AECOM

Nipomo Community Services District

Southland Wastewater Treatment Facility **MASTER PLAN**

Nipomo Community Services District

District General Manager Bruce Buel

District Engineer Peter Sevcik, PE

Utility Superintendent Tina Grietens

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Project Manager Mike Nunley, PE

Project Engineer Eileen Shields, EIT

January 2009

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EXECUTIVE SUMMARY

Introduction

The Nipomo Community Services District (District) owns and operates the Southland Wastewater Treatment Facility (WWTF), which treats a combination of domestic and commercial wastewater from the community of Nipomo, California. The WWTF has a permitted capacity of 900,000 gallons per day (gpd) based on the maximum monthly demand. Wastewater is treated by four aerated ponds and discharged to onsite infiltration basins.

On February 7, 2006 the District received a Notice of Violation (NOV) from the Regional Water Quality Control Board (RWQCB) for several effluent water quality violations reported during 2005. This is the third of a series of reports AECOM (formerly Boyle Engineering) performed in response to the NOV (following the Action Plan, May 2006, and Technical Memorandum, July 2006). This report comprises the WWTF Master Plan, which was prepared to assist in the strategy for future capital improvements.

The purpose of the Master Plan is to evaluate existing and future demands of the WWTF, identify the needed improvements to meet these demands, and develop a capital improvements program to assist the District in planning.

Existing Loads

Monitoring data from the previous two years (September 2006 to August 2008) were analyzed to determine flow demands, peaking factors, loading rates, and solids production. Several flow rates were analyzed and loading rates were determined. Inflow and infiltration was investigated, but did not appear to significantly contribute to plant flows. Table ES-1 summarizes the peaking factors established.

Table ES-1 Summary of Peaking Factors

Flow Condition	Existing Flow (mgd)	Peaking Factor
Average Annual Flow (AAF)	0.59	--
Maximum Monthly Flow (MMF)[1]	0.64	1.09
Peak Daily Flow (PDF)	1.19	2.00
Peak Hourly Flow (PHF)	1.77	3.00

[1] The February 2007 Draft Southland WWTF Master Plan reported a MMF peaking factor of 1.34, based on flow records from Sept. 2004 – Aug. 2006. This report has been updated to reflect flow data from Sept. 2006 – Aug. 2008.

The loading of organic materials and solids in domestic wastewater are important to establish the process capacity of the WWTF. The data from September 2006 through August 2008 were used to establish the following:

- Average Annual BOD_5 loading = 1,370 lb/day
- Maximum Monthly BOD_5 loading = 1,892 lb/day
- Average Annual TSS loading = 1,280 lb/day
- Maximum Monthly TSS loading = 1,950 lb/day

Projected Loads

Plant records from September 2006 to August 2008 indicate an AAF of 0.59 mgd. Under direction of NCSD staff, this study used the projected 2030 AAF from Scenario 1 (which uses existing land use designations) of the Water and Sewer Master Plan (Cannon Associates, December 2007) and derived intermediate future AAFs assuming linearized growth between existing and 2030 flow rates. Peaking factors were used to project other relevant flows. Table ES-2 summarizes current and projected future flow rates. According to this conservative growth projection, the permitted capacity (MMF = 0.9 mgd) could be reached by December 2010. The District should begin planning and designing a plant expansion to ensure sufficient capacity for the future.

Table ES-2 Projected Flow Rates

Flow Condition	Peaking Factor	Existing Flow (mgd)	Projected Flow (mgd)[1]				
			2010	2015	2020	2025	2030
Average Annual Flow (AAF)	--	0.59	0.73	0.97	1.20	1.44	1.67
Maximum Monthly Flow (MMF)[2]	1.09	0.64	0.80	1.06	1.31	1.57	1.82
Peak Daily Flow (PDF)	2.00	1.19	1.46	1.94	2.40	2.88	3.34
Peak Hourly Flow (PHF)	3.00	--	2.19	2.91	3.60	4.32	5.01

[1] Projected AAF based on Water and Sewer Master Plan Update (Cannon Assoc., December 2007)
[2] The February 2007 Draft Southland WWTF Master Plan reported a MMF peaking factor of 1.34, based on flow records from Sept. 2004 – Aug. 2006. This report has been updated to reflect flow data from Sept. 2006 – Aug. 2008.

Projected BOD_5 and TSS loads were determined by dividing the existing average annual and maximum monthly concentrations by the AAF and MMF, respectively. This provides the BOD_5 and TSS loadings in terms of pounds per million gallons. These were multiplied by projected flow rates to find the projected BOD_5 and TSS loadings, shown in Table ES-3.

Table ES-3 Projected BOD_5 and TSS Loading Rates

Year	2006	2010	2015	2020	2025	2030
AAF (mgd)	0.59	0.73	0.97	1.20	1.44	1.67
Average Annual BOD_5 Loading (lb/day)	1,370	1,700	2,250	2,790	3,340	3,880
Average Annual TSS Loading (lb/day)	1,280	1,580	2,100	2,600	3,120	3,620
MMF (mgd)	0.64	0.80	1.06	1.31	1.57	1.82
Maximum Monthly BOD_5 Loading (lb/day)	1,892	2,350	3,130	3,870	4,640	5,380
Maximum Monthly TSS Loading (lb/day)	1,950	2,420	3,220	3,990	4,780	5,550

Frequency diagrams were created using monitoring results for influent BOD_5 and TSS for September 2006 through August 2008. They revealed 90% frequency values of 360 mg/L for BOD_5, and 319 mg/L for TSS. These values are recommended for use in planning and design purposes.

Treatment Capacity

Evaluation of the treatment capacity of the WWTF showed the ability to treat existing influent wastewater under various flow rates and temperature conditions (Table ES-4). However, when projected 2030 flow rates were applied, the plant model did not meet current effluent limits (Table ES-5). If the ponds are operated in two parallel trains of two, the permitted BOD_5 effluent limit is expected to be reached by 2010 during high temperature, high flow conditions according to the conservative growth projections. If the ponds are run in series, the permitted BOD_5 limit will be reached in 2015. However, there are potential conditions that may attribute to increased effluent BOD concentrations when running the ponds in series. We recommend referring to the parallel configuration when estimating plant capacity.

Table ES-4 Modeled Effluent Quality under Existing Flow Conditions

	Temperature (T) and Flow (Q) Conditions		
	Low T, Low Q	High T, High Q	High T, MMF
4 Ponds in Series [BOD_5] (mg/L)	28	15	29
2 Parallel Trains of 2 Ponds [BOD_5] (mg/L)	47	30	48
WDR Effluent BOD_5 limits: Daily Maximum = 100 mg/L, Monthly Mean = 60 mg/L			

Table ES-5 Treatment Capacity of Existing System under Future Flow Conditions

	Temperature (T) and Flow (Q) Conditions		
	Low T, Low Q	High T, High Q	High T, MMF
4 Ponds in Series [BOD_5] (mg/L)	124	155	108
2 Parallel Trains of 2 Ponds [BOD_5] (mg/L)	139	137	125
WDR Effluent BOD_5 limits: Daily Maximum = 100 mg/L, Monthly Mean = 60 mg/L			

System Improvements

Several system improvements are identified in the Master Plan to meet hydraulic demands and improve operability of the plant.

- *Frontage Road trunk main replacement*: A hydraulic analysis was performed on Frontage Road trunk main from Division Street to the WWTF. The entire stretch of 12-inch pipeline was found to be undersized for projected future demands, both AAF and PHF, except one section immediately above Story Street where the slope is nearly 3.5 times that of the next greatest slope in the study reach. We recommend replacing the Frontage Road trunk main with a 21" pipeline to meet the projected demand for 2030. This project should be constructed in the next 2 years.
- *Influent pump station upgrade*: The influent pump station was examined for hydraulic capacity. Two Fairbanks-Morse submersible pumps were installed in 2000, rated at approximately 2300 gpm each. System and pump curves reveal sufficient pump capacity to handle the current peak hour flow with one

pump as a backup. However, an upgrade will be required to maintain 100% redundancy in the future. The current pumps will meet projected demands up to 2018. Analysis indicates that although the existing pumps have the capacity to handle existing flow, the wet well is undersized, causing rapid cycling, which can prematurely wear the pumps. We recommend that the District budget for a wet well replacement and three new screw centrifugal pumps (such as Wemco Hidrostal® or equal) to meet 2030 demands. This project would be most efficiently constructed with the Frontage Road trunk main improvements, but should be in place no later than 2012 to prepare for 2015 projected demands.

- *Screening and grit removal*: The WWTF currently lacks screening or grit removal, with just two grinders to grind large objects ahead of the pump station. Headworks improvements will increase effluent quality and significantly reduce maintenance issues (such as rag entanglement in the aerators) and wear on the plant equipment. Two types of screens and two types of grit removal systems were compared for the WWTF improvement. Two parallel shaftless screw screens (such as Parkson Helisieve® or equal) are recommended for the fine screening, followed by two vortex grit removal systems (such as Jones & Attwood JetAir® or equal). We recommend installing screening and grit removal within the next 2 years.

Treatment Process Upgrade

The WWTF is operating close to its permitted capacity. Plant demands could reach the flow limit (MMF = 0.9 mgd) as early as December 2010 and the effluent BOD_5 limit of 100 mg/L in 2010 during high flow conditions. An upgrade is required. Considering how rapidly demands may meet these limits, the District should begin planning and designing a WWTF upgrade as soon as possible and work with the RWQCB to develop a phased approach for permitting and upgrading the plant.

Water quality goals play a large role in determination of treatment alternatives. Discharge options discussed in this Master Plan include: reuse as irrigation of parks, reuse as groundwater recharge, and offsite infiltration. Both reuse options require tertiary treatment (coagulation, filtration, and disinfection). Infiltration requires the discharger demonstrate no impact to groundwater. Based on conversations with RWQCB staff and review of the Basin Plan, more stringent discharge requirements are inevitable. The existing process will not meet water quality goals that are more stringent than the existing requirements, or act as pretreatment for a tertiary process. Therefore, we recommend the following:

- Sample wastewater effluent for constituents that may effect reuse as irrigation for parks or agriculture
- Perform a user survey to determine the potential market for reclaimed wastewater
- Select a treatment plant process that will provide adequate pretreatment for tertiary filtration to protect the District's options for reuse in the future

Four treatment alternatives were evaluated for the WWTF upgrade: additional aerated ponds, Biolac® wave oxidation system, oxidation ditch, and conventional activated sludge. We recommend the Biolac system because it provides a high quality effluent (sufficient for a tertiary process pretreatment) at a lower cost than any of the other three alternatives examined. Comprehensive life cycle costs are approximately half that of a pond system. It requires a Grade II Operator to manage, with a higher degree of operator involvement than a pond system, but routine operations and maintenance are less complex than the other, more expensive treatment technologies reviewed (oxidation ditch and activated sludge). We recommend retrofitting a portion of Ponds 3 and 4 with Biolac® wave oxidation systems and constructing two clarifiers. Primary ponds 1 and 2 would be converted to aerated sludge holding lagoons. The upgrade could be phased by installing 75% of the aeration equipment required to meet the projected 2030 demands. This is estimated to be sufficient until 2020. Phase II would include installation of additional diffusers and an additional blower.

Solids Handling

We recommend lining the two existing drying beds and installing a decant pumping station concurrently with the Phase I Biolac project. Two additional beds would be constructed with the Phase II Biolac expansion.

Capital Improvements Plan

A Capital Improvement Plan was developed to assist the District in planning and budgeting for WWTF improvements. Major capital improvements can be separated into two categories:

- Facility Improvements: Those projects which would improve plant operability without requiring major process improvements (discussed in Section 7.0).
- Future Process Improvements: Process and capacity improvements to meet anticipated future water quality goals and demands through 2030. While the first phase of the Biolac system should be installed before the plant reaches its permitted capacity (0.9 MGD), the tertiary treatment and disinfection improvement schedule would be dictated by future permitting limits and/or recycling opportunities. The cost for constructing three additional infiltration basins is included in these tables, since it may be desirable as a secondary or “wet-weather” disposal option even if other reuse opportunities arise. However, the capacity of these additional percolation ponds is unknown and should be evaluated as discussed herein.

A 4% annual cost escalation factor was applied to the 2008 project costs summarized below.

Table ES-6 Conceptual Cost Opinions for Facility Improvements

Component	2008 Project Cost	Year to be Completed	Escalated Project Cost to Midpoint of Construction
Frontage Rd. Trunk Main 21" Upgrade	$2,182,000	2011	$2,361,000
Influent Pump Station and Flowmeter Improvements	$967,000	2011	$1,046,000
Spiral Screening System	$512,000	2011	$554,000
Grit Removal System	$629,000	2011	$681,000

Nov 2008 ENR (CCI) = 8602 in all Cost Opinions

Table ES-7 Conceptual Cost Opinions for Process Improvements

Component	2008 Project Cost	Year to be Completed	Escalated Project Cost to Midpoint of Construction
Phase I Biolac System (Capacity = 1.4 MGD MMF, or 75% of 2030 Demands)	$5,734,000	2011	$6,204,000
Phase I Sludge Lagoons	$100,000	2011	$108,200
Phase I Drying Bed Improvements	$1,716,000	2011	$1,857,000
Phase II Biolac System (Capacity = 2.4 MGD MMF, or 100% of 2030 Demands)	$208,000	2017	$308,000
Phase II Drying Beds (2 New)	$1,540,000	2017	$2,108,000
Percolation Ponds	$1,363,000	2017	$1,865,000
Tertiary Filtration	$2,016,000	TBD	--
Chlorination System	$1,748,000	TBD	--
Solar array for alternative energy (see proposal App E)	$4,010,000	TBD	--

1.0 INTRODUCTION

1.1 Background

The Nipomo Community Services District (District) owns and operates the Southland Wastewater Treatment Facility (WWTF), located west of Highway 101 in the southern portion of San Luis Obispo County, California. The WWTF treats a mixture of domestic and industrial wastewater from part of the Nipomo community under Waste Discharge Requirements Order No. 95-75 (attached as Appendix A) with a permitted capacity of 900,000 gallons per day (gpd) based on the maximum monthly demand. A site plan is included as Figure 1-1.

On February 7, 2006, the District received a Notice of Violation (NOV) from the Regional Water Quality Control Board (RWQCB) for several effluent water quality violations reported during 2005. The letter included directives to investigate the dependability of analytical results, investigate treatment facility improvements, and submit a report of actions needed to correct wastewater treatment deficiencies and discharge violations. To facilitate response to the NOV, the District directed Boyle (now AECOM) to perform the following services:

- Prepare an Action Plan for submittal to the RWQCB (completed May 2006);
- Prepare a technical memorandum to address operational improvements to be made in the immediate future (completed July 2006); and
- Prepare a WWTF Master Plan to assist in the strategy for future capital improvements. This report comprises the Master Plan.

1.2 Objectives and Scope of Work

The purpose of this study is to identify improvements needed for the WWTF and the Frontage Road trunk line to meet existing and projected demands and to develop a comprehensive Capital Improvements Program. This Master Plan considered alternative treatment technologies and provided design criteria for a new treatment facility, allowing the District to design and construct improvements necessary to meet the discharge requirements and ultimate build-out demand. Specific tasks performed within this study included:

Review of plant performance and capacity: Monitoring data from September 2006 to August 2008 were analyzed to determine flow demands, peaking factors, loading rates, and solids production. This information was used to evaluate the historical performance of the plant. The existing hydraulic and process capacities of the pumps, pipes, ponds, and aeration systems were evaluated.

Development of design criteria: Projected build-out flow demands for the years 2010, 2015, 2020, 2025, and 2030 and anticipated future water quality standards were used to develop design criteria. Population and wastewater flow projections from the District's Water and Sewer Master Plan were used to develop flow demands. Peaking factors were developed for use in this analysis, as well.

Determination of needed facility improvements: The Plan included evaluation of current facility capacity (process, hydraulic, and solids handling) and identification of improvements needed to meet current demands and treatment requirements. These improvements include screening and grit removal facilities, replacement of the Frontage Road Trunk Main, electrical improvements, and sludge handling facilities and strategies. Cost opinions were provided for solar power and for sludge removal from the drying beds, as well.

Evaluation of alternatives for future plant improvements: Four treatment processes were evaluated based on the ability to meet future demands. Process flow diagrams, site plans, schematics, and planning-level conceptual cost opinions are provided for each alternative.

Development of a Capital Improvements Plan: The schematic diagram, site plan, schedule, and cost are outlined for the recommended improvements.

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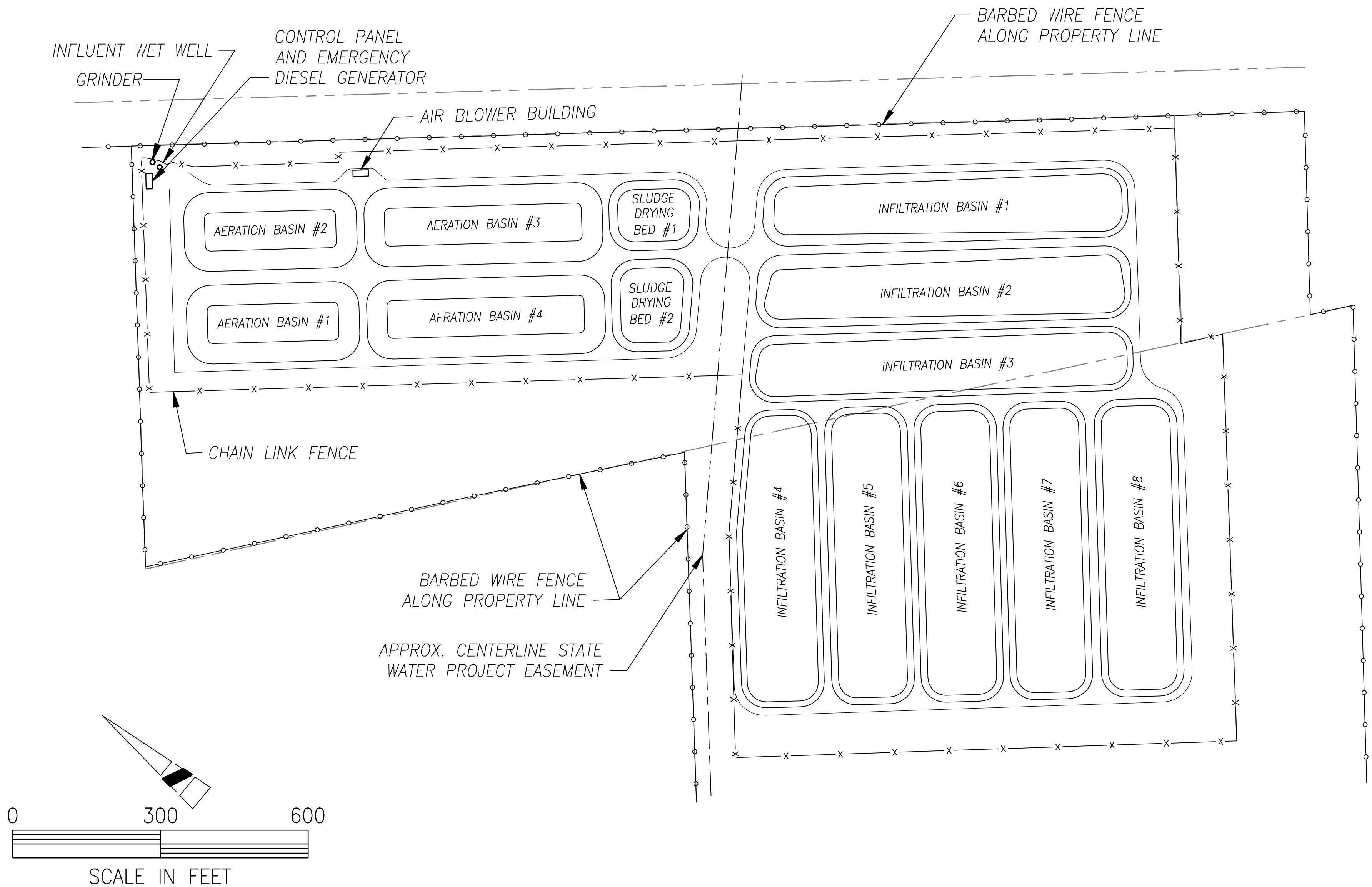

FIGURE 1-1

NCSD SOUTHLAND WWTF MASTER PLAN

SITE PLAN

BEC PROJECT NO. 19996.17

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2.0 EXISTING LOADS

2.1 Flow Analysis

Several flow rates were analyzed in this study. The *Average Annual Flow (AAF)* is the flow rate averaged over the course of the year and is the base flow for the WWTF. Collection and analysis of 2 years of historical flow data (September 2006 through August 2008) yielded an AAF of 0.59 million gallons per day (mgd).

Average Wet Weather Flow (AWWF) was defined as the average daily flow during “wet” months, or months that experience a total rainfall greater than 0.5 inches. San Luis Obispo County provided rainfall data, collected from a gauge at the WWTF. Flow and rainfall records indicate the service area has an AWWF of 0.59 mgd.

Maximum Month Flow (MMF) is an important design flow for the Waste Discharge Requirements (WDR’s) since it is the basis of the plants permitted capacity. MMF is the average daily flow during the maximum month. Flow records indicate a MMF of 0.64 mgd over the past two years (January 2007).

Peak Day Flow (PDF) is the maximum daily flow rate experienced at the WWTF. Flow records show the PDF to be 1.19 mgd (June 23, 2007).

Peak Hour Flow (PHF) is the maximum one-hour flow experienced by the system, and can usually be derived from WWTF records, flow monitoring, or empirical equations used to estimate PHF based on service area population. It is important for design of pumps, pipes, screens, flow meters, grit removal devices and clarifiers.

Peak Dry Weather Flow (PDWF) is the maximum daily flow rate recorded at the WWTF during months when less than 0.5 inches of rain occurs. PDWF for the WWTF is 1.19 mgd (June 23, 2007).

Peak Wet Weather Flow (PWWF) is the maximum daily flow rate recorded at the WWTF during months when 0.5 inches or more rain is recorded. The larger of the PWWF and the PDWF is used as the PDF. PWWF for the District is 0.993 mgd (December 22, 2006).

Table 2-1 summarizes the average and peak daily flows for each month. Also included are the monthly precipitation and peak and average flows. Table 2-2 summarizes existing flows and peaking factors.

Table 2-1 Historic Flow and Precipitation Data

Month	ADF (mgd)	PDF (mgd)	Precipitation (in)
Sep-06	0.570	0.737	0.00
Oct-06	0.584	0.772	0.01
Nov-06	0.586	0.785	0.42
Dec-06	0.597	0.993	2.85
Jan-07	0.638	0.829	0.14
Feb-07	0.623	0.835	0.87
Mar-07	0.599	0.917	0.48
Apr-07	0.589	0.772	0.59
May-07	0.580	0.756	0.08
Jun-07	0.596	1.185	0.00
Jul-07	0.585	1.083	0.00
Aug-07	0.572	0.850	0.10
Sep-07	0.583	1.184	0.00
Oct-07	0.575	0.803	0.15
Nov-07	0.578	0.775	0.01
Dec-07	0.594	0.739	3.72
Jan-08	0.583	0.752	8.70
Feb-08	0.573	0.796	3.71
Mar-08	0.570	0.760	0.12
Apr-08	0.578	0.767	0.48
May-08	0.569	0.842	0.05
Jun-08	0.613	0.903	0.00
Jul-08	0.583	0.818	0.00
Aug-08	0.570	0.745	0.00
	AAF = 0.587	**PDF = 1.185**	**MMF = 0.638**
	ADWF = 0.585	mean PDWF = 0.862	Max PDWF = 1.185
	AWWF = 0.593	mean PWWF = 0.815	Max PWWF = 0.993
Precipitation data collected from onsite rain gauge and provided by SLO County.			

Table 2-2 Summary of Peaking Factors

Flow Condition	Existing Flow (mgd)	Peaking Factor
Average Annual Flow (AAF)	0.59	--
Maximum Monthly Flow (MMF)[2]	0.64	1.09
Peak Daily Flow (PDF)	1.19	2.00
Peak Hourly Flow (PHF)	1.77	3.00

[2] The February 2007 Draft Southland WWTF Master Plan reported a MMF peaking factor of 1.34, based on flow records from September 2004 – August 2006. This report has been updated to reflect flow data from Sept 2006 – Aug 2008.

2.2 Loading Rates and Solids Production

The loading of organic material and solids in domestic wastewater are important to determine the process capacity of a wastewater treatment facility. The loading can be obtained through monitoring the flow rate, biological oxygen demand (BOD_5), and total suspended solids (TSS) of the influent wastewater. Influent TSS and BOD_5 are measured weekly at the Southland WWTF. To estimate loading conditions (lbs/day) over the past two years (September 2006 – August 2008), the average concentrations were multiplied by the daily flow rates for the month. Table 2-3 summarizes the results and shows the average and maximum values.

Table 2-3 Influent BOD_5 Concentrations and Loading

Month-Year	Average Daily Flow (mgd)	Monthly Average BOD_5 (mg/L)	Monthly Average TSS (mg/L)	Average Daily BOD_5 loading (lb/day)	Average Daily TSS loading (lb/day)
Sep-06	0.570	320	218	1,521	1,036
Oct-06	0.584	270	210	1,315	1,023
Nov-06	0.586	295	250	1,443	1,222
Dec-06	0.597	273	228	1,357	1,135
Jan-07	0.638	278	254	1,479	1,352
Feb-07	0.623	308	302	1,598	1,569
Mar-07	0.599	250	300	1,246	1,499
Apr-07	0.589	291	238	1,428	1,169
May-07	0.580	310	248	1,500	1,200
Jun-07	0.596	287	310	1,424	1,541
Jul-07	0.595	311	238	1,545	1,181
Aug-07	0.572	285	252	1,361	1,202
Sep-07	0.583	297	208	1,444	1,011
Oct-07	0.575	272	244	1,304	1,170
Nov-07	0.578	393	290	1,892	1,398
Dec-07	0.594	243	188	1,205	931
Jan-08	0.583	238	252	1,156	1,225
Feb-08	0.573	262	408	1,251	1,950
Mar-08	0.570	290	333	1,379	1,583
Apr-08	0.578	247	262	1,192	1,263
May-08	0.569	252	274	1,195	1,300
Jun-08	0.613	242	194	1,236	1,350
Jul-08	0.583	237	240	1,150	1,167
Aug-08	0.570	264	205	1,255	1,250
AVERAGE	0.587	280	256	**1,370**	**1,280**
MAXIMUM				**1,892**	**1,950**

As the solids layer, including grit, sludge, and screenings, builds up on the bottom of the ponds, the retention time decreases and the effluent water quality is reduced. Over the past three years, sludge has been removed from each aeration pond and transferred to the sludge drying beds. The WWTF has been operating with all four ponds since July 25, 2008. An estimation of volume and weight of the sludge and cost for removal from the beds and disposal is included in Section 8.8.

2.3 Inflow and Infiltration

The potential impact from inflow and infiltration was investigated. *Infiltration* is the water entering a sewer system and service connections from groundwater, through such means as defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include inflow and is relatively constant over a period of days, weeks, or even months if high groundwater conditions persist near the sewer system. *Inflow* is the water discharged into a sewer system and service connections from such sources as roof and foundation drains, manhole covers, cross connections from storm sewers, and catch basins. Inflow does not include infiltration. Inflow varies rapidly with rainfall conditions, with flows rising and falling within minutes or hours of a severe storm event with significant runoff.

Figure 2-1 compares the total precipitation, as measured by San Luis Obispo County at the WWTF, with the average daily flow for each month between September 2006 and August 2008. Typically, potential influence of infiltration on treatment plant flow rates can be estimated by observing patterns in the total rainfall plotted with the average daily flows for each month. Based on comparison of rainfall and monthly flows (Figure 2-1) it appears infiltration is not significant.

The impact of inflow can be estimated by the difference between wet weather and dry weather peak daily flows. Plant records indicate peak day flows during wet weather months are generally less than dry weather peak day flows, suggesting that inflow is not a significant contribution to wastewater flow.

For these reasons, inflow/infiltration (I/I) is not considered significant in this capacity analysis. The annual average flow (AAF), peak daily flow (PDF), and peak hourly flow (PHF) were used to analyze existing and future capacity and it was assumed these peaks would occur during dry weather periods.

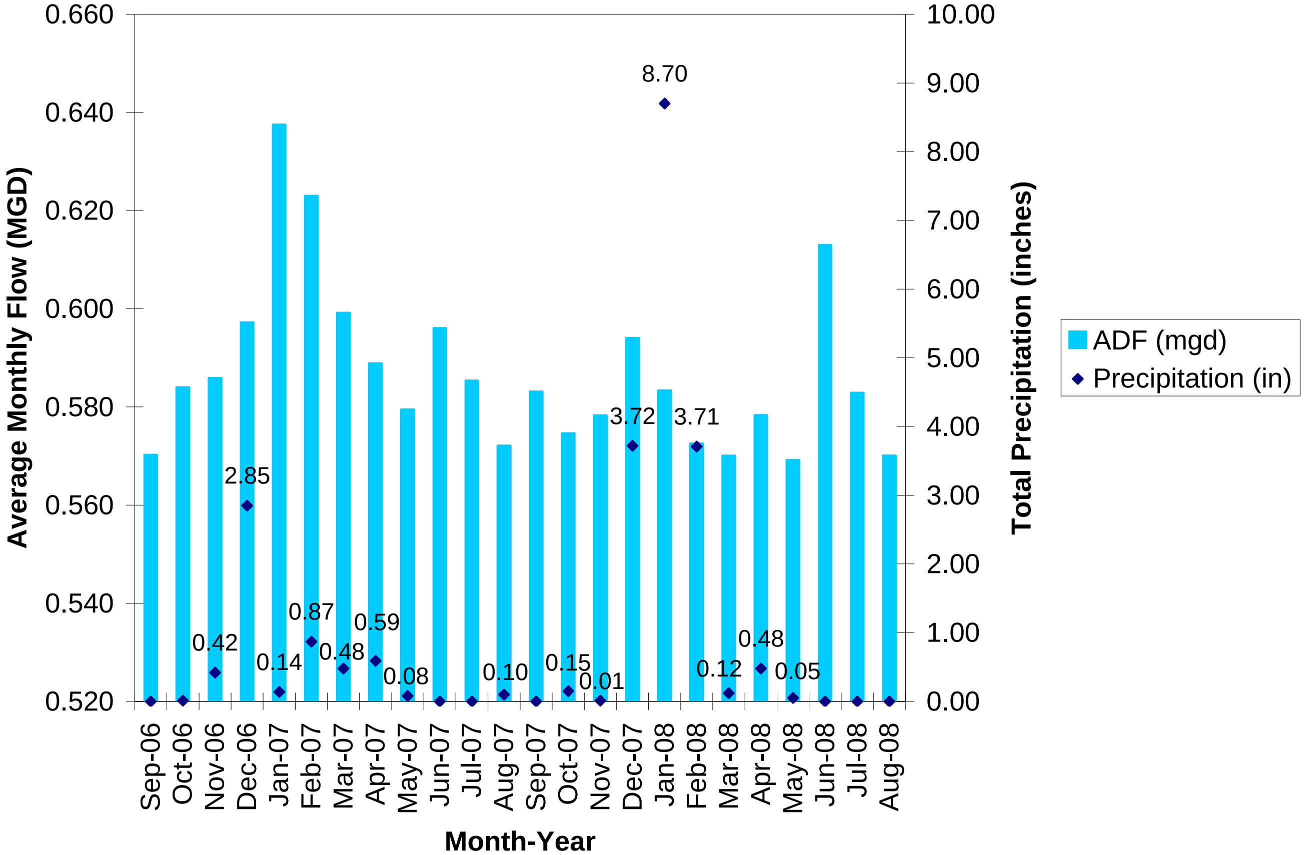


Figure 2-1 Southland Monthly Average Daily Flows and Total Precipitation (Sept 2006 – Aug 2008)

3.0 PROJECTED LOADS

3.1 Projected Future Flow Demands

Plant records from the past 2 years revealed an AAF of 0.59 mgd. This number is comparable to the AAF, 0.63 mgd, found in the NCSD Water and Sewer Master Plan Update (December 2007, Cannon Associates), which utilized sewer duty factors and land-use planning information to project sewer flow rates. Based on direction from NCSD, this study used the projected 2030 AAF from Scenario 1 (using existing land use designations) of the Water and Sewer Master Plan and derived intermediate future AAFs assuming a linearized growth between existing and 2030 flow rates. Table 3-1 shows the existing and projected flow rates under the design flow conditions discussed in Section 2.0. The permitted capacity (MMF = 0.9 mgd) could be reached by December 2010 according to this conservatively high growth projection. However, based on current growth rates it may not be reached until 2011 or possibly later. The theoretical BOD reduction capacity of the ponds (discussed in Section 5.0) may allow the plant to operate at higher flows than the permitted capacity. In any event, the plant is operating close to its permitted capacity and the District should begin planning and designing a plant expansion.

Table 3-1 Projected Flow Rates

Flow Condition	Peaking Factor	Existing Flow (mgd)	Projected Flow (mgd)[1]				
			2010	2015	2020	2025	2030
Average Annual Flow (AAF)	--	0.59	0.73	0.97	1.20	1.44	1.67
Maximum Monthly Flow (MMF) [2]	1.09	0.64	0.80	1.06	1.31	1.57	1.82
Peak Daily Flow (PDF)	2.00	1.19	1.46	1.94	2.40	2.88	3.34
Peak Hourly Flow (PHF)	3.00	--	2.19	2.91	3.60	4.32	5.01

[1] Projected AAF based on Water and Sewer Master Plan Update (Cannon Assoc., December 2007)
[2] The February 2007 Draft Southland WWTF Master Plan reported a MMF peaking factor of 1.34, based on flow records from September 2004 – August 2006. This report has been updated to reflect flow data from Sept 2006 – Aug 2008.

3.2 Projected Future Plant Loading

In evaluating future improvements, BOD_5 and TSS loadings and concentrations are important parameters for sizing biological treatment and solids handling processes.

<u>Loading</u>: The projected BOD_5 and TSS loadings were determined by dividing the existing average annual and maximum monthly BOD_5 and TSS loadings (see Table 2-3) by the AAF and MMF, respectively. This provides the

loadings in terms of pounds per million gallons. These terms were multiplied by the projected flow rates to find the projected BOD_5 and TSS loadings shown in Table 3-2.

Table 3-2 Projected BOD_5 and TSS Loading Rates

Year	Existing	2010	2015	2020	2025	2030
AAF (mgd)	0.59	0.73	0.97	1.20	1.44	1.67
Average Annual BOD_5 Loading (lb/day)	1,370	1,700	2,250	2,790	3,340	3,880
Average Annual TSS Loading (lb/day)	1,280	1,580	2,100	2,600	3,120	3,620
MMF (mgd)	0.64	0.80	1.06	1.31	1.57	1.82
Maximum Monthly BOD_5 Loading (lb/day)	1,892	2,350	3,130	3,870	4,640	5,380
Maximum Monthly TSS Loading (lb/day)	1,950	2,420	3,220	3,990	4,780	5,550

Concentration: Frequency diagrams are useful for determining design conditions when planning wastewater treatment plant improvements. Figures 3-1 and 3-2 are frequency diagrams illustrating the monitoring test results for the influent BOD_5 and influent TSS, respectively, for September 2006 through August 2008. The frequency diagram reveals that 90% of the time the influent BOD_5 concentration is less than 360 mg/L. The 90^{th} percentile influent TSS concentration is 319 mg/L. The use of the 90% frequency values for design BOD_5 and TSS concentrations is recommended for planning and design purposes, because it provides a reasonable level of confidence in the treatment plant performance relative to the actual wastewater conditions.

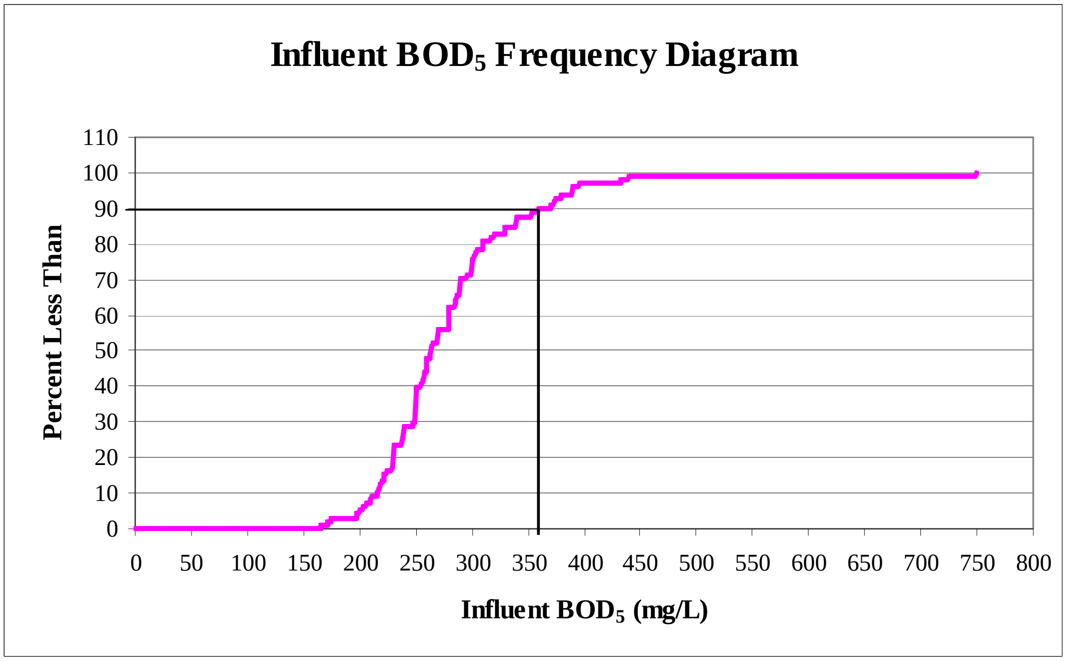


Figure 3-1 Influent BOD_5 Frequency Diagram

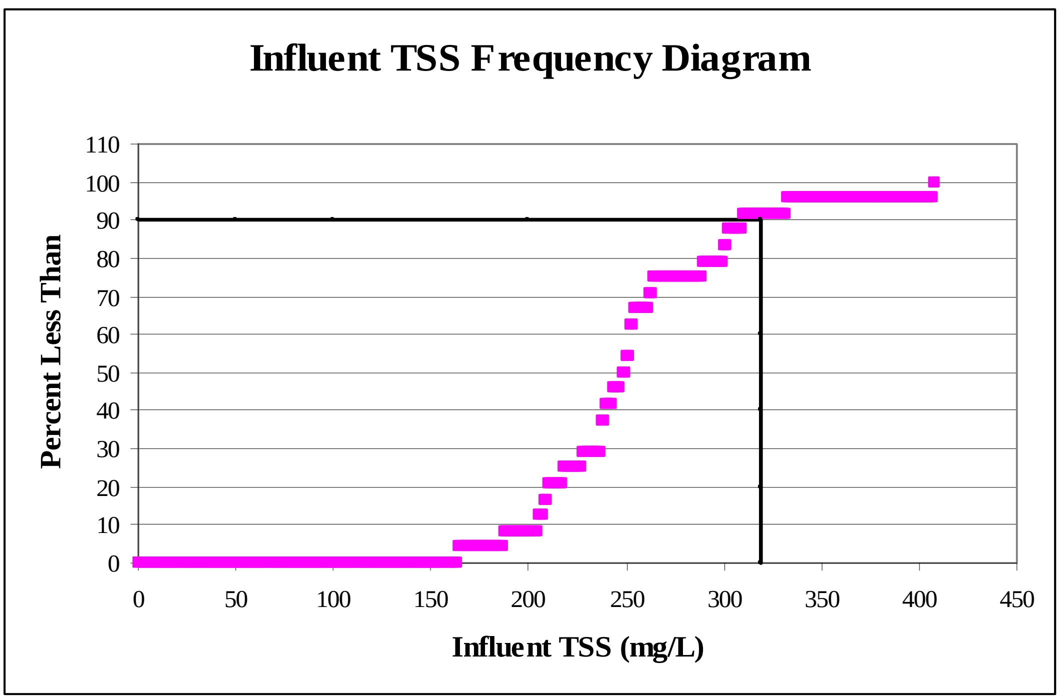


Figure 3-2 Influent TSS Frequency Diagram

Future sludge production was estimated for a 5-year period at the projected 2030 AAF based on the 90^{th} percentile influent TSS concentration shown in the frequency diagram. Assuming a density of 15%, approximately 2.6 million gallons of sludge is expected to accumulate over 5 years. This is equivalent to 20% of the existing pond system volume. Calculations are included in Appendix B.

4.0 EXISTING WASTEWATER TREATMENT FACILITY

4.1 Waste Discharge Requirements

The Nipomo CSD operates the Southland WWTF under Waste Discharge Requirements Order No. 95-75 (attached as Appendix A). The permitted capacity of the plant is 900,000 gpd, which is based on the maximum monthly flow. Table 4-1 summarizes the effluent quality requirements for the facility.

Table 4-1 Effluent Water Quality Requirements

Parameter	**Max 30-Day Mean**	**Max Daily**
Settleable Solids (SS) – mL/L	0.2	0.5
Total Suspended Solids (TSS) – mg/L	60	100
Biochemical Oxygen Demand, 5-day (BOD_5) – mg/L	60	100
Dissolved Oxygen - mg/L	Minimum 1.0	
Additional Limits/Requirements		
pH	6.5 -- 8.4	
Receiving Groundwater	Nitrate levels shall not exceed 10 mg/L downstream of the disposal area. Groundwater samples upstream and downstream of the sprayfields shall not demonstrate a statistically significant increase in nitrate, sodium, chloride, and TDS.	

4.2 System Components

The Southland WWTF process flow diagram is included as Figure 4-1 for the existing treatment facilities. The main system components are as follows:

Headworks: The purpose of the headworks is to grind large solids in the influent and pump the wastewater into treatment. The Southland WWTF headworks consist of a Parshall flume, two grinders, and two Fairbanks Morse submersible influent pumps.

Grinders	
Number of grinders	2
Type	Vertical inline
Horsepower	10
Reducer	43:1
Capacity of each, gpm	2500

Influent Pumps	
Number of pumps	2
Capacity of each, gpm	2331, 2421
Motor horsepower, each	35
Pump speed, rpm	1180
TDH, ft	45

Parshall Flume	
Throat width, in	9
Min flow rate, gpm	1.2
Max flow rate, gpm	5,599

Aeration Ponds: The aeration ponds provide a zone for solids settling and aerobic treatment for the wastewater. The ponds were retrofitted in 1999 with a total of 116 submerged Ramco 12/8 MASP aerators; 46 in each of Ponds 1 and 2, and 12 in each of Ponds 3 and 4. Ponds 3 and 4, the larger two ponds, were originally constructed with floating baffles to isolate a settling zone for additional removal of solids. Due to repeated complications (plugging, etc.), the submerged aerators have been replaced with mechanical aerators. Additionally, the baffles were removed in 2007 to increase aeration volume in Ponds 3 and 4.

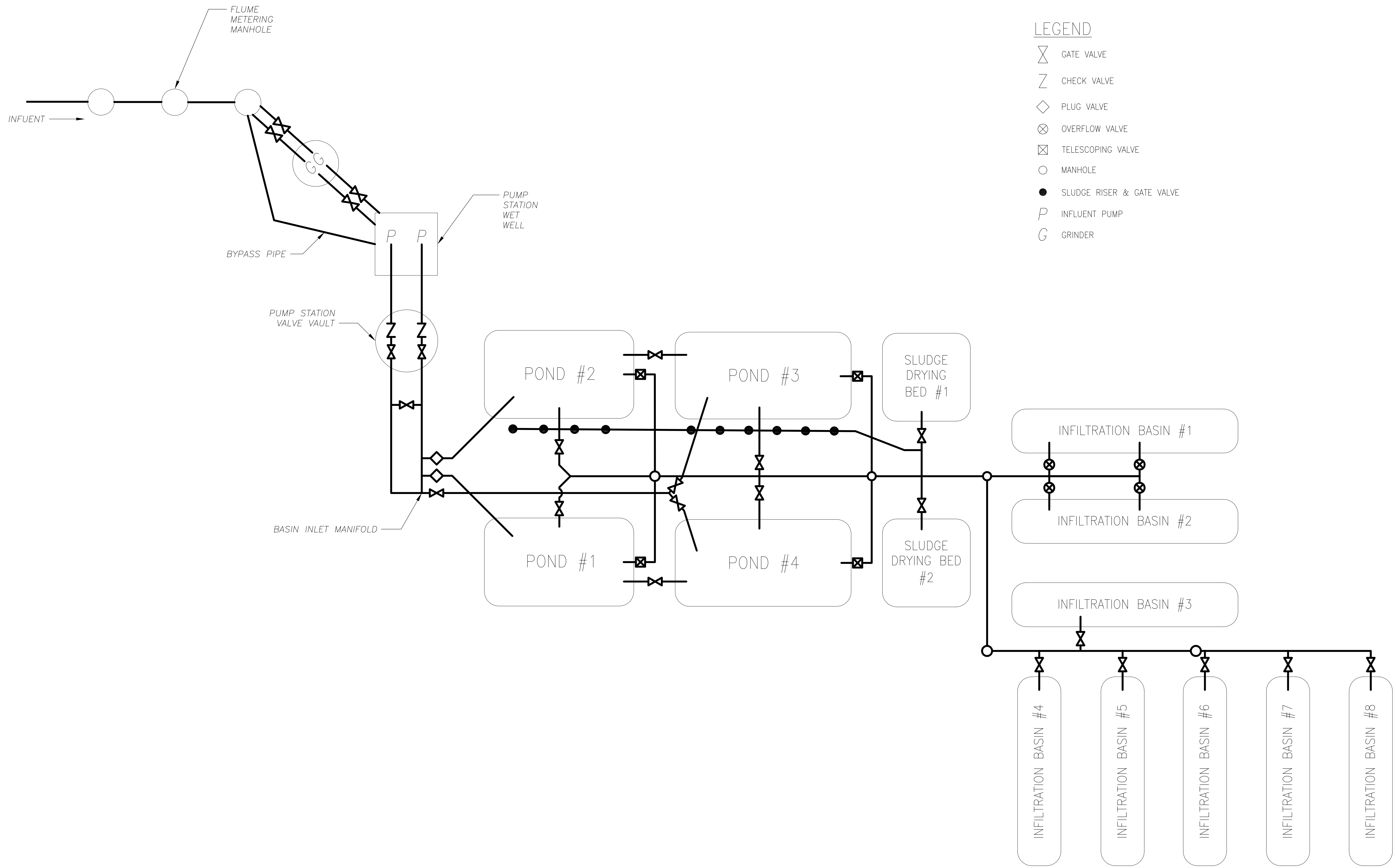
Aerated Ponds	
Number of Ponds	4
Design Average Flow, mgd	0.94
Normal Operating Depth, ft	14
Total Surface Area, acres each	(2) @ 1.09, (2) @ 1.49
Total Liquid Volume, MG	10.7
Total Aeration Blower Power, hp	150
Mechanical Aerators, total hp (# of units)	120 (15)
Pond 1	(2) 5 hP + (3) 10 hP
Pond 2	(2) 5 hP + (2) 10 hP
Pond 3	(2) 5 hP + (1) 10 hP
Pond 4	(3) 10 hP

Infiltration Basins: Further treatment is provided as the aeration pond effluent percolates through the soil beneath the infiltration basins. Several mechanisms work to improve the water quality. Filtration and adsorption through the soil remove suspended solids, bacteria, and viruses. Biodegradation reduces organic material and may have the potential to provide denitrification. The groundwater beneath the infiltration basins is monitored (for boron, sodium, chloride, total nitrogen, total dissolved solids, and sulfate) to ensure that adequate treatment is provided. As described in other studies, the District recently discovered that a mound of plant effluent is growing underneath the plant, supported by an aquitard at 60 to 100 feet below the ground surface.

Infiltration Basins	
Number of Basins	8
Annual Loading, ft	73
Total Area, acres	14.46
Application period, days/basin	7
Drying Period, days/basin	49

Sludge Drying Beds: The sludge drying beds provide an area for evaporation of liquid weight from sludge before disposal. This is important to reduce hauling costs as it is usually based on total weight of the bulk sludge. The beds also provide room for the operators to mix and turn sludge piles as they dry, in order to facilitate more efficient evaporation and thus accelerate the drying process.

Sludge Drying Beds	
Number of Beds	2
Combined capacity, MG	1.9



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NCSD SOUTHLAND WWTF MASTER PLAN

EXISTING PROCESS FLOW DIAGRAM

BEC PROJECT NO. 19996.17

FIGURE 4-1

4.3 Effluent Quality

Table 4-2 summarizes the WWTF effluent monitoring results for the past 2 years. Results exceeding effluent water quality limits are underlined. One potential cause for violations is insufficient retention time and/or aeration due to one pond being offline for cleaning and maintenance (approx 2004 through July 2008). Evaluation of the previously installed Ramco subsurface aeration system revealed limitations that could result in poor BOD removal. Phased replacement of the subsurface aeration system began in spring of 2004. The baffles in Ponds 3 and 4 were removed in 2007 to increase aerated volume, and all subsurface diffusers were replaced with mechanical surface aerators by July 25, 2008.

During maintenance of the system, District staff discovered an open bypass valve that caused short-circuiting between the primary ponds and the outlet from the secondary ponds, near the effluent sampling station. The valve has since been closed.

The vertical position of outlets in the aeration ponds influences the solids concentration in the effluent. Floating debris on top may interfere with effluent quality; therefore the outlet should be submerged. Also, the outlet should be located above the sludge/solids blanket at the bottom (approximately 6 feet from the water surface). Ideal outlet location is 2 to 3 feet from the top of the water surface where optimal water quality is expected. The outlets from Ponds 1 and 2 were set at 5 feet from the bottom, but the outlet from Pond 1 was raised by approximately 3 feet in 2004. The outlets from Ponds 3 and 4 were designed as floating outlets that adjust with the water to remain at approximately 2 to 3 feet below the water surface. However, the floating outlets were observed by operators to not work properly resulting in the outlets settling to the bottom of the ponds. This likely resulted in solids being decanted directly to the downstream ponds. The District recently replaced the outlets from Ponds 3 and 4 with fixed 90-degree elbows at a depth 2 to 3 feet below the water surface. Plant performance in August 2008 and on (until plant upgrades are performed) will reflect operations with all four ponds online and the outlets on Ponds 3 and 4 replaced.

Another challenge faced by the operators is the inability to direct effluent from either Pond 3 or Pond 4 to the inlet of the other secondary pond. Therefore, if either primary pond (1 or 2) is removed from service, the other three ponds cannot be operated in series (Ponds 3 and 4 must be operated in parallel).

Table 4-2 Historical Plant Effluent

Month/ Year	Flow			BOD_5			TSS			DO			SS
	Min. (mgd)	**Max.** (mgd)	**Mo. Avg.** (mgd)	**Min.** (mg/L)	**Max.** (mg/L)	**Mo. Avg.** (mg/L)	**Min.** (mg/L)	**Max.** (mg/L)	**Mo. Avg.** (mg/L)	**Min.** (mg/L)	**Max.** (mg/L)	**Mo. Avg.** (mg/L)	**Mo. Avg.** (mg/L)
Sep-06	0.348	0.737	0.570	21.8	**150**	**71.2**	36	51	44.2	3.6	4.3	3.9	<0.05
Oct-06	0.371	0.772	0.584	54	85	**68.3**	24	59	38.3	**0.8**	3.6	2.5	<0.05
Nov-06	0.38	0.785	0.586	30	100	57.8	20	100	41.4	3.9	5.4	4.7	<0.05
Dec-06	0.368	0.993	0.597	29	68	41.8	18	31	25.3	3.8	6.0	4.9	<0.05
Jan-07	0.318	0.829	0.638	20	32	24.7	14	40	26.8	3.6	4.3	3.9	<0.05
Feb-07	0.326	0.835	0.623	22	30	26.2	4.3	33	22.8	3.5	6.1	4.8	<0.05
Mar-07	0.361	0.917	0.599	26	28.8	27.7	23	40	31.5	5.0	5.6	5.3	<0.05
Apr-07	0.398	0.772	0.589	28	**111**	51.8	30	41	37.8	4.1	4.5	4.3	<0.05
May-07	0.422	0.756	0.580	25	**158**	**65.6**	28	56	41.4	3.9	4.5	4.1	<0.05
Jun-07	0.287	1.185	0.596	36	**112**	**73**	20	50	33.4	3.4	4.5	4.1	<0.05
Jul-07	0.277	1.083	0.585	21	36	28.3	24	36	29.3	3.9	4.4	4.2	<0.05
Aug-07	0.284	0.85	0.572	2	**123**	53.3	18	42	32	3.9	4.6	4.3	<0.05
Avg			**0.593**			**49.1**			**33.7**			**4.3**	**<0.05**
Max		**1.185**			**158**	**73**		**100**	**44.2**		**6.1**		
Min	**0.277**			**2**			**4.3**			**0.8**			
Sep-07	0.067	1.184	0.583	2.15	**107**	43.5	10	28	17	4.2	4.5	4.4	<0.05
Oct-07	0.365	0.803	0.575	9.3	14.7	11.7	10	13	11.4	4.2	4.7	4.4	<0.05
Nov-07	0.319	0.775	0.578	58	**185**	**92.8**	17	24	19.5	3.9	5.3	4.7	<0.05
Dec-07	0.305	0.739	0.594	21.6	**147**	**94.2**	16	60	36.3	1.8	8.4	4.9	<0.05
Jan-08	0.302	0.752	0.583	23	37	28.9	17	29	24.2	7.1	8.1	7.7	<0.05
Feb-08	0.338	0.796	0.573	8.1	26.7	13.4	18	40	27	7.3	8.5	8.1	<0.05
Mar-08	0.359	0.76	0.570	12.5	37	27.9	24	60	40	6.9	7.9	7.2	<0.05
Apr-08	0.428	0.767	0.578	54	**175**	**108**	31	50	43.4	5.3	6.4	5.8	<0.05
May-08	0.376	0.842	0.569	63	**162**	**103**	16	70	36	5.8	6.6	6.1	<0.05
Jun-08	0.288	0.903	0.613	42.9	**168**	**108**	31	70	53.2	3.1	7.3	5.7	<0.05
Jul-08	0.391	0.818	0.583	66.1	**171**	**121**	38.4	100	68	5.0	6.2	5.5	<0.05
Aug-08	0.371	0.745	0.570	30.8	56	39.2	37	47	43	5.5	7.0	5.9	<0.05
Avg			**0.581**			**66.0**			**34.9**			**5.9**	**<0.05**
Max		**1.184**			**185**	**121**		**100**	**68**		**8.5**		
Min	**0.067**			**2.15**			**10**			**1.8**			

5.0 PLANT PERFORMANCE AND CAPACITY

5.1 Ability of Existing System to Meet Current Demand

Hydraulic Capacity of Trunk Main

A hydraulic analysis was performed on the Frontage Road trunk main from Division Street to the WWTF to examine the ability to handle existing flow demands as part of this study (Figure 5-1). Water surface elevations were estimated for both AAF and PHF conditions to develop the hydraulic profile. Figure 5-2 displays the estimated water levels and flow rates for each section, and identifies those that are undersized. The ratio of water depth to pipe diameter (d/D) was used to evaluate the pipe sizes under various flow conditions with the following criteria:

Flow Condition	**Allowable Water Depth (d/D)**
AAF	0.5
PHF	0.75

Flow rates for each section of the Frontage Road trunk main were adjusted for incoming wastewater flows. The percent of total flow in each contributing pipeline was estimated based on the number of dwelling units on the incoming line. There are three incoming pipelines between Division Street and the WWTF: an 8-inch pipe at Southland Street, and two 12-inch pipes at Story Street. An approximate dwelling unit count was performed for each contributing sub-area using an aerial photo taken in 2006. Flow rates were calculated assuming 3.34 people per dwelling unit and an average of 60 gallons per capita per day, based on total measured flow and population. Table 5-1 displays the estimated contributing flow rates for each incoming pipeline.

Table 5-1 Estimated Contributing Flows to Frontage Road Trunk Main

Wastewater Pipeline	Percent of Total Flow	AAF (mgd)	PHF (mgd)
Frontage Rd at WWTF	100	0.60	1.8
Southland St	5	0.03	0.09
Story St (NE inlet)	20	0.12	0.36
Story St (NW inlet)	10	0.06	0.18

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LEGEND

- PROPERTY BOUNDARY
- SEWER LATERAL
- STUDY AREA

NOT TO SCALE

FIGURE 5-1	NCSD SOUTHLAND WWTF MASTER PLAN FRONTAGE ROAD TRUNK MAIN STUDY AREA	BEC PROJECT NO. 19996.17

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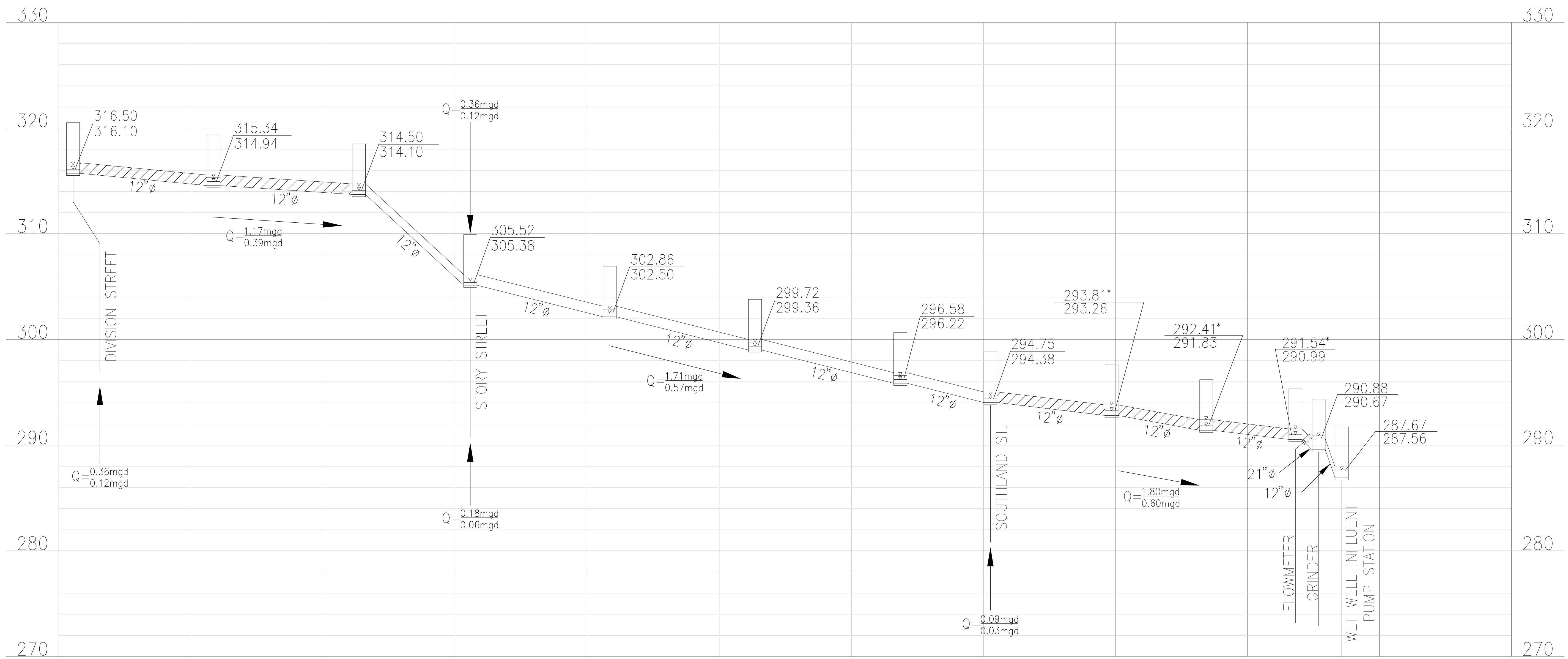

*DEPTH IS 82–100% OF PIPE DIAMETER (SHOWN AS 100%)

LEGEND

PHF / AAF

$Q = \frac{PHF}{AAF}$

d/D>0.5 DURING AAF AND >0.75 PHF

d/D>0.75 DURING PHF

d/D>0.5 DURING AAF

SCALE:
HORIZ. 1"=400'
VERT. 1"=10'

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NCSD SOUTHLAND WWTF MASTER PLAN

FRONTAGE ROAD TRUNK MAIN
HYDRAULIC PROFILE FOR EXISTING DEMANDS

BEC PROJECT NO. 19996.17

FIGURE 5-2

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Influent Pump Station

The influent pump station was examined for hydraulic capacity. Two Fairbanks-Morse submersible pumps were installed in 2000. They are rated at approximately 2300 gpm each, providing enough capacity to handle the current peak hour flow of approximately 1230 gpm with one pump as a backup. System and pump curves were generated which confirmed this for the specific system conditions (Figure 5-3).

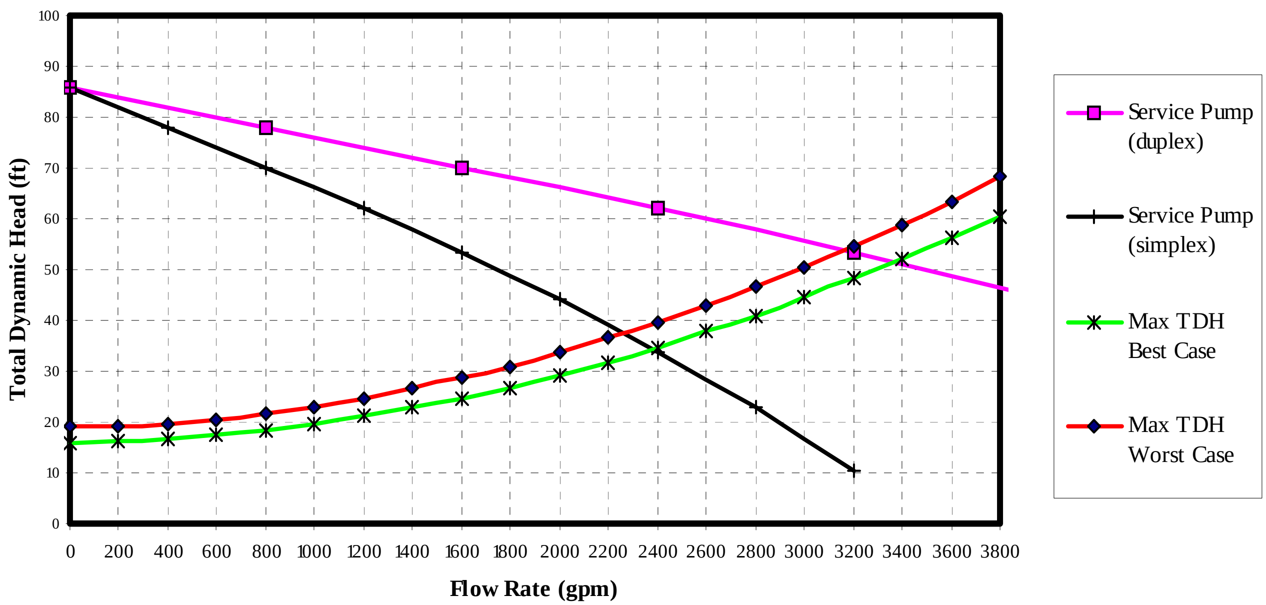


Figure 5-3 Composite Service Pump Curve and System Curve

It is important that influent wetwells are sized with the correct volume and controls for optimized pump station operation. Wet wells should be large enough to prevent rapid pump cycling, which wears the motor and electronics, and small enough to reduce residence time and minimize odors and settling/accumulation of solids. The influent wet well is 8-feet in diameter. Analysis indicates that the wet well is undersized. The following equation is used to determine the recommended storage volume for a wet well[1]:

$$V = \frac{Tq}{4}$$

Where, T is the allowable minimum cycle time between starts, q is the rated capacity of a single pump, and V is the active volume of the wet well. The active volume is defined as the amount of storage available between pump cycles. To protect the pumps, the recommended minimum cycle time is 10 minutes per pump. Under this condition, the desired wet well active volume for the pump station is 2875 gallons, or 370 ft^3. With 3.7 feet

[1] Sanks, Robert L. *Pumping Station Design*, 2nd Edition. Butterworth-Heinemann: (1998), 370.

between the levels when the lead pump turns on and off, the current active volume is 186 ft^3, half the volume recommended for existing conditions.

Treatment Capacity

The ability to treat the current influent wastewater was evaluated using various historic flow and temperature conditions. First-order rate kinetics were used to estimate BOD_5 degradation in the aeration ponds. The analysis showed that the current treatment system is able to handle existing conditions and treat incoming wastewater to acceptable levels provided adequate aeration is accomplished and transfer of clarified effluent between the primary ponds to the secondary ponds is withdrawn from proper level above sludge blanket and below pond surface. The 90^{th} percentile BOD_5 (360 mg/L) was applied and the analyses were run under two assumed configurations: four ponds in series and two ponds in series (two parallel flow trains). Both configurations were examined under different combinations of temperature and flow conditions (summer and winter temperatures, and high, low, and maximum month daily flow rates).

Analyses show the configuration using four ponds in series theoretically performs better than the series of two ponds, providing a 92 – 96% reduction in BOD_5 concentration (from 360 mg/L to 15 – 29 mg/L). The two ponds in series configuration also shows the ability for adequate levels of treatment, providing effluent BOD_5 concentrations between 30 and 48 mg/L, or an 87 – 92% reduction of BOD_5. However, several other factors can hinder the ponds' capability to reduce BOD. Extended detention times can result in poorly settled sludge in the final aeration steps. This sludge may be suspended in the ponds and may cause an increase in effluent BOD. For this reason, we recommend using the parallel model to determine if the ponds provide sufficient retention time as opposed to the ponds in series. The modeling cannot provide an accurate prediction of effluent BOD_5 concentrations, but is useful in evaluating retention time and determining appropriate pond volumes. Table 5-2 summarizes the results of the analysis and indicates that sufficient retention time and pond volume are available under existing conditions. Calculations are included in Appendix B.

Table 5-2 Modeled Effluent Quality under Existing Flow Conditions

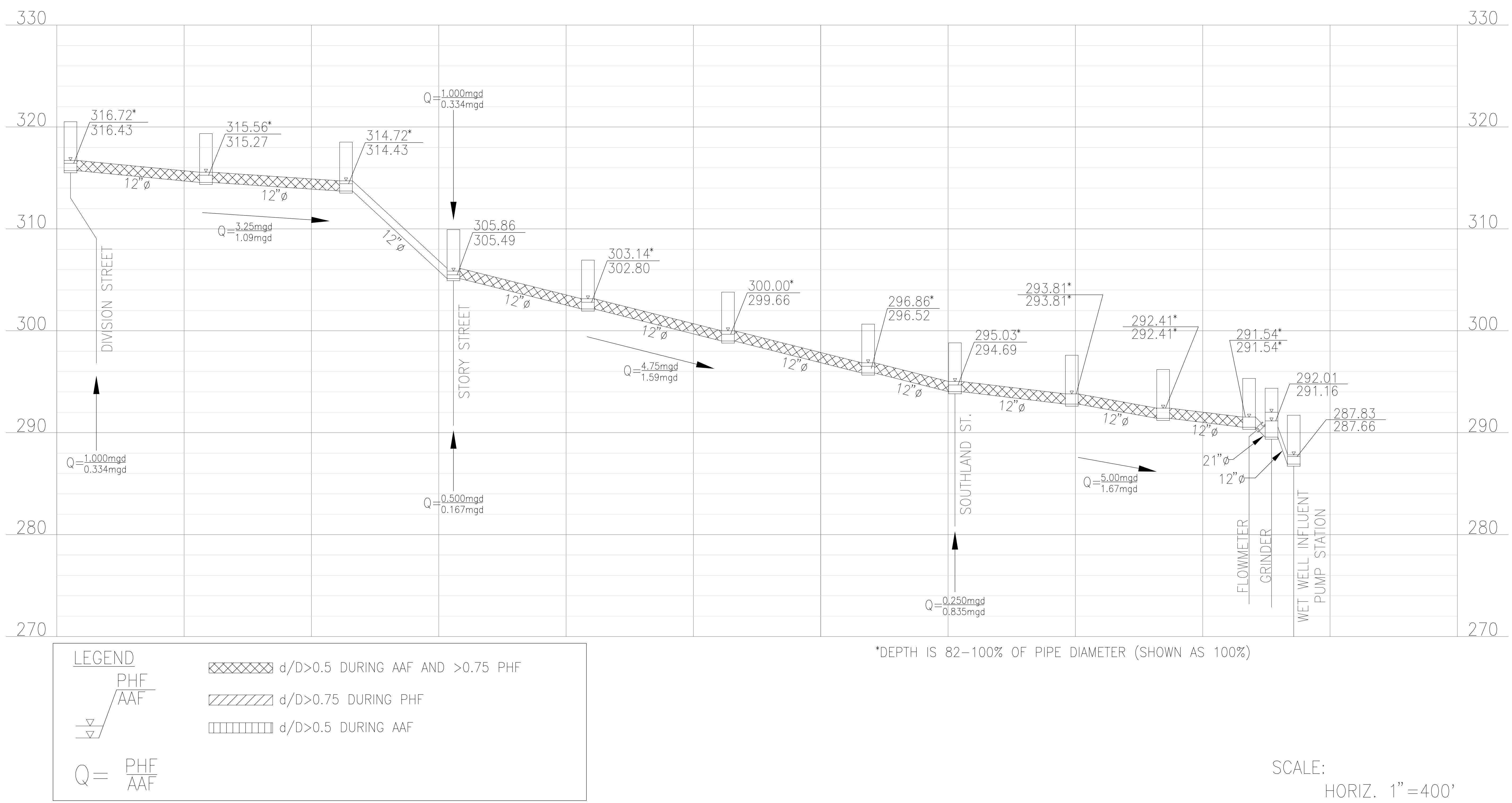
	Temperature (T) and Flow (Q) Conditions		
	Low T, Low Q	High T, High Q	High T, MMF
4 Ponds in Series $[BOD_5]$ (mg/L)	28	15	29
2 Parallel Trains of 2 Ponds $[BOD_5]$ (mg/L)	47	30	48
WDR Effluent BOD_5 Limits: Daily = 100 mg/L; Monthly = 60 mg/L			

5.2 Ability of Existing System to Meet Future Demand

<u>Frontage Road Trunk Main</u>

The Frontage Road Trunk Main from Division Street to the WWTF was examined to determine the ability to handle future flow demands. The water surface elevations were estimated using the projected AAF and PHF to form the hydraulic profile, included as Figure 5-4. Flow rates were adjusted for incoming wastewater pipelines, using the same method as previously discussed.

The same d/D criteria as for the existing hydraulic capacity analysis were used to identify undersized pipe. The entire stretch of 12-inch pipeline examined was found to be undersized for both AAF and PHF, except one section immediately above the Story Street intersection where the slope is 2.1%, nearly 3.5 times that of the next greatest slope in the study reach. If the other pipes are replaced, it is recommended that this pipe be replaced as well.



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FRONTAGE ROAD TRUNK MAIN
HYDRAULIC PROFILE FOR 2030 PROJECTED DEMANDS

BEC PROJECT NO. 19996.17

FIGURE 5-4

WWTF Hydraulic Capacity

Available record drawings were used to develop a hydraulic grade line through the wastewater treatment facility for future peak day flow. Overflow weirs and outlet control devices dictate the water levels in the secondary ponds. A hydraulic analysis was performed through the pipes and valves connecting the primary to the secondary ponds to determine the water levels in the primary ponds. Hydraulically, the current pond system has sufficient capacity to meet future flow demands. Treatment capacity is addressed in the subsequent section. Figure 5-5 displays the hydraulic grade line through the treatment facility.

Influent Pump Station

The influent pump station was analyzed for future capacity. Based on the pump and system curves, included as Figure 5-3 above, the pumps are undersized to handle the year 2030 PHF of 3500 gpm. The duplex pump curve indicates that the two existing pumps pumping together will be capable of delivering the flow. However, an upgrade is required to maintain 100% redundancy in the future.

Since the desired wet well volume is dependent on pump capacity, the wet well volume should be increased when the pumps are replaced with larger pumps. Assuming two 3500-gpm pumps are installed to meet PHF, the future required active wet well volume should be 585 ft^3 to maintain a 10-minute cycle time per pump during PHF. It should be noted that the analysis is based on the existing system. If changes are made to the headworks the analysis will need to be revisited to properly size influent pumps and wet well. The addition of screening and grit removal systems will add to system head loss, potentially requiring additional pump capacity.

Treatment Capacity

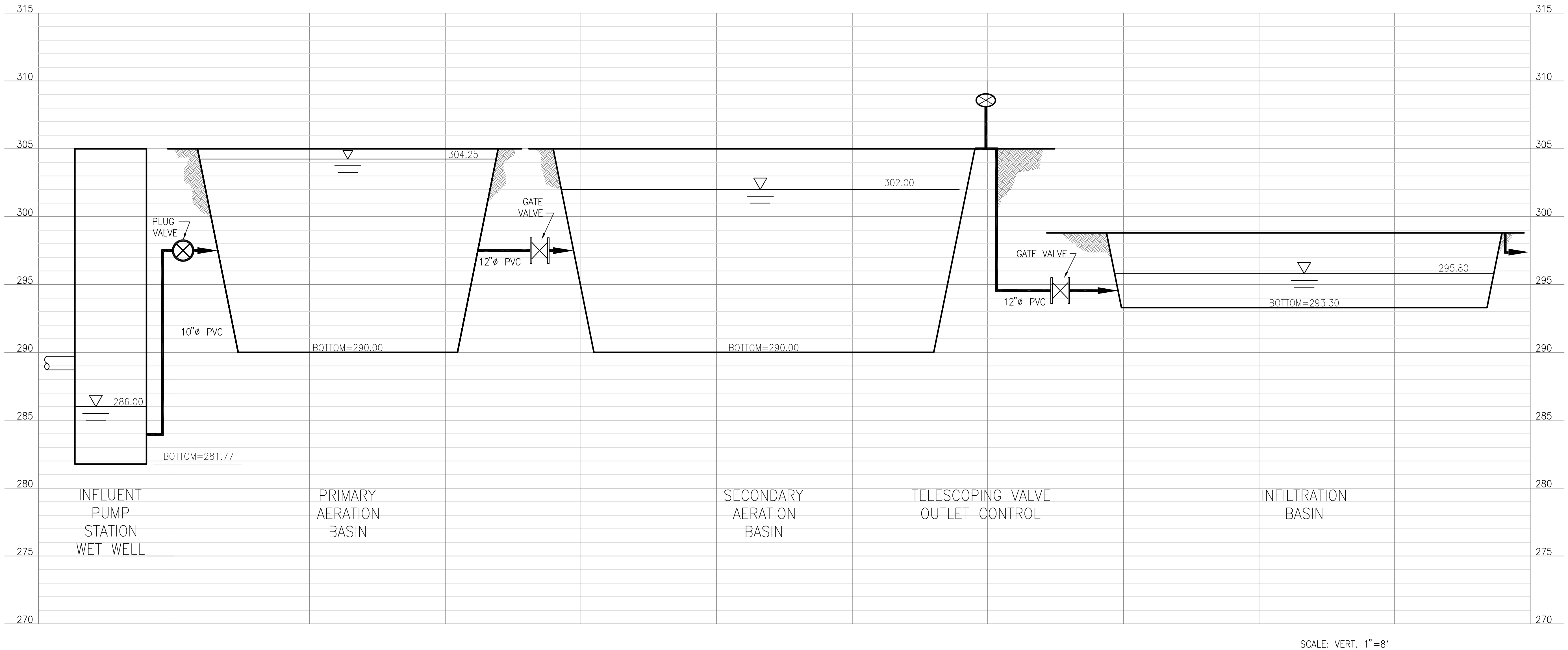
The ability of the existing system to treat future wastewater flow was evaluated using projected hydraulic demands for applicable 2030 flow rates (PDF, AAF, and MMF), the 90^{th} percentile BOD_5 concentration (360 mg/L), and two boundary temperature conditions (summer and winter). Two configurations were examined: four ponds in series, and two parallel trains with two ponds in each train. First-order rate kinetics were applied to predict BOD_5 degradation. Table 5-3 summarizes the results of the analysis. Neither configuration appears to provide sufficient treatment under any boundary flow condition. Full calculations are included in Appendix B.

Table 5-3 Treatment Capacity of Existing System under Future Flow Conditions

	Temperature (T) and Flow (Q) Conditions		
	Low T, Low Q	**High T, High Q**	**High T, MMF**
4 Ponds in Series [BOD_5] (mg/L)	124	155	108
2 Parallel Trains of 2 Ponds [BOD_5] (mg/L)	139	167	125
WDR Effluent BOD_5 Limits: Daily maximum = 100 mg/L; Monthly mean = 60 mg/L			

If the ponds are operated in two parallel trains of two, the treatment modeling indicates the permitted BOD_5 effluent limit is expected to be reached by 2011 during high temperature, high flow conditions. If the ponds are run in series, the permitted BOD_5 limit may be reached in 2015 but sludge settleability becomes a concern in series operation, as discussed elsewhere in this study.

Regardless, the District should begin planning and design of a wastewater treatment plant upgrade as soon as possible since the facility is nearing the permitted capacity (see Section 3.0).



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NCSD SOUTHLAND WWTF MASTER PLAN

TREATMENT PLANT HYDRAULIC PROFILE FOR 2030 PEAK DAY FLOW

BEC PROJECT NO. 19996.17

FIGURE 5-5

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6.0 WATER QUALITY GOALS

6.1 Recycled Water Usage

Currently, the Southland Wastewater Treatment Facility (WWTF) discharges to eight infiltration basins and eventually to groundwater. The selection of treatment processes, associated plant improvements, pumping stations, pipelines, and storage facilities depend on the end user or final destination of the wastewater. Depending on the usage option chosen, different regulatory requirements will be enforced; also, the WDRs will need to be revised for recycled water use. The usage options considered in this section are as follows: 1) Unrestricted Urban Usage, 2) Groundwater Recharge, and 3) Maintain Current Discharge Practices. Depending on the usage option chosen, the WWTF may need to meet recycled wastewater regulations (i.e. California Code of Regulations (CCR) Title 22).

Since this Master Plan was drafted the District has investigated future disposal and reuse options for treated wastewater from Southland WWTF. AECOM recently completed the Preliminary Screening Evaluation of Southland Wastewater Treatment Facility Disposal Alternatives (January 2009). In this report, several potential disposal and reuse alternatives were evaluated. Groundwater recharge reuse was determined "fatally flawed" based on regulatory restrictions and the cost to fulfill the requirements for diluent water. However, because of the potential benefits and in case the District desires to pursue the option in the future, an evaluation of groundwater recharge reuse is presented in Section 6.3 below.

6.2 Option 1 - Unrestricted Urban Reuse (Disinfected Tertiary Recycled Water)

<u>Regulatory Requirements</u>

The California Code of Regulations (CCR) Title 22, Division 4, Chapter 3, Sections 60301 through 60355 are used to regulate recycled wastewater and are administered jointly by California Department of Health Services (CDPH) and RWQCB.

Disinfected tertiary recycled wastewater requires a level of treatment that meets the most stringent requirements for all uses allowed under the Title 22 criteria. Potential users include farmlands, parks and playgrounds, schoolyards, unrestricted access golf courses, roadway landscaping, and residential and commercial landscaping. This study focuses on landscaping application for parks. Owners of these facilities, CDPH, RWQCB, County, and possibly local authorities will be involved in wastewater reuse contracts and permitting. The Waste Discharge Requirements for the WWTF would need to be revised to allow reuse of plant effluent for unrestricted urban use. Disinfected tertiary treatment requires oxidation, coagulation[2], filtration and disinfection. These treatment stages will need to be added to the WWTP as part of the upgrades if this reuse option is pursued. According to Title 22 requirements, the median total coliform limit in reclaimed water is 2.2 MPN/100mL, and the maximum total coliform standard is 23 MPN/100mL. The median total coliform number is determined from samples of bacteria collected from the last 7-days of analysis. The maximum total coliform should not be exceeded in one sample over 30 consecutive days.

Contracts with end users are typically required for guaranteeing a demand for treated wastewater. In addition, facilities and appurtenances needed for recycling include transmission pipelines, pump stations, storage reservoirs, and property or easements for locating these facilities.

<u>Water Quality Objectives</u>

Water quality objectives for unrestricted urban use are primarily driven by public safety and suitability for application. Safety assurances are written into Title 22 requirements through standards for effluent coliform concentrations and usage restrictions, such as pipeline distance from potable water pipelines, proximity to groundwater, and restrictions near eating facilities and drinking fountains.

There have been multiple studies to determine constituents of concern in reclaimed water used for irrigation. Suitability of water for irrigation is directly related to the concentration and kind of chemical constituents present. The water constituents that may affect recycled water suitability for irrigation of grasses and ornamental plants include electrical conductivity of the irrigation water (EC_W), sodium adsorption ratio (SAR), bicarbonates, chlorides, and boron. General irrigation water quality guidelines are shown on Table 6-1. A summary of the effluent[3] (treated wastewater) quality from the Nipomo Southland Wastewater Treatment Facility (WWTF) is presented in Table 6-2. Crop specific tolerance limits are presented in Table 6-3.

<u>Electric Conductivity/TDS</u>

Salinity can be indirectly measured by electrical conductivity. The units of conductance are typically decisiemens per meter (dS/m), which is equivalent to millimhos per centimeter (mmhos/cm). Multiple devices and protocols exist for the monitoring/measuring of electrical conductivity, including in-office and in-field measurements.

EC_w is the electrical conductivity of the irrigation water. It is a measure of the total salt content of the irrigation water and is used to quantify its salinity. Since the EC of the treatment plant effluent is not currently monitored, no conclusions can be drawn as to the suitability of the effluent's salinity for irrigation. If the effluent salinity

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[2] Coagulation is not typically required if membrane filtration is used and/or turbidity requirements are met.

(measured as EC) is within the water quality guidelines summarized in Table 6-1 for irrigation water salinity (measured as EC_w), there should be no EC associated effluent reuse restrictions. However, if the effluent salinity tends toward the “Increasing Problems” or “Severe Problems” range, intensive irrigation management may be required in order to control soil salinity levels. Adequate rainfall will assist the salt leaching process and help to mitigate the accumulation of soluble salts in the soil profile.

[3] Effluent is currently secondary

Table 6-1 Guidelines for Interpretation of Water Quality for Irrigation

Problem and Related Constituent	References	Water Quality Guidelines: No Problem	Increasing Problems	Severe Problems
Salinity[1]				
EC_w of irrigation water (mmhos/cm)	1,2	<0.75	0.75-3.0	>3.0
TDS (mg/l) or (ppm)	2	<450	450-2000	>2000
Permeability				
EC_w of irrigation water (mmhos/cm)	1	>0.5	<0.5	<0.2
adj.SAR[2]	1	<6.0	6.0-9.0	>9.0
Specific ion toxicity from root absorption[3]				
Sodium (evaluated by adj.SAR)	1,2	<3.0	3.0-9.0	>9.0[4]
Chloride (meq/l)	1	<4	4.0-10.0	>10
Chloride (mg/l)	1,2	<142	142-355	>355
Boron (mg/l)	1	<0.5	0.5-2.0	2.0-10.0
Specific ion toxicity from foliar absorption[5] (sprinkler irrigation)				
Sodium (meq/l)	1	<3.0	>3.0	--
Sodium (mg/l)	1,2	<69	>69	--
Chloride (meq/l)	1	<3.0	>3.0	--
Chloride (mg/l)	1	<106	>106	--
Miscellaneous[6]				
Total Nitrogen (NH_4-N and NO_3-N) (mg/l) for sensitive crops	1,2	<5	5-30	>30
(The following apply only for irrigation by overhead sprinklers)				
Bicarbonate (HCO_3) (meq/l)	1	1.5	1.5-8.5	>8.5
Bicarbonate (HCO_3) (mg/l)	1,2	<90	90-520	>520
Residual Chlorine (mg/l)	2	<1.0	1.0-5.0	>5.0
PH	1,2	Normal range = 6.5-8.4		

[1] Assumes water for crop plus needed water for leaching requirement will be applied. Crops vary in tolerance to salinity

[2] adj.SAR (adjusted sodium absorption ratio) is calculated form a modified equation developed by U.S. Salinity Laboratory to include added effects of precipitation or dissolution of calcium in soils and related to CO_3 + HCO_3 concentrations. Permeability problems, related to low EC or high adj.SAR of water, can be reduced if necessary by adding gypsum.

[3] Most tree crops and woody ornamentals are sensitive to sodium and chloride. Most annual crops are not sensitive.

[4] Shrinking-swelling type soils (montmorillonite type clay minerals); higher values apply for others.

[5] Leaf areas wet by sprinklers may show a leaf burn due to sodium or chloride absorption under low-humidity / high-evaporation conditions. (Evaporation increases ion concentration in water films on leaves between rotations of sprinkler heads.)

[6] Excess N may affect production of quality of certain crops, i.e., sugar beets, citrus, avocados, apricots, and grapes. HCO_3 with overhead sprinkler irrigation may cause a white carbonate deposit to form on fruit and leaves.

Reference 1: Ayers, Robert S., Quality of Water for Irrigation, Journal of the Irrigation and Drainage Division, ASCE, June 1977. (Table 1, page 136)

Reference 2: Irrigation with Reclaimed Municipal Wastewater – A Guidance Manual, California State Water Resources Control Board, Report Number 84-1 WR, July 1984. (Table 3-4, page 3-11)

Note: Interpretations are based on possible effects of constituents on crops or soils or both. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation.

Table 6-2 Summary of Effluent Quality from NCSD Southland WWTF

Constituent	Units	Range of Results[1]	Comparison to Table 6-1 Guidelines
Bicarbonate	mg/l or ppm	--	--
Boron	mg/l	--	--
Chloride	mg/l	208 – 234	Increasing problems for root and foliar absorption[2]
Total Nitrogen	mg/l	28 – 46	Increasing to severe problem for sensitive crops[2]
pH	--	7.4 – 7.7	Within normal range
TDS	mg/l	980 – 1180	Within increasing problems range[2]
EC	dS/m or mmhos/cm	--	--
Sodium	mg/l	184 – 209	Increasing problems for foliar absorption[2]
SAR	--	--	--
$SAR_{adjusted}$	--	--	--

-- Indicates constituents are not currently monitored
[1]Effluent quality data is based on Discharger Self Monitoring Reports from July 2004 through August 2006.
[2]Crops vary in tolerance to the constituents above in Table 6-2. Table 6-1 summarizes general irrigation water guidelines as published by the quoted references. Care should be taken in interpretation and application of this data.

Sodium Adsorption Ratio

The sodium adsorption ratio (SAR) is the most reliable index of sodium hazard to crops and soils. A moderately high SAR will not generally result in a toxic effect to most plants. However, some crops are sensitive to excess sodium. Foliar toxicity may exist due to elevated sodium concentrations: however, it is a site/crop-specific phenomenon.

A reduction in soil permeability is a major problem that occurs with high-sodium irrigation water. Applying water with an SAR below 6 does not usually result in permeability problems. If the SAR is between 6 and 9, permeability problems can occur on fine-textured soils. An SAR above 9 will likely result in permeability problems on all mineral soils except course, sandy soils.

Bicarbonates and Adjusted Sodium Adsorption Ratio (SAR_{adj})

Bicarbonates in irrigation water applied to the soil will precipitate calcium from the cation exchange complex as relatively insoluble calcium carbonate. As exchangeable calcium is lost from the soil, the relative proportion of sodium is increased with a corresponding increase in the sodium hazard (SAR). Bicarbonates in the irrigation water contribute to the overall salinity, but, more importantly, they may result in a previously calcium-dominant soil becoming sodium dominant by precipitating the exchangeable calcium, which, in turn, will reduce soil permeability.

A measure of the bicarbonate hazard in irrigation water can be expressed as the adjusted SAR. See Table 6-1. The adjusted SAR takes into account the concentration of bicarbonates in irrigation water in relation to their effect on potential increases in soil SAR. When the adjusted SAR is less than 6, soil permeability problems generally do not occur. If the adjusted SAR is between 6 to 9, permeability problems can occur on fine-textured soil. An adjusted SAR above 9 will likely result in permeability problems in mineral soils except course, sandy soils, where adverse impacts to soil permeability are not a major concern. Periodic soil treatment (i.e. deep ripping or disking) or water treatment may be required to maintain favorable water infiltration characteristics in project soils.

Bicarbonates in irrigation water may also cause potential problems in micro-irrigation systems as a result of lime precipitation, which can cause emitter plugging. These potential problems are accentuated in alkaline irrigation water.

Chlorides

Chlorides are necessary for plant growth in relatively small amounts. However, high concentrations of chlorides can inhibit growth and result in toxicity to foliage if applied by sprinkler irrigation. Chlorides in irrigation water are toxic to some plant species. The tolerances of select herbaceous crops and ornamentals to chloride are shown on Table 6-3. The chloride concentration of the treatment plant effluent (see Table 6-2) is within the range of increasing problems for root and foliar absorption when compared to the guidelines in Table 6-1. If a sprinkler wets the leaf areas, foliage toxicity (leaf burn) problems may also be apparent as a result of the effluent having a slightly higher-than-desired chloride concentration level (Table 6-2).

Table 6-3 Crop Specific Tolerance Limits for Irrigation Water Quality

Herbaceous Crops & Ornamentals

Crop	Constituent Limits: Salt tolerance – In Sat. Soil Extracts EC_e[1] (dS/m) or (mmhos/cm)	Salt tolerance – In Irrigation Water EC_w[2] (dS/m) or (mmhos/cm)	Chloride tolerance (Cl^-) – In Sat. Soil Extracts[3] (mol/m^3)	Chloride tolerance (Cl^-) – In Sat. Soil Extracts[4] (mg/l)	Boron tolerance – In Soil Water[5] (mg/l)
Herbaceous Crops (grasses,grain,forage):	**Threshold values**		**Threshold values**		**Threshold values**
Alfalfa	2.0	1.3	20	700	4.0 - 6.0
Barley (forage)	6.0	4.0	60	2100	3.4
Bermuda Grass	6.9	4.6	70	2450	--
Fescue Tall Grass	3.9	2.6	40	1400	--
Sorghum	6.8	4.5	70	2450	7.4
Ornamental shrubs and trees:	**Max. Permissible Values**				**Threshold values**
Bougainvillea	> 8	5.3	--	--	--
European Fan Palm	6 - 8	4 - 5.3	--	--	--
Southern Magnolia	4 - 6	2.7 - 4	--	--	--
Strawberry Tree	3 - 4	2 - 2.7	--	--	--
Oleander	6 - 8	4 - 5.3	--	--	2.0 - 4.0
Japanese Boxwood	4 - 6	2.7 - 4	--	--	2.0 - 4.0
Juniper	--	--	--	--	<0.5

-- Indicates data not available

[1] EC_e data adapted from Tables 13.1a, 13.1b, & 13.3 of reference #1 below:

[2] EC_w is the electrical conductivity of the irrigation water. Irrigation water salinities exceeding the stated threshold or maximum permissible values may cause leaf burn, loss of leaves, and/or excessive stunting. EC_w is approximated from the EC_e as follows:

$EC_e/1.5 = EC_w$

This relationship should be valid for normal irrigation practices.

[3] Cl^- tolerance data adapted from Table 13.6 of Reference #1 below:

[4] To convert Cl^- concentrations to mg/l, multiply threshold values by 35. Cl^- concentrations in saturated soil extracts sampled in the rootzone.

[5] Boron tolerance data adapted from Tables 13.7 & 13.9 of Reference #1 below:

Reference 1: ASCE Manuals and Reports on Engineering Practice No. 71, Agricultural Salinity Assessment and Management, 1996 corrected edition

Boron

Boron in irrigation water does not have an effect on soil physical conditions, but in high concentrations it can have a toxic effect on some plants. The tolerance of some crops to boron is shown in Table 6-3. As indicated in Table 6-2, boron is currently not monitored, as it is not a regulated contaminant in the treatment plant's WDR.

Recommendations For Monitoring

In order to fully evaluate the suitability of the wastewater treatment plant effluent for unrestricted use in urban applications, the following constituents/parameters should be monitored, recorded, and evaluated on a quarterly or semiannual basis.

- Effluent Electrical conductivity (EC_w) as previously discussed in this report
- SAR and SAR_{adj} to evaluate the water sodium hazard
- Boron to evaluate potential toxicity to plants
- Fecal coliform

This data is invaluable in fully understanding, evaluating, and identifying potential soil management and crop production problems that can arise as a result of irrigating with the effluent in question.

6.3 Option 2 - Groundwater Recharge Reuse

In August 2008, CDPH released a draft document to regulate groundwater recharge reuse projects (GRRP) called the Groundwater Recharge Reuse Draft Regulations. This document proposed guidelines for maximum percentage of recycled water, retention time, horizontal distance to extraction, and maximum contaminant levels (MCLs). A GRRP is defined as "A project that uses recycled municipal wastewater … planned and operated for the purpose of recharging a groundwater basin designated in the Water Quality Control Plan [defined in the Water Code section 13050(j)] for use as a source of domestic water supply, and has been identified as a GRRP by the RWQCB". Though the regulations are still in draft form and the ultimately adopted criteria are unknown, the document provides useful guidelines for potential groundwater recharge reuse projects. CDPH, RWQCB, local agencies, and landowners will be involved if this usage option is pursued.

The general requirements of the draft regulations indicate that for each GRRP the wastewater management agency shall administer an industrial pretreatment and pollutant source control program. Contaminants for the program will be specified by CDPH based on a review of an engineering report (discussed below) and other available data. The source control program shall include:

1) An assessment of the fate of specified contaminants,
2) A source investigation and monitoring program focused on specified contaminants,
3) An outreach program to the public within service area to manage and minimize discharge of compounds of concern, and
4) A program for maintaining an inventory of compounds discharged into the wastewater collection system.

Upon proposal of a GRRP an engineering report is required for CDPH and RWQCB that includes a comprehensive investigation and evaluation of the GRRP, characterization of the recycled and diluent water quality, evaluation of the impacts on the existing potential uses of the impacted groundwater basin, the proposed means for achieving compliance, and an operations plan. Prior to the operation of a new GRRP, an approved plan shall be in place for providing an alternative source of domestic water supply or an approved treatment if drinking water sources are determined to be unsafe as a result of the GRRP. CDPH will conduct public hearings for the proposed GRRP prior to making recommendations to the RWQCB regarding permitting.

Recycled water used for groundwater recharge reuse projects must meet the definition of filtered, disinfected tertiary wastewater as defined by CDPH. The median and maximum total coliform limits are the same as for the disinfected tertiary wastewater for unrestricted urban use. Filtration will be required to meet turbidity requirements. The recycled municipal wastewater must be retained underground for a minimum of six months prior to extraction for use as a drinking water supply. Methods for demonstrating retention time are outlined in the regulations.

All GRRP must dilute the recycled water to be used as recharge with an approved source of water. The water source must be a potable source of water and cannot contain treated municipal wastewater. The ratio of recycled water to diluent water is regulated through a value termed the “recycled water contribution” (RWC). The RWC is calculated each month using a running monthly average (RMA), which is based on the total volume of recycled municipal wastewater and diluent water for the preceding 60 calendar months. The average RWC shall not exceed the maximum RWC specified by CDPH. The initial maximum RWC will be based on the CDPH review of the engineering report (Section 60320.080), but cannot exceed 0.50 for subsurface application, or 0.20 for surface applications, unless the GRRP provides reverse osmosis and advanced oxidation treatment meeting CDPH requirements. It is possible to increase the maximum RWC with approval from CDPH and RWQCB. Requirements for such approval are outlined in the Draft Regulations.

Total organic carbon (TOC) is monitored in the filtered wastewater or in the recycled municipal wastewater. For filtered wastewater, 24-hour composite samples are to be collected twice per week, unless subsequently treated by reverse osmosis. TOC is not to exceed 16 mg/L based on two consecutive samples and the average of the last four results. For recycled municipal wastewater, 24-hour composite samples are to be collected once per week and the TOC is not to exceed 0.5 mg/L divided by the CDPH-specified RWC based on two consecutive samples and the average of the last four results. Limits may be increased after 10 years with approval of CDPH. The basis for approval is outlined in the Draft Regulations.

Three methods are available to demonstrate the control of organic and inorganic nitrogen compounds. Table 6-4 details each method. Tables 6-5 through 6-10 summarize the maximum contaminant levels (MCLs) for constituents of concern in GRRPs. To determine compliance, samples are to be collected and analyzed quarterly for inorganics, organics, lead and copper, radionuclide chemicals, and disinfection byproducts. Once per year, samples are to be collected and analyzed for secondary constituents.

Table 6-4 Three Methods to Demonstrate Control of Nitrogen Compounds

	Method 1	Method 2	Method 3
Compliance point and monitoring	- Anywhere representative of recycled municipal wastewater or recharge water (including or above mound) - Samples analyzed for total N - Reduced monitoring available	- Anywhere representative of recycled municipal wastewater or recharge water (prior to subsurface application or from within mound or vadose zone prior to reaching the GW table) - Samples analyzed for total N, ammonia, org-N, NO_3, NO_2, DO, and BOD - A GW sample analyzed for DO - Reduced monitoring available	- Only for projects in operation for 20 years or more - Groundwater down-gradient of the recharge area - Samples analyzed for NO_3 and NO_2
Standard(s)	- 5 mg/L total N as an average	- 10 mg/L total N - Limits established in engineering report for other constituents	MCLs for NO_3 and NO_2
Frequency of sampling	2 per week	As established by CDPH and specified in the operations plan	- Specified in engineering report & operations plan - Relatively frequent monitoring at locations between recharge & downgradient domestic wells req'd
Consequences of Failure	- Investigate, correct, and notify based on average of 2 consecutive samples >5 mg/L - Suspend application of recycled municipal wastewater if the 4-week average of all samples >5 mg/L	- Investigate, correct, and notify if average of 2 consecutive samples over the > 10 mg/L Total N or exceeds standard for other constituents - Suspend application of recycled municipal wastewater until the average of 2 consecutive samples meets the limits	- Notify CDPH and RWQCB if > MCLs - Suspend application unless demonstrated that the groundwater no longer exceeds the MCLs
Rationale	Method 1 relies on such a low limit for the Total N in recycled municipal wastewater that the chance that the NO_3 or NO_2 MCL could be exceeded is minute	Method 2 relies on: 1. A low enough limit for Total N in the recycled municipal wastewater that the chance that the NO_3 or NO_2 MCL could be exceeded is low, combined with 2. A set of limits determined for specific GRRP and explained in the engineering report for NO_2, org-N, and/or ammonia necessary to limit oxidation to NO_3 or NO_2, and a set of min levels for an excess DO over BOD requirement in the recycled municipal wastewater and/or a DO requirement in the groundwater as necessary to prevent reduction of NO_3 to NO_2.	Method 3 relies on: 1. A demonstration that historic recharge with water containing comparable levels of nitrogen has not caused a problem, 2. Evidence that recharge water can be tracked and monitored throughout the flow path, and 3. Monitoring to show that MCLs for NO_2 and NO_3 are met in the groundwater.
Endnote 7 of CADPH Draft Regulation for Groundwater Recharge Reuse. 01/15/2008.			

Table 6-5 Maximum Contaminant Level (MCL) for Inorganic Compounds

Inorganic Chemicals	*MCL (mg/L)*
Aluminum	1
Antimony	0.006
Arsenic	0.01
Asbestos	7 MFL*
Barium	1
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.15
Fluoride	2
Mercury	0.002
Nickel	0.1
Nitrate (as NO_3)	45
Nitrate + Nitrite (sum as Nitrogen)	10
Nitrite (as Nitrogen)	1
Perchlorate	0.006
Selenium	0.05
Thallium	0.002
MFL = million fibers per liter, for fibers exceeding 10 um in length	

Table 6-6 Maximum Contaminant Levels for Radioactivity

Radioactivity	*MCL (pCi/l)*
Combined Radium-226 & Radium-228	5
Gross Alpha particle activity (including Radium-226, but excluding Radon & Uranium)	15
Tritium	20,000
Strontium-90	8
Beta/photon emitters	4 millinem/year
Uranium	20

Table 6-7 Reporting Limits and Action Levels for Lead and Copper

Constituent	*DLR[a] (mg/L)*	*Action Level[b] (mg/L)*
Lead	0.005	0.015
Copper	0.050	1.3
[a] DLR = Detection limit for reporting purposes [b] Action level is based on the 90th percentile level		

Table 6-8 Maximum Contaminant Levels for Organic Compounds

Non-Volatile Synthetic Organic Chemicals	***MCL (mg/L)***	***Volatile Organic Compounds***	***MCL (mg/L)***
Alachlor	0.002	Benzene	0.001
Atrazine	0.001	Carbon Tetrachloride	0.0005
Bentazon	0.018	1,2-Dichlorobenzene	0.6
Benzo(a)pyrene	0.0002	1,4-Dichlorobenzene	0.005
Charbofuran	0.018	1,1-Dichloroethane	0.005
Chlordane	0.0001	1,2-Dichloroethane	0.0005
2,4-D	0.07	1,1-Dichloroethylene	0.006
Dalapon	0.2	cis-1,2-Dichloroethylene	0.006
Dibromochloropropane (DBCP)	0.0002	trans-1,2-Dichloroethylene	0.01
Di(2-ethylhexyl)adipate	0.4	Dichlrormethane	0.005
Di(2-ethylhexyl)phthalate	0.004	1,2-Dichloropropane	0.005
Dinoseb	0.007	1,3-Dichloropropene	0.0005
Diquat	0.02	Ethylbenzene	0.3
Endothall	0.1	Methyl-*tert*-butyl ether	0.013
Endrin	0.002	Monochlorobenzene	0.07
Ethylene Dibromide (EDB)	0.00005	Styrene	0.1
Glyphosate	0.7	1,1,2,2-Tetrachloroethane	0.001
Heptachlor	0.00001	Tetrachloroethylene	0.005
Heptachlor Epoxide	0.00001	Toluene	0.15
Hexachlorobenzene	0.001	1,2,4-Trichlorobenzene	0.005
Hexachlorocyclopentadiene	0.05	1,1,1-Trichloroethane	0.200
Lindane	0.0002	1,1,2-Trichloroethane	0.005
Methoxychlor	0.03	Trichloroethylene	0.005
Molinate	0.02	Trichlorofluoromethane	0.15
Oxamyl	0.05	1,1,2-Trichloro-1, 2,2-Trifluoroethane	1.2
Pentachlorophenol	0.001	Vinyl Chloride	0.0005
Picloram	0.5	Xylene	1.750*
Polychlorinated Biphenyls	0.0005		
Simazine	0.004		
Thiobencarb	0.07		
Toxaphene	0.003		
2,3,7,8-TCDD (Dioxin)	$3x10^{-8}$		
2,4,5-TP (Silvex)	0.05	* MCL is either for a single isomer or the sum of isomers	

Table 6-9 Maximum Contaminant Levels for Disinfection Byproducts

Disinfection Byproduct	*MCL (mg/L)*	*Detection Limit for Reporting Purposes (mg/L)*
Total Trihalomethanes (TTHM)	0.080	
Bromodichloromethane		0.0005
Bromoform		0.0005
Chloroform		0.0005
Dibromochlorormethane		0.0005
Haloacetic acids (five) (HAA5)	0.060	
Monochloroacetic Acid		0.002
Dichloroacetic Acid		0.001
Trichloroacetic Acid		0.001
Monobromoacetic Acid		0.001
Dibromoacetic Acid		0.001
Bromate	0.010	0.005
Chlorite	1.0	0.02

Table 6-10 Maximum Contaminant Levels for Secondary Constituents

Secondary Constituents	*MCL/Units*
Aluminum	.2 mg/L
Color	15 units
Copper	1.0 mg/L
Foaming Agents (MBAS)	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Methyl-*tert*-butyl ether (MTBE)	0.005 mg/L
Odor - Threshold	3 Units
Silver	0.1 mg/L
Thiobencarb	0.001 mg/L
Turbidity	5 NTUs
Zinc	5.0 mg/L
Total Dissolved Solids (TDS)* or	1,000 mg/L
Specific Conductance	1,600 microohms
Chloride*	500 mg/L
Sulfate*	500 mg/L
* Constituents currently regulated under WDR at a lower concentration than specified here.	

The two delivery options typically considered for groundwater recharge are direct injection with groundwater wells or surface spreading and percolation. The latter option may be preferred because it will allow natural filtration of the percolated wastewater throughout the geological subsurface or vadose zone, allowing further biological and filtration treatment. Direct injection is often energy intensive, requires high capital costs due to the requirement for RO treatment, may present public perception concerns, and may require an additional level of treatment to assure the public that contamination is not a significant risk. Another option is subsurface application, which allows percolation through the soil column but is applied beneath the ground surface with perforated pipes, or other technique similar to a leach system, to reduce potential visual impacts and odors.

The District has investigated some potential sites for groundwater recharge. To be effective, the land must have proper soil characteristics for percolation and be located where recharge would increase availability of water in the aquifer. A GRRP will require treatment process improvements, transmission pipelines, pump stations, and property for percolation ponds. Additionally, the District must identify a source of diluent water to blend with the recycled water prior to spreading or injection.

6.4 Option 3 - Maintain Current Discharge Practices

Operating improvements made over the past two years have generally improved the wastewater effluent quality. However, groundwater monitoring and hydrogeological studies have indicated a clay layer between 60 and 140 feet beneath the site. This layer appears to be restricting percolation to groundwater and a mound of treated effluent is growing horizontally and upwards beneath the site.

The Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives was completed in January 2009 (AECOM). The disposal/reuse alternatives considered included the current disposal practice (which was determined to be fatally flawed based on capacity and regulatory considerations), infiltration offsite using surface basins or subsurface systems, and irrigation of landscape or agricultural lands with recycled water. It may be possible to utilize onsite infiltration followed by pumping, for infiltration and storage before transporting the treated effluent offsite. The report provides a ranking to assist the District with determining which alternatives to continue investigating.

6.5 Recommendations

Water quality goals will dictate the appropriate level of treatment for the future wastewater treatment plant. Recommendations to assist in that determination are as follows:

- Implement next phase of effluent disposal and reuse alternatives presenting in the January 2009 Screening Evaluation (ibid).
- Sample effluent for constituents that may effect reuse as irrigation: EC_w, SAR & SAR_{adj}, boron, and fecal coliform.
- Sample effluent for constituents that may effect reuse as recharge: TOC, turbidity, organic and inorganic nitrogen.
- Select a future treatment plant process which will provide adequate pretreatment for filtration. If uses such as park/school irrigation, groundwater recharge, or infiltration (under more stringent permit limits than the plant's current permit) are pursued for the expanded treatment facility, aerated ponds will not provide adequate treatment or pretreatment.

7.0 SYSTEM IMPROVEMENTS

7.1 Frontage Road Trunk Main

A hydraulic analysis based on Manning's equation was performed on the Frontage Road trunk main from Division Street to the WWTF. The analysis allowed identification of trunk main sections that are insufficiently sized to handle existing and/or future flows based on the allowable water depth, or d/D as discussed in Section 5.1 (See Figures 5-2 and 5-4). Several sections currently fail to meet the criteria for PHF and the majority of the line is expected to fail for both average and peak future flow rates. The minimum pipeline diameters needed to meet both existing and projected demand were calculated. A 15-inch pipeline will handle existing flow rates, but a 21-inch replacement is recommended to meet future peak demand. The 15-inch upgrade is estimated to cost approximately $1,800,000. The 21-inch upgrade is estimated to cost about 20% more, at $2,200,000. The cost opinions are based on open trench construction. Pipe bursting or pipe reaming may be an option, but a geotechnical study and identification of nearby utilities would be required to determine feasibility. Additional assumptions are listed with the detailed cost opinions, included in Appendix C.

7.2 Influent Pump Station

Electrical Supply Reliability

The WWTF uses two influent pumps to pump incoming wastewater to treatment ponds. The Fairbanks Morse submersible pumps are 35 HP each and rated at an approximate 2300 gallons per minute (gpm) capacity. Occasionally, the WWTF experiences an imbalance in the utility power supply, which causes temporary pump failure. This causes submergence of the trunk sewer and the Parshall flume throat, resulting in false meter readings. The electrical problem is likely a result of the plant's position as the end user on the distribution line, where many "up-stream" residential developments, which are single-phase loads, create an imbalance in the line's three-phase voltage. This theory was substantiated by a data logger that revealed voltage differences of up to 12-15 volts between phases. While this is a problem for the District, it is within the delivery tolerances allowed by Pacific Gas & Electric (PG&E) for their customers. The District has installed motor savers on the pumps, to protect the motors during voltage imbalances, but this results in deactivating the motors and causing surcharges. A small voltage imbalance can create a large current imbalance, and may thereby increase heat in the motors and lead to premature motor failure.

Several methods were considered to reduce or eliminate the electrical problem at the pumps, as follows:

1. Variable-Frequency Drives (VFDs) convert the three-phase power to a direct current and then convert it back to an adjustable frequency three-phase voltage. By slightly oversizing the VFD, the VFD can accommodate a severe input voltage imbalance and produce a completely balanced output voltage to the motor. Disadvantage is high cost and complexity.

2. The solid-state starter (Allen Bradley Dialog Plus) has a unique feature called a phase re-balance feature. In lieu of bypassing the solid state starter once it gets the motor up to speed, as is conventionally done, the solid state starter remains in the circuit and reduces the voltage of the high phase(s) to balance it with the other phases(s). We recommend a bypass contactor also be installed as a backup to the solid state starter with a hand switch with "soft-start only, bypass only and normal" positions. This option appears to be the most favorable with regard to cost and operability.

3. A larger motor on the same pump could handle the voltage imbalances without overloading any of the three motor phases since the rating of the motor phases would be higher. Disadvantage is that pump and wiring must also be replaced resulting in a high cost. However, if District is planning on a pump replacement for other reasons, this is the simplest and least technical option at about the same cost as the solid state starter.

Wetwell and Pumping Capacity

Analyses show the existing influent pumps have capacity to handle existing flow, but will need to be upgraded to maintain redundancy while meeting future demands. The wetwell volume calculations also showed that the wet well is undersized for existing conditions. The cycle time was calculated to be 3 minutes for existing peak hour conditions. However, staff has estimated that the pumps are cycling every 15 minutes during peak hour flow. Additional investigation is recommended to fully evaluate the existing pump station and determine appropriate alternatives to meet future demand. An excessive number of pump starts per hour (greater than 4 or 5) results in shorter useful life for starters and motors.

On a short-term basis, assuming no pump station upgrades are performed for several years, retrofiting the existing pumps with VFDs was investigated as an option to reduce required capacity of the wet well. VFDs will allow the pumps to run at a reduced speed. They also assist with the voltage imbalances as discussed above. The disadvantages are cost, some decreased efficiency, and complexity of operation. In order to retrofit the pumps with VFDs, the minimum flow must be determined. It is not recommended to operate pumps at flows less than 30% below their best efficiency point to maintain sufficient shaft speed for discharge against the static head. Review of the pump curve indicates the highest efficiency point for the existing influent pumps is at 2000 gpm. Therefore the recommended minimum flow rate is 1400 gpm, at an operating speed of 850 rpm. At this flow the required active volume to provide a 10-minute cycle time per pump at peak flow is 1750 gallons or 220 ft^3. Though this is nearly half the volume needed without VFDs, the existing wet well is still smaller than desired for pump cycling (existing active volume of 186 ft^3).

Installing VFDs on the existing pumps is not recommended at this time, since pump capacity will eventually need to be increased to meet 2030 flow. The existing pumps are each rated at 2300 gpm, or 3.3 mgd. Peak demand with the existing pumps (while maintaining 100% redundancy) is projected to occur in 2018. Therefore, it is recommended that new pumps be installed by 2015 (at the latest – constructing a new pump station could be accomplished sooner, while upgrading the Frontage Road trunk main to reduce construction cost and minimize plant service outages) to provide a "planning buffer" since flow projections are imprecise. Either the existing pumps could be replaced with two new pumps, or a third pump could be installed to meet peak demands while operating in parallel with one of the existing pumps.

Solids Handling

Alternatives to the existing submersible solids-handling pumps warrant investigation. Operators have reported problems with the existing pumps clogging from rags and other large materials. There are no screens upstream of the pumps, only grinders, which pass material through the influent pump station and into the wastewater treatment facility. Screw-centrifugal pumps (such as a Wemco Hidrostal® or approved equal) combine the high efficiency of a centrifugal pump (80% or greater) with the clog-free advantage of a vortex pump. The screw impeller provides a smooth flow and low turbulence, reducing hydraulic losses, keeping power costs down. The large screw channel from suction to discharge reduces clogging and maintenance.

To further enhance solids removal and continual cleaning of the wetwell, a prerotation basin can be installed in the wet well. Wemco offers the Prerostal® System with the Hidrostal® pump. The basin is constructed with a partial weir to induce rotation towards an inclined tangential entrance channel, where a bellmouth suction pipe draws water into the pump and causes the liquid to enter the impeller at a different angle than the pump was originally designed for. The result is a lower head-capacity curve and a reduction in energy consumption. The higher the velocity in the prerotation basin, the greater the decrease in capacity from original design. With the geometry of the prerotation basin and gravity as the control mechanism, the discharge flow automatically matches the influent flow rate without changing pump speed. Using a constant pump and motor speed the flow can be varied to as low as 35% of it's design capacity. A major benefit to the system is that the pump will automatically draw floating and settled solids, which will reduce odors and eliminates the need for cleaning the wet well. Screenings and floatables would then be removed by a downstream screening and grit removal system (see Section 7.3)

Recommended Influent Lift Station Improvements

At this time we recommend that the District budget for a pump station replacement, including a new wet well with a prerotation basin and three screw centrifugal pumps, sized so that any two could handle the PHF at 2030. The budget for this work is summarized in Table 7-1:

Table 7-1 Cost Opinion for Influent Pump Station Upgrade

Item	Estimated Installed Cost
Flow Metering Manhole	$40,000
3 Screw Centrifugal Pumps	$140,000
Valves and Piping	$150,000
Wetwell	$200,000
Demolish/Salvage Existing Facility	$20,000
Electrical, Controls, and Instrumentation	$70,000
Engineering/Admin (20% of Subtotal)	$124,000
Contingency (30% of Total)	$223,200
Total	$967,200

7.3 Screening and Grit Removal

Two screen technologies were investigated for headworks improvement: shaftless spiral and in-channel moving screens. Each screen would feature 6-mm openings, all stainless steel hardware and wetted parts, pressure wash capability, and capacity for future (2030) PHF. We also recommend using two screens in parallel (each with 100% PHF capacity) for process redundancy. The costs are compared in Table 7-2, with a detailed breakdown in Appendix C, and product information in Appendix D.

Shaftless spiral screens (such as the Parkson Hycor® Helisieve® or approved equal) are in-channel, units that combines screening, conveying, and dewatering (Figure 7-1). They are typically mounted in a concrete channel with a grated cover. A bypass channel should be provided in case the units become clogged and the screen stops functioning. The spiral conveyor is fitted with a steel brush for continuous cleaning of the screen surface. The conveyor operates intermittently, based on time, differential level, or manual initiation of the screen cleaning cycle. A bagger unit can be added for collection of screenings. The shaft pivots out of the channel for maintenance accessibility. This equipment requires no submerged end bearings or intermediate hanger bearings.

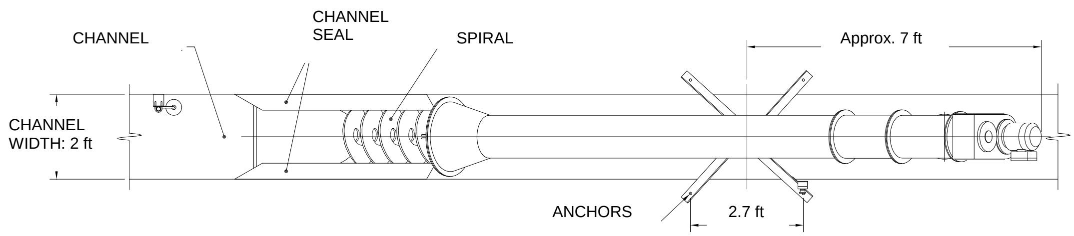


Figure 7-1 Top view Hycor® Helisieve®

An alternative is an in-channel, moving screen (such the Parkson Aqua Guard® or approved equal), as shown in Figure 7-2. Similar to the shaftless spiral screen, the moving screen operates intermittently, based on time, differential level, or manual initiation of screen cleaning cycle. This reduces power consumption and wear on the equipment. It is self cleaning and all moving parts can be accessed above water level. The screen pivots out of the channel for ease of maintenance.

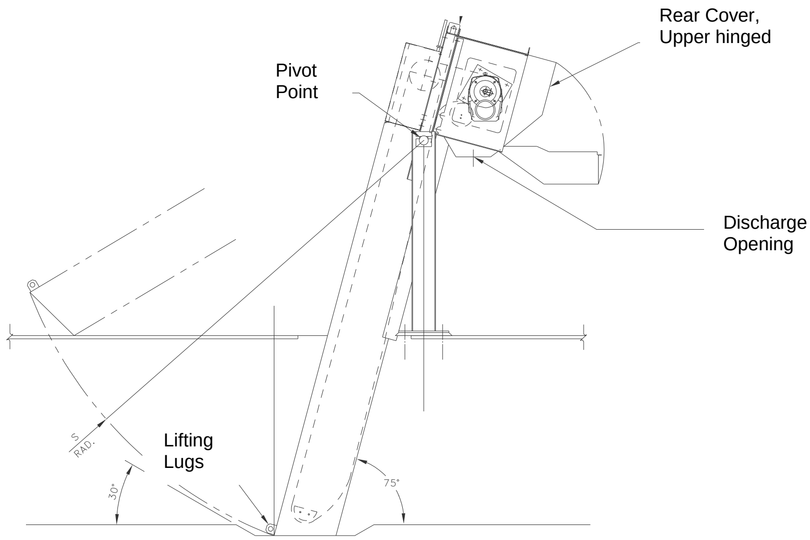


Figure 7-2 Profile view AquaGuard®

Alternatives for Grit Removal

Two systems were investigated for grit removal: vortex and aerated systems. Costs are included in Table 7-2. The Jones & Attwood® Jetair is a vortex flow and tangential entry grit trap (Figure 7-3). Coupled with a Jones & Attwood Screw Classifier, the system is designed to separate inorganic solids from influent wastewater. Either two units could be installed, each able to handle 50% of the projected 2030 PHF and allow temporary operation with one unit while maintenance is performed on the other, or one unit with a bypass could be provided to handle 100% of PHF.

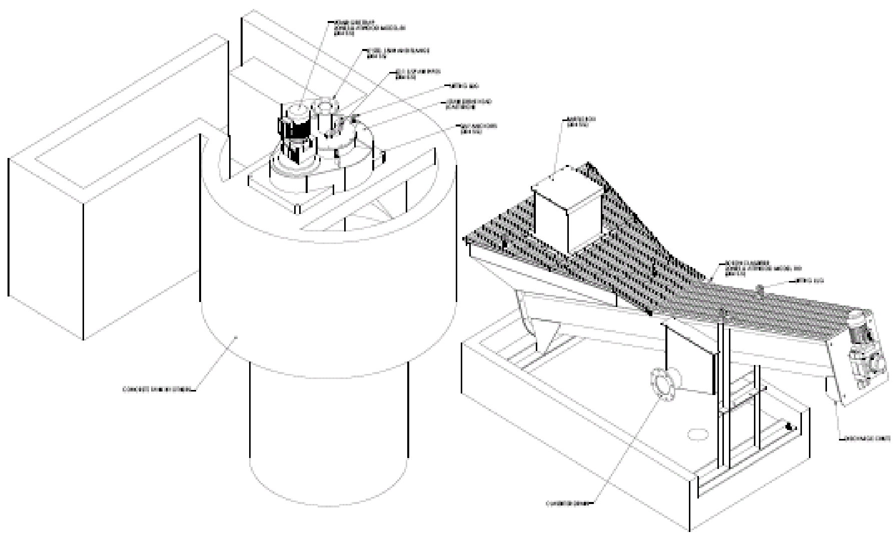


Figure 7-3 Jones & Attwood JetAir® and Screw Classifier

(Detailed photographs and drawings included in Appendix D)

An aerated grit chamber is an economical alternative to vortex grit removal. Air is introduced from one side of a rectangular chamber, perpendicular to the wastewater flow to create a spiral flow pattern through the tank. Heavier grit particles settle to the bottom of the chamber, while lighter particles – primarily organics – remain suspended and pass through. When compared to the vortex grit removal system, aerated grit chambers require more air piping, diffusers, and mixing, which demand more power and maintenance, but are typically less expensive to construct. Aerated grit chambers require blowers to blow air through the water and overcome static head from the depth of diffusers. Since the District already has blowers onsite, and an air line is near the existing headworks, they already have aeration capability for the chambers. Aerated grit chambers sometimes contribute to odors and headworks corrosion through the creation and release of hydrogen sulfide.

<u>Drum Screens</u>

A potential alternative to screening and grit removal systems is a drum screen. A drum screen will remove more material than a mechanical screen alone, but less than a combined system as presented above. The advantage to this option is having only one headworks system to maintain, assumedly simplifying operations. However, drum screens often require more maintenance than other screens, since they typically have a smaller opening than mechanical screens (3 mm verses 6 mm) and can clog more frequently. Though more expensive than other types of screens, when comparing to a dual screen and grit removal system, the capital costs are similar. Drum screens require continuous wash water at higher flow rates than required for coarser screens (described above) and conveying, dewatering, and bagging must be performed separately.

Table 7-2 Cost Opinions for Screening and Grit Removal Systems

Improvement Option	Estimated Installed Cost
Screens	
(2) Parkson HLS500 Hycor® Helisieve®	$512,000
(2) Parkson Aqua Guard® AG-MN-A	$855,000
Grit Removal	
(2) Jones & Attwood JetAir 100 Grit Trap + Model 100 Screw Classifier	$629,000
(2) Aerated Grit Chambers[4]	$588,000

Recommendations for Screening and Grit Removal Systems

Two (2) shaftless screw screens are recommended for screening, since they require lower capital cost and provide better dewatering and compaction of solids than a mechanical screen.

A vortex grit removal system (such as the Jones & Attwood JetAir® grit trap) is recommended as part of the headworks improvements at the WWTF. The capital costs are higher than an aerated grit chamber, but the system requires less maintenance than an aerated grit chamber which requires regular repair and replacement of air valves, fittings, diffusers and piping in the basins

7.4 Sludge Removal

Currently, ponds are drained by temporary pumps and piping systems to remove sludge and convey it to the drying beds. Buried sludge removal pipes are installed, but no longer used. Testing would be required to determine if the pipes are functional. Draining a pond is a time-consuming task and the WWTF must take the pond out of service, requiring operation using the remaining ponds until the sludge removal is complete.

Two alternative removal methods were investigated to reduce maintenance time and avoid taking the ponds out of service. One alternative is to retrofit the pond with a central sump and submersible pump, as shown in Figure 7-4. This improvement would be done in conjunction with the addition of a pier/walkway to the center of the pond. The pond floor would be sloped towards the center to encourage settling towards the center sump for sludge removal, where a submersible pump would transport the sludge through a pipeline that would be routed along the walkway to the drying beds.

Several problems are anticipated with this option. First, long-term effectiveness is questionable. Once the pump removes the sludge in the immediate area, water would fill the void much faster than the surrounding sludge and the pump would start drawing mainly water. Second, even if a design were created to render this option effective, the economic impact of re-grading is likely to be significantly greater than that of other sludge removal alternatives. Construction cost is estimated at approximately $220,000 - $275,000 per pond.

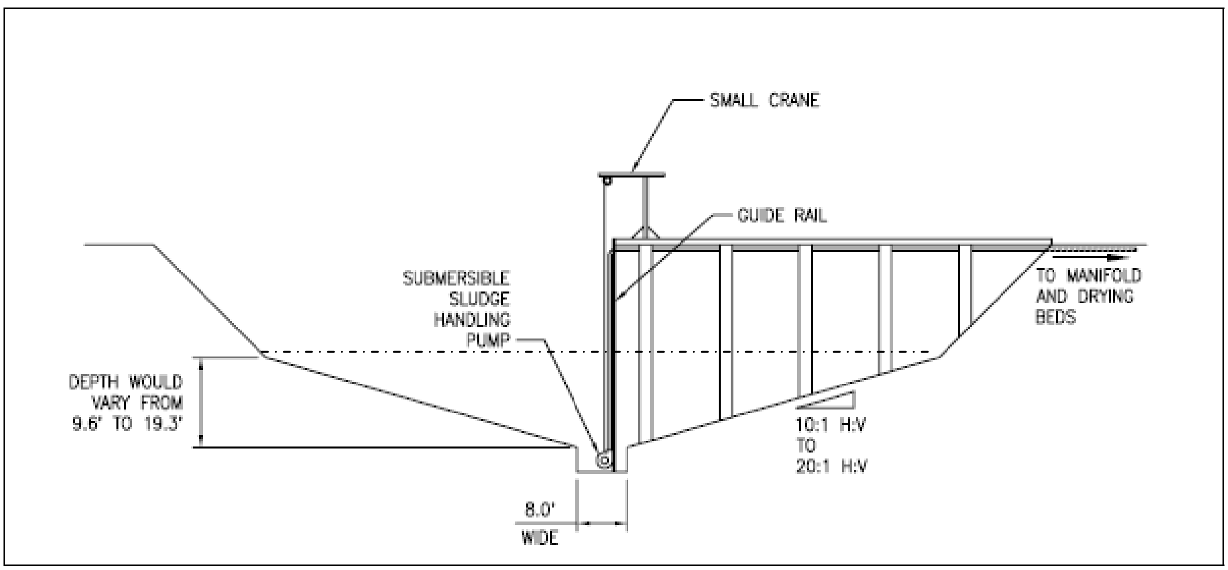


Figure 7-4 Conceptual schematic of pond with sump

A second alternative is to dredge the ponds. Crisafulli offers a dredge rental program. Other vendors may provide a similar service. The Crisafulli system and rental service was evaluated in this study, but competitors should be identified and consulted if the District wishes to proceed with this alternative. The FLUMP® (floating

[4] Includes cost for grit classifier, which is estimated at $150,000 for the grit chambers.

lagoon pumper) is an unmanned, remote-controlled electric dredge. The Model ST-3 standard duty Flump® offers a sludge discharge capacity of up to 25 cubic yards per hour and a dredging depth of 0 – 8 feet, though it can be customized for greater depths. A floating dredge allows the basin to remain full during the sludge removal process. The cutterhead can be fitted with a cage for liner protection. It uses a patented floating discharge system and is able to discharge sludge from distances of up to 500 feet from shore. The dredges are moved, manually or automatically, along a tensioned steel cable extending across the pond and fixed to steel posts. The ST-3 runs on 460 volts and can be powered by a 75 hp generator.

Maneuvering around the surface aerators is one of the challenges in using a cable-directed dredging unit. However, if aerators were relocated in approximately ½ of the pond, the dredge could operate within that area while the aerators in the other ½ of the pond continue to function.

Figure 7-5 Severe duty Flump® operating on traverse system to dredge a pig lagoon

The rental package for the standard ST-3 Flump® includes the control panel, 200 feet of floating discharge pipe, a 4 post manual traverse system, and 500 feet of power and control cord. The estimated cost is shown in Table 7-3. Additional product information can be found in Appendix D.

Table 7-3 ST-3 FLUMP® Cost Opinion

1 month rental package (+ 100' additional float pipe)	$7,070
Round-trip freight	$5,350
Installation + 2-day training	$3,960
Damage deposit	$3,345
Total estimated cost for 1st month (with deposit)	$19,725
Cost per month for subsequent dredging (with deposit)	$15,765
Cost based on January 2007 quote	

7.5 Operability and Automation

Automation and Controls

The Southland Wastewater Treatment Facility is on the District's read-only Supervisory Control and Data Acquisition network. The following systems are transmitted by radio across the District's web-based system:

- Influent flow (gpm)
- Influent pump 1 on
- Influent pump 2 on
- High wetwell level
- Grinder 1 on
- Grinder 2 on
- Power outage
- Generator on

The level of automation and controls at the plant is relatively low. Influent pumps are activated by float switches in the wetwell. This is the only pumping facility on site – flow through the ponds and to the percolation ponds is gravity-driven. In the event of a power failure, an automatic transfer switch will activate the onsite diesel generator, which provides power to the aerators and the lift station.

Monitoring/Analytical Capabilities

The District has an influent flow meter and 5 staff gauges to monitor levels in 5 of the percolation ponds. The District has a basic laboratory for in-house process control onsite and uses some portable analytical kits for measuring some parameters such as pH, DO, nitrate, and nitrite levels. It is our understanding that the District intends to install staff gauges in all of the percolation ponds.

In addition to these changes, we would recommend adding current meters to read and transmit amperage for each aerator, pumps, and grinders (if they remain in operation). This would allow operators to remotely detect problems that would increase or decrease load (and cause changes in current) on the motors, such as clogged pumps, "ragging" of aerators, and blockage in the grinders. A greater level of automation could be achieved with reconfiguration of the aerator controls and dissolved oxygen probes to control aerators by DO levels. A system could be developed to allow staff to step-up or step-down the number of aerators in operation to maintain consistent DO levels. At a minimum, if the aerators remain in operation, it is recommended that the aerators closest to the outlets be provided with DO controls since these aerators would face lower regular BOD loading than the inlet-side aerators.

Laboratory equipment should be purchased to allow District staff to measure BOD as a "quality control" method to check laboratory results, since they have been questionable (in the past). The lab could also be outfitted to perform sludge volume index (SVI) and total suspended solids (TSS). The laboratory should also have a vented hood, to allow the District to run Chemical Oxygen Demand (COD) tests and other tests which require ventilation for safety.

Improved Pond Access

Representative sampling is a goal for any wastewater treatment plant. Building piers for access into the pond interior area is a relatively simple improvement to gain better access for representative sampling. It is difficult to obtain representative samples at the shore due to floating and submerged debris build up caused by wind and pond circulation patterns. Construction of a pier would require draining the ponds and modification to the liners for installed footings or piles with columns for support. Placement should be near the pond outlet where the majority of the treatment has been accomplished, extending out to the deepest part of the pond to avoid collection of material from the sides when sampling. The side-slope ends approximately 42-feet from the edge of the pond. The walkway should be aluminum-framed with stainless steel handrails. Gatordock makes an aluminum fixed pier. A 40-foot long by 6 feet wide DuraDock® with handrails is expected to cost approximately $16,000. This includes the cost of four plastic coated wood pilings and shipping. It does not include costs associated with modification of the liner or installation of an anchoring system. The main disadvantages to a fixed pier include the disruption of service for construction, the potential for interference with pond retrofits or sludge removal, and the cost and potential problems with modifying the pond liner.

An alternative option is a floating pier with anchoring to the side of the pond. ShoreMaster's floating Polydock® is made from UV-resistant polyethylene (Figure 7-6). A straight 48-foot long Polydock® (6-feet wide) with handrails and an 8-foot long gangway is estimated to cost approximately $20,000, plus costs for an anchoring system.

Figure 7-6 ShoreMaster's Polydock®

7.6 Recommendations for Facility Improvements

Several system improvements are recommended.

- *Frontage Road trunk main replacement*: Hydraulic analysis revealed deficiencies in the size of the Frontage Road trunk main. We recommend replacing the Frontage Road trunk main with a 21" pipeline to meet the projected demand for 2030. This project should be constructed in the next 2 years.
- *Influent pump station upgrade*: The influent pump station will need improvements to handle future conditions. Analysis indicates that though the existing pumps have the capacity to handle existing flow, the wet well is undersized, causing rapid cycling, which can prematurely wear the pumps. We recommend that the District budget for a wet well replacement and three new screw centrifugal pumps (such as Wemco Hidrostal® or equal) to meet 2030 demands. This project would be most efficiently constructed with the Frontage Road trunk main improvements, but should be in place no later than 2012 to prepare for 2015 projected demands.
- *Screening and grit removal*: Headworks improvements will increase effluent quality and significantly reduce maintenance issues (such as rag entanglement in the aerators) and wear on the plant equipment. Two parallel shaftless screw screens (such as Parkson Helisieve® or equal) is recommended for the fine

screening, followed by two vortex grit removal systems (such as Jones & Attwood JetAir® or equal). We recommend installing screening and grit removal within the next 2 years.

- *Solids handling*: If needed, rent a portable dredging unit (such as the Crisafulli Flump®) for future sludge removal from the aerated ponds.
- *Control and automation*: If the District maintains the pond system for the future treatment process, we recommend adding current meters to aerators, pumps, and grinders to read and transmit amperage, and reconfiguration of the aerator controls and dissolved oxygen probes to control the aerators by DO levels.
- *Increase pond access*: Fixed and floating piers were investigated. Floating piers can provide pond access at a reasonable cost without constructing a permanent structure or damaging the pond liner. If pond access is desired for sampling or monitoring, or for access to pond outlet, we recommend installing a floating dock.

8.0 FUTURE PROCESS ALTERNATIVES

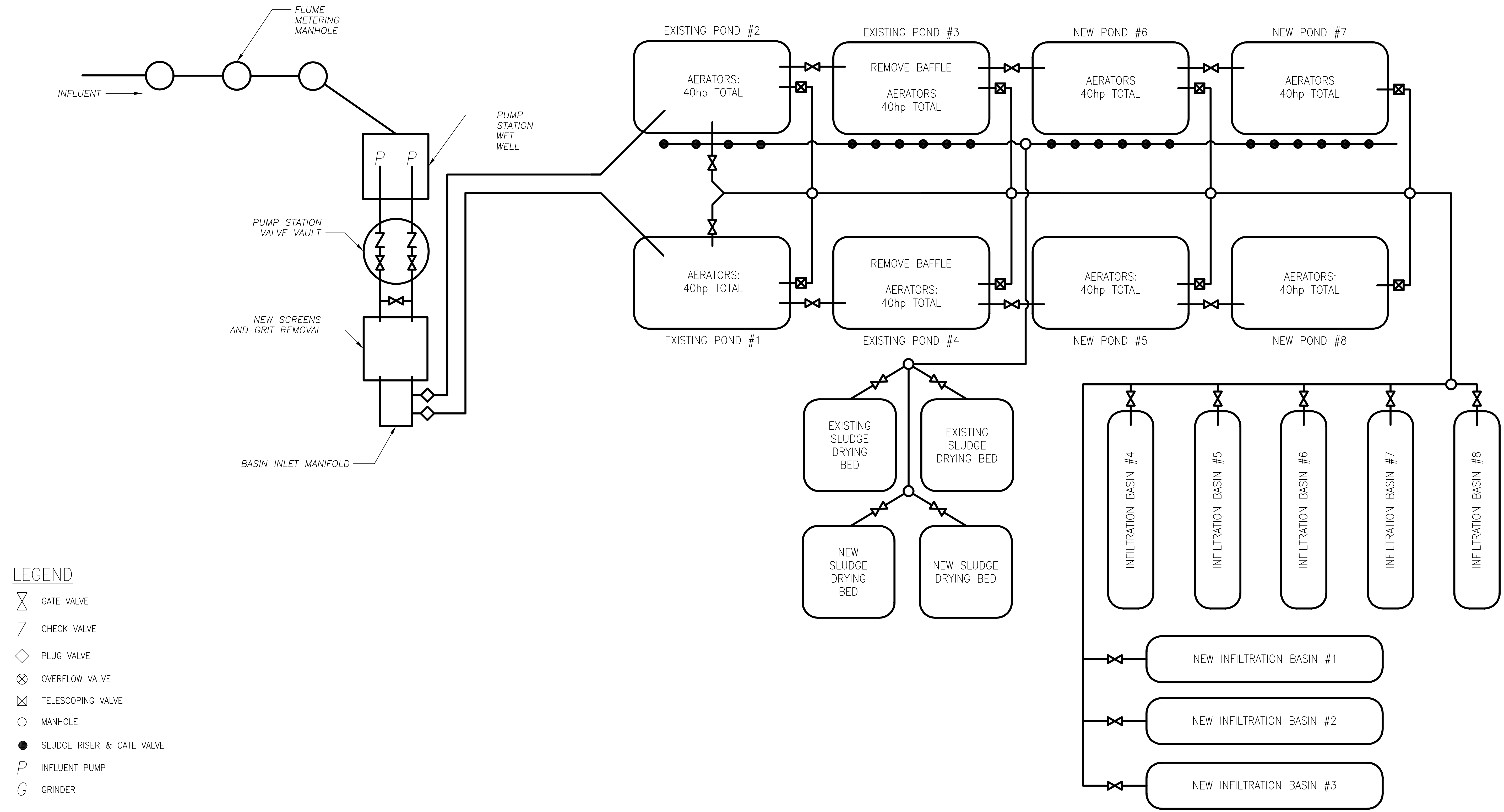
The anticipated effluent requirements for permitting and future flow increases necessitate investigation of treatment process alternatives. Four alternatives were reviewed and are discussed below: expansion of the current treatment process with additional aerated ponds, a conversion to Biolac® Wave Oxidation System (an extended aeration technology), a conventional activated sludge system, and an oxidation ditch. Most of these options could be implemented in phases, spreading the capital cost out over several years. A summary of comparative cost opinions is shown in Table 8-2. Cost details are included in Appendix C. Sizing and cost opinions are based on meeting an AAF of 1.67 mgd, for 2030 demand.

8.1 Expansion of Aerated Ponds

The WWTF currently uses four aerated ponds for treatment. Under normal operation, the wastewater flow from the influent pump station is split into the primary ponds, Ponds 1 and 2, then flows into the secondary ponds, Ponds 4 and 3, respectively. The inlet and outlet ends of the secondary ponds were previously split with a baffle curtain to minimize short-circuiting and provide a quiescent zone. The front 40% of each pond was aerated with two 5-hp mechanical surface aerators, and the back 60% was a stabilization basin, providing settling time. In 2007, the baffle curtain was removed to maximize aerated volume. The WWTF currently runs 3 aerators each in Ponds 3 and 4. Pond 3 has two 5 hP aerators and one 10 hP. Pond 4 contains three 10 hP aerators. The District plans to replace all existing 5-hp aerators with 10-hp aerators. Figure 4-1 shows the existing process flow diagram.

Based on the projected flows discussed in Section 3.0 and a monthly mean BOD_5 effluent goal of 40 mg/L, four additional ponds would be needed, each with an equivalent liquid volume of the existing secondary ponds (approximately 3.1 million gallons). Calculations were performed with the assumption that the baffling in the existing secondary ponds would be removed to provide additional aerated capacity for treating increased flows. Appendix B contains the complete calculations. Additional aerators, providing 195 hp more, will be needed for adequate aeration in the new ponds (total of 315 hp). The process flow diagram for this option is provided as Figure 8-1. A recommended layout for the four additional ponds is shown as a site plan in Figure 8-2. Though there is open area behind the existing ponds, only two ponds of this size will fit. We would recommend constructing the four new aeration basins in place of the existing infiltration basins #1, 2, and 3. Additional sludge drying beds could be constructed in the area behind the existing aeration ponds and there is room to the southwest, behind infiltration basins #4 through #8, to construct additional infiltration basins. The improvements could be implemented in phases, as the demand requires.

One of the main disadvantages to constructing additional aerated ponds is the inability to meet a higher level of treatment than is currently required in the WDRs, as well as poor nitrogen removal. In addition, aerated or facultative ponds will not produce effluent that can be efficiently filtered for recycled water applications such irrigation at parks or schools. This option will sufficiently treat the wastewater with projected future hydraulic and loading demands with respect to current water quality goals. However, more stringent water quality regulations are anticipated for the future and if the District chooses to pursue groundwater recharge or another reuse alternative, additional treatment to reduce nitrogen concentrations and other constituents in the effluent will be required. The capital cost is for this option is one of the highest, due to the large amount of excavation and fill required. The cost opinion does not include excavation and grading for additional infiltration basins or sludge drying beds, which are discussed in Sections 8.6 and 8.7.



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NCSD SOUTHLAND WWTF MASTER PLAN

EXPANSION OF AERATED PONDS
PROCESS FLOW DIAGRAM

BEC PROJECT NO. 19996.17

FIGURE 8-1

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DWG: W:\Nipomo CSD (19996)\19996.38 Southland WWTF Master Plan Update\Final Report\CAD\FIGURE 8-2.dwg USER: FroelicherJ
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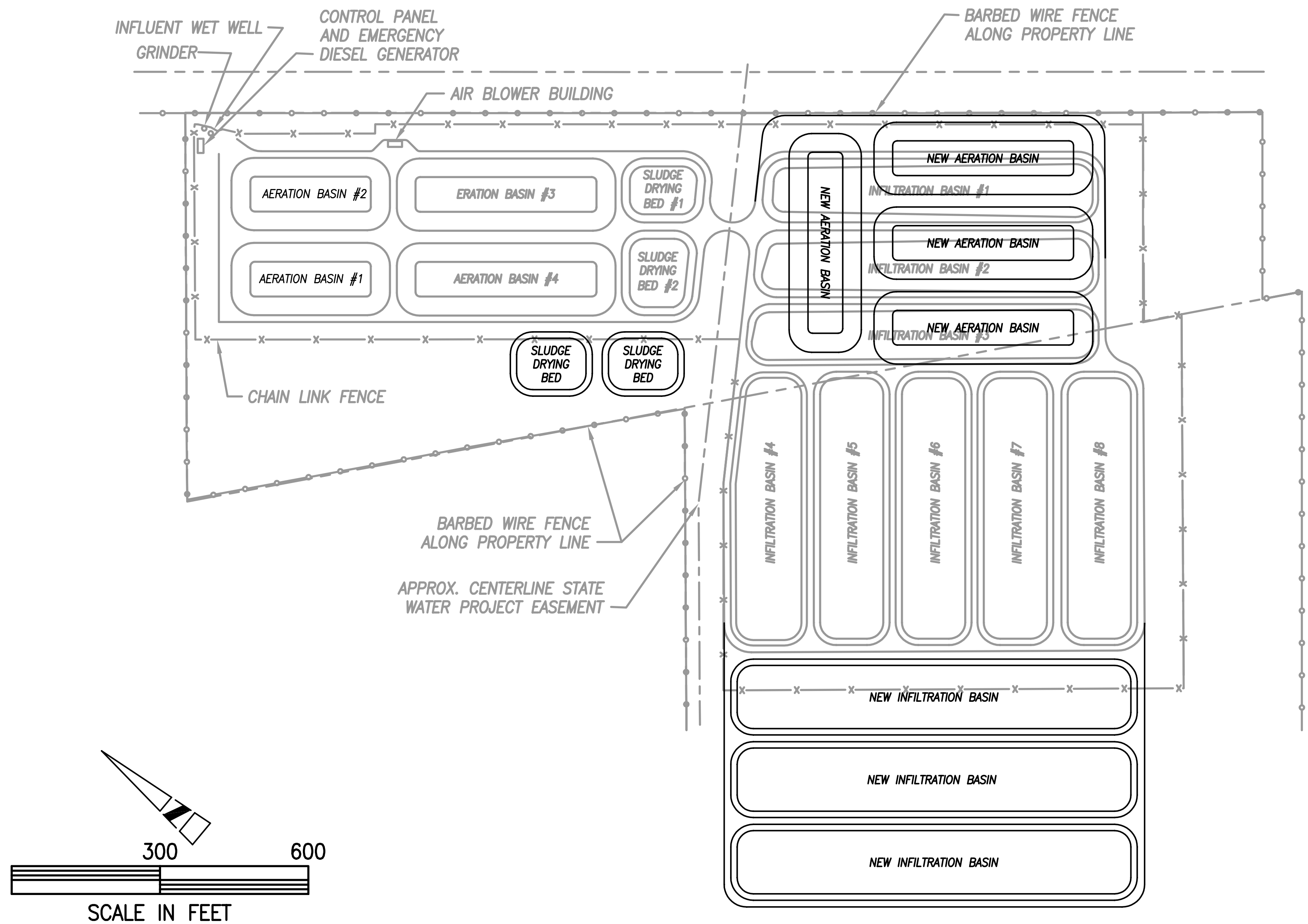

FIGURE 8-2

NCSD SOUTHLAND WWTF MASTER PLAN

ALTERNATE 1:
SITE PLAN FOR AERATED PONDS

BEC PROJECT NO. 19996.17

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8.2 Biolac® Conversion

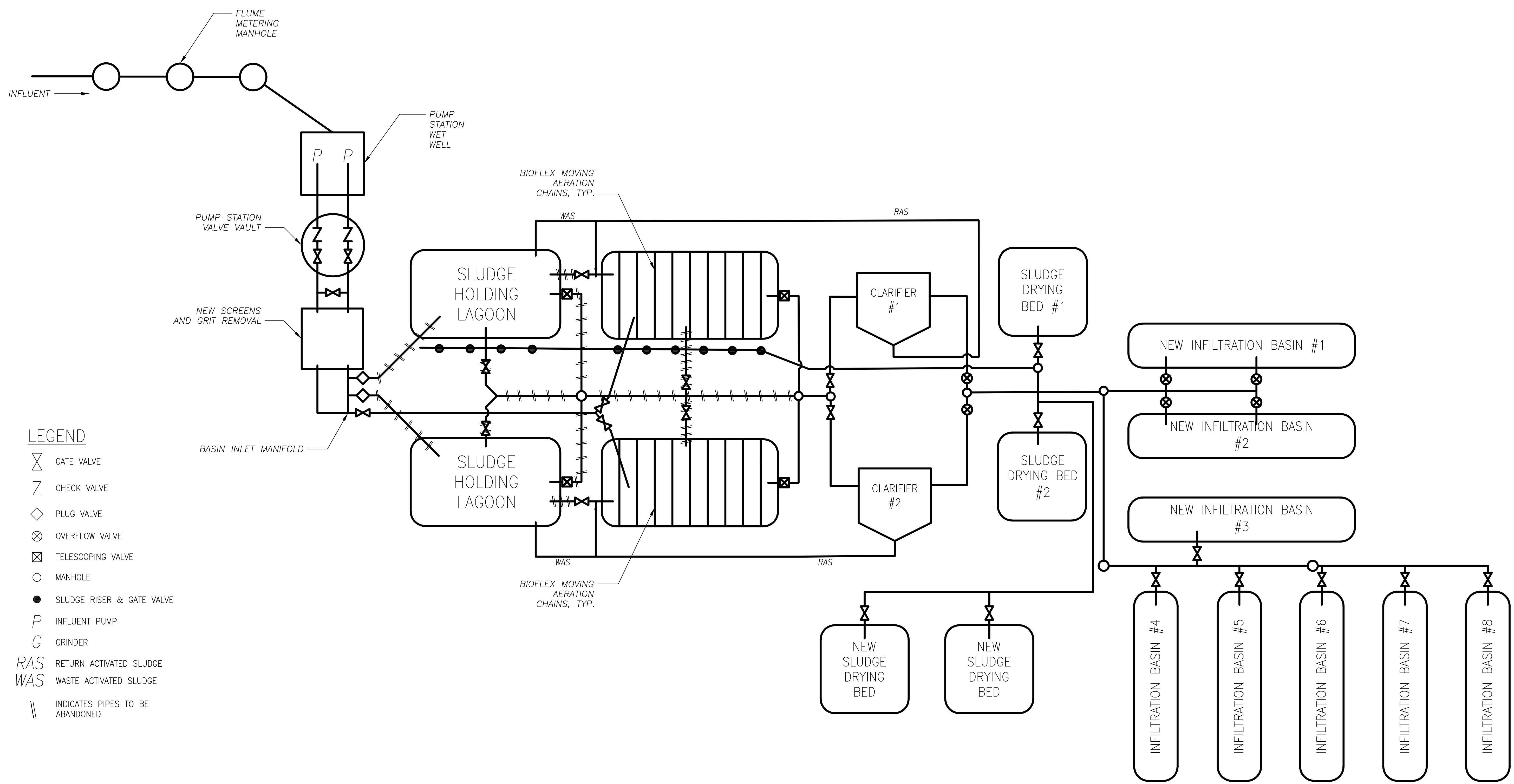
The Parkson Biolac® Wave Oxidation System is an extended aeration process that utilizes a longer solids retention time (SRT) and moving aeration chains to reduce BOD and TSS concentrations to below 15 mg/L and total nitrogen to less than 10 mg/L. The extended SRT increases the stability of the system, allowing for fluctuating loads under similar operating conditions. Airflow to the moving aeration chains can be controlled to create a wave of aerobic and anoxic zones, resulting in nitrification and denitrification. Multiple fine-bubble diffusers are mounted on the flexible air tubing suspended across the pond. The flexible Biolac aeration system maintains the required mixing and suspension of solids at 4 cubic feet per minute per 1000 cubic feet of aeration basin volume, half that required for a typical stationary aeration system. Appendix D contains additional product information.

The process flow diagram for a Biolac retrofit and site plan are shown as Figures 8-3 and 8-4. One main advantage to this option is the high level of treatment provided within a small footprint and relatively lower cost than comparable technologies. It can be retrofitted into the existing ponds with some piping modifications and can utilize the existing blowers. To handle the future projected flow rates, two secondary ponds will eventually need to be converted to Biolac systems. This would include installation of the Wave Oxidation system, which will each fit within the footprint of a pond, and new secondary clarifiers. A Biolac system in one pond will provide adequate treatment until the MMF reaches approximately 1.4 mgd, currently projected for 2020, allowing a phased upgrade. This would leave three aeration ponds for the facility to stay online during the retrofit. Otherwise, for redundancy, two ponds could be retrofitted with sufficient diffusers to meet the 2020 demands and additional diffusers could be added later. After the conversion, the unused primary ponds could be used for sludge holding and digestion. Sand or multi-media filtration can easily be added to the treatment train to provide a higher quality effluent if required, whereas conventional aerated or facultative pond systems do not produce effluent quality that is compatible with filtration equipment.

The main disadvantage to a Biolac upgrade is increased maintenance and control requirements, inherent in the higher level of technology. Blower controls are needed for aeration cycling. The diffuser sheets will need to be replaced approximately every 5 to 7 years and the air tubing will need replacing about every 7 to 10 years. The diffuser assemblies are designed for neutral buoyancy, and are lightweight and compact for easy retrieval. For the level of treatment, Biolac appears the most maintainable when compared with activated sludge and oxidation ditch systems – simple, accessible parts, relatively inexpensive to replace.

The life-cycle power and replacement costs for a Biolac system were compared to that of an aerated pond system. Power consumption and material needs to the year 2030 were determined assuming the systems were constructed to meet the projected 2030 demands. The cumulative present-worth costs for Biolac would be approximately $8,015,000, while a pond system would cost approximately $12,700,000. Figure 8-5 summarizes the comparative, cumulative life cycle costs, assuming the system is built this year. Costs for disposal systems and sludge drying beds were not included, since it is assumed these facilities would be the same cost for each alternative. Assumptions are included in the detailed cost opinion in Appendix C.

It should be noted that a Biolac system will require a Grade II Wastewater Treatment Operator for the Chief Plant Operator (as an extended aeration process), whereas pond systems require only Grade I certification. Therefore, the District must ensure that a Grade II Operator directs plant operations if Biolac is selected. Shift supervisors are required to have at least a Grade I certification, and operators are to have an operator-in-training certification or higher.



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NCSD SOUTHLAND WWTF MASTER PLAN

BIOLAC® CONVERSION
PROCESS FLOW DIAGRAM

BEC PROJECT NO. 19996.17

FIGURE 8-3

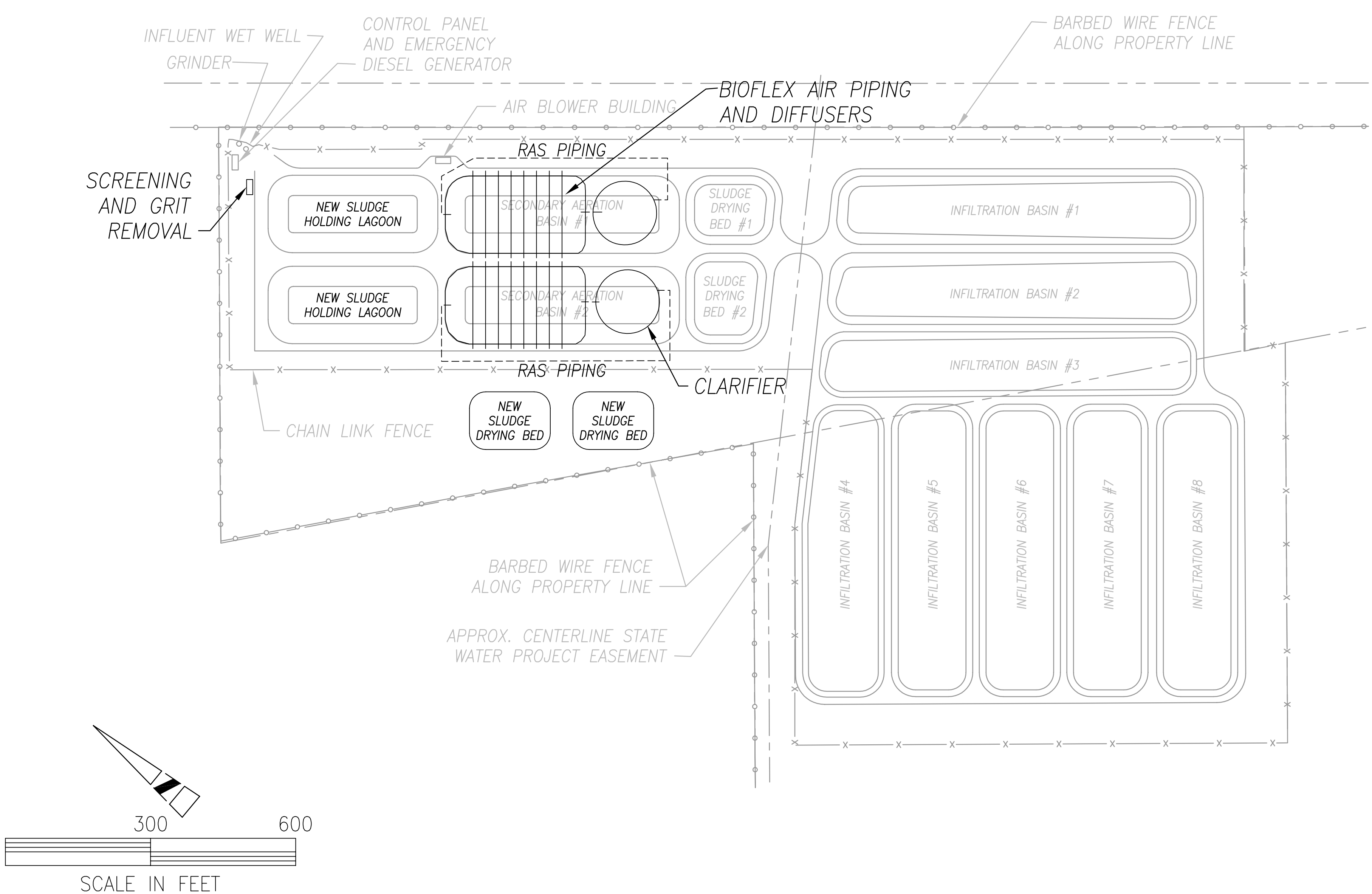

FIGURE 8-4	NCSD SOUTHLAND WWTF MASTER PLAN ALTERNATE 2: SITE PLAN FOR BIOLAC	BEC PROJECT NO. 19996.17	BOYLE ENGINEERING CORPORATION

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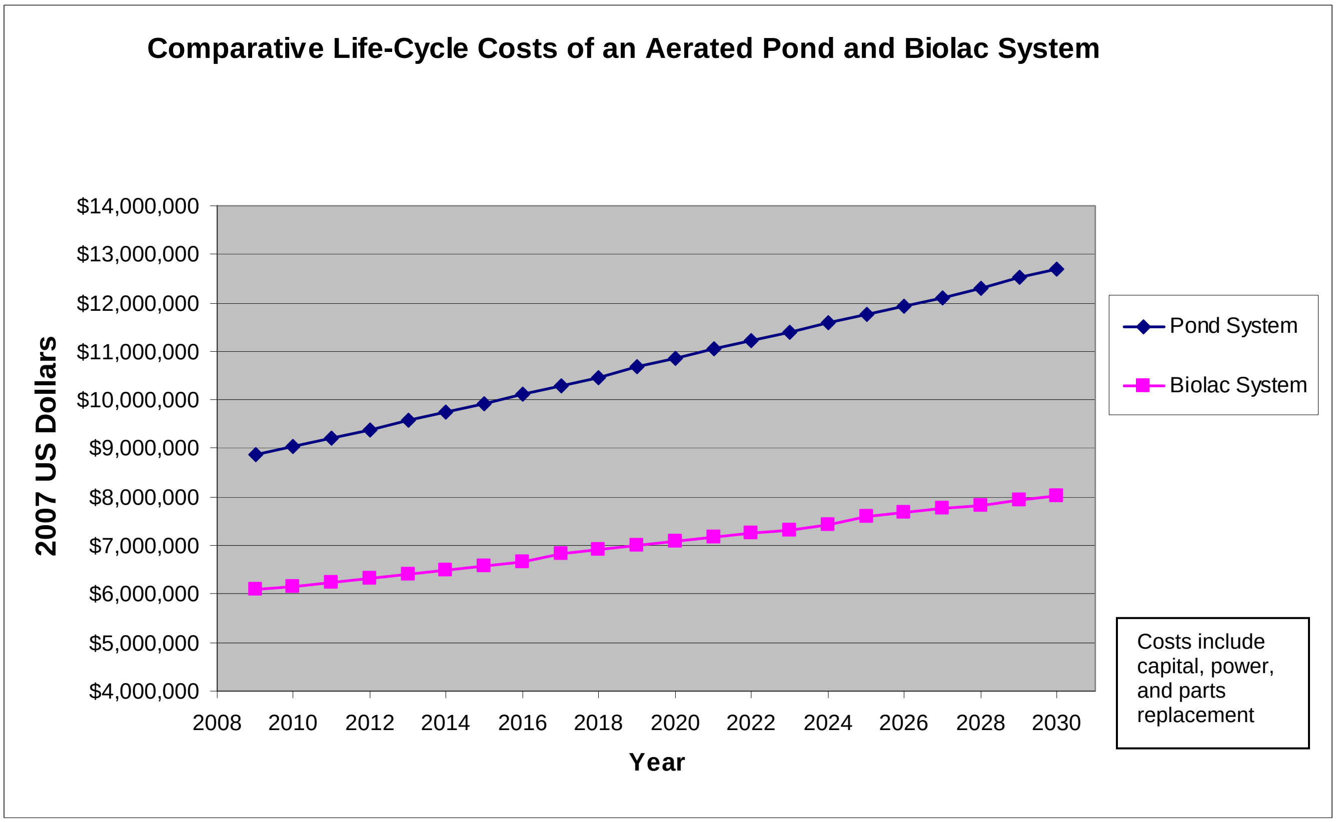

Figure 8-5 Comparative Life-Cycle Costs of an Aerated Pond System and a Biolac® System

8.3 Activated Sludge

Activated sludge systems are constructed in various configurations, but three basic components are necessary: 1) a reactor for suspension and aeration of microorganisms, 2) primary and secondary clarifiers for liquid-solid separation, and 3) a system to recycle activated sludge from the secondary clarifier to the reactor influent[5]. The basic process flow diagram is shown as Figure 8-6.

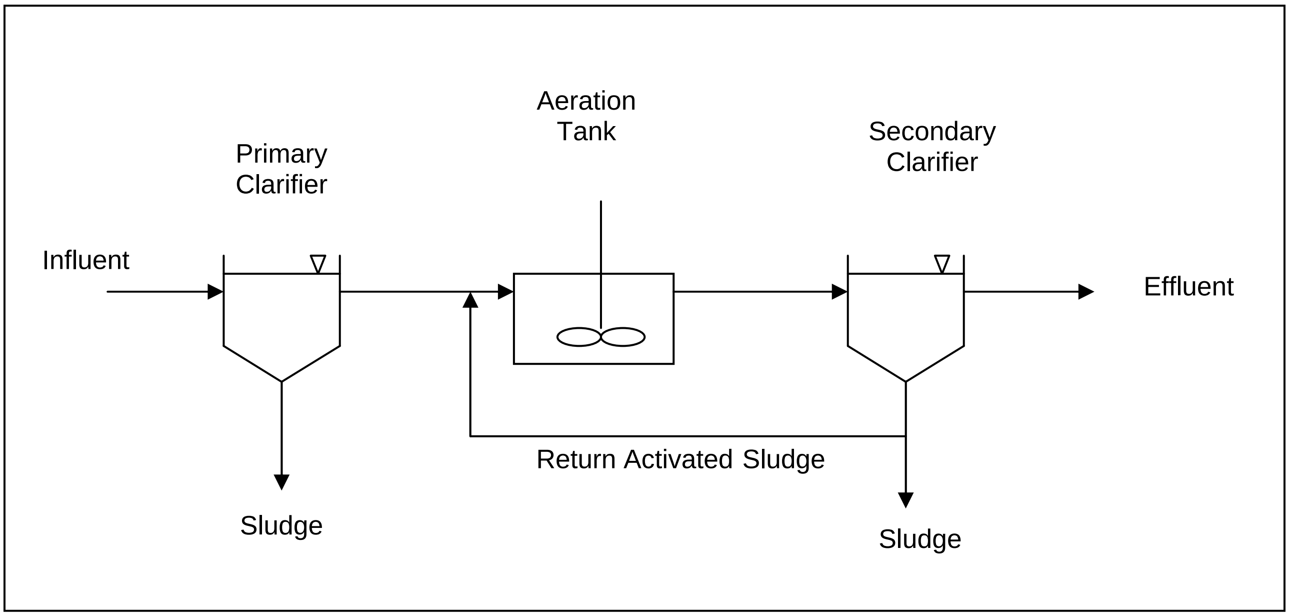

Figure 8-6 Completely mixed activated sludge process flow diagram

A typical system for projected 2030 flows would include two primary clarifiers, each with a 40-foot diameter, two aeration basins with a total volume of approximately 52,000 cubic feet (0.4 MG), two secondary clarifiers with 60-foot diameters, and a return activated sludge system. Some advantages to activated sludge include the small footprint, and the option to modify for nitrification, should a higher quality effluent be desired. It delivers a higher quality effluent than the existing aerated ponds. The main disadvantages are the high capital cost, mainly due to concrete and earthwork, and a relatively high operating cost, because of aeration requirements. Denitrification requires additional steps and recycling and may require the addition of a carbon source, such as methanol. Though operation and control is similar to the Biolac system discussed above, upsets in the microbial balance can

5 George Tchobanoglous, et al. Wastewater *Engineering Treatment and Reuse,* 4th Edition. Tate McGraw-Hill Publishing Company Limited: New Delhi (2005).

cause operational problems like sludge bulking or foaming more frequently than expected with Biolac. The relative footprint for an activated sludge system is shown in Figure 8-7.

8.4 Oxidation Ditch

An oxidation ditch is a ring-shaped channel equipped with aeration and mixing devices. Influent wastewater is mixed with return activated sludge in an anoxic chamber to accomplish biological nutrient removal (nitrogen). The design mimics the kinetics of a completely mixed reactor in the aerated sections, with plug flow along the channels. The aeration zone, located at a turn in the channel, provides oxidation of BOD and ammonia and establishes constant flow, driving the mixed liquor along the channels. As wastewater leaves the aeration zone, oxygen concentrations decrease and denitrification occurs. The process flow diagram for this option is included as Figure 8-8 and the relative footprint is shown in Figure 8-7.

The Eimco Carrousel® System is an example of a closed loop oxidation ditch reactor. The configuration is custom designed based on influent characteristics, and aeration and effluent requirements. Aerators are placed in such a way as to ensure solids suspension in the entire channel. The Eimco Excell™Aerator incorporates a surface aerator on a common shaft with a lower turbine. The system is designed to be able to draw only 15-30 % of the nameplate power and maintain sufficient mixing throughout the channel. This allows for the build-out design to save energy during low influent loadings. Oxidation ditches provide a higher quality effluent than aerated ponds and can handle fluctuating loads. Disadvantages include the high capital cost due to the great amount of concrete required and relatively expensive equipment.

Table 8-1 Cost Opinion and Relative Size for Future Treatment Options

Treatment Process	Total Capital Cost (2008 US $)	Total Estimated Footprint (acre)
Additional Aeration Ponds (4)	$8,680,000	7.8 +
Biolac® Wave Oxidation System	$6,014,000	Within 2 existing secondary ponds
Eimo Carrousel 3000 + 2 secondary clarifiers	$7,197,000	0.45
Activated Sludge + primary & secondary clarifiers	$7,638,000	0.23

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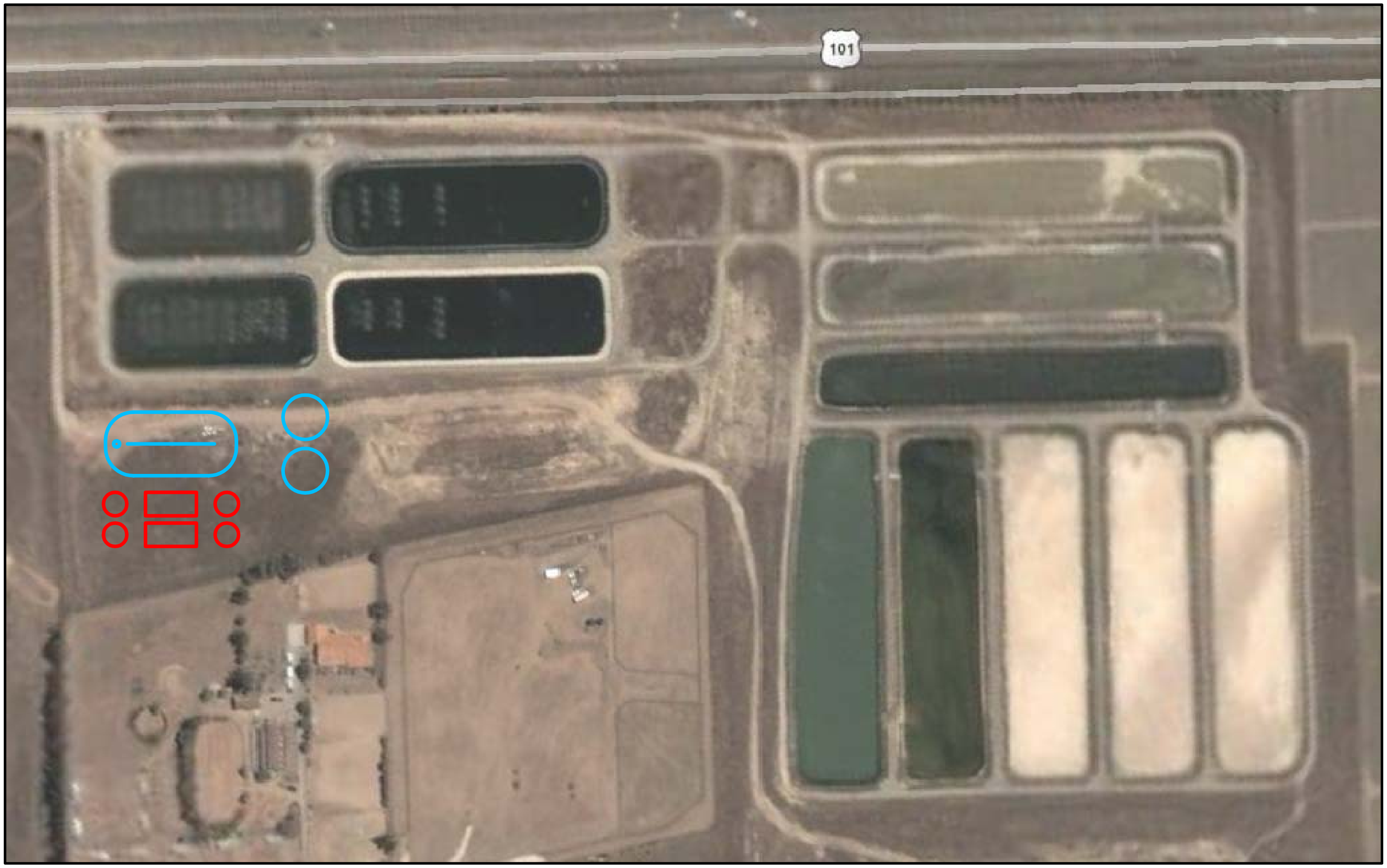

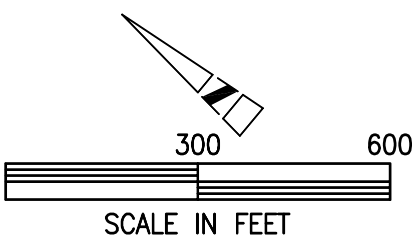

LEGEND

OXIDATION DITCH SYSTEM

ACTIVATED SLUDGE SYSTEM

FIGURE 8-7	NCSD SOUTHLAND WWTF MASTER PLAN ALTERNATES 3 & 4: SITE PLAN FOR OXIDATION DITCH & ACTIVATED SLUDGE SYSTEMS	BEC PROJECT NO. 19996.17

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DWG: W:\Nipomo CSD (19996)\19996.38 Southland WWTF Master Plan Update\Final Report\CAD\FIGURE 8-8.dwg USER: FroelicherJ
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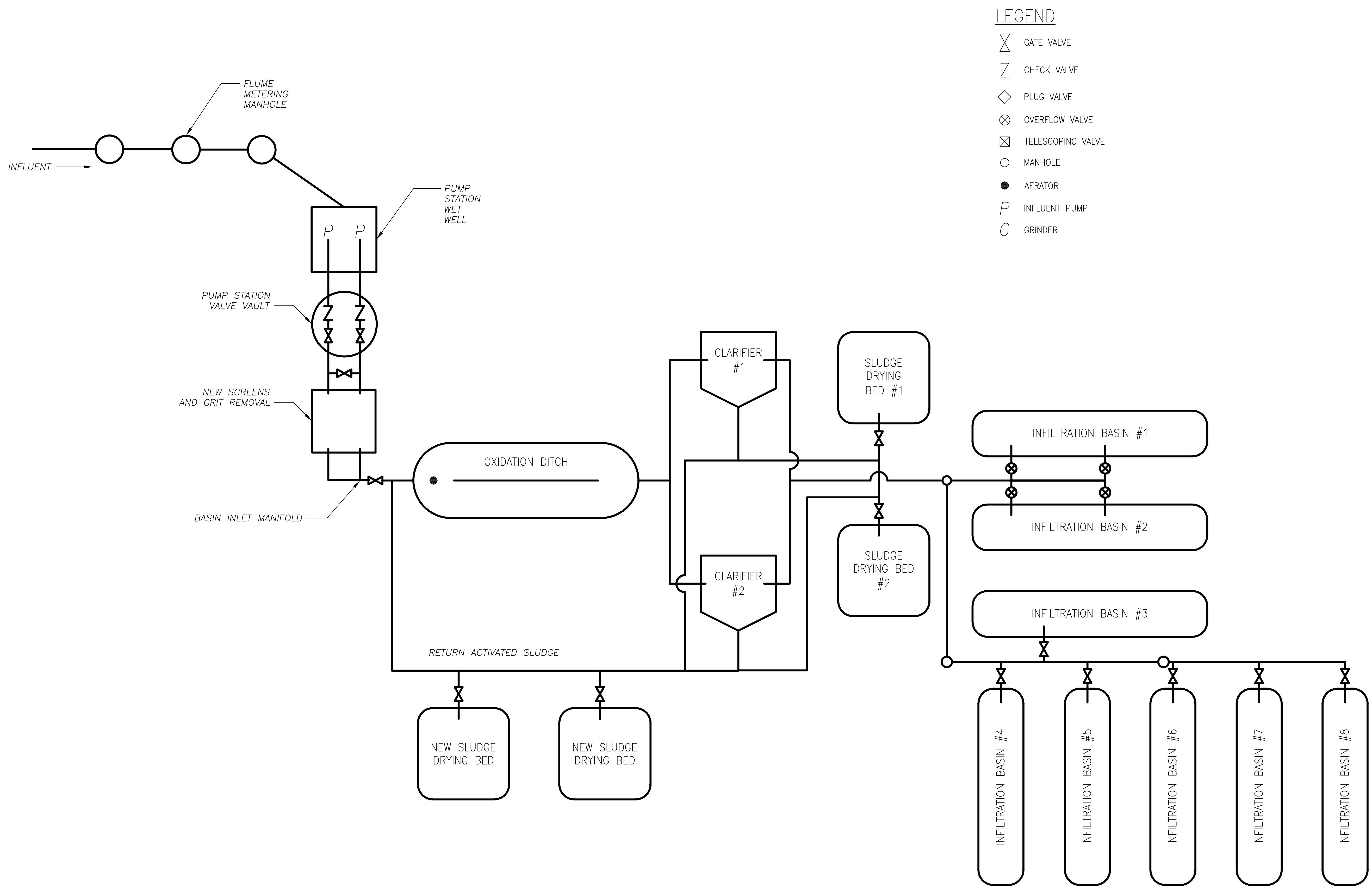

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NCSD SOUTHLAND WWTF MASTER PLAN

OXIDATION DITCH
PROCESS FLOW DIAGRAM

BEC PROJECT NO. 19996.17

FIGURE 8-8

8.5 Tertiary Treatment

The level of treatment will be dictated by water quality goals and regulations and the decided end use, as discussed in Section 6.0. Section 6.0 evaluates three end uses: unrestricted urban reuse (irrigation of parks), groundwater recharge reuse, and percolation (the current disposal method). Reuse options will require tertiary treatment (coagulation, filtration, and disinfection) to meet Title 22 and additional regulatory requirements. Under the existing WDR, the current disposal method does not require tertiary treatment. However, the current trend in water quality regulations suggest a higher quality effluent and/or groundwater monitoring may be required to demonstrate that groundwater is not being negatively impacted at some point in the foreseeable future. Alternatives for filtration and disinfection were investigated and are discussed below. A detailed cost opinion is included in Appendix C, and Appendix D contains additional product information for the filtration and UV systems.

In order to provide relatively constant flows to the tertiary treatment systems discussed below, it is assumed the upstream treatment process will provide flow equalization in order to limit short-term peak flows (such as the PHF) to the peak day flow (PDF). Pumping facilities to transfer pond effluent to the filters would likely be required for either alternative, and are included in the cost opinions.

<u>Filtration</u>

Either filtration option would require coagulant feed and mixing equipment upstream of the filters for compliance with Title 22 requirements. It is assumed that coagulant feed and mixing facilities would cost approximately $100,000 for 2030 design flows.

Option 1: Advanced Sand Filtration (Parkson Dynasand)

The Dynasand filtration system consists of upflow, modular sand filters with integral backwash. The internal wash system does not require backwash pumps or wash water storage tanks, reducing energy costs, the need for clean water storage, and the system footprint. Each filter is continuously backwashed, eliminating the need for downtime to clean the filters. Dynasand filters have been approved for Title 22 compliance.

To meet 2030 PDF, a minimum of 10 modules are needed. Therefore, we recommend 6 filtration cells with 2 modules per cell. This way one cell could be taken offline at a time without exceeding the maximum allowable loading rate (5 gpm/ft^2) for Title 22 compliance. Arranging the cells in 2 columns with 3 rows, the total approximate footprint would be 45 feet long by 15 feet wide. The estimated capital cost is approximately $2,780,000. Construction could be phased with flow demand.

Option 2: Rotating Disk Filtration (Aqua-Aerobic Aquadisk)

The Aquadisk rotating disk filter system uses nylon pile cloth media. Backwashing occurs at a predetermined water level or time without interrupting treatment. Filters arrive completely assembled in a stainless steel tank. Each unit includes a vacuum backwash, a hopper-bottom tank, a solids removal manifold system, and a fully automatic PLC-based control system. Two 10-disk filters are recommended to provide 100% redundancy. The system was sized to meet 2030 PDF. Each unit is approximately 10 feet wide, 20 feet long and 10 feet high. The estimated capital cost for the system is approximately $2,020,000.

<u>Disinfection</u>

Option 1: Chlorine Contact Basin

For chlorine disinfection, 90-minutes of contact time (at PDF) is required to meet Title 22 standards. To provide this level of treatment, the basin will need a volume of 27,900 ft^3. We recommend two parallel channels for redundancy and ease of maintenance. Chlorine dosing and monitoring equipment will be needed. The dosing can be paced off the influent flow meter. The estimated capital cost for a chlorine disinfection system is approximately $1,750,000.

Option 2: UV Disinfection

The Trojan UV3000 Plus™ is a reliable and proven disinfection system that uses low pressure, high output variable power amalgam lamps. The system was designed with an emphasis on dependable performance and simplified maintenance. It is equipped with an automatic chemical/mechanical cleaning system, called ActiClean™, consisting of submersible wiper assemblies with on each UV module. ActiClean™ maintains 95% sleeve transmittance and works while the system is in operation, eliminating the need to go offline for cleaning. To meet design flow for 2030, a system with five banks (four duty, one redundant) is recommended, with nine 8-lamp modules per bank, for a total of 360 lamps. The total estimated capital cost for this option is approximately $4,550,000.

8.6 Solids Handling

The additional biological activity of any of the extended aeration processes discussed (Biolac®, oxidation ditch, or activated sludge) provides a higher level of treatment and produces a greater volume of sludge than the existing aerated pond system. This will require additional storage space for solids handling. If the District pursues activated sludge or oxidation ditch treatment, all of the existing aerated ponds will be available and could be used for sludge treatment and storage.

A Biolac system retrofit (least capital cost option) will leave the two primary ponds for use. Odor control can be provided by maintaining an aerated, 2- to 4-foot depth of water over the sludge. This would require the installation of two (2) 10-hp brush aerators in each pond. We recommend the District budget for approximately $100,000 ($50,000 per pond) in addition to the capital cost shown in Table 8.1 for aerators and other miscellaneous equipment needed to convert the primary ponds to sludge lagoons.

The sludge produced from a Biolac system at Year 2030 conditions was calculated as an example. Biolac typically yields 0.6 pounds of solids per pound of BOD removed. Assuming the influent BOD_5 concentration is equal to the average BOD_5 concentration (265 mg/L), TSS is 319 mg/L (70% as fixed solids), and Biolac reduces BOD_5 to 5 mg/L, approximately 3500 pounds of sludge would be produced per day during average flow conditions. Assuming 2% solids, the volume of sludge produced would be approximately 2800 ft^3 per day. Over time, it is expected that the sludge concentration in the ponds would compress, resulting an average of 6% solids (assuming negligible anaerobic degradation of sludge).

With three feet for freeboard, each primary pond has a total volume of 424,000 ft^3. At 2% solids, the ponds can provide a minimum of 150 days of storage each (approximately 10 months total). If solids reach 6% within the first year of storage, the ponds may store approximately 2 years of sludge at 2030 flows. It is assumed the sludge would be removed by a portable pump and conveyed through temporary sludge piping to the District's sludge drying beds.

Although the District has used the existing drying beds successfully for many years, we recommend upgrading them. The beds are not lined, and any infiltration through the bottom of the beds could contribute to groundwater degradation. In addition, the beds will be used more regularly in the future and should be lined with concrete to allow vehicles and equipment to work in the ponds without getting stuck. Therefore, initially (during construction of the Phase I Biolac improvements – in the next 2 years) we recommend lining the beds with concrete and installing a decanting pump station for dewatering the beds and conveying supernatant back to the plant's headworks for treatment. This will provide the District with maximum use of their drying beds, by regularly removing any liquid volume from the ponds and leaving more volume for receiving sludge from the holding ponds. Actively "working" the sludge in drying beds can remove 50-75% of the water from the sludge. At 2030 demands, one year of "dried" sludge (50% solids) would occupy approximately 50% of the proposed drying bed volume, and would require approximately 140 standard 10-cy truck trips for removal. If solids content is increased to 75% through continual compression, raking, and further evaporation, this would be reduced to 70 truck trips.

In the next phase of construction, it is recommended that the District construct two (2) new sludge drying beds by 2017 (simultaneously with Phase II upgrade of the Biolac system to meet 2030 demands) similar in size to the existing beds. All four (4) beds should be connected by common valves and piping from the existing sludge header adjacent to the ponds, and should be connected to the decanting pump station.

Cost opinion for Phases I and II is provided below:

Table 8-2 Cost Opinions for Sludge Drying Beds

Phase I – Modify Existing Sludge Drying Beds

Item	Description	Unit	Unit Price	Quantity	Amount
1	Concrete Bed Liner	LS	$600,000	1	$600,000
2	Decant Pump Station and Piping	LS	$500,000	1	$500,000
3	Engineering/Admin (20% of earthwork)				$220,000
	Subtotal				$1,320,000
4	Contingency (30% of subtotal)				$396,000
	Total				$1,716,000

Phase II – New Sludge Drying Beds

Item	Description	Unit	Unit Price	Quantity	Amount
1	Excavation for 2 beds (160’ x 200’ x 5’)	YD^3	$25.00	11,860	$296,500
2	Concrete Bed Liner	LS	$600,000	1	$600,000
3	Piping (10% of Subtotal)				$90,000
4	Engineering/Admin (20% of Subtotal)				$197,300
	Subtotal				$1,183,800
5	Contingency (30% of subtotal)				$355,140
	Total				$1,540,000

Note: Totals rounded to nearest $1,000

If odors are a concern in the future, the District should explore various sludge treatment processes such as belt press filtration and/or centrifuge to reduce volume prior to storage in the drying beds.

8.7 Wastewater Disposal

Various end-use options for treated wastewater were discussed in Section 6.0: reuse as irrigation for parks, groundwater recharge reuse, and maintain onsite percolation for filtration and potentially for seasonal storage before transporting offsite for infiltration or other reuse. The Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives (AECOM, January 2009) further discusses potential disposal and reuse alternatives. If the District chooses to continue onsite percolation as a wet-weather disposal or secondary disposal method, additional infiltration basins will likely be needed, especially if additional aeration ponds are built as the future treatment alternative. Table 8-3 shows the approximate costs to construct three new infiltration basins. As discussed in previous sections of the report, percolation capacity of the site must be evaluated. At least three basins (approximately 110 ft by 650 ft) could fit on the District's property without requiring additional land.

Table 8-3 Cost Opinion for Infiltration Basins

Item	Description	Unit	Unit Price	Quantity	Amount
1	Excavation for 3 basins (110' x 650' x 5')	YD^3	$20.00	39,730	$794,600
2	Piping (10% of earthwork)				$79,460
3	Engineering/Admin (20% of Subtotal)				$174,840
	Subtotal				$1,048,900
4	Contingency (30% of subtotal)				$314,700
	Total				$1,363,000

8.8 Removal of Sludge from Drying Beds during Construction

In a November 30, 2007, Technical Memorandum (Appendix E), Boyle evaluated various options for long-term sludge management at Southland and Blacklake WWTFs. The Memorandum developed costs for hauling sludge to a landfill, San Jose Composting (Kern County) or to Engel & Grey (Santa Maria).

Removing sludge from the drying beds will present a significant cost during construction. Assuming the existing drying beds (approximately 50,800 square feet of surface area) have depths of 5 feet or 8 feet of sludge, we would expect to have 254,000 cubic feet or 406,000 cubic feet of sludge. If the average density is in the range of

10-30% solids at a specific gravity of 1.06, we would anticipate the volumes are equivalent to 1,100 and 1,800 tons, respectively.

It is unlikely a composting facility will take these solids since there is no grit removal or screening at the plant, but the landfill might take them. Since landfill and composting facilities' policies may change in the next year, it is recommended that this analysis be reviewed and revised prior to beginning plant construction.

The budget numbers summarized below are considered to be an adequate, current planning-level cost for hauling solids to a landfill. Reducing volume by drying these solids will decrease hauling and tipping costs:

- Excavation of Sludge (5-ft Depth) = $100,000 ($10 per cubic yard)
- Excavation of Sludge (8-ft Depth) = $150,000 ($15 per cubic yard)
- Total Tipping and Hauling Cost per Truck Load = $1,500 ($1330 from 2007 Technical Memorandum with 10% Escalation)
- Total Sludge Disposal Cost (5-ft Depth = 45 Loads) = $170,000
- Total Sludge Disposal Cost (8-ft Depth = 72 Loads) = $260,000

8.9 Alternative Energy Supply

The District is interested in pursuing alternative energy to provide power for the expanded Southland WWTF. A proposal received from SPG Solar (See Appendix F) described a 500-kW solar array that could be placed on a 3.5 acre area adjacent to the existing plant. If implemented, the SPG project would cost approximately $4,010,000 in capital cost or a Power Purchase Agreement could be executed between the District and SPG Solar to provide approximately 1,000,000 kWh/yr at around $0.11/kWh with 3% annual escalation or $0.105/kWh with 4% annual escalation. The SPG proposal does not include site preparation, fencing, lighting, drainage, or other improvements beyond installation of the solar arrays and electrical conduits to the plant's control center.

Although this proposal is included for budgetary purposes, an evaluation of solar power alternatives should be performed prior to implementing a project. No analysis has been performed on the SPG Solar proposal and it is unknown if it would be appropriate for providing power to the proposed treatment project.

8.10 Recommendations

The WWTF will require an upgrade to handle future demands. Several processes were evaluated. When compared to the aerated pond system, a Biolac® system can provide a higher level of treatment at a lower capital and operating cost. It requires a higher degree of operator involvement than the current system, but routine operations and maintenance are less complex than the other, more expensive treatment technologies reviewed herein (oxidation ditch and activated sludge).

We recommend installing sufficient aeration capacity to meet 75% of 2030 demands in Phase I of plant upgrades, as well as lining the existing sludge drying beds and installing a decanting pump station [6]. Ponds 3 and 4 should be relined and retrofit with Biolac wave oxidation systems and clarifiers should be constructed. The existing primary ponds should be used for onsite sludge storage and anaerobic reduction prior to drying.

Phase II would involve upgrading the Biolac system capacity to meet 2030 demands and installing two additional lined sludge drying beds.

Three (3) infiltration basins, similar in size to the existing ponds, could fit on the existing WWTF site. The ultimate capacity of the existing and new ponds should be determined so the District can decide whether to use the onsite infiltration basins as filtration and potentially "wet-weather" storage prior to offsite infiltration or some reuse alternative.

[6] Phase I improvements meet Scenario 1 demands from the Water and Sewer Master Plan Update (Cannon Associates, December 2007).

9.0 CONCLUSIONS & RECOMMENDATIONS

9.1 Conclusions

The Southland WWTF is approaching the permitted capacity (MMF = 900,000 gpd). Flowrates could reach this limit as early as 2010 and the WWTF is expected to exceed effluent quality limits (average monthly BOD_5 = 60 mg/L) in 2011 during high flow conditions. An upgrade is required to handle future demands and water quality goals. The District should work with RWQCB to develop a phased approach to upgrading the Wastewater Treatment Facility. A schedule for this work is outlined in Section 10.0.

Water quality goals will dictate future plant process improvements. Feasible usage options include direct reuse (irrigation) and offsite infiltration (disposal). Based on conversations with RWQCB staff, and review of Basin Plan criteria, more stringent discharge requirements to eliminate impacts on groundwater are inevitable. These requirements may include nitrogen limits and salts limits in the future. The existing treatment process is not adequate to meet water quality goals that are more stringent than the current discharge requirements, including requirements for tertiary treatment (for park/school irrigation) or pretreatment requirements for future salts removal if required.

An examination of existing and future hydraulic demands on the system revealed deficiencies as discussed below:

- The capacity of the Frontage Road trunk main is inadequate for existing conditions;
- The influent pumps can meet projected flow demands through 2015, however the wetwell is undersized for existing demands and may cause excessive motor wear. The influent pump station will not meet 2030 demands.
- The plant is nearing its rated capacity, and could exceed permitted flow limits by 2010, according to the flow projections presented in this report.

Four alternatives were evaluated for the WWTF treatment upgrade: additional aerated ponds, Biolac® wave oxidation system, oxidation ditch, and conventional activated sludge. The first option is an extension of the current treatment process at the plant. The following three are variations of activated sludge technology, which provides a higher quality effluent and a basis for tertiary treatment. The Biolac system provides extended aeration at a lower cost than any of the other three alternatives examined. Life cycle costs are approximately half that of a pond system. Additional treatment can be easily added to the process train, providing flexibility for the potential of tertiary treatment.

9.2 Recommendations

As discussed in previous sections, we recommend the following as a result of our analysis in this Master Plan:

- Begin planning and permitting efforts for a wastewater treatment plant expansion as soon as possible;
- The District should consult with RWQCB to acquire either interim adjustment to effluent limits, or to permitted flows, during planning and design of a treatment facility expansion. They should also seek RWQCB support on the recommendations and schedule presented in this Master Plan. Details are discussed in Section 8.0.
- If reuse is an option, a user survey should be conducted to see if a viable market for irrigation is available. (See Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives, ibid, for additional discussion).
- Since expansion of percolation area may be required on an interim basis, regardless of future reuse opportunities, we recommend assessing available onsite percolation capacity and evaluating groundwater conditions beneath the plant.
- Screening and grit removal systems will improve treatment and reduce wear on system components. We recommend installing two (2) shaftless screw screens and two (2) vortex-type grit removal vaults.
- Sludge in the drying beds will need to be removed before construction. As discussed in Section 8.8, volume is estimated between 254,000 and 406,000 ft^3 and the weight between 1,100 and 1,800 tons, respectively.
- Biolac® is the recommended wastewater treatment process based on capability to meet more stringent discharge limits; nitrogen removal capabilities; low level of complexity compared with activated sludge systems; and low capital/lifecycle costs compared with the other alternatives evaluated herein. Ponds 3 and 4 should be relined and retrofitted with the Biolac wave oxidation system. External clarifiers will also be required. The system should be constructed in two phases – Phase I would provide 75% of the 2030 capacity [7], and Phase II would meet 2030 demands.
- The District should have a Class II Operator managing the Biolac system.
- The primary treatment ponds should be converted to aerated sludge holding lagoons.
- The two existing drying beds should be lined and a decanting pump station should be provided. Two additional drying beds should be constructed to meet 2030 solids handling demands. If odors become a concern in the future, due to increase in development around the plant site, more rigorous solids processing may be required.

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[7] Phase I improvements meet Scenario 1 demands from the Water and Sewer Master Plan Update (Canon Associates, December 2007).

10.0 RECOMMENDED CAPITAL IMPROVEMENTS PLAN & OPINION OF PROBABLE COST

The analysis presented in the previous sections addresses improvements required to meet existing demands, as well as future demands and water quality goals. Major capital improvements can be separated into two categories:

- Facility Improvements: Those projects which would improve plant operability without requiring major process improvements.
- Future Process Improvements (Schedule TBD): Process and capacity improvements to meet anticipated future water quality goals and demands through 2030. While the first phase of the Biolac® system should be installed before the plant reaches its permitted capacity (0.9 MGD), the tertiary treatment and disinfection improvement schedule would be dictated by future permitting limits and/or recycling opportunities.

A 4% annual cost escalation factor was applied to the 2008 project costs summarized below.

Table 10-1 Conceptual Cost Opinions for Facility Improvements

Component	2008 Project Cost	Year to be Completed	Escalated Project Cost to Midpoint of Construction
Frontage Rd. Trunk Main 21" Upgrade	$2,182,000	2011	$2,361,000
Influent Pump Station and Flowmeter Improvements	$967,000	2011	$1,046,000
Spiral Screening System	$512,000	2011	$554,000
Grit Removal System	$629,000	2011	$681,000

Nov 2008 ENR (CCI) = 8602 in all Cost Opinions

Table 10-1 includes the Frontage Rd. Trunk Main Upgrade, which will remedy existing hydraulic deficiencies in the pipeline; Screening and Grit Removal Systems, as requested by District staff to improve operability of the plant and improve pond performance; and the Influent Pump Station and Flowmeter Improvements. Although the existing pump station capacity is adequate through 2015, as discussed in Section 7.0, it is recommended that this project be installed at the same time as the Frontage Road Trunk Main project since both will require deep excavations (greater than 20 ft depth), bypass pumping, and could be more efficiently constructed as one project.

Table 10-2 Conceptual Cost Opinions for Process Improvements [8]

Component	2008 Project Cost	Year to be Completed	Escalated Project Cost to Midpoint of Construction
Phase I Biolac System (Capacity = 1.4 MGD MMF, or 75% of 2030 Demands)	$5,734,000	2011	$6,204,000
Phase I Sludge Lagoons	$100,000	2011	$108,200
Phase I Drying Bed Improvements	$1,716,000	2011	$1,857,000
Phase II Biolac System (Capacity = 1.8 MGD MMF, or 100% of 2030 Demands)	$280,000	2017	$308,000
Phase II Drying Beds (2 New)	$1,540,000	2017	$2,108,000
Percolation Ponds	$1,363,000	2017	$1,865,000
Tertiary Filtration	$2,016,000	TBD	--
Chlorination System	$1,748,000	TBD	--
Solar array for alternative energy (see proposal App E)	$4,010,000	TBD	--

Table 10-2 includes construction of the wave oxidation system and integral clarifiers in the existing secondary ponds in phases. The project cost summaries in Section 8.0 include a cost of $6,014,000 for a complete wave oxidation system and clarifiers with adequate capacity through 2030. The Phase I project would include the Biolac system and clarifiers, sludge lagoons, and improvements to the existing sludge drying beds. Conversion to Biolac would involve liner replacement, installation of aeration lines, modification (cut and fill) of each secondary pond, and installation of two secondary clarifiers. Ponds 1 and 2 can serve as sludge holding lagoons and installation of simple brush aerators will assist with degradation and odors. Phase I should be accomplished within the same timeline as the headworks improvements (recommended as part of the same project) since the plant currently treats 0.64 MGD on a maximum month basis, with a permitted MMF capacity of 0.90 MGD. Diffusers would be installed to meet a capacity of 75% of 2030 Demands (approximate to projected 2020 Demands). Phase II would include installation of additional diffusers and an additional blower to meet 2030 Demands.

Blowers/Aeration: Although blower condition was not assessed in detail in this study, the existing blowers may be capable of supporting aeration demand for the first few years of operation. This should be explored during preliminary facility design. However, cost for new blowers was included in the project cost opinions for planning purposes.

[8] Phase I improvements meet Scenario 1 demands from the Water and Sewer Master Plan Update (Canon Associates, December 2007).

Solids Handling Facilities: At the same time the Phase I Biolac project is constructed, we recommend converting the existing primary treatment ponds to aerated sludge holding lagoons, lining the District's existing drying beds, and constructing a decanting pump station. Two additional drying beds would be installed if needed prior to 2015, or in conjunction with the Phase II Biolac expansion in 2015.

If odors become a concern near the plant site, additional solids handling facilities (such as a centrifuge or belt press) may be required to process sludge before storing or drying it onsite.

Disposal or Reuse Option: Evaluating potential discharge, percolation, or reuse opportunities will require further investigation by the District. Currently, the District is investigating potential disposal and reuse opportunities through the Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives (ibid).

11.0 BASIS FOR ASSESSMENT OF RATES & FEES

The objectives of this section are 1) to establish guidelines for determining the value of the existing facilities at Southland WWTF that would remain in service for future demands, and 2) to recommend a cost allocation strategy for existing ratepayers and new development to assist in funding Phase I WWTF improvements. [9]

<u>Use of Existing Facilities</u>

The process schematic of the existing WWTF is included as Figure 4-1. If the Biolac® System is installed, all the basins, drying beds, and percolation ponds will remain in service with the recommended upgrades. However, the influent trunk main, flow meter, and pump station will be replaced. The grinder will be replaced with screening and grit removal systems in order to reduce the amount of solids in the influent and resulting wear on equipment.

The recommended process improvement, a Biolac® system, utilizes two of the four existing aerated ponds as basins (the two larger, secondary aeration ponds). The flow diagram and site plan (with the existing facilities in gray) for the Biolac® retrofit are included as Figures 8-3 and 8-4. With this alternative, the mechanical aerators will be replaced with a Wave Oxidation™ system and clarifiers. Existing aeration piping will be abandoned or removed. The District will be able to use the blower building and three existing blowers, but may need to add or replace some in the future as demand increases. The Biolac® upgrade is recommended in phases as discussed in Section 10.

With increased biological treatment of any extended aeration processes, a greater amount of sludge will be produced than is currently generated. The two existing primary aerated ponds would be operated as sludge holding lagoons to provide treatment and storage. The aeration system will need to be removed and brush aerators will be added to maintain an aerated layer of water over the sludge.

The two existing sludge drying beds will continue in service. In order to meet increased demands, we recommend adding concrete liners and a decanting pump station for dewatering the beds and conveying the supernatant back to the plant’s headworks for treatment. This retrofit is recommended to coincide with the Phase I Biolac improvements (see Table 11-2). During the second phase of construction, two new drying beds should be installed to ensure storage and dewatering capacity for buildout demands.

The WWTF currently uses onsite infiltration basins for final treatment and disposal of the effluent. Continued onsite percolation is assumed in this report, but pending studies and future policy direction regarding wastewater

[9] Though Phase II improvements are discussed in this report, the cost-sharing strategy was developed only for Phase I at this time based on direction from the Board during the April 11, 2007 NCSD Board Meeting.

reuse and disposal may require additional plant improvements. An analysis is currently underway to investigate the potential impacts to groundwater and the District is exploring sites for reuse and/or offsite disposal. A survey to identify prospective users of reclaimed wastewater is recommended, as well.

Cost-Sharing Strategy

Nearly all the recommended improvements have two objectives: meet existing demands, and handle anticipated demands from future development. To assist the District in developing a cost-sharing strategy for the Phase I WWTF improvements, each project cost is separated into two funding categories: existing customers and future development, as shown in Table 11-1.

Table 11-1 Recommended Funding Allocation

Demands	AAF (mgd)	Percentage
Existing	0.59	47 %
Future Development	0.66	53 %
Total Phase I Capacity	1.25	100 %

The project costs are then divided between existing ratepayers and future development based on relative capacity.

Table 11-2 Proposed Cost-Sharing for Recommended Phase I WWTF Improvements

Component	2008 Project Cost	Year to be Complete	Escalated Project Cost to Midpoint of Construction[1]	% Capacity for Existing Users	Cost for Existing Users[2] (midpoint of construction)	% Capacity for Future Development	Cost for Future Development (midpoint of construction)
FACILITY IMPROVEMENTS							
Frontage Rd. Trunk Main 21" Upgrade	$2,182,000	2011	$2,361,000	47	$1,115,000	53	$1,247,000
Influent Pump Station and Flowmeter Improvements	$967,000	2011	$1,046,000	47	$494,000	53	$553,000
Spiral Screening System	$512,000	2011	$554,000	47	$262,000	53	$293,000
Grit Removal System	$629,000	2011	$681,000	47	$322,000	53	$360,000
PROCESS IMPROVEMENTS							
Phase I Biolac System (Capacity = 1.4 MGD MMF, or 75% of 2030 Demands)	$6,014,000	2011	$8,229,000	47	$3,885,000	53	$4,345,000
Phase I Sludge Lagoons	$100,000	2011	$108,200	47	$50,900	53	$57,300
Phase I Drying Bed Improvements	$1,716,000	2011	$1,857,000	47	$877,000	53	$981,000
Percolation Ponds	$1,363,000	2017	$1,865,000	47	$877,000	53	$988,000

[1] Cost is escalated using a 4% annual cost escalation.
[2] Percent capacity is determined by ratio of flow demands for existing users to total future demand.

APPENDIX A

WASTE DISCHARGE ORDER
MONITORING & REPORTING PROGRAM

Cal/EPA

Central Coast Regional Water Quality Control Board

81 Higuera Street
Suite 200
San Luis Obispo, CA
93401-5427
(805) 549-3147
FAX (805) 543-0397

Pete Wilson
Governor

Certified P 381 741 818

October 29, 1997

Mr. Doug Jones, General Manager
Nipomo Community Services District
261 Dana Street, Suite 101
Nipomo, CA 93444

Dear Mr. Jones:

WASTE DISCHARGE REQUIREMENTS FOR NIPOMO COMMUNITY SERVICES DISTRICT, SOUTHLAND WASTEWATER WORKS, SAN LUIS OBISPO COUNTY, ORDER NO. 97-75

Enclosed is a copy of Order No. 97-75, Nipomo Community Services District, Southland Wastewater Works, San Luis Obispo County, which was adopted by this Board on October 24, 1997.

Sincerely,

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, CENTRAL COAST REGION

BY [signature]
Roger W. Briggs
Executive Officer

Enclosure

p:\cm\final.ltr

cc: Garing Taylor & Assoc.
141 East Elm Street
Arroyo Grande, Ca 93420

RECEIVED
NOV 04 1997
NIPOMO COMMUNITY SERVICES DISTRICT

WDID No. 400104001

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

81 Higuera Street Suite #200
San Luis Obispo, California 93401

ORDER NO. 97-75

WASTE DISCHARGE REQUIREMENTS FOR NIPOMO COMMUNITY SERVICES DISTRICT, SOUTHLAND WASTEWATER WORKS, SAN LUIS OBISPO COUNTY

The California Regional Water Quality Control Board, Central Coast Region (Board), finds;

1. Nipomo Community Services District (Discharger) owns and operates a municipal wastewater treatment facility which serves the town of Nipomo.

2. The Discharger filed a Report of Waste Discharge, in accordance with Section 13260 of the California Water Code, for authorization to increase discharges to the wastewater facility on January 24, 1996, and supplemented the Report of Waste Discharge with additional information on July 31, and September 30, 1996, and July 9, 1997. The discharge is currently regulated by Waste Discharge Requirements Order No. 84-56 adopted by the Board on July 13, 1984.

3. The treatment facility consists of influent grinding and aerated lagoons. Treated wastewater is discharged to 5.3 acres of percolation beds. Current design capacity is 360,000 gallons per day (1360 m^3/day), and design capacity of the expanded facilities is 900,000 gallons per day (3406 m^3/day), for which 14.5 acres total percolation basin area will be needed.

4. The percolation beds are located on level topography consisting of sandy soils. Perched ground water occurs at approximately 30 to 40 feet below ground surface, however the quality and direction of flow of this perched water is not clearly determined. A deeper ground water supply occurs at approximately 180 to 200 feet below ground surface and flows toward the southwest. Ground water constituent concentrations in the vicinity of the discharge are reportedly:

Total Dissolved Solids	260 mg/l
Sodium	36 mg/l
Chloride	36 mg/l
Nitrate (as N)	11 mg/l
Sulfate	22 mg/l
Boron	<0.1 mg/l

5. Nipomo Creek, tributary to the Santa Maria River, is located approximately 1/4 mile northeast of the discharge facilities and flows in a southeasterly direction. The wastewater facilities are not within the 100-year flood plain of Nipomo Creek.

6. The Water Quality Control Plan, Central Coast Basin (Basin Plan) was adopted by the Board on September 8, 1994. The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of State waters.

7. Present and anticipated beneficial uses of ground water in the vicinity of the discharge include: Domestic, Municipal, Agricultural and Industrial Supply.

8. Water quality objectives specified in the Basin Plan for ground water in the vicinity of the discharge include:

Total Dissolved Solids	710 mg/l
Sodium	90 mg/l
Chloride	95 mg/l
Nitrate (as N)	5.7 mg/l
Sulfate	22 mg/l
Boron	0.15 mg/l

9. Nipomo Community Services District certified a final Environmental Impact Report for the existing wastewater facilities in accordance with provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et. seq.) and the California Code of Regulations on July 14, 1983. The Environmental Impact Report identified potential impacts to water quality from the discharge of nitrates and dissolved solids to ground water. Mitigations include changes in the design and operation of the facility and implementation of a sewer use ordinance. Nipomo Community Services District certified an Initial Study and Negative Declaration for proposed expansion of the wastewater facilities on October 2, 1996, which found no significant potential for impact to surface or ground water quality from the expanded discharge.

10. Discharge of Waste is a privilege, not a right, and authorization to discharge is conditional upon the discharge complying with provisions of Division 7 of the California Water Code and any more stringent effluent limitations necessary to implement water quality control plans, to protect beneficial uses, and to prevent nuisance. Compliance with this Order should assume this and mitigate any potential adverse changes in water quality due to discharge.

11. On **August 5, 1997,** the Board notified the Discharger and interested agencies and persons of its intent to revise waste discharge requirements for the discharge and has provided them with a copy of the proposed Order and an opportunity to submit written views and comments.

12. After considering all comments pertaining to this discharge during a public hearing on October 24, 1997, this Order was found consistent with the above findings.

IT IS HEREBY ORDERED, pursuant to authority in Section 13263 of the California Water Code, Nipomo Community Services District, its agents, successors, and assigns, may discharge treated wastewater from the Wastewater Treatment Facility, providing compliance is maintained with the following:

(Note: Other prohibitions and conditions, definitions, and the method of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated January 1984.)

Throughout these requirements footnote ([A]) is listed to indicate those requirements specified from the Basin Plan. Requirements not referenced are based on Staff's professional judgment.

A. PROHIBITIONS

1. Discharge to areas other than the disposal areas shown on Attachment A is prohibited.
2. Discharge of any wastes including overflow, bypass, seepage, overspray and runoff from transport, treatment, or disposal systems to adjacent drainageways or adjacent properties is prohibited.

B. DISCHARGE LIMITATIONS

1. Effluent flow averaged over each month shall not exceed 360,000 gpd. After completion of the facility expansion, monthly flow shall not exceed 900,000 gpd. Incremental flow increases (600,000 gpd Phase I and 900,000 gpd Phase II) shall be allowed with written approval of the Executive Officer, after the Discharger demonstrates that expansion of the facilities is completed.

2. Effluent discharged to the disposal facilities shall not exceed the following parameters:

Parameter	Units	Month. Mean	Daily Maximum
BOD_5	mg/l	60	100
Suspended Solids	mg/l	60	100
Settleable Solids	ml/l	0.2	0.5
pH[A]	Within the range 6.5 to 8.4		
Dissolved Oxygen	mg/l	Minimum 1.0	

3. Wastewater treatment and disposal facilities shall be managed to exclude the public and posted to warn the public of the presence of wastewater.

4. Freeboard in all ponds shall exceed two feet at all times, unless the ponds are specifically designed for a different freeboard.

C. GROUND WATER LIMITATIONS

1. The treatment or discharge shall not cause nitrate concentrations in the ground water downgradient of the disposal facilities to exceed 10.0 mg/l (as N).

2. The discharge shall not cause a significant increase of mineral constituent concentrations in underlying ground waters, as determined by comparison of representative samples of groundwater collected from wells located upgradient and downgradient of the disposal area.

3. The discharge shall not cause concentrations of chemicals and radionuclides in groundwater to exceed limits set forth in Title 22, Chapter 15, Articles 4, 4.5, 5 and 5.5 of the California Code of Regulations.[A]

D. PROVISIONS

1. The requirements prescribed by this Order supersede requirements prescribed by Order No. 84-56 adopted by the Board on July 13, 1984. Order No. 84-56 "Waste Discharge Requirements for Nipomo Community Services District and Local Sewering Entity of San Luis Obispo County Service Area No. 1" is hereby rescinded.

2. Discharger shall comply with "Monitoring and Reporting Program No. 97-75", as specified by the Executive Officer.

3. Discharger shall comply with the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated January, 1984.

4. Discharger shall implement salts best management practices within the sewer service area to minimize salts contributions to the sewer system and subsequent discharge to the disposal facilities.

5. Discharger shall submit results and conclusions of the ground water investigation described in Monitoring and Reporting Program by October 24, 1998. If the investigation indicates the discharge may be impacting ground water in the vicinity, proposed mitigation measures (additional treatment and a time schedule) shall be submitted with the summary report. Incremental flow increases shall be authorized (as described in Discharge Limitation B.1.)

based on findings of the ground water investigation and ongoing monitoring.

6. Pursuant to Title 23, Division 3, Chapter 9, of the California Code of Regulations, the Discharger must submit a written report to the Executive Officer not later than April 24, 2001, addressing:

   a. Whether there will be changes in the continuity, character, location, or volume of the discharge; and,

   b. Whether, in the Discharger's opinion, there is any portion of the Order that is incorrect, obsolete, or otherwise in need of revision.

I, ROGER W. BRIGGS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on October 24, 1997.

for Executive Officer

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM NO. 97-75

FOR

NIPOMO COMMUNITY SERVICES DISTRICT,
SOUTHLAND WASTEWATER WORKS,
SAN LUIS OBISPO COUNTY

Influent Monitoring

Representative samples of the treatment plant influent shall be collected and analyzed as follows:

Parameter	Units	Type of Sample	Sampling and Analyzing Frequency
Maximum Flow	MGD	Metered	Daily
Average Flow	MGD	Calculated	Monthly

Effluent Monitoring

Representative samples of the treatment plant effluent shall be collected and analyzed as follows:

Parameter	Units	Type of Sample	Sampling and Analyzing Frequency
Settleable Solids	ml/l	Grab	Daily
Biochemical Oxygen Demand	mg/l	6-hr. Composite	Weekly
Suspended Solids	mg/l	6-hr. Composite	Weekly
Dissolved Oxygen	mg/l	Grab	Weekly
pH	pH Units	Grab	Weekly
Total Dissolved Solids	mg/l	6-hr. Composite	Semi-annually (Jan/July)
Sodium	mg/l	6-hr. Composite	Semi-annually (Jan/July)
Chloride	mg/l	6-hr. Composite	Semi-annually (Jan/July)
Total Nitrogen (as N)	mg/l	6-hr. Composite	Semi-annually (Jan/July)

Ground Water Monitoring

Discharger shall install new monitoring wells upgradient and downgradient of the disposal area which facilitate representative sampling from the first available ground water. Discharger shall be responsible for determining direction of ground water flow and level to determine the appropriate location and depth of upgradient and downgradient monitoring wells. The monitoring wells shall meet or exceed well standards contained in the Department of Water Resources Bulletins 74-81 and 74-90. Discharger shall also comply with the monitoring well reporting provisions of Section 13750 through 13755 of the California Water Code.

Discharger shall investigate ground water upgradient and downgradient of the discharge in order to identify impacts caused by the discharge. Ground water sampling should include (but not be limited to) the constituents listed below in the ongoing ground water monitoring program. Impacts and mitigation measure shall be summarized in a report to the Executive Officer as specified in Provision D.5 of Order No. 97-75.

The ongoing ground water monitoring program shall include representative upgradient and downgradient samples collected from the first available ground water and analyzed as follows:

Parameter	Units	Type of Sample	Sampling and Analyzing Frequency
Static Water Level	Feet (below ground surface and elevation)		Semi-annually (Jan/July)
Total Dissolved Solids	mg/l	Grab	Semi-annually (Jan/July)
Sodium	mg/l	Grab	Semi-annually (Jan/July)
Chloride	mg/l	Grab	Semi-annually (Jan/July)
Total Nitrogen (as N) *	mg/l	Grab	Semi-annually (Jan/July)
Sulfate	mg/l	Grab	Semi-annually (Jan/July)
Boron	mg/l	Grab	Semi-annually (Jan/July)

*Each component nitrogen form shall be quantified as N.

Reporting

Monthly monitoring reports shall be submitted to the Regional Board by the 30th day of the month following sampling. In reporting the monitoring data, the Discharger shall arrange the data in tabular form so the date, constituents, and concentrations are readily discernible. The data shall be summarized to demonstrate compliance with waste discharge requirements. Any noncompliance with requirements must be identified and addressed according to Standard Provision C.5.

ORDERED BY [signature]
Executive Officer

October 24, 1997
Date

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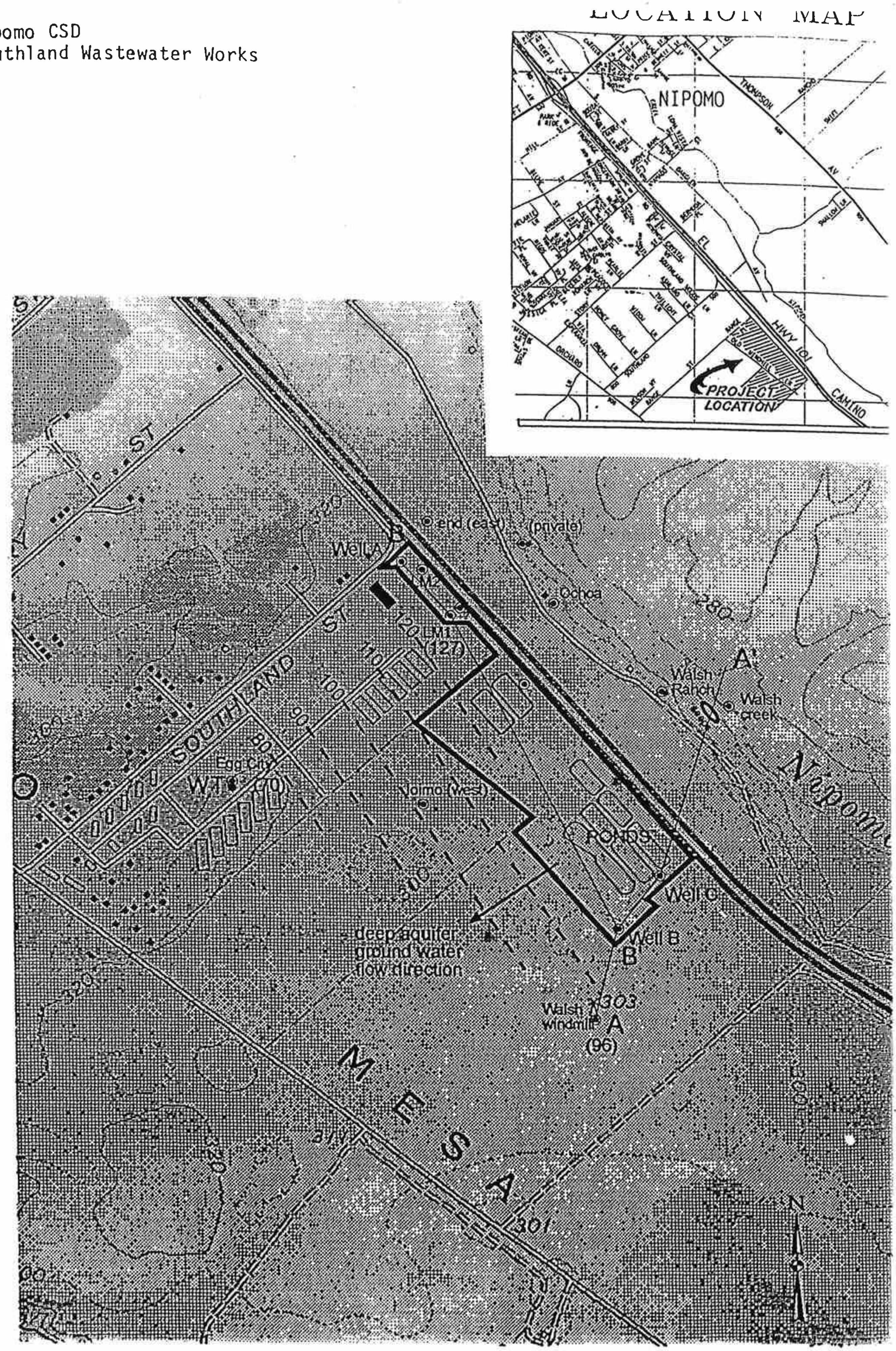
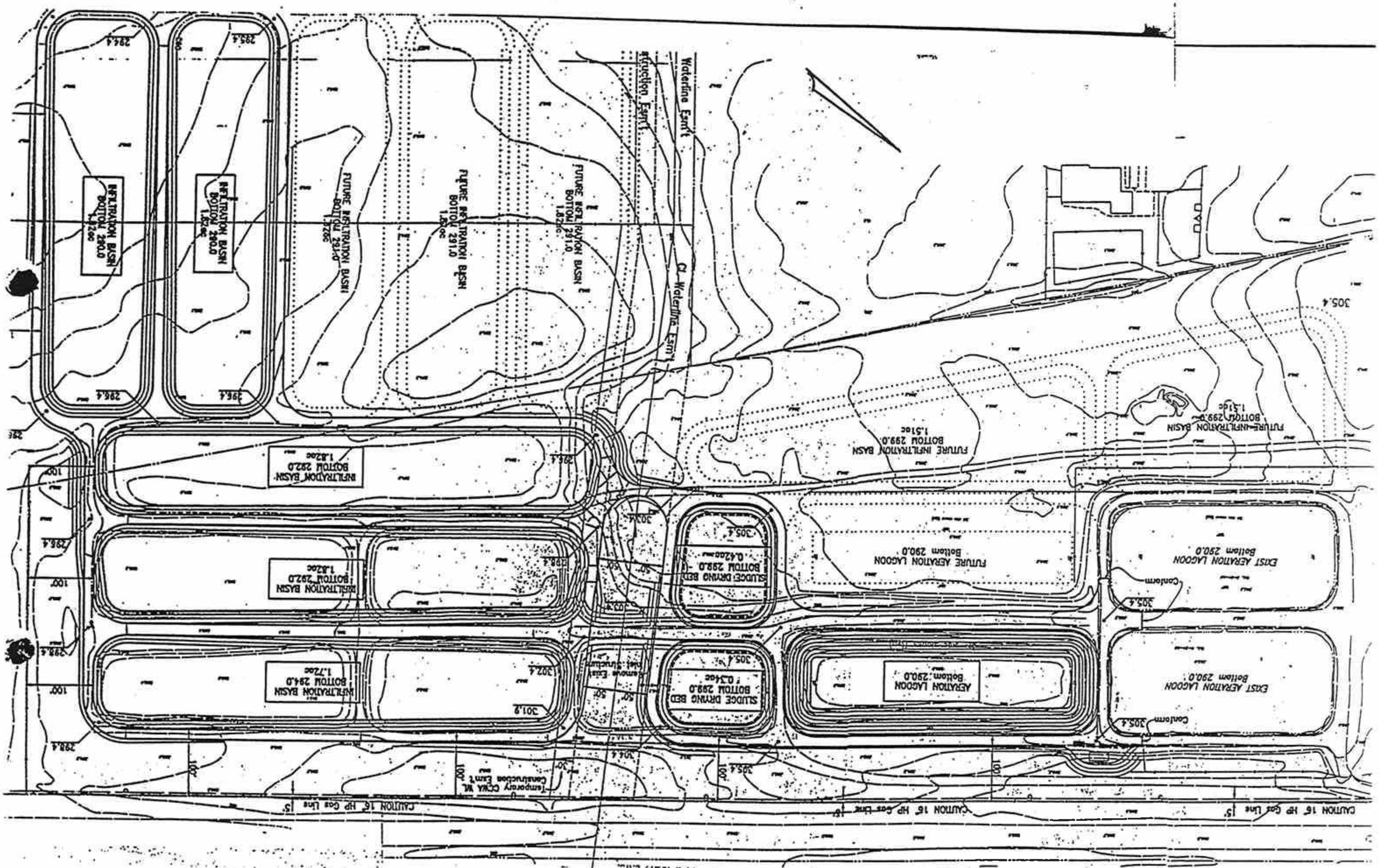
Nipomo CSD
Southland Wastewater Works





ATTACHMENT B

Nipomo CSD - Southland Wastewater Works

APPENDIX B

CALCULATIONS

BOYLE ENGINEERING

ENGINEERS, SURVEYORS, PLANNERS

BY:	EKS	**DATE:**	11/17/2008	**SUBJECT:**	SOUTHLAND WWTF	**JOB NO.**	19996.17
CHKD. BY:		**DATE:**			EXISTING TREATMENT CAPACITY		

BOD Removal in Ponds

$$\frac{C_n}{C_o} = \frac{1}{1+(k/nt)^n}$$ First order for *n* equally sized lagoons in series (ref. M&E p 843)

$$C = \frac{C_o}{1+(kV/Q)}$$ First order for each lagoon with unique volume and/ or removal rate (ref. M&E p 843)

Effluent BOD_5 Goal

C = 80 mg/L* (conserv. assumption of 80% of eff. Limitation)

Inffluent BOD_5

C_o = 360 mg/ L (Sept06 - Aug08 90th percentile BOD_5)

Estimated Inf. BOD_u = 529.2 mg/ L (inf. BOD_5 x 1.47)

$k_T = k_{20}(1.036)^{T-20}$

k_{20} =	0.276	d^{-1} (first-order rate constant at 20^{o}C)			
T_L =	49.4	^{o}F (Approximate ground temp., Dec)			
=	9.7	^{o}C	=	282.8	^{o}K
T_H =	71.5	^{o}F (Approximate ground temp., July)			
=	21.9	^{o}C	=	295.1	^{o}K
k_L =	0.19	d^{-1}			
k_H =	0.30	d^{-1}			

Flows (current 2008)

Jan-08	0.638	mgd	= Q_H (Conservative flow)
Mar-08	0.57	mgd	= Q_L
Permitted MMF	0.900	mgd	= Q_{MMF}

Volumes

Primary	=	295,700	ft^3
	=	2,211,984	gallons

*Fraction of Secondary Ponds for clarification: 0

Secondary	=	417,300	ft^3 (total volume available for aeration)
	=	3,121,613	gallons

Aeration requirement (oxygen demand)

O_2 demand (lb/ day) = Co x 1.5 x Q_{Ave} x 8.34e-6

Note: 1mg/L = 8.34e-6 lb/gal;

Calculated oxygen demands

Cu =	540	mg/ L (1.5 x Co)
Q_L =	570,000	gpd
Q_H =	638,000	gpd
Q_{MMF} =	900,000	gpd

Oxygen demand for low flow rate:	**2,567.1**	**lb O_2/ day**
Oxygen demand for high flow rate:	**2,873.3**	**lb O_2/ day**
Oxygen demand for permit MMFflow rate:	**4,053.2**	**lb O_2/ day**

BOYLE ENGINEERING

ENGINEERS, SURVEYORS, PLANNERS

BY: EKS **DATE:** 11/17/2008 **SUBJECT:** SOUTHLAND WWTF **JOB NO.** 19996.17

CHKD. BY: ______ **DATE:** ______ EXISTING TREATMENT CAPACITY

Current System Aeration Capacity

Calculate actual oxygen transfer rate for low-speed surface aerators

$$N = N_o \times \frac{B\,C_W - C_l}{C_{S\,20}} \times 1.024^{T-20} \times a$$

N_o =	2.5	lb O_2/ HP.hr (O_2 transferred under std. cond. for low-speed surface)
B =	1	(salinity-surface tension factor, typically 1)
$C_{W\,L}$ =	11.0	mg/ L (oxygen saturation concentration at temp 9.7C and 300 ft, M&E)
$C_{W\,H}$ =	8.5	mg/ L (oxygen saturation concentration at temp 21.9C and 300 ft, M&E)
C_l =	2.0	mg/ L (operating oxygen concentration)
$C_{S\,20}$ =	9.08	mg/ L (oxygen saturation concentration at temp 20C)
T_L =	49.4	^oF (Approximate ground temp., Dec)
=	9.7	^oC
T_H =	71.5	^oF (Approximate ground temp., July)
=	21.9	^oC
a =	0.82	oxygen transfer correction factor for municipal wastewater
N_L =	**1.95**	**lb O_2/ HP.hr (low temp)**
N_H =	**2.01**	**lb O_2/ HP.hr (high temp)**
Available HP =	110	HP (for surface aerators)
$AOTR_L$ =	**5140.8**	**lb O_2/ day (low temp)**
$AOTR_H$ =	**5295.8**	**lb O_2/ day (high temp)**

BOYLE ENGINEERING

ENGINEERS, SURVEYORS, PLANNERS

BY:	EKS	**DATE:**	11/17/2008	**SUBJECT:**	SOUTHLAND WWTF	**JOB NO.**	19996.17
CHKD. BY:		**DATE:**			EXISTING TREATMENT CAPACITY		

Four Ponds in Series - Winter Season (Low temp & low flow condition)

Pond #1	V_1 =	2,211,984	gallons		
	Q =	570,000	gpd		
	k_L =	0.19	d^{-1}		
	t =	3.88	days		
	C_o =	360	mg/L		
	C_1 =	206.5	mg/ L		
Pond #2	V_2 =	2,211,984	gallons		
	Q =	570,000	gpd		
	k_L =	0.19	d^{-1}		
	t =	3.88	days		
	C_1 =	206.5	mg/ L		
	C_2 =	118.5	mg/ L		
Pond #3	V_3 =	3,121,613	gallons		
	Q =	570,000	gpd		
	k_L =	0.19	d^{-1}		
	t =	5.48	days		
	C_2 =	118.5	mg/ L		
	C_3 =	57.8	mg/ L		
Pond #4	V_4 =	3,121,613	gallons		
	Q =	570,000	gpd		
	k_L =	0.19	d^{-1}		
	t =	5.48	days		
	C_3 =	57.8	mg/ L		
	C_4 =	**28.2**	**mg/ L**	total retention time =	**18.71**
	% reduction =	**92%**			

Four Ponds in Series - Summer Season (High temp & high flow condition)

Pond #1	V_1 =	2,211,984	gallons
	Q =	638,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.47	days
	C_o =	360	mg/L
	C_1 =	177.8	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	638,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.47	days
	C_1 =	177.8	mg/ L
	C_2 =	87.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	638,000	gpd
	k_H =	0.30	d^{-1}
	t =	4.89	days
	C_2 =	87.8	mg/ L
	C_3 =	35.9	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	638,000	gpd
	k_H =	0.30	d^{-1}
	t =	4.89	days
	C_3 =	35.9	mg/ L
	C_4 =	**14.7**	**mg/ L**

total retention time = **16.72**

% reduction = **96%**

Four Ponds in Series - MMF Summer Season (High temp & MMF flow condition)

Pond #1	V_1 =	2,211,984	gallons
	Q =	900,000	gpd
	k_H =	0.30	d^{-1}
	t =	2.46	days
	C_o =	360	mg/L
	C_1 =	208.5	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	900,000	gpd
	k_H =	0.30	d^{-1}
	t =	2.46	days
	C_1 =	208.5	mg/ L
	C_2 =	120.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	900,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.47	days
	C_2 =	120.8	mg/ L
	C_3 =	59.6	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	900,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.47	days
	C_3 =	59.6	mg/ L
	C_4 =	**29.4**	**mg/ L**

total retention time = **11.85**

% reduction = **92%**

BOYLE ENGINEERING

ENGINEERS, SURVEYORS, PLANNERS

BY:	EKS	**DATE:**	11/17/2008	**SUBJECT:**	SOUTHLAND WWTF	**JOB NO.**	19996.17
CHKD. BY:		**DATE:**			EXISTING TREATMENT CAPACITY		

Two Ponds in Series, Two parallel flow trains - Winter Season (Low temp & low flow condition)

Pond #1	V_1 =	2,211,984	gallons
	Q =	285,000	gpd
	k_L =	0.19	d^{-1}
	t =	7.76	days
	C_o =	360	mg/L
	C_1 =	144.8	mg/ L
Pond #4	V_3 =	3,121,613	gallons
	Q =	285,000	gpd
	k_L =	0.19	d^{-1}
	t =	10.95	days
	C_1 =	144.8	mg/ L
	C_3 =	**46.7**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	285,000	gpd
	k_L =	0.19	d^{-1}
	t =	7.76	days
	C_o =	360	mg/L
	C_2 =	144.8	mg/ L
Pond #3	V_4 =	3,121,613	gallons
	Q =	285,000	gpd
	k_L =	0.19	d^{-1}
	t =	10.95	days
	C_2 =	144.8	mg/ L
	C_4 =	**46.7**	**mg/ L**

total retention time = **18.71**

% reduction = **87%**

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BY: EKS **DATE:** 11/17/2008 **SUBJECT:** SOUTHLAND WWTF **JOB NO.** 19996.17

CHKD. BY: ______ **DATE:** ______ EXISTING TREATMENT CAPACITY

Two Ponds in Series, Two parallel flow trains - Summer Season (High temp & high flow condition)

Pond #1	V_1 =	2,211,984	gallons
	Q =	319,000	gpd
	k_H =	0.30	d^{-1}
	t =	6.93	days
	C_o =	360	mg/L
	C_1 =	118.0	mg/ L
Pond #4	V_3 =	3,121,613	gallons
	Q =	319,000	gpd
	k_H =	0.30	d^{-1}
	t =	9.79	days
	C_1 =	118.0	mg/ L
	C_3 =	**30.3**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	319,000	gpd
	k_H =	0.30	d^{-1}
	t =	6.93	days
	C_o =	360	mg/L
	C_2 =	118.0	mg/ L
Pond #3	V_4 =	3,121,613	gallons
	Q =	319,000	gpd
	k_H =	0.30	d^{-1}
	t =	9.79	days
	C_2 =	118.0	mg/ L
	C_4 =	**30.3**	**mg/ L**

total retention time = **16.72**

% reduction = **92%**

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BY:	EKS	**DATE:**	11/17/2008	**SUBJECT:**	SOUTHLAND WWTF	**JOB NO.**	19996.17
CHKD. BY:		**DATE:**			EXISTING TREATMENT CAPACITY		

Two Ponds in Series, Two parallel flow trains - MMF Summer Season (High temp & MMF flow cond.)

Pond #1	V_1 =	2,211,984	gallons
	Q =	450,000	gpd
	k_H =	0.30	d^{-1}
	t =	4.92	days
	C_o =	360	mg/L
	C_1 =	146.7	mg/ L
Pond #4	V_3 =	3,121,613	gallons
	Q =	450,000	gpd
	k_H =	0.30	d^{-1}
	t =	6.94	days
	C_1 =	146.7	mg/ L
	C_3 =	**48.1**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	450,000	gpd
	k_H =	0.30	d^{-1}
	t =	4.92	days
	C_o =	360	mg/L
	C_2 =	146.7	mg/ L
Pond #3	V_4 =	3,121,613	gallons
	Q =	450,000	gpd
	k_H =	0.30	d^{-1}
	t =	6.94	days
	C_2 =	146.7	mg/ L
	C_4 =	**48.1**	**mg/ L**
	% reduction =	**87%**	

total retention time = **11.85**

*M&E Reference: Wastewater Engineering Treatment and Reuse, 4th Edition

BOD Removal in Ponds

$$\frac{C_n}{C_o} = \frac{1}{1+(k/nt)^n}$$ First order for *n* equally sized lagoons in series (ref. M&E p 843)

$$C = \frac{C_o}{1+(kV/Q)}$$ First order for each lagoon with unique volume and/ or removal rate (ref. M&E p 843)

Effluent BOD_5 Goal

C =	80	mg/L* (conserv. assumption of 80% of eff. Limitation)

Infflуent BOD_5

C_o =	360	mg/ L (Dec 05 - Aug 06 90th percentile BOD_5)
Estimated Inf. BOD_u =	529.2	mg/ L (inf. BOD_5 x 1.47)

$k_T = k_{20}(1.036)^{T-20}$

k_{20} =	0.276	d^{-1} (first-order rate constant at 20°C)			
T_L =	49.4	°F (Approximate ground temp., Dec)			
=	9.7	°C	=	282.8	°K
T_H =	71.5	°F (Approximate ground temp., July)			
=	21.9	°C	=	295.1	°K
k_L =	0.19	d^{-1}			
k_H =	0.30	d^{-1}			

Flows (projected for 2030)

PDF	3.34	mgd	= Q_H
AAF	1.67	mgd	= Q_L
MMF	1.82	mgd	= Q_{MMF}

Volumes

Primary	=	295,700	ft^3
	=	2,211,984	gallons
Secondary	=	417,300	ft^3 (total volume available for aeration)
	=	3,121,613	gallons

Aeration requirement (oxygen demand)

O_2 demand (lb/ day) = Co x 1.5 x Q_{Ave} x 8.34e-6 Note: 1mg/L = 8.34e-6 lb/gal;

Calculated oxygen demands

Cu =	540	mg/ L (1.5 x Co)
Q_L =	1,670,000	gpd
Q_H =	3,340,000	gpd
Q_{MMF} =	1,820,000	gpd

Oxygen demand for low flow rate:	**7,521.0**	**lb O_2/ day**
Oxygen demand for high flow rate:	**15,042.0**	**lb O_2/ day**
Oxygen demand for permit MMFflow rate:	**8,196.6**	**lb O_2/ day**

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Current System Aeration Capacity

Calculate actual oxygen transfer rate for low-speed surface aerators

$$N = N_o \times \frac{B\,C_W - C_l}{C_{S\,20}} \times 1.024^{T-20} \times a$$

N_o =	2.5	lb O_2/ HP.hr (O_2 transferred under std. cond. for low-speed surface)
B =	1	(salinity-surface tension factor, typically 1)
$C_{W\,L}$ =	11.0	mg/ L (oxygen saturation concentration at temp 9.7C and 300 ft, M&E)
$C_{W\,H}$ =	8.5	mg/ L (oxygen saturation concentration at temp 21.9C and 300 ft, M&E)
C_l =	2.0	mg/ L (operating oxygen concentration)
$C_{S\,20}$ =	9.08	mg/ L (oxygen saturation concentration at temp 20C)
T_L =	49.4	^oF (Approximate ground temp., Dec)
=	9.7	^oC
T_H =	71.5	^oF (Approximate ground temp., July)
=	21.9	^oC
a =	0.82	oxygen transfer correction factor for municipal wastewater
N_L =	**1.95**	**lb O_2/ HP.hr (low temp)**
N_H =	**2.01**	**lb O_2/ HP.hr (high temp)**
Available HP =	110	HP
$AOTR_L$ =	**5140.8**	**lb O_2/ day (low temp)**
$AOTR_H$ =	**5295.8**	**lb O_2/ day (high temp)**

Calculate amount of horsepower required to satisfy oxygen demand

Oxygen demand for low flow rate:	7,521.0	lb O_2/ day
Oxygen demand for high flow rate:	15,042.0	lb O_2/ day
Oxygen demand for max month flow rate:	8,196.6	lb O_2/ day

N_L =	1.95	lb O_2/ HP.hr (low temp)
N_H =	2.01	lb O_2/ HP.hr (high temp)

For high flow rate			For max month flow rate		
Total HP =	**315.0**	**HP**	Total HP =	**210.0**	**HP**
$AOTR_L$ =	**14721.3**	**lb O_2/ day (low temp)**	$AOTR_L$ =	**9814.2**	**lb O_2/ day (low temp)**
$AOTR_H$ =	**15165.2**	**lb O_2/ day (high temp)**	$AOTR_H$ =	**10110.1**	**lb O_2/ day (high temp)**

Ponds in Series - Winter Season (Low temp & low flow condition)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.32	days
	C_o =	360	mg/L
	C_1 =	287.2	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.32	days
	C_1 =	287.2	mg/ L
	C_2 =	229.1	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_2 =	229.1	mg/ L
	C_3 =	168.7	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_3 =	168.7	mg/ L
	C_4 =	**124.2**	**mg/ L**

current % reduction = **65%** total retention time = **6.39** days

Ponds in Series - Winter Season (Low temp & low flow condition)
Add two ponds, V = 3,121,613 gallons each

Pond #1	V_1 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.32	days
	C_o =	360	mg/L
	C_1 =	287.2	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.32	days
	C_1 =	287.2	mg/ L
	C_2 =	229.1	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_2 =	229.1	mg/ L
	C_3 =	168.7	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_3 =	168.7	mg/ L
	C_4 =	**124.2**	**mg/ L**
New Pond 5	V_5 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_4 =	124.2	mg/ L
	C_5 =	**91.5**	**mg/ L**
New Pond 6	V_6 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_L =	0.19	d^{-1}
	t =	1.87	days
	C_5 =	91.5	mg/ L
	C_6 =	**67.4**	**mg/ L**

% reduction **81%** total retention time = **10.13 days**

For ponds in series,
Two additional ponds would treat the wastewater to acceptable levels during low temp, low flow conditions

Ponds in Series - Summer Season (High temp & high flow condition)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons			
	Q =	3,340,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	0.66	days			
	C_o =	360	mg/L			
	C_1 =	301.1	mg/ L			
Pond #2	V_2 =	2,211,984	gallons			
	Q =	3,340,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	0.66	days			
	C_1 =	301.1	mg/ L			
	C_2 =	251.8	mg/ L			
Pond #3	V_3 =	3,121,613	gallons			
	Q =	3,340,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	0.93	days			
	C_2 =	251.8	mg/ L			
	C_3 =	197.3	mg/ L			
Pond #4	V_4 =	3,121,613	gallons			
	Q =	3,340,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	0.93	days			
	C_3 =	197.3	mg/ L			
	C_4 =	**154.5**	**mg/ L**	total retention time =	**3.19**	**days**
	% reduction =	**57%**				

Ponds in Series - Summer Season (High temp & high flow condition)

Add two ponds, V = 3,121,613 gallons each

Pond #1	V_1 =	2,211,984	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.66	days
	C_o =	360	mg/L
	C_1 =	301.1	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.66	days
	C_1 =	301.1	mg/ L
	C_2 =	251.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.93	days
	C_2 =	251.8	mg/ L
	C_3 =	197.3	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.93	days
	C_3 =	197.3	mg/ L
	C_4 =	**154.5**	**mg/ L**
New Pond 5	V_5 =	3,121,613	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.93	days
	C_4 =	154.5	mg/ L
	C_5 =	**121.1**	**mg/ L**
New Pond 6	V_6 =	3,121,613	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.93	days
	C_5 =	121.1	mg/ L
	C_6 =	**94.9**	**mg/ L**

total retention time = **5.06 days**

Two ponds don't reach effluent goal, try additional pond:

New Pond 7	V_7 =	3,121,613	gallons
	Q =	3,340,000	gpd
	k_H =	0.30	d^{-1}
	t =	0.93	days
	C_6 =	94.9	mg/ L
	C_7 =	**74.3**	**mg/ L**

% reduction = **79%** total retention time = **6.00 days**

For ponds in series,
Three additional ponds would treat the wastewater to acceptable levels during high temp, high flow conditions

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CHKD. BY: ______ **DATE:** ______ TREATMENT CAPACITY FOR FUTURE FLOWS

Ponds in Series - MMF Summer Season (High temp & MMF flow condition)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.22	days
	C_o =	360	mg/L
	C_1 =	264.8	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.22	days
	C_1 =	264.8	mg/ L
	C_2 =	194.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.72	days
	C_2 =	194.8	mg/ L
	C_3 =	129.3	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.72	days
	C_3 =	129.3	mg/ L
	C_4 =	**85.8**	**mg/ L**
	% reduction =	**76%**	

total retention time = **5.86 days**

Ponds in Series - MMF Summer Season (High temp & MMF flow condition)

Add ponds V = 3,121,613 gallons

Pond #1	V_1 =	2,211,984	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.22	days
	C_o =	360	mg/L
	C_1 =	264.8	mg/ L
Pond #2	V_2 =	2,211,984	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.22	days
	C_1 =	264.8	mg/ L
	C_2 =	194.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.72	days
	C_2 =	194.8	mg/ L
	C_3 =	129.3	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.72	days
	C_3 =	129.3	mg/ L
	C_4 =	**85.8**	**mg/ L**
New Pond 5	V_5 =	3,121,613	gallons
	Q =	1,820,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.72	days
	C_4 =	85.8	mg/ L
	C_5 =	**56.9**	**mg/ L**
	% reduction =	**84%**	

total retention time = **7.58 days**

For ponds in series,

One additional pond would treat the wastewater to acceptable levels during high temp, max month flow conditions

Two parallel flow trains - Winter Season (Low temp & low flow condition)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons			
	Q =	835,000	gpd			
	k_L =	0.19	d^{-1}			
	t =	2.65	days			
	C_o =	360	mg/L			
	C_1 =	238.8	mg/ L			
Pond #4	V_4 =	3,121,613	gallons			
	Q =	835,000	gpd			
	k_L =	0.19	d^{-1}			
	t =	3.74	days			
	C_1 =	238.8	mg/ L			
	C_4 =	**139.2**	**mg/ L**			
Pond #2	V_2 =	2,211,984	gallons			
	Q =	835,000	gpd			
	k_L =	0.19	d^{-1}			
	t =	2.65	days			
	C_o =	360	mg/L			
	C_2 =	238.8	mg/ L			
Pond #3	V_3 =	3,121,613	gallons			
	Q =	835,000	gpd			
	k_L =	0.19	d^{-1}			
	t =	3.74	days			
	C_2 =	238.8	mg/ L			
	C_3 =	**139.2**	**mg/ L**	total retention time =	**6.39**	**days**
	% reduction =	**61%**				

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Two parallel flow trains - Winter Season (Low temp & low flow condition)

Add two ponds, V = 3,121,613 gallons each

Pond #1	V_1 =	2,211,984	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	2.65	days
	C_o =	360	mg/L
	C_1 =	238.8	mg/ L
Pond #4	V_4 =	3,121,613	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	3.74	days
	C_1 =	238.8	mg/ L
	C_4 =	**139.2**	**mg/ L**
New Pond 5	V_5 =	3,121,613	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	3.74	days
	C_4 =	139.2	mg/ L
	C_5 =	**81.1**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	2.65	days
	C_o =	360	mg/L
	C_2 =	238.8	mg/ L
Pond #3	V_3 =	3,121,613	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	3.74	days
	C_2 =	238.8	mg/ L
	C_3 =	**139.2**	**mg/ L**
New Pond 6	V_6 =	3,121,613	gallons
	Q =	835,000	gpd
	k_L =	0.19	d^{-1}
	t =	3.74	days
	C_3 =	139.2	mg/ L
	C_6 =	**81.1**	**mg/ L**

total retention time = **10.13 days**

% reduction = **77%**

For two parallel flow trains,
Two additional ponds would treat the wastewater to acceptable levels during low temp, low flow conditions

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Two parallel flow trains - Summer Season (High temp & high flow condition)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons			
	Q =	1,670,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	1.32	days			
	C_o =	360	mg/L			
	C_1 =	258.7	mg/ L			
Pond #4	V_3 =	3,121,613	gallons			
	Q =	1,670,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	1.87	days			
	C_1 =	258.7	mg/ L			
	C_3 =	**166.6**	**mg/ L**			
Pond #2	V_2 =	2,211,984	gallons			
	Q =	1,670,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	1.32	days			
	C_o =	360	mg/L			
	C_2 =	258.7	mg/ L			
Pond #3	V_4 =	3,121,613	gallons			
	Q =	1,670,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	1.87	days			
	C_2 =	258.7	mg/ L			
	C_4 =	**166.6**	**mg/ L**	total retention time =	**3.19**	**days**
	% reduction =	**54%**				

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Two parallel flow trains - Summer Season (High temp & high flow condition)

Add four ponds, V = 3,121,613 gallons each

Pond #1	V_1 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.32	days
	C_o =	360	mg/L
	C_1 =	258.7	mg/ L
Pond #4	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_1 =	258.7	mg/ L
	C_3 =	166.6	mg/ L
New Pond 1	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_3 =	166.6	mg/ L
	C_5 =	**107.3**	**mg/ L**
New Pond 2	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_5 =	107.3	mg/ L
	C_7 =	**69.1**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.32	days
	C_o =	360	mg/L
	C_2 =	258.7	mg/ L
Pond #3	V_4 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_2 =	258.7	mg/ L
	C_4 =	166.6	mg/ L
New Pond 3	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_4 =	166.6	mg/ L
	C_6 =	**107.3**	**mg/ L**
New Pond 4	V_3 =	3,121,613	gallons
	Q =	1,670,000	gpd
	k_H =	0.30	d^{-1}
	t =	1.87	days
	C_6 =	107.3	mg/ L
	C_8 =	**69.1**	**mg/ L**

total retention time = **6.93 days**

% reduction = **81%**

For two parallel flow trains,
Four additional ponds are needed treat the wastewater to acceptable levels during high temp, high flow conditions

Two parallel flow trains - MMF Summer Season (High temp & MMF flow cond.)

Current System Under 2030 Flow Conditions

Pond #1	V_1 =	2,211,984	gallons			
	Q =	910,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	2.43	days			
	C_o =	360	mg/L			
	C_1 =	209.5	mg/ L			
Pond #4	V_3 =	3,121,613	gallons			
	Q =	910,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	3.43	days			
	C_1 =	209.5	mg/ L			
	C_3 =	**104.0**	**mg/ L**			
Pond #2	V_2 =	2,211,984	gallons			
	Q =	910,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	2.43	days			
	C_o =	360	mg/L			
	C_2 =	209.5	mg/ L			
Pond #3	V_4 =	3,121,613	gallons			
	Q =	910,000	gpd			
	k_H =	0.30	d^{-1}			
	t =	3.43	days			
	C_2 =	209.5	mg/ L			
	C_4 =	**104.0**	**mg/ L**	total retention time =	**5.86**	**days**
	% reduction =	**71%**				

Three Ponds in Series, Two parallel flow trains - MMF Summer Season (High temp & MMF flow cond.)

Add two ponds, V = 3,121,613 gallons each

Pond #1	V_1 =	2,211,984	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	2.43	days
	C_o =	360	mg/L
	C_1 =	209.5	mg/ L
Pond #4	V_3 =	3,121,613	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.43	days
	C_1 =	209.5	mg/ L
	C_3 =	104.0	mg/ L
New Pond	V_3 =	3,121,613	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.43	days
	C_3 =	104.0	mg/ L
	C_5 =	**51.6**	**mg/ L**
Pond #2	V_2 =	2,211,984	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	2.43	days
	C_o =	360	mg/L
	C_2 =	209.5	mg/ L
Pond #3	V_4 =	3,121,613	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.43	days
	C_2 =	209.5	mg/ L
	C_4 =	104.0	mg/ L
New Pond	V_3 =	3,121,613	gallons
	Q =	910,000	gpd
	k_H =	0.30	d^{-1}
	t =	3.43	days
	C_4 =	104.0	mg/ L
	C_6 =	**51.6**	**mg/ L**

total retention time = **9.29 days**

% reduction = **86%**

For two parallel flow trains,
Two additional ponds would treat the wastewater to acceptable levels during high temp, max month flow conditions

If four additional ponds are added (to meet requirements for PDF as shown above),
concentrations are estimated to be less than 30 mg/L (more than 90% reduction)

*M&E Reference: Wastewater Engineering Treatment and Reuse, 4th Edition

Boyle Engineering Corporation

BY: EKS **DATE:** 12/30/2008 **SUBJECT** Southland WWTF Master Plan **JOB NO:** 19996.17
CHKD. BY: **DATE:** Future Projected Solids Production (2030)

Determine: Volume of solids added to ponds over 5 years at projected 2030 flowrate.

Assumptions:

AAF = 1.67 mgd Average TSSin = 319 mg/L Average TSSout = 40 mg/L

1) Total volume of wastewater treated in past 5 years

V = Q x t
V = 1.67 mgd x 5 yrs x 365 days/yr
V = 3048 Mgal

2) Mass of TSS removed

Mass = (TSS_{in} - TSS_{out}) x V x (8.34 lb/Mgal x mg/L)
Mass = (319 - 40) x (13048) x (8.34)
= 5,719,103 lbs
= 1,143,821 lbs/yr

3) Mass of volatile and fixed solids

$Mass_{VSS}$ = 0.70 x TSS
= 0.70 x (5,719,103)
= 4,003,372 lbs
= 800,674 lbs/yr

$Mass_{Fixed}$ = $Mass_{TSS}$ - $Mass_{VSS}$
= 5,719,103 - 4,003,372
= 1,715,731 lbs
= 343,146 lbs/yr

4) Amount of accumulation at the end of 5 years

Assume 60% VSS reduction occurs within 1 year

$(VSS)_t$ = [0.6 + 0.4(t-1)] x VSS
= [0.6 + 0.4(5-1)] x 800,674
= 1,761,484 lbs

5) Total mass of solids

$Mass_{Total}$ = $Mass_{Fixed}$ + $Mass_{Accumulated}$
= 1,715,731 + 1,761,484
= 3,477,215 lbs

6) Volume of solids (assume 15% solids and density = 1.06*8.34 lb/gal)

V_{Total} = $Mass_{Total}$ / (0.15*density)
= 2,622,215 gal

Boyle Engineering Corporation

BY: EKS **DATE:** 12/30/2008 **SUBJECT** Southland WWTF Master Plan **JOB NO:** 19996.17
CHKD. BY: ____ **DATE:** ________ Future Projected Solids Production (2030)

Potential percentage of solid volume in ponds over 5 years at projected flowrate

Total pond volume (taken from NCSD Southland O&M Manual, July 2000)
Liquid volume = 2 @ 295,700 cf & 2 @ 417,300 cf
Sludge volume = 2 @ 0.5 Mgal & 2 @ 0.7 Mgal

V_{Total} = [2 x 295,700 + 2 x 417,300] x 7.481 gal/cf + 2 x 500,000 + 2 x 700, 000
V_{Total} = 13,067,906 gal

% of solids in pond = $\frac{2,622,215}{13,067,906}$

= 0.20
= 20% of existing pond volume for 5 years at projected future flowrate

APPENDIX C

COST OPINIONS

Nipomo Community Services District

UPGRADE TO FRONTAGE ROAD INTERCEPTOR (15" OPEN TRENCH CONSTRUCTION)

SUMMARY

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Item	Description	Quantity	Unit	Total Unit Price	Amount
1	Mobilization	1	LS	*$50,000.00*	$50,000
2	Pothole Existing Utilities	5	EA	*$750.00*	$3,800
3	Temporary Sewage Bypass	1	LS	*$13,000.00*	$13,000
4	Traffic Control & Regulation	3123	LF	*$10.00*	$31,200
5	Sheeting & Shoring	4208	LF	*$17.50*	$73,600
6	Abandon Existing Pipe in Place	1	LS	*$35,000.00*	$35,000
7	Connect Laterals/Exist Manholes to New Main (8' at Division and Southland)	2	EA	*$4,000.00*	$8,000
8	Connect Trunk/Manhole to New Main (12" at Story)	1	EA	*$8,000.00*	$8,000
9	15-inch PVC Sewer Main (Excavate, Install, backfill, pavement repair)	4208	LF	*$175.00*	$736,500
10	Precast 48-inch I.D. Manholes (15-20 ft)	1	EA	*$9,000.00*	$9,000
11	Precast 48-inch I.D. Manholes (10-14 ft)	7	EA	*$6,000.00*	$42,000
12	Precast 48-inch I.D. Manholes (5-9 ft)	2	EA	*$4,000.00*	$8,000
13	Connect to Existing Metering Manhole at WWTF	1	LS	*$8,000.00*	$8,000
14	Pipeline Cleaning and CCTV Inspection	4208	LF	*$3.00*	$12,600

Sub Total			$1,039,000
Engineering/Administration	30%		$311,700
Contingency	30%		$405,210
Total			$1,756,000

ENR CCI = 8602 (November 2008)

LS = Lump Sum
EA = Each
LF = Linear Foot

Assumptions for Opinion of Cost (By CR):

1. Sewer upgrade to occur within Frontage Rd. paved ROW, in a new trench parallel to existing 12" interceptor sewer.
2. Review of NCSD water atlas indicates presence of water pipes along Frontage Rd.;
As-builts for 12" interceptor indicate presence of 16" Gas. It is assumed the interceptor upgrade can be aligned within the paved ROW w/o utility conflicts or relocates.
3. It is assumed sewage bypass will only be required for last phase of construction, when lateral/trunk connections/manholes are switched over to new sewer.
4. Traffic control only needed from Division to Southland (not on unpaved part to WWTF)

Nipomo Community Services District

UPGRADE TO FRONTAGE ROAD INTERCEPTOR (21" OPEN TRENCH CONSTRUCTION)
SUMMARY
ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Item	Description	Quantity	Unit	Total Unit Price	Amount
1	Mobilization	1	LS	*$50,000.00*	$50,000
2	Pothole Existing Utilities	5	EA	*$750.00*	$3,800
3	Temporary Sewage Bypass	1	LS	*$13,000.00*	$13,000
4	Traffic Control & Regulation	3123	LF	*$10.00*	$31,200
5	Sheeting & Shoring	4208	LF	*$17.50*	$73,600
6	Abandon Existing Pipe in Place	1	LS	*$35,000.00*	$35,000
7	Connect Laterals/Exist Manholes to New Main (8" at Division and Southland)	2	EA	*$4,000.00*	$8,000
8	Connect Trunk/Manhole to New Main (12" at Story)	1	EA	*$8,000.00*	$8,000
9	21-inch PVC Sewer Main (Excavate, Install, backfill, pavement repair)	4208	LF	*$235.00*	$988,900
10	Precast 48-inch I.D. Manholes (15-20 ft)	1	EA	*$9,000.00*	$9,000
11	Precast 48-inch I.D. Manholes (10-14 ft)	7	EA	*$6,000.00*	$42,000
12	Precast 48-inch I.D. Manholes (5-9 ft)	2	EA	*$4,000.00*	$8,000
13	Connect to Existing Metering Manhole at WWTF	1	LS	*$8,000.00*	$8,000
14	Pipeline Cleaning and CCTV Inspection	4208	LF	*$3.00*	$12,600

Sub Total		$1,291,000
Engineering/Administration	30%	$387,300
Contingency	30%	$503,490
Total		$2,182,000

ENR CCI = 8602 (November 2008)

LS = Lump Sum
EA = Each
LF = Linear Foot

Assumptions for Opinion of Cost (By CR):

1. Sewer upgrade to occur within Frontage Rd. paved ROW, in a new trench parallel to existing 12" interceptor sewer.
2. Review of NCSD water atlas indicates presence of water pipes along Frontage Rd.;
As-builts for 12" interceptor indicate presence of 16" Gas. It is assumed the interceptor upgrade can be aligned within the paved ROW w/o utility conflicts or relocates.
3. It is assumed sewage bypass will only be required for last phase of construction, when lateral/trunk connections/manholes are switched over to new sewer.
4. Traffic control only needed from Division to Southland (not on unpaved part to WWTF)

Nipomo Community Services District

SOUTHLAND WASTEWATER TREATMENT FACILITY

MASTER PLAN

Headworks Improvement Options

OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
SCREENS						
I. Parkson HLS400 Hycor® HeliSieve®						
1	HeliSieve® HLS500	EA	$71,000	2	1.5	$213,000
2	2 Concrete channels, w/common wall	YD^3	$1,000	12		$12,000
3	Miscellaneous piping	LS				$21,800
4	Bypass pipe	LS				$10,900
5	Sitework	LS				$16,400
6	Electrical + Instrumentation	LS				$21,800
7	Bagger (optional)	EA	$2,200	2	1.5	$6,600
	Subtotal					$302,500
8	Engineering/Admin (30 % of subtotal)					$90,750
9	Contingency (30% of total)					$117,975
	TOTAL					$512,000
II. Parkson Aqua Guard® AG-MN-A						
1	Aqua Guard® AG-MN-A	EA	$98,200	2	1.5	$294,600
2	2 concrete channels, w/common wall	YD^3	$1,000	9		$9,000
3	Misc. piping	LS				$21,800
4	Bypass pipe	LS				$10,900
5	Sitework	LS				$16,400
6	Electrical + Instrumentation	LS				$21,800
7	Parkson Hycor® Screw Wash & Press Unit SWP20-XX (optional)	EA	$43,700	2	1.5	$131,100
	Subtotal					$505,600
8	Engineering/Admin (30 % of subtotal)					$151,680
9	Contingency (30% of total)					$197,184
	TOTAL					$855,000

ENR CCI = 8602 (November 2008)

Nipomo Community Services District
SOUTHLAND WASTEWATER TREATMENT FACILITY
MASTER PLAN
Headworks Improvement Options
OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
GRIT REMOVAL						
I. Eimco Jones & Attwood JetAir 100 & Screw Classifier 100						
1	JetAir + Classifier + assoc. equipment	EA	$100,000	2	1.5	$300,000
2	Concrete	YD^3	$1,000	20		$21,800
3	Misc. piping	LS				$21,800
4	Electrical + Instrumentation	LS				$16,400
5	Sitework	LS				$5,500
6	Bagger (optional)	EA	$2,200	2	1.5	$6,600
	Subtotal					$372,100
7	Engineering/Admin (30 % of subtotal)					$111,630
8	Contingency (30% of total)					$145,119
	TOTAL					$629,000
II. Aerated Grit Chamber (two at 6' x 6' x 24')						
1	2 concrete chambers	LS				$131,000
3	Air Piping	LS				$32,700
4	Diffusers	LS				$38,200
5	Misc. piping	LS				$27,300
6	Electrical + Instrumentation	LS				$16,400
7	Sitework	LS				$5,500
8	Grit classifier	LS				$96,600
	Subtotal					$347,700
8	Engineering/Admin (30 % of subtotal)					$104,310
9	Contingency (30% of total)					$135,603
	TOTAL					$588,000

ENR CCI = 8602 (November 2008)

LS = Lump sum
EA = Each
LF = Linear Foot
YD^3 = Cubic Yard

Note: These opinions of probable construction costs prepared by Boyle represent its judgment as a design professional and are supplied for the general guidance of NCSD. Since Boyle has no control over the cost of labor and materials, over delays in project bidding or award, or over competitive bidding or market conditions, Boyle does not guarantee the accuracy of such opinions as compared to design-level cost opinions, contractor bids, or actual cost to NCSD.

Nipomo Community Services District
SOUTHLAND WASTEWATER TREATMENT FACILITY
MASTER PLAN
Future Treatment Alternatives
OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
I. Expansion of Aerated Ponds (4)						
1	Excavation for 4 ponds	YD^3	$25	118,550	1.0	$2,963,800
2	Fill for 4 ponds	YD^3	$25	40,400	1.0	$1,010,000
3	Grading for 4 ponds	FT^2	$0.20	207,500	1.0	$41,500
4	4 HDPE Liners (40 mil)	FT^2	$0.33	341,900	1.7	$191,800
5	Mechanical Aerators (15 HP)	EA	$23,600	14	1.7	$561,700
	Subtotal					$4,768,800
6	Piping (10% subtotal)					$476,880
7	Electrical (10% subtotal)					$476,880
8	Engineering/Admin (20 % of subtotal)					$953,760
9	Contingency (30% of total)					$2,002,896
	Total					$8,680,000
II. EIMCO Carrousel ® 3000 (Oxidation Ditch)						
1	Mobilization (3% of subtotal)					$96,378
2	Oxidation Ditch System	LS	$1,522,800	1	1.0	$1,522,800
3	(2) Secondary Clarifiers (D = 60ft)	LS				$1,689,800
	Subtotal					$3,212,600
4	Sitework (20% of Subtotal)					$642,520
5	Piping (15% subtotal)					$481,890
6	Electrical (15% subtotal)					$481,890
7	Engineering/Admin (20 % of subtotal)					$642,520
8	Contingency (30% of total)					$1,638,426
	Total					$7,197,000
III. Parkson Biolac® Wave Oxidation System						
1	Biolac® System in 2 secondary ponds	EA	$520,000	1	1.7	$884,000
2	(2) HDPE Liner (40 mil)	FT^2	$0.40	170,968	1.7	$116,300
3	(2) Secondary Clarifiers (D = 60ft)	LS				$1,689,800
4	Earthwork (fill part of retrofitted ponds)	YD^3	$20	12250	1.0	$245,000
5	Instrumentation	LS				$100,000
5	Modification of air piping	LF	$50	970	1.0	$48,500
	Subtotal					$3,083,600
6	Piping (15% of subtotal)					$462,540
7	Electrical (15% of subtotal)					$462,540
8	Engineering/Admin (20 % of subtotal)					$616,720
9	Contingency (30% of total)					$1,387,620
	Total					$6,014,000

ENR CCI = 8602 (November 2008)

Nipomo Community Services District
SOUTHLAND WASTEWATER TREATMENT FACILITY
MASTER PLAN
Future Treatment Alternatives
OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
IV. Completely Mixed Activated Sludge						
1	Mobilization (3% of subtotal)					$112,041
2	(2) Aeration Basins	LS				$844,900
3	(2) Primary Clarifiers (D = 40ft)	LS				$1,200,000
4	(2) Secondary Clarifiers (D = 60ft)	LS				$1,689,800
	Subtotal					$3,734,700
5	Sitework (5% of Subtotal)					$186,735
6	Piping (15% of subtotal)					$560,205
7	Electrical (15% of subtotal)					$560,205
8	Engineering/Admin (20 % of subtotal)					$746,940
9	Contingency (30% of total)					$1,736,636
	Total					$7,638,000

ENR CCI = 8602 (November 2008)

LS = Lump sum
EA = Each
LF = Linear Foot
YD^3 = Cubic Yard

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Nipomo Community Services District

SOUTHLAND WASTEWATER TREATMENT FACILITY

MASTER PLAN

AERATED POND SYSTEM vs. BIOLAC SYSTEM

OPINION OF PROBABLE OPERATING AND MAINTENANCE COST

Life cycle costs to 2030

I. AERATED POND SYSTEM

Year	Capital Cost	Power Cost	Parts Cost	Total Cost	Cumulative Cost
2009	$8,680,000	$178,500	$0	$8,858,500	$8,858,500
2010	$0	$178,500	$0	$178,500	$9,037,000
2011	$0	$178,500	$0	$178,500	$9,215,500
2012	$0	$178,500	$0	$178,500	$9,394,000
2013	$0	$178,500	$0	$178,500	$9,572,500
2014	$0	$178,500	$0	$178,500	$9,751,000
2015	$0	$178,500	$0	$178,500	$9,929,500
2016	$0	$178,500	$0	$178,500	$10,108,000
2017	$0	$178,500	$0	$178,500	$10,286,500
2018	$0	$178,500	$0	$178,500	$10,465,000
2019	$0	$178,500	$44,500	$223,000	$10,688,000
2020	$0	$178,500	$0	$178,500	$10,866,500
2021	$0	$178,500	$0	$178,500	$11,045,000
2022	$0	$178,500	$0	$178,500	$11,223,500
2023	$0	$178,500	$0	$178,500	$11,402,000
2024	$0	$178,500	$0	$178,500	$11,580,500
2025	$0	$178,500	$0	$178,500	$11,759,000
2026	$0	$178,500	$0	$178,500	$11,937,500
2027	$0	$178,500	$0	$178,500	$12,116,000
2028	$0	$178,500	$0	$178,500	$12,294,500
2029	$0	$178,500	$44,500	$223,000	$12,517,500
2030	$0	$178,500	$0	$178,500	$12,696,000

Notes:

1. Project is built in 2009 for 2030 design flows.
2. Parts replacement consists of 14 aerators, replaced every 10 years.
3. Power is based on required power for 2018, 210 hp.

II. BIOLAC SYSTEM

Year	Capital Cost	Power Cost	Parts Cost	Total Cost	Cumulative Cost
2009	$6,014,000	$76,500	$0	$6,090,500	$6,090,500
2010	$0	$76,500	$0	$76,500	$6,167,000
2011	$0	$76,500	0	$76,500	$6,243,500
2012	$0	$76,500	$0	$76,500	$6,320,000
2013	$0	$76,500	$0	$76,500	$6,396,500
2014	$0	$76,500	$31,500	$108,000	$6,504,500
2015	$0	$76,500	$0	$76,500	$6,581,000
2016	$0	$76,500	$0	$76,500	$6,657,500
2017	$0	$76,500	$96,000	$172,500	$6,830,000
2018	$0	$76,500	$0	$76,500	$6,906,500
2019	$0	$76,500	$31,500	$108,000	$7,014,500
2020	$0	$76,500	$0	$76,500	$7,091,000
2021	$0	$76,500	$0	$76,500	$7,167,500
2022	$0	$76,500	$0	$76,500	$7,244,000
2023	$0	$76,500	$0	$76,500	$7,320,500
2024	$0	$76,500	$31,500	$108,000	$7,428,500
2025	$0	$76,500	$96,000	$172,500	$7,601,000
2026	$0	$76,500	$0	$76,500	$7,677,500
2027	$0	$76,500	$0	$76,500	$7,754,000
2028	$0	$76,500	$0	$76,500	$7,830,500
2029	$0	$76,500	$31,500	$108,000	$7,938,500
2030	$0	$76,500	$0	$76,500	$8,015,000

Notes:

1. Assume project is built in 2009 for 2030 design flows.
2. Parts replacement consists of diffusers, replaced every 5 years, and air hoses, replaced every 8 years.
3. Power is based on required power for 2018, 90 hp.

Note: These opinions of probable construction costs prepared by Boyle represent its judgment as a design professional and are supplied for the general guidance of NCSD. Since Boyle has no control over the cost of labor and materials, over delays in project bidding or award, or over competitive bidding or market conditions, Boyle does not guarantee the accuracy of such opinions as compared to design-level cost opinions, contractor bids, or actual cost to NCSD.

Nipomo Community Services District

SOUTHLAND WASTEWATER TREATMENT FACILITY

MASTER PLAN

Tertiary Treatment Alternatives

OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
FILTRATION						
I. Parkson Dynasand						
1	Coagulation & Mixing System	LS				$100,000
2	Pumping System	LS				$200,000
3	Filter Module	EA	$32,000	12	1.7	$652,800
4	Air compressors	EA	$13,750	2	1.7	$46,800
5	Concrete	YD^3	$1,100	270	1.0	$297,000
6	Ladders, handrails, grates	LS				$80,000
7	Instrumentation & Controls	LS				$50,000
	Subtotal					$1,426,600
8	Sitework (10% of subtotal)					$142,660
9	Piping (10% subtotal)					$142,660
10	Electrical (10% subtotal)					$142,660
11	Engineering/Admin (20 % of subtotal)					$285,320
12	Contingency (30% of total)					$641,970
	Total					$2,782,000
II. Aqua-Aerobic Aquadisk						
1	Coagulation & Mixing System	LS				$100,000
2	Pumping System	LS				$200,000
3	Filter Unit (10 disk) with controls	EA	$346,500	2	1.7	$693,000
4	Concrete foundation	YD^3	$1,100	24	1.0	$26,400
5	Ladders, handrails, grates	LS				$50,000
	Subtotal					$1,069,400
6	Sitework (5% of Subtotal)					$53,470
7	Piping (10% subtotal)					$106,940
8	Electrical (10% subtotal)					$106,940
9	Engineering/Admin (20 % of subtotal)					$213,880
10	Contingency (30% of total)					$465,189
	Total					$2,016,000
DISINFECTION						
I. Chlorine Contact Basin						
1	(2) Concrete basins	YD^3	$1,100	352	1.0	$387,200
2	Chlorine feed system & storage	LS				$380,000
3	Instrumentation & controls	LS				$100,000
	Subtotal					$867,200
5	Sitework (10% of subtotal)					$86,720
6	Piping (15% of subtotal)					$130,080
7	Electrical (10% of subtotal)					$86,720
8	Engineering/Admin (20 % of subtotal)					$173,440
9	Contingency (30% of total)					$403,248
	Total					$1,748,000

ENR CCI = 8602 (November 2002)

Nipomo Community Services District

SOUTHLAND WASTEWATER TREATMENT FACILITY

MASTER PLAN

Tertiary Treatment Alternatives

OPINION OF PROBABLE CAPITAL COST

Item	Description	Unit	Unit Price	Quantity	Installation Adjustment	Amount
II. Trojan UV3000 Plus™						
1	UV banks and equipment	LS	$780,000		1.7	$1,326,000
2	Concrete	YD^3	$1,100	37	1.0	$40,700
3	Instrumentation & controls	LS				$100,000
4	Ladders, handrails, and grates	LS				$80,000
	Subtotal					$1,546,700
5	Sitework (10% of Subtotal)					$154,670
6	Piping (15% of subtotal)					$232,005
7	Electrical (15% of subtotal)					$232,005
8	Engineering/Admin (20 % of subtotal)					$309,340
9	Contingency (30% of total)					$742,416
	Total					$4,544,000

ENR CCI = 8602 (November 2008)

LS = Lump sum

EA = Each

LF = Linear Foot

YD^3 = Cubic Yard

Note: These opinions of probable construction costs prepared by Boyle represent its judgment as a design professional and are supplied for the general guidance of NCSD. Since Boyle has no control over the cost of labor and materials, over delays in project bidding or award, or over competitive bidding or market conditions, Boyle does not guarantee the accuracy of such opinions as compared to design-level cost opinions, contractor bids, or actual cost to NCSD.

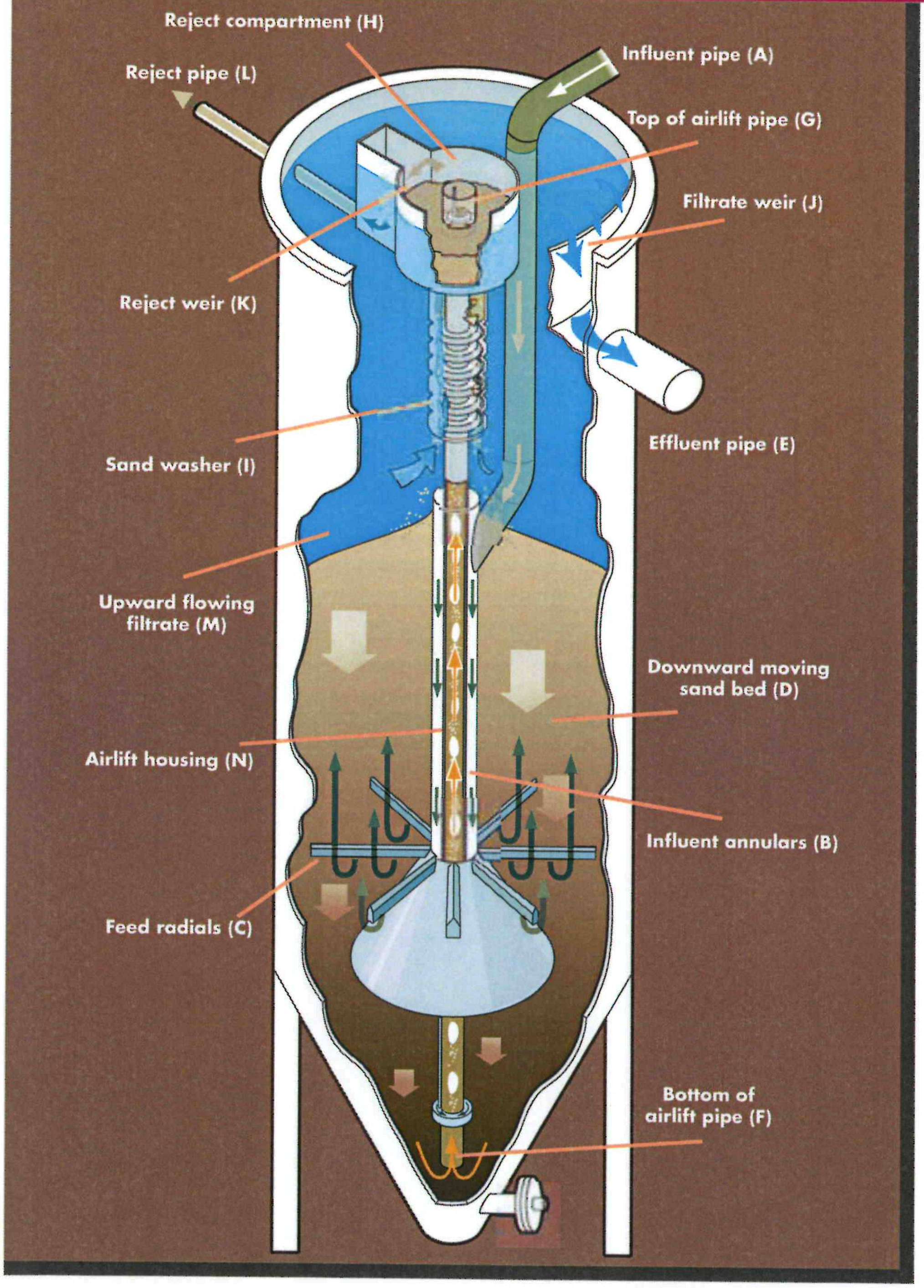
PARKSON CORPORATION

DYNASAND®

CONTINUOUS, UPFLOW, GRANULAR MEDIA FILTER

The DynaSand® Filter

Simplicity, low maintenance, outstanding performance



The DynaSand filter is an upflow, deep bed, granular media filter with continuous backwash. The filter media is cleaned by a simple internal washing system that does not require backwash pumps or storage tanks. The absence of backwash pumps means low energy consumption.

The DynaSand filter's deep media bed allows it to handle high levels of suspended solids. This heavy-duty performance may eliminate the need for pre-sedimentation or flotation steps in the treatment process in some applications.

The DynaSand filter is available in various sizes and configurations. This flexibility allows for customization to fit specific site and application requirements.

DynaSand Principles of Operation

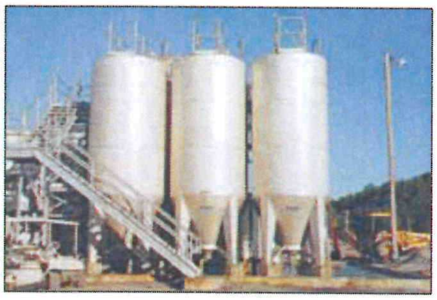
Influent Filtration Influent feed is introduced at the top of the filter (A) and flows downward through an annular section (B) between the influent feed pipe and airlift housing. The feed is introduced into the bottom of the sand bed through a series of feed radials (C) that are open at the bottom. As the influent flows upward (M) through the downward moving sand bed (D), organic and inorganic impurities are captured by the sand. The clean, polished filtrate continues to move upward and exits at the top of the filter over the filtrate weir (J) and out through the effluent pipe (E).

Sand Cleaning The sand bed containing captured impurities is drawn downward into the center of the filter where the airlift pipe (F) is located. A small volume of compressed air is introduced at the bottom of the airlift, drawing the sand into the airlift pipe. The sand is scoured within the airlift pipe at an intensity of 100-150 SCFM/ft². The effectiveness of this scouring process is vastly greater than what can be expected in conventional sand filtration backwash. The scouring dislodges any solid particles attached to the sand grains.

The dirty slurry is pushed to the top of the airlift (G) and into the reject compartment (H). From the reject compartment, the sand falls into the sand washer (I) and the lighter reject solids are carried over the reject weir (K) and out the reject pipe (L). As the sand cascades down through the concentric stages of the washer, it encounters a small amount of polished filtrate moving upward, driven by the difference in water level between the filtrate pool and the reject weir. The heavier, coarser sand grains fall through this small countercurrent flow while the remaining contaminants are carried back up to the reject compartment. The clean, recycled sand is deposited on the top of the sand bed where it once again begins the influent cleaning process and its eventual migration to the bottom of the filter.

DynaSand® Filter Configurations

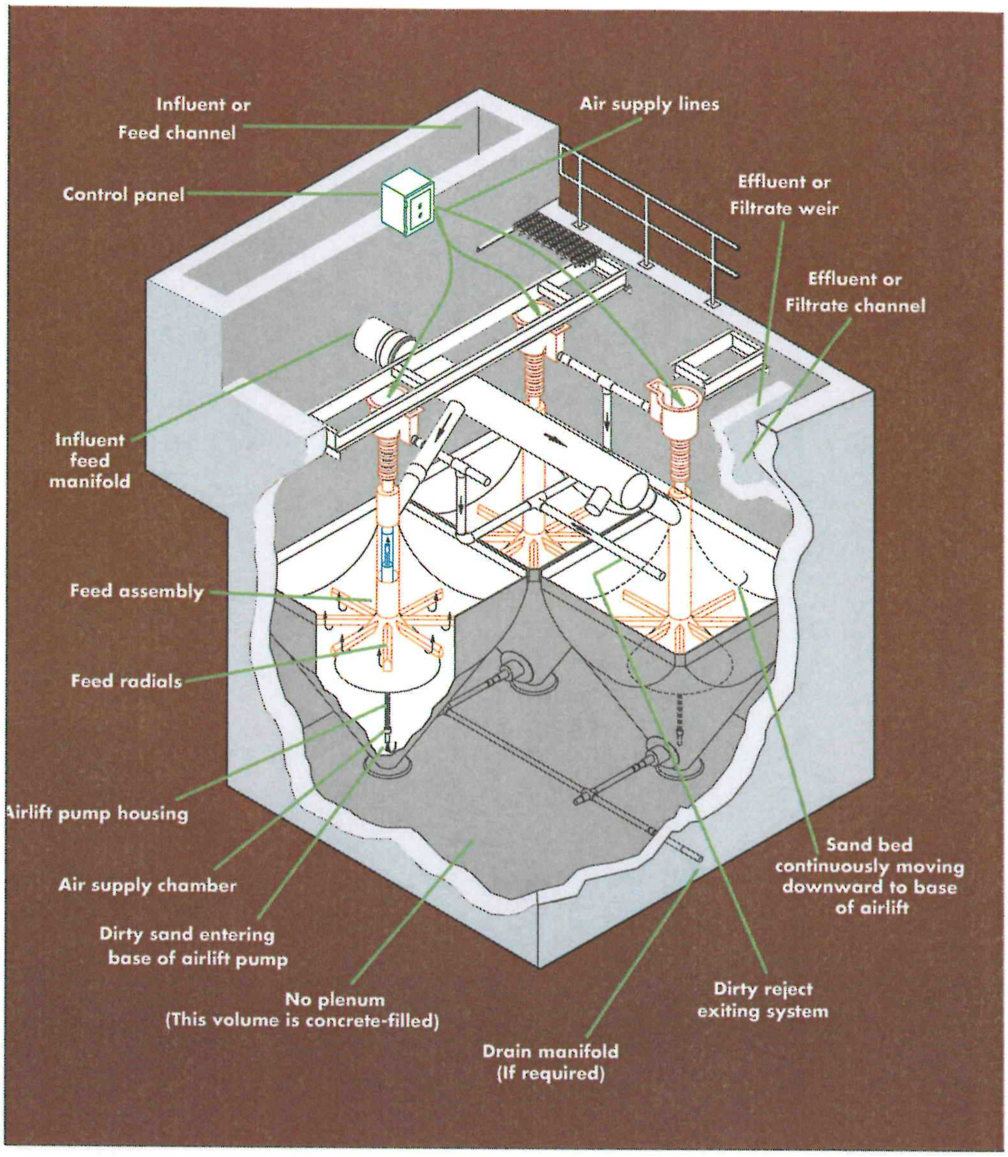
The DynaSand filter is available as either stand alone package units or in a modular concrete design. The package units are constructed of either 304 SST or FRP. Materials of construction for the internal components of both package and concrete units are SST and/or FRP. Filters are available in 40" standard bed or 80" deep-bed design depending on the nature of the application. Concrete modules are frequently used for high flow capacity systems by placing multiple modules into a common filter cell. The modules in a filter cell share a common filter bed where cones at the bottom of each module distribute sand to their respective airlifts and sand washers.



DynaSand Filter above ground package units

A concrete DynaSand installation can be designed for any size filter area. This enables the technology to be applied to any size water or wastewater treatment plant. Since all filter beds are being continuously cleaned, the pressure drop remains low and even throughout all the filters. Equal pressure drop ensures even distribution of feed to each filter without the need for splitter boxes or flow controls. Therefore, a typical multiple unit installation can use a common header pipe with feed connections and isolation valves for each filter.

DynaSand Filter modules in concrete basin

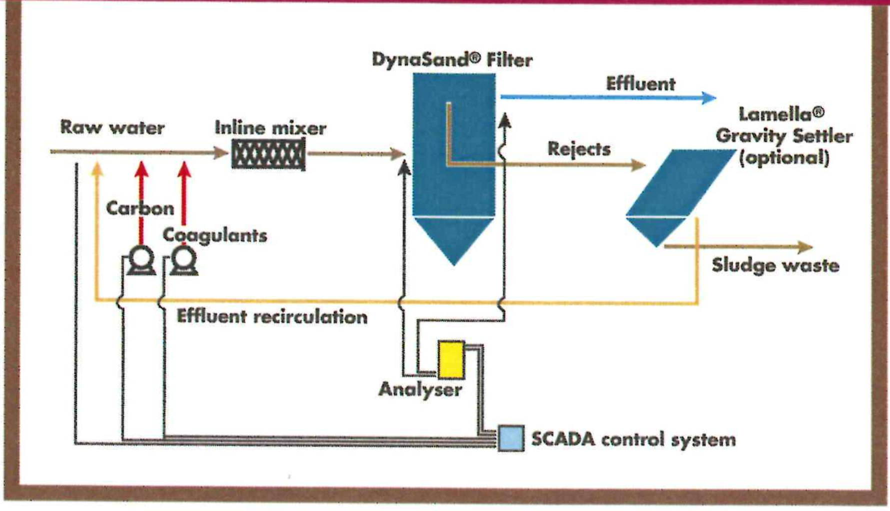


Features	Benefits
Continuously Cleaned Sand Bed	**No shutdown for backwash cycles** **Elimination of ancillary backwash equipment** **No flow control valves, splitter boxes, or backwash controls**
No Underdrains or Screens	**No short-circuiting**
Sand Washed with Filtrate	**Optimum sand-washing efficiency** **Superior filtrate quality**
No Level Control	**Reduced operator attention** **Minimizes overall pressure-drop**
Internal, Vertical Airlift	**Reduces potential for pluggage** **Significantly reduces wear/maintenance** **Can be easily maintained without filter shutdown**
Low Power Requirements	**Up to 70% less compressed air vs. other self-cleaning filters**

DynaSand® Filter Continuous Contact Filtration Process

Water and wastewater treatment in conventional plants typically involves flocculation, clarification and filtration. Direct filtration eliminates clarification but still requires flocculation. The DynaSand filter utilizes a proprietary process known as Continuous Contact Filtration. The DynaSand filter's 80" media bed depth provides greater hydraulic residence times and more opportunity for floc formation and attachment. Thus, coagulation, flocculation and separation can be performed within the sand bed, eliminating the need for external flocculators and clarifiers. Equipment savings can be substantial, up to 85% compared to conventional treatment and 50% compared to direct filtration. The DynaSand Continuous Contact Filtration process is better suited to remove small floc, which can help reduce chemical requirements by 20-30% over conventional treatment.

Applications The DynaSand filter is currently providing exceptional treatment in over 8,000 installations worldwide in a wide variety of applications.



DynaSand Applications – partial list

Tertiary filtration • Algae removal • Potable water (turbidity and color) • Oil removal • Process water • Brine filtration • Metal finishing • Cooling tower blowdown • Steel mill scale • Chemical processing • Phosphorus removal • Product recovery • Denitrification • Cryptosporidium and Giardia removal • Surface water • Ground water • Arsenic removal • Effluent reuse

Typical Data	Loading rate (gpm/ft^2)	Influent solids	Filtrate solids
Tertiary Filtration	3-5	20-50 ppm SS	5-10 ppm SS
Potable Water – Turbidity	4-5	10-30 NTU	0.1-0.5 NTU
Potable Water – Color	4-5	10–120 ACU	1-5 ACU
Process Water	5	10-30 NTU	0.1-0.5 NTU
Metal Finishing	4-6	20-50 ppm SS	2-5 ppm SS
Steel Mill Scale	8-10	50-300 ppm SS	5-10 ppm SS
Phosphorus Removal	3-5	<1 ppm Total P	<0.1 ppm Total P
Algae Removal	2-4	100 ppm SS	10-20 ppm SS
Denitrification	3-4	10-15 ppm TN	<3 ppm TN
Oil Removal	2-6	<50 ppm O&G	5-10 ppm O&G

PARKSON CORPORATION

ISO 9001:2000 Certified
Quality Management System

www.parkson.com

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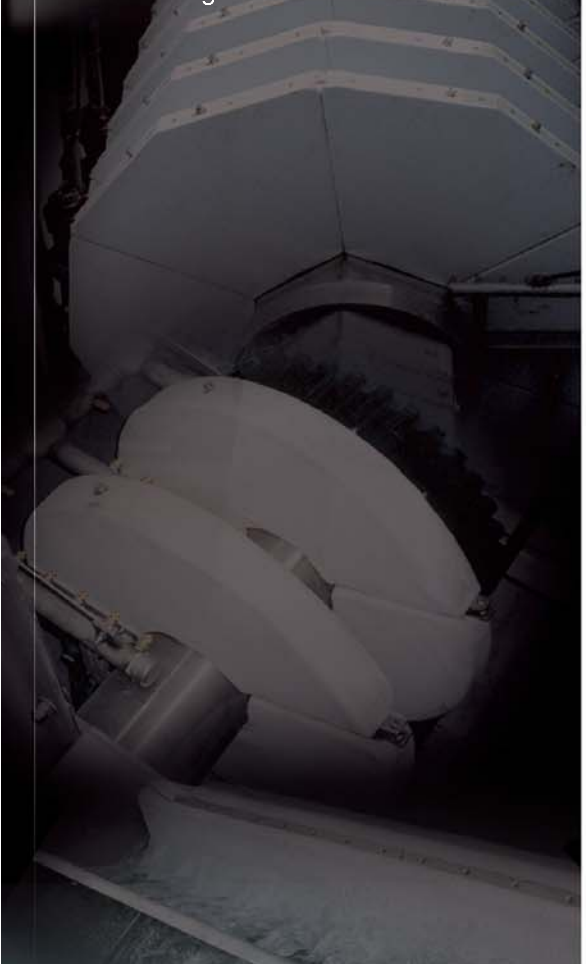
Aqua-Aerobic Systems, Inc.

Cloth Media Leader

Partnering for Solutions

For over twenty five years, Aqua-Aerobic Systems, Inc. has been dedicated to maintaining a leadership role in the process of solid/liquid separation for the purification of water and wastewater.

Our success is justified by our reliable designs, application expertise, quality manufacturing and ongoing research and development. We pledge to continue to partner with our customers, providing solutions with innovative and proven technologies.



A product of our commitment to developing the best solutions for the needs of our customers is the unique media utilized in Aqua's family of cloth media filtration systems. These media have been carefully engineered for quality, durability and performance to provide several process and mechanical advantages compared to alternative filtration media. Aqua's cloth media has been adapted to a variety of mechanical configurations to maximize performance and value. A variety of cloth media are available to provide customized solid/liquid separation solutions for a broad range of municipal and industrial applications.

Advantages

- Unique cloth media
- Reuse quality effluent
- Low backwash rate
- Small footprint
- Low head requirements
- No downtime for backwashing
- Less maintenance than sand filters
- New plants or retrofits
- Lowest life-cycle cost

Applications

Municipal Reuse/Recycle

- 29.8 MGD Avg. Daily Flow
- AquaDisk® filters handle flows in excess of design while maintaining effluent quality.

Phosphorus Removal

- 3 MGD Avg. Daily Flow
- AquaDisk® filter's small footprint and ability to expand without adding equipment are advantages with limited land space.

Traveling Bridge Filter Retrofits

- 36 MGD Avg. Daily Flow
- AquaDiamond™ filter retrofitted into existing 16' sand filter bed and doubled the sand filter's maximum design hydraulic capacity.

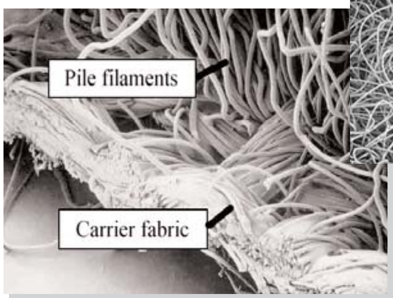
Deep Bed Filter Retrofits

- 25 MGD Avg. Daily Flow
- AquaDisk® filter retrofitted into existing 16' deep bed filter eliminating the need for construction of new basins.

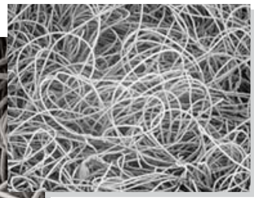
Industrial Reuse

- 3 MGD Avg. Daily Flow
- AquaDisk® filter effluent is reused at a nearby power plant as cooling tower supply water.

Unique Cloth Media



Microscopic view of pile media.



Microscopic view of needlefelt media.

Aqua's cloth media filtration systems utilize state-of-the-art cloth media. Only Aqua offers a variety of "true" cloth media, each with distinctive characteristics which can be custom-applied to your specific application. The depth of the media is inherent to the cloth's ability to consistently store and remove solid particles, resulting in optimal effluent quality.

Ongoing Commitment

Aqua's proactive experience with research and development results in cloth media filtration products that virtually meet any tertiary requirements. We are dedicated to obtaining extensive knowledge on media, textile construction, durability, and impact on performance by working directly with textile manufacturers and independent testing laboratories. Our research efforts include continued development through partnerships with universities who test our products for durability and performance. Our commitment to research and development and piloting programs provides our customers with more media and configuration options to suite individual application needs.

Evolution of Aqua's Cloth Media Technology

- 1991 – Introduction to Needlefelt Cloth Media
- 1992 – First AquaDisk® Filter Installation
- 1998 – Launched Aqua MiniDisk™ Filter
- 2001 – Introduction to Pile Cloth Media
- 2002 – First Pile Cloth Media Installation & Launched AquaDrum™ Filter
- 2003 – Launched Aqua Diamond® Filter
- 2004 – First AquaDiamond® Filter Installation
- 2005 – Prototyping New Cloth Media

Continuous Testing

Pile Cloth Operation

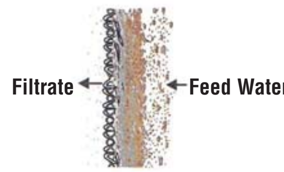
Natural State

Normal Operation

Active Filter Depth

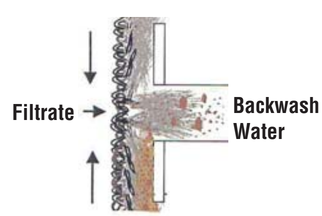
When wetted and mounted in a vertical configuration, densley packed fibers overlay one another, creating depth for the efficient removal and storage of solids.

Normal Operation



Solids retained on and within the cloth form an additional filter layer which provides enhanced filtration.

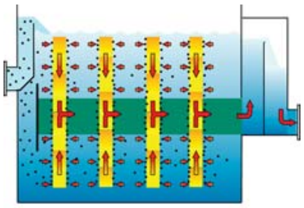
Backwash



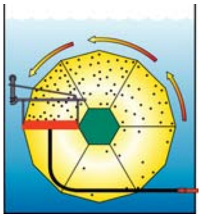
During backwash, filtrate is drawn back through the cloth. The suction causes the pile fibers to revert back to a natural state.

Cloth Media Configurations

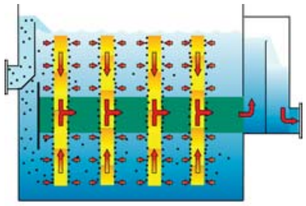
Operation



Inlet wastewater enters the tank or basin, completely submerging the cloth media. By gravity, liquid passes through the cloth media. As solids accumulate on and within the media, a mat is formed and the liquid level in the tank or basin increases. The filtered liquid enters the internal portion of the disk where it is directed to final discharge through the center shaft.



At a predetermined level or time, the backwash cycle will be initiated. Solids are backwashed from the surface by liquid suction from both sides of each disk. During backwash, disks are cleaned in multiples of two, unless a single disk unit is utilized. Disks rotate slowly, allowing each segment to be cleaned. Backwash water is directed to the headworks. Filtration is not interrupted during this cycle.



The filtration process requires no moving parts. Heavier solids are allowed to settle to the bottom portion of the filter tank. These solids are then pumped on an intermittent basis back to the headworks, digester or other solids collection area of the treatment plant.

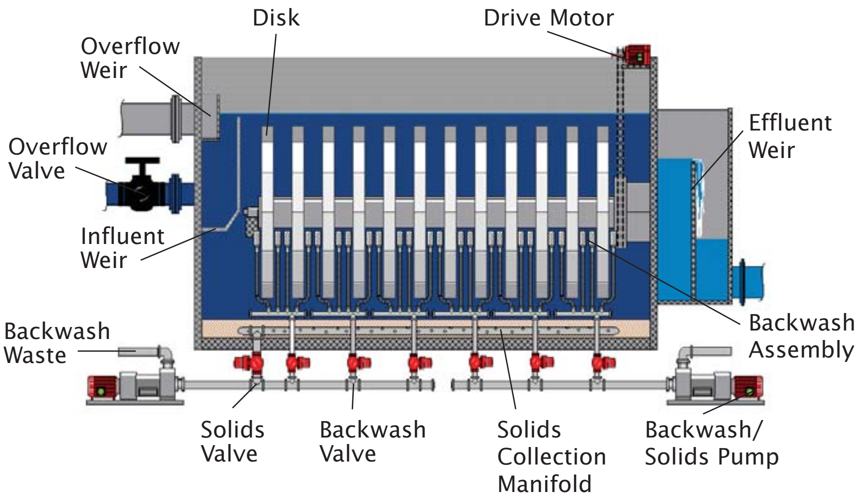
AquaDisk®

Aqua was first in the market, dating back to 1991, with the cloth media disk configuration as an alternative to conventional granular media filtration technologies. A history of exceptional operating experience and durability continue to make AquaDisk® the disk filter of choice.

Two AquaDisk® Filters with walkway access.

Features

- Up to 12 vertically oriented disks per unit
- Gravity flow operation
- Average hydraulic capacity from 0.25 to 3.0 MGD per unit
- Available in painted steel, stainless steel or concrete tanks
- Steel tank package units minimize field installation requirements
- Fully automatic, PLC based control system



Aqua MiniDisk™

The Aqua MiniDisk™ filter provides the solution for smaller flows. It is based on the same operating strategies as its larger counterpart, the AquaDisk®, but with smaller diameter disks.

Internal view of 4-disk Aqua MiniDisk™

Features

- Up to 6 vertically oriented disks per unit
- Average hydraulic capacity from 50,000 to 300,000 GPD
- Available in painted steel or stainless steel tanks
- Gravity flow operation
- Steel tank packaged units minimize field installation requirements
- Fully automatic, PLC based control system

Cloth Media Configurations

AquaDiamond®

The AquaDiamond® is a unique combination of two time-proven technologies; traveling bridge and cloth media filtration. The result is three times the flow capacity of a traveling bridge filter with an equivalent footprint, making it ideal for new plants or sand filter retrofits.

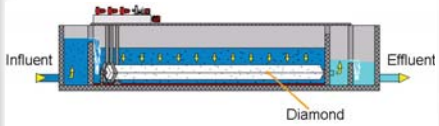
Overview of AquaDiamond® filter retrofitted into a 16' wide sand filter cell.

Features

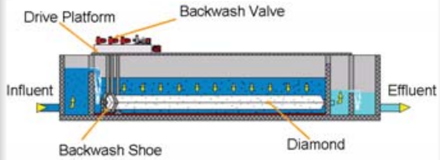
- Up to 8 vertically oriented, diamond-shaped cloth media laterals per unit
- Gravity flow operation
- Available in concrete tanks
- Variable speed drive platform and backwash pump for immediate response to solids excursions
- Four-wheel drive platform designed for better guidance and traction
- Fully automatic, PLC based control system

AquaDiamond® backwash assembly and laterals.

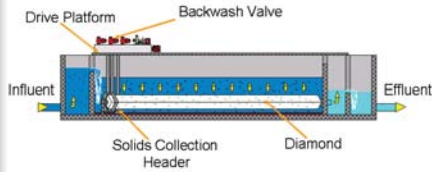
Operation



The cloth media is completely submerged during filtration. Solids are deposited on the outside of the cloth as the influent wastewater flows through. The filtered effluent is collected inside the diamond lateral and flows by gravity, to discharge. The filtration process requires no moving parts. Increased headloss due to the deposited solids automatically initiates periodic backwashing.



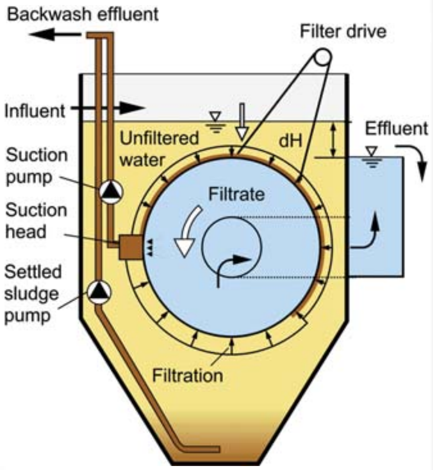
During backwash, a pump provides suction to the vacuum heads, allowing solids to be vacuumed from the cloth as the platform traverses the length of the diamond laterals. The platform operates only during backwashing and solids collection.



Because of the vertical orientation of the media, some solids will settle to the basin floor during normal operation. Small suction headers provide a means for collecting and discharging the settled solids. The solids collection process utilizes the backwash pump for suction.

Cloth Media Configurations

Operation



Solids are deposited on the outside of the cloth as the influent wastewater flows through. The filtered effluent is collected inside the drum and is discharged. Increased headloss due to the deposited solids automatically initiates periodic backwashing.

A pump provides suction to the vacuum head, allowing solids to be vacuumed from the cloth as the drum slowly rotates. Likewise, solids settling in the tank are suctioned and discharged. The drum only rotates during backwashing.

AquaDrum™

A drum style support structure covered with our unique cloth media is the basis of design for the AquaDrum™. It provides another small flow solution where driving head is particularly limited.

Overall view of an AquaDrum™ filter.

Internal view of AquaDrum™ filter.

Features

- One cloth media covered drum per unit
- Gravity flow operation
- Average hydraulic capacity from 60,000 to 375,000 GPD
- Available in stainless steel or concrete tanks

Technology Comparison

Of course, performance is not the only factor in choosing the right filter technology. Life-cycle cost plays an equally important role in the decision making process. Several other key factors should also be considered during the evaluation process.

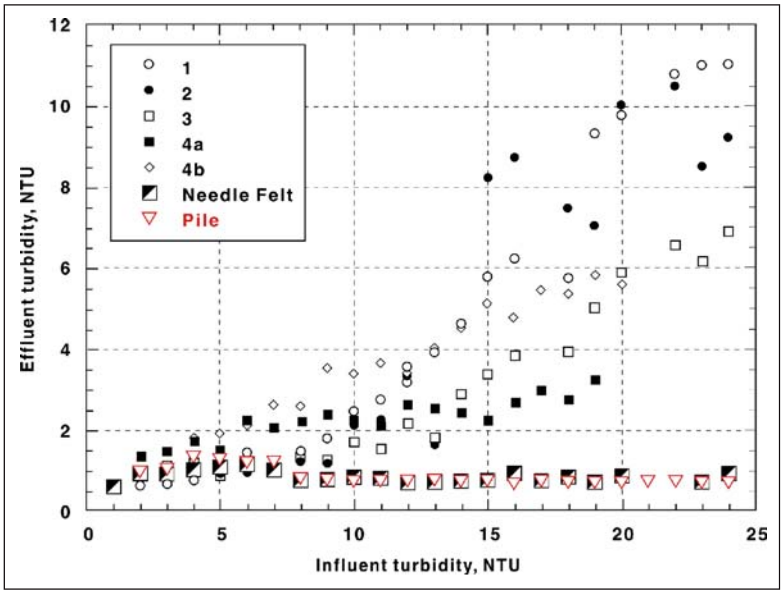
	Aqua-Aerobic Cloth Media	Granular Media	Micro Screens
Depth of Filtration	■	■	
High Solids Loading	■		
Small Footprint	■		■
Ease of Media Handling	■		■
Multiple Media Options	■	■	
Retrofits	■		■
Configuration options provided by a single manufacturer	■		◢

Cloth Media Performance

Documented Testing & Operating Data

The exceptional performance of Aqua's cloth media filtration technology has been fully documented through years of testing and gathering of operating data from full-scale installations.The table below resulted from independent testing and summarizes the performance of both our needlefelt and pile cloth media in comparison to other, more conventional wastewater filtration technologies. It shows that Aqua's unique cloth media produces consistently lower effluent turbidity values over a wider range of influent turbidities than the other technologies tested. This high standard of performance has been demonstrated on all of the cloth media mechanical configurations offered by Aqua-Aerobic.

This chart indicates the comparison of effluent versus influent turbidity for cloth media filtration at 14.7 m/hr and various filters at 9.8 m/hr.



- ○ Deep-bed, continuous backwash upflow mono-medium filters
- ● Shallow depth, automatic backwash mono, dual and multi-medium downward flow filters
- □ Deep-bed, mono-medium downward and/or upward filters
- ■ Shallow-depth, mono-medium filters
- ◇ Shallow-depth, dual medium filters
- ◪ Cloth Media Disk Filter (needlefelt media)
- ▽ Cloth Media Disk Filter (pile media)

Service Capabilities

Application and Engineering - Aqua has process, mechanical and electrical engineers on staff.

Laboratory Testing - Aqua can evaluate a sample of your wastewater and provide you with an analysis.

Piloting - Pilot filter units are available to evaluate effluent results for any application.

Aftermarket - Aqua offers parts sales and numerous service programs including: SpareCare®, 24/7 Customer Service, Cloth Media Replacement and Rental and Lease options.

Operator Training - Aqua offers installation supervision and training to help you understand how your equipment/ system operates and and preventative maintenance that keeps your equipment operating efficiently.

Technical Seminars - Aqua provides a one-day Process and Product Application Seminar with Cloth Media Filtration as a main topic.

AquaDisk® pilot unit

Aqua-Jet®
Surface Aerators

Aqua-Jet II®
Contained Flow Aerators

AquaDDM®
Direct Drive Mixer-Blenders

Aqua MixAir®
Aeration Systems

Aqua EnduraDisc®
Fine Bubble Diffusers

Aqua EnduraTube®
Fine Bubble Diffusers

Aqua CB-24®
Coarse Bubble Diffusers

AquaSBR®
Sequencing Batch Reactors

AquaExcel™
Batch Reactors with AquaEnsure™

AquaEnsure™
Maintenance-Free Decanter

Aqua MSBR®
Modified Sequencing Batch Reactor

AquaPASS™
Phased Activated Sludge Systems

AquaMB Process™
Multiple Barrier Membrane System

AquaDisk®
Cloth Media Filters

Aqua MiniDisk™
Cloth Media Filters

AquaDiamond®
Cloth Media Filters

AquaDrum™
Cloth Media Filters

AquaABF®
Automatic Backwash Filters

ThermoFlo®
Surface Spray Coolers

IntelliPRO™
Process Management System

Contact Your Local Representative:

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6306 N. Alpine Rd. • P.O. Box 2026 • Rockford, IL 61130
Phone: 815/654-2501 • Fax: 815/654-2508 • Toll Free: 877/214-9625
Email: solutions@aqua-aerobic.com • www.aqua-aerobic.com

The information contained herein relative to data, dimensions and recommendations as to size, power and assembly are for purpose of estimation only. These values should not be assumed to be universally applicable to specific design problems. Particular designs, installations and plants may call for specific requirements. Consult Aqua-Aerobic Systems, Inc. for exact recommendations or specific needs.

Patents Apply. Patents Pending.

Bulletin #600G 07/05

TROJAN UV3000 PLUS™

WASTEWATER DISINFECTION

The Reference Standard in UV

Proven, chemical-free disinfection from the industry leader

Trojan Technologies is an ISO 9001: 2000 registered company that has set the standard for proven UV technology and ongoing innovation for more than 25 years. With unmatched scientific and technical expertise, and a global network of water treatment specialists, representatives and technicians, Trojan is trusted more than any other firm as the best choice for municipal UV solutions. Trojan has the largest UV installation base – over 4,000 municipal installations worldwide – and almost one in five North American wastewater treatment plants rely on our proven, chemical-free disinfection solutions.

The TrojanUV3000Plus™ is one of the reasons why. This highly flexible system has demonstrated its effective, reliable performance around the world in over 400 installations. It is well suited to wastewater disinfection applications with a wide range of flow rates, including challenging effluent such as combined sewer overflows, primary and tertiary wastewater reclamation and reuse.

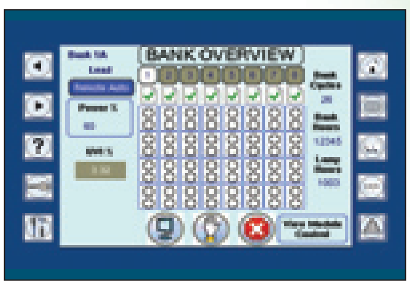
Following a review with Plant Operators and Engineers, the proven infrastructure of the TrojanUV3000Plus™ has been refined to make it even more operator-friendly. The result is more dependable performance, simplified maintenance, and maximized UV lamp output at end-of-lamp life. It also incorporates innovative features to reduce O&M costs, including variable output electronic ballasts and Trojan's revolutionary ActiClean™ system – the industry's only chemical/mechanical sleeve cleaning system.

TROJANUV3000PLUS™

Designed for efficient, reliable performance

System Control Center (SCC)

The SCC monitors and controls all UV functions, including dose pacing – the automatic, flow-based program that ensures proper disinfection levels while conserving power and extending lamp life. The microprocessor-based SCC is integrated onto one Power Distribution Center, and features a user-friendly, touch-screen HMI display with weatherproof cover, and Modbus Ethernet SCADA connectivity. For systems treating larger flows, or where more sophisticated control is desired, a PLC-based System Control Center is available. It features a separate wall-mount panel with colour, touch-screen HMI, Ethernet/IP SCADA connectivity, automatic slide/sluice gate control for multiple channels, and integrated Flash memory trend logging (flow, power, UVT, dose).



Alarms

Extensive alarm reporting system ensures fast, accurate diagnosing of system process and maintenance alarms. Programmable control software can generate unique alarms for individual applications.

Power Distribution Center (PDC)

The PDC powers each bank of modules. Its ergonomic, angled design provides easy access to module power cables and hoses for the ActiClean™ cleaning system. The robust stainless steel enclosure is mounted across the channel, with module fuses and interlock relays visually aligned with module receptacles for fast diagnostics. Modules are individually overload protected for safety. Like all TrojanUV3000Plus™ components, the PDC can be installed outdoors and requires no shelter or HVAC.

UV Intensity Sensor

The UV intensity sensor continually monitors UV lamp output. The ActiClean™ system automatically cleans the sensor sleeve every time lamp sleeves are cleaned.

Electronic Ballasts

The variable-output (60 - 100% power) electronic ballast is mounted in its own TYPE 6P (IP67) rated enclosure within the module frame. Features “quick connect” electrical connections. Cooling is by convection.

ActiClean™ Cleaning System

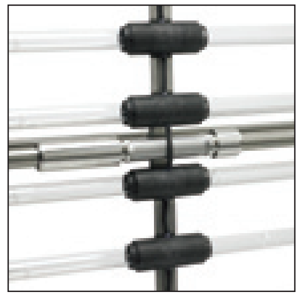
The system consists of two components:

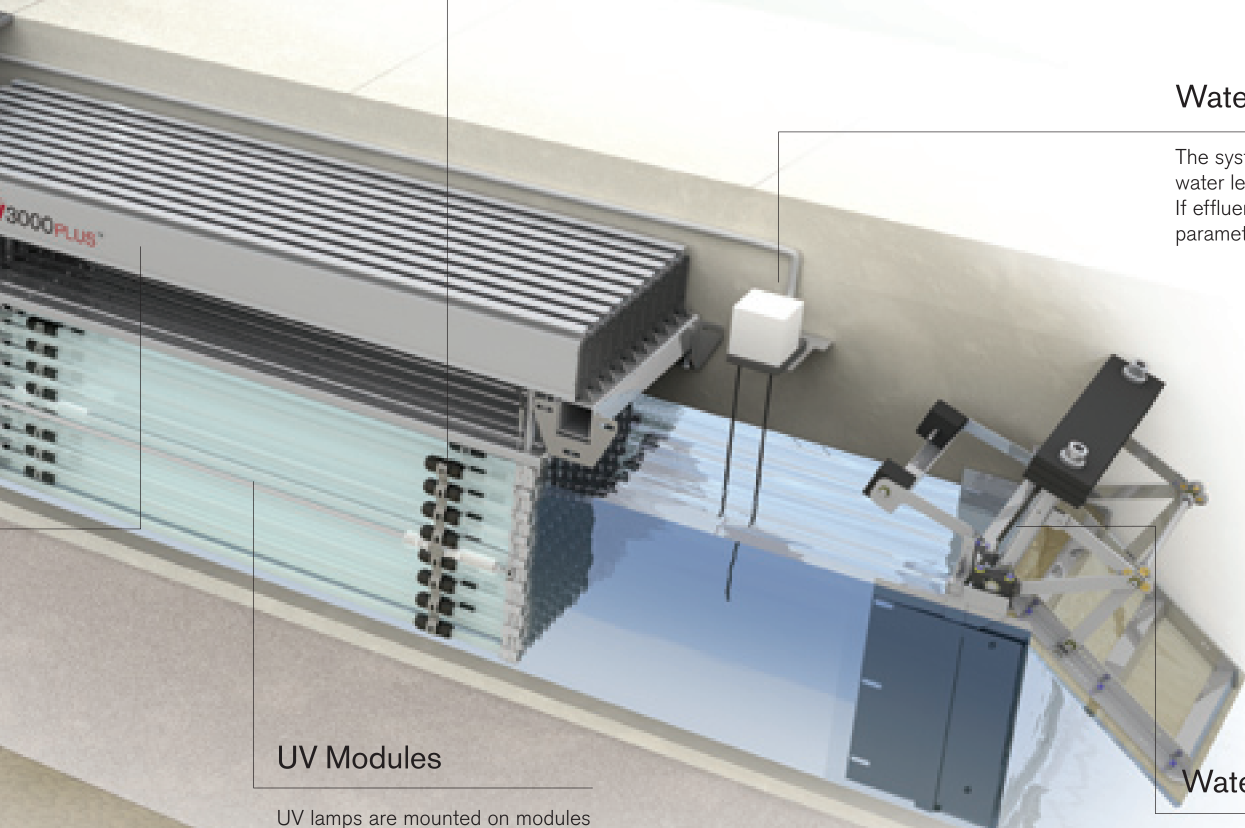
1. Hydraulic System Center (HSC)

The HSC actuates the ActiClean™ cleaning system, and is mounted close to the channel in a stainless steel enclosure. It contains the pump, valves and ancillary equipment required to operate the cleaning system, and links to the extend/retract hoses of the module wiper drives via a manifold located on the underside of the PDC.

2. ActiClean™ Wiper Assembly

A submersible wiper drive on each UV module drives the wiper carriage assembly along the module. Attached wiper canisters surround the quartz sleeves, and are filled with Trojan's ActiClean™ Gel. The gel uses food grade ingredients and contacts the lamp sleeves between the two wiper seals. Cleaning takes place while the lamps are submerged and while they are operating.





Water Level Sensor

The system includes an electrode low water level sensor for each channel. If effluent levels fall below defined parameters, an alarm will be activated.

UV Modules

UV lamps are mounted on modules installed in open channels. The lamps are enclosed in quartz sleeves, and positioned horizontally and parallel to water flow. A bank is made up of multiple modules placed in parallel. All ballast and lamp wiring runs inside the module frame.

Water Level Controller

A fixed weir, motorized weir gate, or Automatic Level Control gate (shown), is required in the channel to maintain the appropriate water level over the lamps. Trojan engineers will work with you to select the appropriate level control device for your application.

Key Benefits

TrojanUV3000Plus™

Increased operator, community and environmental safety. The TrojanUV3000Plus™ uses environmentally-friendly ultraviolet light – the safest alternative for wastewater disinfection. No disinfection by-products are created, and no chemicals must be transported, stored or handled.

Well suited to changing regulations. Trojan UV systems do not have any negative impact on receiving waters and do not produce disinfection by-products, making them a strategic, long-term choice as regulations become increasingly stringent.

Most efficient UV system available versus competitive low-pressure, high-output (LPHO) or amalgam lamp-based systems.

Reduces operating costs by as much as 30% per year. Long-lasting amalgam lamps and variable-output ballasts optimize UV output to meet wastewater conditions and maximize system efficiency versus competitive UV systems.

Proven disinfection based on actual dose delivery testing (bioassay validation), and over 400 TrojanUV3000Plus™ installations worldwide. Real-world, field performance data eliminates sizing assumptions resulting from theoretical dose calculations.

Dual-action sleeve cleaning system improves performance and reduces labor costs. Automatic ActiClean™ chemical/mechanical cleaning system maintains sleeve transmittance of at least 95%, and works online – eliminating the need to remove modules from the channel.

Reduced installation costs. The compact TrojanUV3000Plus™ can be retrofitted into existing chlorine contact tanks, and comes pre-tested, pre-assembled and pre-wired to minimize installation costs.

Outdoor installation flexibility. The entire TrojanUV3000Plus™ system can be installed outdoors, eliminating the need and costs of a building, shelter, and HVAC for ballast cooling.

Guaranteed performance and comprehensive warranty. Trojan systems include a Lifetime Performance Guarantee, the best lamp warranty in the industry, and use lamps from multiple approved suppliers. Ask for details.

ActiClean™ Dual-Action, Automatic Cleaning System

Chemical/mechanical cleaning system eliminates sleeve fouling

Benefits:

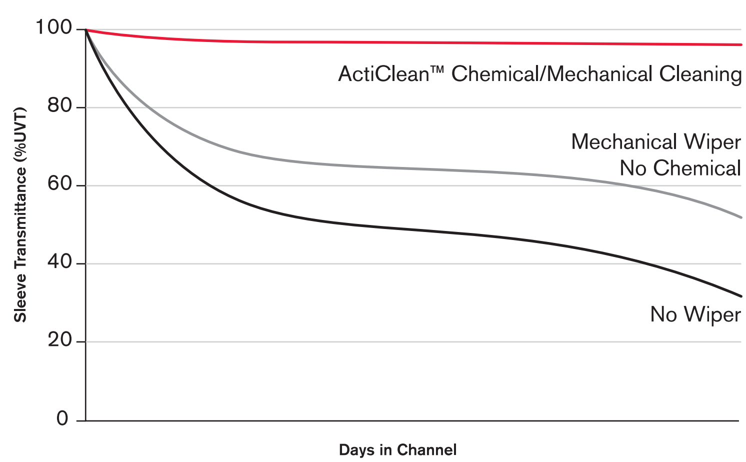
- Cleans 50% more effectively than mechanical wiping alone
- Improves lamp performance for more reliable dose delivery
- Elimination of fouling factor reduces equipment sizing requirements and power consumption
- Automatic, online cleaning reduces O&M costs associated with manual cleaning
- Combination of chemical and mechanical cleaning action removes deposits on quartz lamp and sensor sleeves much more effectively than mechanical wiping alone
- Innovative wiper design incorporates a small quantity of ActiClean™ Gel for superior, dual-action cleaning
- Cleans automatically while the lamps are disinfecting. There's no need to shut down the system, remove or bypass lamp modules for routine cleaning
- Proven in hundreds of systems around the world, including use in plants where heavy fouling had previously prohibited the use of UV disinfection technology
- ActiClean™ can be added to an installed TrojanUV3000Plus™ not originally equipped with a cleaning system

ActiClean™ Gel is Safe to Handle

- ActiClean™ Gel is comprised of food-grade ingredients
- Quick connect on cleaning system allows for easy refill of gel solution
- Lubricating action of ActiClean™ Gel maximizes life of wiper seals

The dual-action, chemical/mechanical cleaning with the ActiClean™ system provides superior sleeve cleaning and reduces maintenance costs. Fouling and residue build-up on quartz sleeves reduces system efficiency. ActiClean™ maintains at least 95% transmittance, ensuring sleeves are clean and the system is consistently delivering accurate dosing while reducing power consumption.

Efficacy of Cleaning Technologies to Control Sleeve Fouling

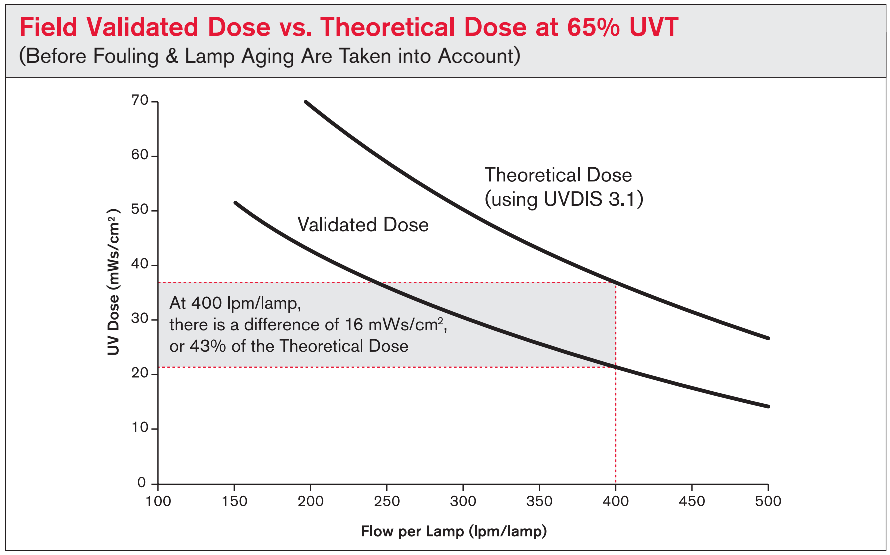


Regulatory-Endorsed Bioassay Validation

Real-world testing ensures accurate dose delivery

Benefits:

- Performance data is generated from actual field testing over a range of flow rates, effluent quality, and UVTs
- Provides physical verification that system will perform as expected; ensures public and environmental safety
- Provides accurate assessment of equipment sizing needs
- The TrojanUV3000Plus™ has been thoroughly validated through real-world bioassay testing under a wide range of operating conditions
- In-field bioassay testing offers the peace of mind and improved public and environmental safety of verified dose delivery – not theoretical calculations
- The USEPA has endorsed bioassays as the standard for assessment and comparison of UV technologies
- The disinfection performance ratings for the TrojanUV3000Plus™ are proof that what you see is what you actually get



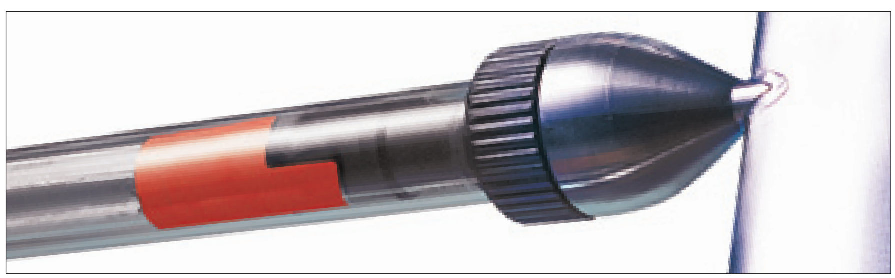
This shows the validated dose of an actual working system and the theoretical dose calculated using UVDIS. Note that the UVDIS 3.1 dose calculation overestimates the system performance.

Amalgam Lamps Require Less Energy

Require fewer lamps and reduce O&M costs

Benefits:

- Draw less energy than competitive high-output systems – only 250 Watts per lamp
- Stable UV output over a wide range of water temperatures
- Fewer lamps are required to deliver the required dose, which reduces O&M costs
- Can treat lower quality wastewater such as primary effluents, combined sewer overflows, and storm water
- Fewer lamps allow systems to be located in compact spaces, reducing installation costs



Trojan's high efficiency amalgam lamps generate stable UV output in a wide range of water temperatures.

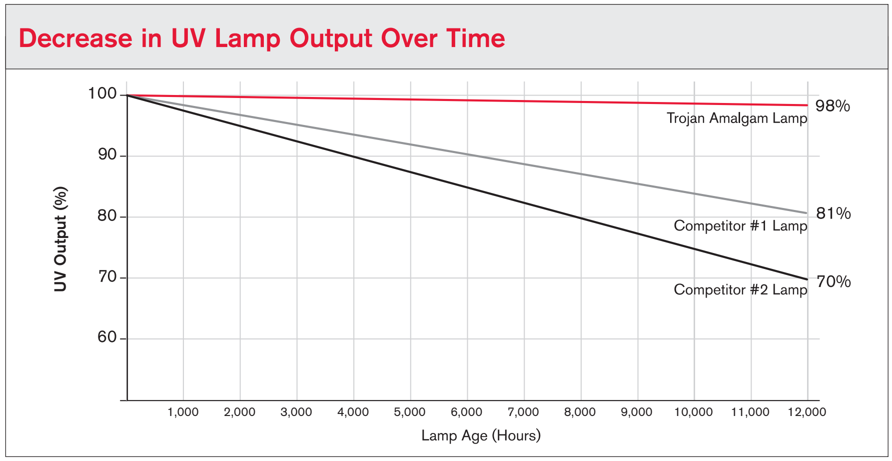
- Trojan's amalgam lamps produce significantly higher UV output than conventional low-output lamps
- Fast and simple lamp changeouts; replacing a 50-lamp system takes less than two hours and requires no tools
- The lamps are sealed inside heavy-duty quartz sleeves by Trojan's multi-seal system, maintaining a watertight barrier around the internal wiring while individually isolating each lamp and the module frame
- Lamps are pre-heated for reliable startup

Amalgam Lamps Maintain Maximum UV Output

Trojan lamps deliver 98% of full UV output after more than one year of use

Benefits:

- Trojan's high efficiency, amalgam lamps deliver the most consistent UV output
- Trojan lamps have 20% less decline in UV output after 12,000 hours of use compared to competitive UV lamps
- Validated performance assures you of reliable dose delivery and prolonged lamp life



The lamps used on the TrojanUV3000Plus™ system have been independently validated to maintain 98% of original output after 12,000 hours of operation.

Open-Channel Architecture Designed for Outdoor Installation

Cost-effective to install and expand

Benefits:

- Compact, open-channel design allows cost-effective installation in existing effluent channels and chlorine contact chambers
- System can be installed outdoors to reduce capital costs – no building, shelter or HVAC is required
- Gravity-fed design eliminates costs of pressurized vessels, piping and pumps
- Scalable architecture allows precise sizing – reduces capital and O&M costs associated with oversizing
- Modular design is readily expandable to meet new regulatory or capacity requirements
- Trojan's thorough design approach ensures that effluent quality, upstream treatment processes, and O&M needs are addressed in system configurations
- Horizontal lamp mounting delivers optimal hydraulic performance. This arrangement induces turbulence and dispersion, maximizing wastewater exposure to UV output

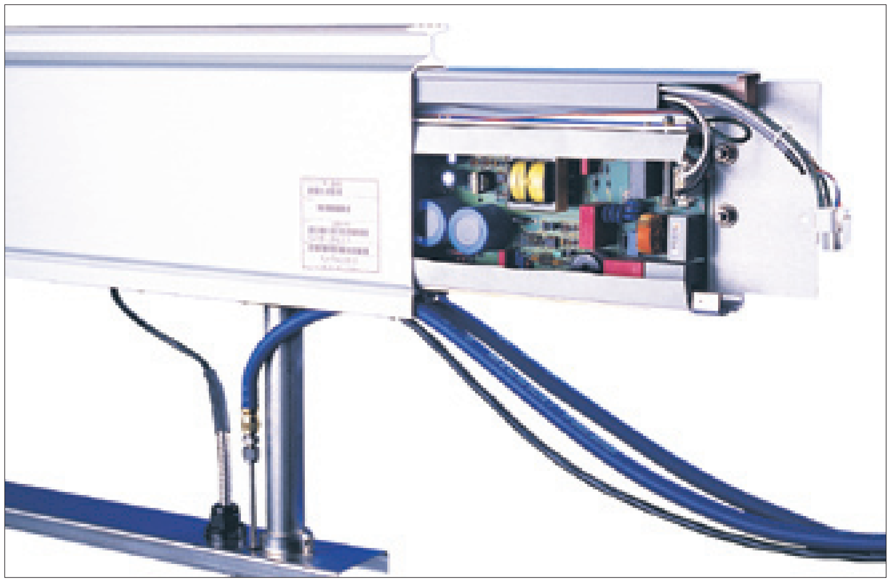
The TrojanUV3000Plus™ system delivers flexibility and cost savings through its simple installation in existing channels and chlorine contact chambers. The system can be situated outdoors with no additional building, shelter or cooling requirements.

Advanced, Self-Contained UV Module

Dramatically reduces footprint size and eliminates costs of air conditioning

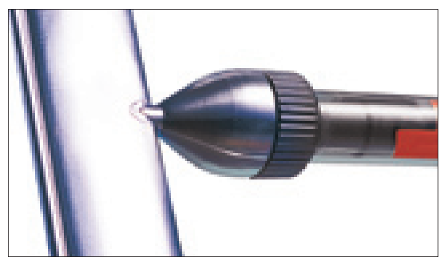
Benefits:

- Lamps are protected in a fully submersible, 316 stainless steel frame
- Waterproof module frame protects cables from effluent, fouling and UV light
- Electronic ballasts are housed right in the module, reducing the system footprint, minimizing installation time and costs, and eliminating the need for separate external cabinets
- Ballast enclosures are rated TYPE 6P (IP67) – air/water tight
- Module leg and lamp connector have a hydrodynamic profile to reduce headloss
- The variable-output, electronic ballast is mounted in an enclosure integrated within the module frame
- Wiring is pre-installed and factory-tested



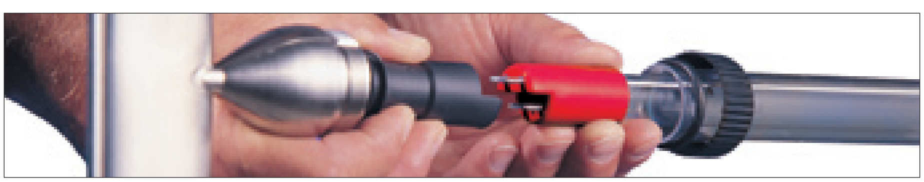
Module-mounted ballasts allow for compact installation, convection cooling, and protect wires and cables from exposure to effluent and UV light.

- Cooling ballasts by convection eliminates costs associated with air conditioning and forced-air cooling



Module leg and lamp connector have a hydrodynamic profile to reduce headloss and potential for debris fouling.

Designed for Easy Maintenance



Trojan UV lamps are easily replaced in minutes without the need for tools.

- TrojanUV3000Plus™ lamps are warranted for 12,000 hours
- Modular design allows for maintenance on one module without disrupting disinfection performance
- Maintenance limited to replacing lamps and cleaning solution
- Automated ActiClean™ cleaning system reduces manual labor associated with cleaning sleeves

Quick connect allows for easy refill of ActiClean™ Gel.

TROJANUV3000PLUS™

System Specifications

System Characteristics	TrojanUV3000Plus™
Typical Applications	Wide range of wastewater treatment plants
Lamp Type	High-efficiency Amalgam
Ballast Type	Electronic, variable output (60 to 100% power)
Input Power Per Lamp	250 Watts
Lamp Configuration	Horizontal, parallel flow
Module Configuration	4, 6 or 8 lamps per module
Level Control Device Options	ALC, fixed weir or motorized weir gate
Water Level Sensor	1 electrode low water level sensor per channel
Enclosure Ratings:	
Module Frame / Ballast Enclosure	TYPE 6P (IP68) / TYPE 6P (IP67)
All Other Enclosures	TYPE 4X (IP56)
Ballast Cooling Method	Convection; no air conditioning or forced air required
Installation Location	Indoor or outdoor
Sleeve Cleaning System:	
ActiClean™ Cleaning System	Optional Automatic Chemical/Mechanical Cleaning System
ActiClean™ Cleaning Gel	Non-corrosive, operator-friendly
Recommended Fouling Factor	1.0
System Control Center:	
Controller	Microprocessor or PLC-based
Analog Inputs (Typical)	Flow (4-20 mA) and UVT (4-20 mA)
Discrete Outputs (Typical)	Bank status, common alarms and SCADA communication
Maximum Distance from UV Channel	500 ft. (152 m)
Electrical Requirements:	
Power Distribution Center	208Y/120V, 3 phase, 4 wire + GND, 60 Hz (Max. 8 modules per PDC) 480Y/277V, 3 phase, 4 wire + GND, 60 Hz 380Y/220V, 3 phase, 4 wire + GND, 50/60 Hz 400Y/230V, 3 phase, 4 wire + GND, 50/60 Hz 415Y/240V, 3 phase, 4 wire + GND, 50/60 Hz
System Control Center (stand alone)	120V, single phase, 2 wire + GND, 60 Hz, 1.8 kVA 220/230/240V, single phase, 2 wire + GND, 50/60 Hz, 1.8kVA
Hydraulic System Center (for ActiClean™)	208V, 3 phase, 3 wire + GND, 60 Hz 380/400/415 V, 3 phase, 3 wire + GND, 50/60 Hz 480 V, 3 phase, 3 wire + GND, 60 Hz or 2.5kVA HSC powered from PDC
Water Level Sensor	24VDC powered from PDC

Find out how your wastewater treatment plant can benefit from the TrojanUV3000Plus™ – call us today.

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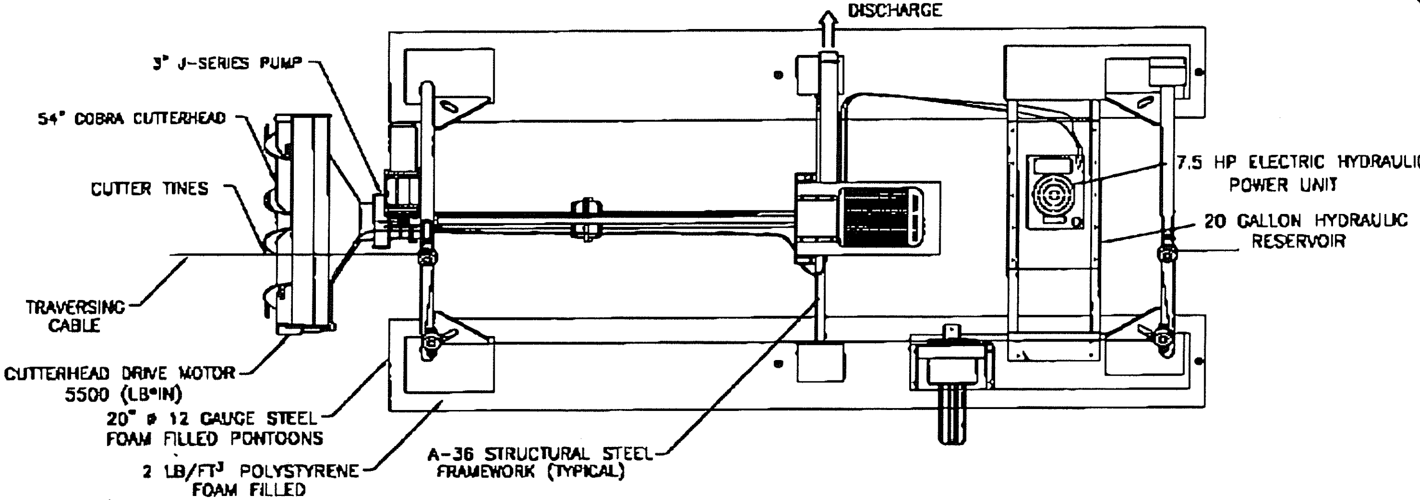
Hach/Trojan Technologies (China): 86-10-65150290

Products in this brochure may be covered by one or more of the following patents:
U.S. 4,872,980; 5,006,244; 5,418,370; RE 36,896; 6,342,188; 6,635,613; 6,646,269; 6,663,318; 6,719,491; 6,830,697; 7,018,975
Can. 1,327,877; 2,117,040; 2,239,925
Other patents pending.

MWW-003 (0107) TROW-1040

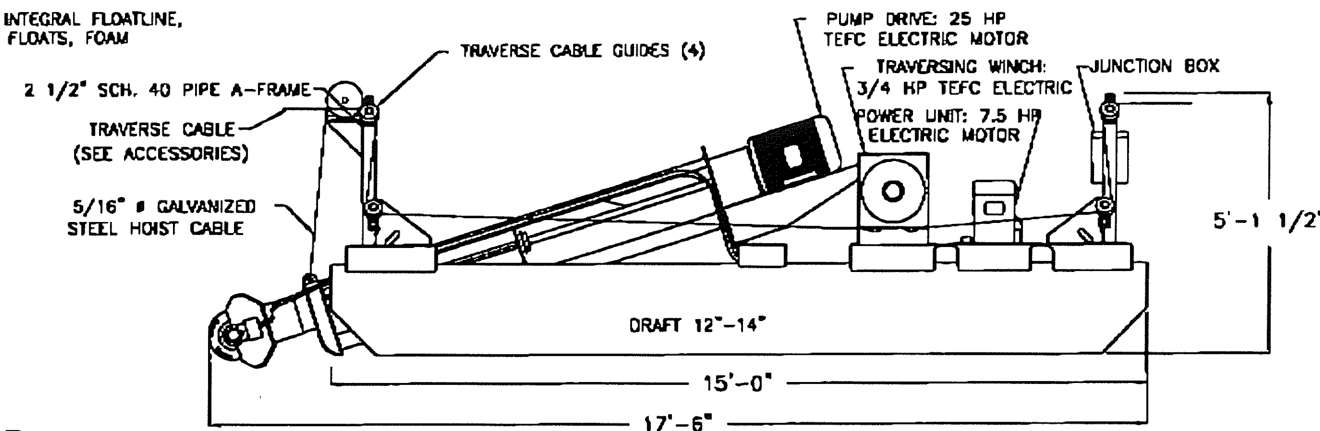
TROJANUV
WATER CONFIDENCE™



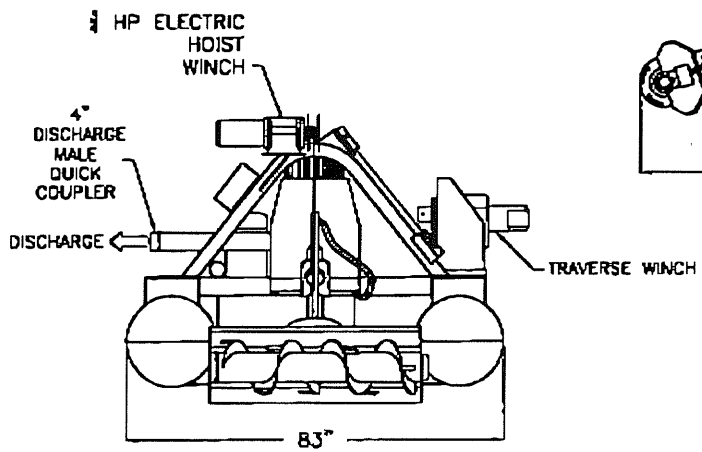
TOP VIEW

AVAILABLE ACCESSORIES:

TRAVERSE SYSTEMS........................2 POST, 4 POST
CONTROL PANEL............................NEMA 3R STANDARD
CONTROL CABLE............................TYPE SO
FLOATING DISCHARGE SYSTEMS.......ALUMINUM INTEGRAL FLOATLINE, BALL TYPE FLOATS, FOAM



SIDE VIEW



FRONT VIEW

REV. 3 MDM 1/8/03

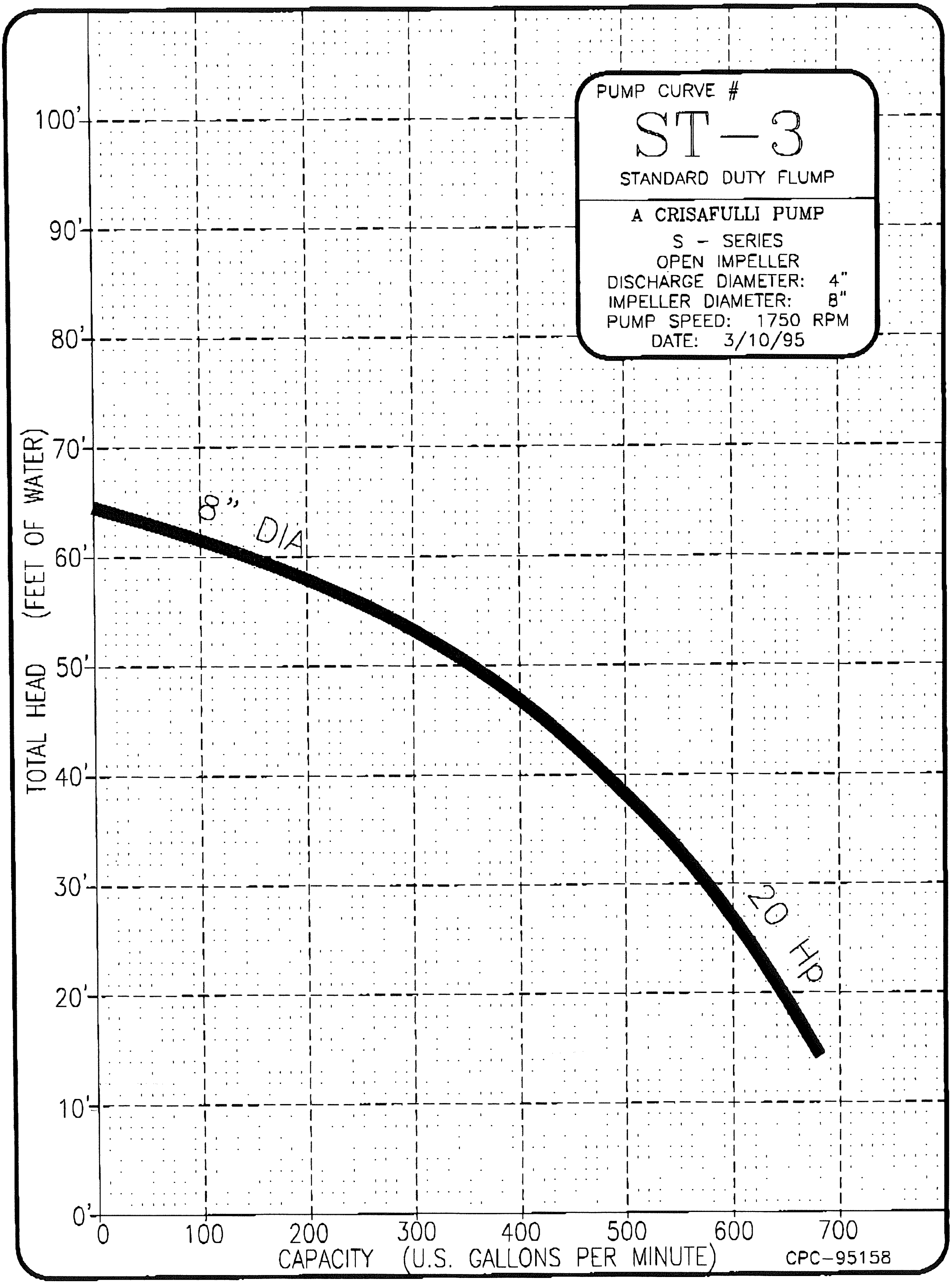
SRS Crisafulli

PHONE: (406) 365-3393
FAX: (406) 365-8088

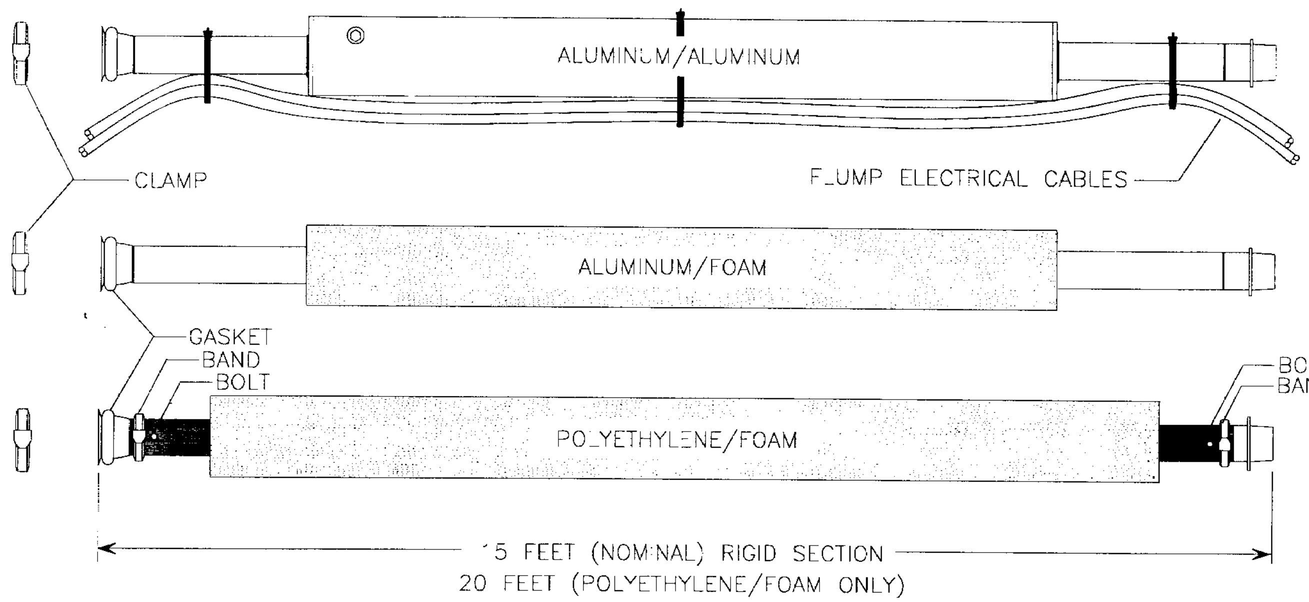
Sludge Removal Systems

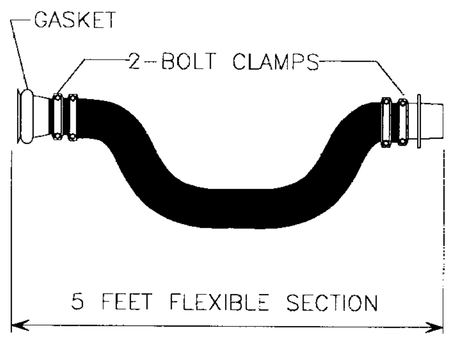
STANDARD DUTY FLUMP

Dwn By: MJB	Ckd.: D.R.T.	Date: 4-6-95	Dwg.#: CPC 94524


PUMP CURVE #
ST-3
STANDARD DUTY FLUMP
A CRISAFULLI PUMP
S - SERIES
OPEN IMPELLER
DISCHARGE DIAMETER: 4"
IMPELLER DIAMETER: 8"
PUMP SPEED: 1750 RPM
DATE: 3/10/95
TOTAL HEAD (FEET OF WATER)
100'
90'
80'
70'
60'
50'
40'
30'
20'
10'
0'
8" DIA
20 HP
0
100
200
300
400
500
600
700
CAPACITY (U.S. GALLONS PER MINUTE)
CPC-95158

LIGHTWEIGHT • FLOATING • SLUDGE/SLURRY TRANSFER • BOLTLESS





*FEATURES

ASSEMBLED LENGTH	20 FEET (6.1 METERS)
RIGID SECTION	15 FEET LONG (4.57 METERS) RIGID PIPE SECTION WITH MALE/FEMALE IRRIGATION QUICK COUPLERS BANDED**& BOLTED (POLY ONLY) ON EACH END, RUBBER GASKET, LOCKING CLAMP, AND AN INTEGRAL 10 FOOT FLOAT.
MATERIALS OF CONSTRUCTION	ALUMINUM OR PE3408 UHMW POLYETHYLENE
FLEXIBLE SECTION	5 FEET LONG (1.52 METERS) FLEXIBLE 100 PSI HOSE SECTION WITH MALE/FEMALE IRRIGATION QUICK COUPLERS (2)2-BOLT CLAMPS*** ON EACH END, RUBBER GASKET, AND A LOCKING CLAMP.
MATERIALS OF CONSTRUCTION	AN ABRASION RESISTANT CORE, NYLON (OR VYTACORD) REINFORCING AND AN EXTERIOR ABRASION RESISTANT COVER.
QUICK COUPLERS	GALVANIZED STEEL AND/OR ALUMINUM IRRIGATION QUICK COUPLERS.
CABLE CLAMPS	ADJUSTABLE ELASTOMERIC HOSE/CABLE CLAMPS (2 PER FLOAT ASSEMBLY)

OPTIONAL FEATURES

CORROSION RESISTANT	STAINLESS STEEL FASTENERS AND COUPLERS
ASSEMBLY LENGTH	10 FEET TO 40 FEET

*THESE FEATURES MAY CHANGE WITHOUT NOTICE. ** STAINLESS STEEL
*** MILD STEEL ZINC COATED

LIGHTWEIGHT FLEXIBILITY

THE CRISAFULLI INTEGRAL FLOATING DISCHARGE LINE SOLVES THE PROBLEM GENERALLY ASSOCIATED WITH STANDARD DISCHARGE SYSTEMS. THE SYSTEM IS DESIGNED TO ALLOW MAXIMUM FLEXIBILITY WITHOUT HOSE KINKING OR WITHOUT FRETTING THE HOSE. THE INTEGRAL FLOATS REDUCE THE AMOUNT OF DRAG CAUSED BY THE FLOATS AS THEY MOVE THROUGH THE LIQUID OR SLUDGE. THE INTEGRAL FLOATS ALSO ALLOW THE SECTIONS TO BE STACKED WITHOUT THE QUICK DISCONNECTS BEING DAMAGED. EACH SECTION CAN BE HANDLED EASILY AND QUICKLY SET UP.

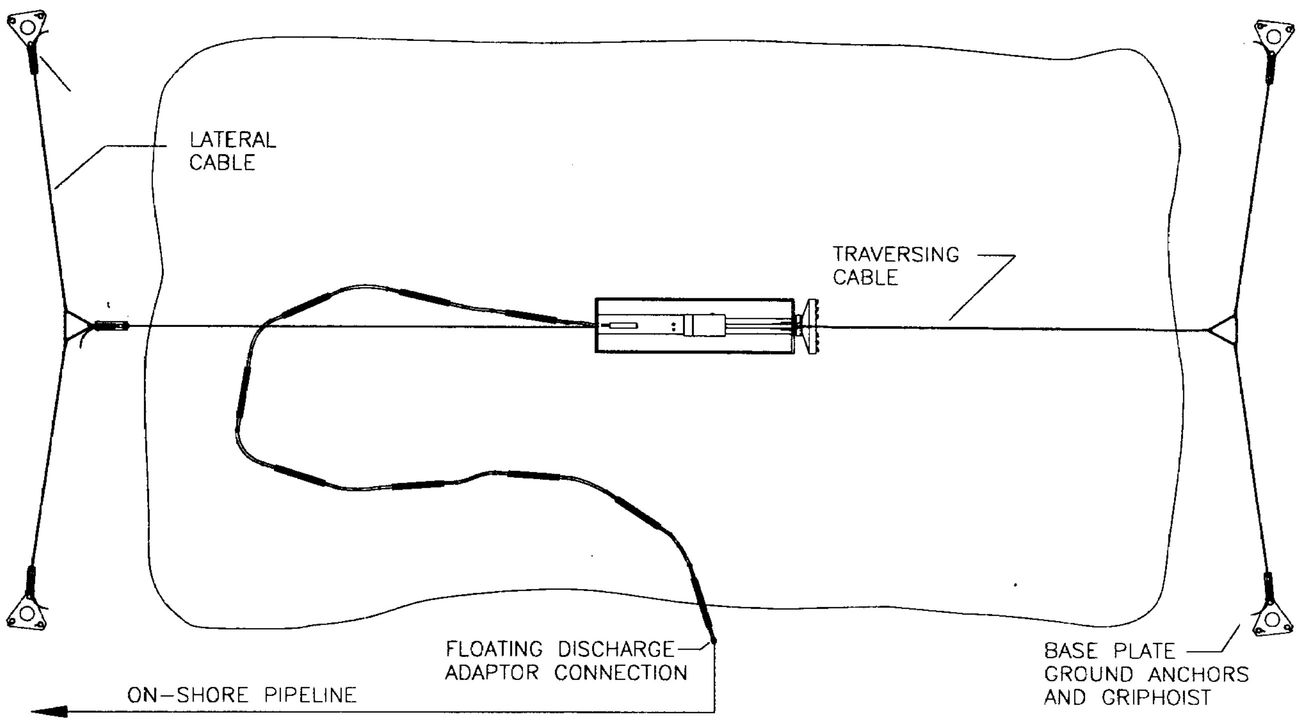
NOMINAL DIAMETER	RIGID SECTION						FLEX SECTION
	ALUM/ALUM		ALUM/FOAM		POLY/FOAM		
	RATED PSI	LBS.	RATED PSI	LBS.	RATED PSI	LBS.	LBS.
3"	125	30	125	30	160	40	10
4"	125	35	125	35	110	50	15
6"	125	40	125	40	80	90	20
8"	95	65	95	55	65	125	30
10"			75	75	50	165	45
12"			75	105	50	235	55

REV. 2 (JLB) 6-27-96

SRS
Crisafulli Sludge Removal Systems

INTEGRAL FLOATING DISCHARGE PIPELINE

Dwn By: CKR	Ckd.:	Date: 7/3/91	Dwg.#: CPC-91338

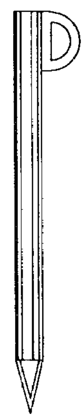


*FEATURES

TRAVERSING CABLE	400' STANDARD, 3/8" DIAMETER 7X19 GALVANIZED STEEL CABLE (OPTIONAL LENGTHS AVAILABLE)
TENSION TRIANGLES	(2) 1/2" DIAMETER A36 STEEL TENSION TRIANGLES WITH FULL PENETRATION WELDS
LATERAL CABLES	210' STANDARD, C-16 GALVANIZED STEEL CABLE (OPTIONAL LENGTHS AVAILABLE)
GRIPHOISTS (TM)	(5) TWO TON GRIPHOIST CABLE TENSIONERS WITH HANDLES
BASE PLATES	(4) 3/16" STEEL TRIANGLE BASE PLATES
GROUND ANCHORS	(12) 48" LONG A36 STEEL ANCHORS, POINTED WITH D-RING HANDLES

OPTIONAL FEATURES

CORROSION RESISTANT	STAINLESS STEEL COMPONENTS (EXCEPT GRIPHOISTS)



GROUND ANCHORS

THE 4 LATERAL CABLES MAY EITHER BE ANCHORED WITH 3 GROUND ANCHORS & TRIANGLE BASE PLATE, A TREE, A ROCK OR ANYTHING SOLID.

* THESE FEATURES MAY CHANGE WITHOUT NOTICE

REV. (4) BY J.L.B. 10-19-95

SRS Crisafulli — Sludge Removal Systems

DREDGE
4-POST MANUAL TRAVERSING
CABLING SYSTEM

Dwn By: CKR	Ckd.:	Date: 7/10/91	Dwg.#: CPC-91344

PARKSON CORPORATION

BIOLAC® WASTEWATER TREATMENT SYSTEM

Biolac® Wastewater Treatment System
Extended sludge age biological technology

This innovative process features

- **Low-loaded activated sludge technology**
- **High oxygen transfer efficiency delivery system**
- **Exceptional mixing energy from controlled aeration chain movement**
- **Simple system construction**

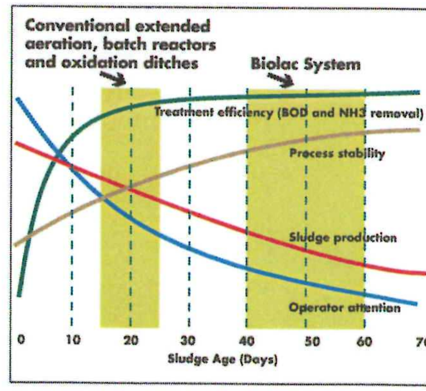
The Biolac System is an innovative activated sludge process using extended retention of biological solids to create an extremely stable, easily operated system.

The capabilities of this unique technology far exceed ordinary extended aeration treatment. The Biolac process maximizes the stability of the operating environment and provides high efficiency treatment. The design ensures the lowest-cost construction and guarantees operational simplicity. Over 500 Biolac Systems are installed throughout North America treating municipal wastewater and many types of industrial wastewater.

The Biolac system utilizes a longer sludge age than other aerobic systems. Sludge age, also known as SRT (solids retention time) or MCRT (mean cell residence time), defines the operating characteristics of any aerobic biological treatment system. A longer sludge age dramatically lowers effluent BOD and ammonia levels. The Biolac long sludge age process produces BOD levels of less than 10 mg/l and complete nitrification (less than 1 mg/l ammonia). Minor modifications to the system will extend its capabilities to denitrification and biological phosphorus removal.

While most extended aeration systems reach their maximum mixing capability at sludge ages of approximately 15-25 days, the Biolac System efficiently and uniformly mixes the aeration volumes associated with 30-70 day sludge age treatment.

The large quantity of biomass treats widely fluctuating loads with very few operational changes. Extreme sludge stability allows sludge wasting to non-aerated sludge ponds or basins and long storage times.



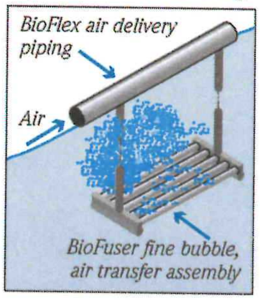
Aeration Components

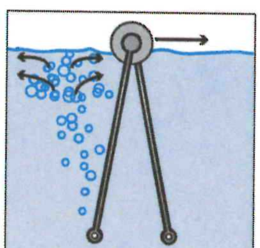
SIMPLE PROCESS CONTROL AND OPERATION

The control and operation of the Biolac® process is similar to that of conventional extended aeration. Parkson provides a very basic system to control both the process and aeration. Additional controls required for denitrification, phosphorus removal, dissolved oxygen control and SCADA communications are also available.

AERATION SYSTEM COMPONENTS

The ability to mix large basin volumes using minimal energy is a function of the unique BioFlex® moving aeration chains and the attached BioFuser® fine bubble diffuser assemblies. The gentle, controlled back and forth motion of the chains and diffusers distributes the oxygen transfer and mixing energy evenly throughout the basin area. No additional airflow is required to maintain mixing.



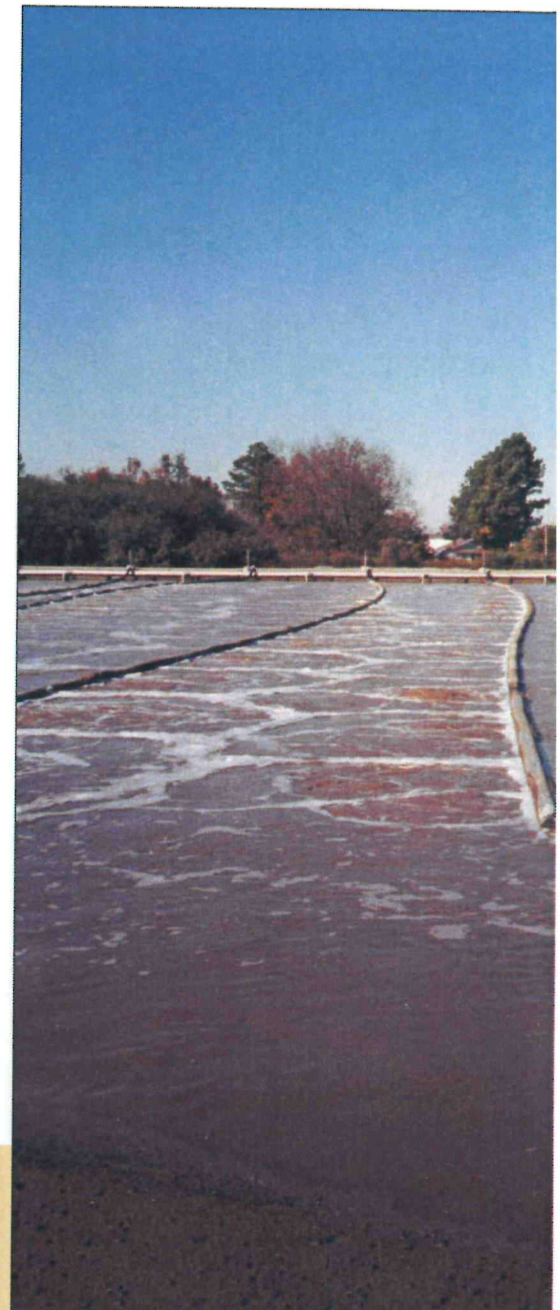


Controlled oxygen transfer and mixing energy

Stationary fine-bubble aeration systems require 8-10 CFM of air per 1000 cu. ft. of aeration basin volume. The Biolac System maintains the required mixing of the activated sludge and suspension of the solids at only 4 CFM per 1000 cu.ft. of aeration basin volume. Mixing of a Biolac basin typically requires 35-50 percent of the energy of the design oxygen requirement. Therefore, air delivery to the basin can be reduced during periods of low loading without the risk of solids settling out of the wastewater.

SYSTEM CONSTRUCTION

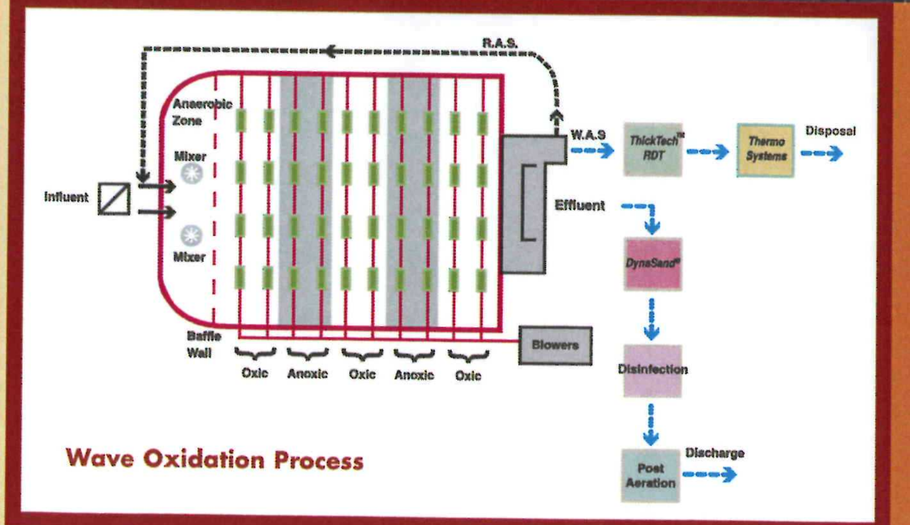
A major advantage of the Biolac system is its low installed cost. Most systems require costly in-ground concrete basins for the activated sludge portion of the process. A Biolac system can be installed in earthen basins, either lined or unlined. The BioFuser fine bubble diffusers require no mounting to basin floors or associated anchors and leveling. These diffusers are suspended from the BioFlex aeration chains above the basin floor. The only concrete structural work required is for the simple internal clarifier(s) and blower/control buildings.



Biological Nutrient Removal

Simple control of the air distribution to the BioFlex chains creates moving waves of oxic and anoxic zones within the basin. This repeated cycling of environments nitrifies and denitrifies the wastewater without recycle pumping or additional external basins. This mode of Biolac operation is known as the Wave Oxidation™ process. No additional in-basin equipment is required and simple timer-operated actuator valves regulate manipulation of the air distribution.

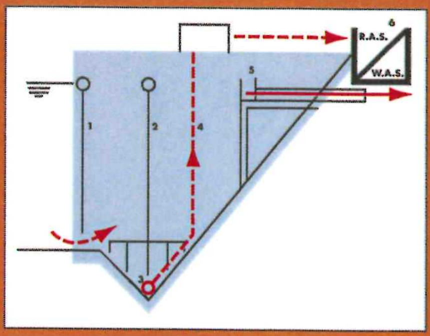
Biological phosphorus removal can also be accomplished by incorporating an anaerobic zone.



Wave Oxidation Process

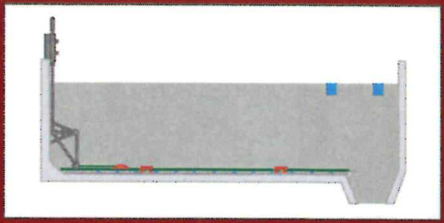
Type "R" Clarifier

Land space and hydraulic efficiencies are maximized using the type "R" clarifier. The clarifier design incorporates a common wall between the clarifier and aeration basin. The inlet ports in the bottom of the wall create negligible hydraulic headloss and promote efficient solids removal by filtering the flow through the upper layer of the sludge blanket. The hopper-style bottom simplifies sludge concentration and removal, and minimizes clarifier HRT. The sludge return airlift pump provides important flexibility in RAS flows with no moving parts. All maintenance is performed from the surface without dewatering the clarifier.



Type "SS" Clarifier

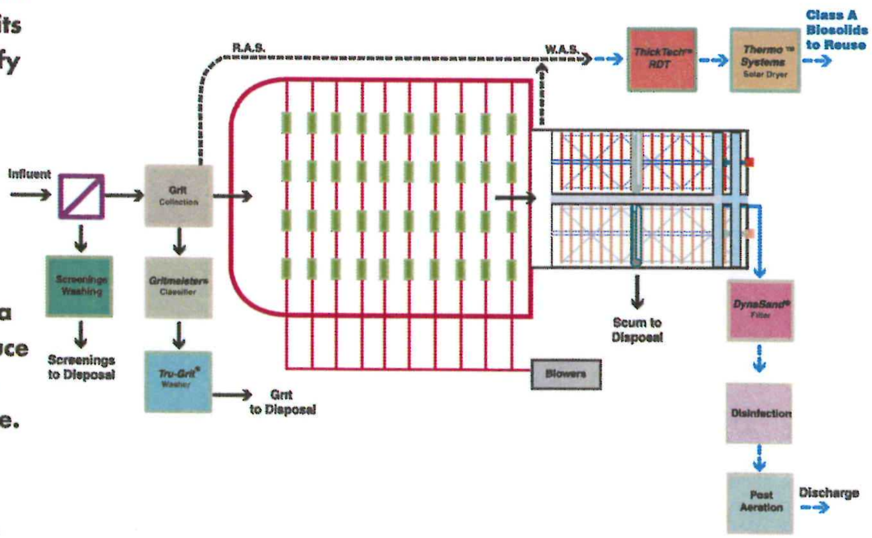
Higher flow systems incorporate a flat-bottom internal clarifier utilizing the Parkson SuperScraper™ sludge removal system. This clarifier design maintains the efficiencies of the common wall layout while providing ample clarification surface area within the footprint of the aeration basin width. The SuperScraper system moves settled solids along the bottom of the clarifier to an integral collection trough. The unique design of the scraper blades and gentle forward movement of the SuperScraper system concentrates the biological solids as they are moved along the bottom of the clarifier without disturbing the sludge blanket.



A Parkson *Complete* Wastewater Treatment System

The Parkson "Complete" system featured here utilizes the Biolac® process with two flat-bottom internal Type SS clarifiers. SuperScraper™ units are installed in the clarifier bottoms to simplify sludge removal. Influent screening with grit removal and appropriate residuals management such as washing, dewatering and conveying are included.

Sludge from the clarifiers is sent to the ThickTech™ rotary drum thickener and on to a THERMO-SYSTEM™ solar sludge dryer to reduce the volume of sludge by 50% and produce a Class "A" product suitable for beneficial reuse. Clarifier effluent is polished by a DynaSand® filter followed by disinfection and post-aeration as the final steps prior to discharge.



PARKSON CORPORATION

ISO 9001:2000 Certified
Quality Management System

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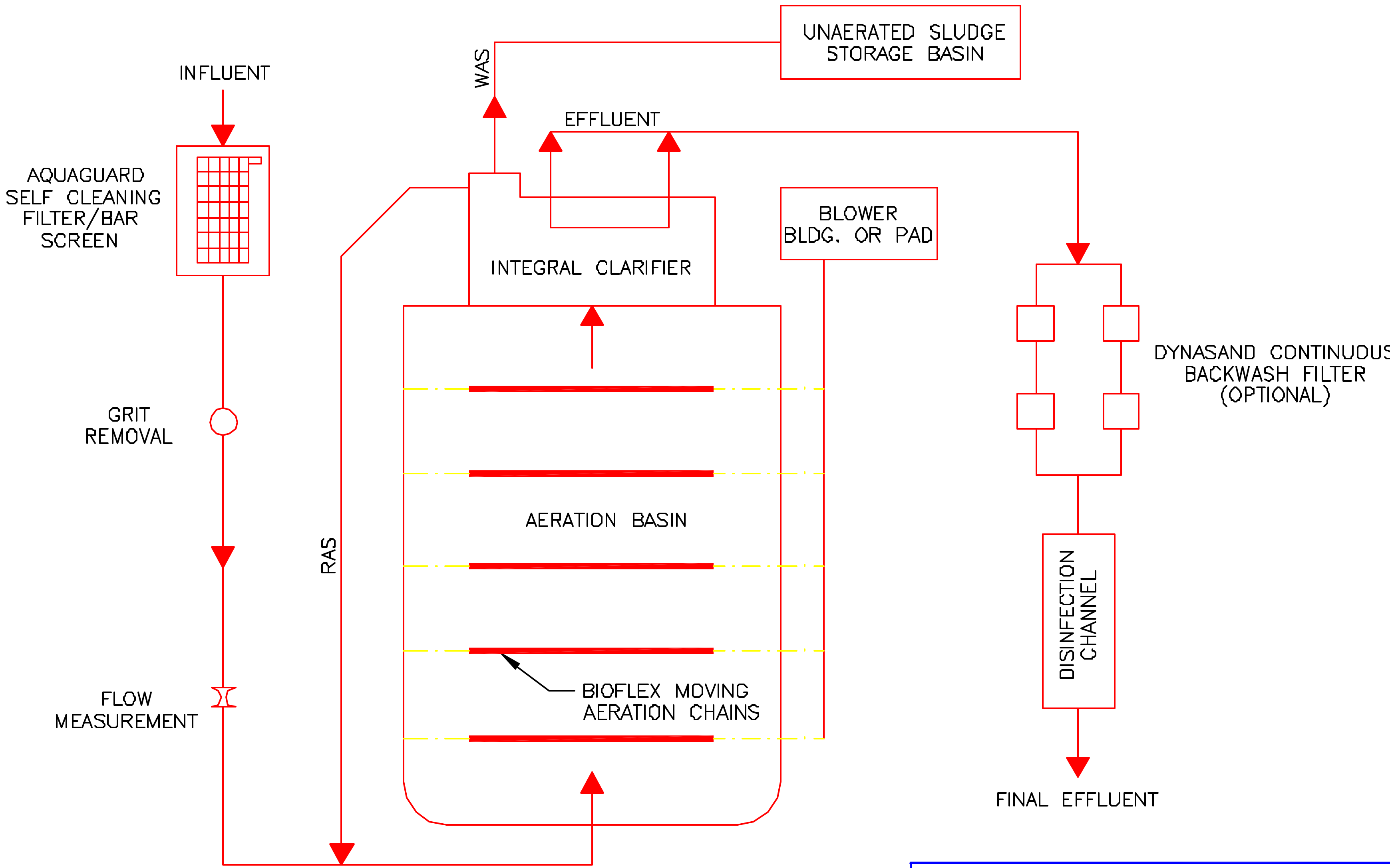


THE OWNER, PROJECT ENGINEER, AND ALL OTHERS INVOLVED WITH THE PROJECT DESIGN MUST IMPLEMENT AND FOLLOW ALL SAFETY STANDARDS REQUIRED BY LOCAL, STATE AND FEDERAL LAWS WHEN INCORPORATING PARKSON CORPORATION EQUIPMENT INTO THE OVERALL PROJECT DESIGN. PARKSON CORPORATION WILL NOT BE RESPONSIBLE FOR LOCATION AND/OR PLACEMENT OF EQUIPMENT IN THE PLANT DESIGN, NOR IS PARKSON RESPONSIBLE FOR PLANT SAFETY DESIGN AND FOR THE FAILURE TO FOLLOW APPROPRIATE SAFETY PRECAUTIONS IN THE OPERATION AND MAINTENANCE OF PARKSON CORPORATION EQUIPMENT.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
FLOW DIAGRAM

Drawn By G.C.	Checked By	Approved By	Micro Rev.	CAD No. SD1	Loc. status SD1
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD Int scale 1
Location			Dwg. No. SD-1		Rev. A

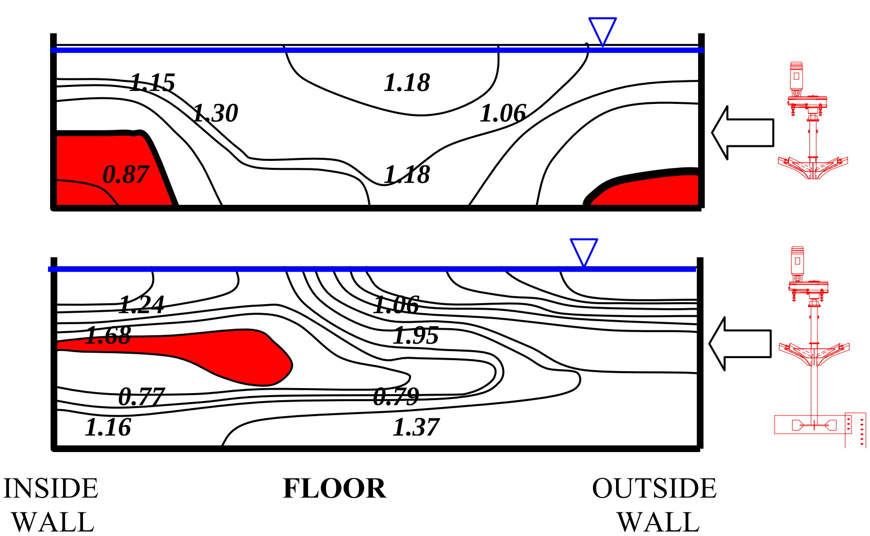
INTRODUCING THE CARROUSEL® 3000

When EIMCO introduced the Carrousel System in the 1970s, most communities were simply trying to achieve secondary treatment—20/20 (BOD/TSS) permits. Over the last three decades, permits have become more stringent (usually requiring nutrient removal), the desire to save power more important, and space available for new plants more limited. The Carrousel 3000, the culmination of more than 29 years of continuous improvement of the Carrousel System, has responded to these market changes. Some milestones in the Carrousel process are shown below:

- *1976 - EIMCO brings the Carrousel® oxidation ditch to the U.S*
- *1979 - EIMCO installs the first BNR plant in the U.S. designed on process kinetics*
- *1987 - EIMCO introduces the DenitIR® Carrousel® system for free internal recycle*
- *1989 - EIMCO introduces the dual-impeller aerator*
- *1990 - EIMCO introduces the A^2C process, reducing the biological nutrient removal process from five stages to three.*
- *2000 - EIMCO introduces the Deep Tank Carrousel for depths greater than 20 ft.*
- *2001 - EIMCO introduces the ACE™ control system to control power use 24-hours/day.*
- *2004 - EIMCO introduces the **ExcellAerator** for maximum process control & energy savings*

EIMCO's pilot-scale plant in Salt Lake City, Utah

The EIMCO **ExcellAerator** incorporates a lower turbine system on a common shaft with the surface aerating impeller. Velocity enhancing baffles (patent pending) are installed near the lower turbine. The ExcellAerator allows 70-85% power turndown while maintaining sufficient mixing throughout the basin.



The EIMCO ExcellAerator, inherent power turndown capability, innovative basin configurations, and our effective (but simple) ACE™ control system:

- Lower Power Costs
- Improve Nitrogen Removal
- Reduce Footprint
- Reduce Maintenance Requirements

(see pages iv and v)

VELOCITY PROFILE IN A FULL-SCALE OXIDATION DITCH

Numbers are velocities in feet per second in the channel cross-section from a full-scale test. The low velocities are shown in red. The low floor velocities along the inside and outside walls are eliminated with the addition of the EIMCO lower turbine system.

The EIMCO Carrousel® System Description

Award Winning Process For Biological Treatment

KEY FEATURES

- ***BOD, TSS, AND NH_3-N REMOVAL***
- ***FEWER PIECES OF EQUIPMENT MEANS LOWER INSTALLED COST***
- ***SIMPLE AND EASY TO OPERATE***
- ***WON OVER 70 EPA, STATE AND LOCAL AWARDS SINCE 1988***
- ***HYDRAULICALLY EFFICIENT SO 70-85% POWER TURNDOWN IS POSSIBLE***
- ***ON SITE PROCESS TRAINING AND EIMCO'S TECHNICAL SUPPORT***

Background

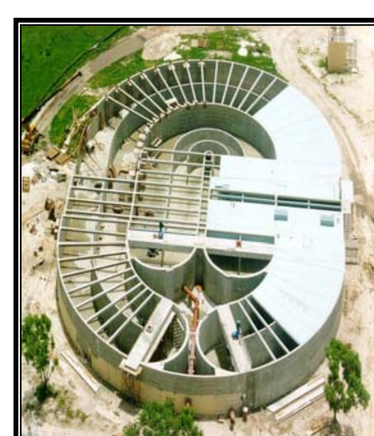
The EIMCO Carrousel System is one of the most successful and widely accepted processes available for biological wastewater treatment. More than 619 treatment plants in the United States and 950 worldwide depend on Carrousel Systems to remove organic contaminants and provide biological nutrient removal. Among owners and operators, the Carrousel System is universally praised for its stability, simplicity, ease of operation and maintenance, low operating cost, and consistent effluent quality.

Developed by DHV Consulting Engineers of the Netherlands, the Carrousel System is unique in that every installation is custom engineered using a proprietary hydraulic model. Eimco Water Technologies engineers use this model to evaluate the energy requirements of a proposed design, to efficiently match treatment capacity to actual requirements, and to define the most affordable layout for a specific site.

As a result, Carrousel System plants display extraordinary operating flexibility and energy economy. Their hydraulic efficiency provides full solids suspension with minimal mixing energy, allowing aeration input to be varied from full power to 15% -30% of the installed power. The ability to actively manage energy use in response to daily, seasonal and service life demand cycles offers the owner significant opportunities to minimize operating expense while maintaining strict permit compliance.

Physical Description

The Carrousel System is a closed loop, oxidation ditch reactor that provides the aerobic component of a very efficient activated sludge system. The layout is a typically a "hotdog" (schematic next page) or "folded over" (photo at top) design. Internal partition walls define flow channels. More creative design configurations are possible as shown in the picture to the right. Vertically mounted, large diameter, low-speed surface aerators are installed at the channel turns, slightly offset in the direction of flow from the centerline of internal partition walls. This arrangement allows the aerators to function as large-scale pumps, driving mixed liquor from upstream to downstream channels and establishing a constant flow velocity. It also divides the basin volume into complete mix and plug flow hydraulic environments, where short intervals of intense aeration and mixing alternate with longer intervals of relatively quiescent, but fully mixed conditions.

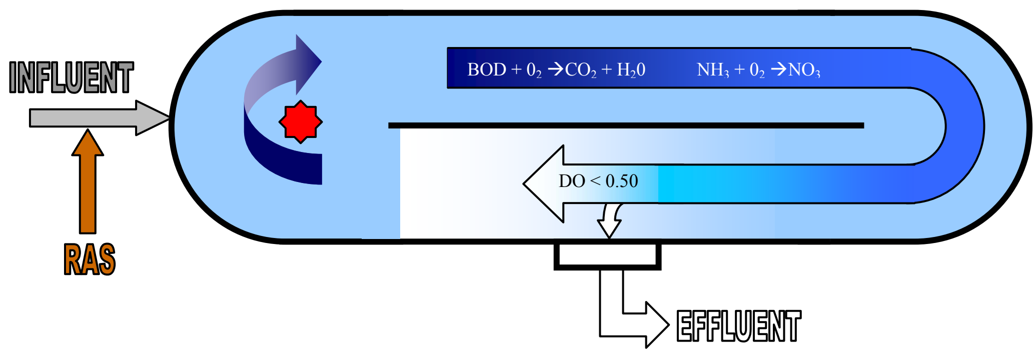


The EIMCO Carrousel® System Description (cont'd)

Award Winning Process For Biological Treatment

Operating Description

In the aeration zone, influent wastewater and returned activated sludge (RAS) are introduced under intense, concentrated mixing action, providing immediate dilution in a mixed liquor volume of 50 to 100 times the influent flow and eliminating the possibility of short circuiting. The concentration of aeration power in a confined volume enhances oxygen transfer efficiency and establishes a uniform dissolved oxygen profile throughout the channel depth.



As mixed liquor enters the downstream channel, the complete mix conditions give way to a plug flow environment in which the channel velocity maintains an energy level high enough to keep solids suspended, but low enough to allow progressive bioflocculation of the mixed liquor solids. In the channels, natural respiration of the biomass produces a gradual drop in DO concentration, which can be managed for various process objectives, including denitrification. The low DO entering the aeration zone also increases oxygen transfer. An overflow weir is located upstream of the aeration zone to take maximum advantage of oxygen management practices and bioflocculation in the downstream channels.

By concentrating the input of mixing and aeration energy in a small portion of the basin volume, and by using the channel velocity to maintain solids suspension in the larger volume, the Carrousel System provides more flexible, efficient aeration with fewer aerators than other oxidation ditch systems and with significantly lower overall power requirements than complete mix systems. The reduced number of aerators and their convenient location simplify and greatly reduce mechanical maintenance requirements.

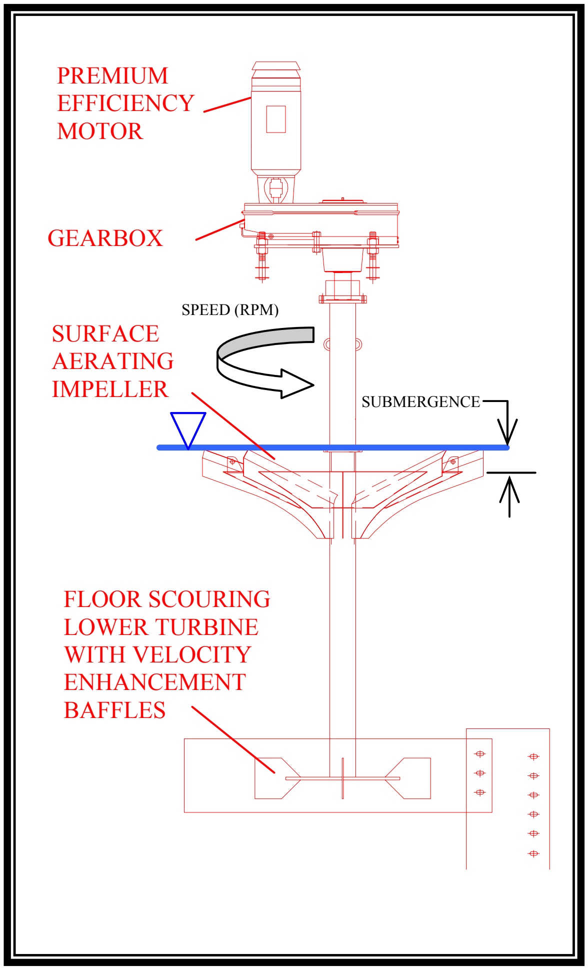
Maximum Mixing, Minimum Power

The operating economies described above depend on a reactor basin where channel velocity is maintained with **the smallest possible input of aeration energy**. All dimensions and specifications that influence this capability are evaluated using the DHV Carrousel System hydraulic model, including impeller type, impeller diameter, aerator rotational speed, aeration zone depth, channel depth and width. The resulting hydraulic efficiency ensures that solids remain in suspension using only a fraction of the installed power.

A Proposal of Excellence

The EIMCO Carrousel System proposed in this document will ensure your client of wastewater treatment performance that will reliably meet the plant's specified effluent discharge limits. In addition, it will provide the owner with a treatment system that is simpler, more stable, easier to operate and maintain and less expensive to operate than any other oxidation ditch configuration. It will provide a flexible platform for future upgrades should they be required by service area growth or more restrictive discharge regulations. Eimco engineers provide process training and start-up technical support so that Carrousel systems perform to their specifications from Day 1. For these reasons, the Carrousel system is a responsible technology investment for you and your client.

THE EXCELL™ AERATOR AND ACE™ CONTROL SYSTEM



The Carrousel process is an inherently efficient system, but it is the EIMCO ExcellAerator that extends that efficiency to all phases of a plant's life—from start-up to maturity. Most plants spend much of their life receiving influent loadings that are less than the design loadings. The ExcellAerator has a surface aerating impeller to provide aeration and mixing and a patented lower turbine system. The lower turbine increases floor velocity by 10-15% compared to older single-impeller designs. The ExcellAerator can draw only 15-30% of nameplate power and maintain sufficient mixing! Power to the aerator is controlled by (1) the rotational speed (rpm) of the impeller and (2) the submergence of the impeller blades.

Power turndown saves communities thousands of dollars in energy annually. In addition, power turndown (or, more specifically, aeration turndown) is essential for nutrient removal plants. Without adequate power turndown, over-aeration often exhibits itself by producing copious quantities of "pin floc".

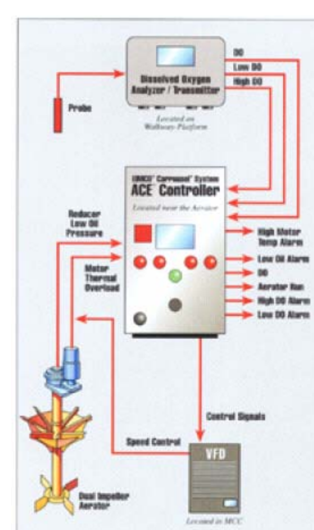
Engineers must design plants with installed aeration capacity that accommodates future loading and redundancy requirements. With the EIMCO process, operators can run the ExcellAerator at much less than the installed power, saving energy and achieving nutrient removal throughout the life of the plant.

EIMCO EXCELLAERATOR

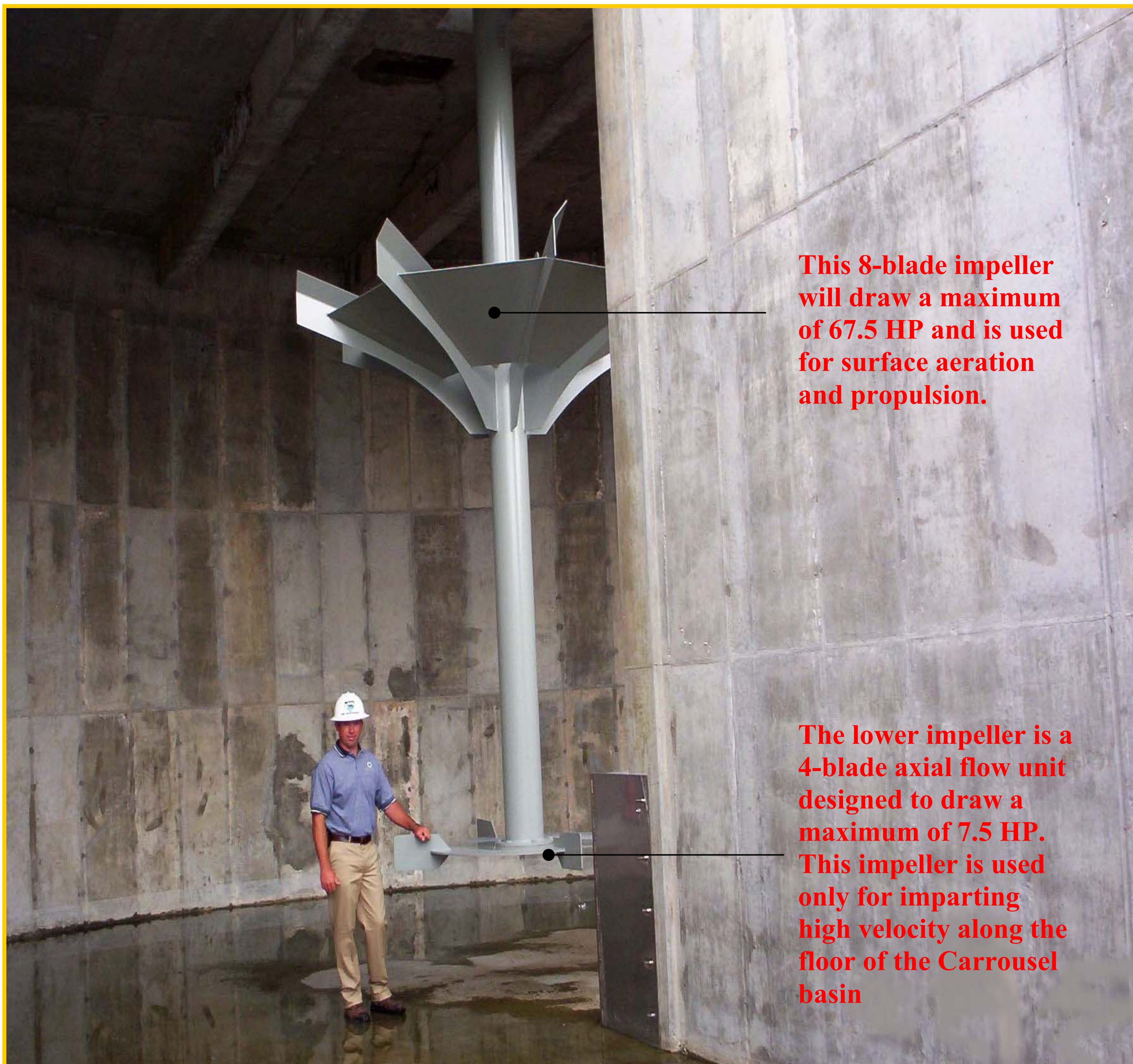
MAXIMUM POWER TURNDOWN DESIGNED FOR THE LIFE OF THE PLANT

The EIMCO Automated Control of Energy (ACE™) System:

Eimco Water Technologies offers the optional ACE system to match delivered aeration power to the oxygen demand of the influent wastewater. The ACE system adjusts aerator power (by adjusting rotational speed of the impeller) to maintain dissolved oxygen in the Carrousel basin at an optimum setpoint. The ACE system is compatible with most plant SCADA systems and dissolved oxygen probes. The ACE system is custom-programmed by an Eimco engineer for each installation—taking into account the specific dissolved oxygen profile in the system, impeller size, and treatment goals. Our customers typically find the cost of the ACE system can be recovered in 2-4 years, based on power savings alone. The process benefits of the ACE system are equally important in nutrient removal plants. Through simple control of dissolved oxygen, the ACE system maximizes nitrogen and phosphorus removal 24 hours per day.



Eimco Dual Impeller Aerator

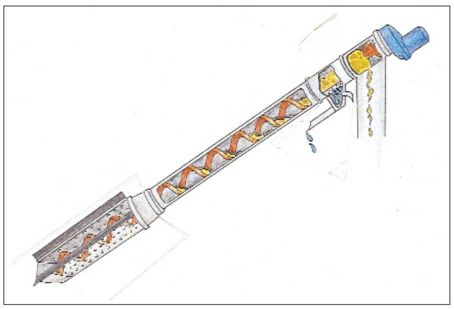


APPENDIX D

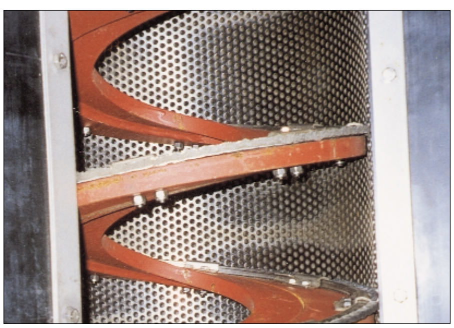
PRODUCT INFORMATION

PARKSON CORPORATION

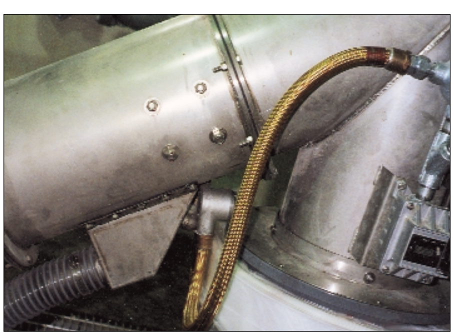
Hycor® Helisieve® In-Channel Fine Screen Model HLS



Combines screening, conveying and dewatering into one reliable, automatic, cost-efficient system.



Durable spiral brush keeps the screen clean.



Close-up view of the new drain box with optional explosion-proof wiring.

All-in-one screening, conveying and dewatering system

The Helisieve system uses shaftless spiral technology to perform screening, solids conveying and dewatering in one cost efficient operation. The heart of the system is a heavy-duty carbon steel spiral that conveys screenings to the dewatering zone and dewaters them to acceptable landfill requirements. The spiral is fabricated in a continuous flight to assure a strong, stable structure. It is surrounded by a stainless steel tube that encloses screenings, minimizes odors and provides clean, hygienic operation.

The Helisieve's shaftless core handles a greater volume of solids than shafted screw designs. Fibrous and bulky solids have a clear, barrier-free path to the dewatering zone. The shaftless design also eliminates the need for maintenance-intensive bottom support bearings and intermediate hanger bearings.

The Helisieve system performs three operations in one:

Screening. Influent moves into the fine screening area where the perforated screen removes solids. A spiral-mounted brush keeps the screen surface clean.

Conveying. The spiral moves the screenings upward through the transport area. There is no shaft to restrict flow or become entangled with long, stringy solids.

Dewatering. Solids are dewatered by compression against a plug of material formed in the flightless zone. Liquid is discharged through a perforated screen. A removable drain box simplifies access to the screen and solids plug. Solids at 40% dry weight are common.

Put Hycor® shaftless spiral technology to work for you!

- Cost-effective — integrates three processes: screening, conveying and dewatering, in one compact unit.
- Efficient — the shaftless spiral provides greater conveying capacity and eliminates entanglement of solids around a shaft.
- Lowers disposal costs — dewatering reduces weight and volume. Forty percent dry weight solids are common.
- Hygienic — screens are enclosed by the stainless steel tube and can be discharged directly into sealed containers to minimize odor and handling. Optional bagger assemblies simplify disposal.
- Designed to last — rugged steel alloy spiral fabricated in a continuous flight to tight manufacturing tolerances.
- Compact and easy to install — shipped assembled, with flexible seals, for quick channel positioning, or in its own tank housing.
- Economical — one low horsepower gearmotor drives the entire system.
- Up-front serviceability — pivots out for easy access for above-channel maintenance.
- Low maintenance — no troublesome submerged end bearings or intermediate hanger bearings.

Screen openings

0.125" and 0.250" (6 mm) diameter and .040" x .4" perforated slots. Other opening sizes are possible.

Shown with optional hydraulic drive design and heat trace jacket.

Helisieve Plus® in-tank system for pumped flows

Screens, conveys and dewaters like the Helisieve unit, but is self-contained in a stainless steel tank. Suitable for industrial and municipal processes.

PARKSON CORPORATION

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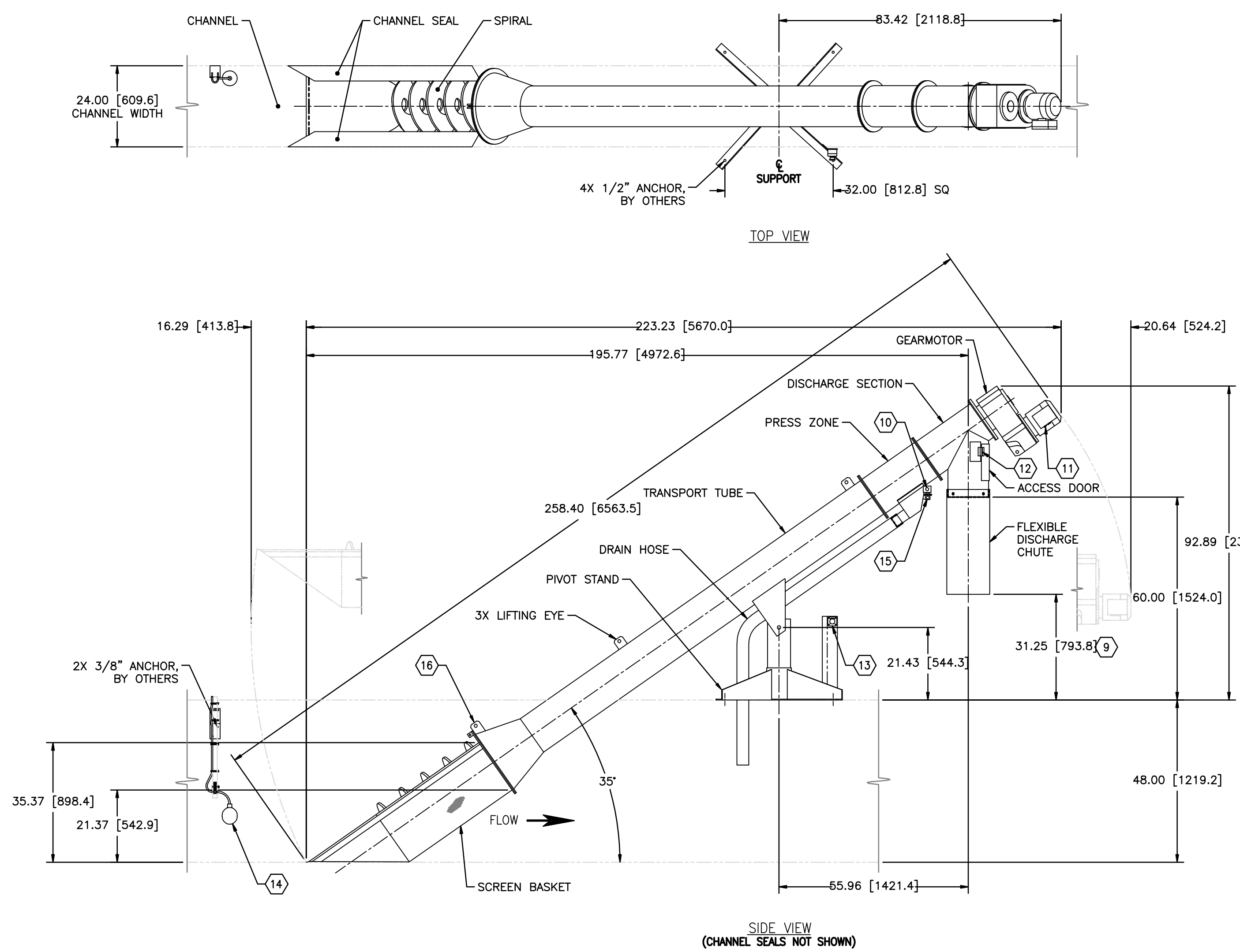
AN AXEL JOHNSON INC. COMPANY



NOTE:

1. ALL 304L STAINLESS STEEL CONSTRUCTION EXCEPT FOR REDUCER, MOTOR, SPIRAL, ELECTRICAL FIXTURES, DISCHARGE CHUTE, AND CHANNEL SEALS.
2. GEARMOTOR: 1.5 HP [1.1 kW], 1800 RPM, 230/460 V, 3 PH, 60 HZ, TEFC, SEVERE DUTY.
3. SPIRAL SPEED: 7.4 RPM.
4. SCREEN OPENING: ø.25 [ø6.4].
5. RECOMMENDED CLEARANCE TO BE 36.00 [914.4] AROUND AND ABOVE UNIT.
6. WEIGHT: 1,755 LB [795 kg].
7. DIMENSIONS WRITTEN IN INCHES [mm] UNLESS OTHERWISE SPECIFIED.
8. PROVIDE SUFFICIENT FLEXIBILITY IN WATER AND ELECTRICAL CONNECTIONS TO ALLOW THE UNIT TO PIVOT OUT OF THE CHANNEL. ALL INTERCONNECTING WIRING, CONDUIT AND PIPING FROM UNIT MOUNTED DEVICES WILL BE SUPPLIED BY OTHERS.
9. GROUND CLEARANCE FOR DISCHARGE RECEPTACLE. DO NOT REMOVE FLEXIBLE DISCHARGE CHUTE/GUARD.
10. NEMA 4X SOLENOID VALVE: 1/2" NPT CONDUIT CONNECTION.
11. MOTOR: 2X 1/2" NPT CONDUIT CONNECTION.
12. NEMA 4X INTERLOCK SWITCH: 6 FOOT [1.8 M] LONG INTEGRAL CABLE.
13. NEMA 4X LOCAL E-STOP: 1/2" NPT CONDUIT CONNECTION.
14. FLOAT SWITCH: 20 FOOT [6.1 M] LONG INTEGRAL CABLE (MOUNTING BRACKET INCLUDED; 1" PIPE PROVIDED BY OTHERS).
15. 3/4" NPT WATER SPRAY CONNECTION.
16. UNIT IS BASKET END HEAVY. CUSTOMER MUST PROVIDE LIFTING DEVICE TO PIVOT UNIT OUT OF CHANNEL. LIFTING CAPABILITY MUST EQUAL A MINIMUM OF 60% OF UNIT WEIGHT, APPLIED AT LIFTING POINT SHOWN. CHANNEL MUST BE EMPTY AND SCREEN BASKET CLEAR OF SOLIDS.
17. STANDARD UNIT SHOWN. CONSULT PARKSON CORPORATION OR YOUR LOCAL HYCOR PRODUCTS REPRESENTATIVE FOR AVAILABLE OPTIONS.

PARKSON CORPORATION

The Owner, Project Engineer, and all others involved with the project design must implement and follow all safety standards required by local, state and federal laws when incorporating Parkson Corporation equipment into the overall project design. Parkson Corporation will not be responsible for location and/or placement of equipment in the plant design, nor is Parkson Corporation responsible for plant safety design and for the failure to follow appropriate safety precautions in the operation and maintenance of Parkson Corporation equipment.

REV	DESCRIPTION	DATE	BY

DRAWN BY	DATE	REFERENCE INFORMATION REV DATE: 03/31/04
CHECKED BY	DATE	
SCALE 1/32" = 1"		INFORMATION ONLY

PROJECT NAME

TITLE
HLS500
HYCOR® HELISIEVE® UNIT

DRAWING NO

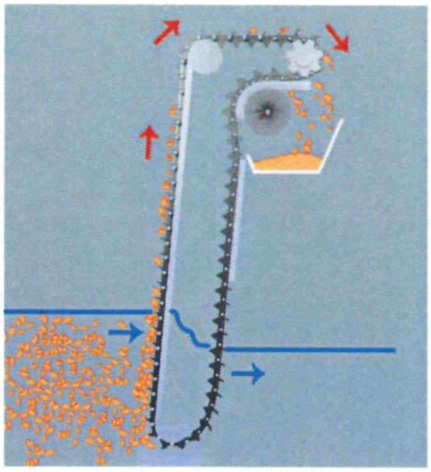
REV

PARKSON CORPORATION

Aqua Guard®

Self-Cleaning Moving Media Channel Screen

The Aqua Guard screen is a self-cleaning, in-channel screening device that utilizes a unique filter element system designed to automatically remove a wide range of floating and suspended solids from wastewater.



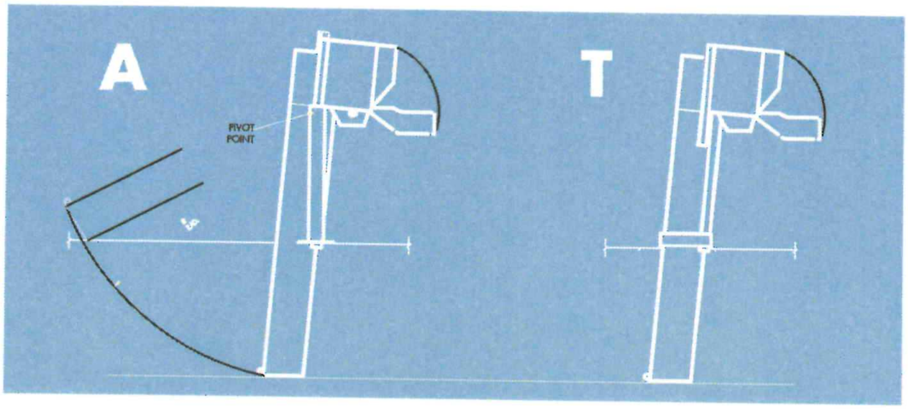
A specific configuration of filter elements is mounted on a series of parallel shafts to form an endless moving belt that collects, conveys and discharges solids greater than the element spacing. Spacing from 0.04" (1 mm) to 1.18" (30 mm) is available.

Principle of Operation Solids contained in a wastewater flow are captured on the filter elements and carried upward on the belt assembly to discharge at the rear of the unit. Two-stage screening is achieved which results in minimal headloss. Coarse filtration occurs on the forward screen face and fine filtration on the recessed face.

As the rake tip of one row of filter elements passes between the shank arm of the lower row, the elements automatically clean themselves. The unit is equipped with a rotating brush that provides additional removal of solids.

Features / Benefits

Features	Benefits
• Low power consumption (1.0 HP or less) • Self-cleaning • Intermittent operation • No submerged bearings • All moving parts can be accessed and serviced above water level • Screens pivots out of channel	Low Operation Costs & Ease of Maintenance
• Coarse and fine screening in one unit • Ability to build precoat	High capture rates
• Flows to 100 MGD in a single unit	High capacity
• Delivered fully assembled • No attachment to sides or bottom of channel	Ease of installation



The Aqua Guard® Screen styles A and T are available in Standard or Heavy Duty design.

Design Parameters Standard screen widths are 1.0' to 9.0' depending on the model with flow rates up to 100 MGD with a single unit. Two frame styles are available depending on space and channel depth requirements. Type A is a pivoting design and Type T is a stationary design.

The Aqua Guard screen can be installed at angles of 60°, 75° and 85° depending on the frame and model selected. For maximum efficiency of operation, greater flow rate and higher solids removal, the recommended angle of inclination is 75°.

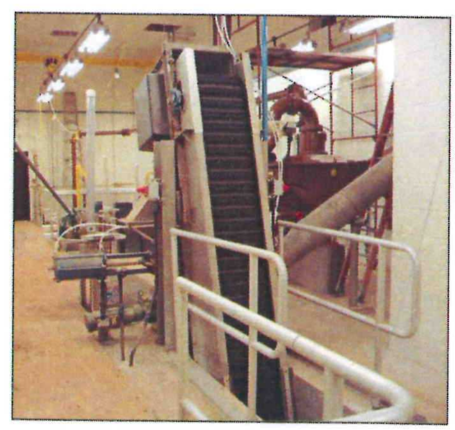
The screen conveys solids up and out of the channel at a speed of 7ft/min. The maximum amount of debris, in cubic yards per hour, that can be removed from the stream is a function of model and angle.

Movement of the screen can be continuous or intermittent. However, intermittent operation is recommended. This allows a mat of solids to build on the filter-rake elements which increases the solids capture rate.

Performance Parkson has over 5,000 installations in a wide variety of municipal and industrial applications.

Design Parameters	Model MN (Standard)	Model S (Heavy Duty)
Minimum Channel Width (in.)	12	24
Maximum Screen Width (in.)	66	108
Maximum Design Headloss (in)	10	20
Fine Horizontal Spacing (in/mm.)	1/24 (1mm)	1/24 (1mm)
	1/8 (3mm)	1/8 (3mm)
	1/4 (6mm)	1/4 (6mm)
	5/8 (15mm)	5/8 (15mm)
		1 1/4 (30mm)
Coarse Horizontal Spacing (in/mm)	1/8 (4mm)	1/8 (4mm)
	3/8 (8mm)	3/8 (8mm)
	5/8 (14mm)	5/8 (14mm)
	1 3/8 (34mm)	1 3/8 (34mm)
		2 5/8 (69mm)
Fine Spacing Contact Surface Area (ft)	0.81	0.901
	0.73	0.733
	0.63	0.694
	0.57	0.591
		0.547
*Trash Capacity (yds^3/hr)		
60°	0.75	2.32
75°	0.50	1.27
85°	0.28	0.99
Filtration Dual	(Coarse & Fine)	(Coarse & Fine)

Based on yds^3/hr per one foot of effective width



Aqua Guard MN 75° 1.5' x 12' in operation

PARKSON CORPORATION

ISO 9001:2000 Certified
Quality Management System

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AG090105

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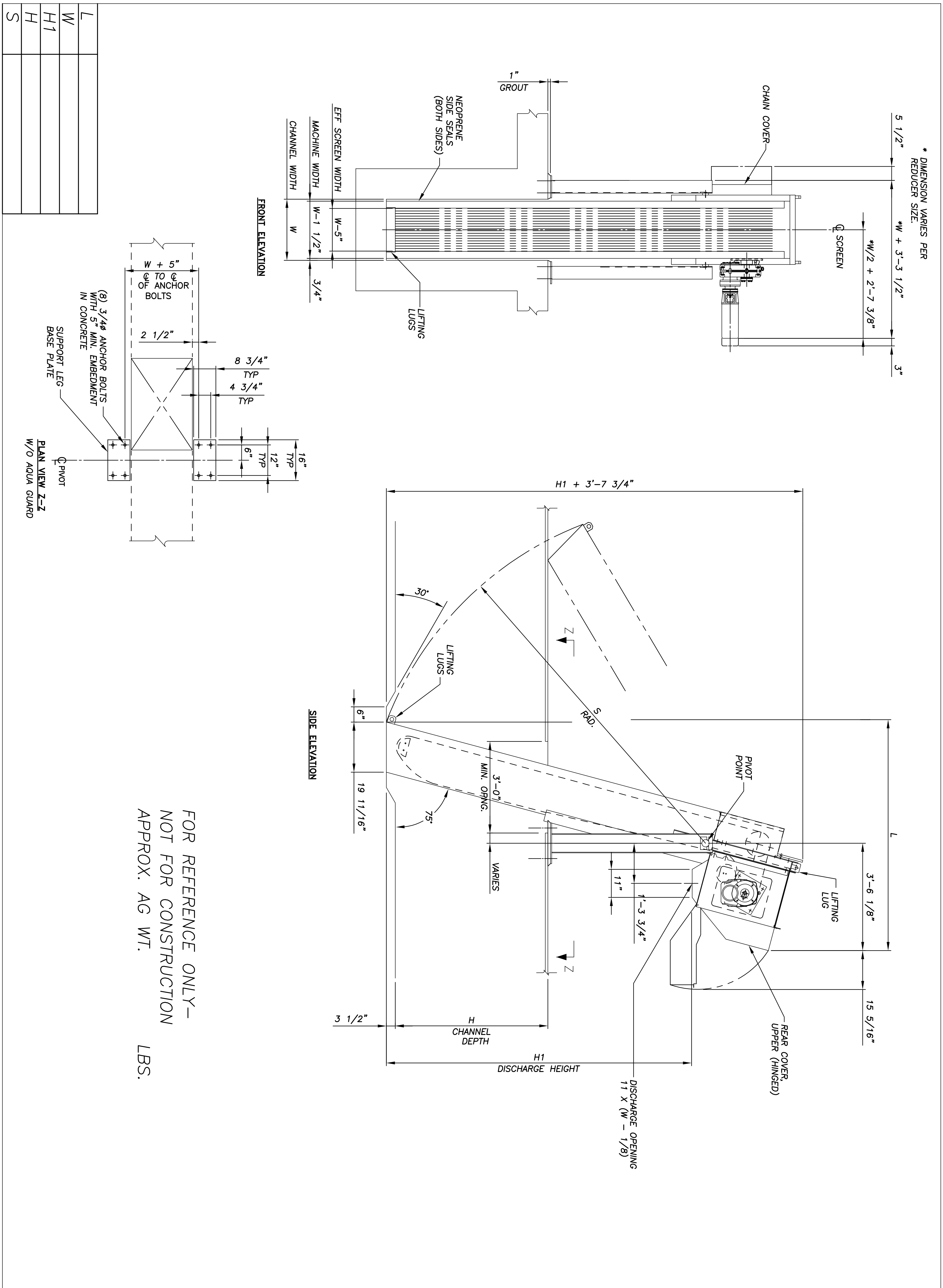

THE OWNER, PROJECT ENGINEER, AND ALL OTHERS INVOLVED WITH THE PROJECT DESIGN MUST IMPLEMENT AND FOLLOW ALL SAFETY STANDARDS REQUIRED BY LOCAL, STATE AND FEDERAL LAWS WHEN INCORPORATING PARKSON CORPORATION EQUIPMENT INTO THE OVERALL PROJECT DESIGN. PARKSON CORPORATION WILL NOT BE RESPONSIBLE FOR LOCATION AND/OR PLACEMENT OF EQUIPMENT IN THE PLANT DESIGN, NOR IS PARKSON RESPONSIBLE FOR PLANT SAFETY DESIGN AND FOR THE FAILURE TO FOLLOW APPROPRIATE SAFETY PRECAUTIONS IN THE OPERATION AND MAINTENANCE OF PARKSON CORPORATION EQUIPMENT.

UNLESS OTHERWISE SPECIFIED	SIGNATURES		DATE
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TOLERANCE: ±	CHECKED:		
	APPROVED:		
	SIZE: D	SCALE: NONE	

REVISION	DATE:	BY:	CHECKED:
	APPROVED:	DESCRIPTION	

PARKSON CORPORATION

Aqua Guard ®Screen

GENERAL ARRANGEMENT

AG-MN-A 75°

PROJECT NUMBER:	DRAWING FILE NUMBER:	REVISION:
PROJECT NAME:	SHEET NUMBER: 1 OF 1	

EIMCO WATER TECHNOLOGIES

Jones+Attwood® JetAir

The New Advanced Grit Removal System

A new circular, vortex grit trap that introduces air floatation to enhance the in-tank classification of the mineral solids.

Patents applied for

A GL&V COMPANY

Introduction

The circular chamber, vortex flow and tangential entry grit traps are now an established method of grit removal from waste water. They form an integral part of the headworks to the waste water treatment plant.

Pista SA of Switzerland introduced the original circular grit trap in 1960. Jones + Attwood were given a world wide selling agreement by Pista for the life of the patent. Jones + Attwood have installed thousands of grit traps throughout the world and lead the field with grit removal technologies.

The new Jetair is the third generation of 'grit traps'. Each in its own right has expanded the boundaries of efficiency for performance and reliability.

Now, the functions of the mechanism have been analysed further and this new development allows the two most fundamental features to be enhanced separately and therefore achieve a maximum result for both.

All grit traps currently available include a means of achieving the rotary motion around the chamber, thus inducing the vortex that encourages solids to migrate to the centre of the chamber for collection. The impeller or propeller is so shaped and sized (and in some cases adjustable) to perform classification of the solids.

Combining these two important functions inevitably results in compromises being made and one or both features will have their effectiveness reduced.

The Jetair provides an impeller that is designed to create the rotary motion only. The correct flow pattern is therefore achievable with this new fixed geometry impeller. Classification of the grit is achieved by the continuous aeration that surrounds the periphery of the impeller.

Low pressure air is delivered to the impeller which expels it in a controlled way from its periphery. The rotation of the impeller drags the air and increases its flow path. This results in the annulus between the edge of the impeller and the grit hopper wall being filled with small air bubbles. The solids that will normally find their way to the hopper with the grit particles are now rejected by the floatation provided by the bubbles. The unwanted solids, rags, paper and other light materials are floated upwards where the surface currents move these solids out of the trap.

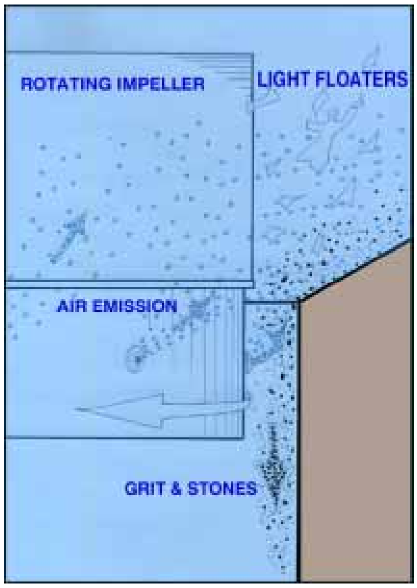
This innovation provides the ideal vortex inducing flow pattern, whilst every solid particle that will enter the 'trapped zone' will pass through the selective air curtain. Therefore the two main features of a grit trap, circular flow and classification, are satisfactorily provided.

The continuous aeration of the incoming flow at this location in the headworks is beneficial to the treatment process.

The illustration shows the importance of providing a controlled aperture for the passage of grit and stones to the collection hopper. The whole of the aperture (annulus) is filled with air bubbles.

There are no fixed supports or pipes to interfere with the passage of the heavy solids.

The vanes of the impeller are now independent of the classification and serve the purpose only of generating the vortex flow.



Pumping of the grit/water mixture can be performed by air-lift pump or motorised grit pumps.

Eimco Water Technologies manufacture and supply the full range of grit separation and grit processing equipment.

Civil construction and installation.

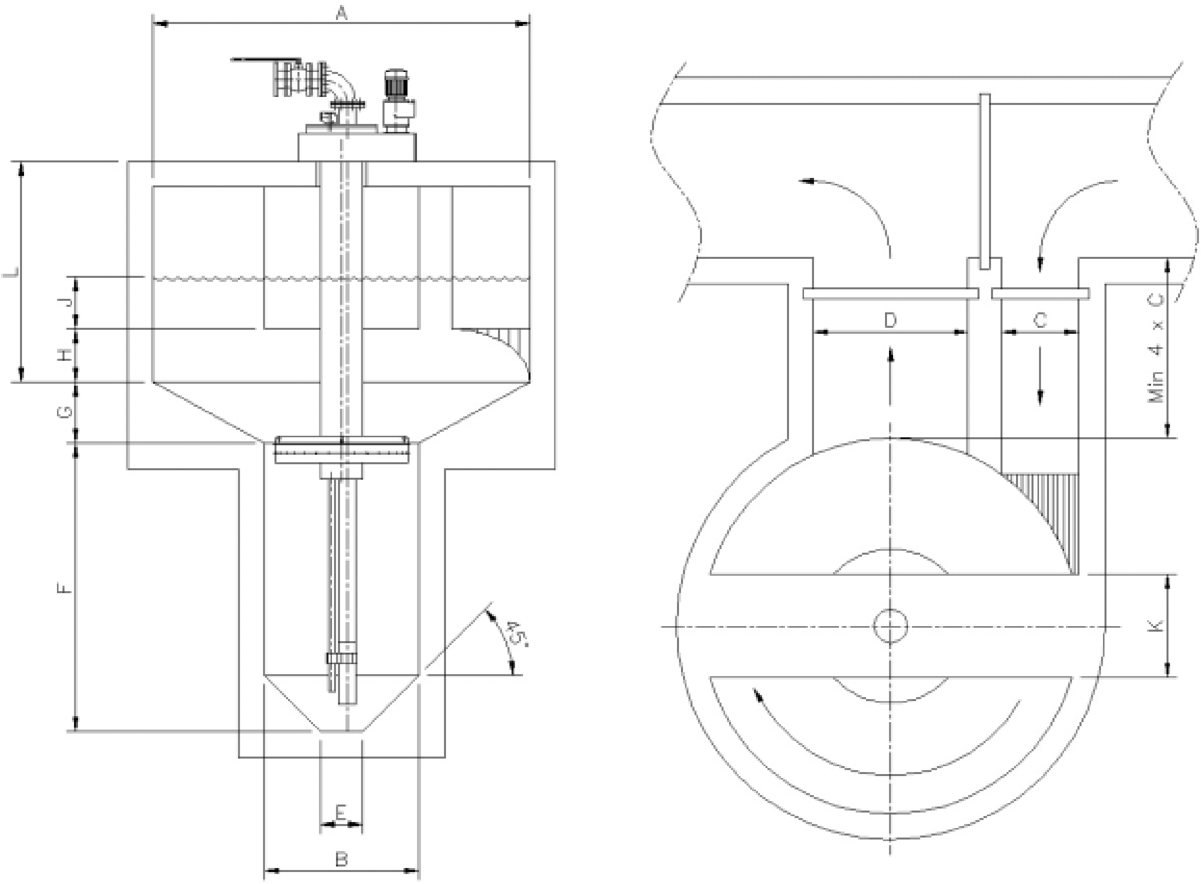
The effects of the continuous aeration can be clearly seen on the tank surface.

The completed Jetair installation.

The small additional blower is designed for quiet operation.

The new Jetair Grit Trap will be supplied with the conventional methods of grit transfer.

Jones+Attwood® JetAir



JetAir Grit Trap dimensions in metres

Jetair Size	Flow 1/sec	A	B	C	D	E	F	G	H	J	K	L
A50	50	1.83	1.0	0.305	0.61	0.30	1.40	0.30	0.30	0.20	0.80	1.10
A100	110	2.13	1.0	0.380	0.76	0.30	1.40	0.30	0.30	0.30	0.80	1.10
A200	180	2.43	1.0	0.450	0.90	0.30	1.35	0.40	0.30	0.40	0.80	1.15
A300	310	3.05	1.0	0.610	1.20	0.30	1.55	0.45	0.30	0.45	0.80	1.35
A550	530	3.65	1.5	0.750	1.50	0.40	1.70	0.60	0.51	0.58	0.80	1.45
A900	880	4.87	1.5	1.00	2.00	0.40	2.20	1.00	0.51	0.60	0.80	1.85
A1300	1320	5.48	1.5	1.10	2.20	0.40	2.20	1.00	0.61	0.63	0.80	1.85
A1750	1750	5.80	1.5	1.20	2.40	0.40	2.50	1.30	0.75	0.70	0.80	1.95
A2000	2200	6.10	1.5	1.20	2.40	0.40	2.50	1.30	0.89	0.75	0.80	1.95

Please note – larger sizes are available. Request details if required.

EIMCO WATERTECHNOLOGIES

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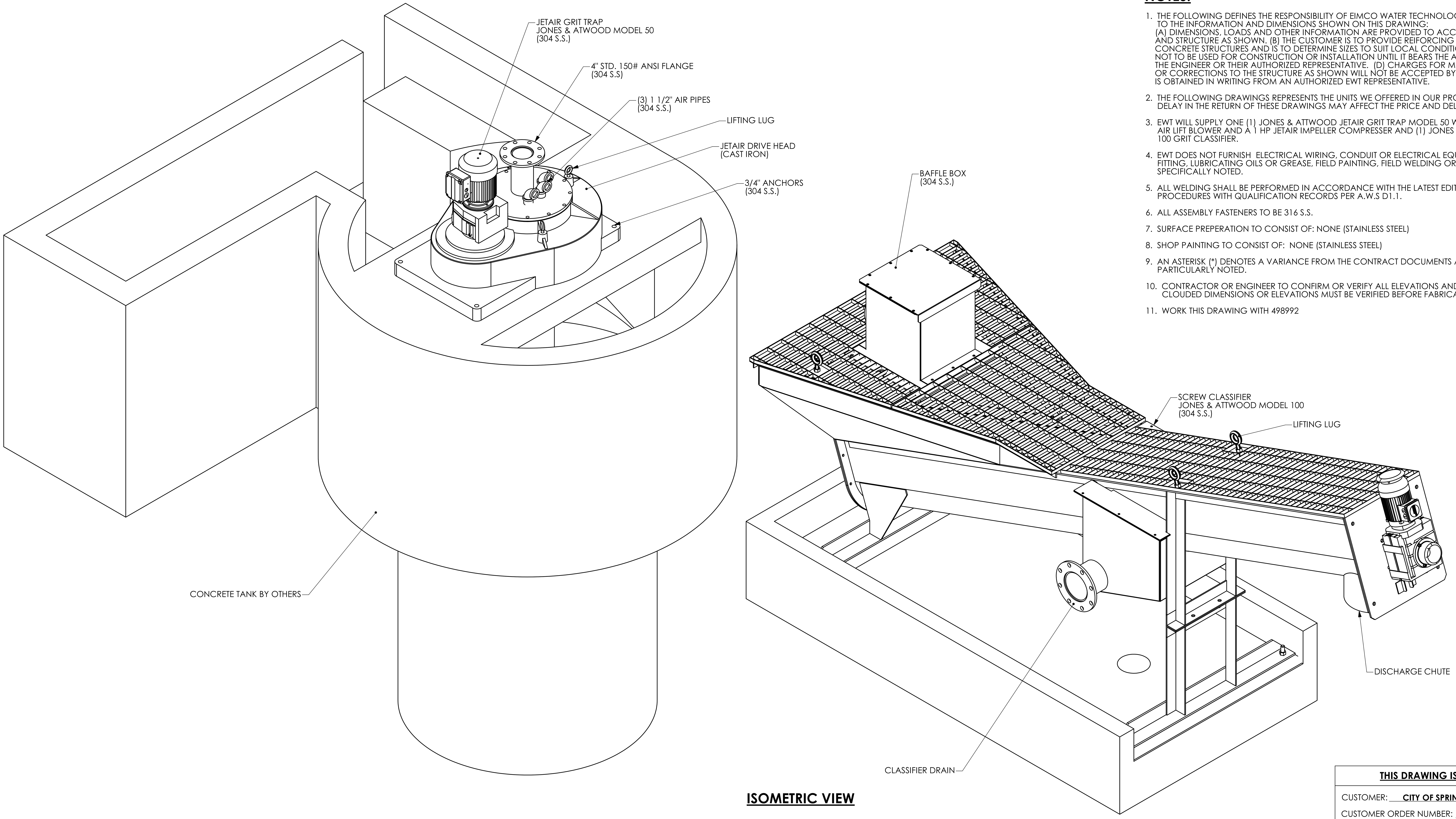

ISOMETRIC VIEW

NOTES:

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2. THE FOLLOWING DRAWINGS REPRESENTS THE UNITS WE OFFERED IN OUR PROPOSAL. ALTERATIONS OR DELAY IN THE RETURN OF THESE DRAWINGS MAY AFFECT THE PRICE AND DELAY SHIPMENT.
3. EWT WILL SUPPLY ONE (1) JONES & ATTWOOD JETAIR GRIT TRAP MODEL 50 WITH A 5 HP AIR SCOUR, AIR LIFT BLOWER AND A 1 HP JETAIR IMPELLER COMPRESSER AND (1) JONES & ATTWOOD MODEL 100 GRIT CLASSIFIER.
4. EWT DOES NOT FURNISH ELECTRICAL WIRING, CONDUIT OR ELECTRICAL EQUIPTMENT, PIPING, VALVES OR FITTING, LUBRICATING OILS OR GREASE, FIELD PAINTING, FIELD WELDING OR ERECTION EXCEPT AS SPECIFICALLY NOTED.
5. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF A.W.S. WELDING PROCEDURES WITH QUALIFICATION RECORDS PER A.W.S D1.1.
6. ALL ASSEMBLY FASTENERS TO BE 316 S.S.
7. SURFACE PREPERATION TO CONSIST OF: NONE (STAINLESS STEEL)
8. SHOP PAINTING TO CONSIST OF: NONE (STAINLESS STEEL)
9. AN ASTERISK (*) DENOTES A VARIANCE FROM THE CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED.
10. CONTRACTOR OR ENGINEER TO CONFIRM OR VERIFY ALL ELEVATIONS AND DIMENSIONS. CLOUDED DIMENSIONS OR ELEVATIONS MUST BE VERIFIED BEFORE FABRICATION.
11. WORK THIS DRAWING WITH 498992

THIS DRAWING IS CERTIFIED FOR:

CUSTOMER: **CITY OF SPRINGFIELD, GEORGIA**
CUSTOMER ORDER NUMBER: **001206**
EWT ORDER NUMBER: **CSW0000028**
PROJECT: **CITY OF SPRINGFIELD WWTF**
PROJECT LOCATION: **SPRINGFIELD, GA**
CONSULTING ENGINEER: **NONE**
BY: **KURT BOUWHUIS** DATE: **JULY 7, 2006**

EIMCO WATER TECHNOLOGIES — A GL&V COMPANY

REVISION	EN	BY	APPR.	DATE			
					D	ORIGINAL S.O.	
					C	CSW0000028	
					B	DATE	7/7/2006
INITIAL RELEASE					A	DRAWN	KRB
						CHECK'D	JLQ

GENERAL ARRANGEMENT
MODEL50 JETAIR W/MODEL 100 CLASSIFIER

DO NOT SCALE PRINTS
REF. FROM
SHEET 1 OF 1
DWG. NO. **498991**
REV A

APPENDIX E

REVIEW OF SLUDGE MANAGEMENT OPTIONS

MEMORANDUM

TO: Bruce Buel, General Manager — November 30, 2007

FROM: Malcolm McEwen
Eileen Shields

SUBJECT: Review of Solids Management Options

DRAFT

Introduction

The District faces several challenges related to wastewater management at Southland Wastewater Treatment Facility (WWTF), including short-term and long-term solids management. Sludge handling at Black Lake and Southland WWTFs has been a concern, and will likely continue to be a concern through the foreseeable future. Ongoing planning efforts (such as the Sewer Master Plan, Southland WWTF Master Plan, Supplemental Water Alternatives Evaluation, and ongoing Southland WWTF Groundwater Evaluation) will assist the District in developing a strategy for addressing these challenges.

In order to provide support during project development, Boyle was hired to prepare a review of regulatory issues, "classifications" of sludge, conceptual processing options, and typical capital and operations/management costs. These issues are summarized below and more fully reviewed in the remainder of this memorandum.

Regulatory Issues

Current regulations concerning solids from wastewater treatment plants are layered and complex. Not surprisingly, the differences in regulations begin with the names used to describe the material in question:

Biosolids or Sewage Sludge?

Federal regulations concerning sewage sludge became effective on March 22, 1993 (The Standards for the Use or Disposal of Sewage Sludge, 40 CFR Part 503). However, since that time the USEPA is apparently discontinuing the use of the term "sewage sludge" in favor of the term "biosolids."

The California Integrated Waste Management Board uses both terms, and describes the difference: "Biosolids are the end product after treating sewage sludge with anaerobic digestion in combination with heat." (www.ciwmb.ca.gov/Organics/Biosolids/)

San Luis Obispo County defines "treated sewage sludge/biosolids" according to the source of the material and its ability to meet various requirements of 40 CFR Part 503.

Federal Regulations

The following summary is taken from a staff report prepared for the California Integrated Waste Management Board:

The US Environmental Protection Agency (USEPA) is responsible for the development and implementation of federal rules and regulations regarding biosolids processing, use, and disposal. The primary federal regulation for biosolids management is 40 Code of Federal Regulations (CFR) 503 (Part 503). In California, the 503 rule is enforced through National Pollutant Discharge Elimination System (NPDES) permits. Promulgated in 1993, the regulations under Part 503 apply to land application, surface disposal, and incineration of biosolids.

Numerous federal regulations in addition to Part 503 also apply to biosolids management.

Federal Classifications

According to the USEPA's *A Plain English Guide to the EPA Part 503 Biosolids Rule* there are 4 categories of biosolids:

1. Exceptional Quality Biosolids: Although not explicitly defined in the Part 503 rule, the Plain English Guide uses the term Exceptional Quality (EQ) to characterize biosolids that meet low-pollutant and Class A pathogen reduction (virtual absence of pathogens) limits and that have a reduced level of degradable compounds that attract vectors.

   EQ biosolids are considered a product that is virtually unregulated for use, whether used in bulk, or sold or given away in bags or other containers.

2. Pollutant Concentration Biosolids: Although not explicitly defined in the Part 503 rule, the Plain English Guide uses the term Pollutant Concentration (PC) to refer to biosolids that meet the same low-pollutant concentration limits as EQ biosolids, but only meet Class B pathogen reduction and/or are subjected to site management practices rather than treatment options to reduce vector attraction properties.

   If pathogens (Salmonella sp. bacteria, enteric viruses, and viable helminth ova) are below detectable levels, the biosolids meet the Class A designation. Biosolids are designated Class B if pathogens are detectable but have been reduced to levels that do not pose a threat to public health and the environment as long as actions are taken to prevent exposure to the biosolids after their use or disposal. When Class B biosolids are land applied, certain restrictions must be met at the application site; other requirements have to be met when Class B biosolids are surface disposed. The land application restrictions allow natural processes to further reduce pathogens in the biosolids before the public has access to the site.

   – A Plain English Guide to the EPA Part 503 Biosolids Rule

   Unlike EQ biosolids, PC biosolids may only be applied in bulk and are subject to general requirements and management practices; however, tracking of pollutant loadings to the land is not required.

   Cumulative levels of pollutants added to land by EQ or PC biosolids do not have to be tracked because the risk assessment has shown that the life of a site would be at least 100 to 300 years under the conservative parameters assumed.

3. Cumulative Pollutant Loading Rate (CPLR) [Biosolids]: CPLR biosolids typically exceed at least one of the pollutant concentration limits for EQ and PC biosolids but meet the ceiling concentration limits. Such biosolids must be applied to land in bulk form. The cumulative levels of biosolids pollutants applied to each site must be tracked and cannot exceed the CPLR.

4. Annual Pollutant Loading Rate (APLR) [Biosolids]: APLR biosolids are biosolids that are sold or given away in a bag or other container for application to the land that exceed the pollutant limits for EQ biosolids but meet the ceiling concentration limits (see below). These biosolids must meet APLR requirements and must be accompanied by specific biosolids application rate information on a label or handout that includes instructions on the material's proper use.

The pollutant limits noted above are summarized below:

USEPA Pollutant Limits for Biosolids

Reference	Table 1 §503.13	Table 2 §503.13	Table 3 §503.13	Table 4 §503.13
Pollutant	**Ceiling Concentration Limits for All Biosolids Applied to Land (milligrams kilogram) [a]**	**Pollutant Concentration Limits for EQ and PC Biosolids (milligrams per per kilogram) [a]**	**Cumulative Pollutant Loading Rate Limits for CPLR Biosolids (kilograms per hectare)**	**Annual Pollutant Loading Rate Limits for APLR Biosolids (kilograms per hectare per 365-day period)**
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Chromium	3,000	1,200	3,000	150
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum [b]	75	-	-	-
Nickel	420	420	420	21
Selenium	100	36	100	5.0
Zinc	7,500	2,800	2,800	140
Applies to:	All biosolids that are land applied	Bulk biosolids and bagged biosolids[c]	Bulk biosolids	Bagged biosolids[c]

Notes:
a Dry-weight basis
b As a result of the February 25, 1994, Amendment to the rule, the limits for molybdenum were deleted from the Part 503 rule pending EPA reconsideration.
c Bagged biosolids are sold or given away in a bag or other container.

Note that recent analytical results for Southland and Blacklake sludge show metals concentrations well below these limits:

Pollutant Levels in District Biosolids Sampled on 8/16/2007

Pollutant	Controlling Pollutant Concentration Limits for Biosolids (mg/kg)	Southland WWTF Sludge (maximum of 3 samples) (mg/kg)	Blacklake WWTF Sludge (maximum of 2 samples) (mg/kg)
Arsenic	41	< 0.25	< 0.25
Cadmium	39	< 0.50	< 0.50
Chromium	1,200	0.54	0.90
Copper	1,500	127	34.2
Lead	300	< 0.25	< 0.25
Mercury	17	< 0.20	< 0.20
Molybdenum	75	0.98	1.41
Nickel	420	< 0.50	0.59
Selenium	36	< 0.50	< 0.50
Zinc	2,800	22.1	34.6

Federal Regulation of Composted Biosolids

The Code of Federal Regulations, Title 40, Part 503 (40 CFR 503) defines time and temperature requirements for Class A and Class B products, as shown below. Composted biosolids that meet both Class A requirements and the maximum pollutant levels of Part 503 are considered "exceptional quality" (EQ) and can be sold in bags or bulk and used without additional regulatory restrictions. Class B composted biosolids can be used on agricultural land where there is no public contact provided additional site restrictions are met.

40 CFR 503 Time and Temperature Requirements for Biosolids Composting

Product	Regulatory Requirements
Class A	Aerated static pile or in-vessel: 55 ˚C for at least 3 days. Windrow: 55 ˚C for at least 15 days with 5 turns.
Class B	40 ˚C or higher for 5 days during which temperatures exceed 55 ˚C for at least 4 hours

Source: 40 CFR Part 503, via US EPA. Biosolids Technology Fact Sheet, Use of Composting for Biosolids Management. September 2002.

California State Regulations

Numerous California agencies have the ability to regulate biosolids management practices, as summarized below:

Agency	Authority
California Department of Health Services (DHS)	The DHS administers the California Hazardous Waste Control Law (HWCL) and has responsibility for determining whether biosolids are a hazardous or nonhazardous material.
State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs)	Through its nine RWQCBs, the SWRCB allows for individual waste discharge requirements (WDRs), or general waste discharge requirements (GWDRs) to regulate the discharge of biosolids to land. In order to streamline the permitting process, the SWRCB authorized the RWQCBs to prescribe GWDRs for Class B and Class A biosolids.
California Integrated Waste Management Board (CIWMB)	In 1995, the CIWMB established composting regulations that are applicable to biosolids composting. The regulations were amended by the CIWMB in November 2002 and last revised effective April 2003.
California Air Resources Board (CARB)	The CARB conducted a review of the PM-10 (10 microns in diameter) standard as a requirement of the Children's Environmental Protection Act (Senate Bill 25, 1999, Chapter 731). The anticipated tightening of air particulate standards will increase regulatory control of agriculture, particularly the application of biosolids products, such as compost at agricultural sites.

Source: California Integrated Waste Management Board Meeting, Agenda Item 4, 4/13/2004.

California State Classifications

According to the California Integrated Waste Management Board, there are essentially three categories of biosolids: Class B biosolids, Class A biosolids, and Exceptional Quality (EQ) biosolids.

- Class B biosolids may have low levels of pathogens which rapidly die-off when applied to soils, essentially becoming pathogen-free within a short period following application when the "Part 503" Rule requirements are followed.

- Class A biosolids are essentially free of pathogens prior to land application. The metal contents requirements under the Part 503 Rule are the same for Class A and Class B biosolids.

- Exceptional Quality biosolids have lower metals concentration requirements than either Class A or Class B biosolids and have the same pathogen levels as Class A biosolids.

County Regulations

Land application of "biosolids," (also referred to as "treated sewage sludge") is regulated under Chapter 8.13 of the Health and Safety Code. Key provisions of that regulation include:

- Defines biosolids and exceptional quality biosolids.
- Remains in effect until 2/28/2010 or until a permanent ordinance is adopted, which ever occurs first.
- Requires notification of the Public Health Department, Environmental Health Services Division 30 days prior to the land application of biosolids exceeding or equaling 5 cubic yards,
- Places a moratorium on land application of biosolids other than exceptional quality biosolids.
- Places a cap of 1,500 cubic yards on the cumulative total of exceptional quality biosolids that can be land applied within SLO County in any 12-month period,
- Allows unused capacity (of the 1,500 cubic yards noted above) to be carried over for a 12-month period.
- "Biosolids" as used in this ordinance also excludes biosolids that have been composted with other organic products such as green waste and sold in bulk form.

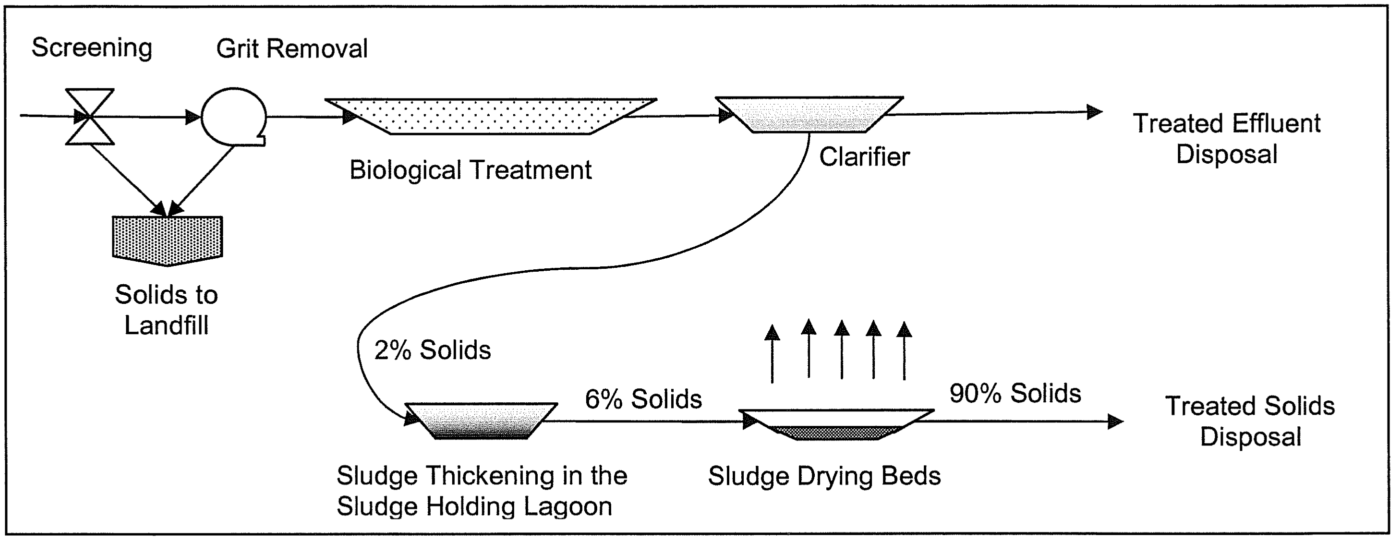
Current NCSD Solids Management Approach

Influent solids entering the Southland WWTF pass through grinders at the plant headworks before being pumped to the aeration ponds. The aeration ponds provide a zone for solids settling and aerobic treatment for the wastewater. Two types of solids are contained within the ponds: inorganic solids and end products of aerobic degradation of organic waste. Anaerobic zones exist near the bottom of the ponds, allowing some solids digestion to take place. Solids that build up in the aeration ponds are periodically moved to onsite drying beds.

Influent solids in Blacklake WWTF receive similar treatment: grinding then settling in the aeration ponds. When solids are removed from the Blacklake aeration ponds they are transported to the Southland WWTF for drying.

Solids are not removed from the Southland site on a regular schedule because their rate of accumulation is small in comparison to the volume available for storage and digestion. The present plan for disposal involves on-site drying then either land application or hauling to a landfill. The solids currently drying on-site contain a significant quantity of grit and other fixed solids, as well as sand and gravel which were incorporated into the material during its removal from the settling ponds. These materials make the sludge unacceptable by the nearest composting facility (Engel & Gray in Santa Maria). Planned headworks improvements (screening and grit-removal) will reduce the amount of these unacceptable materials in the sludge generated at Southland WWTF in the future.

Expected Solids Loading



Future Solids Generation and Treatment Flow Chart for Southland WWTF

For planning purposes, we are assuming the Southland WWTP will be upgraded to use a Biolac® treatment process, and that plant upgrades will include screening and grit removal. Influent solids that pass screening and grit removal will enter the aerated Biolac® treatment pond. During treatment additional solids will be created. (These solids are the residual cellular material of the micro-organisms that provide "treatment" of the wastewater.) Within the Biolac® treatment pond the movement of the diffusers and fine aeration will keep solids in suspension. These suspended solids will pass into clarifiers where settling occurs. From the clarifiers, waste sludge will be pumped into sludge holding lagoons for further settling and storage. Recent analyses (8/16/2007 samples) show a solids content of approximately 2% in the material pumped to the sludge holding lagoons. Further settling occurs in the sludge holding lagoons, increasing the solids content further.

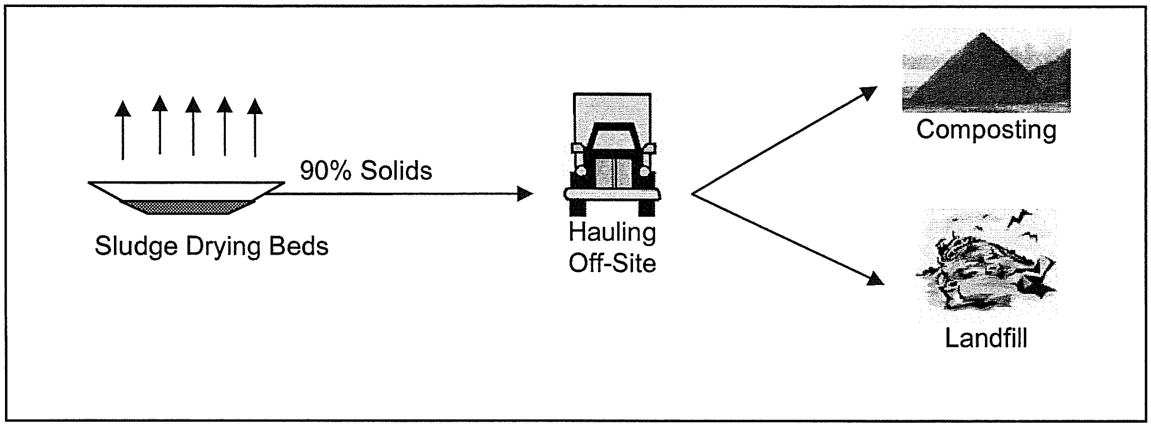
At the buildout flow rate (Average Annual Flow = 1.67 mgd in the year 2030), assuming settling to 6% solids, storage capacity in the Southland WWTF sludge holding lagoons is approximately 1 year. From here, there are several different processing options for the biosolids, as discussed below.

When operated at the full design capacity of 1.67 MGD the Southland WWTF is estimated to produce 3,600 lb/day of solids. Assuming the Blacklake plant produces a similar volume of solids per gallon of wastewater, its average flow of 0.15 MGD would contribute an additional 360 lb/day of solids, bringing the total solids load for the district to approximately 4,000 lb/day. Because no upgrades of the system are anticipated, we assume that accumulated solids from the Blacklake treatment facility will continue to be transported to the Southland site for drying and/or additional treatment.

Conceptual Processing and Disposal Options

Three options for additional processing and disposal or reuse of District biosolids are described below.

Hauling Dried Sludge to Receiving Facility or Landfill



Solids can be hauled to sludge receiving facilities for composting, land application, incineration, or other methods of disposal. Numerous wastewater agencies in SLO County utilize this option, including the South San Luis Obispo WWTP, Pismo Beach, Morro Bay, California Men's Colony, Cambria CSD, San Simeon CSD, and Cypress Ridge. The solids can be taken "wet" from the sludge holding lagoons (at approximately 6% solids). To reduce volume and weight (ultimately, disposal cost), additional processing may include using drying beds, or mechanical dewatering (for example with a belt press or centrifuge) before hauling for disposal or reuse.

Commercially operated composting facilities in Santa Barbara County (Engle and Gray in Santa Maria) and Kern County (San Joaquin Composting) accept sludge from municipal wastewater treatment facilities.

The District can dispose of their sludge by having it hauled to a receiving facility for composting, landfill, or some other disposal option, as shown below.

Several landfills in San Luis Obispo County are willing to accept sludge, at 50% solids or drier, either as inputs to a composting operation, or as waste for landfill.

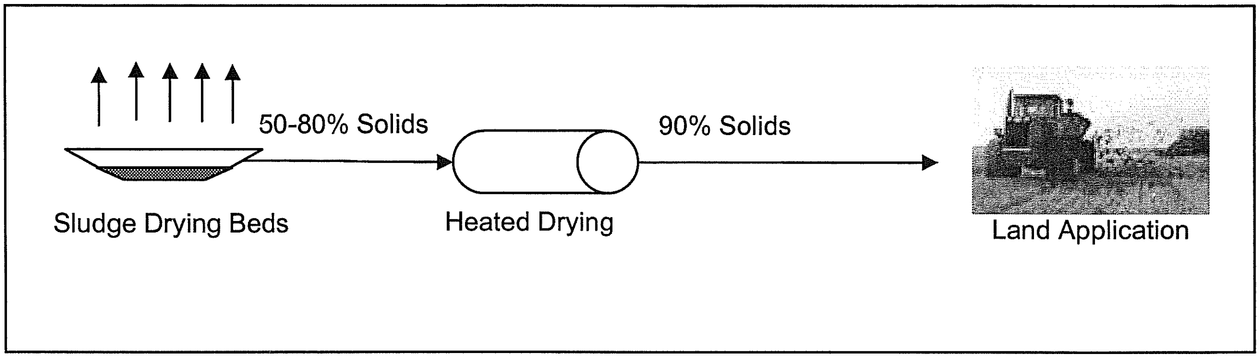
Advantages to hauling include:

- Minimal labor requirements;
- Minimal processing requirements;
- Lowest construction cost option (at the present time);
- Minimal permitting requirements;

Disadvantages include:

- Reliance on receiving facilities;
- The potential for tipping and transportation costs to increase; and
- Loss of a potential resource.

Land Application of Biosolids by District



Biosolids can be applied to land. These applied biosolids replenish organic material and supply nutrients. There are several methods for application and the method selected is dependent on the type of land use and the consistency of the biosolids. Liquid biosolids (containing between 3 and 6 percent solids) can be applied to land surfaces or injected into soil. Dewatered biosolids of up to 30 percent solids have a consistency of damp soil and can be easily applied with conventional agricultural equipment.

Federal regulations establish criteria for biosolids quality and restrictions on land application use. Biosolids must be processed before land application to help minimize odors, reduce vector attraction, and reduce or eliminate pathogens. State and local regulations establish further requirements.

To meet these regulations to minimize odors, reduce vector attraction, and reduce or eliminate pathogens, the District could use a heated drying process following the sludge drying beds, as shown above.

Note that an interim San Luis Obispo County ordinance greatly restricts land application as a viable option. Approved in March 2004, Ordinance 3023 creates a moratorium on the land application of biosolids, other than those classified as exceptional quality (EQ). Composted biosolids are excluded from the County ordinance. The ordinance was initially approved with a 24-month time period, then was amended in February 2006 to extend until February 28, 2010 or until a permanent ordinance is adopted. It places a cap of 1,500 cubic yards on the permissible volume of exceptional quality (EQ) biosolids land applied in the County in any calendar year.

Assuming the District's biosolids were dried to 90% solids, resulting in a bulk density of 1100 pounds per cubic yard, existing Blacklake and Southland WWTF flows would produce approximately 800 cubic yards per year. At Southland plant's upgraded capacity (1.67 MGD) approximately 1,300 cubic yards of biosolids would be produced. Therefore, at these rates the District would now be applying over one-half of the annual biosolids land application allocation for the entire county, and would eventually consume over 80% of the County-wide allocation.

Land application rates are also limited by the ability of the crop to uptake nutrients contained in the biosolids – the "agronomic rate". The agronomic rate is determined by soil conditions, nutrient content of the biosolids (nitrogen typically being the limiting nutrient), crop requirements, and other factors. Typical nitrogen concentrations in municipal wastewater biosolids are 4% (*Use of Reclaimed Water and Sludge in Food Crop Production*, National Academy Press, 1996.) Agronomic loading rates for crops are typically between 150 and 250 lb/acre per year. Assuming 4% total nitrogen in the biosolids, and an agronomic rate limited by 200 lb/acre of nitrogen, approximately 290 acres would be needed for land application of biosolids generated by the Blacklake and upgraded Southland wastewater plants when operated at design capacity. The required area could be larger or smaller depending on the agronomic rate that is determined for the specific soils, crops, management practices, and conditions at the time of application.

Note that public perception may present a significant obstacle to land application. SLO County enacted regulation of land application of biosolids in part due to negative public perception of land application of biosolids. These regulations were intended to "regulate" land application, but have effectively stopped land application of biosolids within the County (pers. comm. with Curt Batson, Director of Environmental Health Department, SLO County).

EQ (exceptional quality) biosolids must be free of pathogens, non-attractive to vectors (rodents and insects), and cannot exceed specified concentrations of various metals. Recent laboratory results tend to indicate that Southland WWTF solids meet the metals requirements. However, requirement to reduce pathogens and vector attraction will require either the use of digestion or composting.

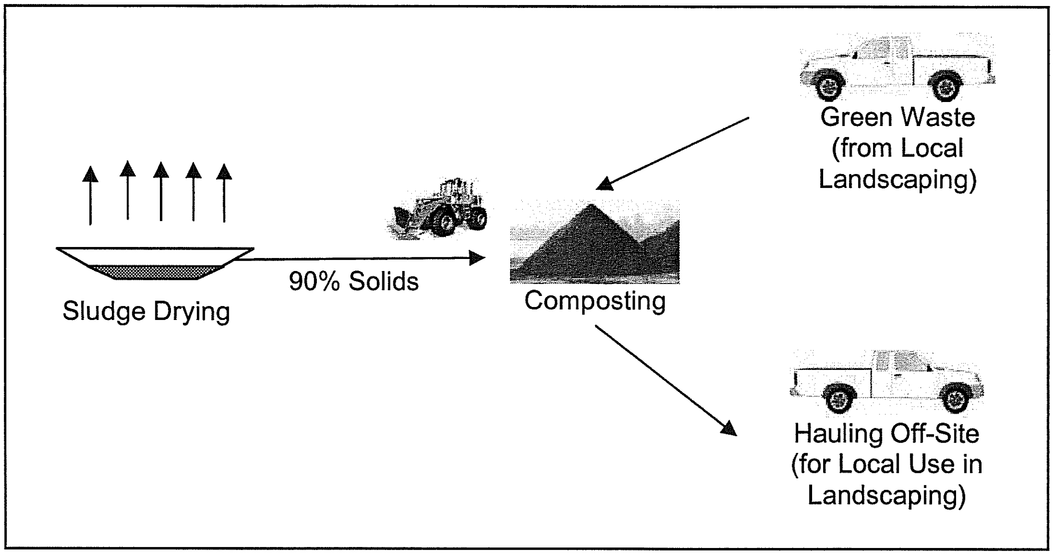
Land application has some advantages in comparison to other disposal options:

- Does not require bulking agents;
- Does not require hauling long distances.

However, land application has several significant disadvantages:

- Significant treatment, monitoring, and reporting requirements;
- Negative public perception; and
- Land application by other facilities may exhaust the allowable County-wide application rate.

Composting Biosolids with Green Waste



Biosolids are composted by being mixed with a bulking agent (typically wood chips, saw dust, or green waste) and placed in piles or an enclosed vessel where microbial activity breaks down the materials and raises the temperature. The increased temperature reduces or eliminates pathogens. Temperature and time requirements for pathogen reduction are dictated by federal, state, and local regulations and vary for the desired end-use of the product. The resulting compost is a humus-like material that can be used as a soil amendment to provide important nutrients and improve soil texture.

To produce composted biosolids the District could dedicate one of the sludge drying beds for this purpose, using locally produced green waste as the bulking agent, as shown below.

There are three common methods for composting municipal wastewater sludge.

- Aerated static piles are long piles of dewatered sludge mechanically mixed with a bulking agent spread over a bed of perforated pipes through which air is transferred. This method has an extensive operating history and is adaptable to changes in biosolids and bulking agent characteristics, but has wide ranging capital costs and requires a moderate amount of labor.

- Windrows are long piles of dewatered sludge mixed with a bulking agent. Because windrows are without supplied air, the piles are mechanically turned periodically to induce air transfer and supply oxygen. Windrows are a proven technology on the small scale and are also adaptable to changes in biosolids and bulking agent characteristic. Capital costs are relatively low, but operations are labor intensive.

- In-vessel composting is done by placing a mixture of dewatered sludge and bulking agent into a silo, vessel, tunnel, or channel. Mixing devices, such as augers or rams, are used to aerate and move the product through to the point of discharge. In-vessel technology has a short operating history, is sensitive to changes in biosolids and bulking agent characteristics, and has high capital costs compared to other methods. In-vessel composting is not labor intensive, but relies highly on mechanical equipment. Main advantages include small land area requirements and increased control of air pollution (odors, dust, particulates, etc) from the compost.

Green waste may be readily available in Nipomo. At the present time annual green waste chipping events are sponsored by the Fire Safe Council with the assistance of the California Department of Forestry and the Air Pollution Control District. Residents are encouraged to pile their clean yard waste materials near the curb for this free on-the-spot chipping service. It may be possible to collect green waste material through this program for composting with biosolids.

Challenges involved with starting a composting program may include:

- Capital cost for equipment and on-site improvements,
- Acquiring an adequate volume of green waste or other bulking agent,
- Labor requirement to maintain the composting,
- The potential for odors at the composting site,
- Meeting regulations for composted biosolids,
- Determining a market for the end product, and
- The risk that future regulations will tighten for composted biosolids.

However, biosolids composting has several desirable aspects, such as:

- Establishing a local beneficial use,
- Creating a resource out of a product previously viewed as waste,
- Less reliance on decreasing landfill space for solids disposal,
- Added flexibility for solids processing, and
- Reduction of transport and disposal fees.

Currently, Morro Bay/Cayucos Wastewater Treatment Plant is the only facility in San Luis Obispo County that composts biosolids from their treatment facility. Since 2002, staff there have been developing the beneficial reuse program and are currently composting approximately 50 percent of the treatment plant's digested biosolids onsite with windrows using EPA 40 CFR 503 guidelines. The facility produces exceptional quality (EQ) biosolids compost using green waste from local arborists and the City of Morro Bay. At this quality, the product is essentially free from restrictions, save record-keeping and laboratory proof of EQ standards. The compost is given away to the public and private landscapers for use.

Typical Capital and O&M Costs

Typical costs for capital improvements and operation and maintenance are projected below. These projections are based on plant flows at buildout. Projected costs are given in present value.

Hauling to Sludge Receiving Facilities/Landfills

The relative cost of wet and dried hauling options are compared below. As is evident, drier sludge costs less to remove.

Table 1 Biosolids Hauling Cost Opinion - Comparison of Varying Solids Content

Option	Units	Wet from Sludge Holding Lagoons	Dry from Sludge Drying Beds
Solids Content	% by weight	6%	90%
Solids Loading Rate	lb/day	3,980	3,980
Sludge Loading (includes water)	tons/year	12,100	700
Truck Capacity	tons	25	25
Truck Loads per year	loads per year	484	28
Trucking Fee to SJ Composting	$/truck load	$680	$483
Tipping fee	$/ton	$26	$26
SJ Composting tipping fee	$/truck load	$650	$650
Total cost per truck	$/truck load	$1,330	$1,133
Cost per year (1)	$/year	$640,000	$32,000
Total cost per ton of sludge (1)	$/ton	$53.00	$45.00
Total cost per ton of solids (1)	$/ton	$890.00	$44.00

(1) Rounded to 2 digits.

Upgrading the existing sludge-drying beds initially and building additional sludge-drying beds in the future is recommended in the Southland Wastewater Treatment Facility Master Plan:

> *Although the District has used the existing drying beds successfully for many years, we recommend upgrading them. The beds are not lined, and any infiltration through the bottom of the beds could contribute to groundwater degradation. In addition, the beds will be used more regularly in the future and should be lined with concrete to allow vehicles and equipment to work in the ponds without getting stuck. Therefore, initially (during construction of the Phase I Biolac improvements – in the next 2 years) we recommend lining the ponds with concrete and installing a decanting pump station for dewatering the beds and conveying supernatant back to the plant's headworks for treatment. ...*

In the next phase of construction, it is recommended that the District construct two (2) new sludge drying beds by 2015 (simultaneously with Phase II upgrade of the Biolac system to meet 2030 demands) similar in size to the existing beds.

Typical present value (2007) costs that can be expected for hauling dried biosolids from the Southland WWTF are summarized below.

Typical Costs for Hauling Offsite	Capital Cost	O&M Cost	Annual Cost [2]
Construct drying beds [1]	$1,540,000		$135,000
Hauling and Tipping Fees;		$32,000	32,000
Contingency		20,000	20,000
Total	$1,540,000	$52,000	$187,000

1. Cost projection for two additional solids drying beds in Southland WWTF Master Plan, 2007.
2. Amortized at 6% over 20 years.

Composting by the District

Capital costs for composting are wide ranging, as there are different technologies. In-vessel composting has the highest capital costs. Aerated piles require the installation of piping to provide air circulation under and into the pile. Windrows offer the lowest capital costs and equipment requirements.

The City of Morro Bay operates their composting pilot project with little to no additional capital costs. Their existing concrete-lined drying beds and a front-end loader are used for composting windrows and green waste is collected from local arborists and the City. The composting operation is run from May through December and ongoing costs include the part-time labor of one employee (approximately ¾-time) and laboratory analyses. Some money is saved by diverting 50 percent of the biosolids that would otherwise be hauled to San Joaquin Composting. The cost to implement a full-scale composting operation onsite as part of the planned Morro Bay treatment plant upgrade was recently estimated to range from $800,000 to $2,400,000. A wide range of costs resulted because a number of different treatment options were examined.

Typical costs that can be expected for windrow composting at the Southland WWTF are summarized below.

Typical Costs for Composting Biosolids	Capital Cost	O&M Cost	Annual Cost [2]
Construct a paved/concrete-lined surface[1]	$1,540,000		$135,000
Front-end loader to move, turn piles [3]	100,000		10,000
One employee, 3/4-time [5]		$38,000	$38,000
Laboratory analyses [4]		20,000	20,000
Fuel, repairs, and contingency		20,000	20,000
Total	$1,640,000	$78,000	$223,000

(1) Cost projection for two additional solids drying beds in Southland WWTF Master Plan, 2007.
(2) Amortized at 6% over 20 years. (3) Based on $95,000 bid for standard bucket loader, City of Santa Maria, May 2005. (4) 6 analyses per year. (5) Based on 2007-08 proposed District budget, average total cost $48,371 per employee.

For comparison purposes, as part of the August 2007 "Viable Project Alternatives Fine Screening Analysis" for the Los Osos Wastewater Project the capital and annual O&M costs for a composting facility for a wastewater treatment plant designed to treat a wet-weather flow of 1.4 MGD were estimated to be $1 million and $180,000/year, respectively.

Land Application

Land application of biosolids (without composting) requires production of Class A exceptional quality (EQ) biosolids. This requirement could be met by using a heat dryer which raises the biosolids temperature to 80 deg C and reduces the moisture content to 10% or less. Hauling costs would be significantly less than for hauling to a disposal/composting facility, assuming the land application site is relatively close to the biosolids treatment site.

Typical costs that can be expected for heat drying and land application are summarized below. These costs do not include the cost of land purchase.

Typical Costs for Land Application	Capital Cost	O&M Cost	Annual Cost [2]
Construction [1]	$3,600,000		$315,000
O&M [1]		$130,000	$130,000
Hauling [3];		20,000	20,000
Contingency		21,000	21,000
Total	$3,600,000	$171,000	$486,000

1. Scaled up from "Viable Project Alternatives Fine Screening Analysis" estimate for Los Osos WWTP operating at 1.4 MGD.
2. Amortized at 6% over 20 years.
3. Assumes no cost for tipping.

Summary

At design capacity the Blacklake WWTP and the upgraded Southland WWTF are expected to produce approximately 4,000 lb/day of solids. A number of different disposal options were considered. Three disposal options appear suitable for the District's needs at this time: (1) hauling to an offsite facility for composting or other disposal method, (2) onsite composting with locally collected green waste, and (3) land application of heat-dried biosolids.

Hauling to an offsite facility involves little additional effort, but may become more expensive as fuel prices rise and regulations change. No capital investments are needed at the present time, but an additional sludge drying bed will need to be constructed as plant flows and associated solids loads increase.

Composting on-site requires some additional capital investment, a dedicated operator, a readily available supply of greenwaste, and a market for the compost.

Land application will require capital investment in a facility to reduce vector attraction, and eliminate pathogens. A recently enacted County ordinance places significant restrictions on the land application option. At projected flow and solids production rates for the year 2030, 290 acres of land may need to be available for land application.

Typical capital and O&M costs for these three options are shown below.

Typical Costs for Biosolids Disposal	Capital Cost	O&M Cost	Annual Cost (2)
Hauling Offsite	$1,540,000(1)	$50,000	$190,000
Onsite Composting	$1,640,000	$80,000	$220,000
Heat-Drying and Land Application	$3,600,000	$170,000	$500,000

(1) Capital improvements for offsite hauling will not be needed until solids loading rates exceed current capacity.
(2) Amortized at 6% over 20 years

❖

Copy to: Mike Nunley, Managing Engineer

DRAFT

APPENDIX F

SPG SOLAR BUDGETARY PROPOSAL FOR SOUTHLAND WWTF

November 12, 2007

Mr. Bruce Buel
General Manager
Nipomo Community Services District
148 S. Wilson Street
Nipomo, CA 93444

Re: Budgetary Proposal – 500kW PV Tracker

Dear Mr. Buel:

Thank you for the opportunity to present this budgetary proposal for your evaluation and planning purposes. The proposed system is custom designed to fit the narrow parcel of land NCSD owns adjacent to the aeration ponds.

The system is sized to fit comfortably on the parcel of land, matches well to the electrical demand of the four pumps to be able to offset demand during peak billing periods, and makes economical use of inverter capacity.

The primary difference between this budgetary proposal and a firm proposal would be that more site due diligence would be done before committing to a price (such as confirming the main panel is an appropriate size for system tie-in), and a comprehensive term sheet would be provided for the PPA program. I have confidence in the costs presented because the site appears straight forward; if the site is saturated we can work with surface footings vs piers – we even have pontoon systems – floatovoltaics!

Again, I appreciate your interest in SPG Solar. Please call if you have any questions… it would be great if this helps a project to come to fruition. For additional information about the company or its products, please view www.SPGsolar.com and www.thompsontec.com .

Sincerely,

Ed Orrett, PE
Sr. Account Executive

P.O Box 9301
Marina Del Rey, CA 90295

310 822 6303
ed.orrett@spgsolar.com

SPG SOLAR

Budgetary Proposal
Nipomo Community Services District
500kW PV Tracker

Ground-mounted, Single-Axis Tracker

PV modules produce the most energy when they are perpendicular to the source of light (the sun). PV systems that follow or "track" the sun across the sky from east to west produce 15-25% more power than a fixed, stationary system.

A standard 1MW ground mounted single-axis tracking PV array (the maximum size PV system able to fully utilize State incentives) requires a rectangular, flat ground area of about 5 acres. Typically this would be in 4 individual building blocks with their own electric drive lines. Rows of PV modules run north-south and are connected by a steel drive line that slowly rotates the rows from east to west during the day. An electronic GPS based controller and a small 1.5 hp electric motor turning a stainless steel screw-jack drive each unit.

For the Nipomo site we have provided a layout for a 500kW AC CEC tracking array using 3,168 Mitsubishi 185 watt modules and two Xantrex 225 kW inverters to fit within the property owned by NCSD adjacent to the aeration ponds (array layout follows). The 500kW peak output would match closely to the demand of the four 120 HP pumps on the site, therefore being able to offset nearly all PG&E utility power needs to the site during peak summer periods.

Although the orientation of the tracking array is 45° off of due East-West, the angle diminishes output only about 4% from ideal. It is possible the design can be finessed to more closely align in an E/W orientation.

SPG Solar uses its proprietary single-axis tracking system manufactured by its affiliated company, Thompson Technology Industries (TTI). All mounting posts and drive mechanisms are galvanized steel for a long and reliable life.

Single-axis Tracking Project Experience

SPG Solar is one of only 4 companies in the world to have designed and manufactured a single-axis tracking PV system, patent pending by our ancillary company Thompson Technology Industries (TTI). SPG's design offers a more robust, durable system than competing designs and is capable of driving 250 kW AC per drive system, enabling a 1MW system to be built using only 4 drive systems if ground-spacing permits.

The TTI single-axis tracker was recently selected after one of the most grueling, in-depth, 12-month, very competitive technical review and economic life-cycle analysis for the largest PV project in the world … a 19.6 MW single-axis tracking project in South Korea.

Projected Annual Power Output

Production Table

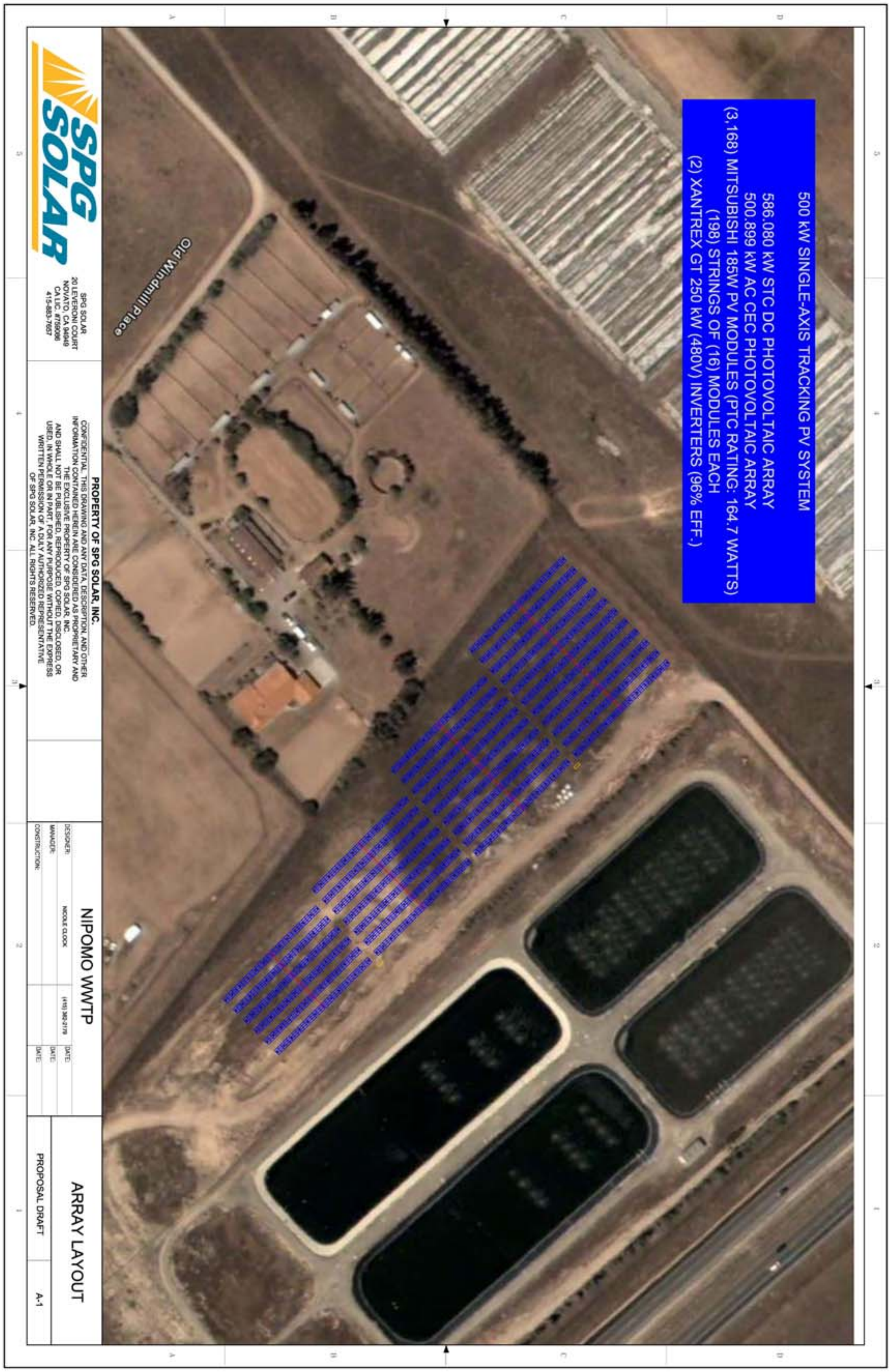
System Size 500.9 kW

Nipomo WWTP

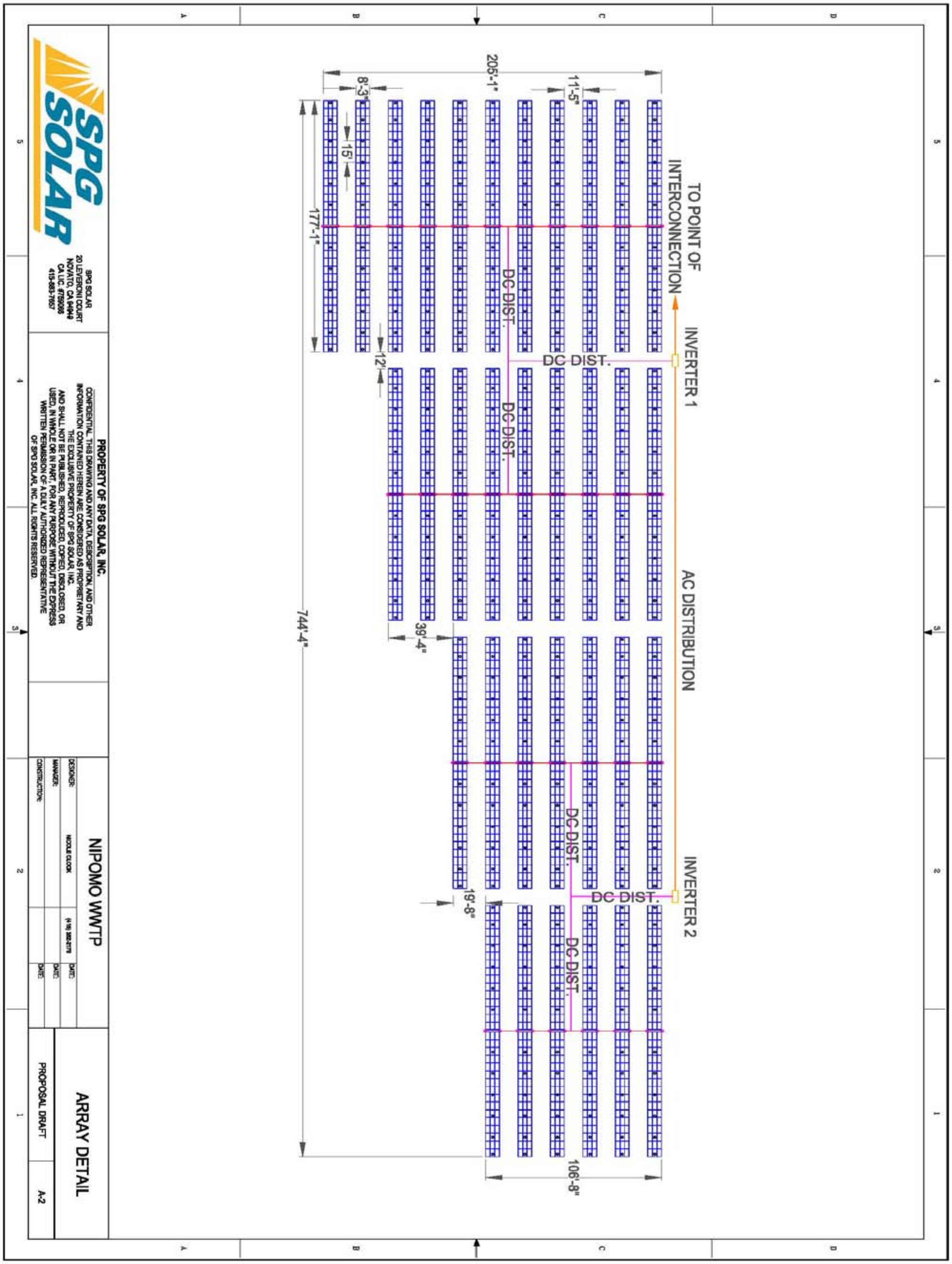
Month	PV Production Peak kWh	PV Production Part-Peak kWh	PV Production Off-Peak kWh	PV Production Total kWh
May	45,476	30,987	34,275	110,738
Jun	52,372	31,998	27,369	111,739
Jul	46,759	30,180	37,729	114,669
Aug	48,549	28,040	29,859	106,448
Sep	39,259	26,451	21,695	87,405
Oct	26,871	20,529	24,517	71,917
Summer Total	**259,286**	**168,185**	**175,444**	**602,916**
Average	**43,214**	**28,031**	**29,241**	**100,486**
Nov	0	41,666	18,439	60,105
Dec	0	38,489	14,476	52,965
Jan	0	34,717	20,433	55,150
Feb	0	40,593	19,725	60,318
Mar	0	57,846	22,478	80,324
Apr	0	63,565	29,770	93,335
Winter Total	**0**	**276,876**	**125,320**	**402,196**
Average	**0**	**46,146**	**20,887**	**67,033**
Grand Total	**259,286**	**445,061**	**300,764**	**1,005,112**

Variations in System Size

The kWh production values, system and PPA pricing can be proportionally increased if land is available for a larger system up to 1MW, requiring 5 acres in a rectangular arrangement. Net metering would be likely for systems over 500kW if the only load on the meter is the pumps. Pricing may increase on a $/W basis for systems smaller than 500kW, and the smallest economical tracker size is 225kW.



500 kW SINGLE-AXIS TRACKING PV SYSTEM
586.080 kW STC DC PHOTOVOLTAIC ARRAY
500.899 kW AC CEC PHOTOVOLTAIC ARRAY
(3,168) MITSUBISHI 185W PV MODULES (PTC RATING: 164.7 WATTS)
(198) STRINGS OF (16) MODULES EACH
(2) XANTREX GT 250 kW (480V) INVERTERS (96% EFF.)
Old Windmill Place
SPG SOLAR
SPG SOLAR
20 LEVERONI COURT
NOVATO, CA 94949
PROPERTY OF SPG SOLAR, INC.
NIPOMO WWTP
DESIGNER:
MANAGER:
CONSTRUCTION:
NICOLE CLOCK
DATE:
DATE:
DATE:
ARRAY LAYOUT
PROPOSAL DRAFT
A-1


205'-1"
8'-3"
11'-5"
15'
177'-1"
12'
TO POINT OF INTERCONNECTION
INVERTER 1
DC DIST.
DC DIST.
DC DIST.
AC DISTRIBUTION
744'-4"
39'-4"
DC DIST.
19'-8"
DC DIST.
INVERTER 2
DC DIST.
106'-8"
PROPERTY OF SPG SOLAR, INC.
NIPOMO WWTP
DESIGNER:
MANAGER:
CONSTRUCTION:
DATE:
DATE:
DATE:
ARRAY DETAIL
PROPOSAL DRAFT
A-2

Assumptions

The 500kW ground-mounted, single-axis tracking system assumes a relatively flat, clear site (<1% slope) with no trees or obstructions. 480V electrical interconnection point within 500'. No fencing, gravel or weed-cloth is included.

Prevailing wage labor rates will apply for installation of purchased systems, but open shop rates can be used for PPAs due to the 3rd party ownership and operation structure.

Proposed PPA rates assume current Level 4 CSI incentive rates will be available and reserved for this project at the time of contract. Level 4 CSI incentive is $0.26 per kWh generated for 5 years for PV systems owned by non-public entities (PPA). Level 4 CSI incentive for public entities (if NCSD owned) is $0.37 per kWh for 5 years.

Exclusions

- Site fencing or landscaping
- Weekend or Overtime work if required by Client
- Site lighting
- Site prep beyond minimal clearing
- Payment & Performance Bonds are extra if required (@1.5%)
- Assumes no DSA review is required

Financial

Installed System Purchase (Budgetary) Prices

Single-axis Tracker	500.9 kW AC CEC	$4,010,000

Budgetary PPA

PPA 15-year Term initial rates with annual escalation		3% escalation	4% escalation
Single-axis Tracker	1,005,112 kWh/yr 1	$0.11/kWh	$0.105/kWh

All CSI incentives are paid monthly for the first 5 years of operation. In the case of PPAs, all incentives will go to the PPA provider. In the case of a purchase, an incentive in the amount of $0.37/kWh generated by the PV system for the first 5 years is currently available and would be paid to the University. All PV system output degrades by approximately 0.5% per year.

SPG Solar partners only with well funded, established financial organizations with substantial solar power experience for all Power Purchase Agreement structures.

PPA Overview

A Power Purchase Agreement, or PPA, is a long-term agreement to buy power from a company that produces electricity. A solar PPA provider builds a solar energy facility on the customer's site and maintains and operates the facility for 15 years or longer. Favorable PPA rates are achieved because the PPA provider is able to utilize the substantial tax benefits that are available with solar investments. The solar facility generates reliable, long-term clean energy for use by the customer.

Under the terms of a PPA, the provider assumes the risks and responsibilities of ownership when it purchases, operates, and maintains the turn-key facility. After installation, maintenance and operations are typically contracted to SPG Solar, who cleans the solar panels regularly, provides preventative maintenance services, repairs any faults, and monitors the energy production and the system's health and well-being. Their customers just run their businesses as usual, without any of the headaches of owning a power plant. At the end of the PPA term, the facility can be purchased by the customer at fair market value or the PPA can be renewed on favorable terms. The PPA enables the customer to benefit from the use of "green" energy, while still receiving some of the benefits of ownership (lower and/or "hedged" electricity costs, positive public image, etc.) and allows them to spend their capital budget on their core businesses.

Project Timeline

SPG Solar will commit to starting system engineering within 30 days from the date of contract and submit plans for NCSD review by 60 days from the date of contract. Construction mobilization will occur from 15 – 60 days following approval and permitting of plans depending on which system option is contracted.

Once construction starts, the tracker can be operational within 4 months.

Warrantees

Module power output:	25 years
Inverter:	10 years
System:	10 years
Perf. Monitoring:	10 years

PPA Warrantees: For the term of the PPA

Training of on-site personnel included for all options.

Warranty of CSI Incentives Eligibility

SPG Solar warrants that all three systems proposed under Options A, B & C are fully eligible for full CSI incentives as specified in the CSI Handbook.

SPG's Service Capabilities
SPG Solar believes that customer aftercare and maintenance are the two most critical components of a successful long term PV project. SPG Solar provides a full time Customer Care Department to assist Customers with any issues that may arise after the commissioning of a system and to ensure all systems are operating at full capacity.

SPG's Customer Care services include daily computerized and human monitoring of every large scale commercial system to ensure that each system is performing as designed, and to search for enhancements that could be made to increase system output.

About SPG Solar, Inc.

SPG Solar, Inc. designs and builds the highest performing solar energy systems in the industry. With over 800 grid-connected PV systems in service, SPG is one of the largest PV engineering and design companies in the United States.

SPG is well-known in the solar industry for its high-performance solar PV systems, which provide customers with the best return on investment (ROI) in the industry, as well as for its state-of-the-art modeling and monitoring systems. In addition, SPG works closely with several leading financial institutions and investment companies to offer attractive long-term Power Purchase Agreements (PPA's).

SPG is unique in having two ancillary companies: SPG Solar International, Inc. a project development / design firm; and Thompson Technology Industries, Inc., a specialty solar technology design/manufacturing firm focused on PV mounting systems and performance monitoring.

SPG Solar is focused on solar photovoltaic (PV), grid-connected systems in California, and has installed more PV systems in that region than any other contractor.

With Corporate headquarters in Northern California and regional offices in San Diego, Oroville, Vacaville, Santa Rosa and Bakersfield (opening soon), SPG is well equipped to design and construct PV projects from the Oregon border to Mexico.

Company Background

SPG was founded in 2001 in response to California's rolling blackouts and skyrocketing energy prices. Originally called Sun Power & Geothermal Energy, the name was shortened to SPG in March 2006. SPG handles not only "routine" solar installations, but unique, challenging solar assignments as well. Rather than the "cookie-cutter", one size fits all approach that many PV contractors use, SPG and its highly trained, professional engineering and installation teams are able to succeed in difficult situations. SPG recently completed the first solar array on the face of a dam … a 600 kWp PV array for Sonoma County Water Agency.

First PV System Installed on the Face of a Dam: Sonoma County Water Agency (600 kW)

Solar power is an engineering and construction business, not a marketing business. While PV certainly delivers exciting environmental benefits and decreased dependence on foreign fossil fuels, PV systems must be designed and installed by construction professionals to ensure their 25+ year operating lives. SPG has its roots in the electrical contracting business, and the SPG organization is built around designing, building and supporting solar projects for discerning customers.

The senior management team at SPG brings more than 200 years direct experience in electrical contracting, construction, utility-scale power plant development, and engineering.

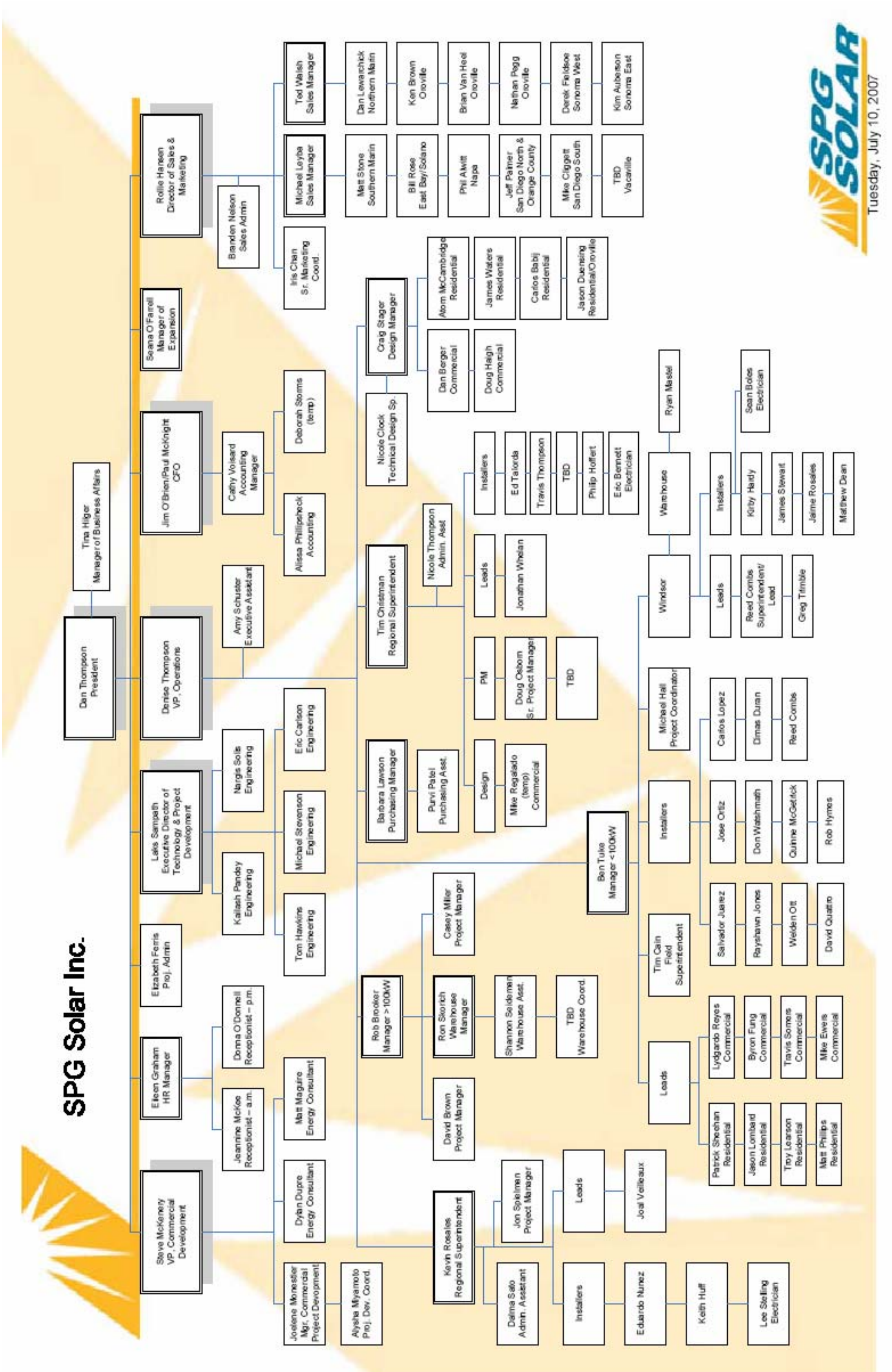
SPG is one of the first turn-key solar installation firms with employees certified by the North American Board of Certified Energy Practitioners (NABCEP). NABCEP is a representative board with involvement of the solar industry, independent installers, the trades, training organizations, educators, national laboratories, and government. SPG has been at the forefront of the industry push for high quality installations, high professional standards, and consumer assurances.

Licenses

SPG is a California licensed and bonded General (B), Electrical (C-10) and Solar (C-46) contractor, license number #759086.

Project personnel will be identified and corresponding resumes provided upon request and when a preliminary date of project start is determined.

The Company organization chart follows.


SPG Solar Inc.
Dan Thompson President
Tina Higer Manager of Business Affairs
Steve McKenery VP, Commercial Development
Eileen Graham HR Manager
Elizabeth Ferris Proj. Admin
Laks Sampath Executive Director of Technology & Project Development
Denise Thompson VP, Operations
Jim O'Brien/Paul McKnight CFO
Seana O'Farrell Manager of Expansion
Rollie Hansen Director of Sales & Marketing
Jeannine McKee Receptionist – a.m.
Donna O'Donnell Receptionist – p.m.
Kailash Pandey Engineering
Nargis Solis Engineering
Amy Schuster Executive Assistant
Cathy Voisard Accounting Manager
Branden Nelson Sales Admin
Joelene Monestier Mgr, Commercial Project Devopment
Dylan Dupre Energy Consultant
Matt Maguire Energy Consultant
Tom Hawkins Engineering
Michael Stevenson Engineering
Eric Carlson Engineering
Alissa Phillipcheck Accounting
Deborah Storms (temp)
Iris Chan Sr. Marketing Coord.
Michael Leyba Sales Manager
Tod Walsh Sales Manager
Matt Stone Southern Marin
Bill Rose East Bay/Solano
Phil Atwitt Napa
Jeff Palmer San Diego North & Orange County
Mike Cliggett San Diego South
TBD Vacaville
Dan Lewarchick Northern Marin
Ken Brown Oroville
Brian Van Heel Oroville
Nathan Pegg Oroville
Derek Fieldsoe Sonoma West
Kim Auberson Sonoma East
Alysha Miyamoto Proj. Dev. Coord.
Rob Brooker Manager >100kW
Barbara Lawson Purchasing Manager
Tim Christman Regional Superintendent
Nicole Clock Technical Design Sp.
Craig Stager Design Manager
Kevin Rosales Regional Superintendent
David Brown Project Manager
Ron Skorich Warehouse Manager
Casey Miller Project Manager
Purvi Patel Purchasing Asst.
Design
Mike Regalado (temp) Commercial
PM
Doug Osborn Sr. Project Manager
TBD
Leads
Jonathan Whelan
Nicole Thompson Admin. Asst
Installers
Ed Taforda
Travis Thompson
TBD
Philip Hoffert
Eric Bennett Electrician
Dan Berger Commercial
Doug Haigh Commercial
Atom McCambridge Residential
James Waters Residential
Carlos Babij Residential
Jason Duensing Residential/Oroville
Dalma Sato Admin. Assistant
Jon Spielman Project Manager
Installers
Eduardo Nunez
Keith Huff
Lee Stelling Electrician
Leads
Josi Veilleaux
Shannon Seideman Warehouse Asst.
TBD Warehouse Coord.
Ben Tuke Manager <100kW
Leads
Patrick Sheehan Residential
Jason Lombard Residential
Troy Learson Residential
Matt Phillips Residential
Lydgardo Reyes Commercial
Byron Fung Commercial
Travis Somers Commercial
Mike Evers Commercial
Tim Cain Field Superintendent
Salvador Juarez
Rayshawn Jones
Welden Ott
David Quattro
Installers
Jose Ortiz
Don Watshmath
Quinne McGetrick
Rob Hymes
Michael Hall Project Coordinator
Carlos Lopez
Dimas Duran
Reed Combs
Windsor
Leads
Reed Combs Superintendent/ Lead
Greg Trimble
Installers
Kirby Hardy
James Stewart
Jaime Rosales
Matthew Dean
Sean Boles Electrician
Warehouse
Ryan Mastel
Tuesday, July 10, 2007

References

Vallecitos Water District
Dale Mason, General Manager
201 Vallecitos De Oro
San Marcos, CA 92069
(760) 744-0460
375 kW SolarPort PV System

Butte College
Mike Miller, Director Facilities Planning
3536 Butte Campus Drive
Oroville, CA 95965
(530) 895-2298
1.06 Megawatt PV System

Sewerage Commission Oroville Region
Ray Sousa, Superintendent
2880 South Fifth Avenue
Oroville, CA 95965
(530) 534-0353
625 kW PV System

South Feather Water & Power
Michael Glaze, General Manager
2310 Oroville Quincy Hwy.
Oroville, CA 95965
(530) 533-4578
566 kW PV System

Monterey Ridge Elementary School
Gould Electric: Bob Taeckens
17117 4 S Ranch Parkway
San Diego, CA 92127
(858) 748-2474
200 kW PV System

Sonoma County Water Agency
Anjenette Hayre, Water Agency Engineer
2150 W. College Ave.
Santa Rosa, CA 95406
(707) 521-1830
600 kW Dam-mounted PV System

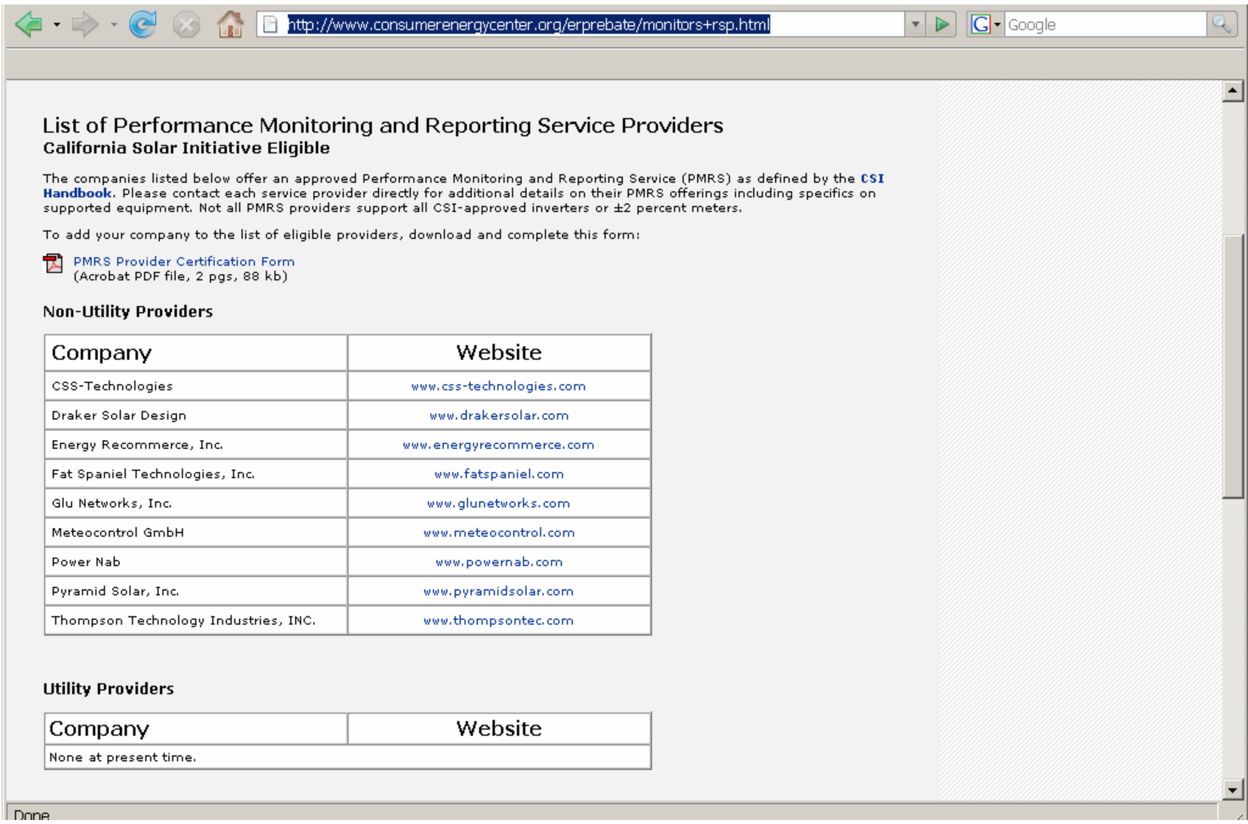
Johnson & Johnson
Mark Loukadis, Operations Manager
3210 Merryfield Row
San Diego, CA 92121
(858) 784-3241
260 kW Rooftop PV System

Butte County
Bill Curry, General Services Director
3-A County Center Drive
Oroville, CA 95965
(530) 538-7261
1.18 Megawatt PV System

Western Wine Services
Tony Politeo, Vice President
820 Hanna Drive
American Canyon, CA 94503
(707) 645-4300
827 kW Rooftop PV Systems

SunSpot Performance Monitoring Reporting System

SPG Solar's bid includes the cost of our proprietary state-of-the-art SunSpot® monitoring and reporting system with a full ten year license, at no extra cost. It is CSI certified and found on the CEC website at http://www.consumerenergycenter.org/erprebate/monitors+rsp.html:



List of Performance Monitoring and Reporting Service Providers
California Solar Initiative Eligible

The companies listed below offer an approved Performance Monitoring and Reporting Service (PMRS) as defined by the CSI Handbook. Please contact each service provider directly for additional details on their PMRS offerings including specifics on supported equipment. Not all PMRS providers support all CSI-approved inverters or ±2 percent meters.

To add your company to the list of eligible providers, download and complete this form:

PMRS Provider Certification Form
(Acrobat PDF file, 2 pgs, 88 kb)

Non-Utility Providers

Company	Website
CSS-Technologies	www.css-technologies.com
Draker Solar Design	www.drakersolar.com
Energy Recommerce, Inc.	www.energyrecommerce.com
Fat Spaniel Technologies, Inc.	www.fatspaniel.com
Glu Networks, Inc.	www.glunetworks.com
Meteocontrol GmbH	www.meteocontrol.com
Power Nab	www.powernab.com
Pyramid Solar, Inc.	www.pyramidsolar.com
Thompson Technology Industries, INC.	www.thompsontec.com

Utility Providers

Company	Website
None at present time.	

This monitoring system is a product of SPG's ancillary company, Thompson Technologies Inc. (TTI).

Since PV systems require very little maintenance, they can easily be forgotten both by staff and by the public. Because of this, SPG has developed the SunSpot® monitoring software and public display kiosks. All information generated by SunSpot® can be viewed by authorized client staff online through a password protected internet site provided and maintained by SPG. Visitors to the Customer location can also view limited system information through the included public display kiosk.

SunSpot® monitoring system will allow the Customer and SPG system analysts to monitor:

- Real time system output
- Cumulative system output
- System performance by daily, monthly, cumulative or defined range

SunSpot® provides an accurate accounting of kilowatt-hours generated daily, monthly or as defined over the life of the system, as well as real-time information on solar PV energy production and solar irradiance. As a value-added service free of charge, SPG will provide annual system reports for the first five years of operations under the SPG Customer Care Program. These reports cross reference the SunSpot® data with utility bills.

SunSpot® provides the following functionality:

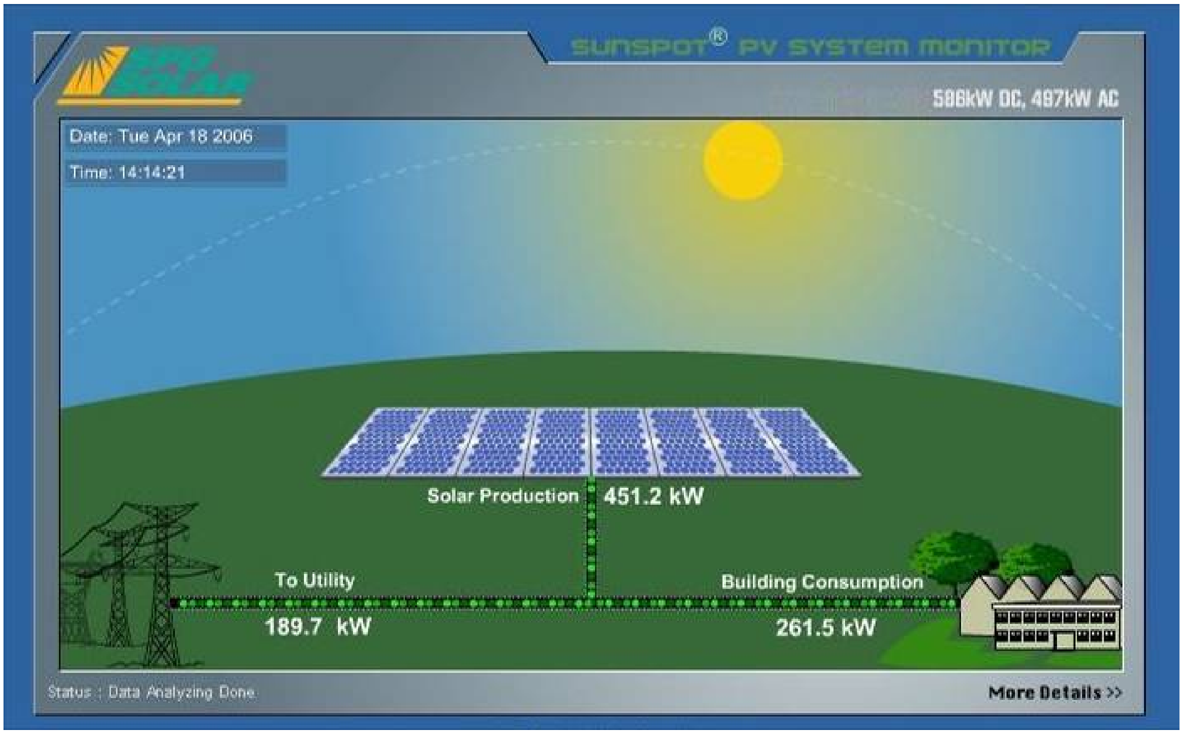
- Live, real-time dynamic data
- Updated data stored at 15-minute intervals
- 24-hour Web access
- All data downloads available in Excel format
- Tracks power flow, accumulated energy usage, solar insolation and other weather factors
- Data acquisition by revenue-grade ANSI electric meters and full-spectrum thermopile pyranometers
- Daily, monthly, yearly data totals
- All data logged to a secure co-located server

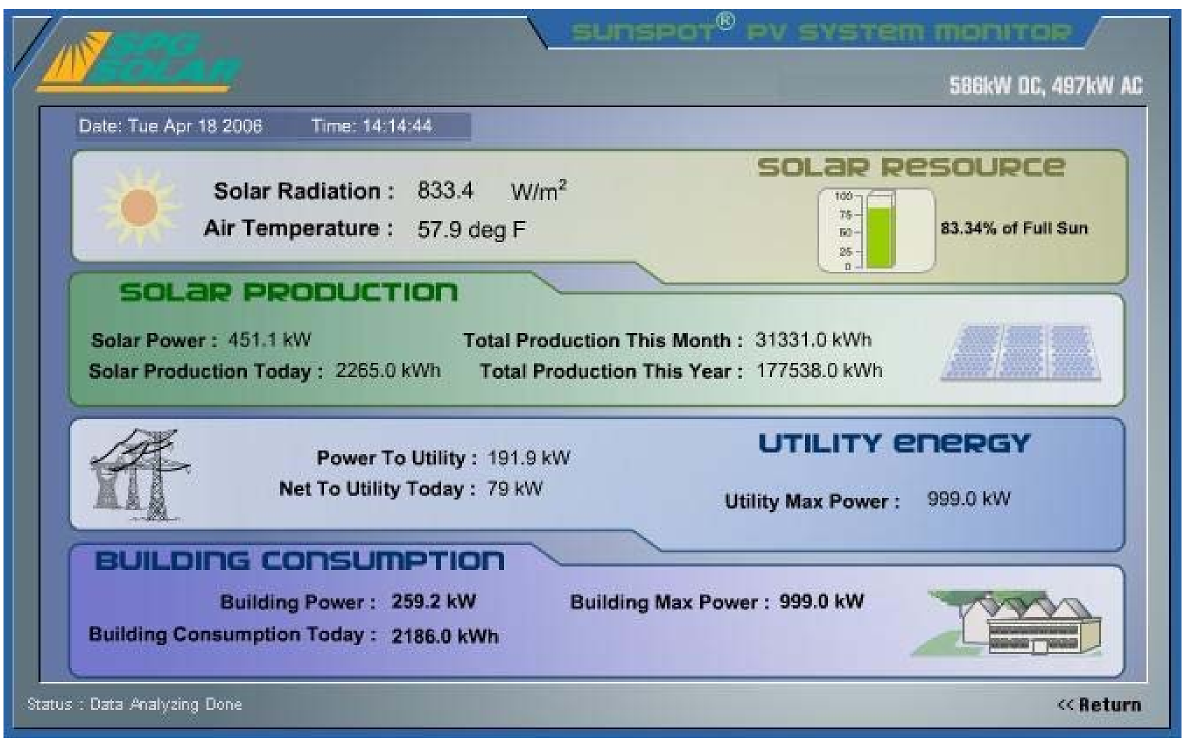
As part of our licensing agreement, SPG's Customer Care services include daily computerized and human monitoring over the web. This is to ensure that each system is performing as designed, and to search for enhancements that could be made to increase system output. When alarm conditions occur, SPG will be able to troubleshoot the entire system to pinpoint the problem area and, if necessary, send out technicians to fix the problem, minimizing any downtime.

There are very few maintenance requirements with the SPG monitoring system. During the first ten years, all regular maintenance requirements and upgrades are included. A 10-year SPG software licensing agreement is required for installation and access to the SunSpot® monitoring system. Customer shall provide a physical connection interface point to their local area network and high speed Internet access in order to operate this software.

The following pages contain actual screen shots of SPG SunSpot® monitoring.

Standard Views





Detailed Views

SUNSEEKER™

- *With the TTI Single-Axis Tracker, you can now get significantly greater energy production with the same affordability as a fixed tilt array*
- *The Single Drive Train system supports up to approximately 350kWp*
- *Designed to minimize foundation requirements*
- *Precision automated controls (UL Listed) with remote monitoring to simplify tracker operation*

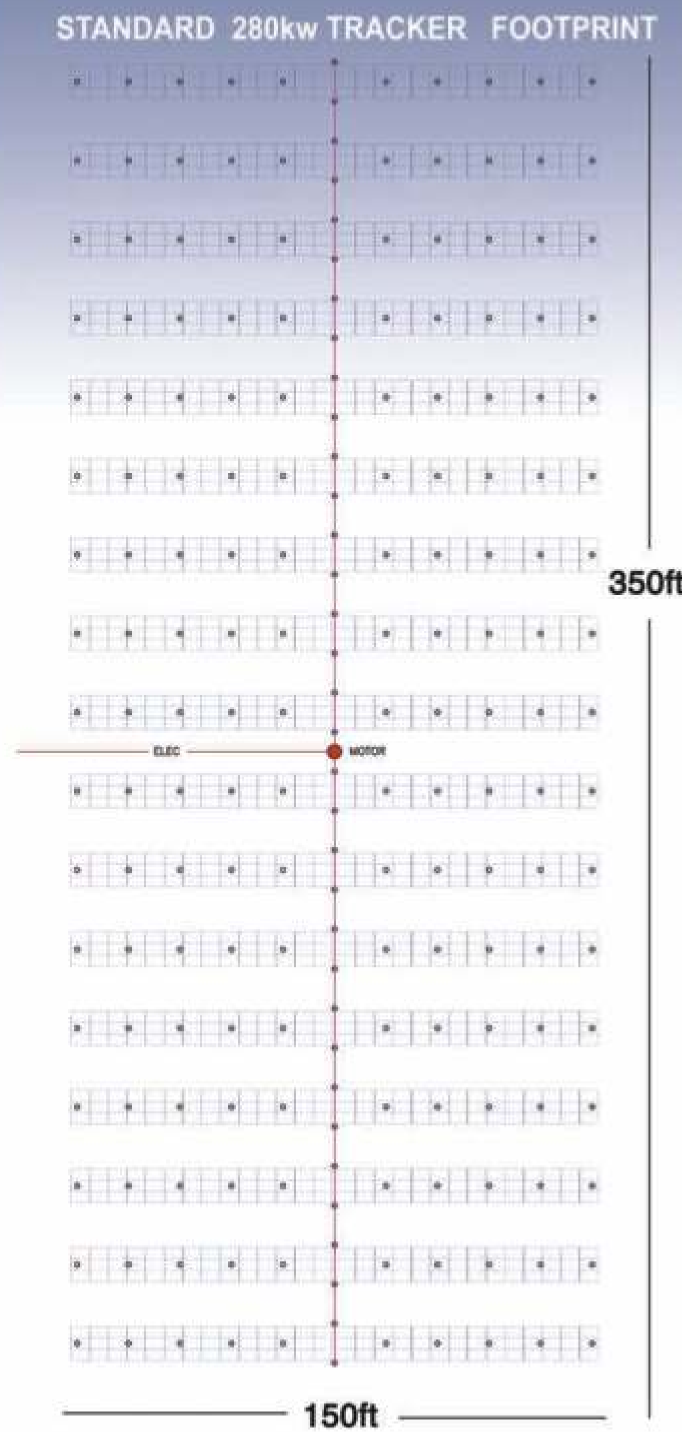
THOMPSON TECHNOLOGY INDUSTRIES, INC.

Maximizing PV Performance

PV Tracking System Specifications

SUNSEEKER™ can consist of a number of standard building blocks.
Each building block has the following specifications:

Power Production Capacity:	Up to 350kW DC Per Building Block
Dimensions:	50,000 ft²
Modules accepted:	All commercially available modules
Tracking System:	Single-axis automatic tracking
Tracking Style:	Stainless steel ram screw driving a ram shaft and rectangular rotation beams
Tracking Drive Motor:	15-ton motor 1 HP,3-phase
Module Rotation Structure:	Dual rectangular rotation beams
Module Support Structure:	Aluminum rails mounted to rotation beams
Module Attachment Style:	Aluminum T-clips Proprietary C-clips
Allowable Wind Load:	90 mph at all angles (higher in stow position)
Module Wind Hold Capacity:	600 lbs.
Wind Protection Method:	Array flattens at 30 mph wind speed
Row Configuration:	Dual or triple module layout
Array Height:	Maximum 8'
Maximum Angle Displacement:	45°
Assembly Method:	Subsystems are factory-preassembled to reduce field construction time
Electrical Conduit Orientation:	Attached to base beams for flood plane protection; integrated rotational bearing minimizes conduit friction
Control Electronics:	Precision GPS calibrated with optional remote control and string-level monitoring



For more information on this product and other available products, please contact us at:

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San Rafael, CA 94903

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Email:
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