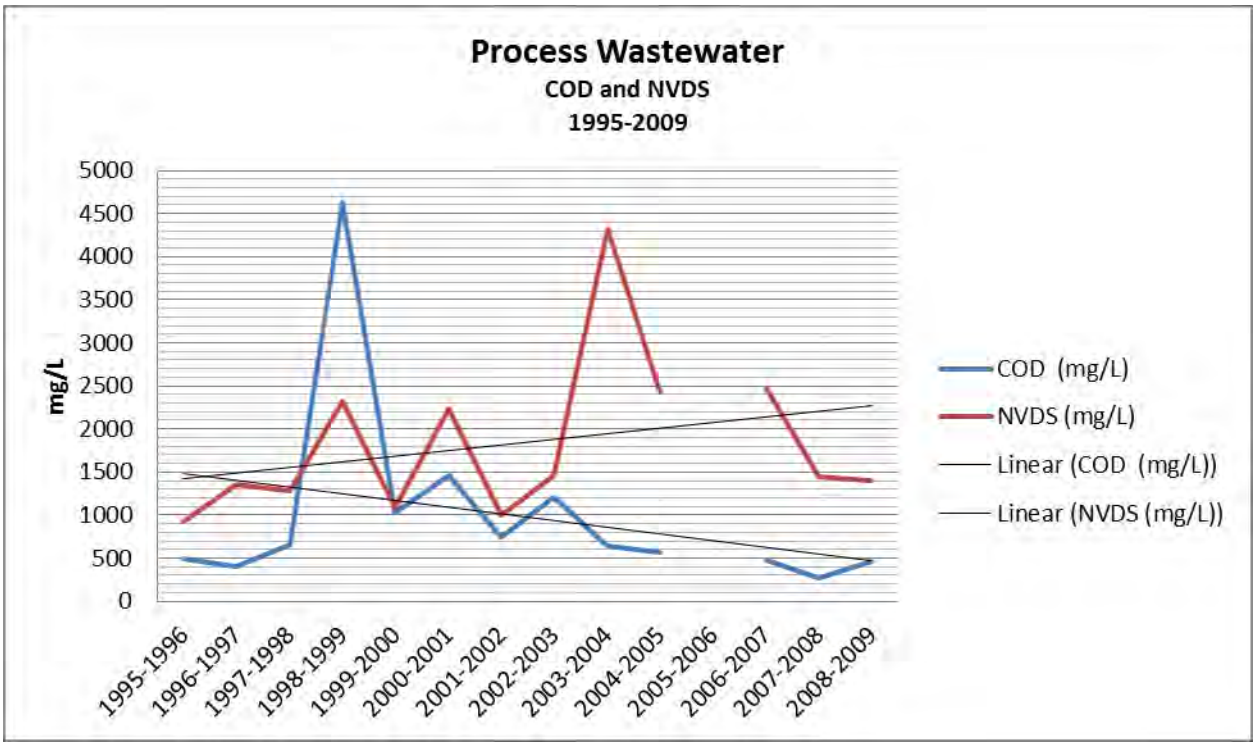

Figure 5. Process wastewater quality, chemical oxygen demand, and nonvolatile dissolved solids (1995–2009).

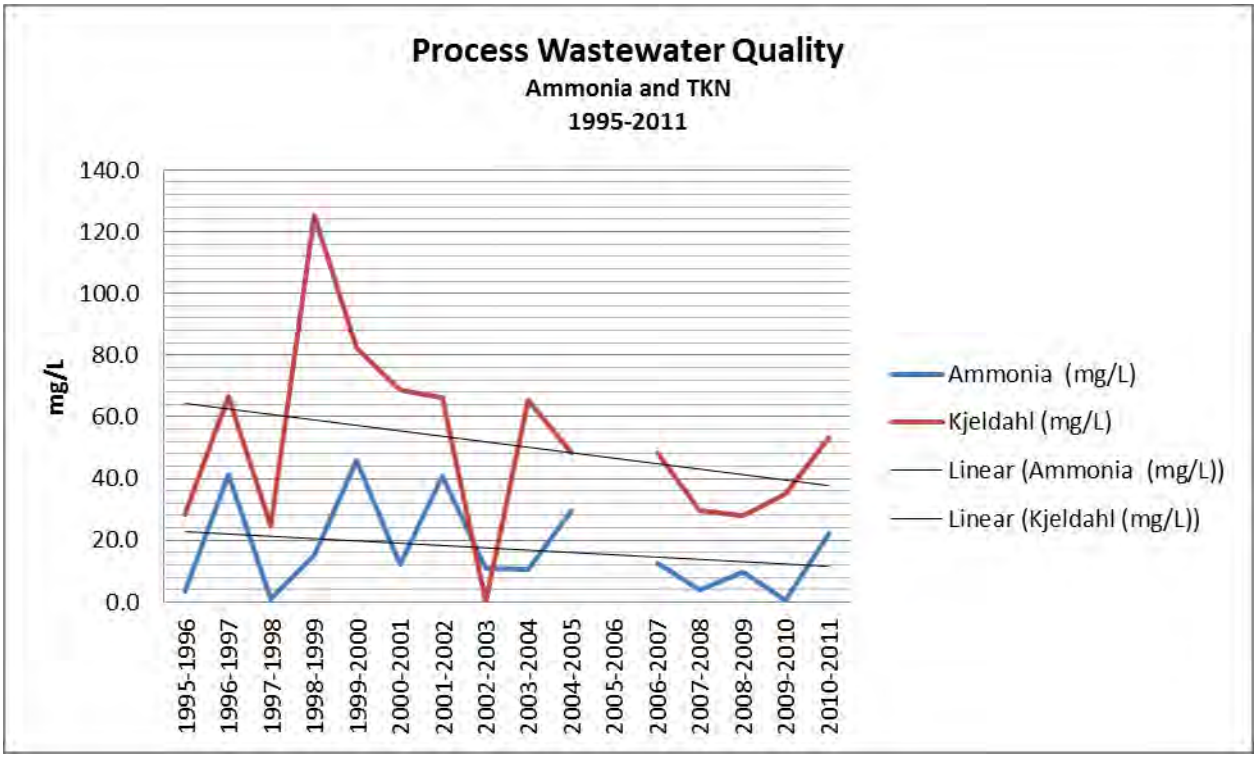

Figure 6. Process wastewater quality, ammonia, and total Kjeldahl nitrogen (1995–2011).

TASCO reported the process wastewater volume generated during the 2010–2011 beet campaign was above normal due to wet and cold weather conditions. The weather conditions caused a deterioration of sugar beets prior to processing, which generated above normal levels of wastewater constituents. During the 2009–2010 campaign, only 5.3 MG of process wastewater was applied (annual average 17.67 MG), and only one sample was taken to characterize the wastewater. The remainder of the process wastewater generated in this campaign was applied the following year.

Figure 4 shows an increasing trend in the process wastewater COD and NVDS concentrations from 1995 to 2011. Figure 5 excludes the 2009–2010 and 2010–2011 campaigns because of the unusual conditions affecting process wastewater flows and quality. Excluding those campaigns, there was an increasing trend for NVDS and a decreasing trend for COD. Between 2004 and 2009, the NVDS concentration declined.

Figure 6 shows a decreasing trend for process wastewater ammonia and total Kjeldahl nitrogen (TKN) concentrations from 1995 to 2011. Nitrate-nitrogen concentrations in process wastewater are very low and do not have an impact on overall nitrogen loading rates.

Overall, process wastewater quality has improved during this permit cycle (COD, ammonia, and TKN). NVDS shows an increase for the period from 1995 through 2011 but a decrease between 2004 through 2009.

Condensate wastewater quality from 1995 to 2011 is shown Table 9 and Figure 7.

Table 9. Condensate wastewater quality (1995–2011).

Campaign Year	COD (mg/L)	Ammonia (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	NVDS (mg/L)
1995–1996	198	101.0	107.3	-0.50	25
1996–1997	232	128.7	142.2	-0.20	92
1997–1998	188	125.3	152.8	0.13	61
1998–1999	104	79.9	92.4	0.40	114
1999–2000	109	64.0	68.0	0.05	69
2000–2001	339	72.2	90.9	0.11	34
2001–2002	217	69.1	77.1	0.14	40
2002–2003	269	32.6	43.2	0.85	95
2003–2004	252	43.0	52.1	0.33	78
2004–2005	107	36.1	44.0	0.60	16
2005–2006	218	47.8	58.9	0.20	7
2006–2007	184	53.5	62.8	0.92	79
2007–2008	165	59.3	73.2	0.39	49
2008–2009	276	48.0	65.4	0.66	50
2009–2010	222	29.8	40.7	4.54	40
2010–2011	172	32.5	38.7	0.12	79
Average	203	63.9	75.6	0.55	58

Notes: chemical oxygen demand (COD); milligrams per liter (mg/L); total Kjeldahl nitrogen (TKN); nonvolatile dissolved solids (NVDS)

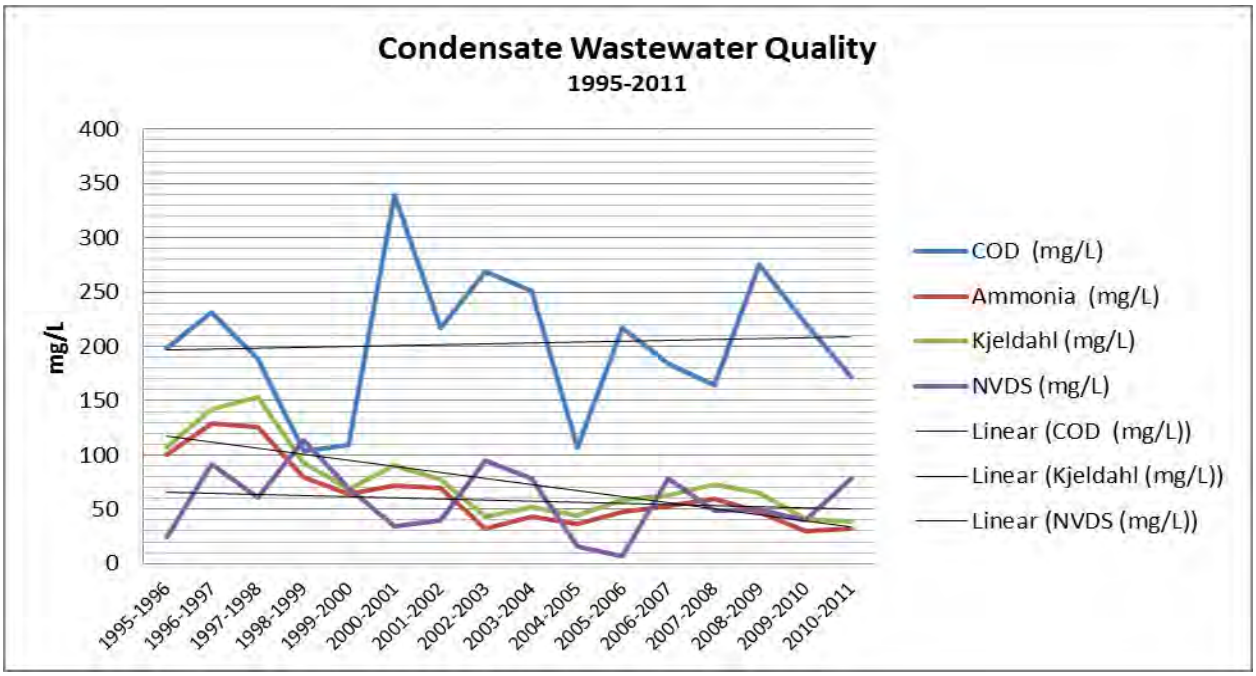

Figure 7. Condensate wastewater quality (1995–2011).

Condensate wastewater is generally much lower strength than the process wastewater, except for nitrogen constituents. The COD concentration averaged 203 mg/L and the NVDS concentration averaged 58 mg/L versus COD at 1,241 mg/L and NVDS at 1,932 mg/L for process wastewater. The average ammonia concentration was 63.9 mg/L, and the TKN concentration was 75.6 mg/L. The ammonia, TKN, and NVDS concentrations showed a decreasing trend, and COD showed a slight increase for the period from 1995 to 2011.

The total mass load of COD, NVDS, and total nitrogen from process and condensate wastewater are shown in Table 10 and Figure 8.

Table 10. Wastewater mass load, process, and condensate wastewater (1995–2011).

Campaign Year	Total Nitrogen (lb/yr)	NVDS (lb/yr)	TDS (lb/yr)	COD (lb/yr)
1995–1996	45,490	157,368	208,322	—
1996–1997	67,163	199,112	277,170	—
1997–1998	76,570	116,819	161,212	—
1998–1999	50,209	349,153	708,957	—
1999–2000	42,115	192,433	319,079	—
2000–2001	67,390	286,122	385,460	—
2001–2002	62,874	142,828	201,027	—
2002–2003	34,965	181,511	221,128	—
2003–2004	36,034	160,518	216,851	—
2004–2005	35,184	259,373	367,029	—
2005–2006	64,458	4,297	20,626	205,254
2006–2007	56,664	639,143	877,731	244,217
2007–2008	76,054	200,767	252,551	150,227
2008–2009	50,483	319,311	431,203	235,956
2009–2010	43,323	207,509	279,774	337,086
2010–2011	63,821	777,610	1,222,682	1,539,094
Average	54,550	262,117	384,425	451,972

Notes: pound per year (lb/yr); nonvolatile dissolved solids (NVDS); total dissolved solids (TDS); chemical oxygen demand (COD).

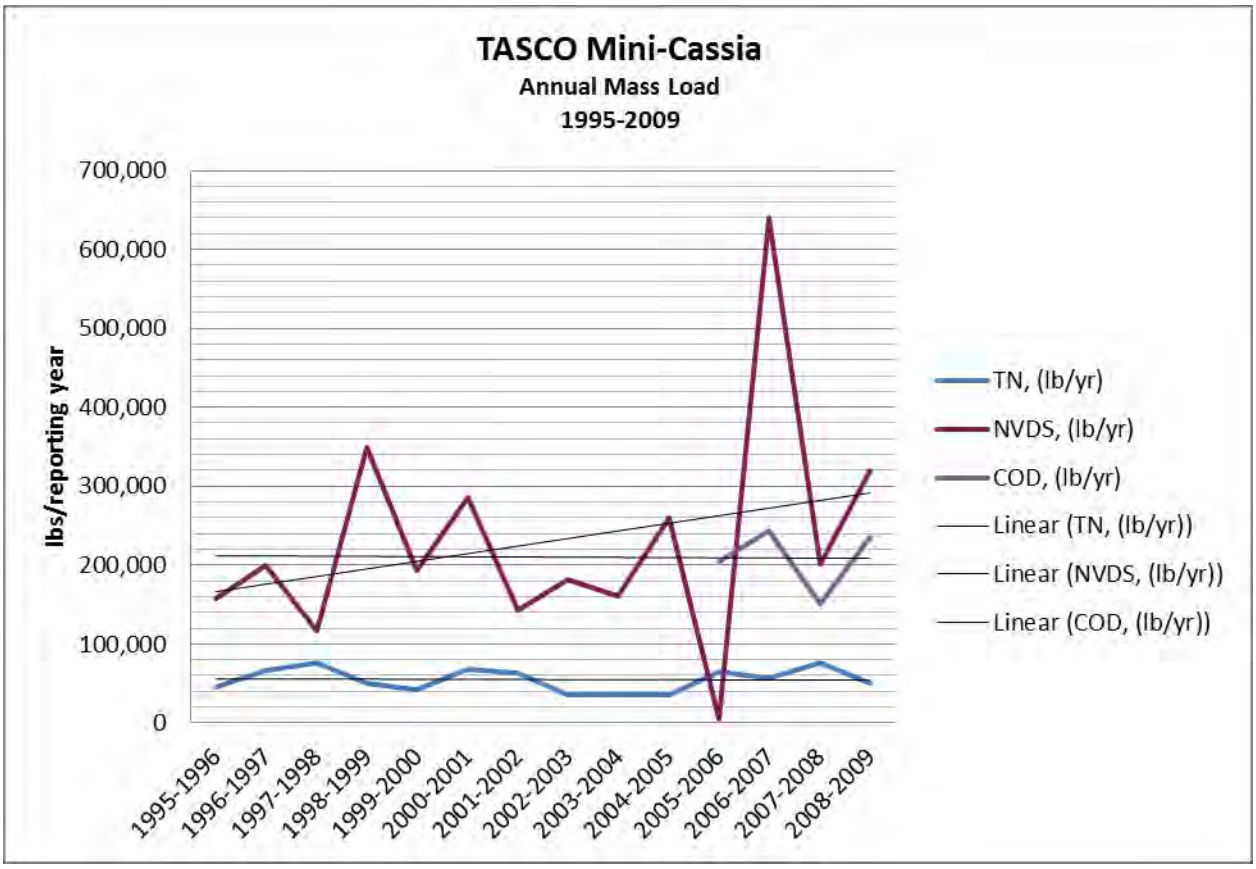

Figure 8. Annual mass load of wastewater constituents (1995–2009).

The linear trend in the total pounds of total nitrogen, NVDS, and COD for land application is shown in Figure 8 for data from 1995 through 2009. Total nitrogen and COD are flat, and NVDS shows an increase.

4.3.2 Wastewater and Irrigation Water Hydraulic Loading Rates

TASCO provided hydraulic and constituent loading rates for each management unit from 1995 to 2009 in Table 3-3 of the permit application (Appendix C). Data from the 2010 and 2011 annual reports were added to this table to provide an up-to-date data set (TASCO 2011a; 2012). Table 11 provides the annual average wastewater hydraulic loading rates for the period from 1995 through 2011.

Table 11. Annual average wastewater hydraulic loading rates (1995–2011).

Management Unit:	1	2	3	4	5	6	7	8	9	10
Name:	East	South	Wilkins Off Site	Goitiandia	Gillette East	Fisk/ Blacker	Seedall	Gillette West Off Site	South Schow	North Schow
Growing season (inches)	7.34	6.24	0.32	4.77	2.49	0.00	5.80	0.80	5.11	1.34
Non-growing season (inches)	2.49	2.36	0.84	1.71	3.03	0.99	2.78	1.43	2.05	3.89
Total inches	9.83	8.60	1.16	6.48	5.52	0.99	8.58	2.23	7.16	5.23

The wastewater hydraulic loading rates in the growing season are well below the crop requirements, and supplemental irrigation water is used to meet crop need. The average non-growing season hydraulic loading rates ranged from 0.84 inches to 3.89 inches. The current permit limits range from 5.8 inches to 9.5 inches. For this period, three exceedances of non-growing season hydraulic limits were noted.

The growing season hydraulic limit is the crop irrigation water requirement (IWR) divided by the efficiency of irrigation system. Typical efficiency values are 70%–75% for hand and wheel lines and 80% for center pivots. The 2011 annual report had a supplemental irrigation water range of 32.55 inches to 52.22 inches for the various crops grown (TASCO 2012). TASCO does not currently measure supplemental irrigation water; the 2011 annual report states supplemental irrigation water rates are estimates based on University of Idaho evapotranspiration values at http://data.kimberly.uidaho.edu/ETIdaho/. DEQ recommends supplemental irrigation water be measured in the new Reuse Permit.

4.3.3 Constituent Loading Rates

Table 12 provides the annual average constituent loading rates for the period from 1995 through 2011.

Table 12. Annual average constituent loading rates (1995–2011).

Management Unit:	1	2	3	4	5	6	7	8	9	10
Name:	**East**	**South**	**Wilkins Off Site**	**Goitiandia**	**Gillette East**	**Fisk/ Blacker**	**Seedall**	**Gillette West Off Site**	**South Schow**	**North Schow**
COD, GS average (lb/acre-d)	4.63	4.45	0.03	0.96	0.55	0.00	4.08	0.11	3.95	0.15
COD, NGS average (lb/acre-d)	2.35	2.23	0.20	0.64	1.08	0.38	1.42	0.65	0.81	1.55
COD, annual average (lb/acre-d)	3.68	3.53	0.10	0.83	0.78	0.16	2.97	0.33	2.65	0.73
GS NVDS, (lb/acre)	1,484	1,800	1	69	41	0	1,357	6	769	106
NGS NVDS (lb/acre)	128	121	8	13	37	7	71	19	15	37
Total NVDS (lb/acre)	1,612	1,920	9	82	78	7	1,429	26	784	143
GS nitrogen (lb/acre)	73.6	71.9	4.5	82.4	46.5	0.0	76.6	16.3	58.0	12.3
NGS nitrogen (lb/acre)	41.7	36.6	18.1	27.7	59.1	30.7	50.0	31.3	33.7	55.8
Total nitrogen (lb/acre)	115.2	108.4	22.6	110.1	105.6	30.7	126.6	47.6	91.7	68.1
Nitrogen from fertilizer (lb/acre)	30.1	50.8	75.4	67.4	83.6	104.3	25.6	118.5	17.5	24.1
Total nitrogen from wastewater and fertilizer (lb/acre)	145.3	159.2	98.0	177.4	189.2	135.0	152.2	166.1	109.2	92.2
GS phosphorus (lb/acre)	2.99	3.90	0.00	0.19	0.13	0.00	2.64	0.04	1.91	0.19
NGS phosphorus (lb/acre)	0.27	0.39	0.22	0.54	0.62	0.13	0.35	0.08	0.11	0.72
Total phosphorus (lb/acre)	3.26	4.29	0.22	0.73	0.75	0.13	2.99	0.12	2.02	0.91

Notes: chemical oxygen demand (COD); growing season (GS); pound per acre per day (lb/acre-d); non-growing season (NGS); nonvolatile dissolved solids (NVDS)

For comparison, the permit constituent loading rate limits are shown in Table 3-1 of the permit application (Appendix C) and discussed below for each constituent. As land application fields were added over time, different limits were established based on site-specific conditions.

4.3.3.1 Chemical Oxygen Demand Loading Rates

The current COD permit limits are 25 pounds per acre per day (lb/acre-d) during the non-growing season and 50 lb/acre-d during the growing season. The average non-growing season COD loading rate ranged from 0.38 lb/acre-d to 2.35 lb/acre-d and the average growing season rate ranged from 0.03 to 4.63 lb/acre-d for the various management units. For this period, one exceedance was noted for the non-growing season COD limit in 1998–1999 on the East Field.

For all management units during this period, the average non-growing season and growing season COD loading rate were 1.13 lb/acre-d and 1.89 lb/acre-d, respectively.

4.3.3.2 Nonvolatile Dissolved Solids Loading Rates

The current NVDS permit limits vary by field from a non-growing limit of 642 lb/acre to an annual limit of 7,600 lb/acre. For this period, one exceedance was noted in 1999–2000 on the Seedall field.

NVDS removed by crops is estimated by the ash contained in the harvested portion of the crop. Typical ash removal values vary from approximately 300 lb/acre for wheat to 1,000 lb/acre for alfalfa as shown in Table 13.

Table 13. Ash removal values.

Crop	Harvested Dry Matter (lb/acre)	Ash Content, % of Dry Matter	Ash (NVDS) Removed (lb/acre)
Alfalfa, 6 tons at 15% moisture	10,200	10	1,020
Wheat, 130 bushel/acre, 60 lb/bushel at 11% moisture	6,942	1	69
Wheat straw, 1.5 tons/acre at 10% moisture	2,700	8	216
Wheat, grain, and straw	—	—	285

Notes: Ash content: alfalfa http://www.uwex.edu/ces/forage/pubs/ash_in_forage.pdf; wheat http://www.nebraskawheat.com/pdfs/Wheat%20and%20Flour%20Testing%20Methods%20Book.pdf and http://www.cwc.org/paper/pa971rpt.pdf; pound per acre (lb/acre); nonvolatile dissolved solids (NVDS)

In general, management units that receive process wastewater have NVDS loading rates (irrigation water NVDS not included) above crop uptake, and those receiving only condensate wastewater are below crop uptake. Examples taken from 2006, 2007, and 2008 annual reports are shown in Table 14.

Table 14. Examples of management unit loading rates from 2006, 2007, and 2008 annual reports.

Annual Report Year	Management Unit	Process Wastewater Applied (MG)	Condensate Wastewater Applied (MG)	Wastewater NVDS Applied (lb/acre)
2006–2007	1	5.43	3.96	2,158
2006–2007	2	5.98	0	5,476
2006–2007	7	4.27	5.77	2,317
2006–2007	8	0	18.42	120
2006–2007	9	3.79	3.99	1,588
2007–2008	1	6.94	5.46	1,414
2007–2008	2	0	5.88	109
2007–2008	4	0	18.53	47
2007–2008	7	3.97	10.33	1,675
2007–2008	9	1.21	21.38	543
2008–2009	1	11.02	5.19	1,672
2008–2009	2	8.93	1.23	2,308
2008–2009	4	0	22.35	127
2008–2009	5	0	13.85	108
2008–2009	9	7.04	3.02	450
2008–2009	10	4.4	15.27	498

Notes: million gallons (MG); nonvolatile dissolved solids (NVDS); pound per acre (lb/acre).

4.3.3.3 Nitrogen and Phosphorus Loading Rates

The current nitrogen permit limits vary by field. Most fields have a limit of 150% of crop nitrogen uptake and removal or a set limit of 300 lb/acre. The North Schow (MU-005010) and South Schow (MU-005009) fields have an annual limit of 250 lb/acre and a non-growing season limit of 150 lb/acre. For all management units during this period, the average annual nitrogen loading rate from wastewater was 83 lb/acre. Including fertilizer, the average nitrogen loading rate was 142 lb/acre.

The average phosphorus loading rates from wastewater for all management units during this period was 1.5 lb/acre. The current permit limits phosphorus loading to 150% of crop uptake.

Estimated crop nutrient removal (pounds per acre) is shown in Table 15.

Table 15. Estimated crop nutrient removal.

Crop	Nitrogen (lb/acre)	150% of Nitrogen Removed (lb/acre)	Phosphorus (lb/acre)	150% of Phosphorus Removed (lb/acre)
Alfalfa, 6 tons at 15% moisture	285	427.5	27	40.5
Sugar beets, 33 tons at 80% moisture	139	208.5	29	43.5
Winter wheat, 130 bushel/acre at 11% moisture	125	187.5	26	37.5

Notes: Nutrients removed in harvested part of crop, values from http://plants.usda.gov/npk/main; pound per acre (lb/acre)

The average total nitrogen loading rates (142 lb/acre including fertilizer) are comparable to crop nitrogen removal rates and generally below the standard permit limit of 150% of crop nitrogen uptake. Phosphorus loading rates from wastewater are well below crop removal rates.

The hydraulic and constituent loading rates have historically been below permit limits, except as noted above.

4.3.4 Soils Monitoring Data

Soils data from 1996 through 2009 are provided in Appendix 4 of the permit application. The *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater* (Guidance [DEQ 2007]) contains tables for interpreting various soil test results. Table 16 shows the values provided by the Stukenholtz Laboratory in Twin Falls for interpreting results.

Table 16. Values used for interpreting soil test results (Stukenholtz Laboratory).

Constituent	Low	Medium	High	Very High
Nitrate	0–5	6–20	21–40	41+
Phosphorus (Olsen Method)	0–15	15–30	30–50	51+
Electrical conductivity, mmhos/cm	0–1.0	1.1–2.5	2.6–5.0	5.1+

Source: DEQ 2007
Notes: millimhos per centimeter (mmhos/cm)

The current permit does not have constituent limits for soil parameters. The soils data are intended to be used as a tool for managing application of wastewater and fertilizer and assisting in overall crop management. Section 5 of the permit application provides an assessment of each management unit with respect to soil and ground water monitoring data.

Most fields are sampled in March or April to determine nitrogen levels prior to the growing season. For fields receiving wastewater during the non-growing season (November 1 through March 31), soil nitrogen levels would be reflected in these samples. Generally, nitrate levels were in the low-to-medium range. Soil salinity measured as electrical conductivity (EC) was at levels that would not impact crop health. Alfalfa is impacted at EC values as low as 2.0 millimhos per centimeter (mmhos/cm). Sugar beets and wheat are more tolerant and not affected until EC reaches 6–7 mmhos/cm (http://www.ext.colostate.edu/pubs/crops/00503.html).

In general, soil constituent levels were in the low and medium ranges. The following exceptions were noted:

- The west portion of the East Farm (referred to as SU-005001A) had very high nutrient and salinity levels between 2002 and 2006 due to replacement of top soil with compost and material removed from the mud pond system (the top soil in the 28 acres on the west side of the field was removed and used in lagoon construction). The soil concentrations peaked in 2004. Nitrate-nitrogen in the upper 3 feet of soil was approximately 1,700 lb/acre; phosphorus was 800 lb/acre; and EC was 7.3, 12.0, and 5.3 mmhos/cm in the 0–1, 1–2, and 2–3 foot depths—levels that could impact crop health. Since 2004, nitrate and EC values have decreased. The 2011 annual report for this part of the East Farm had a nitrate value of approximately 350 pounds in the upper 3 feet, and EC values were 2.2, 4.7, and 2.7 mmhos/cm. The center portion of this field (SU-005001B) also had high nitrate and EC levels during this same period. The high level of soil constituents likely resulted in ground water nitrate and TDS impacts across this field.

- The Manning area east of the mud ponds (not a soil monitoring point in the current permit) is used to store material removed from the mud ponds. This area had elevated levels of nitrate and EC from 2003 through 2005. In 2004, nitrate-nitrogen in the upper 3 feet of soil was approximately 1,850 lb/acre and EC was 11.3, 9.4, and 8.2 mmhos/cm in the 0–1, 1–2, and 2–3 foot depths. In 2006, TASCO quit reporting data for this area.

4.3.5 Ground Water Monitoring Data

The ground water monitoring well network is shown in Figure 2. Section 4.4 of the permit application provides an analysis of the ground water monitoring data from 1999 to 2009. Tables 3-8 through 3-16 from the 2010–2011 annual report provide an updated analysis of ground water nitrate and TDS levels for each management unit (Appendix C) (TASCO 2012).

4.3.5.1 East Farm (MU-005001)

The East Farm has an upgradient well (GW-005030, well H) on the southern edge of the field and a downgradient well (GW-005033, well E) on the northern edge of the field.

Upgradient well H has mean a nitrate value of 4.11 mg/L and TDS value of 438 mg/L. Since 2001, the nitrate values have generally been 2 mg/L or less. The fall 2010 results, 9.26 mg/L, and spring 2011 results, 11.0 mg/L, indicated a recent upgradient source of contamination for this field.

Downgradient well E has a mean nitrate value of 8.89 mg/L and TDS value of 638 mg/L. The nitrate concentration shows an increasing trend in this well. This trend was due, in part, to the application of mud and compost in the western portion of the field. The increase in mean TDS values across this field is 200 mg/L (438 mg/L to 638 mg/L). IDAPA 58.01.11.400.02 and .03 discuss various prevention measures and appropriate actions to address ground water degradation. Since the downgradient TDS level is above the secondary standard, IDAPA 58.01.11.400.03 requires *appropriate* action be taken consisting of investigation, evaluation, or

enforcement. This staff analysis is the evaluation, and the permit conditions will specify appropriate action.

DEQ recommends the NVDS limit for this field be reduced from current limit of 7,600 lb/acre to a level that results in compliance with IDAPA 58.01.11. To determine the NVDS loading rate limit, DEQ leaching and ground water mixing models, calibrated to reflect actual conditions for this field, were used. In the permit application, TASCO requests keeping the current NVDS limit of 7,600 lb/acre or would accept a lower limit if the NVDS limit for some of the other fields are increased. The DEQ recommended NVDS loading rate for each management unit is discussed in section 5.2.3.

4.3.5.2 South Farm (MU-005002)

The South Farm has an upgradient well (GW-005035, well J) on the southern edge of the field and downgradient well (GW-005034, well I) near the northeastern corner of the field.

Upgradient well J has a mean nitrate value of 2.40 mg/L and TDS value of 405 mg/L. Fall samples have nitrate values typically <1 mg/L, and spring samples are 2 mg/L to 5 mg/L, reflecting upgradient irrigation and farm management practices.

Downgradient well I has a mean nitrate value of 0.90 mg/L and TDS value of 777 mg/L. Both nitrate and TDS show decreasing trends in this well. The increase in mean TDS values across this field is 372 mg/L (405 mg/L to 777 mg/L). Since the downgradient TDS level is above the secondary standard, IDAPA 58.01.11.400.03 requires *appropriate* action be taken consisting of investigation, evaluation, or enforcement. DEQ recommends the NVDS limit for this field be reduced from the current limit of 7,600 lb/acre to a level that results in compliance with IDAPA 58.01.11. To determine the NVDS loading rate limit, DEQ leaching and ground water mixing models, calibrated to reflect actual conditions for this field, were used.

4.3.5.3 Wilkins (MU-005003)

Wilkins field has two upgradient wells (GW-005046, well 102 and well 120). Well 102 is located on the southwestern corner of the field and well 120 on the southern edge of the field. No downgradient well is located adjacent to the field. Well 112 (GW-005052) is located approximately 1.5 miles northeast of the field and is used as the downgradient well in the permit application.

Upgradient well 102 has a mean nitrate value of 21.30 mg/L and TDS value of 660 mg/L. The elevated nitrate and TDS do not result from TASCO operations, and the sources are not discussed in the application. Well 120 has seven sample points with a mean nitrate value of 5.96 mg/L and TDS value of 479 mg/L.

Well 112 E has a mean nitrate value of 1.84 mg/L and TDS value of 382 mg/L.

Wilkins is managed as an off-site field and receives only condensate wastewater. The current NVDS annual limit is 642 lb/acre, and TASCO requests the same limit in the new Reuse Permit.

4.3.5.4 Goitiandia (MU-005004)

The Goitiandia field does not have an upgradient well but has a downgradient well (well 120) on the northern edge of the field. This field is bordered on the north by the Wilkins field (MU-005003).

Downgradient well 120 has seven sample points and has a mean nitrate value of 5.96 mg/L and TDS value of 479 mg/L. The current NVDS annual limit is 4,000 lb/acre, which includes supplemental irrigation water. A separate non-growing season NVDS limit of 642 lb/acre applies only to wastewater. A permitted field is downgradient of this field, so there are no immediate downgradient ground water users. TASCO requested an NVDS limit of 2,000 lb/acre excluding supplemental irrigation water and provided a ground water mixing analysis using the DEQ models to support the request in the permit application. DEQ used a similar approach using the DEQ leaching and ground water mixing models to determine the recommended NVDS loading rate limit.

4.3.5.5 East Gillette (MU-005005)

East Gillette has two upgradient wells (GW-005024, well 107 and GW-005026, well A) and a downgradient well (well 121) on the northern edge of the field.

Upgradient well 107 is located near the southwestern corner of the field north of the C Canal. Well A is located about 1,000 feet east of well 107 on the south side of the C Canal. Both of these wells are located in proximity to the mud ponds, which have an estimated seepage volume of 21 MG per year (section 4.2.3.1). Both of these wells are influenced by the C Canal and mud pond seepage.

Well 107 has a mean nitrate value of 0.36 mg/L and TDS value of 624 mg/L. Well A has a mean nitrate value of 12.38 mg/L and TDS value of 596 mg/L. However, the nitrate values at well A have been non-detect since 2006 (except for one sample in July 2010). The TDS values fluctuate to a large extent between the spring and fall samples in both upgradient wells. For well 107, the April TDS averaged 1,127 mg/L, and the October TDS averaged 384 mg/L, indicating a large amount of dilution with low TDS water occurs in the growing season.

Downgradient well 121 has a mean nitrate value of 8.17 mg/L and TDS value of 494 mg/L, based on seven sample results. The current NVDS annual limit is 4,000 lb/acre, which includes supplemental irrigation water. A separate non-growing season NVDS limit of 642 lb/acre applies only to wastewater. TASCO requested an NVDS limit of 2,000 lb/acre excluding supplemental irrigation water and provided a ground water mixing analysis using the DEQ models to support the request in the permit application. DEQ used a similar approach using the DEQ leaching and ground water mixing models to determine the recommended NVDS loading rate limit and the results are discussed in section 5.2.3.

4.3.5.6 Fisk/Blacker (MU-005006)

TASCO has not used the Fisk/Blacker field for land application since 1998, and the permit application requests the field be removed from the new Reuse Permit. The field will be removed from the new Reuse Permit.

4.3.5.7 Seedall (MU-005007)

The Seedall field has an upgradient well (GW-005050, well 109) on the southeastern edge of the field and downgradient well (GW-005054, Seedall well) on the northern edge of the field.

Upgradient well 109 has a mean nitrate value of 17.43 mg/L and TDS value of 433 mg/L. The last four nitrate results (October 2009, April 2010, October 2010, and April 2011) were 9.1, 14.7, 21.2, and 44.6 mg/L indicating an upgradient source of nitrogen contamination is occurring south of the Seedall field outside of TASCO's control.

The downgradient Seedall well has a mean nitrate value of 7.94 mg/L and TDS value of 545 mg/L. Upgradient activities impacting ground water quality make it difficult to analyze this field. Nitrate values decrease across the field. The TDS increase across the field results in a value above the secondary standard, but the downgradient well TDS trend is decreasing. Since the downgradient TDS level is above the secondary standard, IDAPA 58.01.11.400.03 requires *appropriate* action be taken to address the consisting of investigation, evaluation, or enforcement.

The current NVDS limit is 2,500 lb/acre, and TASCO requests the same limit in the new Reuse Permit. To determine the NVDS loading rate limit, DEQ leaching and ground water mixing models, calibrated to reflect actual conditions for this field, were used.

4.3.5.8 West Gillette (MU-005008)

West Gillette does not have any monitoring wells. It is an *off-site* field receiving only condensate wastewater. Annual NVDS loading rates have averaged 26 lb/acre and nitrogen loading rates have averaged 166 lb/acre. The current NVDS annual limit is 642 lb/acre, and TASCO requests the same limit in the new Reuse Permit.

4.3.5.9 South Schow (MU-005009)

South Schow has an upgradient well (GW-005063, well 114) on the southern edge of the field and downgradient well (GW-005064, well 115) on the northern edge of the field.

Upgradient well 114 has a mean nitrate value of 8.54 mg/L and TDS value of 521 mg/L.

Downgradient well 115 has a mean nitrate value of 7.31 mg/L and TDS value of 498 mg/L. Both wells have decreasing nitrate and TDS trends. Ground water quality is currently improving across this field. This field is permitted for *de minimis* loading rates (permit LA-000050-02, Appendix B, issued November 27, 1996), which includes an annual NVDS limit of 4,000 lb/acre for wastewater and irrigation water. On December 10, 1999, the field was additionally permitted

for non-growing season application of condensate wastewater with a non-growing season NVDS limit of 642 lb/acre. This field has typically received both process and condensate wastewater. TASCO requests an NVDS limit of 2,500 lb/acre excluding supplemental irrigation water and provided a ground water mixing analysis to support the request.

DEQ used a similar approach to determine the recommended NVDS loading rate limit. The DEQ leaching and ground water mixing models, calibrated to reflect actual conditions for this field, were used to determine loading rates that would be in compliance with IDAPA 58.01.11.

4.3.5.10 North Schow (MU-005010)

North Schow has an upgradient well (GW-005064, well 115) on the southern edge of the field and two downgradient wells (GW-005066, well 117 and GW-005067, well 118) on the northern edge of the field. This field is located directly north of the South Schow field.

Upgradient well 115 has a mean nitrate value of 7.31 mg/L and TDS value of 498 mg/L.

Downgradient well 117 has a mean nitrate value of 8.61 mg/L and TDS value of 482 mg/L. Downgradient well 118 has a mean nitrate value of 7.87 mg/L and TDS value of 507 mg/L. The average downgradient nitrate value is 8.24 mg/L, and the TDS value is 495 mg/L.

This field has the same limits as South Schow and has typically received only condensate wastewater (received process wastewater in 3 years since 1999), and the annual average NVDS application was 143 lb/acre from wastewater. TASCO requests an NVDS limit of 2,500 lb/acre excluding supplemental irrigation water and provided a ground water mixing analysis to support the request.

DEQ used a similar approach to determine the recommended NVDS loading rate limit. The DEQ leaching and ground water mixing models, calibrated to reflect actual conditions for this field, were used to determine loading rates that would be in compliance with IDAPA 58.01.11.

4.4 Process Wastewater Application on Lime Storage Area

TASCO generated excess wastewater during the 2010–2011 beet campaign due to wet and cold weather conditions and processing of deteriorated sugar beets. Carry over wastewater from the previous campaign further increased the volume of wastewater heading into the 2011 growing season and raised concerns regarding TASCO's ability to comply with permit limits. TASCO and DEQ met on April 14, 2011, to discuss options, including application of process wastewater to the lime storage area at rates equal to or less than the evaporative capacity of the lime material.

As a result of the meeting, TASCO submitted a management plan for this activity dated April 27, 2011 (TASCO 2011c). The management plan provided a characterization of the lime material, including the expected water-holding capacity. The analysis estimated the lime material could hold 0.4 inches of water per inch of material before percolation would occur. TASCO proposed keeping moisture from application within the top 6 inches, resulting in a calculated application

rate of 2.4 inches per application. The applied water would be evaporated from the top 6-inch layer before the next application could occur.

In the management plan, TASCO proposed applying at twice the bare soil evaporation rate or 16 inches (for the period between May 15 and September 30, the bare soil potential evaporation is 8 inches). Over 23 acres, 16 inches of applied wastewater is equal to 10 MG. TASCO proposed tilling each area several days after application to enhance evaporation and justify application rates above the bare soil evaporation rate. In addition TASCO, proposed applying wastewater at conservative increments (initial rates of 0.5 to 1.0 inch per application) to determine if there would be sufficient infiltration to prevent ponding.

The bare soil evaporation rate (potential evapotranspiration) for the Rupert area is approximately 10 inches during the growing season from April 1 through October 31. The National Weather Service Rupert station reports an average bare soil evaporation rate of 9.95 inches, and the Agrimet Rupert station reports 9.69 inches for this same time period (http://data.kimberly.uidaho.edu/ETIdaho [ET Idaho]). Using an evaporation rate of 10 inches and an irrigation efficiency of 75% for hand line sprinklers, the resulting application rate would be 13.33 inches. Assuming a 23-acre application area, this is equal to 8.33 MG. If routine tillage doubles the evaporation rate, the application volume increases to 16.66 MG.

On June 15, 2011, DEQ provided authorization to TASCO to conduct pilot/demonstration activities for applying process wastewater on the lime storage area. The authorization allowed TASCO to apply wastewater in conformance with the April 27, 2011, management plan and additional monitoring, oversight, recording, and reporting requirements specified in the authorization. The authorization expires on June 15, 2013.

In the first year of the demonstration, TASCO applied 8.73 MG (18.08 inches) of process wastewater on 17.78 acres between June 17 and September 9, 2011. TASCO submitted a report on December 14, 2011, summarizing the findings of the application activities and information required by the DEQ authorization. Moisture monitoring of the lime strata indicated no significant moisture change below the 6-inch depth.

Using ET Idaho, the bare soil evaporation rate for the period from June 17 to September 9 is 3.69 inches. Assuming an irrigation efficiency of 75%, the resulting application rate would be 4.92 inches. The actual application rate of 18.08 inches was 3.7 times the bare soil irrigation rate. This demonstrated the tillage practices significantly increased the evaporation rate.

In the second year of the demonstration, TASCO applied 11.98 MG (19.02 inches) of process wastewater on 23.2 acres between April 6 and September 8, 2012. Results were submitted in a report dated November 30, 2012. As in 2011, the moisture monitoring of the lime strata indicated no statistically significant moisture change below the 6-inch depth. The bare soil evaporation rate for the 2012 application period was 7.44 inches, and the irrigation requirement using a 75% efficiency is 9.92 inches. The application rate of 19.02 inches was 1.9 times the bare soil irrigation rate.

The goal of the pilot study was to demonstrate that essentially all of the wastewater applied could be evaporated, and moisture from application did not migrate past a depth of 6 inches below the surface. As part of the monitoring requirements, TASCO analyzed the moisture in the lime strata at 6-inch intervals to a depth of 24 inches (0–6, inches, 6–12 inches, 12–18 inches and 18–24 inches) between each application event. The data showed that no significant moisture migrated below the 6-inch depth.

The lime storage area is divided into 5 application zones, with zone 1 located on the north side and zone 5 on the south. Hand line sprinklers equipped with one-eighth inch nozzles are used for sprinkler application. Details of each zone are shown in Table 17.

Table 17. Lime storage area application zones for 2012.

Zone	Acres	Number of Hand Lines	Number of Nozzles
1	3.6	4	69
2	3.7	4	72
3	5.2	4	100
4	5.6	4	108
5	5.1	4	98
Total	23.2	20	360

DEQ recommends that application of process wastewater and condensate on the lime storage area be incorporated into the new Reuse Permit. Process wastewater was applied on the lime storage area in a manner that evaporated the majority of the water applied, and no significant migration of moisture below the 6-inch depth occurred. A major benefit of this activity will be the significant reduction in the NVDS load on the agricultural fields and resulting ground water TDS impacts. The average process wastewater generation was 17.67 MG between 1995 and 2011. The amount applied during the demonstration was 8.73 MG in 2011 and 11.98 MG in 2012. Using the lime storage area for future application has the capability of reducing the NVDS loading from process wastewater by 50% or more.

5. Permit Conditions

5.1 Hydraulic Loading Rates

Total process or condensate wastewater hydraulic limits are not necessary. The nitrogen, NVDS, and non-growing season hydraulic loading rates are designed to protect ground water.

The growing season hydraulic loading rate should be set at the irrigation water requirement (wastewater and supplemental irrigation water) for the crop being grown. The volume of supplemental irrigation is not currently measured. An estimate is currently provided using University of Idaho evapotranspiration values at http://data.kimberly.uidaho.edu/ETIdaho/

DEQ recommends the supplemental irrigation measurement in the new Reuse Permit. The data will provide actual data for use in the leaching and mixing zone models used to determine NVDS loading limits.

The non-growing season hydraulic loading rates were calculated according to the Guidance and are recommended for the TASCO Mini-Cassia Reuse Permit. The hydraulic loading limits are shown in Table 4-7 of the permit application (Appendix A) and summarized in Table 18.

Table 18. Non-growing season hydraulic loading rates.

Management Unit	Common Name	Non-growing Season Hydraulic Loading Rate Limit (inches)
MU-005001	East Farm	7.8
MU-005002	South Farm	8.5
MU-005003	Wilkins	10.2
MU-005004	Goitiandia	10.2
MU-005005	East Gillette	10.2
MU-005007	Seedall	8.2
MU-005008	West Gillette	10.1
MU-005009	South Schow	7.9
MU-005010	North Schow	9.4

5.2 Constituent Loading Rates

5.2.1 Nitrogen

The nitrogen loading rate should be set at 150% of crop uptake for all fields. The total nitrogen content in the process and condensate wastewater averaged 54,550 pounds per year for the period from 1995 to 2011. Assuming 850 acres are used for crop production, the average nitrogen application rate would be 65 lb/acre. Supplemental nitrogen fertilizer would normally be required to meet crop requirements.

Some fields have fixed numerical nitrogen limits in the current permit (i.e., North and South Schow fields have a limit of 250 pounds of nitrogen per acre). DEQ recommends all numerical limits be removed in the new Reuse Permit.

5.2.2 Phosphorus

The average phosphorus application rate from wastewater was 1.5 lb/acre for the period from 1995 to 2011. Supplemental phosphorus fertilizer would normally be required to meet crop requirements. No loading rate limits are recommended for phosphorus. Monitoring data and fertilizer reporting requirements will be sufficient to evaluate phosphorus in the new Reuse Permit.

5.2.3 Nonvolatile Dissolved Solids

NVDS is the limiting constituent for most management units because crop removal of NVDS (estimated by ash removal) is typically below NVDS application rates. Build-up of NVDS in the soil is managed to prevent salinity levels that could be detrimental to crops. Preventing excessive salinity levels is accomplished by leaching some of the NVDS through the soil column where it can enter the shallow ground water system.

The supplemental irrigation water also contains NVDS, which is not included in the current NVDS loading rate limits for some fields but is included for others. The C Canal average TDS concentration was 241 mg/L, and the NVDS concentration was 157 mg/L for samples taken in 2009–2012. Two samples taken in 1996 had an average NVDS concentration of 217 mg/L. Application of 35 inches of supplemental irrigation water from a source containing 160 mg/L of NVDS would add approximately 1,270 lb/acre of NVDS.

The contribution from irrigation water was included in the DEQ leaching and mixing zone models. These models were calibrated to actual conditions using historical loading rates and ground water conditions for various management units located at this site. The calibrated models were then used to determine NVDS loading rates that would comply with IDAPA 58.01.11.400.02 and .03.

The NVDS limit for each management unit is discussed in the following sections.

5.2.3.1 East Farm (MU-005001)

The current NVDS annual limit on the East Farm field is 7,600 lb/acre. The actual NVDS loading rate from wastewater averaged 1,612 lb/acre from 1995 to 2011. The west portion of the East Farm had very high soil nutrient and salinity levels between 2002 and 2006 due to replacement of topsoil with compost and material removed from the mud ponds. Soil concentrations peaked in 2004 and have been gradually declining over time. The downgradient ground water TDS concentrations have been relatively flat with no statistical trend.

The increase in average ground water TDS across this field is 200 mg/L (438 mg/L to 638 mg/L) or a 45% increase above the upgradient value. A portion of the increase in ground water TDS is attributable to the compost and mud pond solids applied on this field.

The NVDS limit for this management unit should be reduced from 7,600 lb/acre to a level that maintains or improves the downgradient TDS concentration. The average wastewater NVDS loading rate of 1,612 lb/acre has resulted in a stable downgradient ground water TDS concentration.

The calibrated DEQ leaching and mixing zone models were used determine the wastewater NVDS loading rate that would satisfy ground water quality protection requirements. DEQ recommends an NVDS limit of 1,200 lb/acre be set for this field.

5.2.3.2 South Farm (MU-005002)

The current NVDS annual limit on the South Farm field is 7,600 lb/acre. The actual application rate from wastewater averaged 1,920 lb/acre from 1995 to 2011. The downgradient ground water nitrate and TDS levels have been trending down over this time period.

The increase in average ground water TDS across this field is 372 mg/L (405 mg/L to 777 mg/L) or a 92% increase above the upgradient value.

The NVDS limit for this management unit should be reduced from 7,600 lb/acre to a level that improves the downgradient TDS concentration. The calibrated DEQ leaching and mixing zone models were used determine the wastewater NVDS loading rate that would satisfy ground water quality protection requirements. DEQ recommends a limit of 1,000 lb/acre be set for this field.

5.2.3.3 Wilkins (MU-005003)

The current NVDS annual limit on the Wilkins field is 642 lb/acre. The actual wastewater application rate averaged less than 10 lb/acre from 1995 to 2011.

No *edge of field* downgradient monitoring well is available for this management unit to determine ground water quality changes. This is an off-site field which receives only condensate wastewater and the current NVDS limit is acceptable to TASCO. This NVDS loading rate is below typical crop uptake and would satisfy ground water protection requirements. DEQ recommends the NVDS limit remain at 642 lb/acre.

5.2.3.4 Goitiandia (MU-005004)

The current NVDS annual limit on the Goitiandia field is 4,000 lb/acre, which includes supplemental irrigation water and a non-growing season limit of 642 lb/acre. The actual wastewater application rate averaged 82 lb/acre from 1995 to 2011.

No upgradient monitoring well is available to determine ground water quality changes for this field. Based on the calibrated DEQ leaching and mixing zone models, a wastewater NVDS loading rate of 1,900 lb/acre would satisfy ground water quality protection requirements and is recommended for the new Reuse Permit.

5.2.3.5 East Gillette (MU-005005)

The current NVDS annual limit on the East Gillette field is 4,000 lb/acre, which includes supplemental irrigation water and a non-growing season limit of 642 lb/acre. The actual wastewater application rate averaged 78 lb/acre from 1995 to 2011.

The upgradient monitoring wells (well 107 and well A) are influenced by the C Canal and mud ponds and do not provide suitable ground water quality data for comparing to downgradient ground water quality. Well 107 has an average TDS value of 624 mg/L, and well A has average TDS value of 596 mg/L. Downgradient well 121 has an average TDS value of 494 mg/L.

Based on the calibrated DEQ leaching and mixing zone models, a wastewater NVDS loading rate of 1,900 lb/acre would satisfy ground water quality protection requirements and is recommended for the new Reuse Permit.

5.2.3.6 Seedall (MU-005007)

The current NVDS annual limit on the Seedall field is 2,500 lb/acre. The actual wastewater application rate averaged 1,429 lb/acre from 1995 to 2011.

In recent years, the upgradient monitoring well (well 109) is being impacted by a source of nitrogen outside of TASCO's control. Upgradient well 109 has a mean nitrate value of 17.43 mg/L and TDS value of 433 mg/L. The downgradient Seedall well has a mean nitrate value of 7.94 mg/L and TDS value of 545 mg/L. The downgradient TDS values show a decreasing trend at the historical loading rate of 1,429 lb/acre.

Based on the calibrated DEQ leaching and mixing zone models, a wastewater NVDS loading rate of 1,600 lb/acre would satisfy ground water quality protection requirements and is recommended for the new Reuse Permit.

5.2.3.7 West Gillette (MU-005008)

The current NVDS annual limit on the West Gillette field is 642 lb/acre. The actual wastewater application rate averaged 26 lb/acre from 1995 to 2011.

No *edge of field* upgradient or downgradient monitoring well is available for this management unit to determine ground water quality changes. This is an off-site field which receives only condensate wastewater and the current NVDS limit is acceptable to TASCO. This NVDS loading rate is below typical crop uptake and would satisfy ground water protection requirements. DEQ recommends the NVDS limit remain at 642 lb/acre.

5.2.3.8 South Schow (MU-005009)

The current NVDS annual limit on the South Schow field is 4,000 lb/acre, which includes supplemental irrigation water and a non-growing season limit of 642 lb/acre. The actual wastewater application rate averaged 784 lb/acre from 1995 to 2011.

Upgradient well 114 has a mean TDS value of 521 mg/L, and downgradient well 115 has a mean value of 498 mg/L. Both wells have decreasing TDS trends. Ground water TDS quality is currently improving across this field. Based on the calibrated DEQ leaching and mixing zone models, a wastewater NVDS loading rate of 2,200 lb/acre would satisfy ground water quality protection requirements and is recommended for the new Reuse Permit.

5.2.3.9 North Schow (MU-005010)

The current NVDS annual limit on the North Schow field is 4,000 lb/acre, which includes supplemental irrigation water and a non-growing season limit of 642 lb/acre. The actual wastewater application rate averaged 143 lb/acre from 1995 to 2011.

Upgradient well 115 has a mean TDS value of 498 mg/L, and downgradient well 117 and well 118 have an average mean value of 495 mg/L. All three wells have decreasing TDS trends. Ground water TDS quality is currently improving across this field. Based on the calibrated DEQ leaching and mixing zone models, a wastewater NVDS loading rate of 1,500 lb/acre would satisfy ground water quality protection requirements and is recommended for the new Reuse Permit.

5.2.4 Chemical Oxygen Demand

The COD limits should be set at a growing season limit of 50 lb/acre-d and a non-growing season limit of 25 lb/acre-d. These limits are the consistent with the Guidance recommendations and are the same as current permit limits.

DEQ recommends the growing season (April 1 through October 31) and non-growing season (November 1 through March 31) remain the same in the new Reuse Permit.

5.2.5 Lime Storage Area (MU-005011)

Application of process wastewater on the lime storage area was discussed in section 4.4. This activity was authorized by DEQ on June 15, 2011, for a 2-year period. The authorization included monitoring and reporting requirements. The new Reuse Permit will specify revised monitoring and reporting requirements, which will supersede the authorization requirements upon issuance of the final Reuse Permit.

DEQ recommends the following limits, conditions, monitoring, and reporting requirements.

The acceptable application rate is related to the bare soil evaporation divided by the irrigation efficiency (base irrigation rate). During the pilot demonstration, TASCO applied process wastewater at 3.7 and 1.9 times the base irrigation rate and effectively evaporated all the water applied with no significant migration of moisture below the 6-inch depth. DEQ recommends the maximum application rate be set at 3 three times the base irrigation rate.

The base irrigation rate shall be calculated using the actual period of application, the National Weather Service Rupert station, or Rupert Agrimet data for bare soil potential evapotranspiration, and an irrigation efficiency of 75%. For example, if wastewater is applied from May 1 to September 30, the bare soil evaporation is 7.13 inches. Dividing by an irrigation efficiency of 0.75, the base irrigation rate is 9.51 inches. Multiplying this rate by 3 is equal to 28.5 inches. Using an application area of 23.2 acres, the maximum application volume is 18.0 MG. If the full growing application season is used (April 1 through October 31), the application volume would be 25.1 MG.

For comparison, the annual average process wastewater generation between 1995 to 2011 was 17.67 MG. Incorporating this activity in the Reuse Permit will provide TASCO with the ability to apply essentially all of the process wastewater generated on the lime storage area.

The following monitoring is recommended:

- Date and time of application for each zone and the volume of each type of wastewater applied in gallons and inches.
- Moisture monitoring at 6-inch increments to a depth of 18 inches prior to starting application, after the first application, after every fourth subsequent application, and following the final application.
- Monthly wastewater samples. Analyze for nitrogen, COD and NVDS.
- Zones and related acres used for each application season.
- Daily observation and management report during application season.

DEQ recommends the following sections of the April 27, 2011, *Management Plan for Process Water Evaporation Dry Lime Storage Area* (TASCO 2011c) be incorporated by reference in the new Reuse Permit: 3.2.2 Irrigation Frequency, 3.2.3 Dry Lime Management, 3.2.4 Buffer Zones, 3.2.5 Site Personnel and Schedule, and 3.2.6 Odor Management.

5.3 Buffer Zones

A summary of the buffer zones as of March 30, 2000, is provided in Attachment 3 of the permit application. Since that date, buffer zones were specified for MU-005009 (South Schow) and MU-005010 (North Schow) in permit modification Appendix E, dated January 10, 2002 and for MU-005004 (Goitiandia) and MU-005005 (East Gillette) in permit modification Appendix D, dated November 30, 2006. Table 19 summarizes the current buffer zones.

Table 19. Current buffer zones.

Management Unit	Common Name	Buffer Zones
MU-005001	East Farm	Not currently defined
MU-005002	South Farm	Not currently defined
MU-005003	Wilkins	Not currently defined
MU-005004	Goitiandia	Various buffer zones defined for homes, public access areas, natural and man-made surface water, and all water supply wells for process and condensate wastewater in permit modification Appendix D
MU-005005	East Gillette	Various buffer zones defined for homes, public access areas, natural and man-made surface water, and all water supply wells for process and condensate wastewater in permit modification Appendix D
MU-005007	Seedall	Not currently defined
MU-005008	West Gillette	300 feet or more between application areas and homes
MU-005009	South Schow	100 feet or more between application areas and homes
MU-005010	North Schow	100 feet or more between application areas and homes

Notes: Permit modification B dated November 27, 1996, for de minimis sites specified a buffer zone of 300 feet between homes and application sites.

DEQ recommends that a buffer zone plan be submitted as a compliance activity, identifying and updating buffer objects (homes, public access areas, surface waters, and private, public, and irrigation wells) and buffer distances that will be used, including justification for the proposed buffer distances.

5.4 Hydraulic Management Units

TASCO has not used the Fisk/Blacker property (MU-005006) for land application since 1998 and requests this management unit be removed from the new Reuse Permit. This management unit will be removed from the new Reuse Permit.

The off-site fields, Gillette West (MU-005008) and Wilkins (MU-005003), are managed by private farmers and not under the direct control of TASCO. The Wilkins field has not been used since 2005 for condensate application. TASCO requests these fields remain in the new Reuse Permit. Since TASCO has limited control over the operation and management of these fields, conservative limits should remain in place for these fields.

A new management unit will be added for the application of process wastewater on the lime storage area (MU-005011). Monitoring and reporting requirements for this activity will be included in the new Reuse Permit.

5.5 Monitoring and Reporting Requirements

The following items will be incorporated into the monitoring and reporting requirements:

- Annual report reporting period will be revised for consistency with the growing and non-growing season periods. The reporting period will cover operations from November 1 through October 31 of the following year.
- Supplemental irrigation water volume by flow meter or another method approved by DEQ.
- Supplemental irrigation water analysis.
- Biannual monitoring for all ground water monitoring wells.
- Update aquifer properties for MU-005001, MU-005002, MU-005009, and MU-005010. Provide aquifer properties or estimates for MU-005003, MU-005004, MU-005005 and MU-005008.
- Make all soil sampling requirements consistent for all management units (spring samples taken at 0–1, 1–2, and 2–3 foot intervals.
- Add management unit MU-005011 for the lime storage area. Add monitoring and reporting requirements for process wastewater application on the lime storage area.
- Coal ash wastewater analysis.
- Remove Fisk/Blacker management unit (MU-005006) from the Reuse Permit.

5.6 Compliance Activities

5.6.1 Plan of Operation

This compliance activity requires submitting a plan of operation. Once completed, the plan shall be updated as necessary to reflect changes in operational and regulatory requirements, such as the issuance of the new Reuse Permit.

5.6.2 Quality Assurance Project Plan

This compliance activity requires the preparing and implementing a Quality Assurance Project Plan (QAPP) that incorporates all monitoring and reporting required in this permit. The QAPP shall be designed to assist in planning for the collection, analysis, and reporting of all monitoring in support of the new Reuse Permit.

5.6.3 Wastewater Lagoon Seepage Analysis

This compliance activity requires an assessment of the combined effect of lagoon seepage on the local ground water. The assessment can use actual ground water monitoring data or DEQ-approved ground water modeling methods. If the assessment determines the impacts are not in compliance with IDAPA 58.01.11, the permittee shall submit, for DEQ review and approval, a plan and schedule to retest, repair, replace, or decommission the lagoons.

5.6.4 Buffer Zone Plan

DEQ recommends that TASCO submit a buffer zone plan as a compliance activity, which identifies and updates buffer objects (homes, public access areas, surface waters, and private, public, and irrigation wells) and provides justification for the proposed buffer distances.

5.6.5 Manning Property Solids Management

The Manning property had high or very high levels of nitrogen and salts (EC) in sample results submitted in 2006, and no further data have been submitted to DEQ. This area is used for staging mud pond solids, which may be causing the elevated soil concentrations. The Manning property should be soil sampled to determine if high soil concentrations still exist, and if so, a plan to reduce these concentration is recommended. High levels of nitrate-nitrogen and salts in the soil column have the potential to impact ground water quality.

5.6.6 Well Location Acceptability Analysis

Considerable efforts were made by TASCO and DEQ between 1996 and 2003 without final resolution on this analysis. Table 20 is a summary of events on the well location acceptability analysis.

Table 20. Well location acceptability analysis summary.

Date	Document	Summary
May 1, 1997	TASCO WLAA	Final WLAA submitted by TASCO to DEQ following three preliminary draft versions in 1996
May 2000	TASCO WLAA for Schow fields	TASCO submitted a separate WLAA for the Schow fields
June 27, 2001	DEQ staff analysis and draft permit modification in response to final WLAA submitted by TASCO	Required submittal of a plan within 3 months to resolve well/location deficiencies identified by DEQ and complete plan within 6 months
December 7, 2001	TASCO response to DEQ staff analysis and draft permit modification	TASCO requested removal of certain wells from the WLAA and intent to continue evaluating the remaining wells
June 5, 2002	DEQ/TASCO meeting to discuss resolution of WLAA, specifically nitrate issues	Identified 32 domestic wells having nitrate nitrogen issues to be resolved
June 13, 2002	DEQ letter to TASCO	Requested a well-by-well evaluation of 32 wells for nitrate-nitrogen within 30 days
July 1, 2002	TASCO letter to DEQ	Proposed three new monitoring wells to further define ground water conditions to the north and northeast of the factory grounds, support future WLAA work, and finish categorization of domestic wells
July 15, 2002	TASCO letter to DEQ	Requested the 32 wells be recategorized to acceptable locations based on an Environmental Performance Plan to improve ground water quality
March 10, 2003	DEQ staff analysis on TASCO July 15, 2002 letter and April 1, 2002 WLAA supplement	DEQ agreed to recategorize 8 of the wells to acceptable locations and recommended nitrate evaluation of the remainder. Tabled total dissolved solids ground water issues for the existing permit cycle based on source reduction projects including 2007 proposed elimination of lime ponds and implementation of dry lime handling
May 21, 2003	TASCO response to DEQ staff analysis dated March 10, 2003	Requested WLAA status be considered complete based on improvements made and proposed improvements to be implemented. Proposed reevaluation of WLAA in 2008 based on data provided by three new monitoring wells north of the factory grounds
August 8, 2003	DEQ response to TASCO letter dated May 21, 2003	Discussed the use of surrogate monitoring wells to assess the acceptability of domestic wells

Notes: The Amalgamated Sugar Company (TASCO); well location acceptability analysis (WLAA); Idaho Department of Environmental Quality (DEQ); In 2003, DEQ prepared a staff analysis and draft permit, but a final permit was not issued.

DEQ recommends that TASCO submit an updated well location acceptability analysis incorporating data provided by new monitoring wells and implementation of the projects to reduce ground water impacts as discussed in the last correspondence on this subject from TASCO on May 21, 2003.

6. Recommendations

Based on review of applicable state rules, DEQ recommends that draft Reuse Permit I-050-03 be issued for public review and comment.

The permit application contains the applicable requirements and conditions addressed in this staff analysis and the DEQ Guidance.

7. References

DEQ (Idaho Department of Environmental Quality). 2000. *Policy for Addressing Degraded Ground Water Quality Areas*. Boise, ID: DEQ.

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TASCO (The Amalgamated Sugar Company). 1995. TASCO Mini-Cassia Wastewater Land Application Permit Application Permit LA 000050-02. http://www.deq.idaho.gov/media/504655-amalgamated_sugar_paul_wwreuse_permit_final.pdf

TASCO (The Amalgamated Sugar Company). 2011a. *Wastewater Land Application Annual Performance Report for 2010 (September 1, 2009 to August 31, 2010)*. Permit No. LA-000050-02. Boise, ID: HDR Engineering, Inc.

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TASCO (The Amalgamated Sugar Company). 2011c. *Management Plan for Process Water Evaporation Dry Lime Storage Area (April 2011)*. Permit No. LA-000050-02. Boise, ID: HDR Engineering, Inc.

TASCO (The Amalgamated Sugar Company). 2012. *Wastewater Land Application Annual Performance Report (September 1, 2010 to August 31, 2011)*. Permit No. LA-000050-02. Paul, ID: TASCO and HDR Engineering, Inc.

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Appendix A. Section 4 Permit Application Figures and Tables

- **Figure 4-3. Soils**
- **Figure 4-4. October 2008 Ground Water Elevation Contours**
- **Figure 4-5. April 2009 Ground Water Elevation Contours**
- **Table 4-6, Summary of Soil Characteristics**
- **Table 4-7. Proposed HLR_{ngs} for TASCO Mini-Cassia**
- **Table 4-9. Shallow Aquifer Parameter Estimates Determined from Site Monitoring Well Data**

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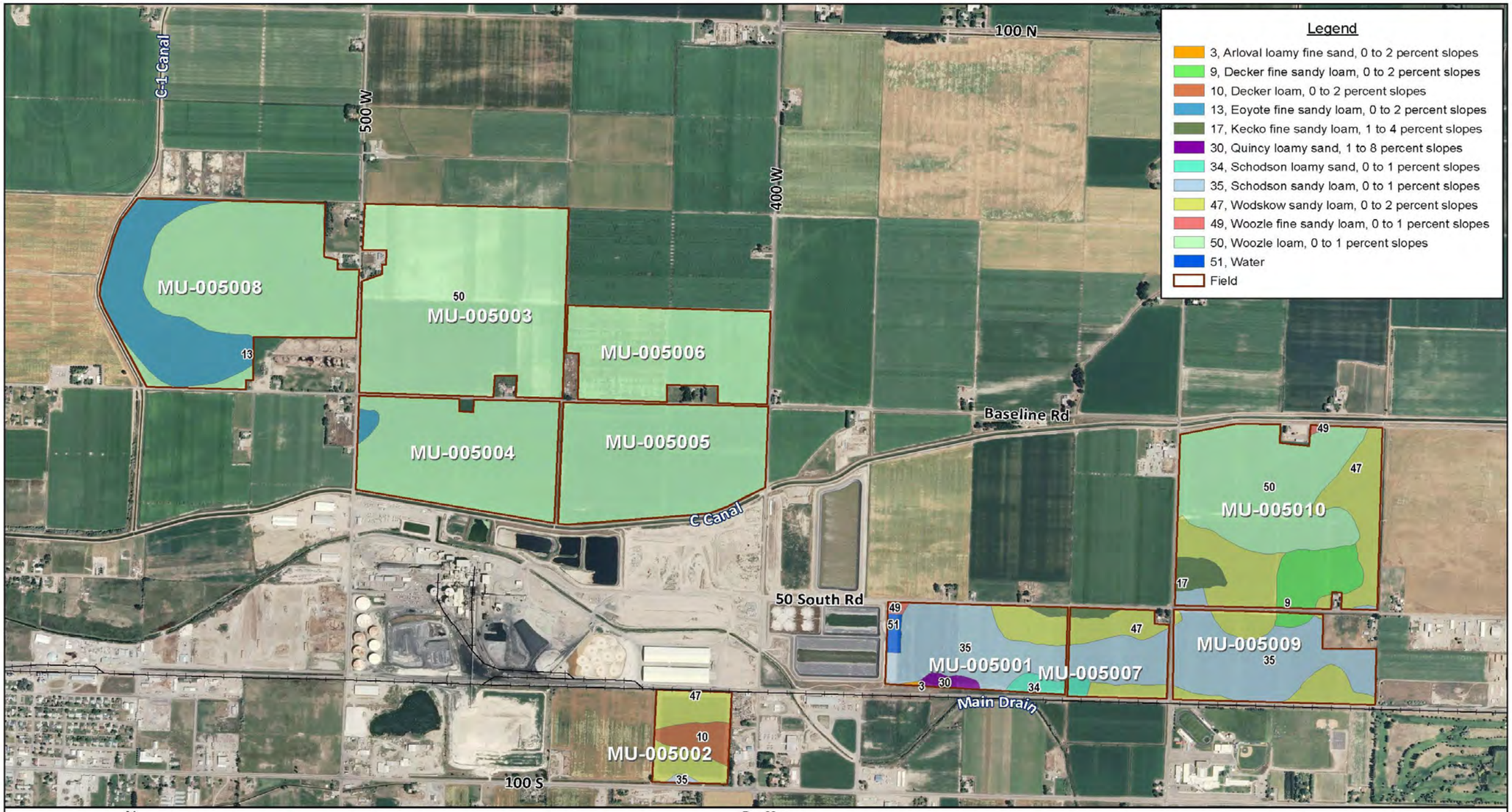

Soils
The Amalgamated Sugar Company
Mini-Cassia Facility, Paul, Idaho

Map Date: 05/19/10
Q:\TASCO\Paul\map_docs\PaulFigures.mxd

Imagery: 2009 1 meter resolution NAIP
Source: NRCS Digital Gateway
Other Data Sources:US Censue Bureau

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Figure 4-3

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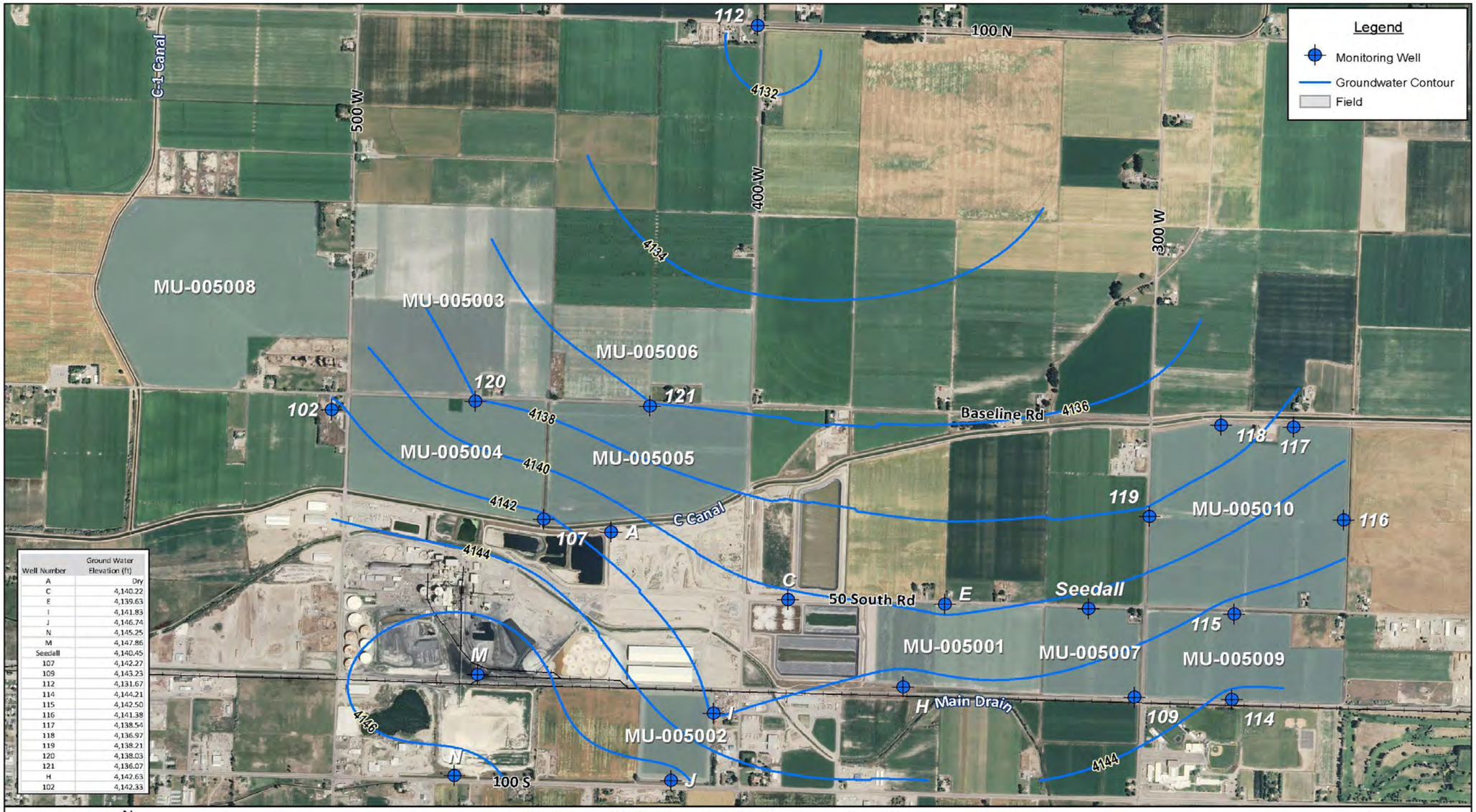

Well Number	Ground Water Elevation (ft)
A	Dry
C	4,140.22
E	4,139.63
I	4,141.83
J	4,146.74
N	4,145.25
M	4,147.86
Seedall	4,140.45
107	4,142.27
109	4,143.23
112	4,131.67
114	4,144.21
115	4,142.50
116	4,141.38
117	4,138.54
118	4,136.97
119	4,138.21
120	4,138.03
121	4,136.07
H	4,142.63
102	4,142.33

N

0 1,000 2,000 3,000 Feet

October 2008 Ground Water Elevation Contours

The Amalgamated Sugar Company
Mini-Cassia Facility, Paul, Idaho

Map Date: 05/19/10
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Imagery: 2009 1 meter resolution NAIP
Source: NRCS Digital Gateway
Other Data Sources:US Censue Bureau

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Figure 4-4

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Well Number	Ground Water Elevation (ft)
A	Dry
C	4,137.12
E	4,136.53
I	4,141.63
J	4,142.94
N	4,144.05
M	4,142.56
Seedall	4,136.95
107	4,136.97
109	Dry
112	Dry
114	4,140.51
115	4,138.30
116	4,136.08
117	4,132.24
118	4,131.17
119	4,133.71
120	4,134.63
121	4,132.47
H	4,140.53
102	Dry

N

0 1,000 2,000 3,000 Feet

April 2009 Ground Water Elevation Contours
The Amalgamated Sugar Company
Mini-Cassia Facility, Paul, Idaho

Map Date: 05/19/10
Q:\TASCO\Paul\map_docs\PaulFigures.mxd

Imagery: 2009 1 meter resolution NAIP
Source: NRCS Digital Gateway
Other Data Sources:US Census Bureau

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Figure 4-5

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TASCO-Mini-Cassia Facility

Table 4-6. Summary of Soil Characteristics

Map Unit Name[1]	Map Unit Symbol	Percent of Field	Soil Depth (in)	Typical Profile	Restrictive Layer (in)	Available Water Capacity (in/in)	Overall Available Water Capacity (in)
East Farm (MU-005001)							
Arloval loamy fine sand, 0 to 2 percent slopes	3	1	60	0-10 in: loamy fine sand 10-23 in: loamy fine sand 23-35 in: loamy fine sand 35-52 in: loamy fine sand 52-60 in: loamy sand	>80	0-10 in: 0.09-0.11 10-23 in: 0.05-0.08 23-35 in: 0.05-0.08 35-52 in: 0.05-0.08 52-60 in: 0.05-0.08	4.5
Quincy loamy sand, 1 to 8 percent slopes	30	5	70	0-16 in: loamy sand 16-36: loamy sand 36-70: stratified sand to loamy sand	> 80	0-16 in: 0.08-0.11 16-36 in: 0.08-0.11 36-70 in: 0.08-0.11	6.0
Schodson loamy sand, 0 to 1 percent slopes	34	6	60	0-9 in: loamy sand 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.06-0.08 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in: 0.08-0.10	5.7
Schodson sandy loam, 0 to 1 percent slopes	35	70	60	0-9 in: sandy loam 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.11-0.13 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in:0.08-0.10	6.1
Wodskow sandy loam, 0 to 2 percent slopes	47	15	60	0-8 in: sandy loam 8-12 in: sandy loam 12-20 in: sandy loam 20-28 in: sandy loam 28-34 in: loam 34-40 in: sandy loam 40-55 in: loamy fine sand 55-60 in: course sand	>80	0-8 in: 0.13-0.16 8-12 in: 0.13-0.16 12-20 in: 0.13-0.16 20-28 in: 0.13-0.16 28-34 in: 0.15-0.17 34-40 in: 0.13-0.16 40-55 in: 0.06-0.09 55-60 in: 0.02-0.05	7.4
Woozle fine sandy loam, 0 to 1 percent slopes	49	1	60	0-10 in: fine sandy loam 10-21 in: loam 21-35in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine same	>80	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
Kecko fine sandy loam, 1 to 4 percent slopes	17	2	62	0-4 in: fine sandy loam 4-9 in: fine sandy loam 9-21 in: fine sandy loam 21-26 in: very fine sandy loam 26-42 in: very fine sandy loam 42-62 in: stratified and to silt loam	>80	0-4 in: 0.12-0.14 4-9 in: 0.13-0.15 9-21 in: 0.13-0.15 21-26 in: 0.13-0.15 26-42 in: 0.13-0.15 42-62 in: 0.03-0.12	7.3
						Weighted Average for Available Water Capacity	6.3
South Farm (MU-005002)							
Decker loam, 0 to 2 percent slopes	10	30	65	0-10 in: fine sandy loam 10-15 in: loam 15-23 in: loam 23-29 in: loam 29-35 in: sandy loam 35-51 in: loam	>80	0-10 in: 0.07-0.11 10-15 in: 0.07-0.15 15-23 in: 0.07-0.15 23-29 in: 0.07-0.15 29-35 in: 0.17-0.15 35-51 in: 0.17-0.15	6.3

TASCO-Mini-Cassia Facility

Table 4-6. Summary of Soil Characteristics

Map Unit Name[1]	Map Unit Symbol	Percent of Field	Soil Depth (in)	Typical Profile	Restrictive Layer (in)	Available Water Capacity (in/in)	Overall Available Water Capacity (in)
				51-65 in: stratified sand to fine sand		51-65 in: 0.09-0.10	
Schodson sandy loam, 0 to 1 percent slopes	35	3	60	0-9 in: sandy loam 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.11-0.13 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in:0.08-0.10	6.1
Wodskow sandy loam, 0 to 2 percent slopes	47	67	60	0-8 in: sandy loam 8-12 in: sandy loam 12-20 in: sandy loam 20-28 in: sandy loam 28-34 in: loam 34-40 in: sandy loam 40-55 in: loamy fine sand 55-60 in: course sand	>80	0-8 in: 0.13-0.16 8-12 in: 0.13-0.16 12-20 in: 0.13-0.16 20-28 in: 0.13-0.16 28-34 in: 0.15-0.17 34-40 in: 0.13-0.16 40-55 in: 0.06-0.09 55-60 in: 0.02-0.05	7.4
						Weighted Average for Available Water Capacity	7.0
Wilkins (MU-005003)							
Woozle loam, 0 to 1 percent slopes	50	100	60	0-10 in: loam 10-21 in: loam 21-35 in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine sand	>10	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35 in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
						Weighted Average for Available Water Capacity	8.7
Goitiandia (MU-005004)							
Boyote fine sandy loam, 0 to 2 percent slopes	13	2	60	0-8 in: fine sandy loam 8-18in: fine sandy loam 18-36 in: fine sandy loam 36-60 in: fine sandy loam	>80	0-8 in: 0.13-0.16 8-18in: 0.13-0.15 18-36 in: 0.13-0.15 36-60 in: 0.13-0.15	8.5
Woozle loam, 0 to 1 percent slopes	50	98	60	0-10 in: loam 10-21 in: loam 21-35 in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine sand	>80	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35 in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
						Weighted Average for Available Water Capacity	8.7
East Gillette (MU-005005)							
Woozle loam, 0 to 1 percent slopes	50	100	60	0-10 in: loam 10-21 in: loam 21-35 in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine sand	>80	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35 in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
						Weighted Average for Available Water Capacity	8.7
Seedall (MU-005007)							
Keeko fine sandy loam, 1 to 4 percent slopes	17	5	62	0-4 in: fine sandy loam 4-9 in: fine sandy loam 9-21 in: fine sandy loam 21-26 in: very fine sandy loam	>80	0-4 in: 0.12-0.14 4-9 in: 0.13-0.15 9-21 in: 0.13-0.15 21-26 in: 0.13-0.15	7.3

TASCO-Mini-Cassia Facility

Table 4-6. Summary of Soil Characteristics

Map Unit Name[1]	Map Unit Symbol	Percent of Field	Soil Depth (in)	Typical Profile	Restrictive Layer (in)	Available Water Capacity (in/in)	Overall Available Water Capacity (in)
				26-42 in: very fine sandy loam 42-62 in: stratified and to silt loam		26-42 in: 0.13-0.15 42-62 in: 0.03-0.12	
Schodson loamy sand, 0 to 1 percent slopes	34	5	60	0-9 in: loamy sand 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.06-0.08 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in: 0.08-0.10	5.7
Schodson sandy loam, 0 to 1 percent slopes	35	52	60	0-9 in: sandy loam 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.11-0.13 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in:0.08-0.10	6.1
Wodskow sandy loam, 0 to 2 percent slopes	47	39	60	0-8 in: sandy loam 8-12 in: sandy loam 12-20 in: sandy loam 20-28 in: sandy loam 28-34 in: loam 34-40 in: sandy loam 40-55 in: loamy fine sand 55-60 in: course sand	>80	0-8 in: 0.13-0.16 8-12 in: 0.13-0.16 12-20 in: 0.13-0.16 20-28 in: 0.13-0.16 28-34 in: 0.15-0.17 34-40 in: 0.13-0.16 40-55 in: 0.06-0.09 55-60 in: 0.02-0.05	7.4
						Weighted Average for Available Water Capacity	6.7
West Gillette (MU-005008)							
Woozle loam, 0 to 1 percent slopes	50	67	60	0-10 in: loam 10-21 in: loam 21-35 in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine sand	>10	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35 in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
Eoyote fine sandy loam, 0 to 2 percent slopes	13	33	60	0-8 in: fine sandy loam 8-18in: fine sandy loam 18-36 in: fine sandy loam 36-60 in: fine sandy loam	>80	0-8 in: 0.13-0.16 8-18in: 0.13-0.15 18-36 in: 0.13-0.15 36-60 in: 0.13-0.15	8.5
						Weighted Average for Available Water Capacity	8.6
South Schow (MU-005009)							
Decker fine sandy loam, 0 to 2 percent slopes	9	3	65	0-10 in: fine sandy loam 10-15 in: loam 15-23 in: loam 23-29 in: loam 29-35 in: sandy loam 35-51 in: loam 51-65 in: stratified sand to fine sand	>80	0-10 in: 0.07-0.11 10-15 in: 0.07-0.15 15-23 in: 0.07-0.15 23-29 in: 0.07-0.15 29-35 in: 0.17-0.15 35-51 in: 0.17-0.15 51-65 in: 0.09-0.10	6.3
Schodson sandy loam, 0 to 1 percent slopes	35	73	60	0-9 in: sandy loam 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.11-0.13 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in:0.08-0.10	6.1
Wodskow sandy loam, 0 to 2 percent slopes	47	24	60	0-8 in: sandy loam	>80	0-8 in: 0.13-0.16	7.4

TASCO-Mini-Cassia Facility

Table 4-6. Summary of Soil Characteristics

Map Unit Name[1]	Map Unit Symbol	Percent of Field	Soil Depth (in)	Typical Profile	Restrictive Layer (in)	Available Water Capacity (in/in)	Overall Available Water Capacity (in)
				8-12 in: sandy loam 12-20 in: sandy loam 20-28 in: sandy loam 28-34 in: loam 34-40 in: sandy loam 40-55 in: loamy fine sand 55-60 in: course sand		8-12 in: 0.13-0.16 12-20 in: 0.13-0.16 20-28 in: 0.13-0.16 28-34 in: 0.15-0.17 34-40 in: 0.13-0.16 40-55 in: 0.06-0.09 55-60 in: 0.02-0.05	
						Weighted Average for Available Water Capacity	6.4
North Schow (MU-005010)							
Decker fine sandy loam, 0 to 2 percent slopes	9	12	65	0-10 in: fine sandy loam 10-15 in: loam 15-23 in: loam 23-29 in: loam 29-35 in: sandy loam 35-51 in: loam 51-65 in: stratified sand to fine sand	>80	0-10 in: 0.07-0.11 10-15 in: 0.07-0.15 15-23 in: 0.07-0.15 23-29 in: 0.07-0.15 29-35 in: 0.17-0.15 35-51 in: 0.17-0.15 51-65 in: 0.09-0.10	6.3
Kecko fine sandy loam, 1 to 4 percent slopes	17	4	62	0-4 in: fine sandy loam 4-9 in: fine sandy loam 9-21 in: fine sandy loam 21-26 in: very fine sandy loam 26-42 in: very fine sandy loam 42-62 in: stratified and to silt loam	>80	0-4 in: 0.12-0.14 4-9 in: 0.13-0.15 9-21 in: 0.13-0.15 21-26 in: 0.13-0.15 26-42 in: 0.13-0.15 42-62 in: 0.03-0.12	7.3
Schodson sandy loam, 0 to 1 percent slopes	35	2	60	0-9 in: sandy loam 9-25 in: sandy loam 25-32 in: loamy course sand 32-43 in: coarse sand 43-60 in: coarse sand	>80	0-9 in: 0.11-0.13 9-25 in: 0.11-0.13 25-32 in: 0.08-0.10 32-43 in: 0.08-0.10 43-60 in:0.08-0.10	6.1
Wodskow sandy loam, 0 to 2 percent slopes	47	30	60	0-8 in: sandy loam 8-12 in: sandy loam 12-20 in: sandy loam 20-28 in: sandy loam 28-34 in: loam 34-40 in: sandy loam 40-55 in: loamy fine sand 55-60 in: course sand	>80	0-8 in: 0.13-0.16 8-12 in: 0.13-0.16 12-20 in: 0.13-0.16 20-28 in: 0.13-0.16 28-34 in: 0.15-0.17 34-40 in: 0.13-0.16 40-55 in: 0.06-0.09 55-60 in: 0.02-0.05	7.4
Woozle loam, 0 to 1 percent slopes	50	52	60	0-10 in: loam 10-21 in: loam 21-35 in: silt loam 35-42 in: silty clay loam 42-47 in: loamy fine sand 47-60 in: fine sand	>10	0-10 in: 0.14-0.19 10-21 in: 0.14-0.20 21-35 in: 0.14-0.20 35-42 in: 0.14-0.20 42-47 in: 0.08-0.11 47-60 in: 0.05-0.10	8.7
						Weighted Average for Available Water Capacity	7.9

[1]Soils data based on NRCS, Minidoka Area, Idaho Soil Survey. Data downloaded from NRCS Web Soil Survey. AWC based on 60 inch depth or the restrictive layer, whichever is shallower.

TASCO-Mini-Cassia Facility

Table 4-7. Proposed HLRngs for TASCO Mini-Cassia										
Parameter	**005001 East Farm**	**005002 South Farm**	**005003 Wilkins**	**005004 Goitiandia**	**005005 East Gillette**	**005007 Seedall**	**005008 West Gillette**	**005009 S Schow**	**005010 N Schow**	**Comment**
	(inches)									
AWC	6.3	7.0	8.7	8.7	8.7	6.7	8.6	6.4	7.9	See Table 4-6
Average E	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	See Table 4-5
Precipitation	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	See Table 4-3
Proposed NGS Hydraulic Limit	**7.8**	**8.5**	**10.2**	**10.2**	**10.2**	**8.2**	**10.1**	**7.9**	**9.4**	Calculated: AWC + E – PPT_{ngs}

TASCO-Mini-Cassia Facility

Table 4-9. Shallow Aquifer Parameter Estimates Determined from Site Monitoring Well Data

Well Number	Test Date	Well Depth (ft bgs)	Pumping Rate (gpm)	Total Drawdown (feet)	Specific Capacity (gpm/ft)	Aquifer Transmissivity (gpd/ft)	Hydraulic Conductivity (ft2/day)	Hydraulic Conductivity (feet/day)	Groundwater Velocity (feet/day)	Darcy Velocity (feet/day)
East Farm Monitoring Wells										
D	1991	14.6	1.7	0.04	43	63,750	8,523	371	1.6	0.6
E	1991	16.0	18.8	1.30	14	21,692	2,900	126	0.5	0.2
F	1991	15.2	18.8	1.55	12	18,194	2,432	106	0.5	0.2
G	1991	15.8	30.0	2.81	11	16,014	2,141	93	0.4	0.1
H	1991	12.7	6.7	0.70	10	14,357	1,919	83	0.4	0.1
V	1991	17.0	30.0	2.97	10	15,152	2,026	88	0.4	0.1
Average Aquifer Parameters- East Farm					**17**	**24,860**	**3,324**	**145**	**0.6**	**0.2**
South Farm Monitoring Wells										
I	1991	13.5	20.0	3.25	6	9,231	1,234	54	0.2	0.1
J	1991	14.2	25.0	4.01	6	9,352	1,250	54	0.2	0.1
Average Aquifer Parameters- South Farm					**6**	**9,291**	**1,242**	**54**	**0.2**	**0.1**
South Schow Site Monitoring Wells										
114	Apr-99	23.0	4.0	0.12	33	50,000	6,684	291	2.3	0.8
115	Apr-99	25.1	3.0	0.09	33	50,000	6,684	291	2.3	0.8
Average Aquifer Parameters- South Schow Site					**33**	**50,000**	**6,684**	**291**	**2.3**	**0.8**
North Schow Site Monitoring Wells										
116	Oct-99	23.5	5.3	0.07	76	113,571	15,183	660	5.3	1.8
117	Oct-99	25.4	4.7	0.11	43	64,091	8,568	373	3.0	1.0
118	Oct-99	31.3	3.5	0.05	70	105,000	14,037	610	4.9	1.7
119	Oct-99	25.7	4.9	0.13	38	56,538	7,559	329	2.6	0.9
Average Aquifer Parameters- North Schow Site					**57**	**84,800**	**11,337**	**493**	**3.9**	**1.4**

Appendix B. Section 2 Permit Application Table

- **Table 2-1. Estimated Pond Wetting Periods, Surface Areas, and Operating Volumes**

TASCO-Mini-Cassia Facility

Table 2-1 Estimated Pond Wetting Periods, Surface Areas, and Operating Volumes
TASCO, Mini-Cassia

Pond	Seepage Test		Days Wetted	Surface Area	Operating Volume (MG)	
	Year	(in/day)	per year	(acres)	Minimum	Maximum
Fly Ash	1995	0.1260	268	3	0	2
Flume Excess	1995	0.0600	365	9	10	22
Mud	2007	0.1730	200 - 365	15	0	4
West Lagoon	1995	0.0100	120 - 365	5.2	0	20
East Lagoon	2005	0.1250	0 - 200	5.2	0	22
South Lagoon	2002	0.0725	0 - 200	13.25	0	66*
North Lagoon	2007	0.0520	300 - 365	19	0	81
Sanitary Lagoon	1997	0.0580	365	2	2	3
Condensate Surge Pond (Hot-tub)	1995	0.0100	300 - 365	1	0	2
Lime Pond - Abandoned	1996	0.0540	0	18		
Scrubber A - Abandoned	1996	0.0290	0	2		
Scrubber B - Abandoned	1996	0.0100	0	1		
Farm Surge Pond - Abandoned						

*South Lagoon prior to expansion in 2003 was 42 (MG)

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Appendix C. Section 3 Permit Application and 2010–2011 Annual Report Tables

- **Table 3-1. Current Permitted Loading Rates**
- **Table 3-3. Summary of Historical and Current Wastewater Loadings to the Management Units**
- **Table 3-8. East Farm (MU-005001) Groundwater Summary**
- **Table 3-9. South Farm (MU-005002) Groundwater Summary**
- **Table 3-10. Wilkins (MU-005003) Groundwater Summary**
- **Table 3-11. Goitiandia (MU-005004) Groundwater Summary**
- **Table 3-12. East Gillette (MU-005005) Groundwater Summary**
- **Table 3-13. Seedall (MU-005007) Groundwater Summary**
- **Table 3-14. South Schow (MU-005009) Groundwater Summary**
- **Table 3-15. North Schow (MU-005010) Groundwater Summary for Nitrate-N**
- **Table 3-16. North Schow (MU-005010) Groundwater Summary for TDS**

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TASCO-Mini-Cassia Facility

Table 3-1 Current Permitted Loading Rates
TASCO Mini-Cassia

Acreage/Site Loading Limits	Onsite Acreage MU-005001 & MU-005002	Onsite Acreage Goitiandia & East Gillette MU-005004 & MU-005005	Offsite Acreage	Seedall Acreage MU-005007	South Schow MU-005009	North Schow MU-005010
	Permit	Permit	Permit	Permit	Permit	Permit
Acres	87	176	395	35	65	155
WW Loading Total in.	Crop Consumptive Use Divided by Irrigation	Crop Consumptive Use Divided by Irrigation	9.5	Crop Consumptive Use Divided by Irrigation	Crop Consumptive Use Divided by Irrigation	Crop Consumptive Use Divided by Irrigation
WW Loading NGS in.	7	9.5	9.5	7	5.8	7.5
WW NVDS Loading lbs/ac/yr	7600	4000 (Total) 642 (NGS)	642	2500	4000 (Total) 642 (NGS)	4000 (Total) 642 (NGS)
GS COD Loading lb/ac/day	50	50	50	50	50	50
NGS COD Loading lb/ac/day	25	25	25	25	25	25
Nitrogen Loading lbs/ac/yr (Includes fertilizer application and WW nitrogen loadings)	150% of crop uptake or 300 lbs/ac/yr	150% of crop uptake	150% of crop uptake or 300 lbs/ac/yr	150% of crop uptake or 300 lbs/ac/yr	250 (Total) 150 (NGS)	250 (Total) 150 (NGS)
Phosphorus Loading lbs/ac/yr (Includes fertilizer application and WW phosphorus loadings)	150% of crop uptake	150% of crop uptake	150% of crop uptake	150% of crop uptake	150% of crop uptake	150% of crop uptake

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TASCO-Mini-Cassia Facility

Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units TASCO Mini-Cassia

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005001	Growing	1995-1996	4.10	1.4	932.0	30.0	
	Number of Days	1996-1997	5.45	2.7	1522.0	83.0	
	215	1997-1998	4.88	0.9	695.0	66.0	
		1998-1999	5.84	16	1935.0	142.0	
		1999-2000	0.24	0.2	32.0	5.0	
		2000-2001	6.09	0.7	77.0	118.4	
		2001-2002	3.74	2.2	1038.9	61.9	
		2002-2003	5.09	2.5	643.5	11.8	
		2003-2004	3.31	0.4	20.9	17.6	
		2004-2005	7.39	2.1	1490.0	52.3	
		2005-2006	4.09	0.2	23.6	16.0	
		2006-2007	5.76	1.8	2158.3	47.0	
		2007-2008	7.61	1.5	1414.4	87.6	
		2008-2009	8.40	3.5	1661.2	44.4	
	Non-Growing	1995-1996	0.00	0.0	0.0	0.0	
	Number of Days	1996-1997	0.00	0.0	0.0	0.0	
	150	1997-1998	0.00	0.0	0.0	0.0	
		1998-1999	3.31	17.0	1059.0	49.0	
		1999-2000	6.76	4.7	193.0	150.0	
		2000-2001	4.69	2.2	20.9	100.2	
		2001-2002	5.75	1.0	147.2	101.7	
East Farm		2002-2003	3.25	1.3	47.3	47.4	
		2003-2004	2.20	0.4	0.5	23.4	
		2004-2005	0.00	0.0	0.0	0.0	
		2005-2006	3.75	0.8	0.9	47.2	
		2006-2007	0.00	0.0	0.0	0.0	
		2007-2008	0.00	0.0	0.0	0.0	
		2008-2009	1.55	0.1	10.5	23.2	
	Total	1995-1996	4.10	0.8	932.0	30.0	111
	Number of Days	1996-1997	5.45	1.6	1522.0	83.0	6
	365	1997-1998	4.88	0.5	695.0	66.0	6
		1998-1999	9.15	16.4	2994.0	191.0	6
		1999-2000	7.00	2.1	225.0	155.0	0
		2000-2001	10.78	1.3	97.9	218.6	50
		2001-2002	9.49	1.7	1186.1	163.6	0
		2002-2003	8.34	2.0	690.8	59.2	0
		2003-2004	5.51	0.4	21.4	41.0	37
		2004-2005	7.39	1.2	1490.0	52.3	0
		2005-2006	7.84	0.4	24.5	63.2	14.93
		2006-2007	5.76	1.1	2158.3	47.0	36
		2007-2008	7.61	0.9	1414.4	87.6	85
		2008-2009	9.95	2.09	1671.7	67.6	72

TASCO-Mini-Cassia Facility

Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005002	Growing	1995-1996	4.10	1.7	940.0	28.0	
	Number of Days	1996-1997**					
	215	1997-1998	4.05	1.8	1180.0	23.0	
		1998-1999	4.63	19.0	2184.0	134.0	
		1999-2000	3.40	1.8	1697.0	32.0	
		2000-2001	7.34	4.8	766.4	139.6	
		2001-2002	6.56	2.0	800.5	104.3	
		2002-2003	10.15	5.8	1336.2	55.0	
		2003-2004	6.65	4.0	4283.1	135.8	
		2004-2005	12.55	4.3	3388.2	92.5	
		2005-2006	6.43	0.3	37.2	25.3	
		2006-2007	8.17	4.9	5476.0	77.3	
		2007-2008	0.00	0.0	0.0	0.0	
		2008-2009	13.87	9.1	2307.6	122.4	
	Non-Growing	1995-1996	0.00	0.0	0.0	0.0	
	Number of Days	1996-1997**					
	150	1997-1998	0.00	0.0	0.0	0.0	
		1998-1999	4.32	22.0	1382.0	64.0	
		1999-2000	6.12	5.4	229.0	139.0	
		2000-2001	4.58	1.6	15.6	96.9	
		2001-2002	0.87	0.2	22.3	15.4	
South Farm		2002-2003	3.10	2.2	154.7	21.1	
		2003-2004	0.00	0.0	0.0	0.0	
		2004-2005	0.00	0.0	0.0	0.0	
		2005-2006	5.46	1.1	1.2	60.1	
		2006-2007	0.00	0.0	0.0	0.0	
		2007-2008	8.03	2.0	109.1	148.4	
		2008-2009	0.00	0.0	0.0	0.0	
	Total	1995-1996	4.10	1.0	940.0	28.0	124
	Number of Days	1996-1997**					310
	365	1997-1998	4.05	1.1	1180.0	23.0	6
		1998-1999	8.95	20.2	3566.0	198.0	6
		1999-2000	9.52	3.3	1926.0	171.0	22
		2000-2001	11.92	3.5	782.0	236.6	0
		2001-2002	7.43	1.3	822.8	119.7	0
		2002-2003	13.25	4.3	1490.9	76.1	0
		2003-2004	6.65	2.4	4283.1	135.8	133
		2004-2005	12.55	2.5	3388.2	92.5	0
		2005-2006	11.89	0.6	38.4	85.4	17
		2006-2007	8.17	2.9	5476.0	77.3	0
		2007-2008	8.03	0.8	109.1	148.4	61
		2008-2009	13.87	5.36	2307.6	122.4	0

TASCO-Mini-Cassia Facility

Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005003	Growing	1995-1996	0.00	0	0.0	0.0	
	Number of Days	1996-1997	0.00	0	0.0	0.0	
	215	1997-1998**					
		1998-1999	1.86	0.3	36.0	39.0	
		1999-2000**					
		2000-2001**					
		2001-2002	0.00	0.0	0.0	0.0	
		2002-2003**					
		2003-2004	1.49	0.1	0.3	20.6	
		2004-2005	0.00	0.0	0.0	0.0	
		2005-2006**					
		2006-2007**					
		2007-2008**					
		2008-2009**					
	Non-Growing	1995-1996	3.39	1.9	39.0	105.0	
	Number of Days	1996-1997	5.30	1.3	62.0	141.0	
	150	1997-1998**					
		1998-1999	3.30	0.7	84.0	102.0	
		1999-2000**					
		2000-2001**					
		2001-2002	2.23	0.4	12.6	45.5	
		2002-2003**					
Wilkins		2003-2004	0.00	0.0	0.0	0.0	
		2004-2005	1.40	0.3	4.9	16.6	
		2005-2006**					
		2006-2007**					
		2007-2008**					
		2008-2009**					
	Total	1995-1996	3.39	0.8	39.0	105.0	118
	Number of Days	1996-1997	5.30	0.5	62.0	141.0	66
	365	1997-1998**					
		1998-1999	5.16	0.5	120.0	141.0	110
		1999-2000**					
		2000-2001**					122
		2001-2002	2.23	0.2	12.6	45.5	106
		2002-2003**					114
		2003-2004	1.49	0.1	0.3	20.6	95
		2004-2005	1.40	0.1	4.9	16.6	57.6
		2005-2006**					98.8
		2006-2007**					19
		2007-2008**					58
		2008-2009**					96.2

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Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005004	Growing	1995-1996	3.00	0.4	7.0	73.0	
	Number of Days	1996-1997	2.96	0.8	86.0	118.0	
	215	1997-1998	2.64	0.3	17.0	85.0	
		1998-1999	3.63	0.5	73.0	81.0	
		1999-2000	3.84	0.53	14.0	100.0	
		2000-2001	3.98	0.47	49.6	77.2	
		2001-2002	6.88	0.88	101.7	125.8	
		2002-2003	5.01	0.70	71.6	70.1	
		2003-2004	5.00	0.50	10.8	77.6	
		2004-2005	5.80	0.40	61.4	61.6	
		2005-2006	2.68	0.20	0.6	46.2	
		2006-2007††	5.70	0.90	24.4	81.1	
		2007-2008	5.11	0.70	11.6	84.4	
		2008-2009	4.83	0.79	105.6	72.5	
	Non-Growing	1995-1996	1.29	0.30	7.0	40.0	
	Number of Days	1996-1997	0.00	0.00	0.0	0.0	
	150	1997-1998	1.04	0.20	8.0	40.0	
		1998-1999	0.00	0.00	0.0	0.0	
		1999-2000	0.00	0.00	0.0	0.0	
		2000-2001	0.40	0.15	2.8	8.7	
		2001-2002	0.00	0.00	0.0	0.0	
		2002-2003	0.00	0.00	0.0	0.0	
Goitiandia		2003-2004	1.84	0.60	11.2	7.7	
		2004-2005	3.43	0.80	0.8	46.6	
		2005-2006	4.74	2.80	4.0	74.5	
		2006-2007††	0.00	0.00	0.0	0.0	
		2007-2008	2.73	1.10	35.1	59.3	
		2008-2009	4.63	1.37	21.0	89.0	
	Total	1995-1996	4.29	0.4	14.0	113.0	82
	Number of Days	1996-1997	2.96	0.5	86.0	118.0	120
	365	1997-1998	3.68	0.3	25.0	125.0	134
		1998-1999	3.63	0.3	73.0	81.0	224
		1999-2000	3.84	0.3	14.0	100.0	93
		2000-2001	4.38	0.3	52.4	85.9	65
		2001-2002	6.88	0.5	101.7	125.8	84
		2002-2003	5.01	0.4	71.6	70.1	9
		2003-2004	6.84	0.5	22.0	85.3	57
		2004-2005	9.23	0.6	62.2	108.2	39.2
		2005-2006	7.42	1.3	4.6	120.7	70.4
		2006-2007††	5.70	0.5	24.4	81.1	0
		2007-2008	7.84	0.9	46.7	143.7	0
		2008-2009	9.46	1.0	126.6	161.5	0

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Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005005	Growing	1995-1996	5.30	1.00	49.0	122.0	
	Number of Days	1996-1997	0.00	0.00	0.0	0.0	
	215	1997-1998	3.57	0.70	10.0	102.0	
		1998-1999	0.00	0.00	0.0	0.0	
		1999-2000**					
		2000-2001**					
		2001-2002	2.35	0.31	31.9	40.4	
		2002-2003	5.16	0.70	59.8	66.0	
		2003-2004	0.00	0.00	0.0	0.0	
		2004-2005	4.96	0.30	35.7	48.2	
		2005-2006	1.63	0.10	0.4	28.1	
		2006-2007††	0.00	0.00	0.0	0.0	
		2007-2008	0.00	0.00	0.0	0.0	
		2008-2009	2.59	0.42	93.9	41.7	
	Non-Growing	1995-1996	0.00	0.00	0.0	0.0	
	Number of Days	1996-1997	5.40	1.40	173.0	318.0	
	150	1997-1998	0.00	0.00	0.0	0.0	
		1998-1999	7.96	1.40	203.0	246.0	
		1999-2000**					
		2000-2001**					
		2001-2002	3.59	1.07	22.9	63.0	
East Gillette		2002-2003	0.00	0.00	0.0	0.0	
		2003-2004	4.70	1.90	11.3	60.3	
		2004-2005	0.00	0.00	0.0	0.0	
		2005-2006	7.12	4.60	1.6	118.5	
		2006-2007††	6.31	2.20	237.4	107.2	
		2007-2008	8.70	2.20	51.1	221.0	
		2008-2009	3.14	0.93	14.2	60.3	
	Total	1995-1996	5.30	0.6	49.0	122.0	220
	Number of Days	1996-1997	5.40	0.6	173.0	318.0	160
	365	1997-1998	3.57	0.4	10.0	102.0	123
		1998-1999	7.96	0.6	203.0	246.0	0
		1999-2000**					255
		2000-2001**					37
		2001-2002	5.94	0.6	54.8	103.4	220
		2002-2003	5.16	0.4	59.8	66.0	9
		2003-2004	4.70	0.8	11.3	60.3	175
		2004-2005	4.96	0.2	35.7	48.2	0
		2005-2006	8.75	1.9	2.0	146.6	10
		2006-2007††	6.31	0.9	237.4	107.2	13
		2007-2008	8.70	0.9	51.1	221.0	38
		2008-2009	5.73	0.6	108.1	102.0	10

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Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005006	Growing	1995-1996	0.00	0.0	0.0	0.0	
	Number of Days	1996-1997	0.00	0.0	0.0	0.0	
	215	1997-1998	0.00	0.0	0.0	0.0	
		1998-1999**	0.00	0.0	0.0	0.0	
		1999-2000**	0.00	0.0	0.0	0.0	
		2000-2001**	0.00	0.0	0.0	0.0	
		2001-2002**	0.00	0.0			
		2002-2003**	0.00	0.0			
		2003-2004**	0.00	0.0			
		2004-2005**	0.00	0.0			
		2005-2006**	0.00	0.0			
		2006-2007**	0.00	0.0			
		2007-2008**	0.00	0.0			
		2008-2009**	0.00	0.0			
	Non-Growing	1995-1996	5.66	2.1	6.0	145.0	
	Number of Days	1996-1997	6.20	1.7	78.0	166.0	
	150	1997-1998	4.67	2.1	28.0	243.0	
		1998-1999**	0.00	0.0	0.0	0.0	
		1999-2000**	0.00	0.0	0.0	0.0	
		2000-2001**	0.00	0.0	0.0	0.0	
		2001-2002**	0.00	0.0			
Fisk/Blacker		2002-2003**	0.00	0.0			
		2003-2004**	0.00	0.0			
		2004-2005**	0.00	0.0			
		2005-2006**	0.00	0.0			
		2006-2007**	0.00	0.0			
		2007-2008**	0.00	0.0			
		2008-2009**	0.00	0.0			
	Total	1995-1996	5.66	0.9	6.0	145.0	165
	Number of Days	1996-1997	6.20	0.7	78.0	166.0	70
	365	1997-1998	4.67	0.9	28.0	243.0	0
		1998-1999**					ND
		1999-2000**					ND
		2000-2001**					0
		2001-2002**					ND
		2002-2003**					52
		2003-2004**					282
		2004-2005**					50
		2005-2006**					51.5
		2006-2007**					100
		2007-2008**					9.9
		2008-2009**					75

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Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005007	Growing	1995-1996	7.20	2.4	1383.0	59.0	
	Number of Days	1996-1997	4.00	1.6	1123.0	61.0	
	215	1997-1998	3.70	0.8	489.0	51.0	
		1998-1999	5.51	17.0	1960.0	142.0	
		1999-2000	5.92	4.1	2180.0	79.0	
		2000-2001	8.07	7.2	1266.8	141.6	
		2001-2002	5.07	3.6	1231.2	79.5	
		2002-2003	8.82	0.8	191.7	47.9	
		2003-2004	5.13	3.5	424.6	88.2	
		2004-2005	6.92	2.6	2156.6	53.4	
		2005-2006	0.00	0.0	0.0	0.0	
		2006-2007	6.38	1.2	2226.2	68.8	
		2007-2008	8.82	1.5	1589.9	114.6	
		2008-2009	4.24	0.9	795.6	44.2	
	Non-Growing	1995-1996	0.00	0.0	0.0	0.0	
	Number of Days	1996-1997	0.00	0.0	0.0	0.0	
	150	1997-1998	0.00	0.0	0.0	0.0	
		1998-1999	1.13	5.0	408.0	15.0	
		1999-2000	5.45	5.2	230.0	125.0	
		2000-2001	3.59	1.3	569.2	76.0	
		2001-2002	4.81	0.8	123.0	85.0	
		2002-2003	0.20	0.1	3.0	2.9	
Seedall		2003-2004	0.00	0.0	0.0	0.0	
		2004-2005	0.00	0.0	0.0	0.0	
		2005-2006	5.47	2.5	1.2	138.8	
		2006-2007	4.18	1.5	90.4	59.0	
		2007-2008	6.23	1.5	84.6	115.2	
		2008-2009	3.18	0.3	21.7	47.8	
	Total	1995-1996	7.20	1.4	1383.0	59.0	83
	Number of Days	1996-1997	4.00	0.4	1123.0	61.0	6
	365	1997-1998	3.70	0.5	489.0	51.0	6
		1998-1999	6.64	12.1	2368.0	157.0	6
		1999-2000	11.37	4.6	2410.0	204.0	22
		2000-2001	11.66	4.8	1836.0	217.6	0
		2001-2002	9.88	2.5	1354.2	164.5	0
		2002-2003	9.02	0.5	194.7	50.9	0
		2003-2004	5.13	2.1	424.6	88.2	122
		2004-2005	6.92	1.5	2156.6	53.4	0
		2005-2006	5.47	1.0	1.2	138.8	0
		2006-2007	10.56	1.3	2316.6	127.8	11
		2007-2008	15.05	1.5	1674.5	229.8	14
		2008-2009	7.42	0.6	817.3	92.0	0

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Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005008	Growing	1995-1996	0.00	0.00	0.0	0.0	
	Number of Days	1996-1997	0.00	0.00	0.0	0.0	
	215	1997-1998	2.00	0.29	13.0	65.0	
		1998-1999**	0.00	0.00	0.0	0.0	
		1999-2000	3.10	0.50	16.0	78.0	
		2000-2001	0.00	0.00	0.0	0.0	
		2001-2002**	0.00	0.00	0.0	0.0	
		2002-2003	0.69	0.10	9.9	9.7	
		2003-2004	0.12	0.00	0.3	1.9	
		2004-2005**	0.00	0.00	0.0	0.0	
		2005-2006**	0.00	0.00	0.0	0.0	
		2006-2007	2.48	0.40	16.8	36.5	
		2007-2008	2.08	0.30	4.7	32.9	
		2008-2009	1.07	0.07	4.9	16.1	
	Non-Growing	1995-1996	0.00	0.00	0.0	0.0	
	Number of Days	1996-1997	2.10	1.30	27.2	58.0	
	150	1997-1998	4.40	0.92	35.0	186.0	
		1998-1999**	0.00	0.00	0.0	0.0	
		1999-2000	0.86	0.00	0.0	20.0	
		2000-2001	2.64	1.00	25.0	58.0	
		2001-2002**	0.00	0.00	0.0	0.0	
West Gillette		2002-2003	1.19	0.60	13.5	13.2	
		2003-2004	2.46	0.70	16.7	7.4	
		2004-2005**	0.00	0.00	0.0	0.0	
		2005-2006**	0.00	0.00	0.0	0.0	
		2006-2007	1.90	0.60	103.2	30.0	
		2007-2008	0.00	0.00	0.0	0.0	
		2008-2009	0.00	0.00	0.0	0.0	
	Total	1995-1996					
	Number of Days	1996-1997	2.10	0.5	27.2	58.0	200
	365	1997-1998	6.40	0.5	48.0	251.0	142
		1998-1999**	0.00	0.0	0.0	0.0	ND
		1999-2000	3.96	0.3	16.0	98.0	101
		2000-2001	2.64	0.4	25.0	58.0	237
		2001-2002**					109
		2002-2003	1.88	0.3	23.4	22.9	72
		2003-2004	2.58	0.3	17.0	9.3	235
		2004-2005**					131.3
		2005-2006**					18
		2006-2007	4.38	0.5	120.0	66.5	164
		2007-2008	2.08	0.2	4.7	32.9	190
		2008-2009	1.07	0.04	4.9	16.1	20

TASCO-Mini-Cassia Facility

Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005009	Growing	1995-1996					
	Number of Days	1996-1997					
	215	1997-1998					
		1998-1999†	0.68	24	719.0	23.0	
		1999-2000	5.52	4.2	1982.3	75.0	
		2000-2001	5.10	7.1	2770.3	71.2	
		2001-2002	6.33	2.4	427.9	94.8	
		2002-2003	2.77	3.6	917.3	5.0	
		2003-2004	5.55	2.2	253.5	56.5	
		2004-2005	4.83	0.3	14.9	20.3	
		2005-2006	2.60	0.2	4.4	29.5	
		2006-2007	4.41	0.6	1588.9	56.9	
		2007-2008	8.21	0.7	488.8	104.3	
		2008-2009	5.70	4.2	450.3	60.4	
	Non-Growing	1995-1996					
	Number of Days	1996-1997					
	150	1997-1998					
		1998-1999†	0.00	0.00			
		1999-2000	3.23	0.96	4.7	56.0	
		2000-2001	6.23	4.10	30.8	128.8	
		2001-2002	3.40	1.23	9.2	68.9	
South Schow		2002-2003	5.06	2.50	66.8	69.6	
		2003-2004	0.14	0.00	0.0	1.4	
		2004-2005	0.00	0.00	0.0	0.0	
		2005-2006	2.00	0.40	0.5	22.1	
		2006-2007	0.00	0.00	0.0	0.0	
		2007-2008	4.59	1.10	54.1	80.5	
		2008-2009	0.00	0.00	0.0	0.0	
	Total	1995-1996					
	Number of Days	1996-1997					
	365	1997-1998					
		1998-1999†	0.68	2.0	719.0	23.0	20
		1999-2000	8.75	2.9	1987.0	131.0	22
		2000-2001	11.33	5.9	2801.1	200.0	0
		2001-2002	9.73	1.9	437.1	163.7	0
		2002-2003	7.83	3.1	984.1	74.6	0
		2003-2004	5.68	1.3	253.5	57.9	65
		2004-2005	4.83	0.2	14.9	20.3	46
		2005-2006	4.60	0.3	4.9	51.6	0
		2006-2007	4.41	0.4	1588.9	56.9	11
		2007-2008	12.80	0.9	542.9	184.8	17.5
		2008-2009	5.70	2.47	450.3	60.4	0

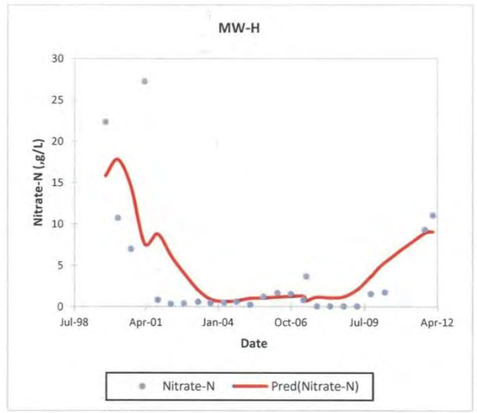
TASCO-Mini-Cassia Facility

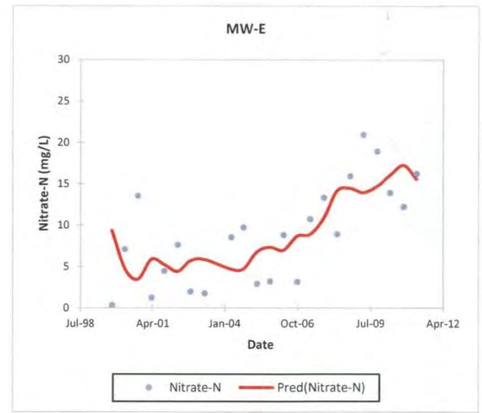
Table 3-3 Summary of Historical and Current Waste Water Loadings to the Management Units

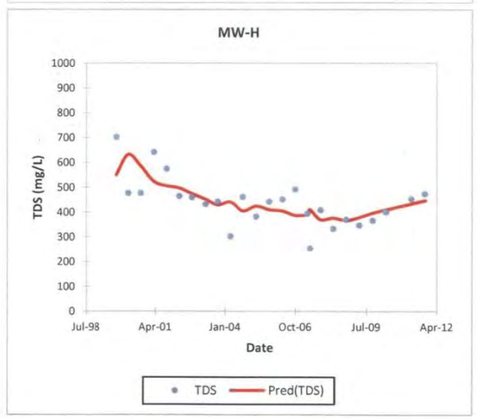
	Season	Campaign	Hydraulic Applied	COD Applied	NVDS Applied	Total Nitrogen	
						Wastewater	Fertilizer
			(in/ac/yr)	(lb/ac/day)	(lb/ac/yr)	(lb/ac/yr)	(lb/ac/yr)
MU-005010	Growing	1995-1996					
	Number of Days	1996-1997					
	215	1997-1998					
		1998-1999					
		1999-2000†					
		2000-2001					
		2001-2002	1.45	0.14	4.9	22.4	
		2002-2003	1.12	0.10	48.9	7.0	
		2003-2004	0.67	0.10	0.2	3.0	
		2004-2005	1.60	0.10	0.4	4.9	
		2005-2006	3.45	0.30	4.3	42.0	
		2006-2007	1.20	0.40	744.4	14.9	
		2007-2008	3.40	0.30	45.2	37.1	
		2008-2009	1.04	0.47	173.7	12.2	
	Non-Growing	1995-1996					
	Number of Days	1996-1997					
	150	1997-1998					
		1998-1999					
		1999-2000†	0.32	0.00	0.6	5.8	
		2000-2001	5.25	4.33	22.0	115.3	
		2001-2002	2.83	1.80	4.2	53.0	
North Schow		2002-2003	3.77	2.20	45.0	49.0	
		2003-2004	4.49	1.00	1.0	48.6	
		2004-2005	4.11	1.20	0.9	65.0	
		2005-2006	6.29	2.30	1.4	129.5	
		2006-2007	5.64	3.50	183.2	78.1	
		2007-2008	1.40	0.30	15.2	23.9	
		2008-2009	3.63	0.32	324.7	54.6	
	Total	1995-1996					
	Number of Days	1996-1997					
	365	1997-1998					
		1998-1999					
		1999-2000†	0.32	0.0	0.6	5.8	
		2000-2001	5.25	1.8	22.0	115.3	0
		2001-2002	4.28	0.8	9.1	75.4	0
		2002-2003	4.89	1.0	93.9	56.0	0
		2003-2004	5.16	0.5	1.2	51.6	0
		2004-2005	5.71	0.6	1.3	69.9	0
		2005-2006	9.74	1.1	5.7	171.5	0
		2006-2007	6.84	1.7	927.6	93.0	100
		2007-2008	4.80	0.3	60.4	61.0	39.4
		2008-2009	4.67	0.4	498.4	66.8	19.9

Table 3-8. East Farm (MU-005001) Groundwater Summary

Irrigation Acreage	60
Gradient ft/ft	0.002
Groundwater Direction	North
Groundwater Velocity, ft/day	0.6
Travel time for conservative compound from upgradient well to downgradient well (approximate)	6 years
Upgradient Wells	H
Downgradient Wells	E







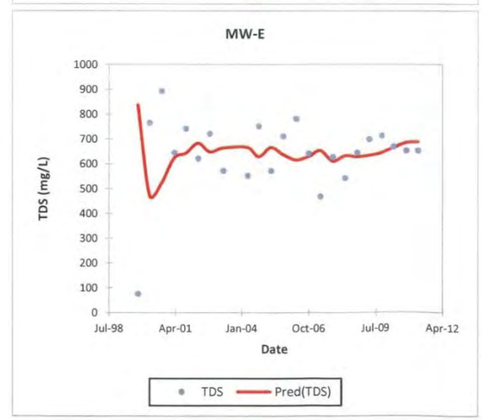
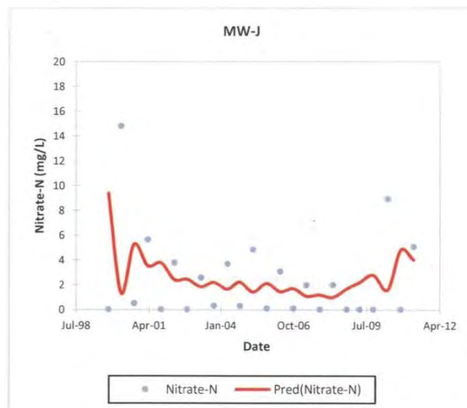
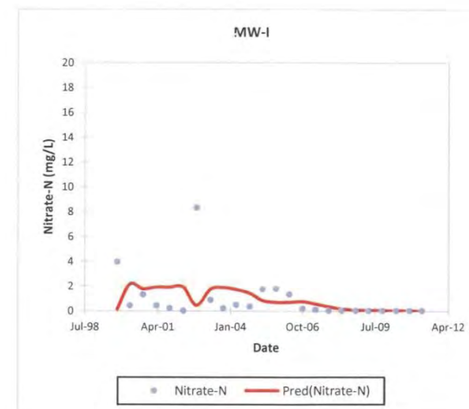
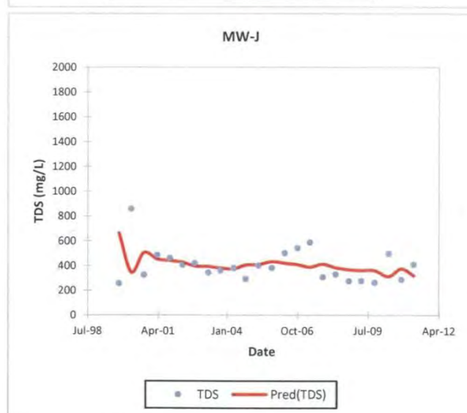


Table 3-9. South Farm (MU-005002) Groundwater Summary

Irrigation Acreage	27
Gradient ft/ft	0.002
Groundwater Direction	Northeast
Groundwater Velocity, ft/day	0.2
Travel time for conservative compound from upgradient well to downgradient well (approximate)	13 years
Upgradient Wells	J
Downgradient Wells	I







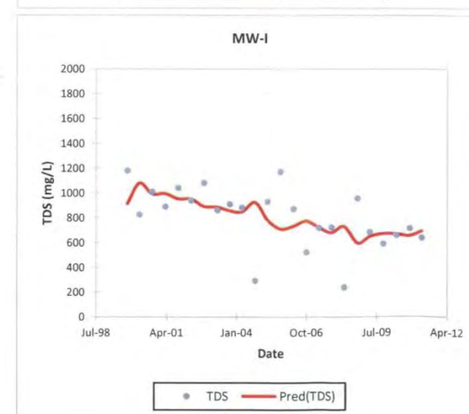
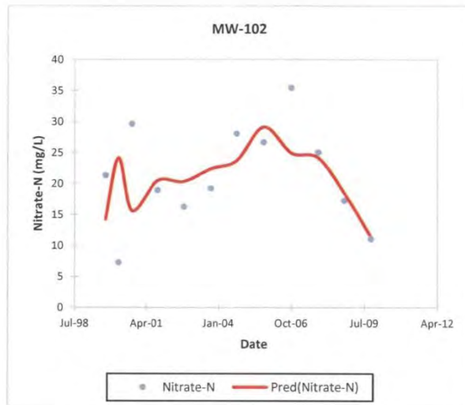
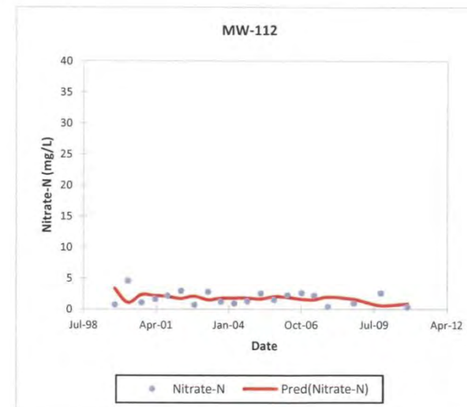
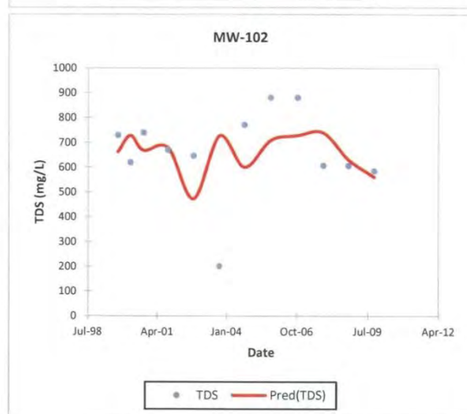


Table 3-10. Wilkins (MU-005003) Groundwater Summary

Irrigation Acreage	160
Gradient ft/ft	0.003
Groundwater Direction	Northeast
Groundwater Velocity, ft/day	0.5
Travel time for conservative compound from upgradient well to downgradient well (approximate)	40 years
Upgradient Wells	102
Downgradient Wells	112







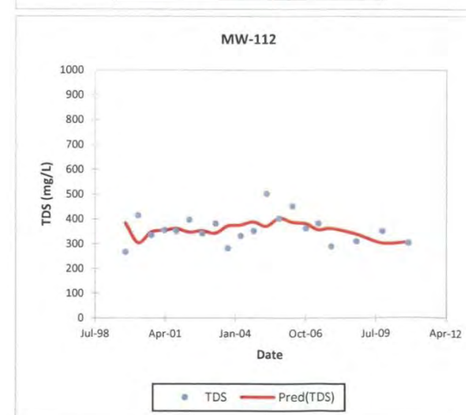
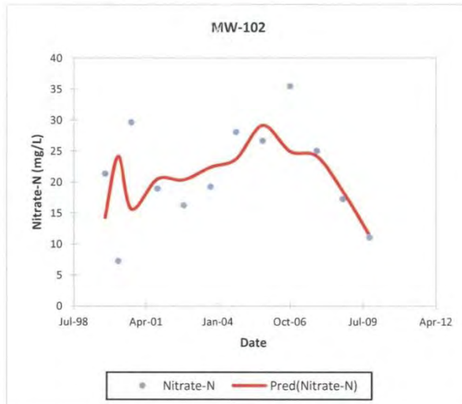
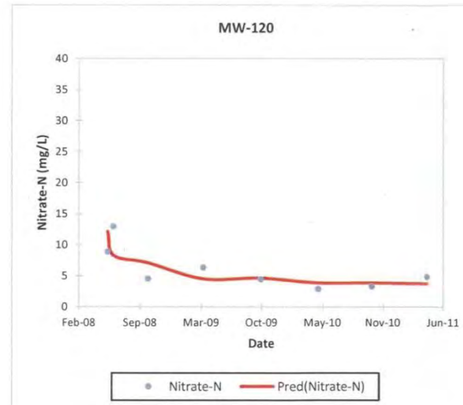
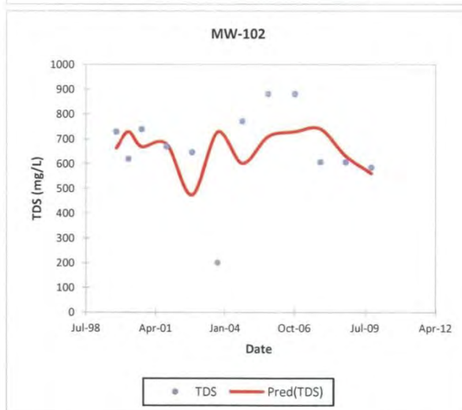


Table 3-11. Goitiandia (MU-005004) Groundwater Summary

Irrigation Acreage	87
Gradient ft/ft	0.003
Groundwater Direction	Northeast
Groundwater Velocity, ft/day	0.5
Travel time for conservative compound from upgradient well to downgradient well (approximate)	N/A
Upgradient Wells	122 (proposed well); 102 is cross-gradient
Downgradient Wells	120







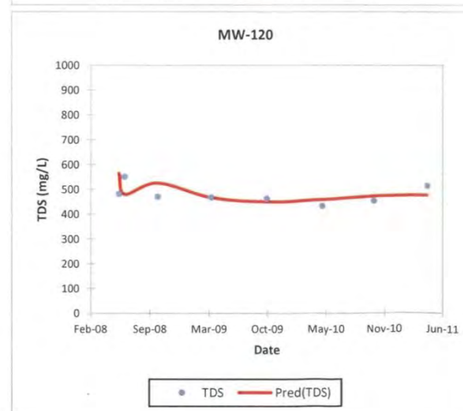
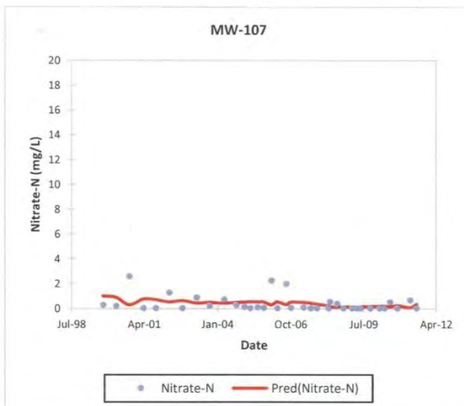
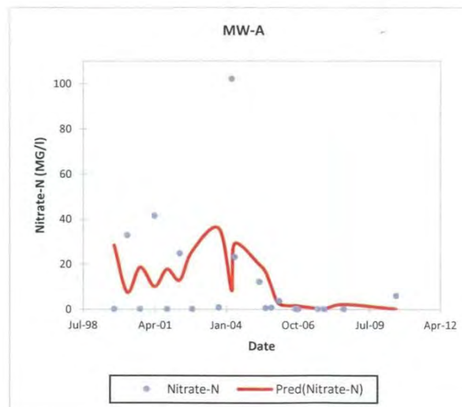
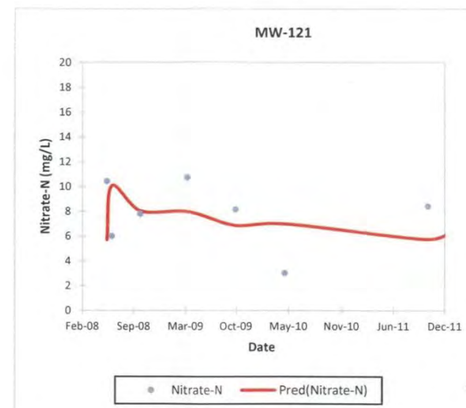


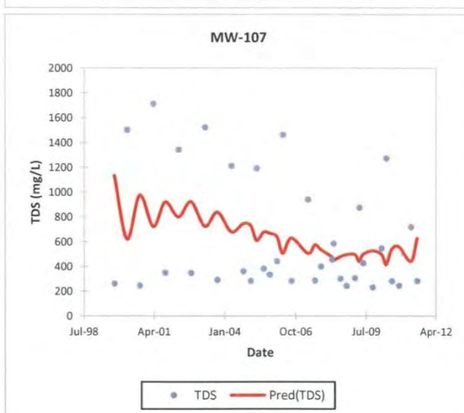
Table 3-12. East Gillette (MU-005005) Groundwater Summary

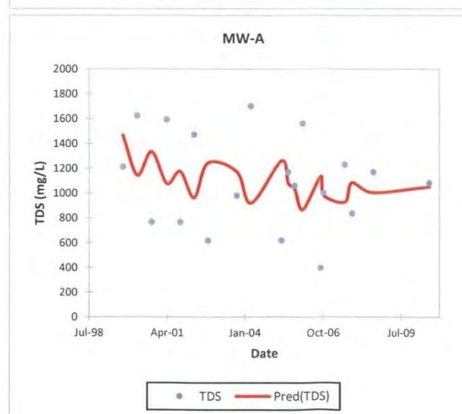
Irrigation Acreage	89
Gradient ft/ft	0.003
Groundwater Direction	Northeast
Groundwater Velocity, ft/day	0.5
Travel time for conservative compound from upgradient well to downgradient well (approximate)	10 years
Upgradient Wells	107, A
Downgradient Wells	121











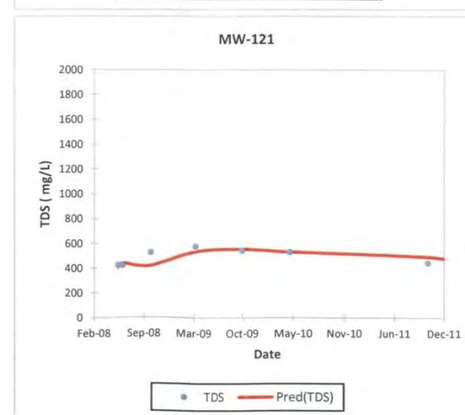
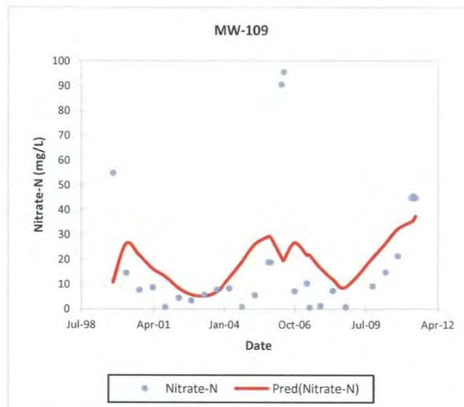
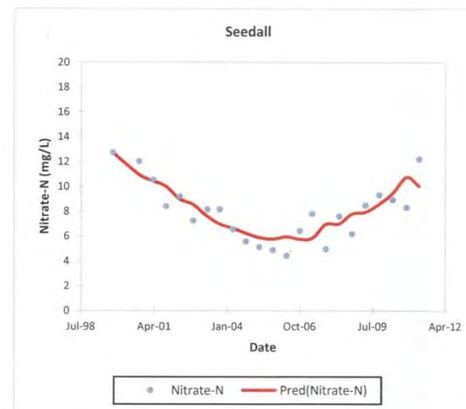
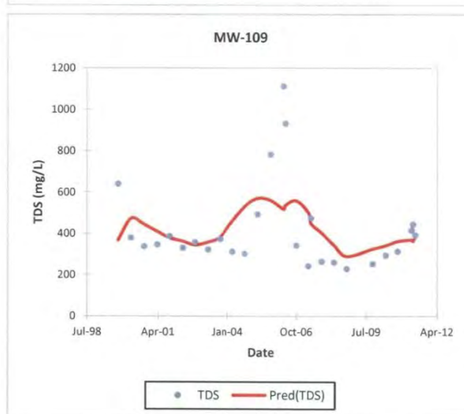


Table 3-13. Seedall (MU-005007) Groundwater Summary

Irrigation Acreage	35
Gradient ft/ft	0.003
Groundwater Direction	Northwest
Groundwater Velocity, ft/day	1.4
Travel time for conservative compound from upgradient well to downgradient well (approximate)	2 years
Upgradient Wells	109
Downgradient Wells	Seedall







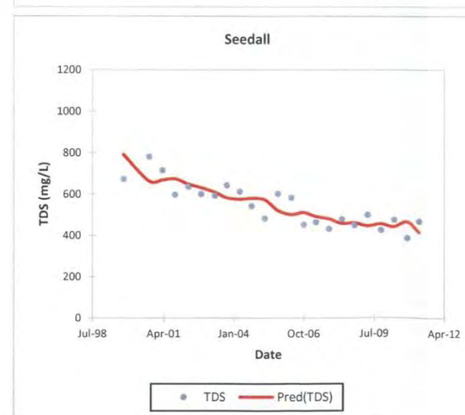
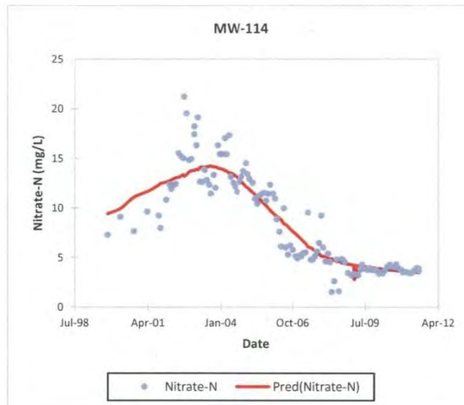
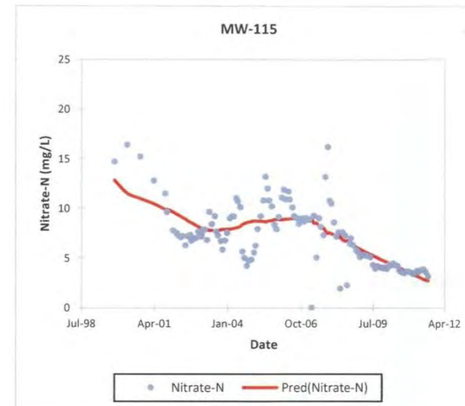
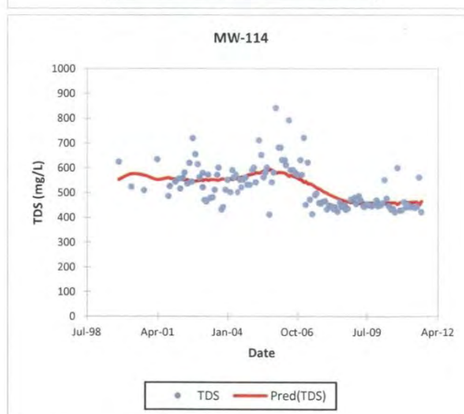


Table 3-14. South Schow (MU-005009) Groundwater Summary

Irrigation Acreage	65
Gradient ft/ft	0.003
Groundwater Direction	Northwest
Groundwater Velocity, ft/day	2.3
Travel time for conservative compound from upgradient well to downgradient well (approximate)	1 year
Upgradient Wells	114
Downgradient Wells	115







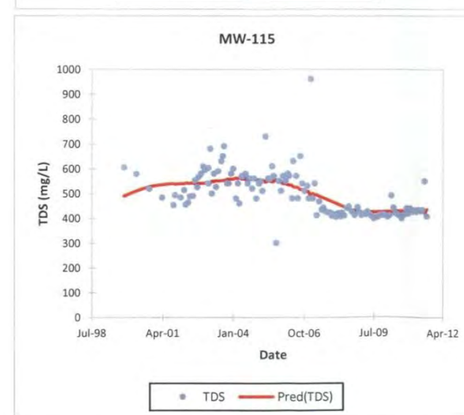
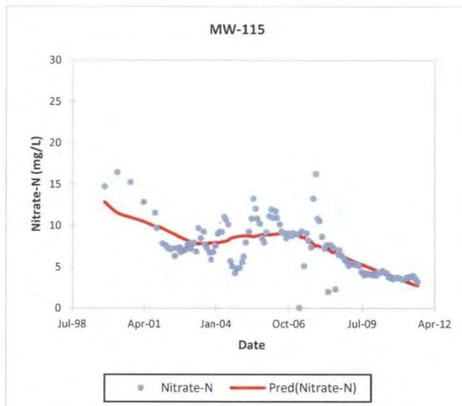
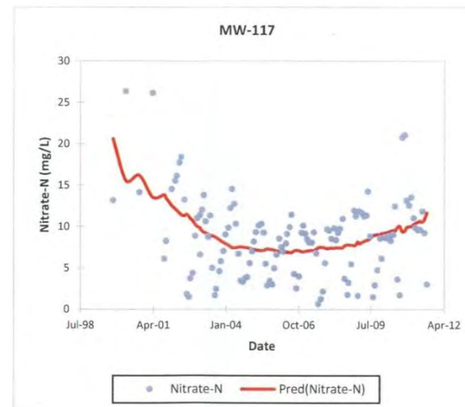
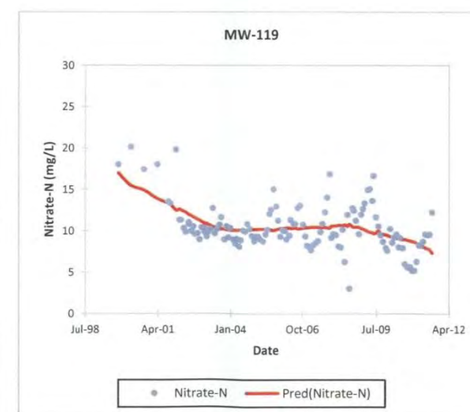


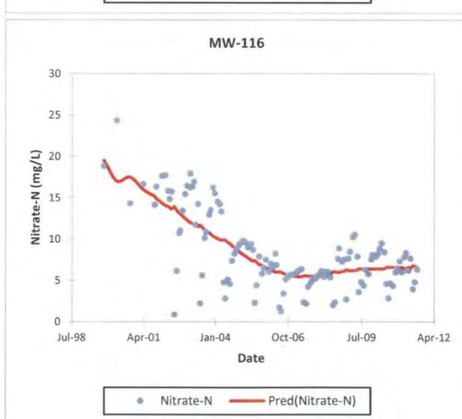
Table 3-15. North Schow (MU-005010) Groundwater Summary for Nitrate-N

Irrigation Acreage	155
Gradient ft/ft	0.003
Groundwater Direction	Northwest
Groundwater Velocity, ft/day	3.9
Travel time for conservative compound to travel from upgradient to downgradient wells	
Upgradient Wells	115, 116
Downgradient Wells	119, 117, 118









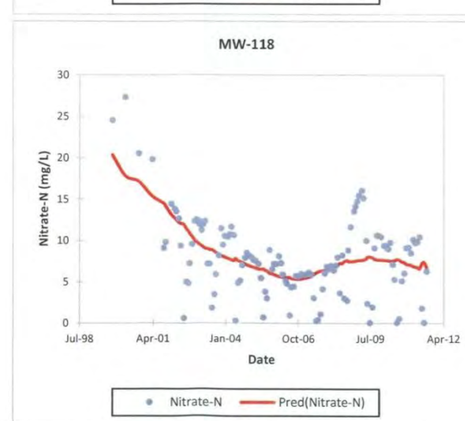
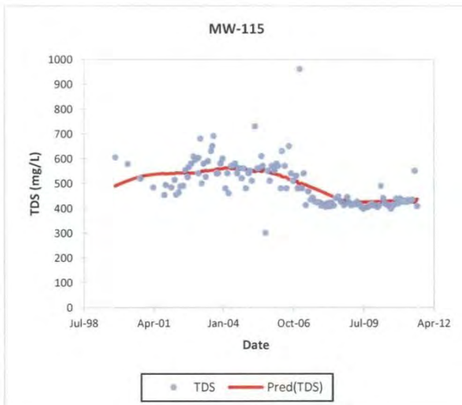
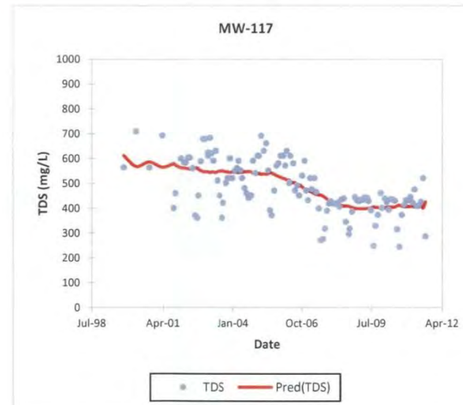
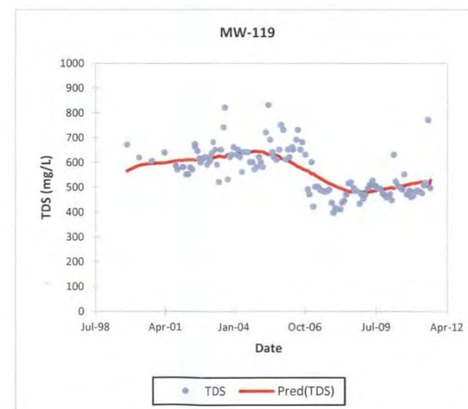
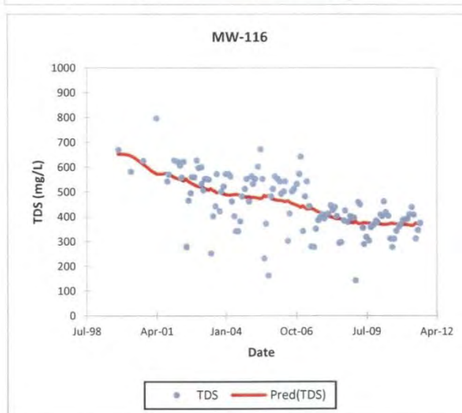
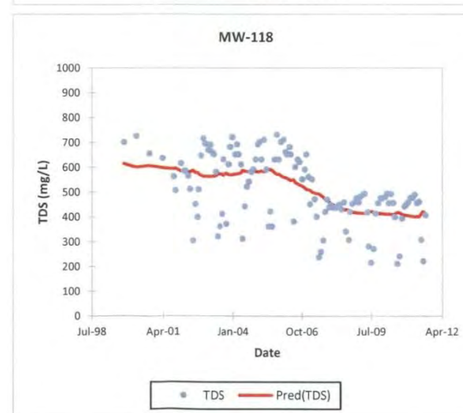


Table 3-16. North Schow (MU-005010) Groundwater Summary for TDS

Irrigation Acreage	155
Gradient ft/ft	0.003
Groundwater Direction	Northwest
Groundwater Velocity, ft/day	3.9
Travel time for conservative compound from upgradient well to downgradient well (approximate)	1 year (115 to 119)
Upgradient Wells	115, 116
Downgradient Wells	119, 117, 118