City of Sunrise, Florida

SOUTHWEST WASTEWATER TREATMENT FACILITY ADVANCED WASTEWATER TREATMENT (AWT) AND REUSE PILOT TESTING PROGRAM

Final Report

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MWH

CITY OF SUNRISE

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Section 1

1. INTRODUCTION

1.1 BACKGROUND AND OVERVIEW

The City of Sunrise pilot tested a select group of emerging advanced wastewater treatment (AWT) technologies for future application to meet potential wastewater reuse initiatives. This pilot plant study was part of the City's continuing efforts to determine feasible Alternative Water Supply (AWS) options in support of the South Florida Water Management District's (SFWMD) regulations, as well their goals and objectives. One of these potential initiatives is the conversion of the Southwest Wastewater Treatment Facility (SWWWTF) to a membrane bioreactor (MBR) facility for treatment of raw wastewater to a level required for groundwater recharge.

The SWWWTF is located in Davie, Florida adjacent to a residential neighborhood just west of I-75, as shown in **Figure 1-1**. The treatment facility consists of influent screening, biological treatment (extended aeration - oxidation ditches), clarification and disinfection. The treated effluent from the SWWWTF is currently discharged to percolation ponds on the site.

Figure 1-1
Southwest Wastewater Treatment Facility (SWWWTF)
Site location

The SWWWTF is being evaluated for decommissioning, and Sunrise Utilities is investigating the option for upgrading the plant to meet AWT requirements using the

MBR process in order to treat wastewater to the level required for groundwater recharge through the use of rapid infiltration trenches. The groundwater recharge would potentially serve to recharge the Biscayne aquifer.

1.2 PROJECT OBJECTIVES

The purpose of this pilot study was to evaluate the technical and economic feasibility of treating raw wastewater with commercially available AWT technologies to required water quality standards that are in line with current Florida Department of Environmental Protection (FDEP) and Broward County regulations for groundwater recharge. In addition, the program was to determine whether the MBR technology in combination with additional treatment can achieve a higher level of nutrient removal required for groundwater recharge.

The pilot study includes the following objectives:

- Review of applicable State and local (Broward County) water quality standards to determine, which standards would apply to the proposed groundwater recharge reuse scenario.
- Demonstrate the ability of commercially available advanced wastewater treatment technology to treat raw sewage to water quality standards in line with current FDEP standards and Broward County for ground water discharge.
- Determine whether the MBR technology alone, or in combination with additional treatment technologies can achieve the high level of nutrient removal required for groundwater discharge.
- Evaluate capability of selected treatment processes to remove/oxidize micro constituents.

1.3 REPORT ORGANIZATION

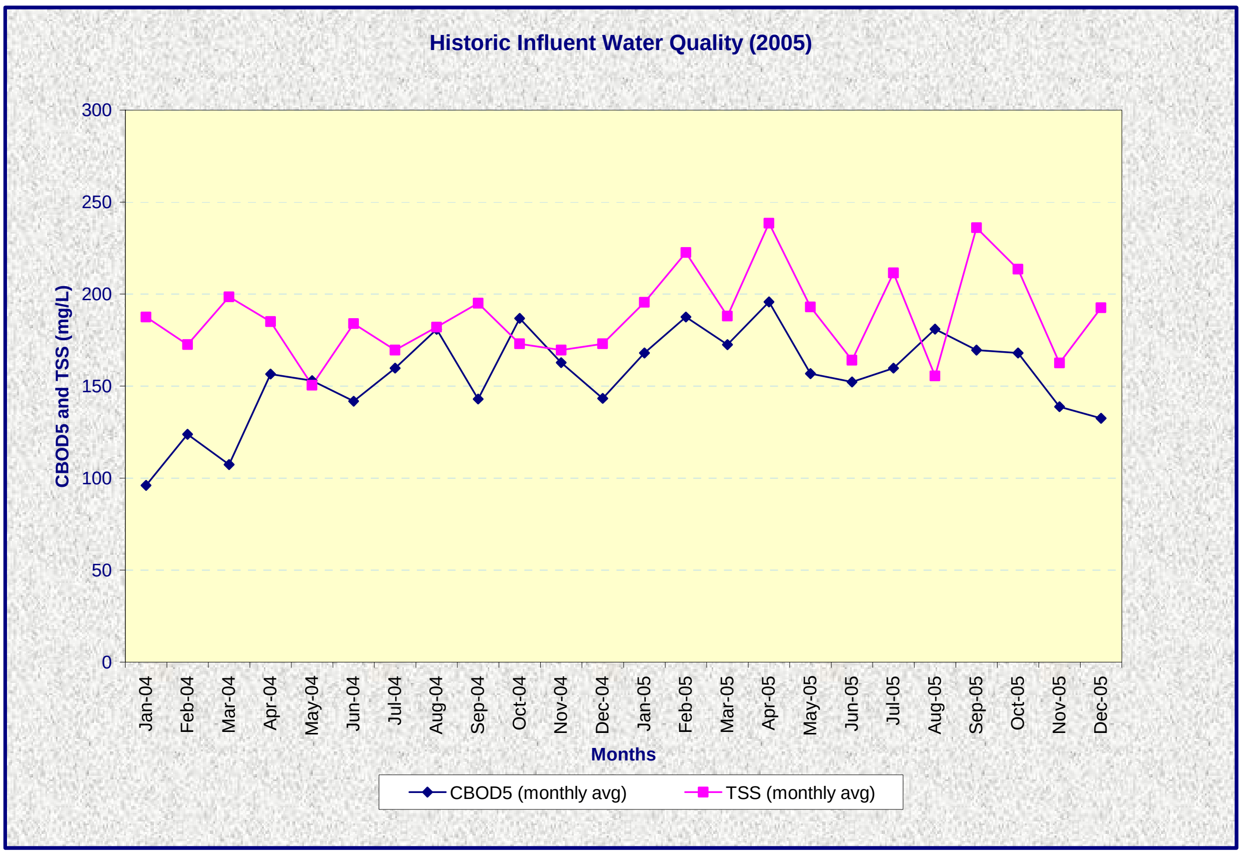
Following this Introduction, Section 2 of this report provides influent wastewater characterization, regulatory overview and the water quality goals needed for pilot performance. Section 3 provides the project approach for the pilot study including the project schedule, sampling plan, and sampling and testing methods, and Section 4 provides the pilot testing results. Section 5 provides project outcomes including technology recommendations, scale up and probable opinions of construction costs. The conclusions, recommendations and benefits of the project are discussed in the final Section 6. Additional results and data not included in the main body of the report are provided in Appendices to this report.

Section 2

2.1 HISTORIC WASTEWATER QUALITY

Historical influent wastewater quality at the SWWWTP was obtained from the Monthly Operating Reports and was plotted for monthly averages based on weekly data of 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) for the Years 2004 to 2005 as shown in **Figure 2-1**. The influent TSS concentration is determined to range from 150 milligrams per liter (mg/L) to 240 mg/L, and the influent $CBOD_5$ is determined to range from 96 mg/L to 196 mg/L.

Figure 2-1
Historic Influent Water Quality (2005)



2.2 WASTEWATER INFLUENT CHARACTERIZATION

A detailed wastewater characterization study was performed on the influent, effluent locations at SWWWTP. This characterization included the following:

- Influent Profile - Influent wastewater quality was sampled and analyzed for all the constituents included primary and secondary drinking water standards, and ground water standards for Broward County. The purpose of this analysis was to determine which contaminants beyond the standard domestic wastewater pollutants potentially exceed regulatory standards and require special attention. The detailed results of these analyses are provided in **Appendix B**.

- Influent, Effluent and Process Control One-Week Characterization - For selected constituents, composite sampling and analyses were carried out over a period for seven days on both influent and effluent samples, and internal process control parameters, recycle flows, and waste streams at the SWWWTF. The selected constituents represent pollutants typically found in domestic wastewater and indicators required in the design of wastewater treatment facilities. These analyses were carried out to assist in the design of the pilot treatment facilities and included the following:

  - Total Suspended Solids (TSS)
  - Volatile Suspended Solids (VSS)
  - Nitrate (NO_3), Nitrite (NO_2), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Nitrogen (TN)
  - Phosphate (PO4), Dissolved and Total Phosphorous (P),
  - Uninhibited Biological Oxygen Demand (BOD_5), Total Chemical Oxygen Demand (COD), soluble Chemical Oxygen Demand (sCOD), flocculated-filtered Chemical Oxygen Demand (CODff), Carbonaceous Biological Oxygen Demand ($CBOD_5$), and soluble Carbonaceous Biological Oxygen Demand (CBODs).
  - Alkalinity, pH and Temperature.

  Summarized in **Tables 2-1a and 2-1b** are the major influent and effluent concentrations of the various constituents that were sampled over a seven day period.

Table 2-1a
Detailed One-Week Wastewater Influent Characterization

Compound		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Min	Avg	Max
TSS	mg/L	230	190	66	120	92	62	66	62	118	230
Alkalinity	mg/L	260	260	230	220	230	240	250	220	241	260
Phosphate, Total as P	mg/L	20	30	33	20	8	25	20	8	22	33
Phosphorus, Total	mg/L	7	10	11	7	6	8	7	6	8	11
COD	mg/L	430	430	460	500	420	620	490	420	479	620
Nitrogen, Total	mg/L	64	100	52	52	48	56	47	47	60	100
CBOD	mg/L	210	200	130	170	180	340	260	130	213	340

Table 2-1b
Detailed One-Week Wastewater Effluent Characterization

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Min	Avg	Max
TSS	mg/L	5	5	0	4	4	0	0	0	3	5
Alkalinity	mg/L	92	88	100	88	92	100	96	88	94	100
Phosphate, Total as P	mg/L	7	9	8	9	12	4	10	4	8	12
Phosphorus, Total	mg/L	2	3	3	3	4	4	3	2	3	4
COD	mg/L	70	58	60	60	56	68	56	56	61	70
Nitrogen, Total	mg/L	4	4	4	5	5	4	3	3	4	5
CBOD	mg/L	5	3	4	4	9	3	4	3	5	9

The detailed reports of all the constituents sampled for a single day and for the seven days composite sampling are provided in **Appendix A**. A detailed report of results reported by the laboratory for all constituents is provided in **Appendix B**.

2.3 REGULATORY OVERVIEW

2.3.1 FDEP Wastewater Permit

The FDEP permit FLA013580 for the SWWWTP was issued in September 27, 2006 to operate an existing facility with 0.99 million gallons per day (mgd) Annual Average Daily Flow (AADF) design capacity. However, the FDEP limited the permitted capacity of the SWWWTP to 0.5 mgd Three Month Average Daily Flow (TMADF), which is equivalent to 0.45 mgd on an AADF basis.

Figure 2-2
FDEP SWWWTP Permit Expansion

This permit allows expansion of the SWWWTP to 2.0 mgd on an AADF basis, if the City of Sunrise notifies FDEP three years prior to the expiration date of this Permit (September 26, 2011), of its intent to construct certain improvements such as piping modification, additional aeration capacity, additional secondary clarifier(s), high level disinfection, and rapid rate infiltration trenches. The permit implementation schedule requires completion of rapid rate infiltration trench by October 1, 2008. Reclaimed water effluent limitations established by the FDEP permit for the SWWWTP at AADFs of 0.45 mgd and 0.99 mgd, respectively are shown in **Table 2-2 and 2-3**.

Table 2-2
Reclaimed Water Limitations to Reuse System R-001 at AADF 0.45 mgd

Parameter	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample
Flow	mgd	Maximum	0.45	-	-	-
Carbonaceous BOD (CBOD5) at 20C	mg/L	Maximum	20.0	30.0	45.0	60.0
Solids, Total Suspended	mg/L	Maximum	20.0	30.0	45.0	60.0
pH	su	Range	-	-	-	6.0 to 8.5
Coliform, Fecal	#/100m L	Maximum	See PC I.A.4.	Weekly	Grab	EFF-001
Total Residual Chlorine (For Disinfection)	mg/L	Minimum	-	-	-	0.5
Total Nitrogen, Nitrate, Total (as N)	Mg/L	Maximum	-	-	-	10.0

PC = Permit Condition

Table 2-3
Reclaimed Water Limitations to Reuse System R-001 at AADF of 0.99 mgd

Parameter	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample
Flow	mgd	Maximum	0.99	Report	-	-
Carbonaceous BOD (CBOD5) at 20C	mg/L	Maximum	20.0	30.0	45.0	60.0
Solids, Total Suspended	mg/L	Maximum	-	-	-	5.0
pH	su	Range	-	-	-	6.5 to 8.5
Coliform, Fecal, % less than detection	PERCE NT	Minimum	See P C I.A.11.			
Coliform, Fecal	#/100m L	Maximum	See PC I.A.11.			
Total Residual Chlorine (For Disinfection)	mg/L	Minimum	-	-	-	1.0
Total Nitrogen, Nitrate, Total (as N)	mg/L	Maximum	10.0	12.5	15.0	20.0
Giardia	CYSTS/ 100 L	Maximum	-	-	-	Report
Cryptosporidium	OOCYS TS/100 L	Maximum	-	-	-	Report
Primary Drinking Water Standards	mg/L	Maximum	See PC I.A.13.			
Secondary Drinking Water Standards	mg/L	Maximum	See PC I.A.14.			

PC = Permit Condition

2.3.2 Effluent Water Quality Standards for Groundwater Recharge

The effluent discharge from domestic wastewater facilities into the waters of Florida is regulated under the State and Local levels.

2.3.2.1 State of Florida Regulations

Chapter 62-650, *Water Quality Based Effluent Limitations*, of the Florida Administrative Code (F.A.C.) sets water quality based effluent limitations and promulgates implementation of the Chapter 403, *Environmental Control*, of the Florida Statutes (F.S.), concerning the development of effluent limitations for wastewater facilities. The surficial (Biscayne) aquifer is classified as a Class G-1 groundwater under Chapter 62-520.410, F.A.C. where the total dissolved solids (TDS) content is less than 3,000 mg/L. Additionally, Chapter 62-520.420, F.A.C. provides standards for Class G-1 ground waters, where the waters must meet the primary and secondary drinking water quality standards for public water systems.

Chapter 62-600, F.A.C., *Domestic Wastewater Facilities* sets the requirements for domestic wastewater facilities and provides minimum standards for the design of domestic wastewater facilities and to establish minimum treatment and disinfection requirements for the operation of domestic wastewater facilities. Chapter 62-600.530, F.A.C. and Chapter 62-600.440, F.A.C. establishes the treatment and disinfection requirements for reuse of reclaimed water. Domestic wastewater must meet, at a minimum, a treatment standard of secondary treatment, basic disinfection and pH control in order to be reused as reclaimed water.

Chapter 62-610. F.A.C., *Reuse of Reclaimed Water and Land Application* contains detailed regulations governing water reuse in Florida. Rapid rate infiltration basins (RIBs) for ground water recharge are addressed in Part IV of this chapter, and ground water recharge and indirect potable reuse is addressed in Part V. This standard also limits the nitrate concentration to 10 mg/L as Nitrogen (NO_3^-N) as maximum annual average.

Chapter 62-610.521, F.A.C. provides setback distance requirements for RIBs. A setback distance of 500 feet must be provided from the edge of the RIB, percolation pond, basin, or trench embankments, or from the edge of an absorption field to any potable water supply wells that are existing or have been approved by FDEP or by the Department of Health (but not yet constructed). However, the setback distances for potable water supply wells shall be applied only for new or expanded reuse facilities, and will not be applied when considering renewal of a permit. A setback distance of at least 100 feet shall be maintained from the edge of the RIBs, percolation pond, basin, or embankments, or absorption field to buildings that are not part of the treatment facility, utilities system, or municipal operations; or to the site property line.

This setback requirement may be reduced in certain cases such as where high level disinfection and Class I reliability is incorporated into the treatment process. A minimum 100-foot setback distance must be provided from a reclaimed water transmission facility to any public water supply well. A 500-foot setback distance shall be provided from new unlined storage ponds to potable water wells, as regulated in Chapter 62-521.200, F.A.C. Chapter 62-610.523, F.A.C. provides guidelines for design and operation requirements (i.e., loading rates, resting cycles, etc.) for RIBs.

2.3.2.2 Broward County Regulations

Broward County Municipal Codes Chapter 27 regulates the reclaimed water discharge into the ground water. Article V – Water Resource Management of Broward County regulates effluent standards. Section 27-196(b) sets the requirements for effluent discharge to ground waters and requires a compliance with the most stringent standards between the groundwater standards in 27-195 (c) or the FDEP permit requirement. Reuse system discharges are required not to exceed a NO_3-N concentration of 10 mg/L.

2.3.2.3 Water Quality Goals

Water quality goals based on groundwater standards defined by Broward County 27-195, primary and secondary drinking water standards and FDEP permit requirement for SWWWTP were established as shown in **Appendix B**. Additional information with the most stringent standard for water quality is provided in **Table 2-4**.

Broward County Water Quality Standards for ground water recharge are similar to the primary and secondary drinking water standards for majority of the constituents listed. There are cases where the FDEP operating permit has more stringent requirement, and cases where either the County standards exceeds the drinking water standards or vice versa. To evaluate the most suitable and cost effective technology for Alternative Water Supply (AWS) to recharge the Biscayne Aquifer, the water quality goals identified in **Appendix B** should be met.

Of particular note is the fact that the Broward County Chapter 27 Water Quality Standards for groundwater discharge require the level of Total Phosphates (PO4-P) to be less than 10 parts per billion (µg/L). It is speculated that this standard was introduced in the 1970s and represented the detection level for phosphates at that time. It is also speculated that the standard was set in association with the effort to limit phosphorous loading from the Everglades Agricultural Area runoff. This standard does not appear in State drinking water standards.

Table 2-4
Water Quality Goals by Ground Water Recharge

Compound	Broward County Std Chapter 27-195 Groundwater Discharge Standards (mg/L)	State of FL Standard (FDEP /FAC) Drinking Water Standards G-1 Aquifer (mg/L)	Expected Water Quality Goal Most Stringent of State/ County Std. (mg/L)
CBOD 5	N.S.	-	20 ann avg.(a)
	-	-	30 monthly(a)
	-	-	60 single sample(a)
Chlorine (total residual)	1	-	1
Coliform (fecal)	A. 200 colonies per 100 ml for monthly average	-	A. 200 colonies per 100 ml for monthly average
	B. 400 colonies per 100 ml for 10% of samples	-	B. 400 colonies per 100 ml for 10% of samples
	C. 800 colonies per 100 ml in any sample	-	C. 800 colonies per 100 ml in any sample(b)
Coliform (total)	1,000 colonies per 100 ml	-	1,000 colonies per 100 ml
Nitrogen: total Nitrogen as N (Nitrate, Nitrite, NH3, and organic)	N.S.	-	10©
Nitrate (as N)	10	10	10
Nitrite (as N)	1	1	1
Total Nitrate + Nitrite (as N)	10	10	10
pH	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units
Phosphates (total as P)	0.01	-	0.01
Total dissolved solids	500	500	500
Total Suspended solids	-	-	20 ann avg. (a)
	-	-	30 monthly(a)
	-	-	60 single sample(a)
Turbidity	10 NTUs	-	10 NTUs

(a) FDEP requirements
(b) Per FDEP permit at 0.99 mgd AADF, limit is 25/100 mL single sample maximum
(c) Per FDEP permit at 0.45 mgd Total Nitrogen limit is 10 ppm maximum. At 0.99 mgd, the limit is 10 ppm annual avg., 12.5 ppm monthly avg., and 20 ppm single sample.

Comparison of the water quality goals with the wastewater characterization that was performed at the SWWWTP indicates that most constituents are below the standard/goal. Pollutants that are near to or potentially exceed the standards are discussed below:

- Standard Domestic Wastewater Constituents (BOD_5, COD, $CBOD_5$, TSS, TN, TP, fecal coliforms, oils/greases, and turbidity) – these are expected to be above water quality standards in raw wastewater; however, they are expected to be below the Water Quality goals as part of the wastewater treatment process.

- Aluminum - The level of Aluminum in the influent wastewater (0.74 mg/L) exceeds the standard (0.20 mg/L), but Aluminum is expected to be reduced to meet the Water Quality goals, as part of the treatment process.
- Endosulfans – This level (0.12 µg/L) slightly exceeds the standard (0.10 µg/L). Further evaluation of this constituent will be carried out to determine if it will be reduced to a level as part of the treatment process to meet the Water Quality goals.
- Iron (Fe) – The level of iron in the influent wastewater (0.46 mg/L) slightly exceeds the standard (0.30 mg/L), but iron is expected to be oxidized and reduced to a level that meets the Water Quality goals as part of the treatment process.
- Total Dissolved Solids (TDSs) and Chlorides (Cl) – These reflect the salinity of the influent wastewater. The salinity of the influent wastewater is below the water quality standard (TDS = 430 < 500 mg/L and Cl = 100 < 250 mg/L). These two constituents will need to be monitored further, since excessive salinity in the raw wastewater would require reverse osmosis (RO) treatment to meet the water quality goals.
- Zinc - The level of Zinc in the influent wastewater 140 mg/l) exceeds the standard (5 mg/l), and will be further evaluated as part of the treatment process.

Based on the wastewater characterization and water quality goals established in this report, a number of treatment processes were identified as possible treatment technologies to meet these requirements. These technologies include:

- MBR
- Chemical Phosphorus Removal
- RO
- Disinfection

It is recommended that the water quality goals be verified with regulatory agencies including FDEP and Broward County Environmental Protection Division (EPD).

(END OF SECTION)

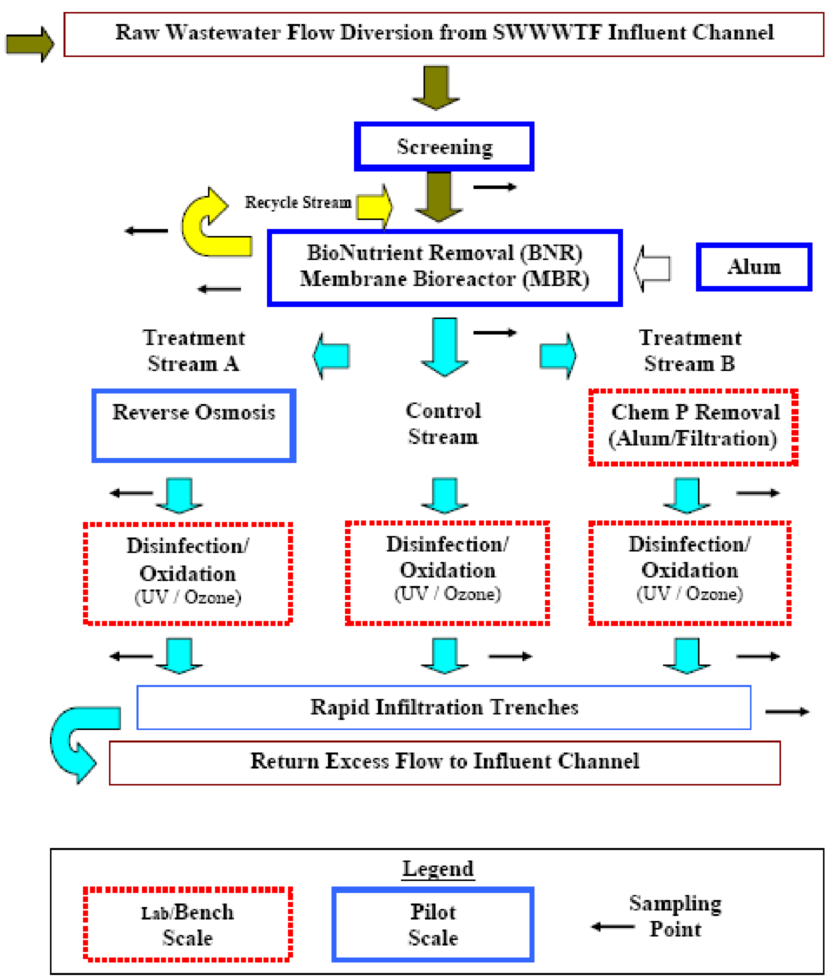
Section 3

3.1 PILOT TESTING DESIGN AND EQUIPMENT DESCRIPTION

The pilot study tested three principal treatment streams as shown on the process flow diagram in **Figure 3-1 and 3-2**. The principal process streams are as follows:

- Control Stream – Bionutrient removal (BNR) membrane bioreactor (MBR) treatment followed by disinfection
- Treatment Stream A – BNR-MBR followed by reverse osmosis and disinfection
- Treatment Stream B – BNR-MBR followed by chemical phosphorus removal (Alum), filtration and disinfection

Figure 3-1
Raw Wastewater Flow Diversion from SWWWTF Influent Channel



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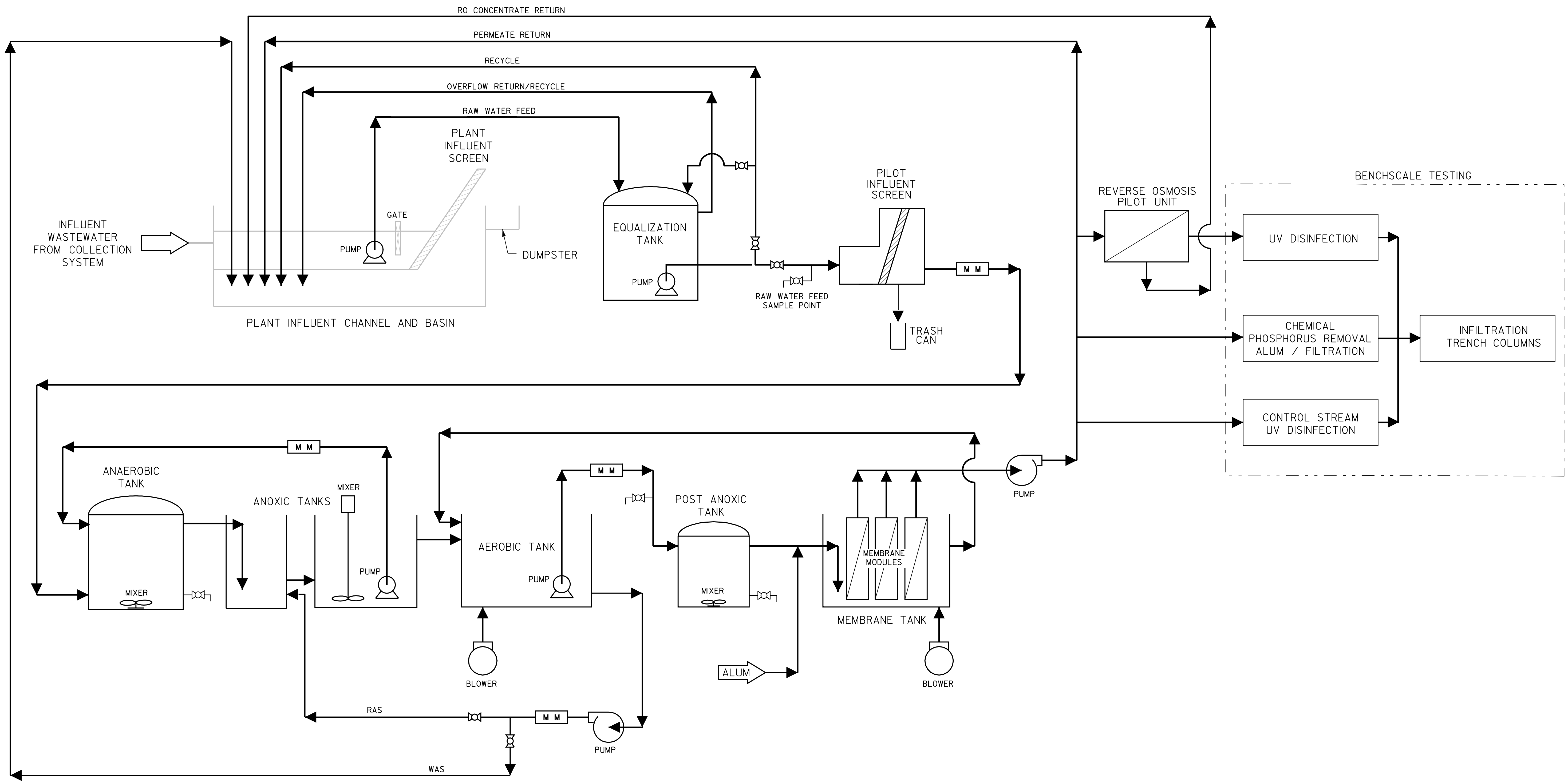
Insert Figure 3-2 here



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ADVANCED WASTEWATER TREATMENT AND REUSE
PILOT TESTING PROCESS FLOW DIAGRAM

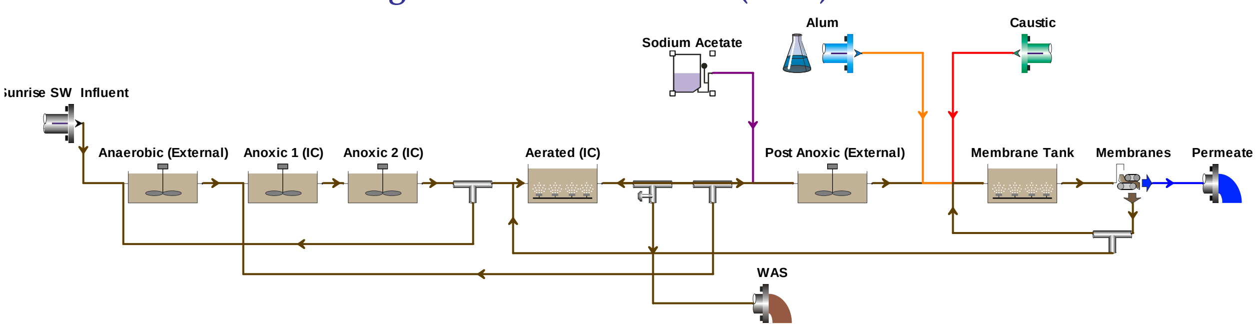
FIGURE
3-2

File: \\Usftls01\USFTLIS01\Projects\MWA\Sunrise\1570867 SWWWTF MBR Pilot Reuse Study\MBR Pilot Plant - Brad's and Other Proj Docs\Proposal\PFD.dgn User: blamay Plot Date: 21-DEC-2007 11:22

3.2 BIONUTRIENT REMOVAL MEMBRANE BIOREACTOR (BNR-MBR) DESCRIPTION

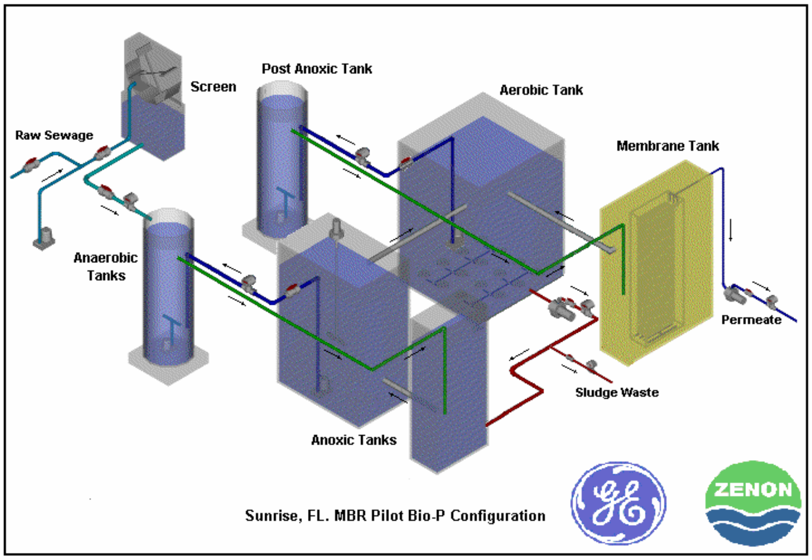
The City of Sunrise's pilot Biological Nutrient Removal (BNR) process is a five-stage treatment process as shown in **Figure 3-3**. It was designed as a modified University of Cape Town (UCT) process where the anoxic reactor is subdivided into two anoxic reactors. The mixed liquor from the second anoxic tank is recycled to the anaerobic tank. The first anoxic reactor receives mixed liquor from the aerobic tank. The pilot wastewater influent was pumped from the SWWWTF inlet channel into the equalization tank followed by external anaerobic tank via a fine screen. The stream from anaerobic tank was treated in an internal pre-anoxic tank, followed by a second anoxic tank, aerobic tank, and an external post anoxic tank. The effluent from post anoxic tank flows to the fifth stage which includes the membranes.

Figure 3-3
Biological Nutrient Removal (BNR) Process



Biological COD, nitrogen and phosphate removal is achieved by manipulating three biochemical reactions under which three groups of organisms can be favored to perform the nitrification, denitrification and biological excess P removal (BEPR) processes. The BNR-MBR pilot plant was designed with reactors sized to optimize P removal since this was the most critical element of the treatment process.

Figure 3-4
MBR Pilot Bio-P Configuration



The MBR pilot unit was provided by GE/Zenon using the ZEEWEED® membranes. The membranes were designed for a flux rate of 17 gallons per day per square foot (gpd/sf). The process stream flow rates are shown in **Table 3-1**.

Table 3-1
BNR-MBR Process Flow Rates

Stream	Flow Rates
Feed and permeate	Q = 4 gpm
Aerobic to De-Ox	3Q = 12 gpm
Aerobic to Post-anoxic	5Q = 20 gpm
Anoxic to Anaerobic	2Q = 8 gpm
Anaerobic to De-Ox	3Q = 12 gpm
De-Ox to Anoxic	6Q = 24 gpm
Anoxic to Aerobic	8Q = 32 gpm
Post-anoxic to Membrane	5Q = 20gpm
Membrane to Aerobic	4Q = 16gpm

The BNR-MBR pilot unit was designed for a solids retention time (SRT) of 15 days and hydraulic retention time of 10 hours. The system operating volume was 2,620 gallons. The mixed liquor suspended solids (MLSS) was in the range of 6,000 to 8,000 mg/L. The membrane air flow rate was 18 standard cubic feet per minute (scfm). Equipment was provided for chemical dosing of aluminum sulfate (alum) for enhanced P removal and caustic soda for pH control.

Figure 3-5
Containerized MBR Pilot Unit

Additional details regarding the BNR-MBR pilot plant design are provided in **Appendix C1**.

3.3 REVERSE OSMOSIS (RO) UNIT DESCRIPTION

The reverse osmosis pilot unit used for the pilot study was provided by GE/Zenon. The two membranes that were tested were a Dow/Filmtec BW30 FR and Hydranautics ESPA2. **Table 3-2** summarizes the testing conditions for the RO pilot, as well as membrane information.

Table 3-2 RO Unit Operational Parameters

Description	Filmtec	Hydranautics
Membrane Type	BW30-4040	ESPA2-4040
Number of Modules	2	2
Total membrane surface area [1]	78 ft^2	85 ft^2
Diameter	4"	4"
Flux rate (with recycle)	12 gfd	12 gfd
Differential Pressure (calculated average)	1.10	0.28
Recovery Rate (with recycle)	37	37
Feed Flow (calculated average)	5.0	5.5
Permeate flow (calculated average)	1.36	1.25
Recirculation Flow (calculated average)	2	2

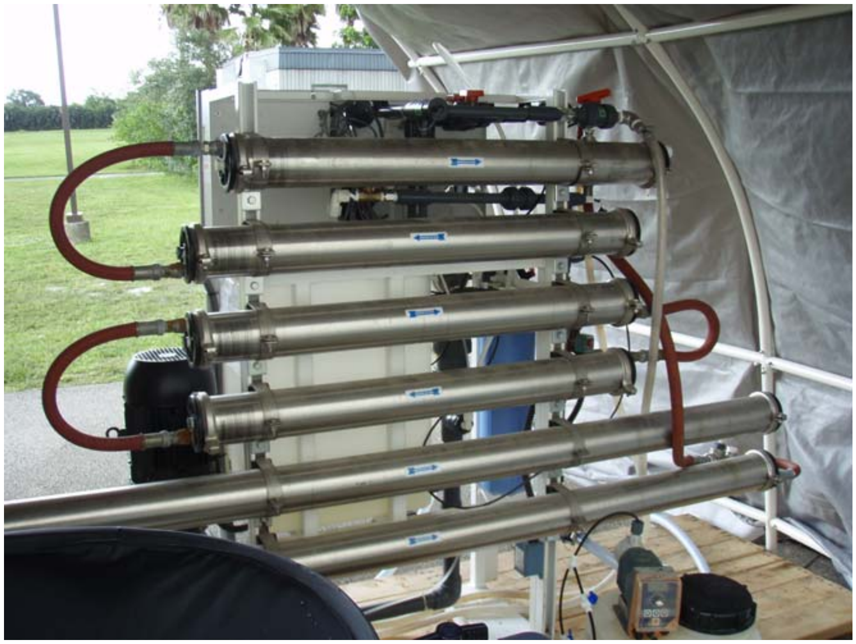
Notes: 1 Nominal Active Surface Area from website: Filmtec BW30-4040 4" = 78 ft2. Hydranautics ESPA2-4040 4" = 85 ft2.

A front view of the pilot plant is shown in **Figure 3-6**, including the PLC panel, pressure vessels, cartridge filter, feed pump is shown to the right of the panel. Feed to the unit was from the break tank behind the RO unit where MBR effluent was stored, and chloramines were added to prevent bio-fouling.

Figure 3-6
Reverse Osmosis Pilot System

The pilot system was configured such that each membrane was tested separately, and loaded into the lower vessel. Two 4-inch diameter, 40-inch long elements were loaded into this vessel for testing. The original configuration of the RO pilot unit was modified to suit the needs of this pilot. Illustrated in **Figure 3-7** are the RO vessels for testing. All vessels except the bottom two-element vessel were isolated. The concentrate was recycled back to the head of the vessel to increase the feed flow to ensure a minimum cross-flow velocity was maintained. This allowed the testing to simulate the first stage of a full-scale array.

Figure 3-7
Sunrise Pressure Vessel Array



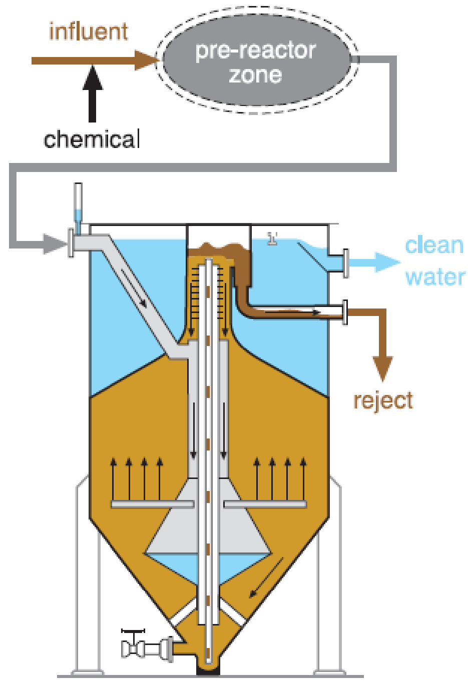
3.4 PHOSPHORUS REMOVAL

In order to achieve additional phosphorus removal, two measures were undertaken as part of Stream B:

- Addition of alum within the MBR pilot unit
- Polishing treatment after the BNR-MBR using an upflow filter with chemical addition of ferric ion.

The upflow sand filter testing was incorporated a unit provided by Blue Water Technologies, Inc. The Blue PRO™ process uses chemical adsorption hydrous ferric oxide (HFO) coated sand for P removal. Continuously regenerating the reactive filter media is accomplished by using a moving bed filter to constantly grind the surface of the media, creating fresh sites for new HFO coating.

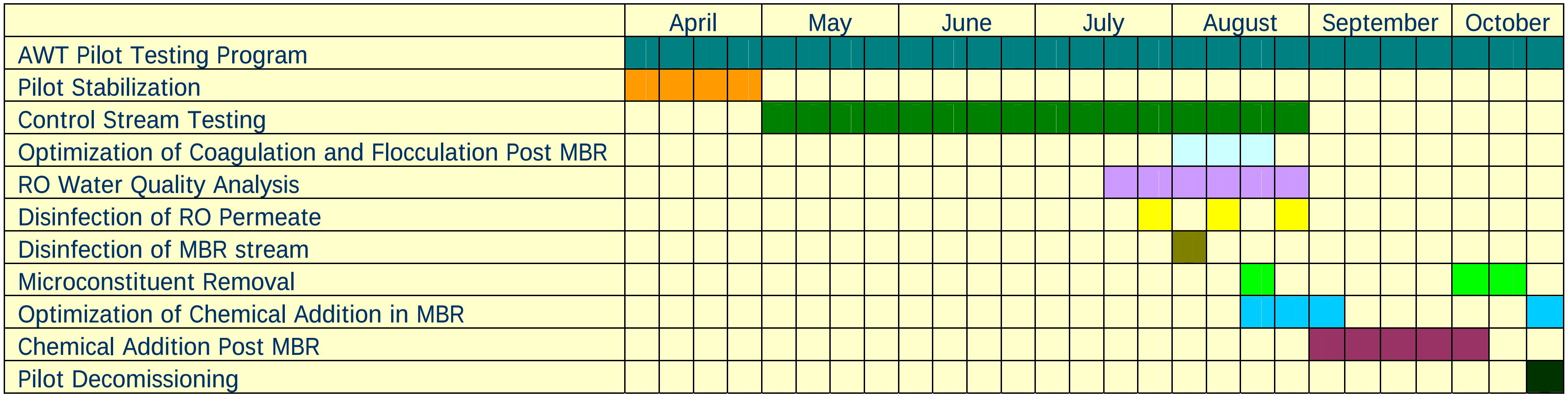
Figure 3-8
Blue PRO Process



Influent wastewater enters the Blue Pro ™ unit, where a commonly-available water treatment chemical (typically ferric chloride) is added to the wastewater before it passes into the pre-reactor zone. This zone allows the proper contact time for the mixture to optimize the adsorption process. The mixture enters the moving bed sand filter through distribution arms at the bottom of the sand bed, then flows upward through the sand bed. After filtration, clean water discharges from the top of the filter on the right. Internally, the sand moves slowly from top to bottom, then returns to the top of the filter via an airlift located in the central assembly. A wash box at the top of the filter separates sand from waste particles. After adsorption, the iron and phosphorus are subsequently abraded off the sand and passed out with the waste particulates. The washbox and airlift are modified specifically for the Blue PRO™ process. The sand is retained within the filter and falls back to the top of the bed. The residuals, including the iron and phosphorus or other contaminants, exit in a reject line and can be routed to the plant's existing solids handling system or preferentially recycled to the plant's secondary system for additional contaminant removal.

3.5 PROJECT SCHEDULE

Table 3-3 Pilot Project Schedule



3.6 SAMPLING PLAN

Table 3-4 Pilot Sampling Plan

Task	Purpose	Description	Issue	Duration
1	Optimize Coagulant Dose	3 different doses of alum - 5, 10, 15, 100 mg/L.	Optimal dosage for chemical P removal within the MBR.	1 day stabilization, 3 days sampling per dosage, 7 days for 100 mg/L dose, 18 days total.
2	Optimize Dentrification	Different doses of sodium acetate.	Optimal dose for Nitrogen removal.	Not performed as denitrification was not necessary for recharge goals.
3	RO Testing	Test two different elements for water quality and performance.	Water quality testing and comparison of element performance.	2 weeks for filmtech element, 5 days for hydronautic element.
4	Disinfection of Control	Vary UV dosage (0, 10, 20, 30).	Disinfection efficiency.	2 weeks
5	Disinfection of RO Permeate	(1) Vary UV dosage (0, 20, 40, 60, 80, 100).	Disinfection efficiency.	2 weeks
		(2) Vary peroxide addition dosage (0, 50,100, 200,300, 400).	Disinfection efficiency.	2 weeks
		(3) MS 2 Seeding.	Effectiveness of RO elements in removing artificially seeded virus.	2 weeks
6	Optimization of Alum Dosage	Perform Jar test at different alum dose 5, 10, 15, 20, 30 and 50	Optimize dose for Coagulant dosing in MBR.	3 weeks
7	Disinfection of GMF Effluent	Vary UV dosage (0, 20, 40, 60, 80, 100).	Disinfection efficiency.	Not performed as no coliform was detected on MBR effluent.
8	Microconstituent removal	Test microconstituent removal by MBR, RO and Chemical addition in MBR.	Treatment technology comparision for microconstituent removal.	3 months
9	Blue Water Testing	Testing with Iron and testing with Iron and oxidant.	Chemical P removal technology testing post MBR.	5 weeks
10	Characterization	MBR Influent and Effluent characterization.	Comparison to water quality goals.	1 month

3.7 SAMPLING AND ANALYSIS

Grab samples were collected for influent stream and 24-hour composite samples were collected for the MBR effluent stream were 24 hour composite samples. RO testing samples were grab samples. All samples that were analyzed for micro-constituents were grab samples. Disinfection analyses performed on the RO permeate and MBR effluent were batch runs.

(END OF SECTION)

Section 4

4. PILOT TESTING RESULTS

4.1 GENERAL

This section presents the test results for the pilot study. The testing results are presented in three groups that include:

- Wastewater characterization testing
- Routine testing
- Micro-constituent testing

4.2 WASTEWATER CHARACTERIZATION

An initial influent (raw) wastewater characterization was performed before the commencement of pilot study in February 2007. A second wastewater characterization was performed for a suite of constituents in September 2007 for both the MBR influent (raw wastewater) and MBR effluent. The MBR influent data represents grab samples, where as MBR effluent data is a combination of 24 hour composite and grab samples depending on the regulatory reporting need. **Appendix F** shows data for all constituents tested during the second stage characterization. The main constituents are provided in **Table 4-1**.

Table 4-1 Phase II Wastewater Characterization

Compound	Broward County Chapter 27-195 Groundwater Discharge Standards (mg/L)	Drinking Water Standards, and DEP G-1 Groundwater Discharge Standard (mg/L)	Water Quality Goal (mg/L)	MBR influent Water Quality (mg/L)	MBR effluent Water Quality (mg/L)
CBOD 5	N.S.	-	20 ann avg.(a)	-	-
	-	-	30 monthly(a)	-	-
	-	-	60 single sample(a)	-	-
BOD5	5	-	5	240	1
Chlorine (total residual)	1	-	1	-	-
Coliform (fecal)	A. 200 colonies per 100 ml for monthly average	-	A. 200 colonies per 100 ml for monthly average	-	-
	B. 400 colonies per 100 ml for 10% of samples	-	B. 400 colonies per 100 ml for 10% of samples	-	-
	C. 800 colonies per 100 ml in any sample	-	C. 800 colonies per 100 ml in any sample(b)	ND	28 colonies per 100 ml sample

Table 4-1 Phase II Wastewater Characterization (Continued)

Compound	Broward County Chapter 27-195 Groundwater Discharge Standards (mg/L)	Drinking Water Standards, and DEP G-1 Groundwater Discharge Standard (mg/L)	Water Quality Goal (mg/L)	MBR influent Water Quality (mg/L)	MBR effluent Water Quality (mg/L)
Coliform (total)	1,000 colonies per 100 ml	-	1,000 colonies per 100 ml	ND	25000 colonies per 100 ml sample
Nitrogen: total Nitrogen as N (Nitrate, Nitrite, NH3, and organic)	N.S.	-	10 (c)	50 mg/L	<10 95% of the time
Nitrate (as N)	10	10	10	0.27	<7 99.9% of the time
Nitrite (as N)	1	1	1	1.8	<1 50% of the time and <2 99.9% of time
Total Nitrate + Nitrite (as N)	10	10	10	2.07	2.18
pH	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	7.81	7.88
Phosphates (total as P)	0.01	-	0.01	5	< 100 80% of the time
Total dissolved solids	500	500	500	420	410
Total Suspended solids	-	-	20 ann avg. (a)	-	-
	-	-	30 monthly(a)	-	-
	-	-	60 single sample(a)	100	< 7 97% of the time
Turbidity	10 NTUs	-	10 NTUs	110 NTU	0.25 NTU
(a) FDEP requirements					
(b) Per FDEP permit at 0.99 mgd AADF, limit is 25/100 mL single sample maximum					
(c) Per FDEP permit at 0.45 mgd Total Nitrogen limit is 10mg/L maximum. At 0.99 mgd, the limit is 10 mg/L annual avg., 12.5 mg/L monthly avg., and 20 mg/L single sample.					

In Summary:

- Standard Domestic Wastewater Constituents (BOD_5, $CBOD_5$, TSS, TN, TP, fecal coliforms, oils/greases, and turbidity) – The effluent was found to be consistently within water quality standards.
- Aluminum - Influent wastewater concentrations (0.32 mg/L) were reduced to 0.12 mg/L, which is below the limit of 0.20 mg/L.
- Iron (Fe) – This was reduced to 0.039 mg/L below the limit of 0.30 mg/L.
- Total Dissolved Solids (TDS) and Chlorides (Cl) – The salinity of the influent wastewater is below the water quality standard (TDS = 420 < 500 mg/L and Cl = 100 < 250 mg/L). MBR effluent was determined to be 410 mg/L, also below the limit.
- Zinc - The influent wastewater concentration (0.13 mg/L) and in MBR effluent is (0.038 mg/L) are both below the limit (5 mg/L).

4.3 ROUTINE TESTING

Routine testing was carried out periodically through the course of pilot program for operational parameters and effluent wastewater concentrations from the following streams:

- MBR
- RO
- Upflow Sand Filter
- Bench scale testing.

4.3.1 MBR Results

MBR testing data is presented in two sets:

- Operational Data – Measured daily onsite realtime.
- Analytical Data (Effluent) – Measured daily as 24 hour composite sample

4.3.1.1 MBR Operational Data

This operational data in this section presents Flux, dissolved oxygen (DO) and turbidity. Realtime operational data is presented in **Appendix G**. Additional operational data was collected onsite on a daily basis and is provided in **Appendix H** under the operator log sheet.

- The MBR unit was operating a flux range of 15 to 17 gallons per ft-square per day (gsfd) and is illustrated in **Figure 4-1**.

- The DO was maintained around 2 mg/L within the aeration tank and was adjusted manually on a daily basis to supply oxygen to the biomass. The DO measurements during this study are presented in **Figure 4-2**.

- As illustrated in **Figure 4-3** the turbidity of the MBR effluent was less then 0.15 NTU for most part of the study. The turbidity meter was clogged in the month of September.

Additional parameters such as transmembrane pressure (TMP), and permeability were also measured and is provided in **Appendix G**.

Figure 4-1 Flux (gfd)

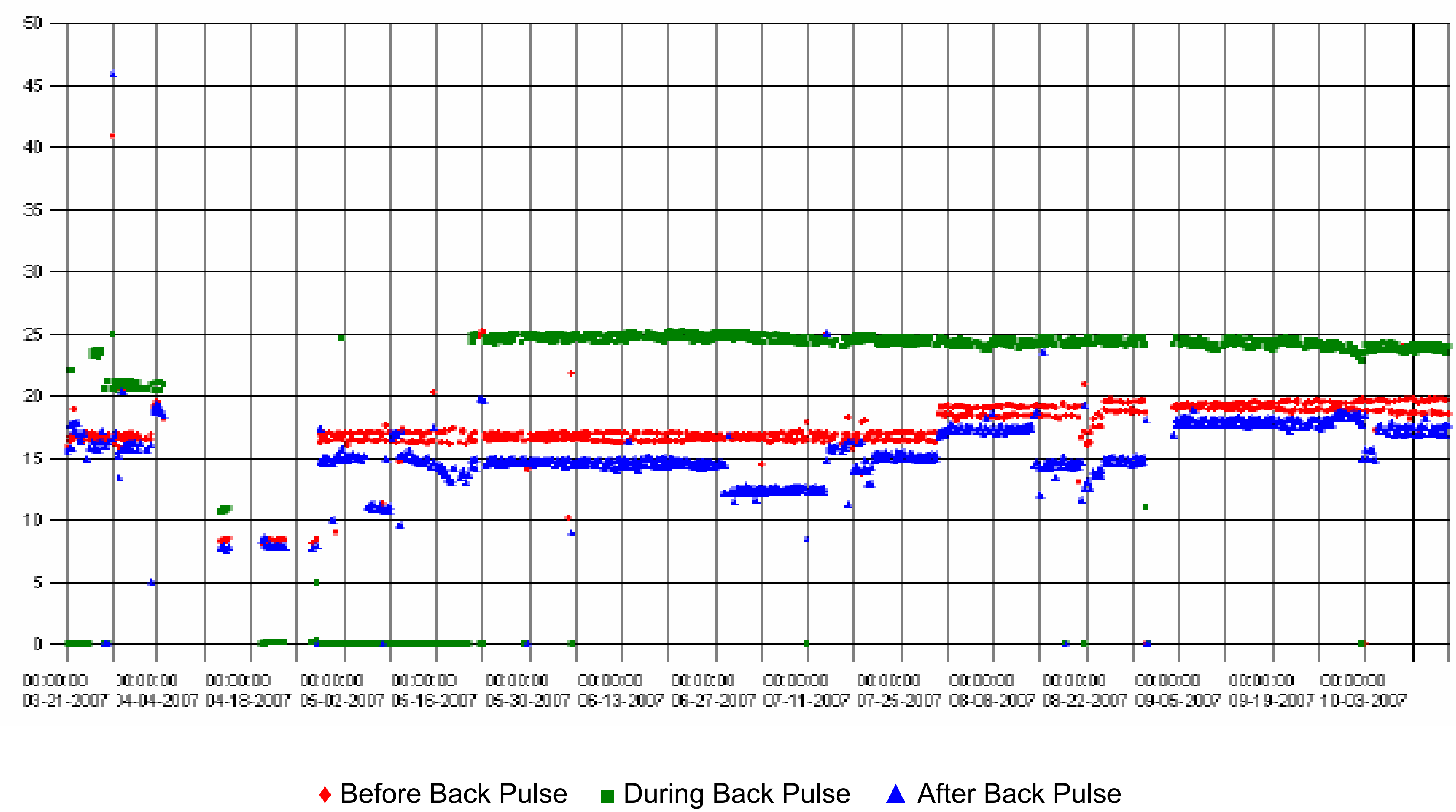


Figure 4-2 Dissolved Oxygen (mg/L)

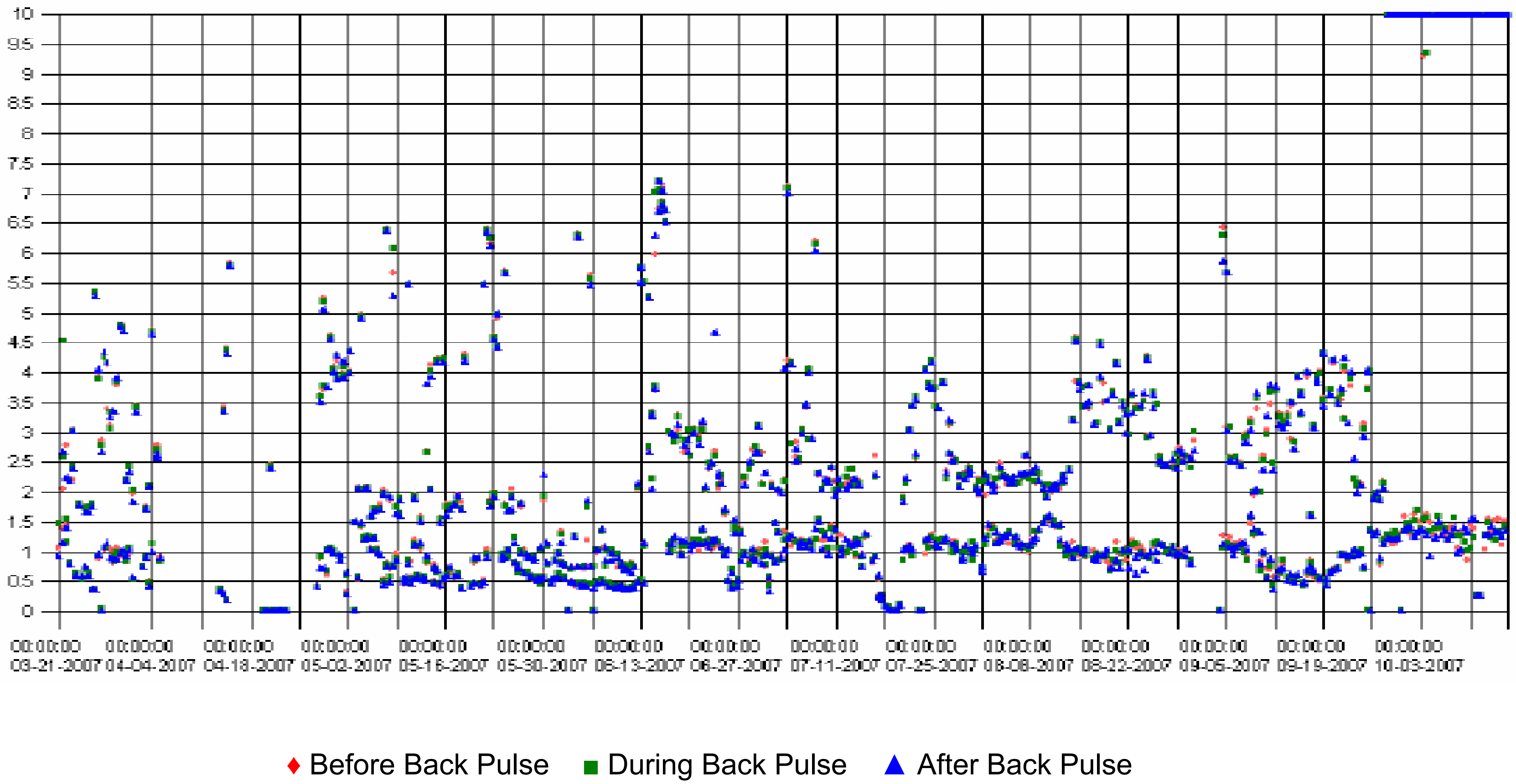
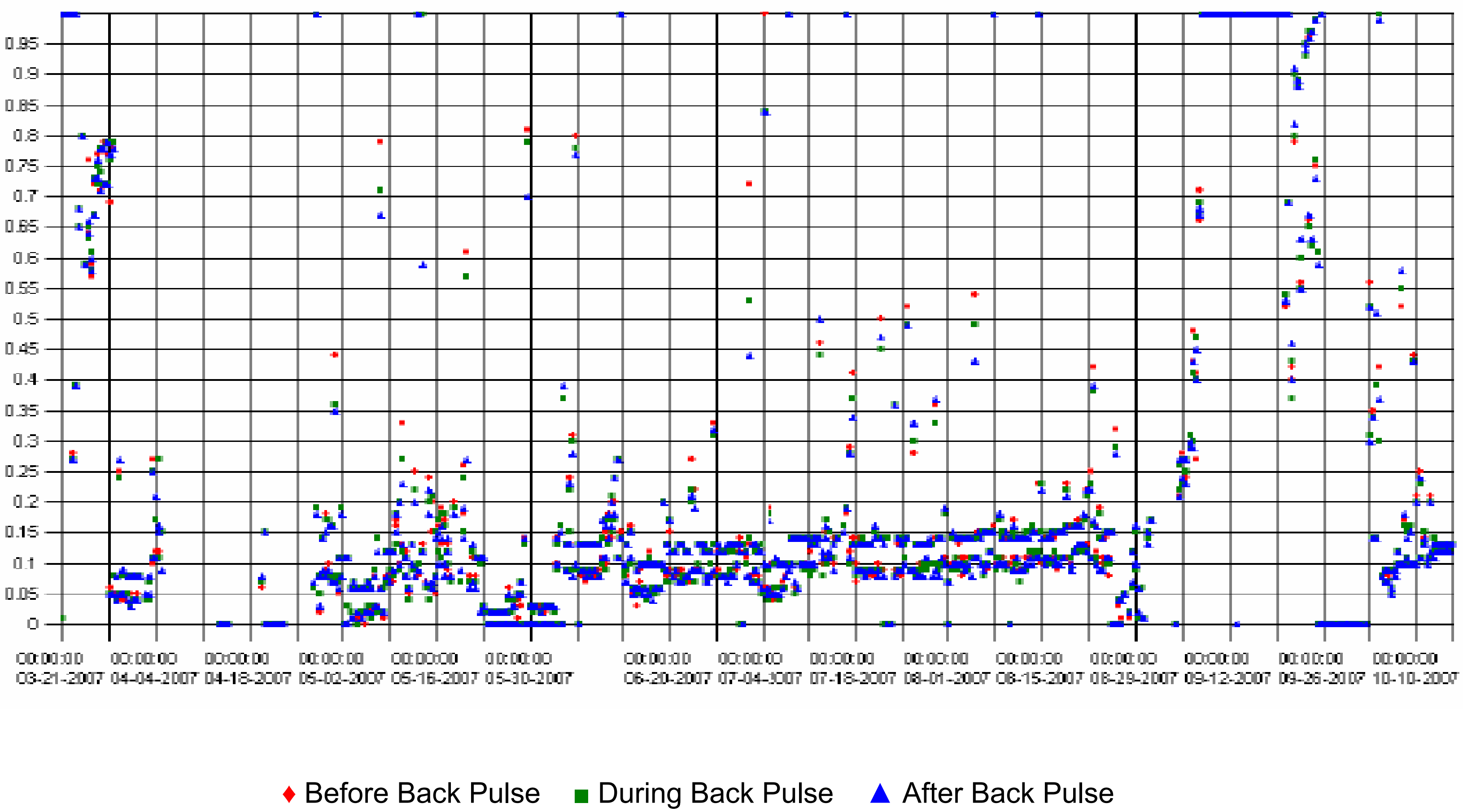


Figure 4-3 Turbidity (NTU)



4.3.1.2 MBR Analytical Effluent Data

Analysis was performed on a daily basis by a certified laboratory to measure the concentration of various constituents in the effluent. The analytical data is presented in **Appendix I** for the duration of the pilot study. Data for major constituents, such as TSS, BOD5, Total Nitrogen and Phosphate is presented in this section as graphs. There are two types of graphs for each constituent:

- MBR influent and MBR effluent data - Grab samples of influent and 24-hour composite sample of effluent were collected and analyzed. These graphs include all the data including pilot startup period and pilot upset periods.

- Probability graphs – All analytical data were filtered to eliminate justifiable skew ness of the data. The elimination includes standby period caused by power outages, stabilization period and laboratory case narrative statements.

Analysis Results indicate the following:

- As indicated in **Figures 4-4 and 4-5**, the MBR influent had an average TSS concentration of 187 mg/L. The TSS were below the detection limit of 3.5 mg/L for most part. The percent probability graph shows that water quality standard is achievable 93% of the time.

- As illustrated in **Figure 4-6** the MBR influent had an average BOD_5 concentration of 240 mg/L. BOD_5 was below the detection limit of 1 mg/L for most part. The probability graph presented in **Figure 4-7** shows that the water quality standard is achievable 90% of the time.

- The MBR influent had an average TN concentration of 40 mg/L. The MBR effluent has an average TN level of 5 mg/L over the pilot study period. The probability graph **(Figure 4-9)** shows that the water quality standard is achievable 95% of the time.

- The orthophosphate in MBR effluent was generally below 1.00 mg/L as shown in **Figure 4-10**. Chemical addition was performed to enhance the phosphate removal in mid-August through the end of August. Alum was dosed at 10, 20, 30 and 50 mg/L, which resulted in phosphate levels consistently to below 0.100 mg/L as illustrated in **Figure 4-11**. The probability graph **(Figure 4-12)** shows that chemical addition can reduce phosphate levels to 0.03 mg/L more then 96% of the time.

Figure 4-4 TSS Removal by MBR

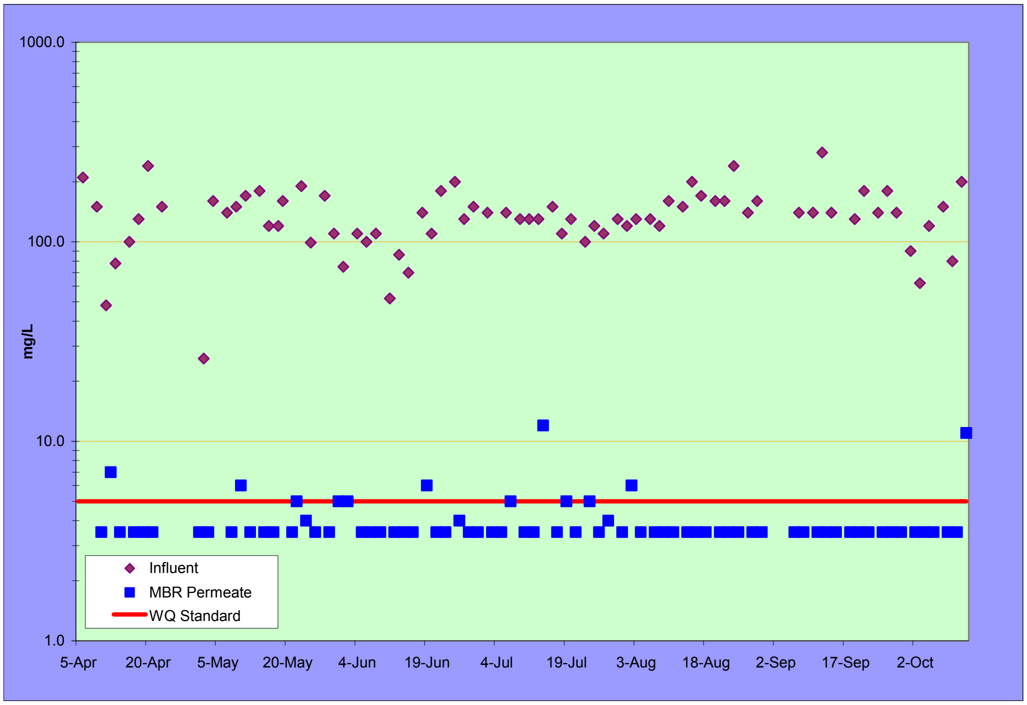


Figure 4-5 Percent Probability of TSS Removal by MBR

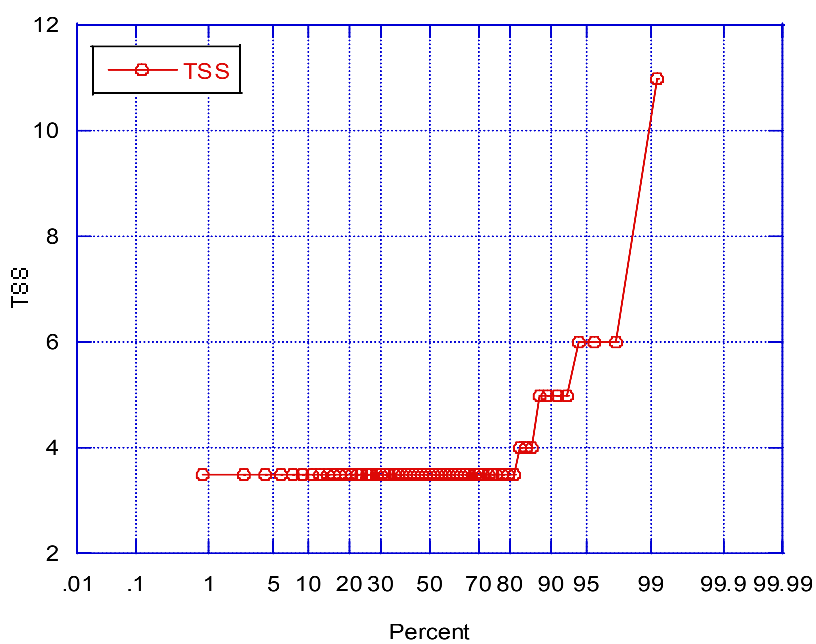


Figure 4-6 BOD5 Removal by MBR

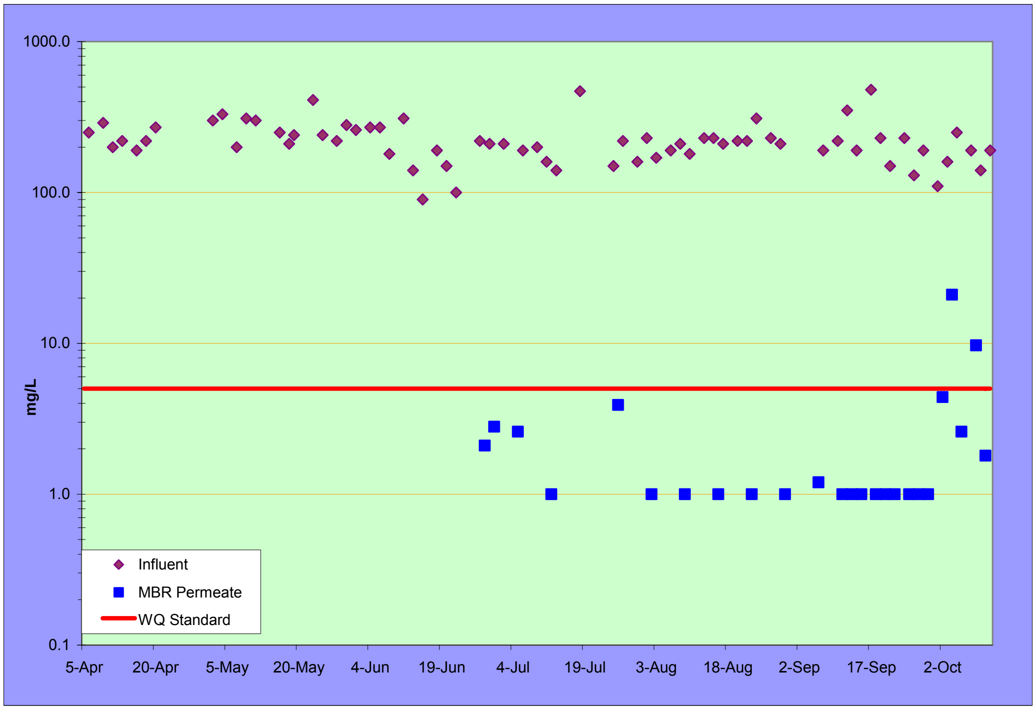


Figure 4-7 Percent Probability of BOD5 Removal by MBR

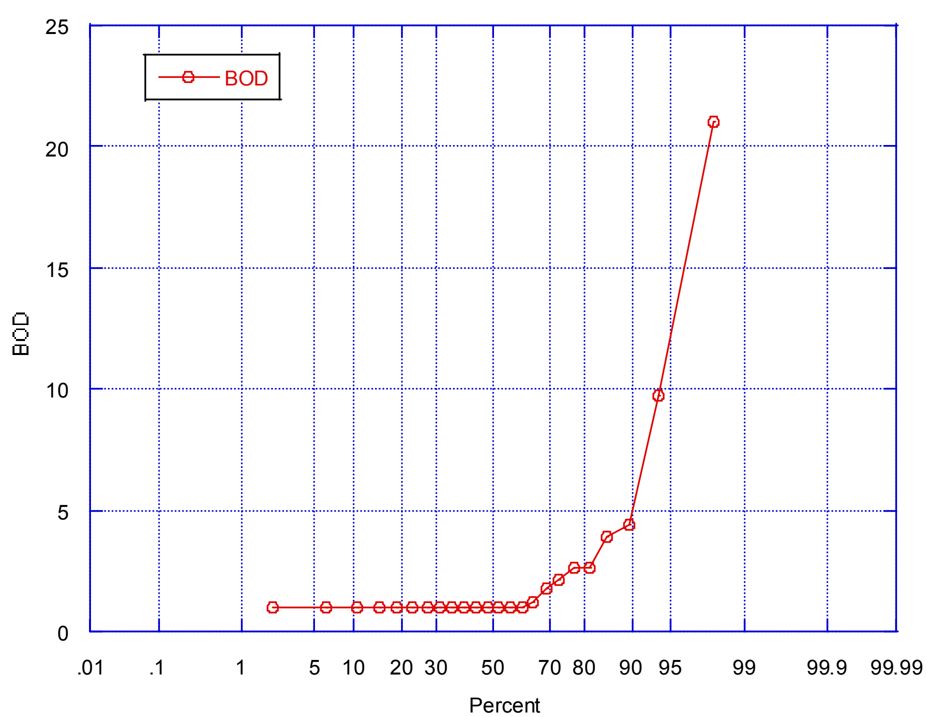


Figure 4-8 Total Nitrogen Removal by MBR

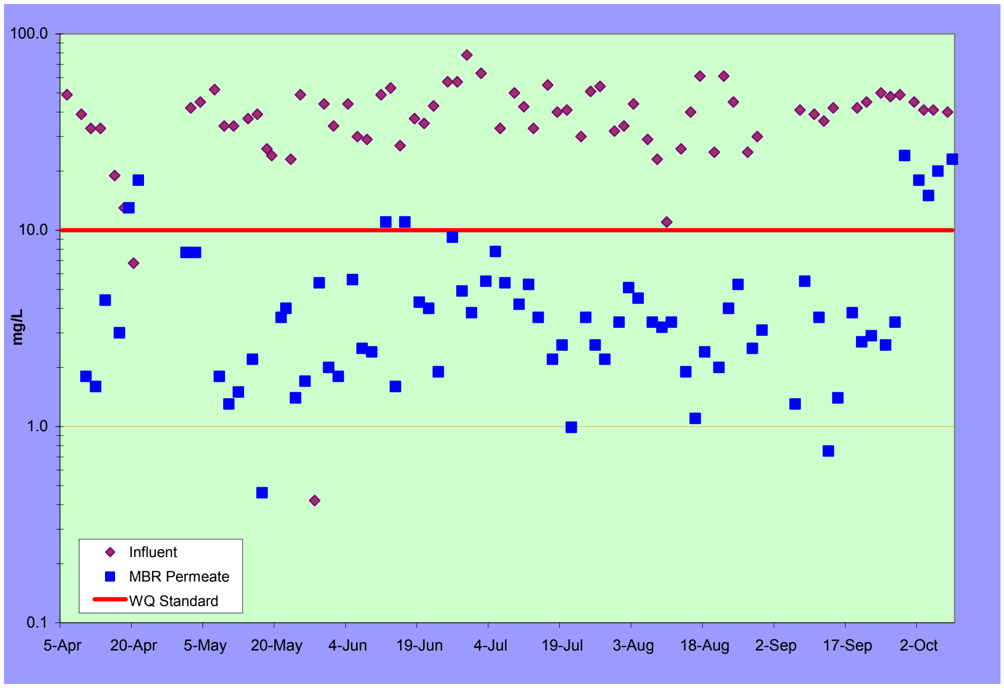


Figure 4-9 Percent Probability of Total Nitrogen Removal by MBR

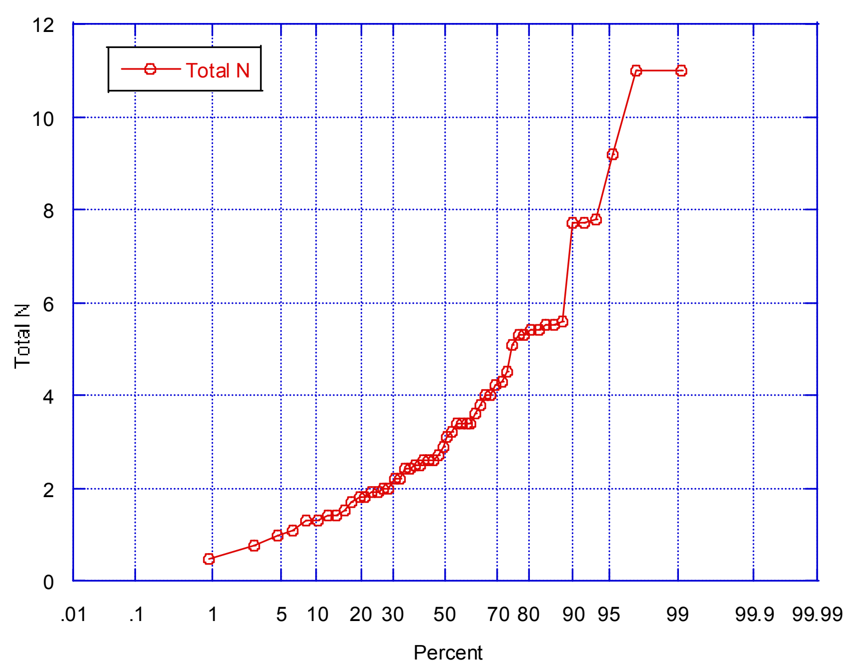


Figure 4-10 Total Phosphate Removal by MBR

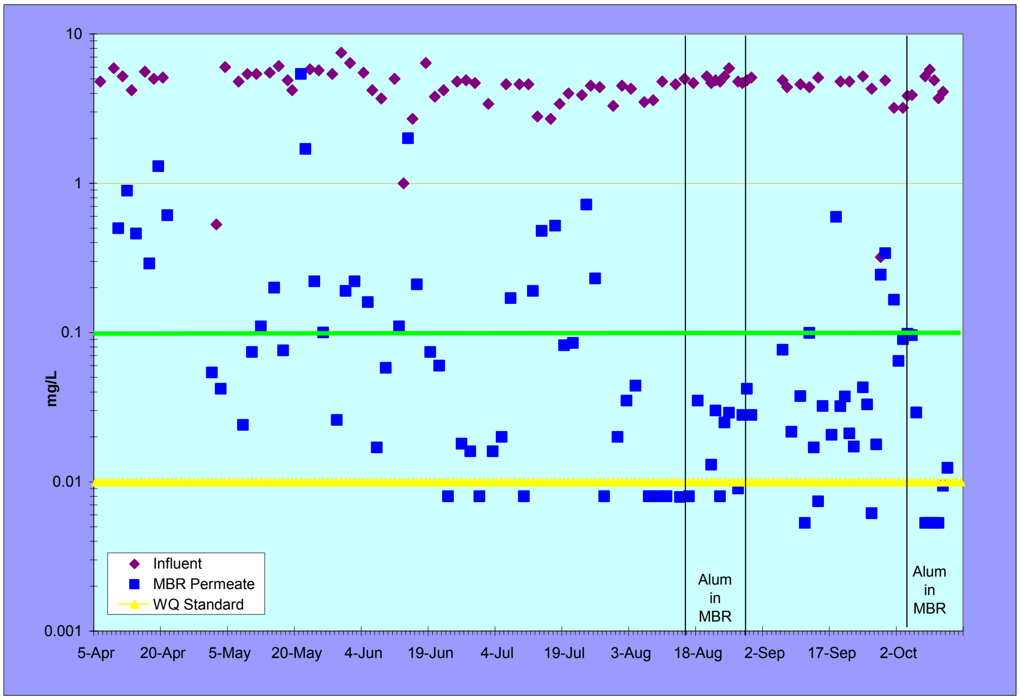


Figure 4-11 Percent Probability of Total Phosphate Removal by MBR

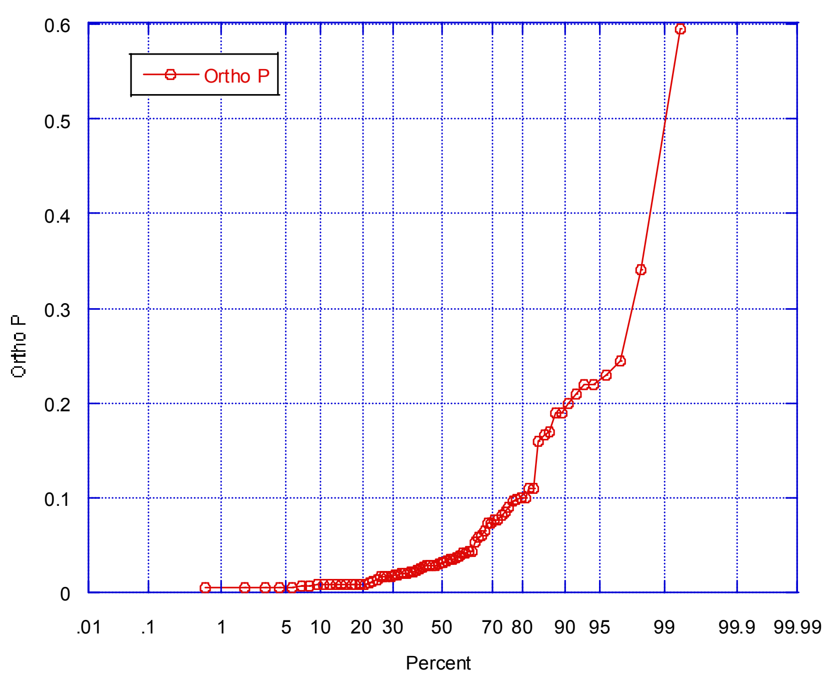
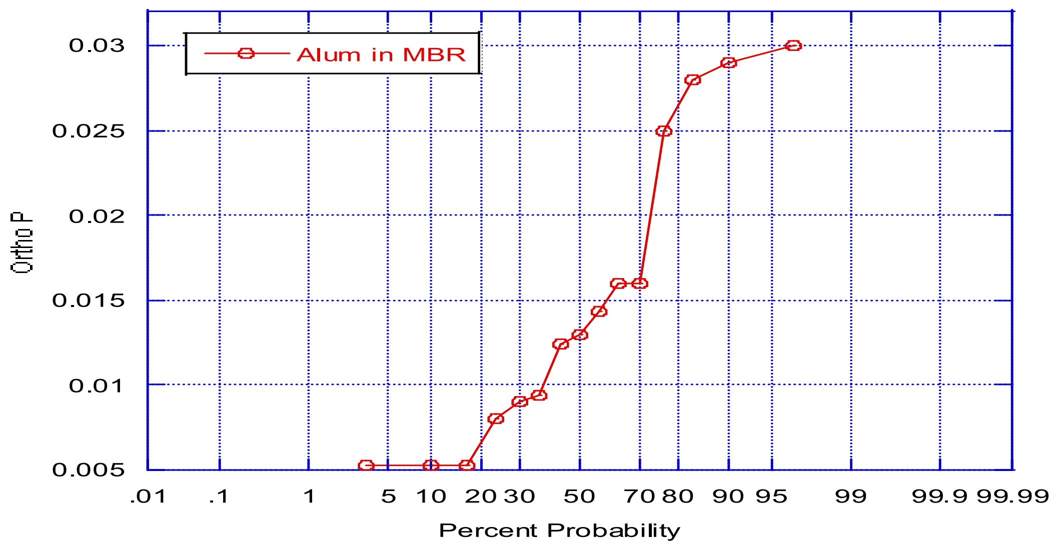


Figure 4-12 Percent Probability of Total Phosphate Removal by MBR (with Alum Addition)



The percent probability is an indicator of the probable chances a single sample can meet the regulated limit. Usually average values are reported for regulated constituents, in such case, the pilot study results show that chemical addition within MBR can reduce the phosphates to 0.015 mg/L on an average for 20 day testing period with varying alum dose of 10 mg/L to 100 mg/L.

4.3.2 RO Results

The RO pilot plant unit was tested for two major parameters:

- Compliance with water quality goals (i.e., phosphorus and pathogen removal)
- Screening for fouling.

This section presents the results of the pilot testing.

4.3.2.1 RO Data

Operational results for the RO testing are presented in **Appendix J**. Typically, the RO pilot system data should be normalized to mute any variations in temperature and salinity. This would allow the determination of the true rate of fouling. For this study, the systems were only operated to screen for fouling, with the primary objective being water quality performance. In addition, the data was manually collected once/day, which did not allow the normalization methods to be applied. However, the operational data shows that there was little to no increase in pressure over the 170 hours each membrane was operated. This indicates that the MBR effluent provided to the system has no major fouling component. However, to fully understand if one element is superior in fouling resistance to another, or if there would be some fouling, the membranes should be operated in a representative array for at least 1000 to 3000 hours of operation.

Water quality performance from new RO elements stabilizes within minutes or hours, therefore all data presented herein is representative of a new element. It should be noted, that the data presented is only for the two-element system and does not fully represent the quality of the permeate from a full-scale system. The full-scale system would have a higher concentration in the permeate than is shown here. However, these results are presented to determine the relative percent rejection. The percent rejection would be similar in the full-scale system. Further, these data are for new membranes, and there is expected to be a water quality degradation of between 10 and 20% over the 5 to 10 year life of the elements.

Phosphorus removal through the RO pilot was not able to be determined since the MBR effluent performance was so great for the period when RO was being tested. However, phosphorus removal in RO is well understood and can be projected using a desktop analysis. A removal of greater than 95% can be expected from the membranes used in this study. The analytical data for RO testing is presented in **Appendix K. Figures 4-13, 4-14 and 4-15** compares the pressure and conductivity of Filmtec and Hydranautics elements.

Figure 4-13 - RO Operating Pressure

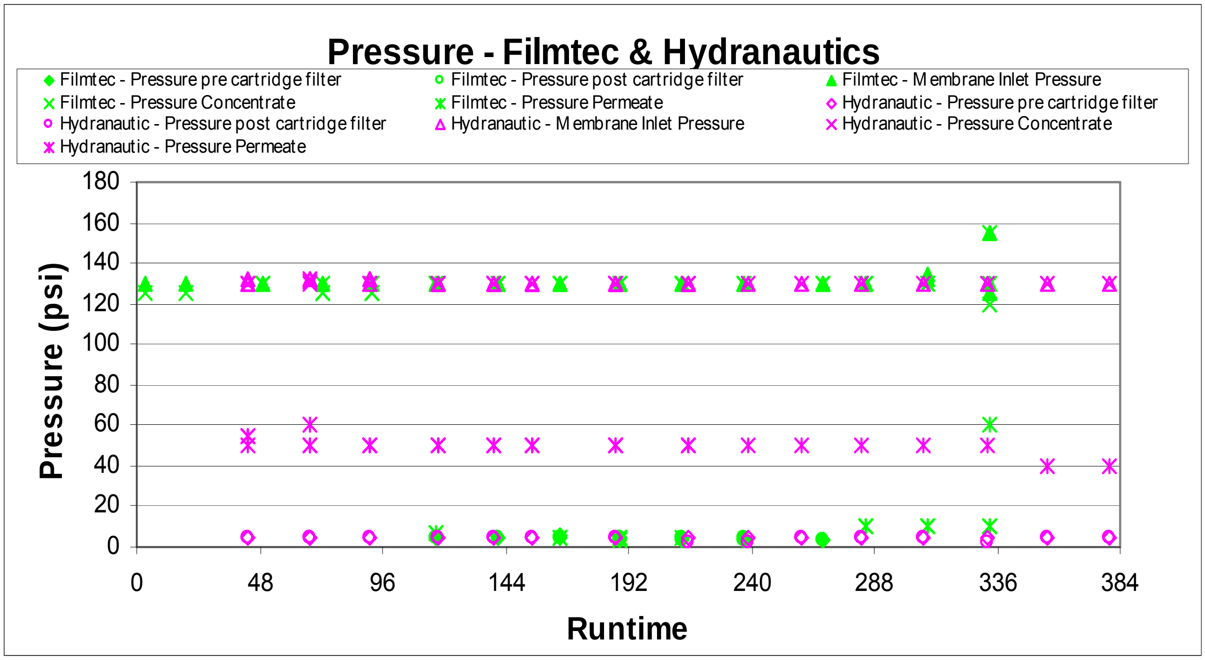


Figure 4-14 - RO Conductivity

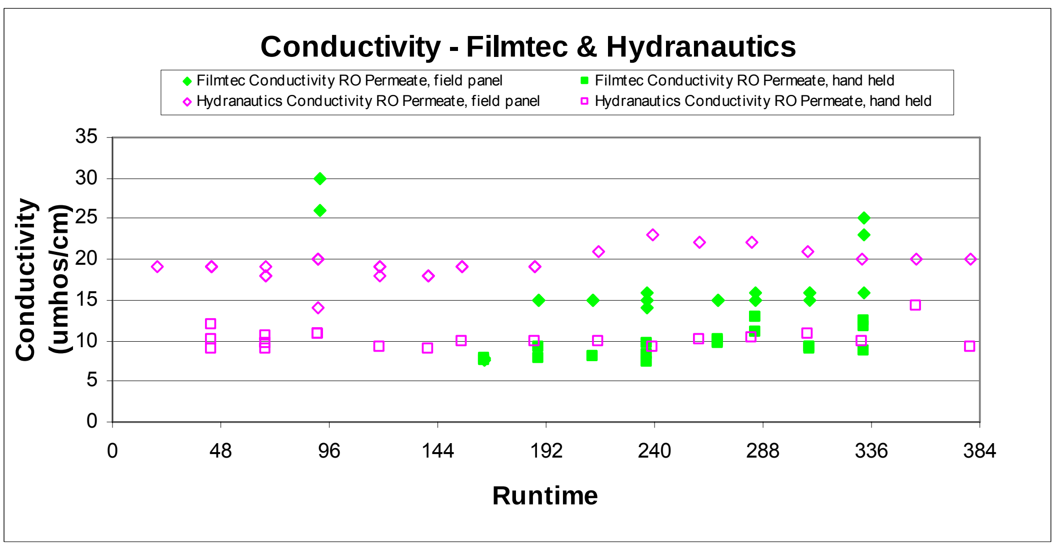
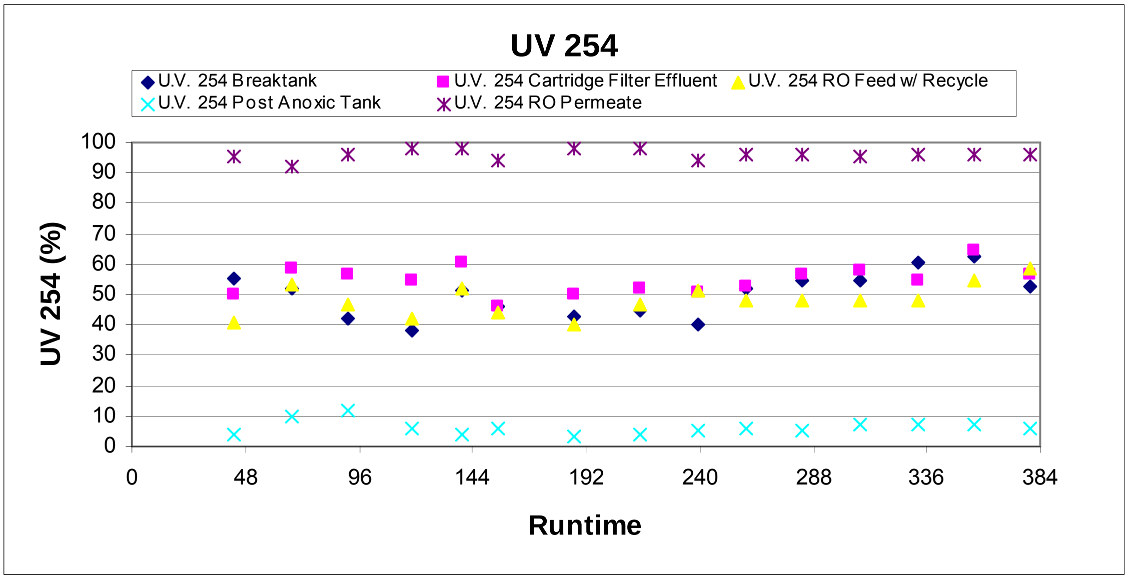


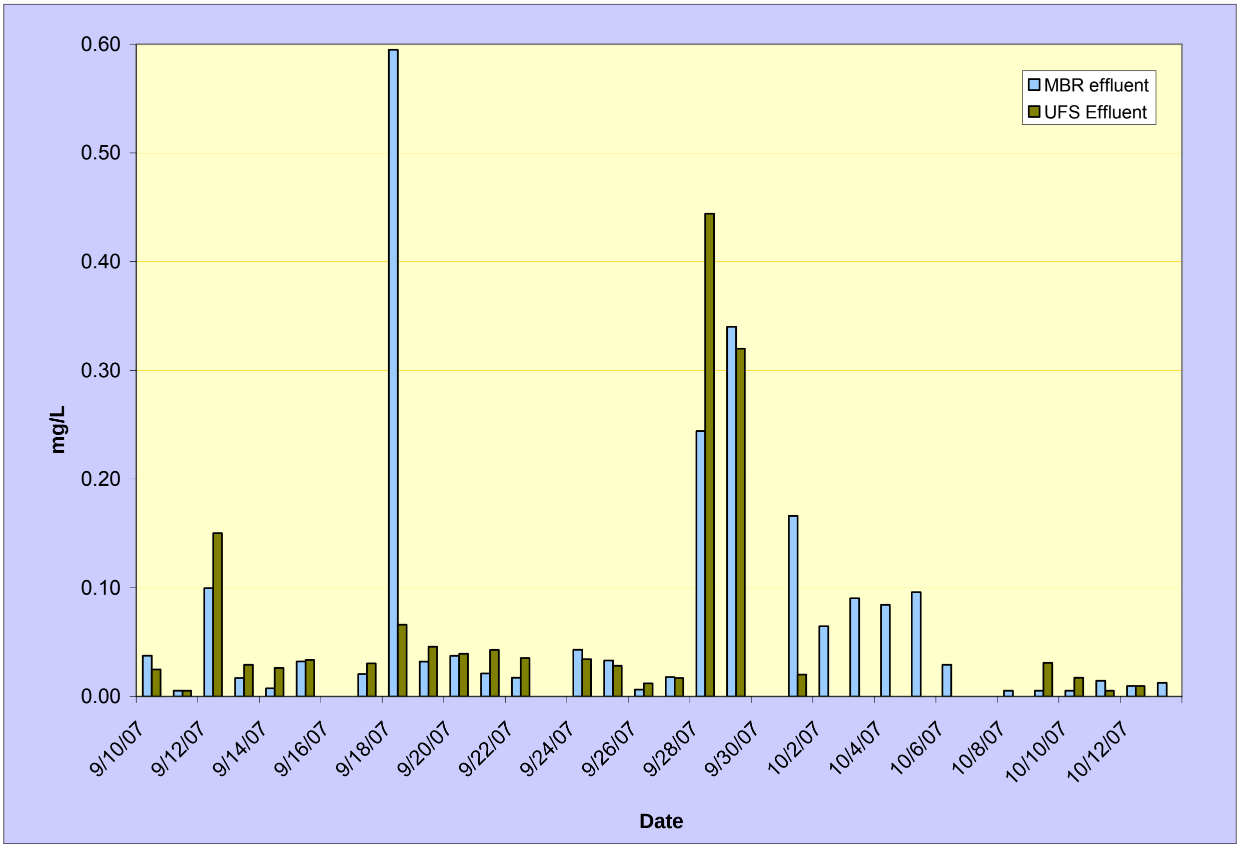
Figure 4-15 – Transmittance of RO Streams



4.3.3 Upflow Sand Filter Results

The upflow sand filter (Bluewater Technologies BluePRO™ unit) testing was performed for a period of over three weeks. **Appendix L** presents the analysis results in detail. The primary objective for testing Blue PRO™ was to study the effect on phosphate removal. **Figure 4-16** presents the effect of the upflow sand filter on phosphate removal. The phosphate levels in Blue PRO™ varies. At high phosphate levels in the MBR effluent, Blue PRO™ was effective; however, at levels as low as 50 mg/L, Blue PRO™ technology did not indicate additional phosphate removal. The testing period was only two months and further testing would be required to establish if the treatment technology can be effective in achieving higher removal rates.

Figure 4-16 – Effect of Upflow Sand Filtration on Phosphate Removal



4.3.4 Bench Scale Testing

Bench scale testing was performed for two test objectives:

- To determine optimum alum dose for the pilot for effective phosphate removal
- To determine disinfection effectiveness on MBR and RO effluent.

A jar testing kit and a collimated beam device was used to conduct these tests. Jar tests were performed for a period of over three weeks where different dosages of alum was applied on the MBR effluent. Various constituents such as turbidity, pH, UV-254 and phosphates were tested for each of these bench scale runs. It was found that the effectiveness of alum on phosphate removal was dependent upon the MBR effluent phosphate levels. Alum dose in the range of 10 to 50 mg/L was found to be effective during the bench test, thus these doses were used within the MBR. **Appendix M** shows the jar test results.

UV disinfection test were performed on a bench scale both on MBR effluent and RO effluent. The indicators used to test UV disinfection was fecal coliform, total coliform, and heterotropic plate count. **Table 4-2** presents the results on fecal coliform removal by UV, and **Appendix N** provides the UV test results.

Table 4-2 - Effect of UV on Fecal Coliform Removal

Date	Raw Influent	MBR Permeate	Post UV	RO Permeate	Post UV
2-Aug	34	25	--	Non Detect	--
4-Aug	100	Non Detect	--	Non Detect	--
7-Aug	180	150	--	2	--
9-Aug	300	44	--	8	Non Detect
15-Aug	--	Non Detect	Non Detect	--	--

4.4 MICROCONSTITUENT TESTING

Microconstituent testing was performed on approximately 42 constituents. These included selected pharmaceuticals and personal care products (PPCPs) and endocrine disrupting compounds (EDCs). Many PPCPs and EDCs fall into this category of emerging contaminants. PPCPs and EDCs are excreted either in their pure form, or as metabolites or conjugates (Daughton and Ternes, 1999), and are found in raw sewage. Although substantial removal of PPCPs and EDCs occurs through conventional wastewater treatment, levels in final wastewater effluent are still above detection limits (Kanda et al., 2003; Nasu et al., 2001; Kirk et al., 2001; Carballa et al., 2004).

Furthermore, a wide range of wastewater-derived PPCPs and EDCs has been detected in surface waters across the United States (Kolpin, et al., 2002) even when reduced concentrations in final wastewater effluent are mixed with natural surface waters, PPCPs and EDCs have been shown to negatively impact aquatic life in the vicinity of discharge (Jobling et al., 1998, Snyder et al., 2003). Research also indicates that adverse effects to aquatic life and rodents can be observed in a laboratory setting, following exposure to some PPCPs and EDCs at very low levels (O'Connor et al., 1996; Purdom et al., 1994; Desbrow et al., 1998). Therefore, although the precise effects on humans are not fully understood, U.S. agencies, such as the Environmental Protection Agency (EPA) and the U.S. Bureau of Reclamation (USBR) have designated the identification and investigation of PPCPs and EDCs to be among their research priorities.

Within the raw sewage, 19 constituents out of 42 were found to be present.

Table 4-3 – Microconstituents Present in Influent

Ibuprofen	2,6-di-tert-butylphenol
N-Nitroso Dimethylamine	4-methylphenol
Phenol	Acetaminophen
Progesterone	Caffeine by GCMS LLE
Sulfamethoxazole	Carbamazepine
Triclosan - EDC phenols	
waste parm	DEET
Trimethoprim	Esterone
Triphenylphosphate	Estradiol
tris (2-butoxyethyl)	
phosphate (TBEP)	Fluoxetine
Gemfibrozil	

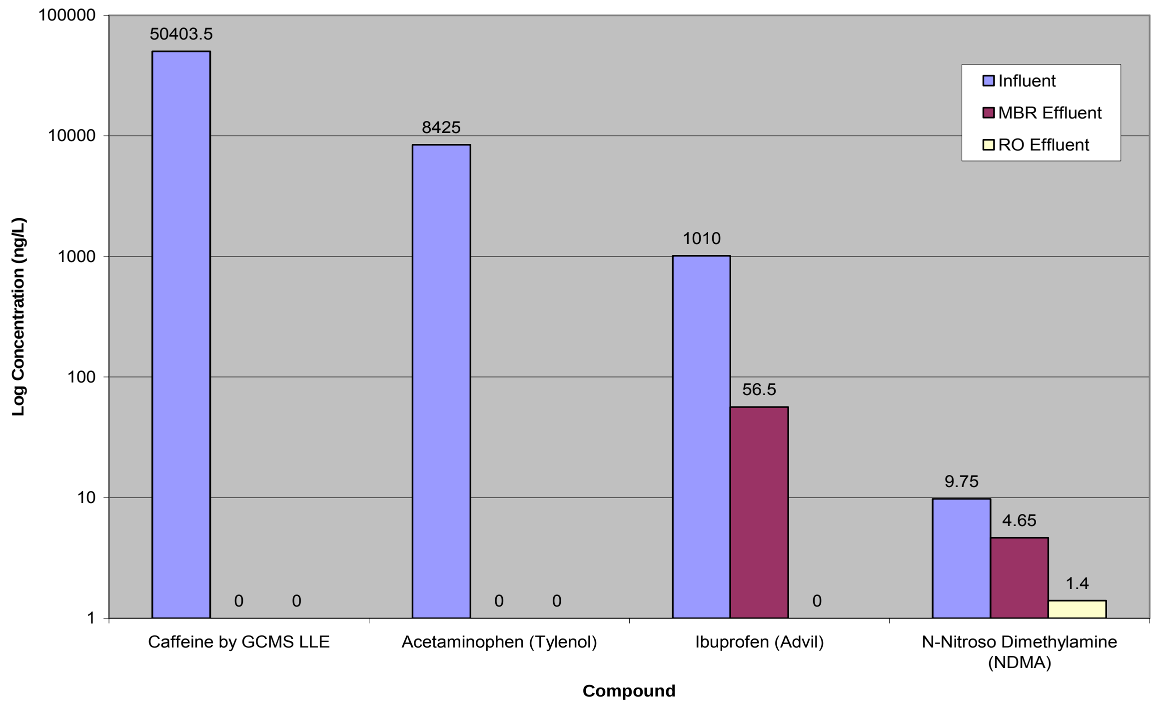
Two rounds of micro-constituent sampling were performed. The first round consisted of sampling the MBR influent, MBR effluent and RO permeate sampled on two separate days. The second round of sampling consisted of sampling the MBR influent and MBR effluent with the chemical addition within the MBR, two separate days were selected for the second round. **Table 4-4** shows that out of the forty two microconstituents sampled only 18 were detected in the wastewater influent out of which 11 were present in the MBR effluent from which only two were detected in RO effluent. The two micro constituents detected in the RO permeate are N-Nitroso Dimethylamine (NDMA) and Trimethoprim. Recent research has shown that these compounds show higher removal rates when advanced oxidation processes are used.

Table 4-4. Microconstituents Present in Plant Influent, MBR Effluent and RO Effluent

Microconstituents	Influent	MBR Effluent	RO Effluent
Ibuprofen	x	x	
N-Nitroso Dimethylamine (NDMA)	x	x	x
Phenol	x		
Progesterone	x		
Sulfamethoxazole	x	x	
Triclosan		x	
Trimethoprim	x	x	x
Triphenylphosphate	x		
tris (2-butoxyethyl) phosphate (TBEP)	x	x	
Gemfibrozil	x	x	
2,6-di-tert-butylphenol	x		
4-methylphenol	x		
Acetaminophen	x		
Caffeine by GCMS LLE	x	x	
Carbamazepine	x	x	
DEET	x	x	
Esterone	x		
Estradiol	x		
Fluoxetine	x		
tris (2-chloroethyl) phosphate (TCEP)		x	

Microconstituent testing data is presented in more detail in **Appendix O**. **Figure 4-17** illustrates the removal of some common microconstituents including Caffeine, acetaminophen, ibuprofen and NDMA.

Figure 4-17 – Microconstituent Sampling Result



Caffeine and acetaminophen were removed to non-detection limits by the MBR. Ibuprofen was removed to non-detection limits by the RO. NDMA was only partially removed by the MBR and RO units.

(END OF SECTION)

Section 5

5.1 TECHNOLOGY ALTERNATIVES

Based on the results of the pilot testing that was conducted on the raw influent wastewater at the City's SWWWTP, incorporation of the MBR technology with UV disinfection proved to be capable of meeting a majority of the project's water quality goals. The MBR treatment with the addition of alum generally resulted in an effluent PO_4-P concentration less than 100 µg/L. When RO was added to the treatment process, effluent PO_4-P concentrations of less than 10 µg/L was attained on a consistent basis.

Based on the results of the pilot program, two treatment processes were developed further as optional means of upgrading the SWWWTF:

- Option 1 - BNR-MBR plus UV Disinfection
- Option 2 - BNR-MBR plus RO and UV Disinfection.

The process flow diagram for these two process streams is shown on **Figure 5-1**.

5.2 EXISTING FACILITY

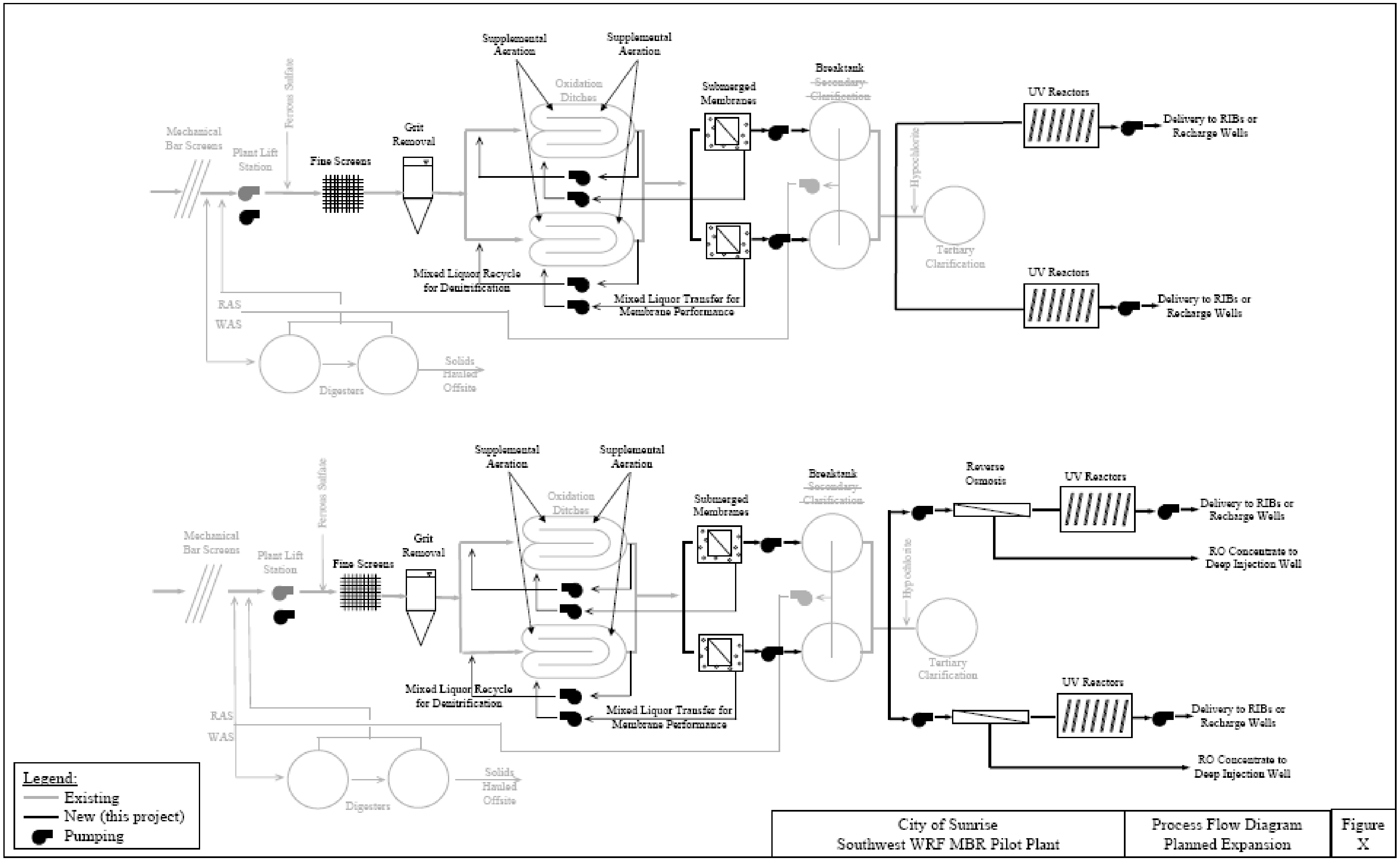
The existing SWWWTF is designed to treat 0.99 mgd, but permitted to treat 0.45 mgd based on the limitations of the effluent percolation ponds.

The influent to the facility flows through a single mechanical 3-millimeter (mm) bar screen where material (i.e., rags, papers, floatables, etc.) that do not pass through the screen are removed from the raw wastewater. The screened wastewater discharges into a lift station that consists of four pumps (3 duty and 1 standby), each with a capacity of 750 gallons per minute (gpm). Ferrous sulfate is added at the influent channel prior to the oxidation ditches for odor control as an oxidant to reduce the hydrogen sulfide (H_2S).

The screened wastewater is pumped to two single-pass oxidation ditches, each with an operating volume of approximately 547,000 gallons. Each ditch is equipped with two surface brush aerators to provide the necessary aeration for biological treatment.

From the oxidation ditches, the mixed liquor flows by gravity to two parallel Spiraflow secondary clarifiers that are each 44 feet in diameter. The supernatant from the secondary clarifiers is routed to a single tertiary clarifier with the same dimensions. The tertiary secondary clarifier functions as a chlorine contact basin for this facility, with the

Figure 5-1 – Process Flow Diagram for Expansion



addition of sodium hypochlorite (NaOCl) to the influent of this treatment unit. The detention time chlorine contact basin (tertiary clarifier) is over 15 minutes during peak hourly flow conditions. However, the configuration of the unit and the lack of baffling may not provide sufficient mixing of the secondary effluent with the NaOCl to classify this unit process as a reliable method of disinfection. The return activated sludge (RAS) from all three clarifiers flows by gravity to the plant lift station where it is mixed with screened wastewater.

The waste activated sludge (WAS) is manually diverted from the RAS line to the primary aerobic digester. The primary digester has the capability of thickening the WAS by shutting off the air and allowing the contents in the tank to settle. The supernatant from the primary digester is then returned to the plant lift station and retreated. The sludge from the primary digester is transferred to the smaller, secondary digester, from where it can be trucked offsite. Under current operations, approximately 60,000 pounds (lbs) of Class B sludge is hauled away each week.

5.3 PROPOSED SWWWTF UPGRADE OPTIONS

This section describes the proposed modifications to upgrade and expand the SWWWTF to treat an average daily flow (ADF) of 2.0 mgd and 4.6 mgd under maximum day flow (MDF) condition is, while incorporating the technologies noted above.

5.3.1 Option 1 - BNR-MBR Upgrade

Specialized processes for both phosphorus and nitrogen control use biological reactors that have baffles for creating zones with different environmental conditions. Several terms are used to describe these zones, which include:

- Aerobic, or oxic is a zone that contains DO concentrations that are generally greater than 1.0 mg/L.
- Anoxic is a zone that has a DO of less than 0.5 mg/L.
- Anaerobic is a zone has an input of organic substrate, contains no DO, and does not have an input of NO_3-N.

Phosphorus removal is the primary driver in this instance, since NO_3-N concentrations of less than 10 mg/L are required for the effluent. There are a number of options available to produce an effluent that provides a high level of phosphorus removal, which includes:

- Biological assimilation
- Chemical precipitation
- Enhanced biological phosphorus removal processes

Phosphorus removal from wastewater has long been achieved through biological assimilation. The basic concept of a biological phosphorus removal system is to cycle the activated sludge microorganisms through an anaerobic zone and then through an aerobic zone, with hydraulic retention times (HRTs) of 2 to 4-hours and 4 to 6-hours, respectively. However, this type of process cannot consistently produce effluents that require very low concentrations of phosphorus, which is required for this facility.

Similarly, chemical precipitation has long been used for phosphorus removal. The chemicals most often employed are compounds of calcium, aluminum, and iron that are added at various points in the process stream (i.e., prior to primary settling, during secondary treatment, or as part of a tertiary treatment process). While concentrations of less than 0.1 mg/L have been reported, the primary concern with chemical precipitation for phosphorus removal continues to be the additional volume of sludge that is produced as a result of the chemical addition required.

Recent advances in Enhanced Bio Phosphorus Removal (EBPR) have managed to achieve very high levels of phosphorus removal. This is because of its potential to achieve low or even very low (<0.1 mg/L) effluent phosphorus levels at a modest cost and with minimal additional sludge production. Although, removal of $CBOD_5$, nitrogen, and phosphorus can all be achieved in a single system, it can be challenging to achieve very low concentrations of both TN and TP using an EBPR process.

In an EBPR process phosphate is removed in the waste activated sludge, which might have 5-percent or more phosphorus (dry weight) as opposed to only 2 to 3-percent in non-EBPR sludges. The EBPR process has been demonstrated in several systems, such as the various Bardenpho processes, and the A/O and A/A/O or A2O processes. A sufficient BOD/P ratio (>25:1) is one requirement for reliable high removal efficiencies, which could be achieved by BOD augmentation through fermentation or addition of a fermentable substrate. Additionally, control of recycle streams is also necessary, so that they do not return too much phosphorus back to the EBPR process.

The existing SWWTF oxidation ditches have sufficient volume to construct the necessary process tankage to achieve the required biological nutrient removal. The existing configuration of the oxidation ditches will need to be modified in order to create the five-stage BNR in order to achieve biological nutrient removal to the target water quality standards. While the volume required to create the necessary zones for the degree of treatment required exist, the method of aeration is not effective in transferring the quantity of oxygen to maintain the process, and thus must be upgraded. Furthermore, the secondary clarifiers are significantly undersized to provide good settling characteristics that are necessary for a biological treatment process of this type. However, the most important factor is that all of these biological processes, none of these processes can consistently produce an effluent to meet to meet the desired effluent standard for PO_4-P.

The work associated with this upgrade would be to converting the existing facility to a BNR facility and incorporate MBR technology into the treatment scheme. The proposed site plan is shown on **Figure 5-2**.

5.3.1.1 Master Lift Station

The existing lift station consists of a mechanical bar screen and pumps. The existing bar screen is a Parkson Aqua-Guard (Model AG-MN-A) bar screen with 3 mm openings, and a design capacity of 1 mgd ADF and 2 mgd MDF. The headloss through the unit is approximately 1-foot during PDF conditions. The existing bar screens will be replaced with fine screening units that will be installed in the new headworks structure.

Downstream of the screen, each of the four existing pumps have a rated capacity of 750 gpm with a total dynamic head of approximately 80-feet. With three of the four pumps running and one on standby, the pumps have a firm capacity of 3.24 mgd.

Additional pumping capacity will need to be installed to achieve 4.6 mgd MDF condition. Furthermore, since the pumps are old and nearing the end of their useful life, it is recommended that they all are replaced with four new pumps. It is recommended that each new pump have a rated capacity of 1050 gpm to achieve MDF with three pumps operating be added during this phase.

5.3.1.2 Headworks

Since the capacity of existing headworks is limited to 1 mgd ADF, a new headworks structure will be required to meet design influent flows.

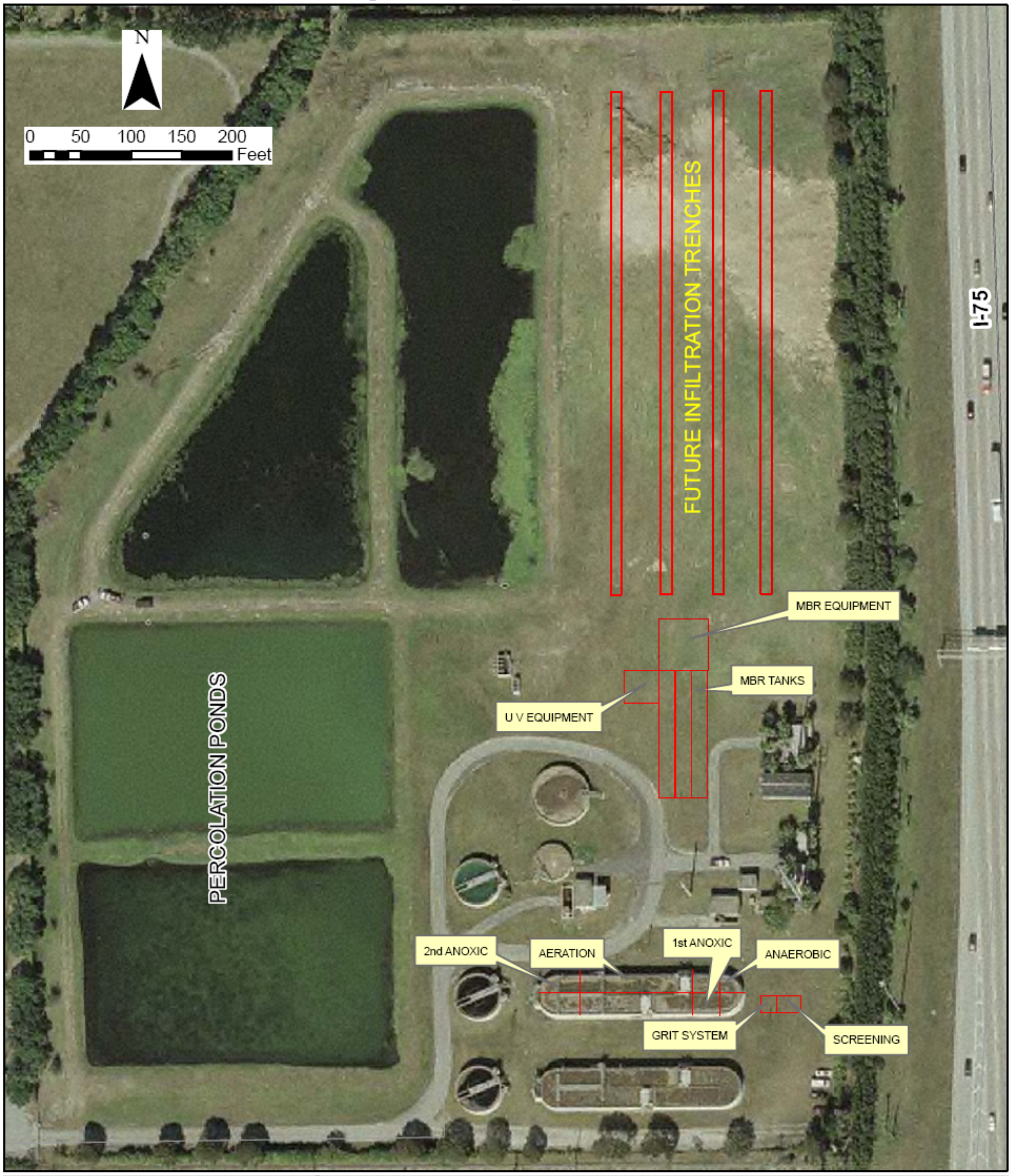
Fine screening will be required to protect MBRs from the accumulation of trash and fibrous materials in the raw wastewater, such as hair and paper fibers that can hinder membrane performance and ultimately diminish membrane life. The accumulation of trash on the membrane surface can effectively reduce the membrane surface area available for permeation, thus increasing the TMP required, or can physically damage the membrane.

Each membrane manufacturer has different guidelines when it comes to screening. In practice, most new facilities are being designed with screens with openings of 1 to 2 mm. Ancillary equipment associated with the screening equipment will include a combination washing/dewatering press to sufficiently reduce the water content in the materials so that they can be discharged at a landfill. A typical screen is illustrated on **Figure 5-3**.

Grit in the raw wastewater will normally settle in process tanks long before it ever reaches the membranes. Although not specifically required for membrane protection, grit removal is recommended for the protection of other equipment such as pumps and diffusers, and to avoid the grit from accumulating in process tanks, causing a decrease in treatment capacity and forcing frequent draining and cleaning of the tanks.

A mechanically induced vortex type grit removal process (i.e., Pista Grit, Eutek Headcell, etc.) is recommended as part of the pre-treatment process. The units should be designed to remove grit from the raw wastewater to as small as 100 microns with minimal headloss. Tangential feed establishes a vortex flow pattern where solids settle and are swept down to the center underflow collection chamber. The grit material is then removed from the unit and pumped to a grit separation, classification, and dewatering system and disposed of in a dumpster for disposal at the landfill.

Figure 5-2 Proposed Site Plan



MWH | CITY OF SUNRISE FLORIDA | City of Sunrise SW WWTP Proposed Site Plan Figure 5-2

Figure 5-3 – Pre-treatment Screen

The equipment that will be installed at the headworks structure will include fine screens, grit removal and ancillary equipment to protect the submerged membranes. For a baseline scale-up concept, the following equipment was assumed to be installed:

- 2 Fine screens with 1 mm openings (rotary drum or band screen unit)
- 1 dewatering washer/compactor for both screening units
- 1 vortex type grit separator 2 Recessed pumps
- 1 dewatering/classifier unit

It was assumed that the aboveground headworks facility may require some degree of odor control, although historically there have been no odor historical complaints at this facility. Common odor control strategies include primary containment (treating air surrounding enclosed equipment) and secondary containment (treating air surrounding enclosed equipment and air inside the headworks building).

5.3.1.3 Aeration Tanks

The existing oxidation ditches will be adapted to operate as a modified University of Cape Town (UCT) process, which will incorporate the anaerobic, first and second anoxic, and aerobic zones in the existing oxidation ditches. With this process, the anaerobic zone is used as the source reactor for the internal mixed liquor recycle

(IMLR), the first anoxic zone receives the RAS, and the nitrate rich recycle (NO_3-R) returned to the second anoxic zone, which minimizes the adverse effects of the nitrates returned to the anaerobic zone.

The results of the process modeling performed and discussed in Section 3, indicated that each oxidation ditch could provide sufficient volume to treat up to 2 mgd an ADF basis. Therefore, it is recommended that only one of the two existing oxidation ditched be modified to incorporate the necessary equipment for the upgrade. Modifications will require the installation of partition walls to create two treatment trains with the oxidation ditch to meet requirements for redundancy. Within each train partition walls will be constructed to create the four stage reactor zones. The fifth stage will be the MBR tanks which will be external to the existing oxidation ditches.

The anaerobic zone and each anoxic zone will be mechanically mixed to simulate the conditions of a complete mix reactor. Several varieties of mixers are available including rigidly mounted blade mixers, floating mixers, submersible mixers and jet mixers. The mixing energy should be sufficient to prevent solids deposition on the anoxic basin floor, but not so great as to cause vortexing and/or excessive air entrainment in the basin.

For the purpose of this report, submersible mixers were chosen since they allow a great deal of flexibility in installation, unlike their dry-mounted counterparts. The mixer can be positioned to develop over a long distance and adapted to the shape of the tank, which ensures the creation of a maximum level of bulk flow. The result will be more efficient mixing and lower power consumption than the other means of mixing.

The supply of oxygen to the suspended biomass represents the largest single energy consumer at the City's WWTF, which is estimated to be approximately over 60-percent of the total energy requirements of this facility. Therefore, with the increasing cost for power, the aeration system and controls will be designed to improve the oxygen transfer efficiency (OTE) of the system, and thus conserve energy.

To improve the OTE of the system, it is recommended that the existing brush aeration system be converted to a fine-bubble or porous diffusion system in all the aeration tanks. The primary reasons that a fine bubble system will be installed include the higher OTE of this type of system over the system currently installed. The proposed system will consist of tapered aeration, which will provide more air (more diffusers) in the first zone, less in the second zone, and the least in the third zone. By providing tapered aeration, better process control is realized, which also results in higher efficiency.

Many types of fine bubble diffusers were evaluated, which included ceramic domes and disks, porous plastic disks, and membranes (circular, tubes and rectangular panels). Other than the shapes of these devices, the primary difference in these types of diffusers is the materials used for construction. Based on the evaluation of the various types of diffusers and materials used, it was determined to incorporate membrane type diffusers into the treatment process. The diffused aeration system will consist of slightly more than 1,800 circular 9-inch diameter membrane diffusers that force compressed air to separate into very small bubbles.

The primary goal of this aeration system will be to provide enough aeration to maintain a DO of 2.0 mg/L throughout the basin. The aeration system will be designed so the system will automatically adjust to reduce the amount of aeration during low demands periods but as oxygen demand increases, the opposite action will occur.

The final diffuser layout will be determined during final design; however, as noted above will include a tapered system layout. The location of the diffusers will be varied based on the oxygen demand gradient. Other considerations for placement of diffusers that will be addressed during the final design will include access, maintenance and cleaning, and the fulfillment of a wide range of air requirements without exceeding the diffuser air flux rates.

Aeration blowers will be required to provide the aeration air for the activated sludge process. The air flow requirement will vary based on flow and load variations. Minimum airflow is typically required during low flow periods in the early morning and high airflow rates are required during high flow/loading periods. Approximately 4,000 scfm will be required to provide the necessary aeration during peak conditions; whereas, under average day conditions, approximately 1,600 scfm of air will be required for the process.

There a many types of centrifugal blowers that can be used to deliver the compressed air to the aeration system, which include fixed speed, variable speed and inlet/discharge guide vane-variable diffuser type blowers. It is recommended that the selected blowers be capable of operating at a wide range of operating conditions to provide flexibility and better process control.

Based on the evaluation conducted, inlet/discharge guide vane-variable diffuser type blowers were determined to be the best suited for this application. This type of blower is based on a single-stage centrifugal operation that incorporates actuators to position the inlet guide vane and variable diffusers to vary blower flowrate and optimize efficiency. These types of aeration blowers are especially well suited for applications with medium to high fluctuations of air flow requirements. However, it should be noted that the primary disadvantages of this type of blower include the high initial cost and a sophisticated computer control system to ensure efficient operation. For this application three 2,000 scfm blowers (2-duty and 1-standby) will be required.

A monitoring system will be incorporated into the process to maintain a DO concentration of 2.0 mg/L, reduce aeration power consumption, increase SWWWTF performance and improve the effluent. The monitoring system will control the aeration system in a manner that as oxygen demand drops; the system will automatically adjust to reduce the amount of aeration. As oxygen demand increases, the opposite action will occur.

The aeration system will be connected into a loop control system where the DO concentration is the primary control signal. The DO levels in the aeration basins will be monitored by DO probes installed along each aeration basin, and will correspond to varying diffuser densities and motorized butterfly valves on each drop leg will be automatically adjusted based on the operators entered DO setpoint.

Changes in DO concentration occur very slowly, so a change in DO will result in a change in the air flow set point, and throttling motorized valves will adjust to maintain this flow rate. As the flow rate changes, the pressure in the system changes and is monitored by pressure sensors. A pressure set point will be maintained by adjustments in the blower inlet throttling valves. To minimize the motorized valve "hunting" and frequent valve movement, DO changes in the aeration basins will be sustained for a minimum period of time before a motorized valve position adjustment is initiated. The final control is to start and stop additional blowers. A blower will be stopped if the amperage drops to the low set point, and an additional blower is brought on if all throttling valves are open and pressure is not maintained.

5.3.1.4 MBR Facilities

The MBR tanks will be installed externally to the existing oxidation ditches. These MBR tanks will house submerged membranes and will be skid-mounted units, based on the planned flow rates, and incorporate all of the ancillary equipment for cleaning, controls and process monitoring. Components used in typical facilities that utilize microfiltration (MF) and ultrafiltration (UF) equipment, include the membranes and associated hardware, a permeation system, a flux maintenance system, a clean-in-place system, an integrity testing or monitoring system, a programmable logic controller (PLC) and the associated instrumentation. The MBR scaleup design is based on a SRT of 15 days, a HRT of 10 hours, flux rate of 17 gfd and a MLSS in the range of 6,000 to 8,000 mg/L. Other than the membranes themselves, the major equipment used in the bioreactor is similar to the equipment used in the bioreactor of a conventional activated sludge process.

Permeation will be achieved by applying slight suction to draw the clean water from the outside-in through the membrane. There are many possible configurations for permeate pumping systems and many different types of permeate pumps. The configuration that will be used in this case is a dedicated permeate pump per membrane train, and each membrane train is equipped with a permeate header that connects all the membrane cassettes/racks within the train. A typical MBR system is illustrated in **Figure 5-4**.

Figure 5-4 – MBR Tankage

The type of permeate pump that will be used will be positive displacement rotary lobe type pumps equipped with a VFD. Since rotary lobe pumps can reverse the direction of flow by reversing the direction of rotation of the lobes, these pumps will serve double duty as both the permeate and the backpulse pumps. During backpulsing, the direction of flow is reversed and the membranes are flushed from the inside-out using permeate stored in a backpulse tank.

For this facility, a fully automated cleaning system will be provided. Stored permeate is backpulsed through the membrane at a specified flow rate and the either citric acid or NaOCI is injected directly into the permeate header using the chemical metering pumps to achieve the desired chemical concentration. Citric acid is used for maintenance or recovery cleaning, while NaOCI for maintenance cleaning, recovery cleaning and to prevent biogrowth and contamination in the permeate tank. In addition, is a separate chemical metering station for each cleaning chemical used will be incorporated as part of the membrane facility. Each metering station will be equipped with an appropriate chemical holding tank, a pair of chemical dosing pumps (one duty, one on-line standby) and a calibration column.

Rotary screw blowers will be used for air scouring, and similar to the permeate pumps each treatment train will have the necessary blowers. For each train, the blowers will discharge into a common membrane air manifold that delivers air to the air header above each membrane tank. Each membrane cassette/rack is connected to the air header above each membrane tank using flexible hose or rigid piping. The air scour blowers were sized based on the maximum cassette/rack spaces in the tank and the maximum possible liquid level in the membrane tank, and was determined to be approximately 400 scfm.

Each membrane equipment manufacturer assembles their membrane system to include a variety of monitored and controlled instrumentation and equipment. The PLCs for the membrane systems provide a variety of critical functions, which include:

- Monitoring of equipment alarms and set-points.
- Trending of operating information such as transmembrane pressure and flow.
- Failsafe control and shutdown of equipment.
- Automated control of certain operating procedures and the execution of operator-initiated or event-triggered activities.

In addition, the membrane system will include a dedicated turbidimeter for each membrane train that will be used to monitor membrane integrity by measuring the turbidity of the permeate from each membrane train separately. In addition, a DO meter will be installed in each membrane tank as a control for the RAS returned to the first anoxic zone.

5.3.1.5 Process Recycle Pumping Facilities

Within the UCT process, there are three types of pumping systems that are critical for the performance of the modified UCT process, which include:

- Internal mixed liquor return (IMLR)
- RAS
- Nitrate rich recycle (NO_3-R)

The first anoxic zone receives the effluent of the anaerobic zone and the RAS from the MBR tanks. The first anoxic zone reduces nitrates only in the RAS. The IMLR from the first anoxic zone is returned to the anaerobic zone to minimize the NO_3 concentration in the recycle as it impacts the fermentation reaction in the same way as DO would. The second anoxic zone receives the NO_3-R recycle from the aeration zone, where bulk denitrification occurs.

The NO_3-R system will be designed to continuously pump a recycle stream that can range between one to six times the influent flow rate, and was designed to operate at four times the influent flow rate under normal operating conditions. The NO_3-R recycle will be pumped from the last anoxic zone back to the anaerobic zone, where a bulk of the denitrification will occur. Although control of this recycle is not imperative to process control, the NO_3-R system will pump continuously. Therefore, efficiency of the pumping system will be critical to the operating costs of the system. This pumping application is somewhat challenging since it is a high flow, low head application. It is recommended for that a non-clog centrifugal pumps be used for this application.

The IMLR will return denitrified recycle from the end of the first anoxic back to the anaerobic zone. The IMLR system was designed to continuously pump a recycle stream that can range between one to four times the influent flow rate, and was designed to operate at two times the influent flow rate under normal operating conditions. Similar to the NO3-R recycle system, the IMLR system faces the same pumping challenges, and therefore non-clog centrifugal pumps were chosen for this application.

The final process recycle is the RAS and WAS pumping systems. RAS from the MBR reactors will be returned to the first anoxic zone to maintain a concentrated biomass for the treatment process. Because microorganisms are continuously synthesized in the process, some of the MLSS must be wasted from the system. Wasting for this process will be accomplished using the same pumps, and the WAS will be pumped to the primary digester for treatment. Similar to the other pumps proposed non-clog centrifugal pumps will be used for this application.

5.3.1.6 UV Disinfection

The permeate from the MBR tanks will enter flow to the effluent disinfection facilities prior to discharge. Due to the effluent chlorine limits ultraviolet (UV) disinfection is the preferred method of disinfection. The effectiveness of a UV disinfection system depends on the characteristics of the wastewater, the intensity of UV radiation, the amount of time the microorganisms are exposed to the radiation, and the reactor configuration.

The UV system proposed for the MBR effluent includes nine in-line low pressure (8-duty and 1-standby) to meet the peak daily flows. The lamps will be oriented parallel to the flow providing efficient dose delivery with minimal induced headloss through the vessel. Included with the system will be an automatic mechanical wiping system within the vessel to eliminate operator involvement for routine quartz sleeve cleaning. The electrical enclosure will house the power distribution, ballast racks and PLC system for each vessel will be used to monitor and control system performance to ensure that full disinfection is being provided at all times.

5.3.1.7 Ancillary Facilities

To meet the effluent water quality limits chemical feed facilities will be required. The pilot plant results indicated that the addition of alum enhanced the removal of phosphates to the low levels required to achieve water quality standards. While the bulk of the influent phosphorus will be removed biologically in the treatment process, alum addition at a rate approximately 5 gpd will be required to achieve removal of phosphates to less than 30 µg/L

5.3.1.8 Groundwater Recharge (Rapid Infiltration Trenches)

The effluent from the UV disinfection process will be pumped to a series of infiltration trenches that will be used for recharge the surficial groundwater. Discharging treated effluent to the subsurface is potentially an environmentally sound practice that could allow additional natural treatment and cooling of effluent, while retaining water in streams and recharging groundwater resources.

Based on preliminary hydrogeological information it is estimated that five trenches will be required to achieve an ADF of 2 mgd. However, hydrogeological conditions will need to be verified during the final design the system to recharge the groundwater. The information that will need to be verified include the soil characteristics, infiltration rates of the soil, the unsaturated zone between land surface, the aquifer must be checked for adequate permeability, and the absence of polluted areas. The aquifer should be sufficiently transmissive to avoid excessive buildup of groundwater mounds.

5.3.2 Option 2 - BNR-MBR + Reverse Osmosis Upgrade

Similar to the base BNR-MBR process, all treatment facilities through the MBR system will remain identical, with no changes. However, the major change to the treatment process will be the addition of an RO system that will treat the effluent from the MBR prior to disinfection. Summarized below are the primary changes to the overall treatment process to incorporate RO into the treatment scheme.

5.3.2.1 Reverse Osmosis

The permeate from the MBR process will be pumped to the RO units for further treatment. Pre-treatment prior to entering the RO units is required. Particulate control is essential in any RO process. The MF and UF proposed for the MBR system are the most suitable pre-treatment for advanced post-treatment of wastewater effluents by RO. Other pre-treatment steps for systems using RO to post-treat the effluent may consist of:

- Sodium bisulfite chemical addition.
- Sulfuric acid chemical addition.
- Scale/threshold inhibitor chemical addition.
- Cartridge filtration.

Reverse osmosis is a pressure driven and diffusion controlled membrane process. Osmosis is defined as the passage of a liquid from a weak to a more concentrated solution across a semi-permeable membrane. Reverse osmosis is achieved by providing adequate pressure to overcome the osmotic pressure so that the feed water flows from the more concentrated solution to the "clean" water side of the membrane. The product water (permeate) is collected in tubes and transported for use as high quality product water. In a concentrate staged system, the concentrate (retentate) stream is passed to subsequent membrane trains for further treatment and then disposal.

Although the proper pre-treatment facilities are often in place, eventually the membrane elements will require cleaning. Cleaning systems are fairly universal in design and construction since they provide the same function regardless of the facility. Cleaning systems are typically designed to clean one stage or train at a time so that foulants are not passed from one stage or train to the next.

The RO system will be operated using an automated systems that will sufficient monitoring instrumentation, adequate preprogrammed control logic with feedback that the system can maintain proper set-points for permeate flow, and event-driven control scenarios for RO systems start-up. Proper chemical feed and recovery set-points must be maintained to provide sufficient permeate flow. These set-points are used to provide flux management and fouling control.

Disposal of RO membrane concentrate (reject) at the SWWWTF will require the installation of a new deep injection well since there no nearby injection wells and no simple means of transferring concentrate through existing pipelines to the injection wells at the Sawgrass WWTF.

5.3.2.2 UV Disinfection

The permeate from the RO process will flow to the effluent disinfection facilities prior to discharge. Similar to the requirements for Option 1, a UV disinfection system is proposed. Since the effluent from the RO process is of a higher quality (minimum transmittance of 75-percent versus 50-percent with the MBR process) fewer units will be required. The UV system proposed for the MBR effluent includes three in-line low pressure (2-duty and 1-standby) to meet the peak daily flows. The same type of equipment will be proposed for this process (i.e., lamps will be oriented parallel, automatic mechanical wiping, electrical enclosure and monitoring equipment, etc.).

5.4 Opinion of Probable Construction Cost

Opinion of probable construction costs were developed at conceptual level for each of the technology alternatives identified above. These cost opinions were developed to provide an indication of the relative cost increments for additional treatment performance and to assist the City in their capital planning.

The cost opinions have been prepared to Class 5 Cost Estimate Levels based on the definition provided by the Association for the Advancement of Cost Engineering (AACE) International Recommended Practice No. 18R-97. These probable opinions of construction costs were prepared for strategic planning purposes for the assessment of viability of the treatment technologies evaluated for the City, as well as for long range capital planning. The probable opinions of construction costs were developed using information obtained from equipment manufacturers, experience with similar facilities, as well as the use of stochastic estimating methods such as cost curves, capacity factors, and other parametric techniques. Expected accuracy ranges are from –20 to –50 percent on the low side and +30 to +100 percent on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.

Summarized in **Tables 5-1** through **5-2** are the opinion of probable construction cost at conceptual level for the two options evaluated to meet the treatment capacity of 2 mgd and water quality goals noted in Section 2.

Table 5-1 Option 1: BNR-MBR Upgrade

ITEM	COST
Headworks	$ 1,500,000
Oxidation Ditches	$ 1,100,000
MBR	$ 4,700,000
Chemical System	$ 300,000
UV Disinfection	$ 1,700,000
Rapid Infiltration Trench	$ 600,000
Electrical Power	$ 800,000
Equipment, yard piping & Site Prep	$ 2,100,000
General Conditions and Contractor OH&P	$ 2,500,000
TOTAL CAPITAL COST	$ 15,000,000

Table 5-2 Option 2: BNR-MBR + Reverse Osmosis Upgrade

ITEM	COST
Headworks	$ 1,500,000
Oxidation Ditches	$ 1,100,000
MBR	$ 4,700,000
Reverse Osmosis	$ 2,100,000
Chemical System	$ 300,000
UV Disinfection	$ 700,000
Concentrate Disposal Well	$ 5,000,000
Rapid Infiltration Trench	$ 600,000
Electrical Power	$ 1,000,000
Equipment, yard piping & Site Prep	$ 2,400,000
General Conditions and Contractor OH&P	$ 3,900,000
TOTAL CAPITAL COST	$ 23,000,000

MWH has no control over costs of labor, materials, competitive bidding environments and procedures, unidentified field conditions, financial and/or market conditions, or other factors likely to affect the Opinion of Probable Construction Cost of this project, all of which are and will unavoidably remain in a state of change, especially in light of the high volatility of the market attributable to Acts of God and other market events beyond the control of the parties. This is a "snapshot in time" and that the reliability of this Opinion of Probable Construction Cost will inherently degrade over time. MWH cannot and does not make any warranty, promise, guarantee, or representation, either express or implied, that proposals, bids, project construction costs, or cost of operation or maintenance will not vary substantially from MWH's good faith Class 5 Opinion of Probable Construction Cost.

(END OF SECTION)

Section 6

MWH

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Key conclusions of this study can be summarized as follows:

- The Biological Nutrient Removal process followed by the Membrane BioReactor (BNR-MBR) with chemical addition is capable of treating the raw sewage and reducing the phosphate in the treated effluent to less then 0.015 mg/L when measured on average basis for the tested period of time.
- The BNR-MBR process with chemical addition is capable of treating the raw sewage and reducing the phosphate in the treated effluent to less then 0.030 mg/L ninety five percent of the time when measured on single sample basis for the tested period of time.
- The BNR-MBR process without out chemical added is capable of treating the raw sewage and reducing the phosphate in the treated effluent to less then 0.100 mg/L eighty five percent of the time when measured on single sample basis for the tested period of time.
- The BNR-MBR process followed by Reverse Osmosis (RO) is capable of treating the raw sewage and reducing the phosphate levels to non detection limits.
- The additional cost in net present value (NPV) of the additional (reverse osmosis) treatment required to reduce the phosphate from 0.015 mg/L to 0.010 mg/L (as required by Broward County Standards) is approximately $15M.

6.2 RECOMMENDATIONS

The following recommendations for further study were developed as a result of this pilot testing:

- Conduct phase II pilot testing which includes aquifer tests and Biscayne aquifer modeling to demonstrate eligibility of one to one reuse recharge credit. This includes successful negotiations of reuse credits with the South Florida Water Management District (SFWMD).
- Move forward with a demonstration phase. Upgrade the existing plant to 0.99 mgd of Average Annual Day Flow by adding the BNR-MBR followed by a UV disinfection system and install Rapid Rate Infiltration Trenches (RIT).
- Record and monitor data over an extended period of time which will confirm the assumption used in the Basis of Design for planned expansions at the facility.
- Determine weather or not an RO is required to meet the state and local reuse recharge regulation based on the outcomes of the demonstration project.

(END OF SECTION)

Appendices

APPENDIX A - Wastewater Characterization for Selected Constituents for Seven Days

SAMPLENAME	ANALYTE	UNITS	CASNUMBER	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Influent Composite	Solids, Total Suspended	mg/L	NA	230	190	66	120	92	62	66
Influent Composite	Volatile Suspended Solids	mg/L		190	170	60	100	76	48	56
Influent Composite	Nitrogen, Nitrate (as N)	mg/L	14797-55-8	ND	ND	ND	ND	ND	ND	ND
Influent Composite	Nitrogen, Nitrite (as N)	mg/L	14797-65-0	ND	ND	0.18	0.18	ND	ND	ND
Influent Composite	Alkalinity	mg/L	NA	260	260	230	220	230	240	250
Influent Composite	Nitrogen, Ammonia (as N)	mg/L	E966655		39	30	27	29	35	28
Influent Composite	Nitrogen, Kjeldahl	mg/L	NA	64	40	52	52	48	56	47
Influent Composite	Nitrogen, Kjeldahl - Dissolved	mg/L		55	ND	52	50	49	ND	ND
Influent Composite	Phosphate, Total as P	mg/L	l4265-44-2	20	30	33	20	7.5	25	20
Influent Composite	Phosphorus - Dissolved	mg/L	7723-14-0	4.5	7.7	5.8	5.6	5.9	6.4	5.7
Influent Composite	Phosphorus, Total	mg/L	7723-14-0	6.6	9.9	11	6.8	6.3	8.2	6.7
Influent Composite	Biochemical Oxygen Demand	mg/L	NA	430	220	160	180	180	350	270
Influent Composite	COD	mg/L	NA	430	430	460	500	420	620	490
Influent Composite	COD - Dissolved	mg/L		310	430	320	330	290	490	380
Influent Composite	COD - Flocculated	mg/L		250	220	230	250	230	340	270
Influent Composite	Nitrogen, Total	mg/L		64	100	52	52	48	56	47
Influent Composite	CBOD	mg/L		210	200	130	170	180	340	260
Influent Composite	CBOD, Dissolved	mg/L		100	130	86	120	110	250	200
Influent Grab	pH (Field)	s.u.		6.64	6.46	6.84	6.60	6.92	6.98	7.05
Influent Grab	Temperature (Field)	°C	NA	23.4	23.7	25.9	25.7	25.9	24.6	24.7
Effluent Composite	Solids, Total Suspended	mg/L	NA	5.0	5.0	ND	4.0	4.0	ND	ND
Effluent Composite	Nitrogen, Nitrate (as N)	mg/L	14797-55-8	2.3	3.1	3.1	3.7	3.6	2.8	2.3
Effluent Composite	Nitrogen, Nitrite (as N)	mg/L	14797-65-0	ND	ND	ND	ND	ND	ND	ND
Effluent Composite	Alkalinity	mg/L	NA	92	88	100	88	92	100	96
Effluent Composite	Nitrogen, Ammonia (as N)	mg/L	E966655	ND	ND	ND	ND	ND	ND	ND
Effluent Composite	Nitrogen, Kjeldahl	mg/L	NA	1.4	1.3	1.2	1.3	1.3	1.2	1.1
Effluent Composite	Nitrogen, Kjeldahl - Dissolved	mg/L		1.2	1.2	1.3	1.2	0.95	ND	ND
Effluent Composite	Phosphate, Total as P	mg/L	l4265-44-2	6.8	9.0	8.1	9.3	12	3.5	9.6
Effluent Composite	Phosphorus - Dissolved	mg/L	7723-14-0	2.2	2.8	2.7	3.0	3.8	4.1	3.3
Effluent Composite	Phosphorus, Total	mg/L	7723-14-0	2.3	3.0	2.7	3.1	4.1	3.5	3.2
Effluent Composite	COD	mg/L	NA	70	58	60	60	56	68	56
Effluent Composite	COD - Dissolved	mg/L		68	54	60	54	52	56	54
Effluent Composite	COD - Flocculated	mg/L		81	60	62	58	50	54	52
Effluent Composite	Nitrogen, Total	mg/L		3.7	4.4	4.3	5.0	4.9	4.0	3.4
Effluent Composite	CBOD	mg/L		5.1	3.3	3.8	4.0	9.3	3.1	4.3
Effluent Composite	CBOD, Dissolved	mg/L		4.5	3.5	4.2	4.1	4.2	3.0	3.7
Mixed Liquor	Solids, Total Suspended	mg/L	NA	3500	4600	3300	3300	3300	2600	4000
Mixed Liquor	pH (Field)	s.u.		4.71	6.90	6.55	6.81	6.68	6.37	6.64
Mixed Liquor	Temperature (Field)	°C	NA	19.0	25.5	23.2	23.6	23.7	24.2	24.2
RAS	Solids, Total Suspended	mg/L	NA	2600	5600	5800	6600	7500	8400	6800
WAS	Solids, Total Suspended	mg/L	NA	20000	10000		15000	15000	9200	13000
Dewatering	Solids, Total Suspended					27				
Dewatering	Volatile Suspended Solids					20				
Dewatering	COD					150				
Influent - Nitrate after BOD Test	Nitrogen, NO2/NO3 (as N)	mg/L	E-10128		ND	ND	ND	ND	ND	ND

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
Acenaphthene	N.S.	-	-	N.S.
Alachlor	0.002	0.002	0.002	<.002
Aldrin	0.001	0.001	0.001	0.00003
Alkalinity	N.S.	-	-	260
Aluminum	0.2	0.2	0.2	0.74
Ammonia (un-ionized)	N.S.	-	-	0.099
Anthracene	N.S.	-	-	0.000034
Antimony	0.006	0.006	0.006	0.001
Arsenic (total)	0.05	0.01	0.01	0.002
Arsenic (trivalent)	N.S.	-	-	0.0003
Asbestos	N/A	7 MFL (million fibers per liter)	7 MFL (million fibers per liter)	N.S.
Atrazine	0.003	0.003	0.003	0.0002
Barium	2	2	2	0.015
Benzene	0.001	0.001	0.001	0.0004
Benzo(a)pyrene	0.0002	0.0002	0.0002	0.000055
Beryllium	0.004	0.004	0.004	0.0018
Beta-hexachlorocyclohexane	N.S.	-	-	0.0000102
BOD 5	5	-	5	430
Bromates	N.S.	0.01	0.01	0.005
Bromine (free molecular)	N.S.	-	-	0.08
Bromoform	-	-	-	0.00016
Cadmium	0.005	0.005	0.005	0.0021
Carbofuran	0.04	0.04	0.04	0.00045
Carbon tetrachloride	0.003	0.003	0.003	0.00041
CBOD 5	N.S.	-	20 ann avg[a]	210
	-	-	30 monthly[a]	
	-	-	60 single sample[a]	
Chlordane	0.002	0.002	0.002	0.0001
Chloride	250	250	250	100
Chlorinated hydrocarbons (not otherwise identified by name)	0.01	-	0.01	N.S.
Chlorine (total residual)	1	-	1	0.85
Chlorine (residual disinfectant)	-	4 as Cl_2	0.5 (min) 4 (max)	N.S.

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
Chloramines	-	4 as Cl_2	4	N.S.
Chlorine Dioxide	-	0.8 (as ClO_2)	0.8	N.S.
Chlorite	N/A	1	1	N.S.
Chlorodibromomethane	N.S.	-	-	0.00023
chloroethylene (vinyl chloride)	0.001	-	0.001	0.00048
Chloroform	N.S.	-	-	N.S.
Chloromethane (methyl chloride)	N.S.	-	-	N.S.
2-chlorophenol	N.S.	-	-	N.S.
Chromium (hexavalent)	N.S.	-	-	N.S.
Chromium (trivalent)	N.S.	-	-	N.S.
Chromium (total)	0.1	0.1	0.1	0.0025
COD	10	-	10	0.43
Coliform (fecal)	A. 200 colonies per 100 ml for monthly average	-	A. 200 colonies per 100 ml for monthly average	14000
	B. 400 colonies per 100 ml for 10% of samples	-	B. 400 colonies per 100 ml for 10% of samples	14000
	C. 800 colonies per 100 ml in any sample	-	C. 800 colonies per 100 ml in any sample[b]	14000
Coliform (total)	1,000 colonies per 100 ml	-	1,000 colonies per 100 ml	126000
Color	No unnatural discoloration	15 color units	15 color units	500 cu
Copper	1	1	1	0.01
Cyanide	0.2	0.2	0.2	0.0026
2,4-d (2,4-dichloro-phenoxyacetic acid)	0.07	0.07	0.07	<0.00009
Dalapon (2,2-dichloro-propionic acid)	0.2	0.2	0.2	<0.0008
DDT	0.0001	-	0.0001	
Demeton	0.0001	-	0.0001	0.00021
Detergent (as MBAS)	N.S.	-		
Dibromochloropropane (DBCP)	0.0002	0.0002	0.0002	0.0000036

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
1,2-dibromoethane (EDB)	0.00002	0.00002	0.00002	0.0000053
1,2-dichlorobenzene (o-dichlorobenzene)	0.6	0.6	0.6	0.00038
1,4-dichlorobenzene (p-dichlorobenzene)	0.075	0.075	0.075	0.0012
Dichloromethane (methylene chloride)	N.S.	-	-	N.S.
Dichlorobromomethane	N.S.	-	-	N.S.
1,2-dichloroethane (ethylene dichloride)	0.003	-	0.003	0.00048
1,1-dichloroethylene (vinylidene chloride)	0.007	0.007	0.007	0.00044
Cis-1,2- dichloroethylene	0.07	0.07	0.07	0.00039
Trans-1,2- dichloroethylene	0.1	0.1	0.1	0.00039
Dichloromethane (methylene chloride)	0.005	0.005	0.005	0.00083
2,4-dichlorophenol	N.S.	-	-	0.0015
2,4-dichlorophenoxy -acetic acid (2,4-D)	0.07	-	0.07	0.00009
2,2-dichloropropionic acid (dalapon)	0.2	-	0.2	0.00008
1,2- dichloropropane	0.005	0.005	0.005	0.0004
Di-(2-ethylhexyl) adipate	0.4	0.4	0.4	0.00036
Di-(2-ethylhexy) phthalate	0.006	0.006	0.006	0.00036
Dieldrin	N.S.	-	-	0.00003
2,4 – dinitrophenol	N.S.	-	-	N.S.
2,4 – dinitrotoluene	N.S.	-	-	N.S.
Dinoseb	0.007	0.007	0.007	0.00006
2,3,7,8-TCDD (Dioxin)	N/A	3×10^{-8}	3×10^{-8}	
Diquat	0.02	0.02	0.02	0.00029
Endosulfan	0.0001		0.0001	0.00012
Endothall	0.01	0.01	0.01	0.0027
Endrin	0.002	0.002	0.002	0.000005
Ethylbenzene	0.03	0.7	0.03	0.00036
Ethylene dichloride (1,2-dicholoroethane, edc)	0.003	0.003	0.003	0.00048
Fluoranthene	N.S.	-	-	N.S.
Fluorene	N.S.	-	-	N.S.
Fluoride	2	2	2	0.53
Foaming Agents	N/A	0.5	0.5	N.S.
Gamma-hexachloro-cyclohexane (lindane)	0.0002	-	0.0002	0.000004
Glyphosate (roundup)	0.7	0.7	0.7	0.0032
Gross alpha	15 pCi/l	-	15 pCi/l	1.17+/-1.35 pCi/l

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
Guthion (azinphos- methyl)	0.0001	-	0.0001	0.000025
Heptachlor	0.0004	0.0004	0.0004	0.000005
Heptachlor epoxide	0.0002	0.0002	0.0002	0.000008
Hexachlorobenzene	N/A	1000	1000	0.0026
Hexachlorobutadiene	N.S.	-	-	0.0017
Hexa-chlorocyclo-pentadiene	0.05	0.05	0.05	0.00042
Haloacetic Acids (Five) (HAA5)	N/A	0.06	0.06	
Iron	0.3	0.3	0.3	0.46
Lead	0.015	0.015	0.015	0.001
Lindane (gamma-hexa-chlorocyclohexane)	0.0002	0.0002	0.0002	
Malathion	0.0001	-	0.0001	<.00029
Manganese	0.05	0.05	0.05	0.022
Mercury	0.002	0.002	0.002	0.00002
Methoxychlor	0.04	0.04	0.04	<.000007
Methylene chloride (dichloromethane)	0.005	-	0.005	0.00083
Mirex	0.0001	-	0.0001	<.0000033
Monochlorobenzene	0.1	0.1	0.1	0.0004
Nickel	0.1	0.1	0.1	0.0059
Nitrogen: total nitrogen as n (nitrate, nitrite, nh 3 , and organic)	N.S.	-	10©	64
Nitrate (as n)	10	10	10	0.062
Nitrite (as n)	1	1	1	0.021
Total nitrate + nitrite (as n)	10	10	10	0.083
Odors	None detectable due to sewage or industrial waste	3 (threshold odor number)	3 (threshold odor number)	100 TO
Oil and grease	Dissolved or emulsified oil or grease shall not exceed 10.0 ppm; no undissolved or visible oil as iridescence shall be present	-	Dissolved or emulsified oil or grease shall not exceed 10.0 ppm; no undissolved or visible oil as iridescence shall be present	25
Oxamyl	0.2	0.2	0.2	0.00052
Oxygen, dissolved	N.S.	-	-	
Parathion	0.042	-	0.042	0.00038
Pathogens (excluding coliforms)	1 per gallon	-	1 per gallon	

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
Pentachlorophenol	0.001	0.001	0.001	0.00002
Perc (perchloro- ethylene, tetrachloro-ethylene, pce)	0.003	-	0.003	
pH	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	6.92
Phenol	N.S.	-	-	N.S.
Phenolic compounds	0.0001	-	0.0001	
Phosphates (total as p)	0.01	-	0.01	20
Phosphorus (total)	N.S.	-	-	66
Phthalate esters	N.S.	-	-	N.S.
Picloram	0.5	0.5	0.5	0.00008
Polychlorinated biphenyls (pcbs)	0.0005	0.0005	0.0005	0.0001
Polyaromatic hydro-carbons (pahs). Total of: acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo-(a,h)-anthracene, indeno(1,2,3-cd)pyrene, and phenanthrene	0.5	-	0.5	
Pyrene	N.S.	-	-	0.000076
Radioactivity:		-	-	
Gross beta radium 226 strontium 90 (In picocuries/l)	1,000 pCi/l 3 pCi/l 10 pCi/l	-	1,000 pCi/l 3 pCi/l 10 pCi/l	7.49+/-1.99pCi/l
Selenium	0.05	0.05	0.05	0.001
Silver	0.1	0.1	0.1	0.00088
Silvex (2,3,5-tp)	0.05	0.05	0.05	0.000038
Solids (floating, suspended or settleable)	None attributable to wastes			N.S.
Simazine	0.004	0.004	0.004	0.00002
Sodium	160	160	160	85
Styrene (vinyl benzene)	0.1	0.1	0.1	0.00056
Sulfate	250	250	250	24
TCE (trichloro-ethylene)	0.003	-	0.003	0.00041
Temperature	Not to be above 90°F	-	Not to be above 90°F	
1,1,2,2-tetra-chloroethane	N.S.	-	-	0.00036
Tetrachloroethylene	0.003	0.003	0.003	0.00002
Thallium	0.002	0.002	0.002	0.0021
Toluene	0.04	1	0.04	430

APPENDIX B
Water Quality Goals
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. mg/L
Total dissolved gases	N.S.	-	-	
Total dissolved solids	500	500	500	430
Total Suspended solids	-	-	20 ann avg [(a)]	
	-	-	30 monthly[(a)]	
	-	-	60 single sample[(a)]	230
Toxaphene	0.003	0.003	0.003	0.0004
Transparency	N.S.	-	-	N.S.
1,2,4-trichloro-benzene	0.07	0.07	0.07	0.0018
1,1,1-trichloroethane	0.2	0.2	0.2	0.00045
Trichloroethylene (tce)	0.003	0.003	0.003	
1,1,2-trichloroethane	0.005	0.005	0.005	0.00048
2,4,6-trichlorophenol	N.S.	-	-	0.0015
Trihalomethanes, total (total trihalomethanes equals the sum of the concen-trations of bromodichloromethane, chlorodibromomethane, tribromomethane (bromoform) and trichloromethane (chloroform))	0.1	0.08	0.08	0.0041
Turbidity	10 NTUs	-	10 NTUs	143
Vinyl chloride (chloroethylene)	0.001	0.001	0.001	0.00048
Xylenes, total	0.02	10	0.02	0.0011
Zinc	5	5	5	140

[(a)] FDEP requirements

[(b)] Per FDEP permit at 0.99 mgd AADF, limit is 25/100 mL single sample maximum

© Per FDEP permit at 0.45 mgd Total Nitrogen limit is 10 ppm maximum. At 0.99 mgd, the limit is 10 ppm annual avg, 12.5 ppm monthly avg, and 20 ppm single sample.

* Per FDEP permit Total Residual Chlorine requirement is 0.5 ppm minimum at 0.45mgd ann. Avg flow and is 0.1 ppm minimum at 0.99 mgd ann. Avg flow.

Sampling Plan - City of Sunrise Pilot
Base Sample Plan (Stabilization Phase - approx 4 weeks starting April 4). **SAMPLE YELLOW BOX DURING STABILIZATION PHASE!!**

Analysis		Pilot Influent		Anaerobic Tank		Anoxic Tank		Aerobic Tank		Post Anoxic Tank		Membrane Tank		Pilot Effluent		Pilot WAS	
		FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE	FREQ/WK	TYPE
BOD5		**3 (MWF)**	**G**											3 (TuTS)	C		
sBOD		**3 (MWF)**	**G**											3 (TuTS)	C		
TCOD		**3 (MWF)**	**G**	1 (W)	G	1 (W)	G	2 (WF)	G	2 (WF)	G			3 (TuTS)	C		
sCOD		**3 (MWF)**	**G**	1 (W)	G	1 (W)	G	2 (WF)	G	2 (WF)	G			**3 (TuTS)**	**C**		
TURB														**1 (Tu)**	**G**		
TP		3 (MWF)	G											**3 (TuTS)**	**C**	2 (WF)	G
oPO4		3 (MWF)	G	1 (W)	G	1 (W)	G	1 (W)	G	1 (WF)	G	2 (WF)	G	**3 (TuTS)**	**C**	2 (WF)	G
NH_4-N		3 (MWF)	G			1 (W)	G	1 (W)	G	1 (W)	G	1 (W)	G	**3 (TuTS)**	**C**		
$NO_2 + NO_3$		3 (MWF)	G	1 (W)	G	1 (W)	G	1 (W)	G	1 (W)	G	3 (MWF)	G	**3 (TuTS)**	**C**		
TKN		3 (MWF)	G											**3 (TuTS)**	**C**		
TSS		3 (MWF)	G	5 (M-F)	G	5 (M-F)	G	**5 (M-F)**	**G**	5 (M-F)	G	**5 (M-F)**	**G**	**3 (TuTS)**	**C**	report I20	G
VSS		3 (MWF)	G	5 (M-F)	G	5 (M-F)	G	**5 (M-F)**	**G**	5 (M-F)	G	**5 (M-F)**	**G**	**3 (TuTS)**	**C**	report I21	G
ALK		3 (MWF)	G					3 (MWF)	G					**3 (TuTS)**	**C**		
pH		3 (MWF)	G	3 (MWF)		3 (MWF)		3 (MWF)		3 (MWF)		3 (MWF)		3 (TuTS)	G		
Temp		3 (MWF)	G														
Chlorine demand	1 (W) Eff only													1 (W)			
Fecal	3 (MWF)																
Time to filter								1(W)	G								
Phosphorus profile				monthly	G	monthly	G	monthly	G	monthly	G	monthly	G				
Nitrogen profile				monthly	G	monthly	G	monthly	G	monthly	G	monthly	G				
sCOD profile				monthly	G	monthly	G	monthly	G	monthly	G	monthly	G				
Respiration rate								monthly	G								
Phosphorus release								weekly	G								
Critical Flux																	

(yellow) STABILIZATION PHASE SAMPLING. **BOLD INDICATES LESS THAN 48 HR TURNAROUND.** **BOLD UNDERLINE INDICATES IMMEDIATE, SAME DAY TURNAROUND** ALL OTHER SAMPLES STANDARD TURNAROUND
(red) Not required during initial Stabilization phase (approx first 4 weeks)
(cyan) By MWH. Check box comments above for requirements
(green) During Week No 1 after Stabilization Phase

G = Grab samples.
C = Composite samples, collected with an autosampler every 60 minutes. Sampler to be setup for collection 24hr in advance of lab collection and analysis
MWF: Monday - Wednesday - Friday
TuTS: Tuesday - Thursday - Saturday
M-F: Monday to Friday
Notes: 1) TN to be calculated and reported from NO2, NO3, TKN and Ammonium measurements. NO2 + NO3 to be measured and reported as combined result

Table 1
Task 1 - Optimization of Coagulant Dosage Sampling Plan (pilot)

Parameter	Raw	Anaerobic Tank	De-Ox Tank	Anoxic Tank	Aerobic Tank	Post Anoxic Tank	Permeate	Total per Dose	Total per Task
UV-254	1/day						1/day	2	14
Turbidity	2/day						2/day	4	28
Total Organic Carbon	2/wk						2/wk	4	4
Temperature	1/day						1/day	2	14
Soluble P (PO4)	1/day	1/day					1/day	2	9
Silt Density Index							1/day	1	7
Phosphorous, Total	1/day						1/day	2	4
pH	1/day						1/day	2	14
Alkalinity	1/day						1/day	2	7

Lab to collect and analyze

MWH/City field crew to collect and record

Sample TOC on Thrusday 7/5/7 and Saturday 7/7/7

Task 3 - RO Testing Sample Plan

Parameter	MBR influent	MBR effluent	Raw RO influent	UF Permeate	RO Influent	RO Permeate	RO Concentrate
Total Suspended Solids							
Total Nitrogen						3/wk	
TOC			3/wk		3/wk	3/wk*	
TDS					3/wk	3/wk	
Orthophosphate (as P)						3/wk	
Phosphorous, Total						3/wk	
Nitrate						3/wk	
Iron					3/wk	3/wk	
Manganese					3/wk	3/wk*	
Heterotrophic Plate Count	3/wk	3/wk	3/wk	3/wk	3/wk	3/wk	3/wk
Fecal Coliform	3/wk	3/wk	3/wk	3/wk		3/wk	3/wk
Color			3/wk			3/wk	
Aluminum (field)					3/wk		
Conductivity					3/wk	3/wk	

All samples to be taken on Tuesday, Thrursday and Saturdays

Task 4
Disinfection of Control Stream

Date: ______________________________

Dose	Sampled water for UV	
	Total Coliform(29)	Fecal (19)
0	410081529	410081519
	UV Treated Water	
	Total Coliform(29)	Fecal (19)
10	421081529	421081519
20	422081529	422081519
30	423081529	423081519

Task 5
Disinfection of RO Permeate Sampling Plan

Name: Sangeeta Date: 8-Aug

RO permeate sampled for UV			
Dose	TSS (03)	HPC (17)	Fecal (19)
0	510080903	510080917	510080919
UV Treated Water			
	TSS (03)	HPC (17)	Fecal (19)
20	521080903	521080917	521080919
40	522080903	522080917	522080919
60	523080903	523080917	523080919
80	524080903	524080917	524080919
100	525080903	525080917	525080919
RO permeate sampled for Peroxide-UV			
	TSS (03)	HPC (17)	Fecal (19)
0	520080903	520080917	520080919
RO permeate with Peroxide			
	TSS (03)	HPC (17)	Fecal (19)
0	530080903	530080917	530080919
	TSS (03)	HPC (17)	Fecal (19)
Peroxide-UV			
50	531080903	531080917	531080919
100	532080903	532080917	532080919
200	533080903	533080917	533080919
300	534080903	534080917	534080919
500	535080903	535080917	535080919

Peroxide dose for disinfection
Stock Solution Preparation

Add Peroxide solution of 200 mL in 800 mL DI water
1.0 mL of this mix to 1000 mL of RO permeate gives a solution strength of 10 mg/L

Task 6 - Jar Test Sample Plan

Client: City of Sunrise

Name: Sangeeta
Coagulant Type: aluminum sulphate 48.5%
Date: ________

Sample ID: ____________
Task ID: Task 6
Subtask ID: ________

COAGULATION DOSES			SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING				FILTERED WATER(6.0µm)			
Jar	Coag Dose	Coag	Ortho P (09)	Total P (12)	Turbidity (02)	TOC (04)	Ortho P (09)	Total P (12)	Turbidity (02)	TOC (04)
#	mg/L	mL	mg/L	mg/L	NTU	mg/L as C	mg/L	mg/L	NTU	mg/L as C
1	0	0	610081609	610081612	610081602	610081604	630081609	630081612	630081602	630081604
2	5	0.5					621081609	621081612	621081602	621081604
3	10	1					622081609	622081612	622081602	622081604
4	15	1.5					623081609	623081612	623081602	623081604
1	0	0	610881609	610881612	610881602	610881604	640081609	640081612	640081602	640081604
2	20	2					624081609	624081612	624081602	624081604
3	30	3					625081609	625081612	625081602	625081604
4	50	5					626081609	626081612	626081602	626081604

Coagulation Time	1	minutes @	80	RPM	95 G	5,700
Flocculation Time	Stage 1 10	minutes @	50	RPM	51 G	30,600
	Stage 1 10	minutes @	27	RPM	21 G	12,600

Sedimentation Time

______________ minutes @ __________________ RPM

Coagulant: Aluminum Sulphate, 48.5% solution

Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

Blue Water Sample Plan

Week 1 sampling Plan (9/10/7 to 9/15/7)					
	Sample Ports				
	MBR effluent		BluePRO eff		Parties analyzing
	Frequency	**Turnaround**	**Frequency**	**Turnaround**	
Parameter	composite		composite		
Total Phosphorous, P	1/day	24 hr	1/day	24 hr	US Biosystems
Ortho- Phosphate, P	1/day	24 hr	1/day	24 hr	US Biosystems
Total suspended soloids	T, Th, S	standard	T, Th, S	standard	KSA
BOD5	T, Th, S	standard	T, Th, S	standard	KSA
Alkalinity (CaCO3)	T, Th, S	standard	T, Th, S	standard	KSA
Total Iron	T, Th, S	standard	T, Th, S	standard	KSA
Total Nitrogen	T, Th, S	standard	T, Th, S	standard	KSA
Color	T, Th, S	standard	T, Th, S	standard	KSA
samples will be analyzed from Monday to Saturday					

Week 2 sampling Plan (9/17/7 to 10/7/7)					
	Sample Ports				
	MBR effluent		BluePRO eff		Parties analyzing
	Frequency	**Turnaround**	**Frequency**	**Turnaround**	
Parameter	composite		composite		
Total Phosphorous, P	1/day	standard	1/day	standard	US Biosystems
Ortho- Phosphate, P	1/day	24 hr	1/day	24 hr	US Biosystems
Total suspended soloids	T, Th, S	standard	T, Th, S	standard	KSA
BOD5	T, Th, S	standard	T, Th, S	standard	KSA
Alkalinity (CaCO3)	T, Th, S	standard	T, Th, S	standard	KSA
Total Iron	T, Th, S	standard	T, Th, S	standard	KSA
Total Nitrogen	T, Th, S	standard	T, Th, S	standard	KSA
Color	T, Th, S	standard	T, Th, S	standard	KSA
samples will be analyzed from Monday to Saturday					

APPENDIX D – BNR/MBR CONFIGURATION

Physical data

Element name	Volume [L]	Area [m2]	Depth [m]	# of diffusers
Aerated (IC)	3402.6000	1.4178	2.4	7
Membrane Tank	1224.1000	0.4534	2.7	2
Anoxic 1 (IC)	491.3000	0.2457	2.0	Un-aerated
Anoxic 2 (IC)	1877.1000	0.9385	2.0	Un-aerated
Post Anoxic (External)	1500.0000	0.6250	2.4	Un-aerated
Anaerobic (External)	2500.0000	1.3889	1.8	Un-aerated

The Dissolved Oxygen setpoint for aerated tank was 2 and for membrane tanks was 5.

Configuration information for all COD Influent units

Operating data Average (flow/time weighted as required)

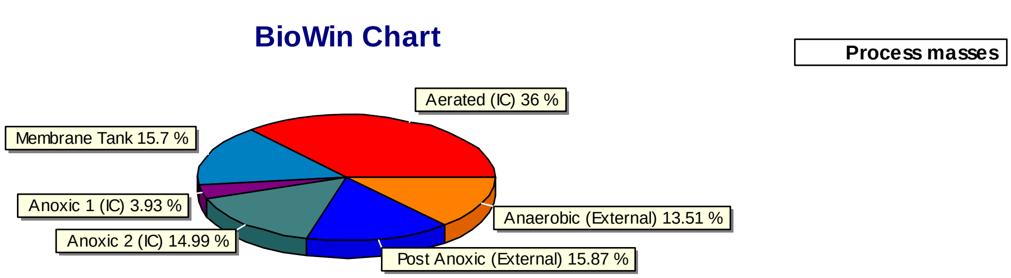
Element name	Sunrise SW Influent
Time	0
Flow	24500
Total COD mgCOD/L	478.57
Total Kjeldahl Nitrogen mgN/L	51.29
Total P mgP/L	7.93
Nitrate N mgN/L	0
pH	6.64
Alkalinity mmol/L	4.83
Inorganic S.S. mgTSS/L	26.70
Calcium mg/L	160.00
Magnesium mg/L	25.00
Dissolved oxygen mg/L	0

BioWin Album

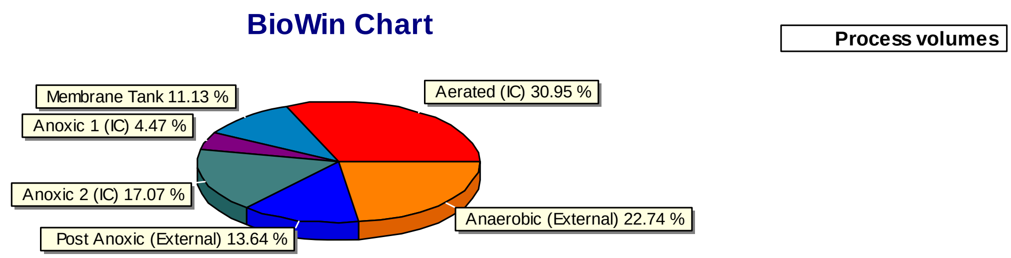
Album page - Recirculation

Elements	Flow [L/d]
Anaerobic Recycle	98000.00
Anoxic Recycle	121870.86
Menbrane Recycle	857434.47
WAS	195370.86

Album page - Mass Fractions



Album page - Mass Fractions



Album page - Aeration

Elements	Total oxygen uptake rate [mg O/L/hr]	Carbonaceous OUR [mg O/L/hr]	Nitrogenous OUR [mg O/L/hr]	Net. nitrite production rate [mg N/L/hr]	Dissolved N2 gas production rate [mg N/L/hr]	Spec. dissolved N2 gas production rate per VSS [mg N/gVSS/hr]	Spec. dissolved N2 gas production per VASS [mg N/gVASS/hr]	OTE [%]	OTR [kg/hr]	SOTE [%]	Off gas flow rate (dry) [m3/hr]	Ammonia N [mg N/L]	Nitrate N [mg N/L]	Air supply rate [m3/hr (20C, 101.325 kPa or 1 atm)]
Aerated (IC)	78.42	30.99	47.44	0.53	0.15	0.03	0.06	3.66	0.26	14.53	25.89	1.03	4.56	25.75
Membrane Tank	56.32	36.73	19.59	-0.12	0.03	0.00	0.01	2.37	0.09	8.19	14.39	0.17	0.65	14.31
Anoxic 1 (IC)	12.48	10.71	1.76	1.42	11.86	2.64	6.28	100.00	0	100.00	0.00	10.99	1.25	0
Anoxic 2 (IC)	0.10	0.08	0.02	-0.60	4.35	0.97	2.30	100.00	0	100.00	0.00	11.40	0.10	0
Post Anoxic (External)	7.98	7.26	0.72	-0.71	15.72	2.67	6.24	100.00	0	100.00	0.00	0.90	0.09	0
Anaerobic (External)	0.00	0.00	0.00	-0.05	0.13	0.04	0.10	100.00	0	100.00	0.01	21.05	0.00	0

Album page - Anaerobic

Anaerobic (External)			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	3105.83	228.28	
Total suspended solids	3971.07	291.87	
Particulate COD	3584.36	263.45	
Filtered COD	126.44	9.29	
Total COD	3710.80	272.74	
Soluble PO4-P	34.41	2.53	
Total P	157.30	11.56	
Filtered TKN	23.69	1.74	
Particulate TKN	209.74	15.42	
Total Kjeldahl Nitrogen	233.43	17.16	
Filtered Carbonaceous BOD	23.06	1.70	
Total Carbonaceous BOD	1137.17	83.58	
Nitrite + Nitrate	0.00	0.00	
Total N	233.43	17.16	
Total inorganic N	21.05	1.55	
Alkalinity	3.98	0.29	mmol/L and kmol/d
pH	6.62		
Volatile fatty acids	15.10	1.11	
Total precipitated solids	0	0	
Total inorganic suspended solids	865.24	63.60	
Ammonia N	21.05	1.55	
Nitrate N	0.00	0.00	

Parameters	Value	Units
Hydraulic residence time	0.8	hours
Flow	73500.00	L/d
MLSS	3971.07	mg/L
Total solids mass	9.93	kg
Total readily biodegradable COD	31.79	mg/L
Total oxygen uptake rate	0.00	mgO/L/hr
Carbonaceous OUR	0.00	mgO/L/hr
Nitrogenous OUR	0.00	mgO/L/hr
Net. ammonia removal rate	-2.89	mgN/L/hr
Nitrate production rate	0.00	mgN/L/hr
Nitrite production rate	0.08	mgN/L/hr
Nitrate removal rate	0.08	mgN/L/hr
Nitrite removal rate	0.13	mgN/L/hr
Net. nitrate production rate	-0.08	mgN/L/hr
Net. nitrite production rate	-0.05	mgN/L/hr
Dissolved N2 gas production rate	0.13	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	0.04	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	0.10	mgN/gVASS/hr
OTE	100.00	%
OTR	0	kg/hr
SOTE	100.00	%
SOTR	0	kg/hr
Air supply rate	0	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	0	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	0	
Off gas flow rate (dry)	0.01	m3/hr
Oxygen content	0	%
Carbon dioxide content	32.15	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.05	mg/L

Album page - Anoxic 1 IC

Anoxic 1 (IC)			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	4496.76	661.02	
Total suspended solids	5873.40	863.39	
Particulate COD	5244.38	770.92	
Filtered COD	89.47	13.15	
Total COD	5333.85	784.08	
Soluble PO4-P	18.50	2.72	
Total P	231.98	34.10	
Filtered TKN	13.23	1.94	
Particulate TKN	311.27	45.76	
Total Kjeldahl Nitrogen	324.50	47.70	
Filtered Carbonaceous BOD	5.74	0.84	
Total Carbonaceous BOD	1620.95	238.28	
Nitrite + Nitrate	1.49	0.22	
Total N	326.00	47.92	
Total inorganic N	12.49	1.84	
Alkalinity	3.20	0.47	mmol/L and kmol/d
pH	6.65		
Volatile fatty acids	1.31	0.19	
Total precipitated solids	0	0	
Total inorganic suspended solids	1376.64	202.37	
Ammonia N	10.99	1.62	
Nitrate N	1.25	0.18	

Parameters	Value	Units
Hydraulic residence time	0.1	hours
Flow	147000.00	L/d
MLSS	5873.40	mg/L
Total solids mass	2.89	kg
Total readily biodegradable COD	8.07	mg/L
Total oxygen uptake rate	12.48	mgO/L/hr
Carbonaceous OUR	10.71	mgO/L/hr
Nitrogenous OUR	1.76	mgO/L/hr
Net. ammonia removal rate	0.59	mgN/L/hr
Nitrate production rate	0.16	mgN/L/hr
Nitrite production rate	13.45	mgN/L/hr
Nitrate removal rate	12.97	mgN/L/hr
Nitrite removal rate	12.04	mgN/L/hr
Net. nitrate production rate	-12.81	mgN/L/hr
Net. nitrite production rate	1.42	mgN/L/hr
Dissolved N2 gas production rate	11.86	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	2.64	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	6.28	mgN/gVASS/hr
OTE	100.00	%
OTR	0	kg/hr
SOTE	100.00	%
SOTR	0	kg/hr
Air supply rate	0	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	0	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	0	
Off gas flow rate (dry)	0.00	m3/hr
Oxygen content	0	%
Carbon dioxide content	39.13	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.10	mg/L

Album page - Anoxic 2 IC

Anoxic 2 (IC)			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	4495.04	660.77	
Total suspended solids	5866.04	862.31	
Particulate COD	5242.84	770.70	
Filtered COD	87.04	12.79	
Total COD	5329.88	783.49	
Soluble PO4-P	20.35	2.99	
Total P	231.98	34.10	
Filtered TKN	13.37	1.97	
Particulate TKN	311.14	45.74	
Total Kjeldahl Nitrogen	324.51	47.70	
Filtered Carbonaceous BOD	2.56	0.38	
Total Carbonaceous BOD	1616.61	237.64	
Nitrite + Nitrate	0.16	0.02	
Total N	324.66	47.73	
Total inorganic N	11.56	1.70	
Alkalinity	3.32	0.49	mmol/L and kmol/d
pH	6.66		
Volatile fatty acids	0.42	0.06	
Total precipitated solids	0	0	
Total inorganic suspended solids	1371.00	201.54	
Ammonia N	11.40	1.68	
Nitrate N	0.10	0.01	

Parameters	Value	Units
Hydraulic residence time	0.3	hours
Flow	147000.00	L/d
MLSS	5866.04	mg/L
Total solids mass	11.01	kg
Total readily biodegradable COD	3.62	mg/L
Total oxygen uptake rate	0.10	mgO/L/hr
Carbonaceous OUR	0.08	mgO/L/hr
Nitrogenous OUR	0.02	mgO/L/hr
Net. ammonia removal rate	-1.33	mgN/L/hr
Nitrate production rate	0.00	mgN/L/hr
Nitrite production rate	3.76	mgN/L/hr
Nitrate removal rate	3.76	mgN/L/hr
Nitrite removal rate	4.36	mgN/L/hr
Net. nitrate production rate	-3.76	mgN/L/hr
Net. nitrite production rate	-0.60	mgN/L/hr
Dissolved N2 gas production rate	4.35	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	0.97	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	2.30	mgN/gVASS/hr
OTE	100.00	%
OTR	0	kg/hr
SOTE	100.00	%
SOTR	0	kg/hr
Air supply rate	0	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	0	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	0	
Off gas flow rate (dry)	0.00	m3/hr
Oxygen content	0	%
Carbon dioxide content	36.44	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.10	mg/L

Album page - Aerated IC

Aerated (IC)			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	5881.76	1152.82	
Total suspended solids	7774.66	1523.83	
Particulate COD	6897.32	1351.87	
Filtered COD	67.05	13.14	
Total COD	6964.37	1365.02	
Soluble PO4-P	1.02	0.20	
Total P	306.66	60.11	
Filtered TKN	3.16	0.62	
Particulate TKN	412.48	80.85	
Total Kjeldahl Nitrogen	415.65	81.47	
Filtered Carbonaceous BOD	1.08	0.21	
Total Carbonaceous BOD	2113.68	414.28	
Nitrite + Nitrate	4.82	0.94	
Total N	420.46	82.41	
Total inorganic N	5.84	1.15	
Alkalinity	2.26	0.44	mmol/L and kmol/d
pH	6.66		
Volatile fatty acids	0.01	0.00	
Total precipitated solids	0	0	
Total inorganic suspended solids	1892.90	371.01	
Ammonia N	1.03	0.20	
Nitrate N	4.56	0.89	

Parameters	Value	Units
Hydraulic residence time	0.4	hours
Flow	196000.00	L/d
MLSS	7774.66	mg/L
Total solids mass	26.45	kg
Total readily biodegradable COD	1.53	mg/L
Total oxygen uptake rate	78.42	mgO/L/hr
Carbonaceous OUR	30.99	mgO/L/hr
Nitrogenous OUR	47.44	mgO/L/hr
Net. ammonia removal rate	11.42	mgN/L/hr
Nitrate production rate	10.33	mgN/L/hr
Nitrite production rate	11.35	mgN/L/hr
Nitrate removal rate	0.29	mgN/L/hr
Nitrite removal rate	10.82	mgN/L/hr
Net. nitrate production rate	10.04	mgN/L/hr
Net. nitrite production rate	0.53	mgN/L/hr
Dissolved N2 gas production rate	0.15	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	0.03	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	0.06	mgN/gVASS/hr
OTE	3.66	%
OTR	0.26	kg/hr
SOTE	14.53	%
SOTR	1.02	kg/hr
Air supply rate	25.75	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	3.68	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	7.00	
Off gas flow rate (dry)	25.89	m3/hr
Oxygen content	20.08	%
Carbon dioxide content	0.83	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.20	mg/L

Album page - Post Anoxic

Post Anoxic (External)			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	5883.74	717.12	
Total suspended solids	7774.46	947.56	
Particulate COD	6901.33	841.14	
Filtered COD	70.73	8.62	
Total COD	6972.06	849.76	
Soluble PO4-P	1.67	0.20	
Total P	306.64	37.37	
Filtered TKN	2.83	0.34	
Particulate TKN	412.82	50.31	
Total Kjeldahl Nitrogen	415.64	50.66	
Filtered Carbonaceous BOD	2.69	0.33	
Total Carbonaceous BOD	2117.26	258.05	
Nitrite + Nitrate	0.14	0.02	
Total N	415.78	50.68	
Total inorganic N	1.04	0.13	
Alkalinity	2.58	0.32	mmol/L and kmol/d
pH	6.65		
Volatile fatty acids	0.15	0.02	
Total precipitated solids	0	0	
Total inorganic suspended solids	1890.72	230.44	
Ammonia N	0.90	0.11	
Nitrate N	0.09	0.01	

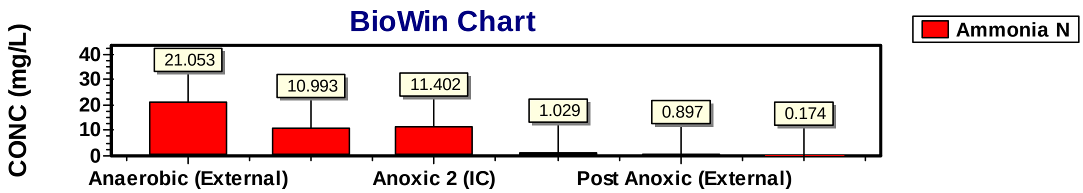
Parameters	Value	Units
Hydraulic residence time	0.3	hours
Flow	121880.86	L/d
MLSS	7774.46	mg/L
Total solids mass	11.66	kg
Total readily biodegradable COD	3.80	mg/L
Total oxygen uptake rate	7.98	mgO/L/hr
Carbonaceous OUR	7.26	mgO/L/hr
Nitrogenous OUR	0.72	mgO/L/hr
Net. ammonia removal rate	0.44	mgN/L/hr
Nitrate production rate	0.06	mgN/L/hr
Nitrite production rate	15.25	mgN/L/hr
Nitrate removal rate	15.18	mgN/L/hr
Nitrite removal rate	15.96	mgN/L/hr
Net. nitrate production rate	-15.12	mgN/L/hr
Net. nitrite production rate	-0.71	mgN/L/hr
Dissolved N2 gas production rate	15.72	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	2.67	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	6.24	mgN/gVASS/hr
OTE	100.00	%
OTR	0	kg/hr
SOTE	100.00	%
SOTR	0	kg/hr
Air supply rate	0	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	0	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	0	
Off gas flow rate (dry)	0.00	m3/hr
Oxygen content	0	%
Carbon dioxide content	66.52	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.20	mg/L

Album page - Membrane Tank

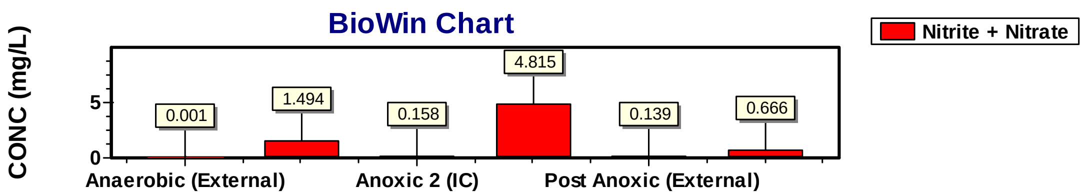
Membrane Tank			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Volatile suspended solids	7126.65	6979.27	
Total suspended solids	9426.98	9232.03	
Particulate COD	8365.48	8192.48	
Filtered COD	66.55	65.17	
Total COD	8432.03	8257.66	
Soluble PO4-P	0.06	0.05	
Total P	372.05	364.35	
Filtered TKN	2.26	2.21	
Particulate TKN	500.94	490.58	
Total Kjeldahl Nitrogen	503.19	492.79	
Filtered Carbonaceous BOD	1.14	1.11	
Total Carbonaceous BOD	2561.63	2508.65	
Nitrite + Nitrate	0.67	0.65	
Total N	503.86	493.44	
Total inorganic N	0.84	0.82	
Alkalinity	2.49	2.44	mmol/L and kmol/d
pH	6.91		
Volatile fatty acids	0.01	0.01	
Total precipitated solids	0	0	
Total inorganic suspended solids	2300.33	2252.76	
Ammonia N	0.17	0.17	
Nitrate N	0.65	0.63	

Parameters	Value	Units
Hydraulic residence time	0.0	hours
Flow	979320.34	L/d
MLSS	9426.98	mg/L
Total solids mass	11.54	kg
Total readily biodegradable COD	1.61	mg/L
Total oxygen uptake rate	56.32	mgO/L/hr
Carbonaceous OUR	36.73	mgO/L/hr
Nitrogenous OUR	19.59	mgO/L/hr
Net. ammonia removal rate	3.00	mgN/L/hr
Nitrate production rate	4.31	mgN/L/hr
Nitrite production rate	4.75	mgN/L/hr
Nitrate removal rate	2.00	mgN/L/hr
Nitrite removal rate	4.87	mgN/L/hr
Net. nitrate production rate	2.31	mgN/L/hr
Net. nitrite production rate	-0.12	mgN/L/hr
Dissolved N2 gas production rate	0.03	mgN/L/hr
Spec. dissolved N2 gas production rate per VSS	0.00	mgN/gVSS/hr
Spec. dissolved N2 gas production per VASS	0.01	mgN/gVASS/hr
OTE	2.37	%
OTR	0.09	kg/hr
SOTE	8.19	%
SOTR	0.32	kg/hr
Air supply rate	14.31	m3/hr (20C, 101.325 kPa or 1 atm)
Air flow rate / diffuser	7.16	m3/hr (20C, 101.325 kPa or 1 atm)
# of diffusers	2.00	
Off gas flow rate (dry)	14.39	m3/hr
Oxygen content	20.33	%
Carbon dioxide content	0.87	%
Ammonia content	0.00	%
Actual DO sat. conc.	8.58	mg/L

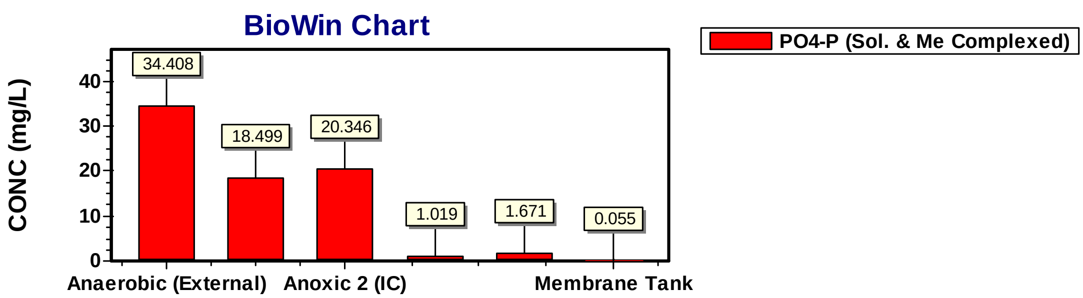
Album page - N profile



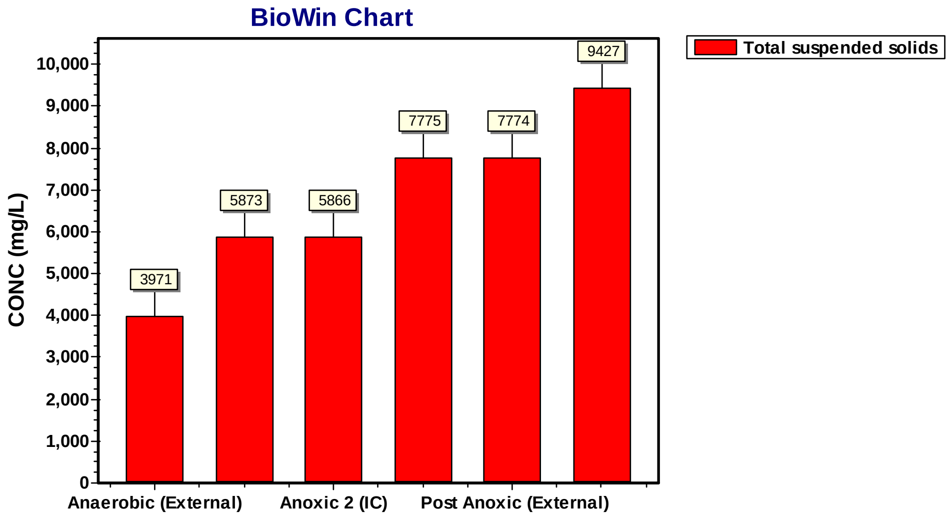
Album page - N profile



Album page - Page 10



Album page - Solids Distribution


BioWin Chart
Total suspended solids
CONC (mg/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
3971
5873
5866
7775
7774
9427
Anaerobic (External)
Anoxic 2 (IC)
Post Anoxic (External)

Appendix D - Pilot Outage Record

Date	Time of Incident	Time Restored	Total Time Off
			Minutes
4/28/07	07:30:36	09:56:38	110
5/18/07	13:28:24	22:12:46	114
5/20/07	09:40:51	Not Restored	859
6/2/07	04:55:59	09:11:00	242
6/3/07	13:07:49	19:07:00	358
6/5/07	Sporadic	Sporadic	110
6/13/07	Sporadic	Sporadic	66
6/14/07	00:00:00	11:16:05	465
6/18/07	14:16:12	16:01:03	88
6/22/07	18:25:50	19:55:25	75
6/23/07	08:17:32	09:50:09	83
7/3/07	17:10:10	20:25:16	176
7/7/07	14:57:27	17:48:40	159
7/10/07	14:48:56	22:26:25	111
7/15/07	14:39:30	Not Restored	560
7/16/07	0:00:00	08:46:21	508
7/21/07	15:08:00	16:42:11	70
7/22/07	20:12:51	22:04:33	105
7/23/07	11:30:46	13:06:04	85
7/31/07	17:40:14	Not Restored	86
8/23/07	08:41:46	10:37:13	106
8/25/07	12:57:29	15:23:21	99
8/31/07	02:37:43	14:42:57	761
9/1/07	01:13:48	Not Restored	1368
9/2/07	0:00:00	Not Restored	1440
9/3/07	0:00:00	Not Restored	1440
9/4/07	0:00:00	10:13:56	1336

APPENDIX F
Phase II Water Quality Characterization
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. Feb 07 mg/L	SWWWTF Inf. Sep 07 mg/L	SWWWTF Eff. Sep 07 mg/L
Alachlor	0.002	0.002	0.002	<.002	0.00038	0.00054
Aldrin	0.001	0.001	0.001	0.00003	0.00005	0.00005
Aluminum	0.2	0.2	0.2	0.74	0.32	0.12
Antimony	0.006	0.006	0.006	0.001	0	0.00054
Arsenic (total)	0.05	0.01	0.01	0.002	0.005	0.005
Asbestos	N/A	7 MFL (million fibers per liter)	7 MFL (million fibers per liter)	N.S.	7.4	0
Atrazine	0.003	0.003	0.003	0.0002	0.00031	0.00044
Barium	2	2	2	0.015	0.013	0.0087
Benzene	0.001	0.001	0.001	0.0004	0.0003	0.0003
Benzo(a)pyrene	0.0002	0.0002	0.0002	0.000055	0.00009	0.00009
Beryllium	0.004	0.004	0.004	0.0018	0	0.0032
BOD 5	5	-	5	430	240	1
Bromates	N.S.	0.01	0.01	0.005	0.0017	0.00084
Cadmium	0.005	0.005	0.005	0.0021	0.003	0.0032
Carbofuran	0.04	0.04	0.04	0.00045	0.0011	0.0011
Carbon tetrachloride	0.003	0.003	0.003	0.00041	0.00024	0.00024
CBOD 5	N.S.	-	20 ann avg[(a)]	210	-	-
	-	-	30 monthly[(a)]		-	-
	-	-	60 single sample[(a)]		-	-
Chlordane	0.002	0.002	0.002	0.0001	-	-
Chloride	250	250	250	100	82	92
Chlorinated hydrocarbons (not otherwise identified by name)	0.01	-	0.01	N.S.	-	-
Chlorine (total residual)	1	-	1	0.85	-	-
Chlorine (residual disinfectant)	-	4 as Cl_2	0.5 (min) 4 (max)	N.S.	-	-
Chloramines	-	4 as Cl_2	4	N.S.	-	-
Chlorine Dioxide	-	0.8 (as ClO_2)	0.8	N.S.	-	-
Chlorite	N/A	1	1	N.S.	-	-
chloroethylene (vinyl chloride)	0.001	-	0.001	0.00048	-	-
Chromium (total)	0.1	0.1	0.1	0.0025	0.003	0.0033
COD	10	-	10	0.43	350	20
Coliform (fecal)	A. 200 colonies per 100 ml for monthly average	-	A. 200 colonies per 100 ml for monthly average	14000	-	-
	B. 400 colonies per 100 ml for 10% of samples	-	B. 400 colonies per 100 ml for 10% of samples	14000	-	-
	C. 800 colonies per 100 ml in any sample	-	C. 800 colonies per 100 ml in any sample[(b)]	14000	1	28
Coliform (total)	1,000 colonies per 100 ml	-	1,000 colonies per 100 ml	126000	1	25000
Color	No unnatural discoloration	15 color units	15 color units	500 cu	200	20
Copper	1	1	1	0.01	0.016	0.0042
Cyanide	0.2	0.2	0.2	0.0026	0.01	0.004
2,4-d (2,4-dichloro-phenoxyacetic acid)	0.07	0.07	0.07	<0.00009	0.0642	0.0642

APPENDIX F
Phase II Water Quality Characterization
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. Feb 07 mg/L	SWWWTF Inf. Sep 07 mg/L	SWWWTF Eff. Sep 07 mg/L
Dalapon (2,2-dichloro-propionic acid)	0.2	0.2	0.2	<0.0008	0.00005	0.00005
DDT	0.0001	-	0.0001		-	-
Demeton	0.0001	-	0.0001	0.00021	-	-
Dibromochloropropane (DBCP)	0.0002	0.0002	0.0002	0.0000036	0.0000036	0.0000036
1,2-dibromoethane (EDB)	0.00002	0.00002	0.00002	0.0000053	0.00023	0.0000053
1,2-dichlorobenzene (o-dichlorobenzene)	0.6	0.6	0.6	0.00038	0.00028	0.00028
1,4-dichlorobenzene (p-dichlorobenzene)	0.075	0.075	0.075	0.0012	0.00098	0.00028
Dichloromethane (methylene chloride)	N.S.	-	-	N.S.	-	-
Dichlorobromomethane	N.S.	-	-	N.S.	0.000156	0.000156
1,2-dichloroethane (ethylene dichloride)	0.003	-	0.003	0.00048	0.00023	0.00023
1,1-dichloroethylene (vinylidene chloride)	0.007	0.007	0.007	0.00044	-	-
Cis-1,2- dichloroethylene	0.07	0.07	0.07	0.00039	0.00024	0.00024
Trans-1,2- dichloroethylene	0.1	0.1	0.1	0.00039	-	-
Dichloromethane (methylene chloride)	0.005	0.005	0.005	0.00083	-	-
2,4-dichlorophenol	N.S.	-	-	0.0015	-	-
2,4-dichlorophenoxy -acetic acid (2,4-D)	0.07	-	0.07	0.00009	0.00642	0.00642
2,2-dichloropropionic acid (dalapon)	0.2	-	0.2	0.00008	0.00005	0.00005
1,2- dichloropropane	0.005	0.005	0.005	0.0004	0.00025	0.00025
Di-(2-ethylhexyl) adipate	0.4	0.4	0.4	0.00036	0.00124	0.00011
Di-(2-ethylhexy) phthalate	0.006	0.006	0.006	0.00036	0.00852	0.00018
Dinoseb	0.007	0.007	0.007	0.00006	0.00008	0.0008
2,3,7,8-TCDD (Dioxin)	N/A	3×10^{-8}	3×10^{-8}		0.58	1.15
Diquat	0.02	0.02	0.02	0.00029	0.002	0.002
Endosulfan	0.0001		0.0001	0.00012	-	-
Endothall	0.01	0.01	0.01	0.0027	0.0203	0.0203
Endrin	0.002	0.002	0.002	0.000005	0.000005	0.000005
Ethylbenzene	0.03	0.7	0.03	0.00036	0.00032	0.00032
Ethylene dichloride (1,2-dicholoroethane, edc)	0.003	0.003	0.003	0.00048	-	-
Fluoride	2	2	2	0.53	4.3	0.84
Foaming Agents	N/A	0.5	0.5	N.S.	-	-
Gamma-hexachloro-cyclohexane (lindane)	0.0002	-	0.0002	0.000004	0.000004	0.000004
Glyphosate (roundup)	0.7	0.7	0.7	0.0032	0.048	0.048
Gross alpha	15 pCi/l	-	15 pCi/l	1.17+/-1.35 pCi/l	.7 +/-0.4	1.2 +/-.8
Guthion (azinphos- methyl)	0.0001	-	0.0001	0.000025	-	-
Heptachlor	0.0004	0.0004	0.0004	0.000005	0.000005	0.000005
Heptachlor epoxide	0.0002	0.0002	0.0002	0.000008	0.000004	0.000004
Hexachlorobenzene	N/A	1000	1000	0.0026	0.00028	0.00028
Hexa-chlorocyclo-pentadiene	0.05	0.05	0.05	0.00042	0.00004	0.00004
Haloacetic Acids (Five) (HAA5)	N/A	0.06	0.06		0.021	0.0039
Iron	0.3	0.3	0.3	0.46	0.038	0.039
Lead	0.015	0.015	0.015	0.001	-	-
Lindane (gamma-hexa-chlorocyclohexane)	0.0002	0.0002	0.0002		#N/A	#N/A
Malathion	0.0001	-	0.0001	<.00029	-	-
Manganese	0.05	0.05	0.05	0.022	0.0074	0.004
Mercury	0.002	0.002	0.002	0.00002	0.000063	0.000071

APPENDIX F
Phase II Water Quality Characterization
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. Feb 07 mg/L	SWWWTF Inf. Sep 07 mg/L	SWWWTF Eff. Sep 07 mg/L
Methoxychlor	0.04	0.04	0.04	<.000007	0.000005	0.000005
Methylene chloride (dichloromethane)	0.005	-	0.005	0.00083	0.00042	0.00042
Mirex	0.0001	-	0.0001	<.0000033	-	-
Monochlorobenzene	0.1	0.1	0.1	0.0004	-	-
Nickel	0.1	0.1	0.1	0.0059	0.002	0.0035
Nitrogen: total nitrogen as n (nitrate, nitrite, nh 3 , and organic)	N.S.	-	10©	64	-	<10
Nitrate (as n)	10	10	10	0.062	0.27	0.78
Nitrite (as n)	1	1	1	0.021	1.8	1.4
Total nitrate + nitrite (as n)	10	10	10	0.083	2.07	2.18
Odors	None detectable due to sewage or industrial waste	3 (threshold odor number)	3 (threshold odor number)	100 TO	200	0 TON
Oil and grease	Dissolved or emulsified oil or grease shall not exceed 10.0 ppm; no undissolved or visible oil as iridescence shall be present	-	Dissolved or emulsified oil or grease shall not exceed 10.0 ppm; no undissolved or visible oil as iridescence shall be present	25	55	20
Oxamyl	0.2	0.2	0.2	0.00052	0.0006	0.0006
Parathion	0.042	-	0.042	0.00038	-	-
Pathogens (excluding coliforms)	1 per gallon	-	1 per gallon		-	-
Pentachlorophenol	0.001	0.001	0.001	0.00002	0.00023	0.00023
Perc (perchloro- ethylene, tetrachloro-ethylene, pce)	0.003	-	0.003		-	-
pH	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	Not less than 6.5 nor more than 8.5 units	6.92	7.81	7.88
Phenolic compounds	0.0001	-	0.0001		-	-
Phosphates (total as p)	0.01	-	0.01	20	-	-
Picloram	0.5	0.5	0.5	0.00008	0.00104	0.0104
Polychlorinated biphenyls (pcbs)	0.0005	0.0005	0.0005	0.0001	0.001	0.001
Polyaromatic hydro-carbons (pahs). Total of: acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo-(a,h)-anthracene, indeno(1,2,3-cd)pyrene, and phenanthrene	0.5	-	0.5		0	0.00038
Radioactivity:		-	-			
Gross beta radium 226 strontium 90 (In picocuries/l)	1,000 pCi/l 3 pCi/l 10 pCi/l	-	1,000 pCi/l 3 pCi/l 10 pCi/l	7.49+/-1.99pCi/l	10.6 +/- 0/5	9.2 +/- .9
Selenium	0.05	0.05	0.05	0.001	1.78	0.0041
Silver	0.1	0.1	0.1	0.00088	0.003	0.003
Silvex (2,3,5-tp)	0.05	0.05	0.05	0.000038	0	0.0045
Simazine	0.004	0.004	0.004	0.00002	0.00031	0.00044
Sodium	160	160	160	85	72	110
Styrene (vinyl benzene)	0.1	0.1	0.1	0.00056	0.00027	0.00027
Sulfate	250	250	250	24	25	38
TCE (trichloro-ethylene)	0.003	-	0.003	0.00041	-	-

APPENDIX F
Phase II Water Quality Characterization
Reuse Via Groundwater Recharge

COMPOUND	Broward 27-195 GROUND (mg/L)	DEP G-1 (mg/L)	Water Quality Goal (mg/L)	SWWWTF Inf. Feb 07 mg/L	SWWWTF Inf. Sep 07 mg/L	SWWWTF Eff. Sep 07 mg/L
Tetrachloroethylene	0.003	0.003	0.003	0.00002	-	-
Thallium	0.002	0.002	0.002	0.0021	-	-
Toluene	0.04	1	0.04	430	0.0066	0.00041
Total dissolved solids	500	500	500	430	420	410
Total Suspended solids	-	-	20 ann avg [(a)]		-	-
	-	-	30 monthly[(a)]		130	3.5
	-	-	60 single sample[(a)]	230	-	-
Toxaphene	0.003	0.003	0.003	0.0004	-	-
1,2,4-trichloro-benzene	0.07	0.07	0.07	0.0018	0.00029	0.00029
1,1,1-trichloroethane	0.2	0.2	0.2	0.00045	0.00022	0.00022
Trichloroethylene (tce)	0.003	0.003	0.003		-	-
1,1,2-trichloroethane	0.005	0.005	0.005	0.00048	0.0003	0.0003
2,4,6-trichlorophenol	N.S.	-	-	0.0015	-	-
Trihalomethanes, total (total trihalomethanes equals the sum of the concen-trations of bromodichloromethane, chlorodibromomethane, tribromomethane (bromoform) and trichloromethane (chloroform))	0.1	0.08	0.08	0.0041	0.00338	0.000849
Turbidity	10 NTUs	-	10 NTUs	143	110	0.25 NTUs
Vinyl chloride (chloroethylene)	0.001	0.001	0.001	0.00048	0.00038	0.00038
Xylenes, total	0.02	10	0.02	0.0011	0.0014	0.00098
Zinc	5	5	5	140	0.13	0.038

[(a)] FDEP requirements

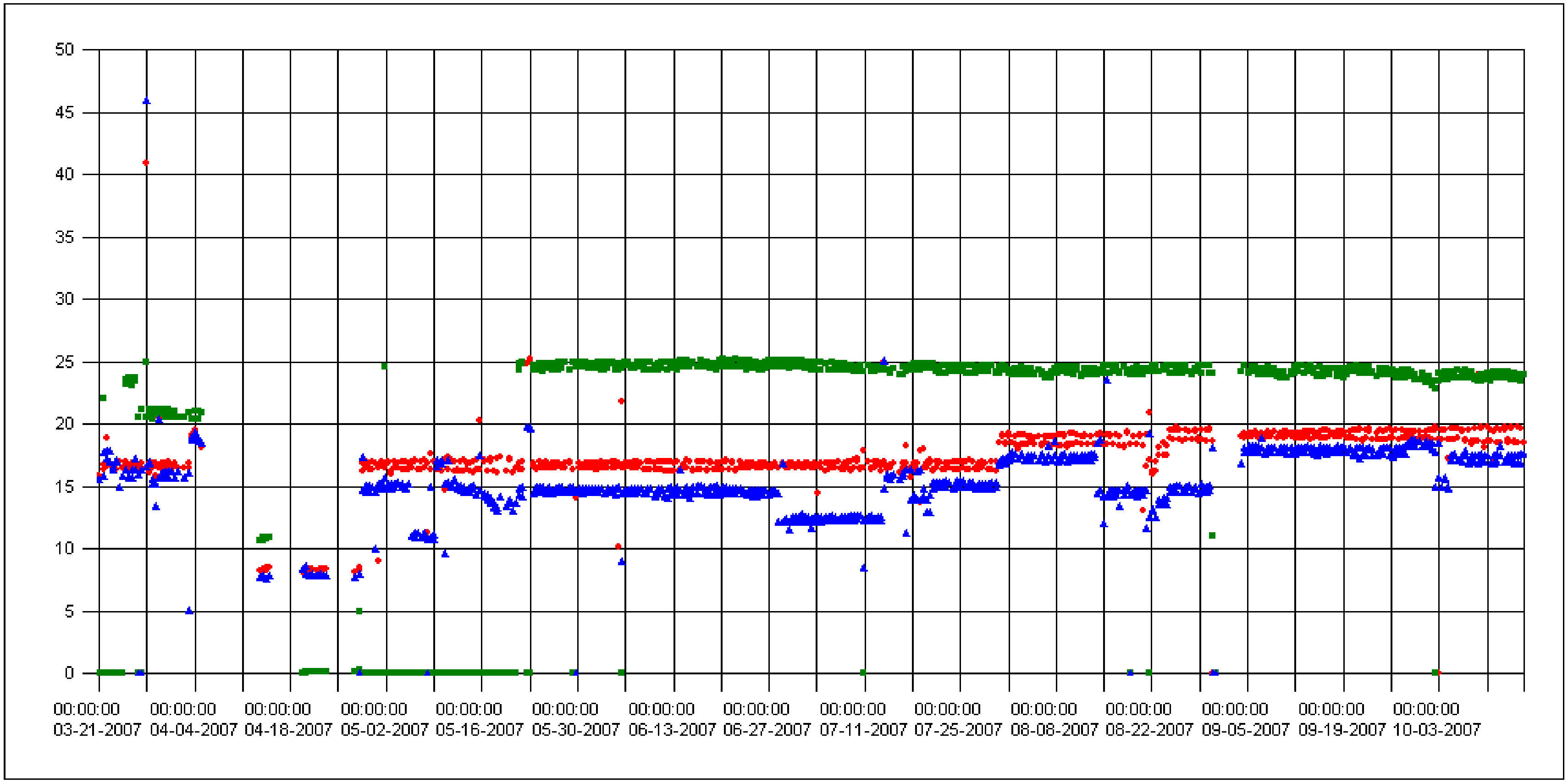
[(b)] Per FDEP permit at 0.99 mgd AADF, limit is 25/100 mL single sample maximum

© Per FDEP permit at 0.45 mgd Total Nitrogen limit is 10 ppm maximum. At 0.99 mgd, the limit is 10 ppm annual avg, 12.5 ppm monthly avg, and 20 ppm single sample.

* Per FDEP permit Total Residual Chlorine requirement is 0.5 ppm minimum at 0.45mgd ann. Avg flow and is 0.1 ppm minimum at 0.99 mgd ann. Avg flow.

APPENDIX A

550469 Sunrise DM - Flux



◆ Before Back Pulse ▲ After Back Pulse ■ During Back Pulse

Figure A- 1 Sunrise FL. Flux

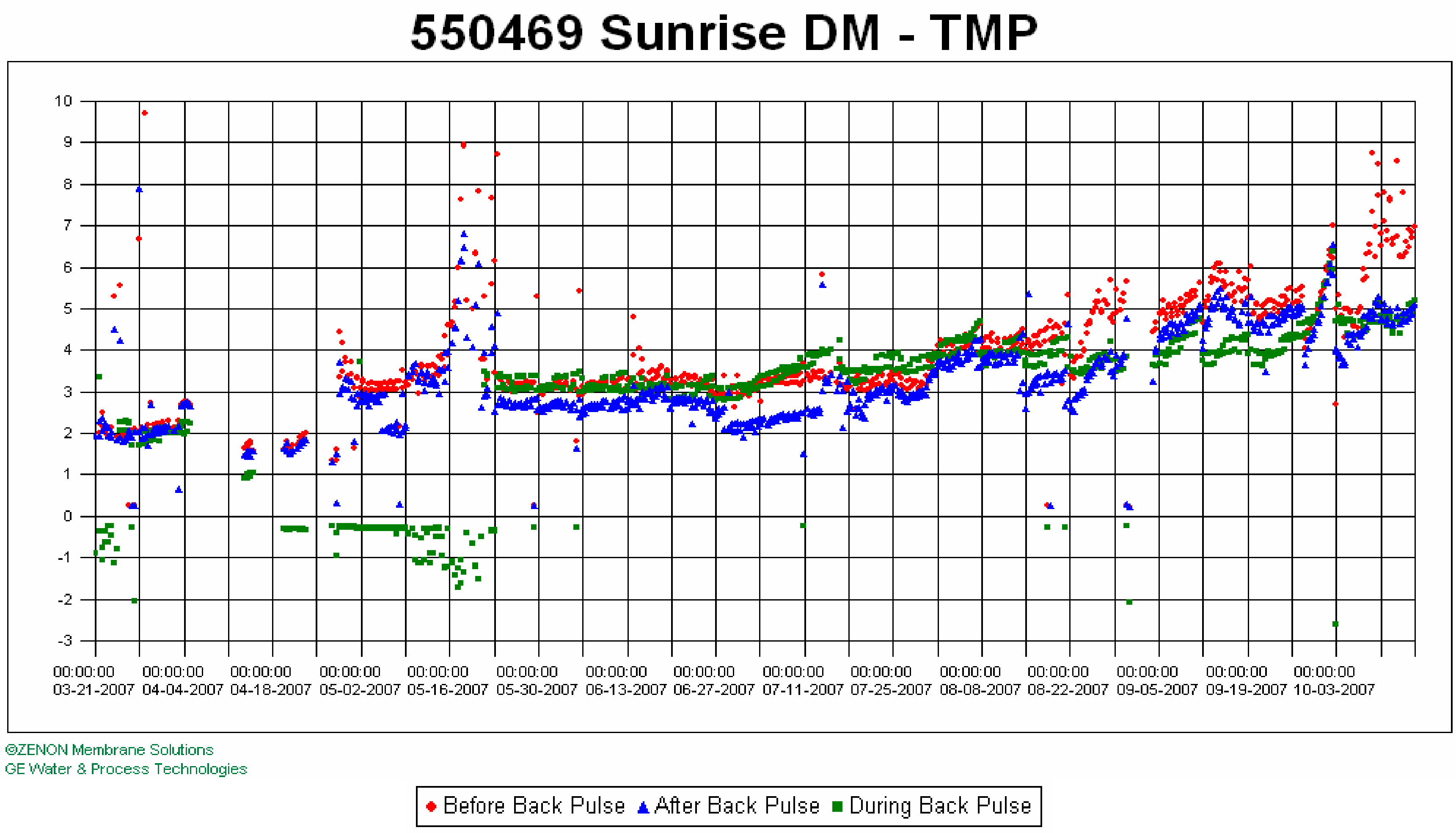


Figure A- 2 Sunrise FL. TMP

550469 Sunrise DM - Temperature Corrected Permeability

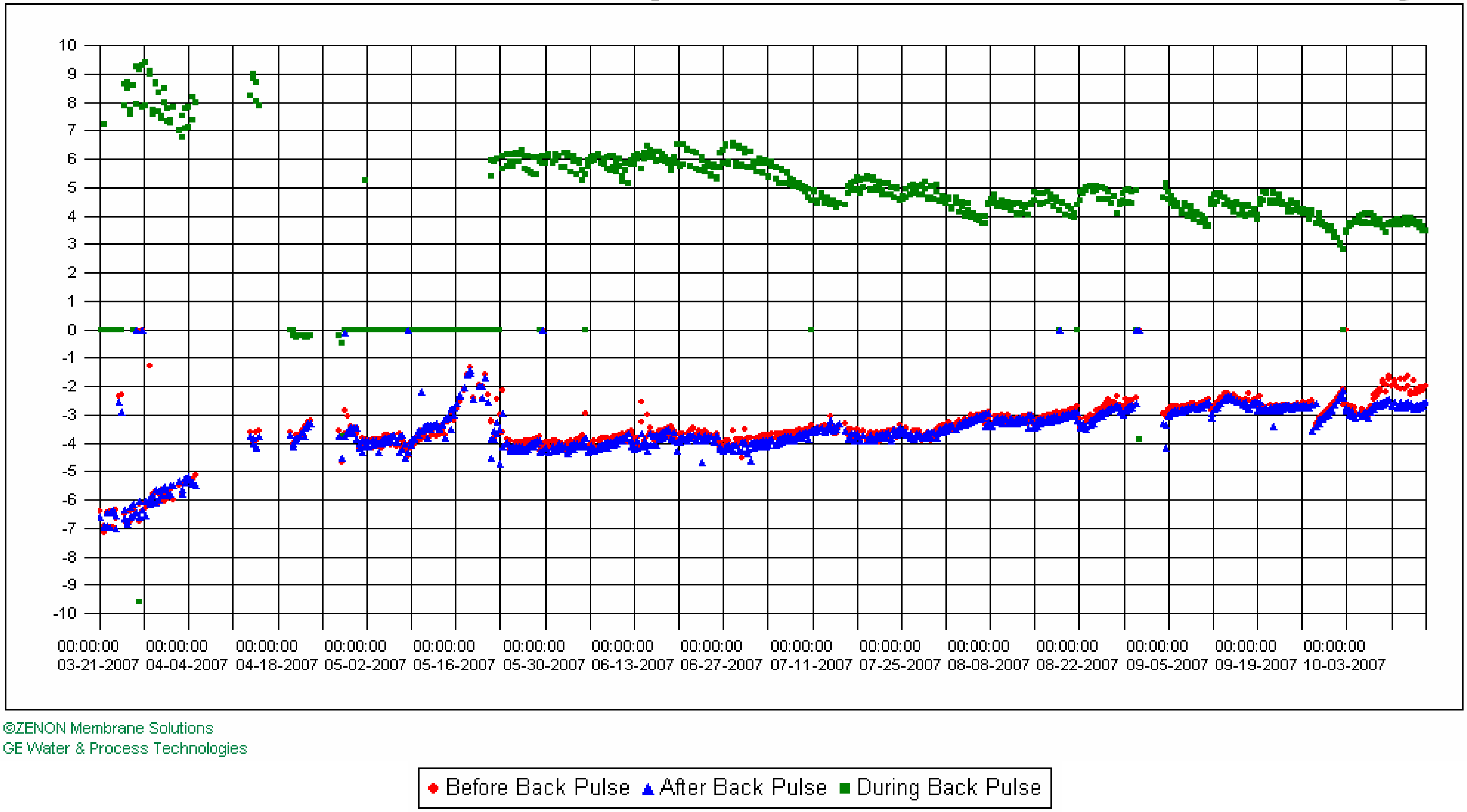


Figure A- 3 Sunrise FL, temperature corrected permeability

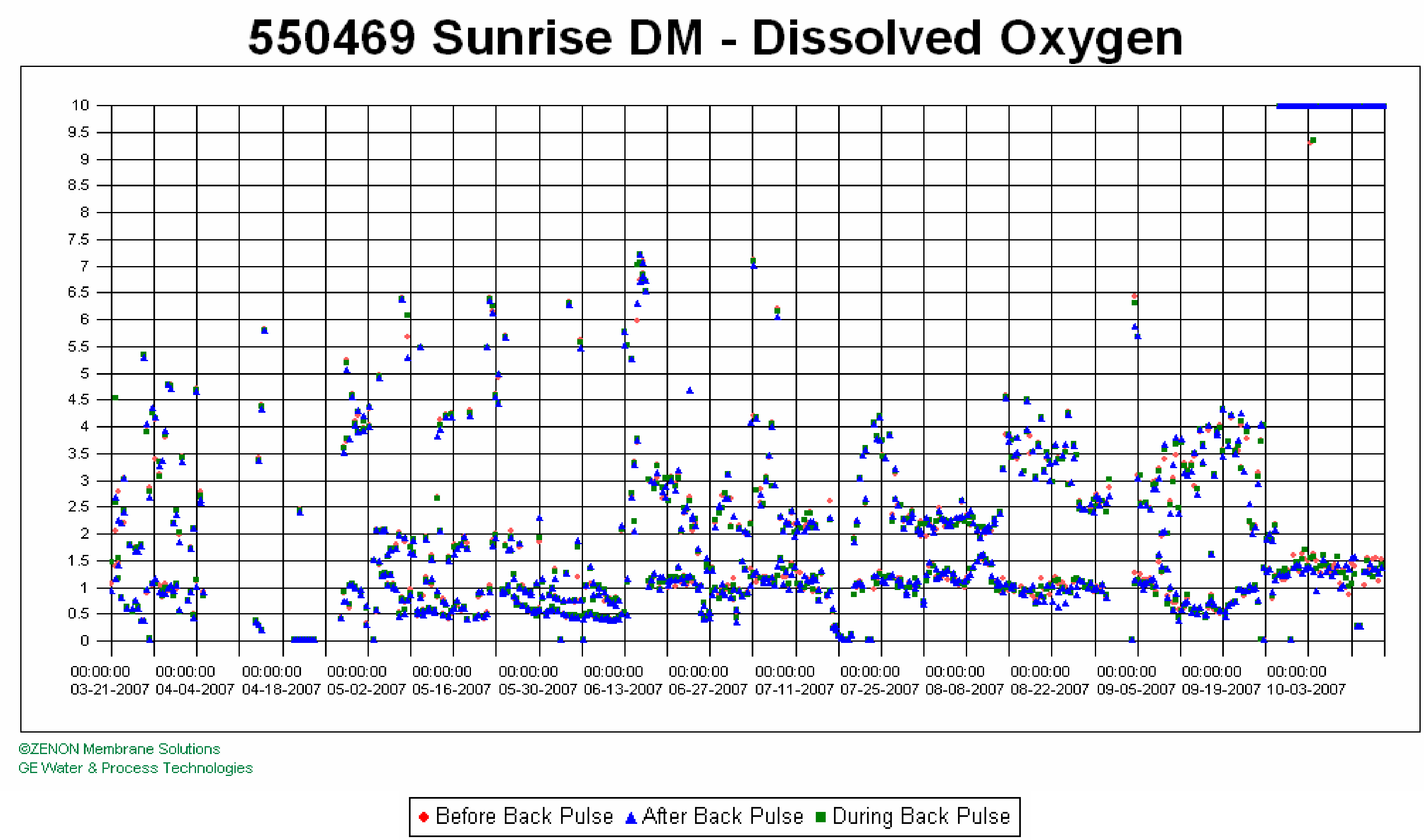


Figure A- 4 Sunrise, FL Dissolved Oxygen

550469 Sunrise DM - Turbidity

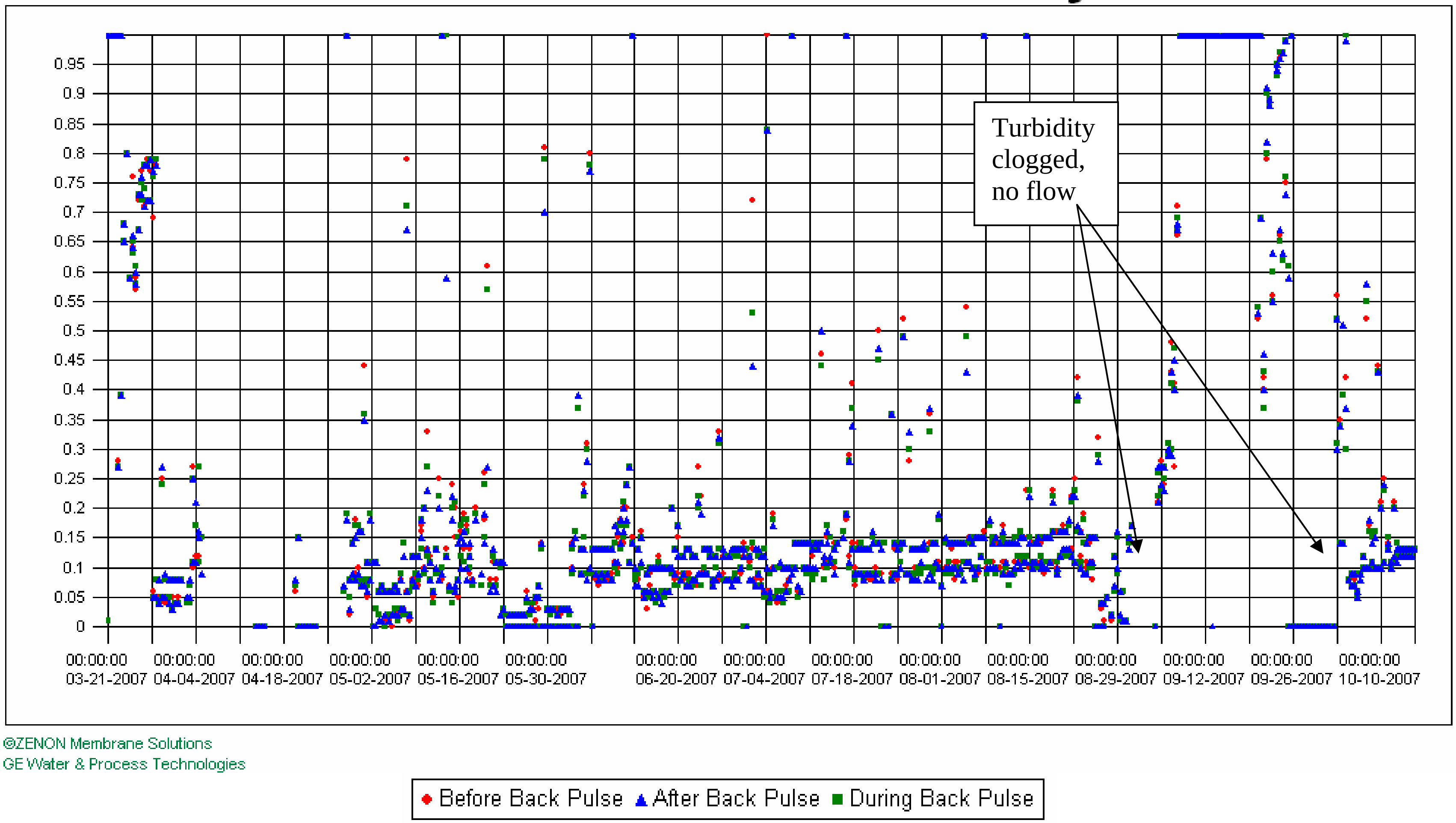


Figure A- 5 Sunrise, FL Turbidity

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Operator Field Log

Parameter		Feed Flow	Perm Flow	TMP Before BP	TMP After BP	Δ TMP	TMP during BP	Perm Temp	RAS (aerobic-Post-anoxic-Anoxic)	RAS (aerobic-Post-anoxic)	Internal RAS (aerobic-anoxic)	Internal RAS (Anoxic - Anaerobic)	Back pulse flow	Aerobic Tank DO	Aerobic Tank Air Flow	Aerobic Tank Visual Inspection	pH	Caustic Added	Caustic Tank Level	Membrane Aeration Mode	Membrane air flow-rotameter	Permeate quality visual inspection	Permeate turbidity	Permeate Turbidity Flow	Net flux	Hypo Maint Clean Performed?	Acid Maint Clean Performed?	Hypo Conc.	Bleach Added to BP Tank	Acid Conc.	Yesterday's Feed Vol.	Yesterday's Waste Sludge Vol.	Yesterday's Discharged Permeate Vol.	Equalization tank level check	SDI15	Transmittance (UV 254)
Instrument		FIT-7620	FIT-3520	PDI-3523	PDI-3523	(H-I)	PDI-3523	TIT-3530	FIT-7320		MAG	MAG	FIT-3520	AIT-7338	FIT-87						FIT-85		AIT 3537	FL 3535												
Date	Time	(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(°F)	(gpm)		(gpm)	(gpm)	(gpm)	(mg/L)	cfm			(L)	(L)		cfm		(NTU)	(ml/min)	(gfd)	yes/no	yes/no	(mg/L)	L	(mg/L)	(gal)					
28-Mar	9:00 AM	9.5	4	-2.09	-2.1	-0.01	2	85	32.2	20.2	12	g 11 cor	4.8	1.9	20	ok				ok	ok	0.78	300			no	no	no ok	no ok		43361	0	4868	ok		
29-Mar	10:34 AM	0	3.9	-2.16	-2.01	0.15	1.95	86.5	32	19.98	12.02	7.9	4.8	1.9	15	ok	6.7			ok	ok	0.07	300			no	no				45172	0	4764	ok		
30-Mar	9:45 AM	9.6	4	-2.17	-2.11	0.06	2.04	86	32	19.63	12.37	8.3	4.01	4.8	15	ok	7.1			ok	ok	0.08	300			no	no	no	no		41474	0	4596	ok		
31-Mar	2:40 PM	9.9	4	-2.21	-2.1	0.11	2.1	87.6	31.8	19.3	12.5	8.1	4.67	1	15	ok	7.1			ok	ok	0.08	300			no	no	no	no		45879	0	5137	ok		
1-Apr																																				
2-Apr	1:30 PM	0.5	4	-2.19	-2.1	0.09	2.09	88.2	32.2	20.2	12	1.7	5	0.93	13	ok	7			ok	40	ok	0.07		300	no	no	no	no		43954	0	4922	ok		
3-Apr	10:00 AM	0.1	4.2	-2.23	-2.23	0	2.22	86.9	29.3	21.6	7.7	4.8	4.31	1.8	15	ok	7			ok	40	ok	0.07		300	no	no	no	no		45860	0	5133	ok		
4-Apr	1:00 PM	0.1	0	-2.72	-2.74	-0.02	2.2	79.5	31.9	23.9	8	4.6	15	2.15	0	ok	7			ok	0	ok	0.13		100	no	no	no	no		45855	0	5527	ok		
5-Apr	1:00 PM	0.1	4	-2.45	-2.43	0.02	2.28	86.5	32	24.2	7.8	8	4	2.08	15	ok	7			ok	40	ok	0.1		100	no	no	no	no		45730	0	4038	ok		
6-Apr	9:45 AM	4.2	4	-2.51	-2.5	0.01	2.1	83.4	32	24.34	7.66	8	4	1.07	15	ok	7			ok	40	ok	0.14		100	no	no	no	no		45426	0	5394	ok		
7-Apr		0.1	4	-3.58	-3.31	0.27	2.63	79.1	32	24	8	8	4.01	1.42	15	ok	7.1			ok	40	ok	0.14		100	no	no	no	no		45804	0	5134	ok		
8-Apr						0				0																										
9-Apr	10:00 AM	0.1	3.2	-3.44	-3.24	0.2	2.38	83.7	30.2	6	24.2																					0				
10-Apr	5:45 PM	9.1	4	-1.65	-1.5	0.15	0.94	88.5	32.1	12.05	20.05	7.9	3.6	0.32	20		7			ok	36	ok	0.08		800	no	no	no	no		28676	0	2773	ok		
11-Apr	10:00 AM	7.9	4	-1.85	-1.63	0.22	1.03	84.2	32.1	24.5	7.6	8	4	0.27	15		7.1				40	ok	0.1		900	no	no	no	no		36298	0	3415	ok		
12-Apr	9:35 AM	0.1	4	-1.85	-1.67	0.18	0.98	84.7	32.2	8.2	24	8.1	4	0.24	30	ok	7			ok	40	ok	0.07		900	no	no	no	no		45780	0	5178	ok		
13-Apr	1:00 PM	0.1	4	-1.69	-1.45	0.24	1	87.1	31.9	10	21.9	8.1	4	2.49	17	ok	7.2			ok	40	ok	0		100	no	no	no	no		45290	0	5097	ok		
14-Apr	9:00 AM	0.1	4	-1.70	-1.53	0.17	0.99	86.2	31	7.8	23.2	8	3.96	0.42	35	ok	7.1			ok	40	ok	0		900	no	no	no	no		39142	0	4071	ok		
15-Apr	8:00 AM	8	7.8	-1.68	-1.59	0.09	1.04	85.9	39	36.58	2.42	8	4	2	0	ok	7			ok	35	ok	0		900						45579	0	64	ok		
16-Apr	9:35 AM	0.01	4	-1.86	-1.68	0.18	1.16	77.5	32	8	24	8.1	4	2.14	30	ok	7.2			ok	40	ok	0		900						45549	0	192	ok		
17-Apr	9:10 AM	0.1	4	-1.94	-1.66	0.28	1.17	78.7	32	8	24	8	4	0.95	15	ok	7.1			ok	40	ok	0		900						45529	0	192	ok		
18-Apr	1:00 PM	0.1	4	-1.80	-1.6	0.2	1.19	83.4	32	8	24	7	4	5.33	0	ok	7.1			ok	40	ok	0.1		850						33778	0	192	ok		
19-Apr	9:15 AM	0.1	4	-1.84	-1.74	0.1	0.35	82.9	32	8	24	8	3.96	0.02	0	ok	7.1			ok	40	ok	0.13		800						43100	0	160	ok		
20-Apr						0				0																										
21-Apr	9:00 AM	0.1	3.5	-1.78	-1.66	0.12	1.17	83.5	32	7.6	24.4	7.9	4	0.02	0	ok	7.1			ok	40	ok	0.13		600						44146	0	129	ok		
22-Apr						0				0																										
23-Apr						0				0																										
24-Apr						0				0																										
25-Apr						0				0																										
26-Apr						0				0																										
27-Apr		0.1	4	-1.60	-1.47	0.13	-0.28	92.5	31.9	19.6	12.3	8.1	3.88	0.47	10	ok	7	no	ok	ok	40	ok	0.9	300		no	no	250	0.8		45814	160	5560	ok		
28-Apr		8	4	-3.69	-3.1	0.59	-0.25	88.4	32	12	20	8		2.1	17	ok	7.2	no	ok	ok	27	ok	0.1	350		no	no	250			39976	160	4514	ok		
29-Apr						0				0																										
30-Apr	2:10 PM	10	4	-3.32	-2.81	0.51	0.27	89.3		-12	12	8		2.00		ok	7			cyclic 10/10	28	ok	350			yes	no	250		800	40005	0	5356	ok		
1-May	8:15 AM	10.1	4	-3.18	-2.95	0.23	0.28	86.0		-12	12	8		4.01		ok	7.1			cyclic 10/10	40	ok	0			yes	no				40865	0	4683	ok		
2-May	8:00 AM	0.1	4	-3.15	-2.93	0.22	-2.8	86.5		-11.9	11.9	8		2.46		ok	7			cyclic 10/10	40	ok	0.105			no	no				43966		5001	ok		
3-May	8:28 AM	0.1	4	-3.22	-2.94	0.28	-0.29	88.3	32.0	19.9	12.1	8.1	4	1.98	14	ok	7	no	ok	cyclic 10/10	38	ok	0.11	350		no	no				45351	0	5297	ok		
4-May	9:03 AM	0.1	4	-3.06	-2.88	0.18	-0.28	88.2	32.1	20.25	11.85	8	3.95	2.05	15	ok	7	no	ok	cyclic 10/10	39	ok	0.04	350		no	no				45316	0	5025	ok		
5-May	8:30 AM	0.1	3.9	-3.14	-2.92	0.22	-0.29	88.8	32.0	20.4	11.6	8.2		1.43		ok	7.1	no	ok	cyclic 10/10	40	ok	0.054	300		no	no				45751	0	5367	ok		

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Operator Field Log

Date	Time	Feed Flow	Perm Flow	TMP Before BP	TMP After BP	Δ TMP	TMP during BP	Perm Temp	RAS (aerobic-Post-anoxic-Anoxic)	RAS (aerobic-Post-anoxic)	Internal RAS (aerobic-anoxic)	Internal RAS (Anoxic - Anaerobic)	Back pulse flow	Aerobic Tank DO	Aerobic Tank Air Flow	Aerobic Tank Visual Inspection	pH	Caustic Added	Caustic Tank Level	Membrane Aeration Mode	Membrane air flow-rotameter	Permeate quality visual inspection	Permeate turbidity	Permeate Turbidity Flow	Net flux	Hypo Maint Clean Performed?	Acid Maint Clean Performed?	Hypo Conc.	Bleach Added to BP Tank	Acid Conc.	Yesterday's Feed Vol.	Yesterday's Waste Sludge Vol.	Yesterday's Discharged Permeate Vol.	Equalization tank level check	SDI15	Transmittance (UV 254)
Instrument	Parameter	FIT-7620	FIT-3520	PDI-3523	PDI-3523	(H-I)	PDI-3523	TIT-3530	FIT-7320		MAG	MAG	FIT-3520	AIT-7338	FIT-87						FIT-85		AIT 3537	FL 3535												
		(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(°F)	(gpm)		(gpm)	(gpm)	(gpm)	(mg/L)	cfm			(L)	(L)		cfm		(NTU)	(ml/min)	(gfd)	yes/no	yes/no	(mg/L)	L	(mg/L)	(gal)					
6-May	8:00 AM	0.1	0	-3.12	-2.1	1.02	-0.3	88.9	32.0	12	20	8		1.34	15.00	ok	7	no	ok	cyclic 10/10	38	ok	0.07	1000		no	no				45752	0	5279	ok		
7-May	1:00 PM	0.1	3.9	-3.10	-2.06	1.04	-0.3	87.4	31.9	19.91	11.99	8		1.06	14	ok	7	no	ok	cyclic 10/10	20	ok	0.05	1000		yes	no	250	0.8		45705	0	5189	ok		
8-May	8:30 AM	10	4	-3.20	-2.13	1.07	-0.3	83.0	32.0	20	12	8		1.33	14	ok	7	no	ok	cyclic 10/10	21	ok	0.041	340		no	no	no	no		44091	0	4994	ok		
9-May	8:30 AM	10.5	4	-3.20	-2.21	0.99	-0.3	85.4	32.0	20.2	11.8	8.1		1.83	15	ok	7	yes	ok	cyclic 10/10	38	ok	0.09	350		no	no		no		44546	0	4980	ok		
10-May	9:00 AM	0.1	4	-3.58	-3.59	-0.01	-0.98	85.3	32.2	20.4	11.8	7.8		0.79	15	ok	7.1	no	ok	cyclic 10/10	35	ok	0.17	300		no	no				45697	34	5325	ok		
11-May	8:08 AM	10	4	-3.52	-3.39	0.13	-1.01	86.2	32.0	20.25	11.75	8.1		1.30	15	ok	7	no	ok	cyclic 10/10	38	ok	0.11	350		no	no				45453	102	5362	ok		
12-May	9:00 AM	0.1	4	-3.56	-3.41	0.15	-1.06	86.6	32.0	20.3	11.7	7.8		0.90	14	ok	7	no	ok	cyclic 10/10	38	ok	0.078	350		no	no				44846	102	5224	ok		
13-May	9:00 AM	0.1	4	-3.55	-2.91	0.64	-0.3	88.1	32.0	20.28	11.72	8.1		1.66	13	ok	7	no	ok	cyclic 10/10	40	ok	1.98	450		no	no				45587	102	5328	ok		
14-May	11:00 AM	10	4	-3.35	-2.91	0.44	-0.33	88.3	32.0	20.3	11.7	8		4.14	15	ok	6.9	59 cm	ok	cyclic 10/10	38	ok	0.274	390		yes	no		0.8		45503	102	5310	ok		
15-May	9:30 AM	0.1	4	-0.31	-3.31	-3	-0.31	87.7	32.0	20.2	11.8	8.1		0.57	15	ok	7	60 cm	ok	cyclic 10/10	38	ok	0.09	390		no	no				43925	102	5109	ok		
16-May	8:20 AM	10.4	4	-4.74	-4.26	0.48	-1.3	87.4	31.9	20.1	11.8	8.1		1.16	15	ok	7	no	ok	cyclic 10/10	38	ok	0.16	330		no	no				44488	102	5147	ok		
17-May	9:20 AM	0.1	4	-6.39	-5.5	0.89	-1.33	87.0	32.0	20.2	11.8	8.1		1.27	14	ok	7	no	ok	cyclic 10/10	30	ok	0.16	310		no	no				45576	85	5309			
18-May	8:30 AM	0.1	4	-6.44	-5.34	1.1	-1.21	89.0	32.0	20	12	7.7		1.14	13	ok	7.1	no	ok	cyclic 10/10	32	ok	0.12	320		no	no				45531	102	5204	ok		
19-May						0				0																										
20-May	9:30 AM	0.1	4	-7.83	-5.91	1.92	-1.52	87.7	32.1	20.29	11.81	8.3		0.66	13	ok	7.0	no	ok	cyclic 10/10	20	ok	0.27	400		yes	no		0.8		43949	68	2947	ok		
21-May	9:00 AM	0.1	4	-7.73	-0.94	6.79	-1.51	88.6	31.8	19.6	12.2	7.9		1.52	15	ok	7.2	no	ok	cyclic 10/10	40	ok	0.839	400		no	no				45853	34	2144	ok		
22-May						0				0																										
23-May	10:00 AM	0.1	6	-7.99	-4.72	3.27	-0.35	89.2	48.0	13.8	34.2	11.9		1.97	0	ok	7.2	no	59	cyclic 10/10	20	ok	0.018	400		no	no		no		54634	376	2824	ok		
24-May	8:40 AM	0.1	4.1	-3.18	-2.77	0.41	3.29	86.7	32	32		8.1		1.6	10	ok	7	no	59	cyclic 10/10	35	ok	0.016	300		no	no		no		55291	145	3232	ok		
25-May	8:30 AM	0.1	4	-3.11	-2.71	0.4	3.14	86.3	32	12	20.0	7.9		2.01	10	ok	7	no	59	cyclic 10/10	35		0.007	350		no	no		no		45484	102	5035	ok		
26-May	7:30 AM	0.1	3.9	-3.10	-2.65	0.45	3.17	87.1	32	11.9	20.1	8.0		1.44	10	ok	7	no	59	cyclic 10/10	40	ok	0.022	350		no	no		no		45403	102	5026	ok		
27-May	8:45 AM	0.1	3.9	-3.18	-2.81	0.37	3.34	88	32	12.1	19.9	7.9		0.62	10	ok	7	no	59	cyclic 10/10	20	ok	0.066	350		no	no		no		45426	101	5022	ok		
28-May	8:50 AM	0.1	4	-3.17	-2.84	0.33	3.37	87.9	32	20	12.0	8.0		0.92	10	ok	6.8	yes	53	cyclic 10/10	35	ok	0.091	300		yes	no		0.8		45473	83	5020	ok		
29-May	9:30 AM	0.1	4	-3.17	-2.84	0.33	3.37	87.9	32	20	12.0	8.0		0.92	10	ok	6.8	yes	53	cyclic 10/10	35	ok	0.091	300		no	no		no		45473	83	5020	ok		
30-May	9:30 AM	0.1	3.9	-3.16	-2.98	0.18	3.31	88.2	32	20	12.0	8.1		1.44	10	ok	7.1	no	53	cyclic 10/10	40	ok	0.051	350		no	no		no		42846	102	4712	ok		
31-May	9:35 AM	0.1	3.8	-3.08	-2.64	0.44	3.05	88.1	32	20.1	11.9	8.0		0.8	11	ok	7	no	53	cyclic 10/10	37	ok	0.027	325		no	no		no		45460	102	4807	ok		
1-Jun	9:00 AM	0.1	3.9	-3.12	-2.69	0.43	3.11	86.8	32	20.2	11.8	7.9		0.75	11	ok	7	no	53	cyclic 10/10	36	ok	0.024	325		no	no		no		45478	102	5061	ok		
2-Jun	9:00 AM	0.1	3.9	-3.10	-2.49	0.61	3.31	85.7	32	20	12.0	8.2		0.002	10	ok	6.9	no	53	cyclic 10/10	36	ok		400		no	no		no		45453	102	5046	ok		
3-Jun						0				0																										
4-Jun						0				0																										
5-Jun						0				0																										
6-Jun	8:30 AM	10.4	4	-3.03	-2.56	0.47	3.08	90.2	31.9	20.1	11.8	8.1		0.62	10	ok	7.1	no	53	cyclic 10/10	35	ok	0.111	325		no	no		no		40313	85	4386	ok		
7-Jun	8:00 AM	10.5	4	-3.08	-2.66	0.42	3.09	87.9	32.1	19.99	12.1	8.0		0.97	10	ok	7	no	53	cyclic 10/10	40	ok	0.134	350		no	no		no		45213	101	5021	ok		
8-Jun	8:00 AM	0.1	4	-3.14	-2.66	0.48	3.07	89.1	31.9	19.9	12.0	7.9		1.08	14	ok	7	no	53	cyclic 10/10	25	ok	0.12	325		no	no		no		45439	102	5056	ok		
9-Jun	8:00 AM	0.1	4	-3.14	-2.77	0.37	3.13	87.8	31.9	19.9	12.0	8.0		0.68	14	ok	7	no	59	cyclic 10/10	35	ok	0.13	350		no	no		no							
10-Jun	8:00 AM	9.7	4	-3.10	-2.76	0.34	3.14	89.2	32	20	12.0	8.0		0.5	10	ok	7.1	no	53	cyclic 10/10	35	ok	0.142	350		no	no		no		45396	102	5036	ok		
11-Jun	8:30 AM	12.2	4.3	-3.18	-2.77	0.41	3.37	90.5	32.2	20.2	12.0	8.0		0.57	10	ok	7.1	no	53	cyclic 10/10	30	ok	0.188	350		no	no		no		45383	102	5042	ok		
12-Jun	8:30 AM	0.1	4	-3.20	-2.57	0.63	3	91.1	32	20	12.0	8.0		1.82	35	ok	7	no	53	cyclic 10/10	30	ok	1.8	350		yes	no		0.8		45368	101	5033	ok		
13-Jun	8:30 AM	10.8	4	-3.25	-2.82	0.43	3.09	87.7	32.1	19.99	12.1	8.0		1.06	35	ok	7.1	no	53	cyclic 10/10	20	ok	0.99	350		no	no		no		42305	85	4688	ok		
14-Jun	1:00 PM	0.1	3.8	-3.20	-2.73	0.47	3.1	89.3	32.1	20.1	12.0	8.1		2.45	27	ok	7.1	no	53	cyclic 10/10	27	ok	0.066	350		no	no		no		43183	112	4619	ok		
15-Jun						0				0																										
16-Jun						0				0																										
17-Jun	7:30 AM	10.8	4	-3.45	-3.05	0.4	3.11	88.2	32	12.1	19.9	12.1		2.09	0	ok	7.1	no	53	cyclic 10/10	45	ok	0.095	350		no	no		no		44329	156	4885	ok		
18-Jun	8:30 AM	0.1	4	-3.44	-3.05	0.39	3.18	88.5	32	12	20.0	12.0		2.38		ok	7	no	53	cyclic 10/10	40	ok	0.091	350		no	no		no		45509	0	5032	ok		
19-Jun	9:00 AM	0.1	4	-3.22	-2.63	0.59	2.96	89.8	32	12	20.0	12.0		2.53	10	ok	7	no	53	cyclic 10/10	45	ok	0.102	350		yes	no		0.8		42680	88	4726	ok		
20-Jun	8:30 AM	0.1	4	-3.32	-2.84	0.48	3.03	88.9	32	11.9	20.1	11.9		2.36	0	ok	7.1	no	53	cyclic 10/10	45	ok	0.088	350		no	no		no		42254	0	4622	ok		
21-Jun	9:00 AM	10.5	4	-3.29	-2.83	0.46	3.05	89.9	32	19.7	12.3	12.3		1.74	12	ok	7	no	53	cyclic 10/10	45	ok	0.112	320		no	no		no		45488	0	5037	ok		

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Operator Field Log

	Parameter	Feed Flow	Perm Flow	TMP Before BP	TMP After BP	Δ TMP	TMP during BP	Perm Temp	RAS (aerobic-Post-anoxic-Anoxic)	RAS (aerobic-Post-anoxic)	Internal RAS (aerobic-anoxic)	Internal RAS (Anoxic - Anaerobic)	Back pulse flow	Aerobic Tank DO	Aerobic Tank Air Flow	Aerobic Tank Visual Inspection	pH	Caustic Added	Caustic Tank Level	Membrane Aeration Mode	Membrane air flow-rotameter	Permeate quality visual inspection	Permeate turbidity	Permeate Turbidity Flow	Net flux	Hypo Maint Clean Performed?	Acid Maint Clean Performed?	Hypo Conc.	Bleach Added to BP Tank	Acid Conc.	Yesterday's Feed Vol.	Yesterday's Waste Sludge Vol.	Yesterday's Discharged Permeate Vol.	Equalization tank level check	SDI15	Transmittance (UV 254)
	Instrument	FIT-7620	FIT-3520	PDI-3523	PDI-3523	(H-I)	PDI-3523	TIT-3530	FIT-7320		MAG	MAG	FIT-3520	AIT-7338	FIT-87						FIT-85		AIT 3537	FL 3535												
Date	Time	(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(°F)	(gpm)		(gpm)	(gpm)	(gpm)	(mg/L)	cfm			(L)	(L)		cfm		(NTU)	(ml/min)	(gfd)	yes/no	yes/no	(mg/L)	L	(mg/L)	(gal)					
22-Jun	8:30 AM	0.1	4	-3.22	-2.84	0.38	2.93	90	32	19.5	12.5	12.5		2.1	15	ok	7	no	53	cyclic 10/10	40	ok	0.124	350		no	no		no		43164	0	5033	ok		
23-Jun	8:15 AM	0.1	4	-3.37	-2.78	0.59	3.07	90	32	19.6	12.4	12.4		1.78	10	ok	7	no	53	cyclic 10/10	45	ok	0.11	350		no	no		no		43146	0	4766	ok		
24-Jun	9:00 AM	0.1	4	-3.20	-2.77	0.43	3.12	90.6	32	32	0.0	0.0		1.03	15	ok	7	no	53	cyclic 10/10	45	ok	0.116	350		no	no		no		42940	0	4744	ok		
25-Jun	8:15 AM	0.1	4	-3.25	-2.8	0.45	3.2	90.7	32	32	0.0	0.0		1.6	15	ok	6.9	no	53	cyclic 10/10	40	ok	0.123	350		no	no		no		45366	0	5033	ok		
26-Jun	9:30 AM	0.1	4	-3.05	-2.57	0.48	3.11	90.4	323	323	0.0	0.0		1.23	15	ok	7	no	53	cyclic 10/10	45	ok	0.115	350		yes	no		0.8		45371	0	5039	ok		
27-Jun	9:30 AM	0.1	4	-3.01	-2.56	0.45	3.05	90.5	32.2	19.6	12.6			1.02	15	ok	7	no	53	cyclic 10/10	40	ok	0.257	350		no	no		no		42127	0	4641	ok		
28-Jun	9:10 AM	0.1	4.1	-3.04	-2.61	0.43	3.06	89.6	32	19.8	12.2			1.75	16	ok	7	no	53	cyclic 10/10	45	ok	0.111	350		no	no		no		45440	0	5040	ok		
29-Jun	9:15 AM	0.1	4	-3.02	-2.18	0.84	3.08	90.4	32	19.7	12.3			2.04	16	ok	7	no	53	cyclic 10/10	45	ok	0.087	350		no	no		no		45418	30	5011	ok		
30-Jun	9:00 AM	0.1	4	-3.07	-2.22	0.85	3.04	91.4	32	12.5	19.5			2.2	15	ok	7	no	53	cyclic 10/10	45	ok	0.122	350		no	no		no		45302	180	4977	ok		
1-Jul	9:40 AM	10.4	4	-3.00	-2.18	0.82	3.09	92.1	32	19.7	12.3			1.23	10	ok	7	no	53	cyclic 10/10	45	ok	0.13	350		no	no		no		42365	150	3538	ok		
2-Jul	8:30 AM	11.6	5.7	-3.10	-2.25	0.85	3.13	90.5	32.2	12.1	20.1			1.15	10	ok	7.1	no	53	cyclic 10/10	45	ok	0.087	380		no	no		no		43351	180	4295	ok		
3-Jul	8:15 AM	10.6	4	-3.18	-2.16	1.02	3.14	90.3	32	12	20.0			1.45	25	ok	7	no	53	cyclic 10/10	45	ok	0.098	350		no	no		no		45236	180	4932	ok		
4-Jul	9:15 AM	10.2	4	-3.24	-2.33	0.91	3.18	89	32	0	12.3			2.11	0	ok	6.9	no	53	cyclic 10/10	40	ok	0.083	400		no	no		no		39736	150	4340	ok		
5-Jul	8:30 AM	0.1	4	-3.23	-2.23	1	3.27	90.5	32	19.8	12.2			1.94	0	ok	7	no	53	cyclic 10/10	45	ok	0.088	400		no	no		no		42830	150	4698	ok		
6-Jul	8:00 AM	0.1	4	-3.30	-2.4	0.9	3.44	90.2	32.1	19.7	12.4			1.49	13	ok	7	no	53	cyclic 10/10	45	ok	0.086	300		no	no		no		45288	180	4971	ok		46.7
7-Jul	8:30 AM	0.1	4	-3.36	-2.43	0.93	3.5	89.5	32.1	19.8	12.3			1.92	0	ok	7.1	no	53	cyclic 10/10	40	ok	0.101	300		no	no		no		45283	180	4969	ok		47.3
8-Jul	8:45 AM	0.1	3.7	-3.39	-2.43	0.96	3.51	89.9	32	19.7	12.3			1.48	10	ok	7	no	53	cyclic 10/10	45	ok	0.1	300		no	no		no		40261	150	4402	ok		45.25
9-Jul	8:45 AM	8.6	3.9	-3.28	-2.47	0.81	3.56	90.5	32	19.6	12.4			1.77	10	ok	7	no	53	cyclic 10/10	45	ok	0.126	350		no	no		no		45278	150	4996	ok		52.3
10-Jul	9:00 AM	0.1	4.1	-3.22	-2.48	0.74	3.56	91.2	32	19.9	12.1			1.73	10	ok	7	no	53	cyclic 10/10	45	ok	0.118	350		no	no		no		44666	180	4895	ok		53.1
11-Jul	9:30 AM	0.1	4	-3.38	-2.52	0.86	3.82	91.1	32	19.8	12.2			1.79	10	ok	6.9	no	53	cyclic 10/10	45	ok	0.113	400		no	no		no		44946	180	5709	ok		49.8
12-Jul	9:00 AM	0.1	4	-3.36	-2.56	0.8	3.89	91	32	19.7	12.3			1.56	10	ok	7	no	53	cyclic 10/10	45	ok	0.131	400		no	no		no		45472	180	5216	ok		50.17
13-Jul	8:20 AM	9.2	4	-3.45	-2.60	0.85	3.95	89.5	32	19.9	12.1			2.22	10	ok	7	no	53	cyclic 10/10	45	ok	0.12	300		no	no		no		44974	150	4708	ok		52.16
14-Jul						0				0																										
15-Jul						0				0																										56
16-Jul	9:40 AM	0.1	4	-3.68	-3.31	0.37	4.04	88.5	32	19.75	12.3	8.0		2.14	15	ok	7.1	no	53	cyclic 10/10	45	ok	0.88	350		yes	no		0.8		76498	300	8194	ok	2.2154	50
17-Jul	8:20 AM	0.1	4	-3.20	-3.23	-0.03	3.52	90.8	32	19.9	12.1	8.0		0.55	15	ok	7.1	no	53	cyclic 10/10	40	ok	0.23	0		no	no		no		27827	120	2947	ok	2.0513	56.5
18-Jul	8:20 AM	0.1	4	-3.23	-2.63	0.6	3.5	91.9	32	19.6	12.4	8.2		0.08	15	ok	7.1	no	53	cyclic 10/10	45	ok	0.11	325		no	no		no		44474	180	4961	ok	2.5547	46.2
19-Jul	8:30 AM	9.5	4.2	-3.20	-2.73	0.47	3.47	92.3	33.5	20.8	12.7	8.4		0.03	16	ok	7.1	no	53	cyclic 10/10	45	ok	0.13	350		no	no		no		45542	180	4165	ok	0.9812	48
20-Jul	1:00 PM	10	4	-3.11	-2.42	0.69	3.52	93.8	32	20	12.0	8.0		1.96	15	ok	7	no	53	cyclic 10/10	45	ok	0.11	350		no	no		no		46161	150	5123	ok	1.344	42.7
21-Jul	8:30 AM	0.1	4	-3.18	-2.96	0.22	3.56	90.1	32	19.9	12.1	8.0		1.87	15	ok	7.1	no	53	cyclic 10/10	40	ok	0.122	350		no	no		no		44887	180	4991	ok	0.4157	54
22-Jul	10:00 AM	0.1	4	-3.25	-3.01	0.24	3.57	90.3	31.9	19.9	12.0	8.0		2		ok	7.1	no	53	cyclic 10/10	40	ok	0.12			no	no		no		43135		4724	ok	0.6625	
23-Jul	8:45 AM	0.1	4	-3.28	-3.06	0.22	3.63	89.8	32	20.00	12.0	8.0		0.02	14	ok	7	no	53	cyclic 10/10	45	ok	0	350		no	no		no		42145	150	4701	ok	0.3644	58.3
24-Jul	1:15 PM	0.1	4	-3.33	-3.1	0.23	3.66	41.9	32	20.00	12.0	8.0		1.5	13	ok	7.1	no	53	cyclic 10/10	45	ok	0.12	350		no	no		no		42824	180	4783	ok	0.6625	58
25-Jul	8:00 AM	10.4	4	-3.40	-3.14	0.26	3.89	90.4	32	20.10	11.9	8.0		2	6	ok	7	no	53	cyclic 10/10	45	ok	0.13	350		no	no		no		45237	180	5061	ok	0	57
26-Jul	8:55 AM	0.1	3.9	-3.27	-2.93	0.34	3.61	90.2	32	20.30	11.7	8.0		1.94	0	ok	7.2	no	53	cyclic 10/10	45	ok	0.11	350		no	no		no		45238	180	5068	ok	0	60.6
27-Jul	8:20 AM	10.4	4	-3.13	-2.93	0.2	3.54	91.7	32	20.30	11.7	8.1		1.98	12	ok	7	no	53	cyclic 10/10	45	ok	0.11	350		no	no		no		43619	180	4856	ok	0	45.6
28-Jul	9:30 AM	0.1	4.2	-3.17	-2.95	0.22	3.74	90.5	32	20.30	11.7	8.1		1.91	12	ok	7	no	53	cyclic 10/10	45	ok	0.12	350		no	no		no		45223	180	5062	ok	0	46
29-Jul	9:00 AM	10.8	4.5	-3.19	-3.01	0.18	3.86	91.3	32	20.30	11.7	8.0		1.92	12	ok	7	no	53	cyclic 10/10	45	ok	0.12	350		no	no		no		45223	180	5064	ok	0	48
30-Jul	9:45 AM	0.1	4.5	-3.23	-3.04	0.19	3.86	89	32	20.30	11.7	8.0		1.37	14	ok	7.1	no	53	cyclic 10/10	45	ok	0.14	375		no	no		no		43759	150	4875	ok	0	42.6
31-Jul	8:00 AM	0.1	4.5	-3.91	-3.47	0.44	3.86	91.2	36	24.00	12.0	8.8		1.55	14	ok	7	no	53	cyclic 10/10	45	ok	0.12	360		no	no		no		47466	180	5335	ok	0	59.6
1-Aug	8:00 AM	0.1	4.3	-4.03	-3.72	0.31	3.95	90.3	36	24.00	12.0	9.2		2.26	33	ok	7.1	no	53	cyclic 10/10	45	ok	0.14	300		no	no		no		48290	180	5507	ok	0	45.3
2-Aug	8:45 AM	0.1	4.5	-4.05	-3.73	0.32	4.07	90.1	36	24.10	11.9	9.1		1.78	21	ok	7	no	53	cyclic 10/10	45	ok	0.13	350		no	no		no		50523	150	5837	ok	0	44.3
3-Aug	8:15 AM	0.1	4.4	-4.13	-3.74	0.39	4.12	91.6	36	22.50	13.5	9.0		1.79	21	ok	7	no	53	cyclic 10/10	45	ok	0.12	350		no	no		no		50580	180	5723	ok	0	55.3
4-Aug	8:30 AM	0.1	4.5	-4.16	-3.89	0.27	4.28	91.1	23.2	9.70	13.5	8.8		1.74	25	ok	7	no	53	cyclic 10/10	45	ok	0.11	350		no	no		no		50598	180	5724	ok	0	
5-Aug	9:00 AM	0.1	3.8	-4.22	-3.94	0.28	4.33	91.9	36.1	22.75	13.4	9.5		2.24	14	ok	7	no	53	cyclic 10/10	35	ok	0.12	300		no	no		no		49056	180	5526	ok	0	46
6-Aug	8:00 AM	0.1	4	-4.36	-4.08	0.28	4.28	92.5	36	23.40	12.6	9.0		1.55	19	ok	7	no	53	cyclic 10/10	45	ok	0.14	300		no	no		no		50592	180	5721	ok	1.064	44.6
7-Aug	7:30 AM	0.1	4.5	-4.41	-4.11	0.3	4.42	91.4	36	22.50	13.5	9.0		2.31	0	ok	7	no	53	cyclic 10/10	45	ok	0.11	300		no	no		no		50588	180	5720	ok	1.02	45.3
8-Aug	7:50 AM	0.1	4.5	-4.15	-3.82	0.33	3.92	91.2	36	22.50	13.5	9.1		1.68	18	ok	7	no	53	cyclic 10/10	45	ok	0.12	350		no	no		no		48790	180	5488	ok	0	48.3

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	Parameter	Feed Flow	Perm Flow	TMP Before BP	TMP After BP	Δ TMP	TMP during BP	Perm Temp	RAS (aerobic-Post-anoxic-Anoxic)	RAS (aerobic-Post-anoxic)	Internal RAS (aerobic-anoxic)	Internal RAS (Anoxic - Anaerobic)	Back pulse flow	Aerobic Tank DO	Aerobic Tank Air Flow	Aerobic Tank Visual Inspection	pH	Caustic Added	Caustic Tank Level	Membrane Aeration Mode	Membrane air flow-rotameter	Permeate quality visual inspection	Permeate turbidity	Permeate Turbidity Flow	Net flux	Hypo Maint Clean Performed?	Acid Maint Clean Performed?	Hypo Conc.	Bleach Added to BP Tank	Acid Conc.	Yesterday's Feed Vol.	Yesterday's Waste Sludge Vol.	Yesterday's Discharged Permeate Vol.	Equalization tank level check	SDI15	Transmittance (UV 254)
	Instrument	FIT-7620	FIT-3520	PDI-3523	PDI-3523	(H-I)	PDI-3523	TIT-3530	FIT-7320		MAG	MAG	FIT-3520	AIT-7338	FIT-87						FIT-85		AIT 3537	FL 3535												
Date	Time	(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(°F)	(gpm)		(gpm)	(gpm)	(gpm)	(mg/L)	cfm			(L)	(L)		cfm		(NTU)	(ml/min)	(gfd)	yes/no	yes/no	(mg/L)	L	(mg/L)	(gal)					
9-Aug	8:00 AM	9.4	4.5	-4.21	-3.9	0.31	3.92	90.7	35.3	21.60	13.7	9.0		1.64	18	ok	7	no	53	cyclic 10/10	45	ok	0.12	325		no	no		no		50200	180	5569	ok	0	44.3
10-Aug	8:00 AM	9.7	4.5	-4.13	-3.85	0.28	3.92	92.4	25.7	12.20	13.5	9.0		1.93	19	ok	7	no	53	cyclic 10/10	45	ok	0.13	300		no	no		no		50614	150	5715	ok	0	54.3
11-Aug	11:00 AM	0.1	4.4	-4.05	-3.83	0.22	4.05	92.7	35.9	22.40	13.5	9.0			18	ok	7	no	53	cyclic 10/10	45	ok	0.13	300		no	no		no		50418	180	5561	ok	0	53.5
12-Aug	9:00 AM	0.1	4.5	-4.16	-3.87	0.29	4.22	92.4	35.9	22.30	13.6	9.0		1.22	15	ok	7	no	53	cyclic 10/10	45	ok	0.12	300		no	no		no		50602	180	5731	ok	0	
13-Aug	8:00 AM	0.1	4.5	-4.24	-3.92	0.32	4.22	91.9	36.1	22.50	13.6	9.4		1.88	0	ok	7	no	53	cyclic 10/10	45	ok	0.13	300		no	no		no		50585	180	5718	ok	0	40.6
14-Aug	8:30 AM	0.1	4.4	-4.36	-4.38	-0.02	4.27	91.5	36.1	22.50	13.6	9.0		2.04	18	ok	7	no	53	cyclic 10/10	45	ok	0.15	150		no	no		no		50584	180	5729	ok	1.1414	43.6
15-Aug	10:00 AM	0.1	4.4	-4.18	-3.16	1.02	3.83	92	36	22.40	13.6	9.0		1.26	14	ok	7	no	53	cyclic 10/10	45	ok	0.13	350		no	no		no		48778	180	5460	ok	0	44
16-Aug	7:50 AM	0.1	4.5	-4.25	-3.25	1	3.81	92.8	35.9	22.20	13.7	22.2		2.2	0	ok	7	no	53	cyclic 10/10	45	ok	0.13	300		no	no		no		50583	180	5632	ok	1.3893	48.3
17-Aug	9:00 AM	0.1	4.5	-4.41	-3.35	1.06	3.86	90.1	35.7	22.20	13.50	22.2		1.57	25	ok	7	no	53	cyclic 10/10	35	ok	0.107	350		no	no		no		50598	180	5647	ok	0.0859	58.66
18-Aug	9:30 AM	0.1	4.5	-4.48	-3.4	1.08	3.92	92.5	36.1	22.20	13.50	22.2		1.8	0	ok	7	no	53	cyclic 10/10	45	ok	0.138	350		no	no		no		50584	180	5639	ok	0.2332	
19-Aug	11:45 AM	0.1	4.5	-4.45	-3.41	1.04	4.03	93	36.1	22.50	13.6			1.85	20	ok	7	no	53	cyclic 10/10	45	ok	0.142	350		no	no		no		49893	150	5553	ok	0.2736	54.6
20-Aug	7:30 AM	0.1	4.5	-4.48	-3.43	1.05	4	92.9	36		13.8			2.02	0	ok	6.8	yes	53	cyclic 10/10	45	ok	0.14	320		no	no		no		50582	180	5638	ok	0	50.6
21-Aug	8:35 AM	0.1	4.5	-4.62	-3.46	1.16	4.25	93.1	36.1		13.8			1.76	22	ok	7	no	53	cyclic 10/10	45	ok	0.16	300		no	no		no		49970	180	5604	ok	0	38.3
22-Aug	10:00 AM	0.1	4	-3.55	-3.81	-0.26	3.87	93.3	32		13.4			1.11	20	ok	7	no	53	cyclic 10/10	45	ok	0.131	250		yes	no	600	no		46084	180	5057	ok	0	42.3
23-Aug	8:30 AM	0.1	3.6	-3.87	-3.98	-0.11	3.5	93.1	34.2		13.5			2.62	0	ok	7	no	53	cyclic 10/10	45	ok	0.141			no	no		no		43561	180	4666	ok	0	54.3
24-Aug	12:50 PM	0.1	4.6	-4.55	-3.33	1.22	3.46	94.3	36.7		13.5			1.47	20	ok	7	no	53	cyclic 10/10	45	ok	0.124			no	no		no		66678	90	2968	ok	0.383	
25-Aug	8:30 AM	0.1	4.5	-4.82	-3.57	1.25	3.75	91.1	36.6		13.6			1.55	20	ok	7.4	no	53	cyclic 10/10	45	ok	0.139	350		no	no		no		50519	180	5626	ok	0.624	
26-Aug	8:15 AM	10.4	4.5	-5.12	-3.72	1.4	3.84	91.9	36.7		13.70	9.2		2.14	0	ok	7	no	53	cyclic 10/10	45	ok	0.02	300		no	no		no		48355	150	5221	ok	0.0716	56.6
27-Aug	8:05 AM	10	4	-5.23	-3.37	1.86	3.85	93.3	36.8		13.80	9.1		1.89	24	ok	7	no	53	cyclic 10/10	45	ok	0.04	300		no	no		no		51635	180	5753	ok	0.1345	52.3
28-Aug	7:40 AM	0.1	4.4	-5.20	-3.9	1.3	4.16	93.2	36.8		13.80	23.0		1.49	18	ok	7	no	53	cyclic 10/10	45	ok	0.052	30		yes	no	800	no		51643	180	5759	ok	0.2943	54.6
29-Aug	9:00 AM	10.6	4.6	-5.11	-3.71	1.4	3.56	93.5	36.7		13.7	9.1		1.14	27	ok	7	no	53	cyclic 10/10	45	ok	0.05	125		no	no		no		49091	180	5440	ok	0	62.3
30-Aug	9:15 AM	0.1	4.5	-5.28	-3.66	1.62	3.66	93.3	36.7		13.7	9.0		1.13	32	ok	7	no	53	cyclic 10/10	45	ok	0.01			no	no		no		51641	180	5257	ok	0	53.3
31-Aug						0																					no		no						0	
1-Sep						0																					no		no						0	
2-Sep						0																					no		no							
3-Sep						0																					no		no							
4-Sep						0																					no		no							
5-Sep	8:00 AM	0.1	4.6	-4.96	-4.43	0.53	3.93	90.9	36.9		13.2	9.1		1.36	15	ok	7	no	53	cyclic 10/10	45	ok	0.256			no	no		no		29417	120	2633	ok		
6-Sep	9:55 AM	0.1	4.5	-5.06	-4.49	0.57	3.97	90.2	36.8			8.9		1.79	15	ok	7	no	53	cyclic 10/10	45	ok	0.33			no	no		no		50870	180	5848	ok		58.3
7-Sep	8:35 AM	0.1	4.6	-5.08	-4.61	0.47	4.23	91.4	36.7			9.2		1.78	17	ok	7	no	53	cyclic 10/10	45	ok	0.55			no	no		no		50905	150	5856	ok		59.6
8-Sep	9:00 AM	0.1	4.6	-5.24	-4.65	0.59	4.28	91.9	36.9			9.2		1.96	15	ok	7.1	no	53	cyclic 10/10	45	ok	2.785	0		no	no		no		50884	188	5861	ok		69.8
9-Sep	8:20 AM	0.1	4.6	-5.24	-4.75	0.49	4.39	90.3	36.8			9.3		2.62	0	ok	7.1	no	53	cyclic 10/10	45	ok	1	0		no	no		no		50425	180	5774	ok		58
10-Sep						0																													0.86	
11-Sep						0																													0.3929	
12-Sep	8:00 AM	0.1	4.6	-5.09	-4.58	0.51	3.86	92.3				8.8		2.62	15	ok	6.9	yes	53	cyclic 10/10	30	ok	1.76	0		no	no		no		40143	150	4246	ok	0.4088	64.6
13-Sep	9:30 AM	0.1	4.5	-5.81	-5.19	0.62	3.91	90.7	36.8			9.4		1.17	15	ok	7																			
14-Sep	8:50 AM	0.1	4.2	-5.94	-5.4	0.54	3.92	91.6	36			9.1		1.36	14	ok	7	no	40	cyclic 10/10	45	ok	1	0		no	no		0		50094	180	5724	ok		52.1
15-Sep						0																														
16-Sep						0																														
17-Sep						0																														
18-Sep	8:30 AM	0.1	4.2	-5.52	-5.06	0.46	4.24	90.3	36.9			9.0		2.87	0	ok	7	no	40	cyclic 10/10	45		2.21	0		no	no		0		49090	120	3106	ok	0.0629	57
19-Sep	7:50 AM	0.1	4.6	-5.83	-5.16	0.67	4.33	89.7	36.8			9.4		2.26	0	ok	7	no	40	cyclic 10/10	45	ok	1.97	0		yes	no		0.8		50648	180	5816	ok	0.2046	59.7
20-Sep	7:30 AM	17.2	4.6	-4.94	-4.65	0.29	3.84	90.8	36.8			9.3		1.43	0	ok	7	no	40	cyclic 10/10	45	ok	1.82	0		no	no		0		49097	150	5620	ok	0.1994	60
21-Sep	8:30 AM	0.1	4.6	-4.95	-4.65	0.3	3.87	90.4	35.7			9.0		1.82	17	ok	7	no	40	cyclic 10/10	45	ok	0.43	0		no	no		0		505667	180	5813	ok	0.3433	58.3
22-Sep	9:30 AM	0.1	4.6	-5.19	-4.64	0.55	3.94	90				9.2		1.6	15	ok	7	no	40	cyclic 10/10	45	ok	0.821	0		no	no		0		47318	180	5649	ok		59
23-Sep	7:15 AM	16.7	4.6	-5.26	-4.47	0.79	3.93	91.7	36.8			9.2		0.87	15	ok	7	no	40	cyclic 10/10	45	ok	0.925	0		no	no		0		52854	180	5847	ok		51.3
24-Sep						0																													0.1393	
25-Sep						0																														

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Southwest WRF MBr Pilot Plant
MBR Operator Field Log

Parameter		Feed Flow	Perm Flow	TMP Before BP	TMP After BP	Δ TMP	TMP during BP	Perm Temp	RAS (aerobic-Post-anoxic-Anoxic)	RAS (aerobic-Post-anoxic)	Internal RAS (aerobic-anoxic)	Internal RAS (Anoxic - Anaerobic)	Back pulse flow	Aerobic Tank DO	Aerobic Tank Air Flow	Aerobic Tank Visual Inspection	pH	Caustic Added	Caustic Tank Level	Membrane Aeration Mode	Membrane air flow-rotameter	Permeate quality visual inspection	Permeate turbidity	Permeate Turbidity Flow	Net flux	Hypo Maint Clean Performed?	Acid Maint Clean Performed?	Hypo Conc.	Bleach Added to BP Tank	Acid Conc.	Yesterday's Feed Vol.	Yesterday's Waste Sludge Vol.	Yesterday's Discharged Permeate Vol.	Equalization tank level check	SDI15	Transmittance (UV 254)
Instrument		FIT-7620	FIT-3520	PDI-3523	PDI-3523	(H-I)	PDI-3523	TIT-3530	FIT-7320		MAG	MAG	FIT-3520	AIT-7338	FIT-87						FIT-85		AIT 3537	FL 3535												
Date	Time	(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(°F)	(gpm)		(gpm)	(gpm)	(gpm)	(mg/L)	cfm			(L)	(L)		cfm		(NTU)	(ml/min)	(gfd)	yes/no	yes/no	(mg/L)	L	(mg/L)	(gal)					
26-Sep						0																	0.18													
27-Sep						0																	0.16													
28-Sep						0																	0.17													
29-Sep						0																														
30-Sep						0																														
1-Oct						0																														
2-Oct						0																														
3-Oct						0																														
4-Oct						0																														
5-Oct						0																														
6-Oct						0																														
7-Oct						0																														
8-Oct						0																														
9-Oct						0																														
10-Oct	9:30 AM	0.1	4	-7.51	-5.04	2.47	4.76	89	36.7			9.3		1.76	0	ok	7	no	ok	cyclic 10/10	45	ok	0.1	350		no	no				47808	180	5297	ok		59.3
11-Oct	8:15 AM	16.6	4.5	-7.21	-4.83	2.38	4.75	89.9	36.7			9.2		5.4	0	ok	7	no	ok	cyclic 10/10	45	ok	0.106	350		no	no				50887	150	5657	ok		68.6
12-Oct	8:30 AM	0.1	4.6	-7.18	-4.88	2.3	4.76	89.8	36.9			9.1		3.8	0	ok	7	no	ok	cyclic 10/10	45	ok	0.12	400		no	no				50856	180	5754	ok		
13-Oct	8:30 AM	0.1	4.6	-6.43	-4.82	1.61	4.7	90	36.7			9.1		9.64	0	ok	7.1	no	ok	cyclic 10/10	30	ok	0.12	350		no	no				50868	180	5823	ok		

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Lab Sampling Data - KSA Laboratory Note: Used for not detected (less or equal to MDL- Method Detection Limit)

Sampling Date and Time	Pilot Influent - Raw Water Quality																				
	Alkalinity	BOD	BOD Dissolved	COD	COD, Dissolved	Nitrogen, Ammonia (as N)	Nitrogen, Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen, Nitrate (as N)	Nitrogen, Nitrite (as N)	Nitrogen, Total	Orthophosphate as P	Phosphorus, Total	Phosphorus Acid Hydrolyzable	TSS	VSS	Turbidity Handheld	pH	pH (Field)	Temp	Temp (Field)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	s.u.		C	C
MDL	5.0	1.0	1.0	8.4	8.40	0.015	0.015	1.80	0.062	0.021	1.80	0.2	0.47		3.50	3.5		-		-	
New MDL									0.270		0.27	0.008									
Date																					
5-Apr																					
6-Apr	260	250	140	330	150	37		49	0.062	0.021	49	4.8	50		210	170		7.06	7	25	28.556
7-Apr																					
8-Apr																					
9-Apr	240	290	220	540	280	39		39	0.062	0.021	39	5.9	1.4		150	120		5.46	N/A	25.7	28.722
10-Apr																					
11-Apr	220	200	120	390	180	33	0.19	33	0.062	0.021	33	5.2	1.6		48	36		6.98	7.1	26.2	29
12-Apr																					
13-Apr	240	220	160	410	250	27		33	0.062	0.021	33	4.2	11		78	68		7.05	7.2	23	30.611
14-Apr																					
15-Apr																					
16-Apr	280	190	120	460	280	41		19	0.062	0.062	19	5.6	16		100	90		7.24	7.2	21.4	25.278
17-Apr																					
18-Apr	240	220	82	350	250	30		13	0.062	0.021	13	5	4.1		130	100		6.76	7.1	22.3	28.556
19-Apr																					
20-Apr	280	270	170	920	280	27		6.8	0.12	0.021	6.8	5.1	19		240	63		5.87	n/a	23.1	-17.78
21-Apr																					
22-Apr																					
23-Apr	250			280	210				0.062	0.021	0.062				150			6.95		28.1	
24-Apr																					
25-Apr	PILOT PLC DOWN - PILOT PLANT OUT OF OPERATION																				
26-Apr																					
27-Apr																					
28-Apr																					
29-Apr																					
30-Apr																					
1-May																					
2-May	270	300	170	480	200	20		42	0.062	0.021	42	0.53	1.8		26	20		6.98	7	26	30
3-May																					
4-May	250	330	170	450	280	29	0.21	45	0.062	0.021	45	6	7		160	150		7.02	7	28	31.278
5-May																					
6-May																					
7-May	200	200	130	460	260	27	0.1	52	0.062	0.021	52	4.8	22		140	130		6.82	7	25	31.611
8-May																					
9-May	260	310	130	570	260	35	0.31	34	0.062	0.021	34	5.4	7.1		150	140		7.16		26	28.333
10-May																					
11-May	240	300	130	510	250	26	0.24	34	0	0	34	5.4	6.4		170	160		7.19	7	26	29.611
12-May																					
13-May																					
14-May	270		140	560	300	38	0.34	36	0.72	0.021	37	5.5	8.2		180	160		7.17	6.9	26	31.167
15-May																					
16-May	290	250	140	460	220	28	0.36	39	0.45	0.021	39	6.1	8.7		120	110		7.15	7	26	30.944
17-May																					
18-May	280	210	96	450	220	19	0.25	26	0.062	0.021	26	4.9	5.6		120	110		7.28	7.1	28	30.556
19-May	260	240	170	440	220	26	0.17	24	0.062	0.021	24	4.2	5.5		160	140		6.89		31	31.667
20-May																					
21-May																					

Sampling Date and Time	Pilot Permeate Water Quality																												Membrane Tank Water Quality		Aerobic Tank Water Quality	
	Alkalinity	BOD	TOC	SBOD	COD	COD Dissolved	Color	Nitrogen Ammonia (as N)	Nitrogen Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen Nitrate as N	Nitrogen Nitrite as (as N)	Nitrogen, Total	Orthophosphate (as P)	Phosphorus, Total	US Bio Orthophosphate (as P)	US Bio Phosphate	US Bio Phosphorus as P	Iron	Aluminum	TSS	Total Organic Halides	VSS	pH (Field)	Effluent Turbidity (Field)	Total Coliform	Heterotrophic Plate Count	Fecal	TSS	VSS	TSS	VSS
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		NTU	cfu/100ml	cfu/ml	cfu/100ml	mg/L	mg/L	mg/L	mg/L
MDL	5.00	2.10		6.3	8.40	8.40		0.015	0.015	0.09	0.06	0.021	0.09	0.016	0.047				0.029	0.035	3.50	0.50	3.50			2.00	22.00	1.00	4	4	4	4
New MDL		1 as of 7/13/0		1.0										.008 as of 7/3/20																		
Date																																
5-Apr																									0.1				1900	1400	3700	3000
6-Apr																									0.14				3600	2500	2600	2200
7-Apr																									0.14							
8-Apr																									0							
9-Apr																									0						8500	6800
10-Apr	120				110	98		0.042	0.015	1.2	0.65	0.021	1.8	0.5	0.047						3.5		3.5	7	0.08				15000	12000	14000	8400
11-Apr																									0.1				16000	11000	14000	9600
12-Apr	120				100	81		0.13		1.6	0.062	0.021	1.6	0.89	0.73						7		3.5	7	0.07				15000	11000	14000	10000
13-Apr																									0						11000	9000
14-Apr	130					75		0.77		3.5	0.92	0.021	4.4	0.46	0.26						3.5		3.5	7.1	0				11000	8100	10000	8000
15-Apr																									0							
16-Apr																									0				11000	8500	10000	8200
17-Apr	150					37		4.6		2.4	0.65	0.021	3	0.29							3.5		3.5	7.1	0				13000	10000	13000	10000
18-Apr																									0.1				11000	8900	12000	8700
19-Apr	150					52		4.6	0.14	12	0.79	0.3	13	1.3	3.4						3.5		3.5	7.1	0.13				8500	6900	1100	890
20-Apr																									0						1400	1400
21-Apr	220					58		8.2		18	0.33	0.021	18	0.61	6.8						3.5		9	7.1	0.13				4800	3800	1400	160
22-Apr																									0							
23-Apr																									0				8100		3400	
24-Apr																									0						2700	
25-Apr																									0							
26-Apr																									0							
27-Apr																									0.9							
28-Apr																									0.1							
29-Apr																									0							
30-Apr																									350							
1-May	170					8.4		14		7.1	0.57	0.021	7.7	0.054	0.19						3.5		3.5	7.1	0				6600	5500	8500	7200
2-May																									0.105				3400	3000	5400	4600
3-May	140					25		8.4	0.049	7.1	0.64	0.021	7.7	0.042	0.14						3.5		3.5	7	0.11				13000	10000	7400	5900
4-May																									0.04				9100	7800	8700	7400
5-May																									0.054				11000	9300	5400	4700
6-May																									0.07							
7-May																									0.05				9500	8200	7500	6000
8-May	150					41		0.21	0.015	1.2	0.58	0.021	1.8	0.024	0.054						3.5		3.5	7	0.041				7600	6500	6900	5900
9-May																									0.09				11000	9000	9200	8000
10-May	160					33		0.037	0.015	1	0.33	0.021	1.3	0.074	0.088						6		4	7.1	0.17				4200	3600	8600	7300
11-May																									0.11				10000	8700	4800	4100
12-May	160					52		0.015	0.015	1	0.46	0.021	1.5	0.11	0.047						3.5		3.5	7	0.078				7900	6900	9100	7900
13-May																									1.98							
14-May																									0.274				6900	5900	10000	8800
15-May	170					43		0.6	0.015	1.8	0.43	0.021	2.2	0.2	0.047						3.5		3.5	7	0.09				14000	12000	10000	8900
16-May																									0.16				10000	8900	9700	8400
17-May	150					20		0.029	0.015	0.091	0.46	0.021	0.46	0.076	0.16						3.5		3.5	7	0.16				4900	4200	8000	7000
18-May																									0.12				9300	8000	9000	7800
19-May																									0				7300	6300	8100	6900
20-May																									0.27							
21-May	180					25		1.5	0.015	3	0.37	0.27	3.6	5.4	9.2						3.5		3.5	7.2	0.839						2600	2300

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Lab Sampling Data - KSA Laboratory Note: Used for not detected (less or equal to MDL- Method Detection Limit)

Sampling Date and Time	Pilot Influent - Raw Water Quality																				
	Alkalinity	BOD	BOD Dissolved	COD	COD, Dissolved	Nitrogen, Ammonia (as N)	Nitrogen, Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen, Nitrate (as N)	Nitrogen, Nitrite (as N)	Nitrogen, Total	Orthophosphate as P	Phosphorus, Total	Phosphorus Acid Hydrolyzable	TSS	VSS	Turbidity Handheld	pH	pH (Field)	Temp	Temp (Field)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	s.u.		C	C
MDL	5.0	1.0	1.0	8.4	8.40	0.015	0.015	1.80	0.062	0.021	1.80	0.2	0.47		3.50	3.5		-		-	
New MDL									0.270		0.27	0.008									
Date																					
22-May																					
23-May	280	410	240	690	360	36	0.087	23	0.062	0.021	23	5.8	6.8		190	180		6.6	7.2	26	31.278
24-May																					
25-May	280	240	110	470	230	18	0.077	49	0.062	0.021	49	5.7	7.3		99	87		6.85	7	26	30.778
26-May																					
27-May																					
28-May	280	220	140	500	230	5.8	0.14	0.42	0.062	0.021	0.42	5.4	7.6		170	160		7.56	6.8	28	-17.78
29-May																					
30-May	250	280	170	490	220	26	0.24	44	0.062	0.021	44	7.5	12		110	100		7.1	7.1	29	31.444
31-May																					
1-Jun	250	260	140	510	270	40	0.28	34	0.062	0.16	34	6.4	9.3		75	65		7.08	7	27	31.778
2-Jun																					
3-Jun																					
4-Jun	260	270	150	540	270	33	1.7	44	0.062	0.15	44	5.5	5.7		110	96		7.89	n/a	27	30.611
5-Jun																					
6-Jun	240	270	170	500	260	31	0.24	30	0.062	0.21	30	4.2	6.3		100	92		7.05	7.1	28	31.056
7-Jun																					
8-Jun	240	180	94	410	190	29	0.15	27	1.5	0.15	29	3.7	5.1		110	96		6.93	7	26	31.222
9-Jun																					
10-Jun																					
11-Jun	220	310	190	600	340	25	0.075	47	1.6	0.31	49	5	5.8		52	56		6.6	7.1	29	29.833
12-Jun																					
13-Jun	230	140	73	370	170	31	0.36	51	1.4	0.14	53	1	5.4		86	77		7.22	7.1	28	-17.78
14-Jun																					
15-Jun	230	90	24	250	130	21	0.22	27	0.062	0.021	27	2.7	4.3		70	60		7.2		27	32.333
16-Jun																					
17-Jun																					
18-Jun	250	190	100	370	180	28	0.27	37	0.062	0.021	37	6.4	7.1		140	120		7.2		26	31
19-Jun																					
20-Jun	230	150	93	380	160	23	0.22	35	0.062	0.021	35	3.8	6.6		110	100		7.2		26	32.5
21-Jun																					
22-Jun	230	100	76	540	280	19	0.18	43	0.062	0.021	43	4.2	5		180	170		7.2		26	
23-Jun																					
24-Jun																					
25-Jun	240	220	140	470	240	37	0.38	57	0.24	0.021	57	4.8	5.9		200	200		7.2	6.9	27	32.56
26-Jun																					
27-Jun	230	220	83	300	200	36	0.015	57	0.062	0.021	57	4.9	6.7		130	120		6.9		26	
28-Jun																					
29-Jun	230	210	110	380	230	36	0.015	77	0.062	1.4	78	4.7	5.8		150	140		7.1		26	
30-Jun																					
1-Jul																					
2-Jul	250	210	120	430	190	31	0.015	61	0.28	2.1	63	3.4	5.8		140	120		7.25		28	
3-Jul																					
4-Jul																					
5-Jul																					
6-Jul		190	110	390	220	30	0.48	31	0.062	2	33	4.6	5.6		140	120		7.33		29	
7-Jul																					

Sampling Date and Time	Pilot Permeate Water Quality																												Membrane Tank Water Quality		Aerobic Tank Water Quality	
	Alkalinity	BOD	TOC	SBOD	COD	COD Dissolved	Color	Nitrogen Ammonia (as N)	Nitrogen Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen Nitrate (as N)	Nitrogen Nitrite as (as N)	Nitrogen, Total	Orthophosphate (as P)	Phosphorus, Total	US Bio Orthophosphate (as P)	US Bio Phosphate	US Bio Phosphorus as P	Iron	Aluminum	TSS	Total Organic Halides	VSS	pH (Field)	Effluent Turbidity (Field)	Total Coliform	Heterotrophic Plate Count	Fecal	TSS	VSS	TSS	VSS
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		NTU	cfu/100ml	cfu/ml	cfu/100ml	mg/L	mg/L	mg/L	mg/L
MDL	5.00	2.10		6.3	8.40	8.40		0.015	0.015	0.09	0.06	0.021	0.09	0.016	0.047				0.029	0.035	3.50	0.50	3.50			2.00	22.00	1.00	4	4	4	4
New MDL		1 as of 7/13/0		1.0										.008 as of 7/3/0																		
Date																																
22-May	170					29		1.2	0.015	2.9	0.69	0.38	4	1.7	2						5		3.5		0				14000	12000	9200	7900
23-May																									0.018						5400	4700
24-May	150					23		0.015	0.015	0.71	0.7	0.021	1.4	0.22	0.41						4		3.5	7	0.016				11000	9400	8200	6800
25-May																									0.007				4800	4100	9300	8000
26-May	150					27		0.03	0.015	0.51	1.2	0.021	1.7	0.1	0.18						3.5		7	7	0.022						8700	7100
27-May																									0.066							
28-May																									0.091				7600	6500	5500	4800
29-May	160					18		2.4	0.015	5	0.4	0.021	5.4	0.026	0.047						3.5		10	6.8	0.091				9500	8200	7900	6800
30-May																									0.051						8300	7000
31-May	150					18		0.48	0.015	1.4	0.55	0.021	2	0.19	0.25						5		5	7	0.027				7600	6600	8500	7300
1-Jun																									0.024				11000	9000	9400	8100
2-Jun	150					33		0.06	0.015	1.4	0.38	0.021	1.8	0.22	0.099						5		4	6.9					9000	7700	9900	6200
3-Jun																																
4-Jun																													8200	7000	12000	7900
5-Jun	150					33		4.4	0.11	5.1	0.48	0.021	5.6	0.16	0.047						3.5		3.5						11000	9900	8200	7800
6-Jun																									0.111				10000	8800	10000	9200
7-Jun	150					43		0.37	0.015	2.1	0.41	0.021	2.5	0.017	0.25						3.5		3.5	7	0.134				11000	10000	11000	8700
8-Jun																									0.12				8800	8700	12000	11000
9-Jun	150					31		0.36	0.015	1.8	0.57	0.021	2.4	0.058	0.12						3.5		3.5	7	0.13				14000	13000	11000	10000
10-Jun																									0.142							
11-Jun																									0.188				12000	11000	10000	9200
12-Jun	140					48		9.8	0.1	11	0.25	0.021	11	0.11	0.15						3.5		3.5	7	1.8						6200	5400
13-Jun																									0.99				7300	6300	8200	7300
14-Jun	120					39		0.063	0.015	1.1	0.48	0.021	1.6	2	2.3						3.5		3.5	7.1	0.066				8700	7000	6200	5700
15-Jun																									0				3700	3200	5000	4800
16-Jun	120					23		2.7	0.033	4.8	5.5	0.52	11	0.21	0.094						3.5		3.5		0				2900	2100	2400	2200
17-Jun																									0.095							
18-Jun																									0.091				3100	2200	3200	2100
19-Jun	130					33		0.59	0.015	2.6	1.3	0.38	4.3	0.074	0.047						6		6		0.102				3300	2100	3200	1900
20-Jun																									0.088				5700	5000	4200	3800
21-Jun	120					35		0.47	0.015	2.1	1.6	0.28	4	0.06	0.047						3.5		4		0.112				7700	7200	7300	6200
22-Jun																									0.124				11000	9800	9600	8400
23-Jun	140					31		0.015	0.015	0.62	1.3	0.21	1.9	0.008	0.047						3.5		3.5		0.11				5000	4600	7600	6400
24-Jun																									0.116							
25-Jun																									0.123				16000	14000	14000	12000
26-Jun	130					39		0.024	0.015	2.4	6.4	0.36	9.2	0.018	0.089						4		3.5	6.9	0.115				14000	12000	12000	11000
27-Jun																									0.257				6100	6100	6400	5800
28-Jun	130	2.1			54	45		0.015	0.015	1.8	1.8	1.3	4.9	0.016	0.047						3.5		3.5		0.111				7800	7200	5800	5200
29-Jun																									0.087				7400	6000	6000	5600
30-Jun	130	2.8		14	29	14		0.015	0.015	1.2	1.3	1.3	3.8	0.008	0.047						3.5		3.5		0.122				7400	6600	6000	5500
1-Jul																									0.13							
2-Jul																									0.087				5100	4500	4300	3800
3-Jul								0.015	0.015	1.9	2.9	0.71	5.5	0.016	0.047						3.5		3.5		0.098				5500	4800	4400	3800
4-Jul																									0.083							
5-Jul		2.6			33	16		1.1	0.015	3.5	2.5	1.8	7.8	0.02	0.047						3.5		3.5		0.088				5500	4800	4600	4300
6-Jul																									0.086				4800	4200	4600	4000
7-Jul	130							0.2	0.015	1.6	2.2	1.6	5.4	0.17	0.047						5		5		0.101				4900	4300	4500	3900

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Lab Sampling Data - KSA Laboratory Note: Used for not detected (less or equal to MDL- Method Detection Limit)

Pilot Influent - Raw Water Quality

Sampling Date and Time	Alkalinity	BOD	BOD Dissolved	COD	COD, Dissolved	Nitrogen, Ammonia (as N)	Nitrogen, Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen, Nitrate (as N)	Nitrogen, Nitrite (as N)	Nitrogen, Total	Orthophosphate as P	Phosphorus, Total	Phosphorus Acid Hydrolyzable	TSS	VSS	Turbidity Handheld	pH	pH (Field)	Temp	Temp (Field)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	s.u.		C	C
MDL	5.0	1.0	1.0	8.4	8.40	0.015	0.015	1.80	0.062	0.021	1.80	0.2	0.47		3.50	3.5		-		-	
New MDL									0.270		0.27	0.008									
Date																					
8-Jul																					
9-Jul		200	83	480	350	12	0.076	49	0.062	1.4	50	4.6	4.4		130	120		6.3		29	
10-Jul																					
11-Jul		160	92	360	160	38	0.58	40.3	0.281	2.02	42.6	4.6	4.6		130	120		7.28		30	
12-Jul																					
13-Jul		140	69	320	150	24	0.18	33			33	2.8	4.3		130	120		7.16		29	
14-Jul																					
15-Jul																					
16-Jul		480	480	640	350	1.5	0.061	55			55	2.7	6.9		150	140		7.15		29	
17-Jul																					
18-Jul		470	450	390	160	2.6	0.042	40	0.062	0.2	40	3.4	5		110	98		7.4		27	
19-Jul																					
20-Jul		430	360	380	180	24	0.3	41	0.062	0.15	41	4	5.2		130	120		7.26		28	
21-Jul																					
22-Jul																					
23-Jul		370	300	280	150	26	0.4	30	0.062	0.021	30	3.9	5		100	94		7.32		29	
24-Jul																					
25-Jul		150	86	430	210	42	0.98	51	0.27	0.25	51	4.5	5.6		120	120		7.32		29	
26-Jul																					
27-Jul		220	120	460	220	27	0.36	54			54	4.4	5.3		110	100		7.22		30	
28-Jul																					
29-Jul																					
30-Jul		160	92	410	170	25	0.26	32	0.27	0.021	32	3.3	3.7		130	120		7.19		28	
31-Jul																					
1-Aug		230	100	330	100	21	0.27	32			34	4.5	4.3		120	110		7.24		29	
2-Aug																					
3-Aug		170	110	410	220	21	0.11	44			44	4.3	4.7		130	110		6.86		28	
4-Aug																					
5-Aug																					
6-Aug		190	93	440	200	12	0.078	29			29	3.5	4.9		130	120			7.32		29.8
7-Aug																					
8-Aug		210	69	480	280	20	0.37	23			23	3.6	3.5		120	110		7.43		28	
9-Aug																					
10-Aug		180	93	420	180	25	0.43	8.4			11	4.8	4.8		160	140		7.31		31	
11-Aug																					
12-Aug																					
13-Aug		230	170	530	270	20	0.22	24			26	4.6	4.4		150	140		7.12			
14-Aug																					
15-Aug		230	120	540	250	23	0.054	38			40	5	6.3		200	180		7.41			
16-Aug																					
17-Aug		210	120	490	230	22	0.37	59			61	4.7	4.8		170	150		7.36		29	
18-Aug																					
19-Aug																					
20-Aug		220	120	250	510	24	0.42	24			25	5.2	5.5		160	150		7.34		30	
21-Aug												4.7	5.6								
22-Aug		220	120	380	230	21	0.31	59			61	4.9	5.1		160	75		7.08		29	
23-Aug												4.8	6.4								

Pilot Permeate Water Quality

Sampling Date and Time	Alkalinity	BOD	TOC	SBOD	COD	COD Dissolved	Color	Nitrogen Ammonia (as N)	Nitrogen Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen Nitrate (as N)	Nitrogen Nitrite as (as N)	Nitrogen, Total	Orthophosphate (as P)	Phosphorus, Total	US Bio Orthophosphate (as P)	US Bio Phosphate	US Bio Phosphorus as P	Iron	Aluminum	TSS	Total Organic Halides	VSS	pH (Field)	Effluent Turbidity (Field)	Total Coliform	Heterotrophic Plate Count	Fecal
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		NTU	cfu/100ml	cfu/ml	cfu/100ml
MDL	5.00	2.10		6.3	8.40	8.40		0.015	0.015	0.09	0.06	0.021	0.09	0.016	0.047				0.029	0.035	3.50	0.50	3.50			2.00	22.00	1.00
New MDL		1 as of 7/13/0		1.0										.008 as of 7/3/20														
Date																												
8-Jul																									0.1			
9-Jul																									0.126			
10-Jul								0.015	0.015	1.2	1.6	1.4	4.2	0.008	0.047						3.5		3.5		0.118			
11-Jul																									0.113			
12-Jul	140	1			12	8.4		0.015	0.015	1.5	2.1	1.7	5.3	0.19	0.047						3.5		3.5		0.131			
13-Jul																									0.12			
14-Jul	140							0.015	0.015	1.2	2.3	0.099	3.6	0.48	0.95						12		12		0			
15-Jul																									0			
16-Jul																									0.88			
17-Jul								0.26	0.015	0.93	1.3	0.021	2.2	0.52	1.3						3.5		3.5	7.12	0.23			
18-Jul																									0.11			
19-Jul	120	310			25	8.4		0.083	0.015	0.95	1.7	0.021	2.6	0.082	1.7						5		3.5	7.32	0.13			
20-Jul																									0.11			
21-Jul	110							0.015	0.015	0.99	0.062	0.021	0.99	0.085	0.82						3.5		3.5		0.122			
22-Jul																									0.12			
23-Jul																									0			
24-Jul								0.095	0.015	1.4	1.9	0.29	3.6	0.72	0.78						5		3.5	7.36	0.12			
25-Jul																									0.13			
26-Jul	120	3.9			22	10		0.027	0.015	0.71	1.9	0.021	2.6	0.23	0.21						3.5		3.5	7.3	0.11			
27-Jul																									0.11			
28-Jul	110							,015	,015	1.2	1	0.021	2.2	0.008	0.047						4		3.5		0.12			
29-Jul																									0.12			
30-Jul																									0.14			
31-Jul								0.015	0.015	0.83			3.4	0.02	0.047						3.5		3.5	7.51	0.12			
1-Aug																									0.14			
2-Aug	130	1			35	33		0.041	0.015	0.98	2.9	1.2	5.1	0.035	0.047						6		6	7.56	0.13			
3-Aug																									0.12			
4-Aug	140							0.015	0.015	0.97	2.3	1.2	4.5	0.044	0.047						3.5		3.5	7.53	0.11			
5-Aug																									0.12			
6-Aug																									0.14			
7-Aug								0.015	0.015	0.58	1.5	1.3	3.4	0.008	0.047						3.5		3.5	7.48	0.11			
8-Aug																									0.12			
9-Aug	150	1		1.8	70	35		0.037	0.015	0.32	1.5	1.4	3.2	0.008	0.047						3.5		3.5	7.61	0.12			
10-Aug																									0.13			
11-Aug	140					14					2	1.4	3.4	0.008	0.047						3.5		3.5		0.13			
12-Aug																									0.12			
13-Aug																									0.13			
14-Aug					25			0.015	0.015	0.5	1.4	0.021	1.9	0.0079	0.047						3.5		3.5	7.31	0.15			
15-Aug																									0.13			
16-Aug	150	1		1	41	20		0.015	0.015	0.091	0.89	0.17	1.1	0.008	0.047						3.5		3.5	7.51	0.13			
17-Aug																									0.107			
18-Aug	150					25		0.015	0.015	0.9	1.2	0.33	2.4	0.035	0.047						3.5		3.5		0.138			
19-Aug																									0.142			
20-Aug																									0.14			
21-Aug						33		0.015	0.015		0.55	1.4	2	0.013	0.047						3.5		3.5	7.47	0.16			
22-Aug														0.03	0.047										0.131			
23-Aug	140	1		1	54	25		0.015	0.015	1.6	1.1	1.3	4	0.008	0.047						3.5		3.5	7.29	0.141	4		1

Membrane Tank Water Quality / Aerobic Tank Water Quality

Sampling Date and Time	Membrane Tank Water Quality TSS	Membrane Tank Water Quality VSS	Aerobic Tank Water Quality TSS	Aerobic Tank Water Quality VSS
Units	mg/L	mg/L	mg/L	mg/L
MDL	4	4	4	4
New MDL				
Date				
8-Jul				
9-Jul	5200	4600	4600	3900
10-Jul	5200	4500	4500	4000
11-Jul	5700	5000	4900	4200
12-Jul	5600	4900	5000	4400
13-Jul	5400	4800	4100	4700
14-Jul	5100	4600	4600	4000
15-Jul				
16-Jul	3000	2700	5500	4700
17-Jul	6000	5200	5100	4400
18-Jul	6000	5200	5100	4400
19-Jul	5900	5100	5200	4500
20-Jul	5900	5200	5000	4400
21-Jul	5700	5000	4700	4200
22-Jul				
23-Jul	6300	5500	5300	4700
24-Jul	6200	5400	5400	4800
25-Jul	6200	5500	5900	5100
26-Jul	6100	5300	5200	4500
27-Jul	5500	4700	6400	5500
28-Jul	6000	5100	5300	4600
29-Jul				
30-Jul	6300	5500	5600	4900
31-Jul	6300	5400	5500	4800
1-Aug	6300	5400	5300	4500
2-Aug	6400	5500	5500	4700
3-Aug	6400	5600	5300	4500
4-Aug	6200	5300	5400	4600
5-Aug				
6-Aug	6700	5800	5700	4800
7-Aug	6300	5400	5600	4800
8-Aug	6400	5500	5700	4900
9-Aug	6700	5700	5800	4900
10-Aug	6400	5500	5700	4900
11-Aug	6300	5600	5400	4700
12-Aug				
13-Aug	7100	6100	6100	5200
14-Aug	7200	6300	6000	5200
15-Aug	7100	6200	5800	5100
16-Aug	7400	6300	7600	6800
17-Aug	7100	6100	6300	5400
18-Aug	7100	6300	5600	5000
19-Aug				
20-Aug	7100	6300	6800	6000
21-Aug	7600	6700	6400	5600
22-Aug	7600	6600	6300	5500
23-Aug	7600	6600	7000	6000

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Lab Sampling Data - KSA Laboratory Note: Used for not detected (less or equal to MDL- Method Detection Limit)

Pilot Influent - Raw Water Quality

Sampling Date and Time	Alkalinity	BOD	BOD Dissolved	COD	COD, Dissolved	Nitrogen, Ammonia (as N)	Nitrogen, Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen, Nitrate (as N)	Nitrogen, Nitrite (as N)	Nitrogen, Total	Orthophosphate as P	Phosphorus, Total	Phosphorus Acid Hydrolyzable	TSS	VSS	Turbidity Handheld	pH	pH (Field)	Temp	Temp (Field)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	s.u.		C	C
MDL	5.0	1.0	1.0	8.4	8.40	0.015	0.015	1.80	0.062	0.021	1.80	0.2	0.47		3.50	3.5		-		-	
New MDL									0.270		0.27	0.008									
Date																					
24-Aug		310	200	620	320	36	0.5	43			45	5.2	7.2		240	220		7.15		33	
25-Aug												5.9	4.6								
26-Aug																					
27-Aug		230	140	490	240	21	0.34	23			25	4.8	5		140	140		7.14		30	
28-Aug												4.7	4.3								
29-Aug		210	120	460	210	29	0.13	28	0.27	1.8	30	4.9	5.4		160	150		7.12		30	
30-Aug												5.1	6.2								
31-Aug																					
1-Sep																					
2-Sep																					
3-Sep																					
4-Sep																					
5-Sep																					
6-Sep												4.9	4.9								
7-Sep		190	110	450	190	35	0.86	39			41	4.4	5.6		140	130			7.39		32
8-Sep																					
9-Sep																					
10-Sep	130	220	130	8.4	8.4	31	0.32	36			39	4.6	5.3		140	120	0.3		7.16		29
11-Sep																					
12-Sep		350	170	930	290	24	0.084	34			36	4.4	4.9		280	260	0.15		6.64		30
13-Sep																					
14-Sep		190	96	400	200	32	0.24	40			42	5.1	6.6		140	130	0.14		7.62		29
15-Sep																					
16-Sep																					
17-Sep		480	480	9400	2700	110	0.82	110			110	19	28		3500	3200			5.39		27.9
18-Sep																					
19-Sep		230	92	330	170	0.073	0.015	41			42	4.8	4.8		130	120	0.17		7.13		29
20-Sep																					
21-Sep		150	110	380	200	31	0.55	43			45	4.8	6.7		180	170	0.13		7.32		31
22-Sep																					
23-Sep																					
24-Sep		230	140	430	230	31	0.17	48			50	5.2	5.4		140	140	0.17		6.87		29.1
25-Sep																					
26-Sep		130	81	360	140	28	1.5	46			48	4.3	4.3		180	160			7.84		30.1
27-Sep																					
28-Sep		190	91	440	210	30	0.5	48			49	0.32	4.7		140	120			7.12		29
29-Sep												4.88	5.14	0.2419							
30-Sep																					
1-Oct		110	64	300	160	24	0.19	44			45	3.2	4		90	84			7.51		30
2-Oct																					
3-Oct		160	110	240	160	25	0.38	39			41	3.2	4.1		62	56			7.34		28.8
4-Oct												3.85	4087	1.13							
5-Oct		250	150	410	250	14	0.064	39			41	3.9	3.6		120	110			6.89		29.2
6-Oct																					
7-Oct																					

Pilot Permeate Water Quality / **Membrane Tank Water Quality** / **Aerobic Tank Water Quality**

Sampling Date and Time	Alkalinity	BOD	TOC	SBOD	COD	COD Dissolved	Color	Nitrogen Ammonia (as N)	Nitrogen Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen Nitrate (as N)	Nitrogen Nitrite as (as N)	Nitrogen, Total	Orthophosphate (as P)	Phosphorus, Total	US Bio Orthophosphate (as P)	US Bio Phosphate	US Bio Phosphorus as P	Iron	Aluminum	TSS	Total Organic Halides	VSS	pH (Field)	Effluent Turbidity (Field)	Total Coliform	Heterotrophic Plate Count	Fecal	Membrane Tank Water Quality TSS	Membrane Tank Water Quality VSS	Aerobic Tank Water Quality TSS	Aerobic Tank Water Quality VSS
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		NTU	cfu/100ml	cfu/ml	cfu/100ml	mg/L	mg/L	mg/L	mg/L
MDL	5.00	2.10		6.3	8.40	8.40		0.015	0.015	0.09	0.06	0.021	0.09	0.016	0.047				0.029	0.035	3.50	0.50	3.50			2.00	22.00	1.00	4	4	4	4
New MDL		1 as of 7/12/0		1.0										.008 as of 7/2/20																		
Date																																
24-Aug														0.025	0.047										0.124				7700	6600	6500	5600
25-Aug	130					33		0.015	0.015	1.7	2.1	1.5	5.3	0.029	0.047						3.5		3.5		0.139	370		380	7900	6700	6600	5600
26-Aug																									0.02							
27-Aug														0.009	0.047										0.04				7900	6600	6700	5700
28-Aug						85		0.015	0.015	0.29	1.1	1.1	2.5	0.028	0.047					0.23	3.5		3.5	7.39	0.052	1		1	8400	7000	6900	5800
29-Aug														0.042	0.047	0.0053	0.016	0.0243							0.05				8300	6700	7000	5700
30-Aug	120	1		1	37	35		0.015	0.015	0.4	1.6	1.1	3.1	0.028	0.047	0.0053	0.016	0.0213		0.28	3.5		3.5	7.23	0.01	4800		1	8500	6800	7100	5800
31-Aug																									0							
1-Sep																									0							
2-Sep																									0							
3-Sep																									0							
4-Sep																									0							
5-Sep																									0.256							
6-Sep	130	1.2		1	27	12		6.4	0.1	10	1.7	1.3	1.3	0.042	0.047	0.0766		0.113			3.5		3.5		0.33	2		1	6100	5000	5300	4300
7-Sep																									0.55				6400	5200	5200	4300
8-Sep	150					8.4		0.81	0.015	2	2.1	1.4	5.5	0.037	0.047	0.0216	0.185	0.0553			3.5		3.5		2.785	1000		600	6200	5200	5300	4300
9-Sep																									1							
10-Sep																0.0375		0.0963							0				6700	5500	5700	4800
11-Sep	150	1			8.4	8.4	30	0.051	0.015	0.26	1.8	1.5	3.6			0.0053		0.0665	0.029		3.5		3.5	7.9	0	4800	22	1300	7000	5800	5800	4800
12-Sep																0.0995		0.148							1.76				6800	5700	6200	5200
13-Sep	150	1		1	43	41	30	0.015	0.015	0.28	0.47	0.021	0.75			0.017		0.0814	0.054	0.23	3.5		3.5	7.21	0	52		30	7400	6300	6100	5100
14-Sep																0.0074		0.035							1				7300	6100	6100	5200
15-Sep	160	1				22	30	0.015	0.015	0.091	1.4	0.021	1.4			0.0322		0.0513	0.036	0.15	3.5		3.5	7.41	0	42		4	7200	6100	6100	5200
16-Sep																									0							
17-Sep																0.0206		0.0533							0						5100	4300
18-Sep	150	1				73	25	0.21	0.015	1.1	1.3	1.4	3.8			0.595		0.645	0.048		3.5		3.5	7.41	2.21	14	11	10	7200	6000	6400	5400
19-Sep																0.0321		0.0576							1.97				7900	6600	6000	5000
20-Sep	150	1		1	33	16	30	0.14	0.015	0.4	0.9	1.4	2.7			0.0373		0.0663	0.044	0.13	3.5		3.5	7.27	1.82	25000		20	7400	6400	6500	5700
21-Sep																0.0211		0.078							0.43				7400	6400	6200	5300
22-Sep	150	1				8.4	18	0.043	0.015	0.33	1.2	1.4	2.9			0.0172		0.0678	0.045	0.1	3.5		3.5	7.16	0.821	25000		25000	7900	6700	6500	5500
23-Sep																									0.925							
24-Sep																0.043		0.064							0				7900	6800	6000	5200
25-Sep	110	1	12			43	40	0.018	0.015	0.84	0.67	1.1	2.6			0.033		0.0355	0.033		3.5		3.5	7.29	0	100		52	7700	6600	6400	5500
26-Sep																0.0062		0.042							0.18				7300	6200	6100	5200
27-Sep	140	1	13	1	18	8.4	30	0.015	0.015	1.2	0.92	1.3	3.4			0.0178		0.0491	0.051	0.13	3.5		3.5		0.16	12		1	7400	6200	6100	5200
28-Sep																0.244		0.258							0.17				7700	6500	6800	5700
29-Sep	180	1	15			68	20	14	0.11	20	2	1.6	24			0.34		0.238	0.083	0.08	3.5		3.5	7.28	0	220		6	7600	6500	6800	5900
30-Sep																									0				7600	6500	6800	5900
1-Oct																0.166		0.196							0				8200	7100	6700	5800
2-Oct	190	4.4	13			58	30	10	0.11	15	1.6	1.7	18			0.0645		0.109	0.068		3.5	89	3.5	7.18	0				7700	6600	6800	5900
3-Oct																0.0903		0.139							0				7600	6600	6500	5800
4-Oct	200	21	18	15	73	45	20	11	0.23	12	1.3	1.8	15			0.0981		0.135	0.065		3.5		3.5	7.58	0	400		1	7900	6800	6500	5800
5-Oct																0.096		0.147							0				8100	7100	6700	5900
6-Oct	130	2.6	20			43	15	15	0.12	18	1	1.1	20			0.0291		0.0587	0.065	0.15	3.5		3.5	6.94	0	4		2	8400	7200	6700	5800
7-Oct																									0							

City of Sunrise
Southwest WRF MBr Pilot Plant
MBR Lab Sampling Data - KSA Laboratory Note: Used for not detected (less or equal to MDL- Method Detection Limit)

Sampling Date and Time	Pilot Influent - Raw Water Quality																				
	Alkalinity	BOD	BOD Dissolved	COD	COD, Dissolved	Nitrogen, Ammonia (as N)	Nitrogen, Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen, Nitrate (as N)	Nitrogen, Nitrite (as N)	Nitrogen, Total	Orthophosphate as P	Phosphorus, Total	Phosphorus Acid Hydrolyzable	TSS	VSS	Turbidity Handheld	pH	pH (Field)	Temp	Temp (Field)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	s.u.		C	C
MDL	5.0	1.0	1.0	8.4	8.40	0.015	0.015	1.80	0.062	0.021	1.80	0.2	0.47		3.50	3.5		-		-	
New MDL									0.270		0.27	0.008									
Date																					
8-Oct		190	100	460	200	34	0.64	38			40	5.2	5.3		150	140			7.41		29
9-Oct												5.76	5.99	0.153							
10-Oct		140	76	400	220	35	0.29	33			35	4.9	5.8		80	76			7.02		29.7
11-Oct												3.71	5.22	1.51							
12-Oct		190	140	370	160	35	0.66	35			37	4.1	5.1		200	140			7.41		29
13-Oct																					
14-Oct																					

Sampling Date and Time	Pilot Permeate Water Quality																												Membrane Tank Water Quality		Aerobic Tank Water Quality	
	Alkalinity	BOD	TOC	SBOD	COD	COD Dissolved	Color	Nitrogen Ammonia (as N)	Nitrogen Ammonia (Unionized)	Nitrogen, Kjeldahl, Total	Nitrogen Nitrate (as N)	Nitrogen Nitrite as (as N)	Nitrogen, Total	Orthophosphate (as P)	Phosphorus, Total	US Bio Orthophosphate (as P)	US Bio Phosphate	US Bio Phosphorus as P	Iron	Aluminum	TSS	Total Organic Halides	VSS	pH (Field)	Effluent Turbidity (Field)	Total Coliform	Heterotrophic Plate Count	Fecal	TSS	VSS	TSS	VSS
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		NTU	cfu/100ml	cfu/ml	cfu/100ml	mg/L	mg/L	mg/L	mg/L
MDL	5.00	2.10		6.3	8.40	8.40		0.015	0.015	0.09	0.06	0.021	0.09	0.016	0.047				0.029	0.035	3.50	0.50	3.50			2.00	22.00	1.00	4	4	4	4
New MDL		1 as of 7/13/0		1.0										.008 as of 7/3/20																		
Date																																
8-Oct			20				40									0.0053		0.0263		0.25					0				9200	7700	7000	5900
9-Oct	180	9.7	17			70	15	25	0.38	21	0.67	1.6	23			0.0053		0.0314	0.037	0.24	3.5		3.5	7.31	0	46		6	8600	7200	7100	6000
10-Oct			23				15									0.0053		0.0342		0.21					0.1						6700	5700
11-Oct	180	1.8	15	1.7	27	14	20	17	0.34	13	0.63	0.021	14			0.0053		0.0272	0.083	0.21	3.5		3.5	7.33	0.106	98		60	8300	7000	6900	5800
12-Oct			17				50									0.0094		0.0311		0.2					0.12				8100	6800	6800	5700
13-Oct	200	2.1	21			31	20	25	0.35	16	0.87	1.8	19			0.0124		0.0379	0.095	0.17	11		10	7.34	0.12	12		4	8600	7400	6900	5800
14-Oct																																

Color Key	
Below MDL =	
Refer to Case Narrative =	
Outlier	
Can Reliably remove =	
Refer to Pilot Event Log =	

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:		Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday		
		Date:		7/31/2007			8/1/2007			8/2/2007			8/3/2007			8/4/2007			8/5/2007			8/6/2007		
		Time:		3:00 PM			7:15 AM			1:00 PM			1:00 PM			8:00 AM			9:00 AM			9:00 AM		
		Operator:		Rick			Rick			Rick			Rick			Dan			SW			Rick		
Compound	**Sampling Location**	**Frequency**																						
U.V. 254	**Breaktank**		%								88			59.60			59			95			45.3	
U.V. 254	**Cartridge Filter Effluent**		%								88.5			62.60			60			95			44.3	
U.V. 254	**RO Feed w/ Recycle**		%								87			47.30			59.1			98			43	
U.V. 254	**Post Anoxic Tank**		%								17			6.00			4			16			4.6	
U.V. 254	**RO Permeate**		%								83.5			87.30			82.5			98.5			74	
Turbidity	**MBR Effluent**	**2 / day**	NTU									0.04	0.05		0.01	0.04		0.02	0.02		0.04	0.2		0.09
Turbidity	**Breaktank**	**2 / day**	NTU									0.03	0.04		0.04	0.02		0.02	0.02		0.04	0.12		0.09
Turbidity	**Cartridge Filter Effluent**	**2 / day**	NTU									0.01	0.03		0.01	0.02		0.02	0.01		0.02	0.13		0.11
Turbidity	**RO Feed w/ Recycle**	**2 / day**	NTU									0.08	0.05		0.04	0.05		0.02	0.03		0.02	0.21		0.11
Temperature	**Breaktank**	**2 / day**	^oc									32.2	31.1		32	31.2		26.2	32		33.7	31.3		33.2
Temperature	**RO Feed w/ Recycle**	**2 / day**	^oc									33.1	32		32.8	32		26.7	33.6		34.6	31.3		34.2
Temperature	**RO Permeate**	**2 / day**	^oc									34.9	32		34.9	32.1		29.2	34		34	32.4		34.8
(4) Pressure	**pre cartridge filter**																		4	4	4	5	4	
(5) Pressure	**post cartridge filter**																		4	4	4	5	4	
(6) Membrane Inlet Pressure		**3 / day**				130	130				130	130	130	130	130	130	130	130	130	130	130	130	130	130
(7) Pressure	**Concentrate**	**3 / day**				125	125				130	130	125	130	125	125	125	130	130	130	130	130	130	130
(8) Pressure	**Permeate**	**3 / day**																	7.22	6.99				
pH	**Breaktank**	**2 / day**										7.24	7.77		7.18	7.16		7.21	7.22	6.97		6.94		7.44
pH	**RO Feed w/ Recycle**	**2 / day**										6.3	7.52		7.37	7.51		7.2	7.44		7.53	7.38		7.8
pH	**RO Permeate**	**2 / day**										7.38	7.4		6.68	7.06		7.2	7.04		6.62	7.63		7.43
(3) Flow Rate	**RO Recycle**	**3 / day**				2	2				2	2	2	2	2	2	2	2	2	2	2	2	2	2
(1) Flow Rate	**RO Permeate**	**3 / day**				1.3	1.3				1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3
(2) Flow Rate	**RO Drain**	**3 / day**				2.3	2.3				2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.3	2.3
(9) Flow Rate	**RO Feed**																			4.5			4.5	
Conductivity	**RO Permeate, field panel**	**3 / day**														26		30						
Conductivity	**RO Permeate, hand held**	**3 / day**																						
Free Chlorine	**Breaktank**																							
Total Chlorine	**Breaktank**																							

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:			**Tuesday**			**Wednesday**			**Thursday**			**Friday**			**Saturday**			**Sunday**			**Monday**	
		Date:			8/7/2007			8/8/2007			8/9/2007			8/10/2007			8/11/2007			8/12/2007			8/13/2007	
		Time:			9:00 AM			9:00 AM			9:00 AM			9:00 AM			4:00 PM			9:00 AM			9:00 AM	
		Operator:			Rick			Rick			Rick			Rick			SW			SW			RH	
Compound	**Sampling Location**	**Frequency**																						
U.V. 254	**Breaktank**		%		45			44			47.3			59.3			61.5			91			46.3	
U.V. 254	**Cartridge Filter Effluent**		%		44.7			44			46.3			59			55			92.5			46.66	
U.V. 254	**RO Feed w/ Recycle**		%		42.6			37.7			40			49.6			46.5			82			38.3	
U.V. 254	**Post Anoxic Tank**		%		0			1			2			8			5			13			4	
U.V. 254	**RO Permeate**		%		78			100			93.6			99.3			99.5			98.5			98	
Turbidity	**MBR Effluent**	**2 / day**	NTU	0.09		0.23	0.03		0.06	0.62		0.7	0.04		0.12	0.08		0.13	0.03		1.12	0.03		0.11
Turbidity	**Breaktank**	**2 / day**	NTU	0.1		0.01	0.02		2.68	0.51		0.57	0.02		0.02	0.09		0.16	0.03		0.96	0.03		0.02
Turbidity	**Cartridge Filter Effluent**	**2 / day**	NTU	0.1		0.03	0.02		0.25	0.08		0.06	0.04		0.04	0.06		0.06	0.19		0.62	0.01		0.03
Turbidity	**RO Feed w/ Recycle**	**2 / day**	NTU	0.12		0.06	0.03		0.33	0.01		0.03	0.07		0.04	0.05		0.07	0.08		0.67	0.02		0.02
Temperature	**Breaktank**	**2 / day**	^oC	32.1		28	32.6		31.5	35.2		33.1	32.7		33.8	34.7		35.3	32.8		33.5	32.2		33
Temperature	**RO Feed w/ Recycle**	**2 / day**	^oC	32		27.9	32.9		32.1	35.7		34	33		34.6	35.9		35	33.1		34.7	32.9		32.7
Temperature	**RO Permeate**	**2 / day**	^oC	33.7		28	33.7		33	35.3		34.2	34.1		35.4	36		36.1	33.7		35.3	33.1		33.1
(4) Pressure	**pre cartridge filter**			6	4	6	5	4	3	5	4	3	5	3	3	3	3	3						
(5) Pressure	**post cartridge filter**			4	4	4	5	4	3	5	4	3	5	3	3	3	3	3						
(6) Membrane Inlet Pressure		**3 / day**		130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	132	135	132
(7) Pressure	**Concentrate**	**3 / day**		130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
(8) Pressure	**Permeate**	**3 / day**		5	4	4	5	4	3	5									10	10	10	10	10	10
pH	**Breaktank**	**2 / day**		7.06		7.11	6.48		7.08	6.65		6.4	7.08		7.38	7.02		7.11	6.75		6.74	7.06		7.16
pH	**RO Feed w/ Recycle**	**2 / day**		7.28		7.12	6.49		7.45	7.1		6.17	7.04		7.35	7.38		7.24	7.41		7.34	6.64		7.31
pH	**RO Permeate**	**2 / day**		7.11		6.63	6.53		7.51	6.78		6.6	5.9		7.66	6.93		7.02	6.92		7.76	7.25		7.76
(3) Flow Rate	**RO Recycle**	**3 / day**		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
(1) Flow Rate	**RO Permeate**	**3 / day**		1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
(2) Flow Rate	**RO Drain**	**3 / day**		2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
(9) Flow Rate	**RO Feed**					4.5	5	4	3	4.6									5.5	5.5	5.5	5.5	5.5	5.5
Conductivity	**RO Permeate, field panel**	**3 / day**		7.5	7.77	7.6	15	15	15	15	15	15	15	14	16	15	15	15	16	15	15	15	16	16
Conductivity	**RO Permeate, hand held**	**3 / day**		7.5	7.77	7.6	7.92	9.12			8.1	8.16	7.31	8.3	9.76	9.87	9.66	10.2	11.1	12.9	12.9	9.02	9.26	9.26
Free Chlorine	**Breaktank**																							
Total Chlorine	**Breaktank**																							

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:		**Tuesday**			**Wednesday**			**Thursday**			**Friday**			**Saturday**			**Sunday**			**Monday**		
		Date:		8/14/2007			8/15/2007			8/16/2007			8/17/2007			8/18/2007			8/19/2007			8/20/2007		
		Time:		9:00 AM			9:00 AM			9:00 AM			9:00 AM			8:30 AM			11:30 AM			9:00 AM		
		Operator:		RH						RH HA			HA RA			Hugo			Hugo			Rick		
Compound	**Sampling Location**	**Frequency**																						
U.V. 254	**Breaktank**		%	44						55.3			52			42.4			38.3			51.3		
U.V. 254	**Cartridge Filter Effluent**		%	44						50.3			58.3			56.3			54.3			60.6		
U.V. 254	**RO Feed w/ Recycle**		%	37.6						40.6			53.3			46.8			42			52		
U.V. 254	**Post Anoxic Tank**		%	5						4			10			12			6			4		
U.V. 254	**RO Permeate**		%	96.3						95.6			92			96			98			98		
Turbidity	**MBR Effluent**	**2 / day**	NTU	0.02		0.23				0.11		0.12	0.14		0.12	0.13			0.14			0.19		
Turbidity	**Breaktank**	**2 / day**	NTU	0.02		0.09				0.13		0.11	0.12		0.14	0.11			0.11			0.15		
Turbidity	**Cartridge Filter Effluent**	**2 / day**	NTU	0.03		0.14				0.1		0.2	0.11		0.14	0.16			0.12			0.14		
Turbidity	**RO Feed w/ Recycle**	**2 / day**	NTU	0.03		0.2				0.13		0.14	0.23		0.2	0.18			0.14			0.15		
Temperature	**Breaktank**	**2 / day**	^oC	32		33.3				32.2		32.8	32		32.3	31.6			31.8			32.6		
Temperature	**RO Feed w/ Recycle**	**2 / day**	^oC	32.9		34				32.7		33.5	31.7		33.5	31.2			31.4			33		
Temperature	**RO Permeate**	**2 / day**	^oC	32.8		34.1				33.2		38.2	32.4		33.8	31			31.6			34		
(4) Pressure	**pre cartridge filter**									4			4		4	4			4			5		
(5) Pressure	**post cartridge filter**									4			4		4	4			4			4		
(6) Membrane Inlet Pressure		**3 / day**		155	125	130				132	130	130	132	132	132	132	132	130	130	130	130	130	130	130
(7) Pressure	**Concentrate**	**3 / day**		155	120	130				130	130	130	132	130	131	130	130	130	130	130	130	130	130	130
(8) Pressure	**Permeate**	**3 / day**		10	10	60				55	55	50	50	60	50	50	50	50	50	50	50	50	50	50
pH	**Breaktank**	**2 / day**		7.06		7.33			6.89	7.11		6.89	6.57	6.72	6.62	6.94		6.94	6.8			6.99		
pH	**RO Feed w/ Recycle**	**2 / day**		7.08		7.37			7.13	6.76		7.13	7.26	6.92	7.13	6.99		6.99	7.18		7.5	6.92		
pH	**RO Permeate**	**2 / day**		7.58		7.4			6.88	7.29		6.88	6.81	7.12	7.11	7.08		7.08	7.26			7.15		
(3) Flow Rate	**RO Recycle**	**3 / day**		2	2	2	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
(1) Flow Rate	**RO Permeate**	**3 / day**		1.3	2.8	1.3	1.3			1.2	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3		1.3	1.2	1.2
(2) Flow Rate	**RO Drain**	**3 / day**		2.3	0.7	2.3	2.3			2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.5	2.3	2.3		2.3	2.3	2.3
(9) Flow Rate	**RO Feed**			5.5	5.5	5.5	4.75			5	5	5	5	5	5	5	5	5	6	6		5.5		5.5
Conductivity	**RO Permeate, field panel**	**3 / day**		16	23	25	19			19	19	19	18	18	19	20	20	14	19	19	18	18		18
Conductivity	**RO Permeate, hand held**	**3 / day**		8.72	11.8	12.4				8.95	11.9	10.2	8.87	9.76	10.7	10.9	10.9	10.9	9.22			9.09		
Free Chlorine	**Breaktank**									0.04	0.06	0	0.07	0.06	0	0.04	0.04	0.03	0.02			0.05		
Total Chlorine	**Breaktank**									0.07	0.11	0.06	0.09	0.06	0.08	0.08	0.08	0.06	0.05			0.08		

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:		Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday		
		Date:		8/21/2007			8/22/2007			8/23/2007			8/24/2007			8/25/2007			8/26/2007			8/27/2007		
		Time:					8:20 AM			12:30 PM			12:30 PM			9:OO AM			8:30 AM			9:00 AM		
		Operator:		Rick			Hugo/Rick			Hugo			Hugo			Hugo			Rick			Rick		
Compound	Sampling Location	Frequency																						
U.V. 254	Breaktank		%	46.3			42.6			44.6			40.3			52			54.6			54.3		
U.V. 254	Cartridge Filter Effluent		%	46			49.9			52.3			50.6			52.6			56.6			58		
U.V. 254	RO Feed w/ Recycle		%	44.3			40.3			46.6			51.3			48.3			48.3			48		
U.V. 254	Post Anoxic Tank		%	6			3			4			5			6			5			7		
U.V. 254	RO Permeate		%	94			98			98			94			96			96			95.6		
Turbidity	MBR Effluent	2 / day	NTU	0.16			0.18			0.14			0.18						0.1			0.14		
Turbidity	Breaktank	2 / day	NTU	0.13			0.2			0.18			0.18			0.14			0.12			0.15		
Turbidity	Cartridge Filter Effluent	2 / day	NTU	0.18			0.16			0.16			0.14			0.11			0.14			0.19		
Turbidity	RO Feed w/ Recycle	2 / day	NTU	0.15			0.16			0.22			0.13			0.13			0.21			0.2		
Temperature	Breaktank	2 / day	^{o}C	32.2			32.3			32.1			32			31.1			31.4			32.5		
Temperature	RO Feed w/ Recycle	2 / day	^{o}C	33.2			29.5			31.1			32.2			31.2			30.6			32		
Temperature	RO Permeate	2 / day	^{o}C	33.6			31.7			31.2			31.8			30.8			32			33		
(4) Pressure	pre cartridge filter			4			4			4			4			4			5			5		
(5) Pressure	post cartridge filter			4			4			2			2			4			4			4		
(6) Membrane Inlet Pressure		3 / day		130	130	130	130	130	130	130	130	130	130			130			130			130		
(7) Pressure	Concentrate	3 / day		130	130	130	130	130	130	130	130	130	130			130			130			130		
(8) Pressure	Permeate	3 / day		50	50	50	50	50	50	50	50	50	50			50			50			50		
pH	Breaktank	2 / day		6.2			7.12			6.82			7.28			6.92			6.94			6.89		
pH	RO Feed w/ Recycle	2 / day		6.9			7.96			6.94			7.14			7.02			7.16			7.24		
pH	RO Permeate	2 / day		6.22			6.87			6.88			7.1			7.12			7.35			7.4		
(3) Flow Rate	RO Recycle	3 / day		2	2	2	2	2	2	2	2	2	2			2			2			2		
(1) Flow Rate	RO Permeate	3 / day		1.2		1.2	1.2		1.2	1.2			1.2			1.2			1.2			1.2		
(2) Flow Rate	RO Drain	3 / day		2.3		2.3	2.3		2.3	2.3			2.3			2.3			2.3			2.3		
(9) Flow Rate	RO Feed			5.5		5.5	5.5		5.5	5.5			5.5			6			6			6.5		
Conductivity	RO Permeate, field panel	3 / day		19		19	19		19	21			23			22			22			21		
Conductivity	RO Permeate, hand held	3 / day		10			10			9.86			9.13			10.1			10.4			10.8		
Free Chlorine	Breaktank			0.05			0.06			0.03			0.04			0.06			0.04			0.04		
Total Chlorine	Breaktank			0.08			0.08			0.05			0.08			0.08			0.06			0.06		

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:		**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**	**Monday**
		Date:		8/28/2007	8/29/2007	8/30/2007	8/31/2007	9/1/2007	9/2/2007	9/3/2007
		Time:		9:30 AM	9:15 AM	9:00 AM				
		Operator:		Hugo/Rick	Rick	Rick				
Compound	**Sampling Location**	**Frequency**								
U.V. 254	**Breaktank**		%	60.3	62.6	52.6				
U.V. 254	**Cartridge Filter Effluent**		%	54.3	64.3	56.3				
U.V. 254	**RO Feed w/ Recycle**		%	48.3	54.6	58.6				
U.V. 254	**Post Anoxic Tank**		%	7	7	6				
U.V. 254	**RO Permeate**		%	96	96	96.3				
Turbidity	**MBR Effluent**	**2 / day**	NTU	0.22	0.15	0.19				
Turbidity	**Breaktank**	**2 / day**	NTU	0.36	0.16	0.16				
Turbidity	**Cartridge Filter Effluent**	**2 / day**	NTU	0.3	0.15	0.14				
Turbidity	**RO Feed w/ Recycle**	**2 / day**	NTU	0.21	0.17	0.16				
Temperature	**Breaktank**	**2 / day**	^{o}C	32.2	32.3	31.2				
Temperature	**RO Feed w/ Recycle**	**2 / day**	^{o}C	32.4	32.4	32.3				
Temperature	**RO Permeate**	**2 / day**	^{o}C	31.9	33.7	32.8				
(4) Pressure	**pre cartridge filter**			4	5	5				
(5) Pressure	**post cartridge filter**			2	4	4				
(6) Membrane Inlet Pressure		**3 / day**		130	130	130				
(7) Pressure	**Concentrate**	**3 / day**		130	130	130				
(8) Pressure	**Permeate**	**3 / day**		50	40	40				
pH	**Breaktank**	**2 / day**		6.82	6.79	7.31				
pH	**RO Feed w/ Recycle**	**2 / day**		7.27	7.26	7.3				
pH	**RO Permeate**	**2 / day**		7.3	7.15	6.93				
(3) Flow Rate	**RO Recycle**	**3 / day**		2	2	2				
(1) Flow Rate	**RO Permeate**	**3 / day**		1.2	1.3	1.2				
(2) Flow Rate	**RO Drain**	**3 / day**		2.3	2.3	2.3				
(9) Flow Rate	**RO Feed**			6.5	6.5	6.5				
Conductivity	**RO Permeate, field panel**	**3 / day**		20	20	20				
Conductivity	**RO Permeate, hand held**	**3 / day**		10	14.4	9.26				
Free Chlorine	**Breaktank**			0.06	0.04	0.03				
Total Chlorine	**Breaktank**			0.08	0.06	0.08				

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Operators Checklist

Operators to complete Edwins log sheet	9:00 AM
R.O. Unit Daily Check list	
UV-245	9:00 AM
pH, Temperature, Turbidity	9:00 AM
Flow rate, Pressure, Conductivity	9:00 AM
Free Chlorine, Total Chlorine	7:00 AM
Ammonia	1:00 PM

		Day:		**Tuesday**			**Wednesday**			**Thursday**			**Friday**			**Saturday**		
		Date:		9/4/2007			9/5/2007			9/6/2007			9/7/2007			9/8/2007		
		Time:																
		Operator:																
Compound	**Sampling Location**	**Frequency**																
U.V. 254	**Breaktank**		%															
U.V. 254	**Cartridge Filter Effluent**		%															
U.V. 254	**RO Feed w/ Recycle**		%															
U.V. 254	**Post Anoxic Tank**		%															
U.V. 254	**RO Permeate**		%															
Turbidity	**MBR Effluent**	**2 / day**	NTU															
Turbidity	**Breaktank**	**2 / day**	NTU															
Turbidity	**Cartridge Filter Effluent**	**2 / day**	NTU															
Turbidity	**RO Feed w/ Recycle**	**2 / day**	NTU															
Temperature	**Breaktank**	**2 / day**	^oC															
Temperature	**RO Feed w/ Recycle**	**2 / day**	^oC															
Temperature	**RO Permeate**	**2 / day**	^oC															
(4) Pressure	**pre cartridge filter**																	
(5) Pressure	**post cartridge filter**																	
(6) Membrane Inlet Pressure		**3 / day**				130												
(7) Pressure	**Concentrate**	**3 / day**				130												
(8) Pressure	**Permeate**	**3 / day**				30												
pH	**Breaktank**	**2 / day**																
pH	**RO Feed w/ Recycle**	**2 / day**																
pH	**RO Permeate**	**2 / day**																
(3) Flow Rate	**RO Recycle**	**3 / day**				2												
(1) Flow Rate	**RO Permeate**	**3 / day**				1.3												
(2) Flow Rate	**RO Drain**	**3 / day**				2.3												
(9) Flow Rate	**RO Feed**					5												
Conductivity	**RO Permeate, field panel**	**3 / day**				22												
Conductivity	**RO Permeate, hand held**	**3 / day**				14.6												
Free Chlorine	**Breaktank**					0.02												
Total Chlorine	**Breaktank**					0.07												

City of Sunrise
Southwest WRF MBR Pilot Plant
R.O. Stream   Lab Sampling Data

		MBR Influent		MBR Effluent		Breaktank Effluent (Raw RO Influent)				Cartridge Filter Permeate (Ultrafilter Permeate)		R.O. Influent (Feed plus Recycle)												R.O. Permeate																	R.O. Concentrate	
		Heterotrophic Plate Count	Fecal Coliform	Heterotrophic Plate Count	Fecal Coliform	TOC	Heterotrophic Plate Count	Fecal Coliform	Color	Heterotrophic Plate Count	Fecal Coliform	TOC	TDS	Conductivity	Phosphorous Total	Ortho Phosphate (PO4)	Phosphate Total as P	Nitrate	Nitrogen Total	Iron	Manganese	Aluminum	Heterotrophic Plate Count	TSS	VSS	TOC	TDS	Conductivity	Ortho Phosphate (PO4)	Phosphorous Total	Nitrate	Nitrite	Nitrogen Kjeldahl	Nitrogen Total	Iron	Manganese	Aluminum	Heterotrophic Plate Count	Fecal Coliform	Color	Heterotrophic Plate Count	Fecal Coliform
	Units	cfu/ml	cfu/100ml	cfu/ml	cfu/100ml	mg/L	cfu/ml	cfu/100ml	cu	cfu/ml	cfu/100ml	mg/L	mg/L	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	cfu/ml	mg/L	mg/L	mg/L	mg/L	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	mg/L	cfu/ml	cfu/100 ml		cfu/ml	cfu/100 ml
	MDL	**1**	**1**	**1**	**1**	**0.47**	**1**	**1**	**2.5**	**1**	**1**	**0.47**	**8.9**	**0**	**0.05**	**0.01**	**0.04**	**0.27**	**0.27**	**0.03**	**0**	**0.04**	**1**	**3.5**		**0.47**	**8.9**	**0**	**0.008**	**0.047**	**0.27**	**0.02**	**0.09**	**0.27**	**0.03**	**0.003**	**0.035**	**1**	**1**	**2.5**	**1**	**1**
Date / Time																																										
8/2/2007						13	4	300	40	2	260	16	1400		0.05	0.01	0.14	2.5	4.8	0.03	0		4	3.5		0.47	8.9		0.008	0.047	0.27			0.27	0.03	0.0034		1	1	2.5		
8/4/2007		35	34	3	25	14	1	160	30	1	120	17	460							x	x	0.16	1	3.5		0.47	8.9		0.008	0.047	0.27	0.02	0.09	0.27	0.03	0.0034	0.056	1	1	15		
8/7/2007		66	100	3	1	14	1	1	50	1	1	17	460							0.1	0.02	1.5	5	3.5		0.47	8.9		0.008	0.047	0.27			0.06	0.03	0.0034	0.071	1	1	2.5		
8/9/2007		270	180	1	150	14	1	54	50	1	1	17	450	798						0.07	0.01	0.63	100			0.47	8.9	6.8	0.008	0.047	0.27				0.03	0.0034	0.13	1	2	2.5		
8/11/2007		74	300	3	44	14	1	22	30	1	2	17	450	860						0.05	0.01	0.17	1			0.47	8.9	7.2	0.008	0.047	0.27			0.01	0.03	0.0034	0.029	1	8	15	1	13
8/14/2007	AM	140	300	1	1	14	1	240	40	1	300	17	8.9	831						0.07	0.02	0.12	1			0.47	8.9	7.7	0.008	0.047	0.27			0.24	0.03	0.0034	0.036	1	26	12	1	50
8/14/2007	PM	66	300	1	310	14	1	20	40	1	5	14	370	714						0.2	0.02	1.7	1			0.47	370	11.3	0.008	0.047	0.30			0.3	0.17	0.0035	3.7	1	1	2.5	1	20
8/16/2007		300	300	63	300	14	130	22	50	68	6	16	440	826						0.1	0.01	0.37	71			0.48	8.9	7.6	0.008	0.047	0.27			0.07	0.03	0.0034	0.37	1	63	7.5	6	26
8/18/2007		230	40	1	45	14	4	75	50	7	46	17	460	920						0.11	0.02	0.08	5			0.47	8.9	8.7	0.008	0.047	0.27			0.07	0.03	0.0034	0.035	1	4	12	5	31

Color Key	
Below MDL =	
Refer to Case Narrative =	
Contact KSA =	
Look into =	
Refer to Pilot Event Log =	

City of Sunrise
Southwest WRF MBR Pilot Plant
BluePRO Analytical Data

	MBR Effluent												Blue Water Effluent								
	Phosphorus* mg/L	Ortho Phosphate* mg/L	Dissolved Ortho Phosphate	TSS	BOD 5	Alkalinity ($CaCO_3$)	Total Iron	Total Nitrogen	color	Ortho Phosphate as P	Acid Hydrolysable Phosphorus	Phosphorus	Phosphorus* mg/L	Ortho Phosphorus* mg/L	Alkalinity ($CaCO_3$)	BOD 5	Total Iron	Color	Total Nitrogen	TSS	Acid Hydrolysable Phosphorus
MDL	0.0053	0.00530		3.5 mg/L	1 mg/L		0.029 mg/L			0.0053	0.0053	0.027	0.0053	0.0053	5 mg/L	1 mg/L	.029 mg/L	2.5 cu		3.5 mg/L	0.0053
Date																					
9/10/2007	0.0963	0.03750											0.0568	0.0248							
9/11/2007	0.0665	0.00530		3.5	1	150	0.029	3.6	30				0.0921	0.0053	150	1.00	2.3	60	1.9	3.5	
9/12/2007	0.148	0.09950											0.211	0.15							
9/13/2007	0.0814	0.01700		3.5	1	150	0.054	0.75	30				0.0794	0.029	150	1.40	0.56	20	1.5	3.5	
9/14/2007	0.035	0.00740											0.0421	0.0262							
9/15/2007	0.0513	0.03220		3.5	1	150	0.036	1.4	30				0.0537	0.0335	160	1.00	0.64	18	3.3	3.5	
9/16/2007	Sunday - sample not taken												Sunday - sample not taken								
9/17/2007	0.0533	0.02060											0.0478	0.0305							
9/18/2007	0.645	0.59500		3.5	1	150	0.048	2.7	25				0.104	0.066	140	1.00	1.1	30	2.6	3.5	
9/19/2007	0.0576	0.03210											0.0696	0.0457							
9/20/2007	0.0663	0.03730		3.5	1	150	0.044	2.3	30				0.0758	0.0393	150	1.00	1.3	50	2.5	3.5	
9/21/2007	0.078	0.02110											0.104	0.0427							
9/22/2007	0.0678	0.01720		3.5	1	150	0.045	1.4	18				0.0583	0.0353	130	1.00	1.3	30	4.2	3.5	
9/23/2007	Sunday - sample not taken												Sunday - sample not taken								
9/24/2007	0.064	0.04300											0.0521	0.0343							
9/25/2007	0.0355	0.03300		3.5	1	110	0.033	2.6	40				0.0446	0.0282	120	2.20	0.44	40	2.7	3.5	
9/26/2007	0.042	0.00616											0.0425	0.012							
9/27/2007	0.0491	0.01780		3.5	1	140	0.051	3.4	30				0.0523	0.0169	140	1.00	0.28	20	3.3	3.5	
9/28/2007	0.258	0.24400											0.427	0.444							
9/29/2007	0.238	0.34000		3.5	1	180	0.083	24	20		0.1399		0.275	0.32	180	1.00	0.19	30	15	3.5	0.0053
9/30/2007	Sunday - sample not taken												Sunday - sample not taken								
10/1/2007	0.196	0.16600											0.149	0.0202							
10/2/2007	0.109	0.06450		3.5	4.4	190	0.068	18	30												
10/3/2007	0.139	0.09030																			
10/4/2007	0.0143	0.08420		3.5	21	200		15	20		0.0229										
10/5/2007	0.147	0.09600																			
10/6/2007	0.0587	0.02910		3.5	2.6	130	0.065	20	15												
10/7/2007	Sunday - sample not taken												Sunday - sample not taken								
10/8/2007	0.0263	0.00530							40												
10/9/2007	0.0314	0.00530		3.5	9.7	180	0.037	2.3	15					0.0309	170		0.061	10		3.5	
10/10/2007	0.0342	0.00530							15				0.0368	0.0172							
10/11/2007	0.029	0.01430		3.5	1.8	180	0.083	14	20		0.0053		0.0554	0.0053	42	6.60	0.091	10	10	3.5	
10/12/2007	0.0311	0.00939							50				0.0311	0.00939							
10/13/2007	0.0379	0.01240		11	2.1	200	0.095	19	20												

9/10/2007 Bluewater started
9/11/2007 Pilot upset for 6 hours (11 am till 5:15 pm)
9/17/2007 Pilot upset for 9.5 hours (2 am till 11:30 am) 9/16/2007
* Ortho Phosphorus and Total Phosphorus are being analyzed by USBiosystems, all other analytes are being done by KSA
BWT off, for AOP setup

Coagulation Experiment

Client: ______________________

Name: ____________ Sample ID: ______________________ Date: 8/5/2007

Coagulant Type: aluminum sulphate 48.5% Task ID: Task 3

Subtask ID: ______

COAGULATION DOSES						SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING									FILTERED WATER(0.8µm)							
Jar	Coag Dose	Coag	An Floc	An Floc	Temp	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity	Turb	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity
#	mg/L	mL	Dose	mL	oC	NTU	oC		Transmittance		mg/L as C	Coliphage (08)	Coliform (19)	(21)	NTU		Transmittance		mg/L as C	oliphage (0	Coliform (19	(21)
1	0	0				0.12	32		52						0.12		64	0.12				
2	25	2.5													27.94		48	0.04				
3	50	5													41.58		42	0.04				
4	75	7.5													57.07		34	0.03				
5	100	10													52.5			0.02				

Coagulation Time 1 minutes @ 80 RPM 95 G 5,700 GT

Flocculation Time
Stage 1
10 minutes @ 50 RPM 51 G 30,600 GT
Stage 1
10 minutes @ 27 RPM 21 G 12,600 GT

Sedimentation Time
_____ minutes @ _____ RPM

Coagulant: Aluminum Sulphate, 48.5% solution

Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

Coagulation Experiment

Client: City of Sunrise

Name: Dronix Suarez
Coagulant Type: aluminum sulphate 48.5%

Sample ID:
Task ID: Task 3
Subtask ID:

Date: 8/8/2007
Time: start - 2:10 pm, end - 3:11 pm, filtered - 4:25 pm

COAGULATION DOSES						SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING									FILTERED WATER(6.0µm)								
Jar	Coag Dose	Coag	An Floc	An Floc	Temp	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity
#	mg/L	mL	Dose	mL	oC	NTU	oC		Transmittance						NTU	oC		Transmittance					
1	0					0.06	31.8	7.04	48.3	0.37					Filtrate								
2	10														1.97	29.9	5.75	48	0.02				
3						After alum addition									sediment								
4	10					6.07	29.5	6.38	36	0.25					157.6	29.6	6.19	3	0.21				
5	50					0.06	31.8	7.04		0.37					1.96	29.5	3.87	68	0.01				
						After alum addition									sediment								
	50					49.57	31.3	4.08	27	0.23					577.3	28.9	3.85	2	0.13				

Coagulation Time 1 minutes @ 80 RPM 95 G 5,700 GT

Flocculation Time Stage 1 10 minutes @ 50 RPM 51 G 30,600 GT
Stage 1 10 minutes @ 27 RPM 21 G 12,600 GT

Sedimentation Time 1 hr minutes @ RPM

Coagulant: Aluminum Sulphate, 48.5% solution
Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

measure turbidity before filter and after sediment

Coagulation Experiment

Client: City of Sunrise

Name: Dronix Suarez
Coagulant Type: aluminum sulphate 48.5%

Sample ID:
Task ID: Task 3
Subtask ID:

Date: 8/7/2007

COAGULATION DOSES						SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING									FILTERED WATER(0.8µm)								
Jar	Coag Dose	Coag	An Floc	An Floc	Temp	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity
#	mg/L	mL	Dose	mL	oC	NTU	oC		Transmittance		mg/L as C	Coliphage (08)	Coliform (19)	(21)	NTU	oC		Transmittance		mg/L as C	oliphage (0	Coliform (19	(21)
1	0																						
2	25														filtrate								
3	50	5				0.01	30.4	7		0.16					4.3	29.9	3.9		0.01				
4	75					After alum addition									sediment								
5	100					2.64	27	6.75		0.12					762.7	29.9	3.9		0.09				

Coagulation Time 1 minutes @ 80 RPM 95 G 5,700 GT

Flocculation Time
Stage 1
10 minutes @ 50 RPM 51 G 30,600 GT
Stage 1
10 minutes @ 27 RPM 21 G 12,600 GT

Sedimentation Time
minutes @ RPM

Coagulant: Aluminum Sulphate, 48.5% solution
Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

Coagulation Experiment

Client: City of Sunrise

Name: Dronix Suarez
Coagulant Type: aluminum sulphate 48.5%

Sample ID:
Task ID: Task 3
Subtask ID:

Date: 8/6/2007

COAGULATION DOSES						SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING									FILTERED WATER(0.8µm)								
Jar	Coag Dose	Coag	An Floc	An Floc	Temp	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity	Turb	Temp	pH	UV-254	Ortho P	TOC (04)	Somatic	Fecal	Alkalinity
#	mg/L	mL	Dose	mL	oC	NTU	oC		Transmittance		mg/L as C	Coliphage (08)	Coliform (19)	(21)	NTU	oC		Transmittance		mg/L as C	oliphage (0	Coliform (19	(21)
1	0																						
2	25	2.5													2.61	29.1	5.3	70/80	0.02				
3	50	5																					
4	75																						
5	100																						

Coagulation Time 1 minutes @ 80 RPM 95 G 5,700 GT

Flocculation Time
Stage 1
10 minutes @ 50 RPM 51 G 30,600 GT
Stage 1
10 minutes @ 27 RPM 21 G 12,600 GT

Sedimentation Time
minutes @ RPM

Coagulant: Aluminum Sulphate, 48.5% solution
Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

Coagulation Experiment

Client: City of Sunrise

Name: Dronix Suarez
Coagulant Type: aluminum sulphate 48.5%

Sample ID:
Task ID: Task 6
Subtask ID:

Date: 8/20/2007

COAGULATION DOSES			SAMPLED WATER CHARACTERISTICS FOR ALUM DOSING								FILTERED WATER(6.0µm)							
Jar	Coag Dose	Coag	Turb (field)	Temp	pH	UV-254 (0.45micron)	Ortho P (09)	Total P (12)	Turbidity (02)	TOC (04)	Turb (field)	Temp	pH	UV-254 (0.45micron)	Ortho P (09)	Total P (12)	Turbidity (02)	TOC (04)
#	mg/L	mL	NTU	oC		Transmittance	mg/L	mg/L	NTU	mg/L as C	NTU	oC		Transmittance	mg/L	mg/L	NTU	mg/L as C
1	0	0	0.52	27.9	6.97	97	0.044	0.11	1.9	15	0.52	28	6.99	97	0.054	0.11	1.2	15
2	5	0.5									26.11	27.3	6.93	65	0.008	0.1	2.6	13
3	10	1									10.04	22.5	6.94	68	0.082	0.11	14	15
4	15	1.5									10.02	26.8	6.4	63	0.028	0.1	4	14
1	0	0	0.52	27.9	6.79	97	0.054	0.097	1.2	16	0.52	28	6.99	97	0.066	0.11	1.2	15
2	20	2									6.16	26.7	6.4	59	0.09	0.11	1.4	9.7
3	30	3									6.18	26.61	4.55	56	0.008	0.1	6.9	8.8
4	50	5									5.45	27.4	3.8	55	0.012	0.11	8.3	10

Coagulation Time 1 minutes @ 80 RPM 95 G 5,700 GT

Flocculation Time
Stage 1
10 minutes @ 50 RPM 51 G 30,600 GT
Stage 1
10 minutes @ 27 RPM 21 G 12,600 GT

Sedimentation Time
minutes @ RPM

Coagulant: Aluminum Sulphate, 48.5% solution
Coagulant Aids : Magna floc 32, Magna floc 34, Magna floc 38 are all inversion emulsion, low degree anionic charge (dose of 0.3, 0.6 and 1 mg/L)

Task 4
Disinfection of Control Stream

Name: Dronix Suarez Date: 15-Aug
Alum Dose in Pilot:

Dose	Sampled water for UV					
	UV-254	Turb	Temp	pH	Total Coliform(29)	Fecal (19)
	Abs.	NTU	^{o}C			
0	56	0.15	29.3	6.87	8	1
	UV Treated Water					
	UV-254	Turb	Temp	pH	Total Coliform(29)	Fecal (19)
	Abs.	NTU	^{o}C			
10	54	0.14	28.2	6.85	6	1
20	56	0.13	27.3	6.81	5	1
30	53	0.14	26.9	6.87	1	1

Task 5
Disinfection of RO Permeate Sampling Results

Name: Dronix   Date: 8-Aug

Dose	Sampled water for UV							
	T	Time	Turb	Temp	pH	TSS (03)	HPC (17)	Fecal (19)
	Trans	(min)	NTU	^oC		mg/L	cfu/mL	cfu/100mL
0	99	0	0.05	30.6	7.01	3.5	2	1
	UV Treated Water							
	UV-254	Time	Turb	Temp	pH	TSS (03)	HPC (17)	Fecal (19)
	Trans	(min)	NTU	^oC		mg/L	cfu/mL	cfu/100mL
20	99	3.4	0.01	31.4	6.39	3.5	1	1
40	99	4.3	0.01	28.3	6.1	3.5	1	1
60	99	6.5	0.01	29.2	5.7	3.5	1	1
80	99	8.64	0.02	27.9	5.63	3.5	1	1
100	99	10.8	0.01	30.3	5.62	3.5	1	1
	Sampled water for Peroxide-UV							
	UV-254	Time	Turb	Temp	pH	TSS (03)	HPC (17)	Fecal (19)
	Trans	(min)	NTU	^oC		mg/L	cfu/mL	cfu/100mL
0	99	0	0.02	29.6	5.59	3.5	1	1
	Sampled water with Peroxide							
	UV-254	Time	Turb	Temp	pH	TSS (03)	HPC (17)	Fecal (19)
	Trans	(min)	NTU	^oC		mg/L	cfu/mL	cfu/100mL
0	86	0	0.03	28.3	5.65	3.5	1	1
	UV-254	Time	Turb	Temp	pH	TSS (03)	HPC (17)	Fecal (19)
	Trans	(min)	NTU	^oC		mg/L	cfu/mL	cfu/100mL
50	86	9.95	0.03	30.5	5.51	3.5	1	1
100	86	19.91	0.03	32.3	5.53	3.5	1	1
200	86	39.81	0.03	32.2	5.82	3.5	1	1
300	86	59.71	0.03	32.2	5.81	3.5	2	1
500	86	99.53	0.03	32.7	5.82	3.5	1	1

City of Sunrise
Pilot Testing - Microconstituent Analysis Result of the MBR and RO Treatment Streams

Microconstituents	MRL	units	Raw	MRL	units	MBRout	MRL	units	RO in	MRL	units	RO out	MRL	units	Raw	MRL	units	MBR out	MRL	units	RO out
			8/17/2007			8/17/2007			8/17/2007			8/17/2007			8/18/2007			8/18/2007			8/18/2007
1,4-dioxane	2.0	ug/l	ND	2.0	ug/l	ND	2.0	ug/l	ND	2.0	ug/l	ND	2.0	ug/l	ND	2.00	ug/l	ND	2.00	ug/l	ND
2,6-di-tert-butylphenol	10.0	ng/l	2600	10.0	ng/l	ND	10.0	ng/l	ND	10	ng/l	ND	10	ng/l	ND	10.00	ng/l	ND	10.00	ng/l	ND
4-methylphenol	25.0	ng/l	55631	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	38757	25.00	ng/l	28	25.00	ng/l	29
4-nonylphenol	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	ND	25.00	ng/l	ND
Acetaminophen	5.0	ng/l	4850	1.0	ng/l	ND	1.0	ng/l	ND	1.0	ng/l	ND	140.0	ng/l	12000	1.00	ng/l	ND	1.00	ng/l	ND
alpha chlordane	10.0	ng/l	ND	10.0	ng/l	ND	10.0	ng/l	ND	10	ng/l	ND	10	ng/l	ND	10.00	ng/l	ND	10.00	ng/l	ND
Bisphenol A (BPA)	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	38	25.00	ng/l	ND
Caffeine by LC-MS-MS	25.0	ng/L	141000	1.0	ng/l	9.2	1.0	ng/l	12	1.0	ng/l	ND	13.0	ng/l	20700	1.00	ng/l	9.9	1.00	ng/l	ND
Caffeine by GCMS LLE	25.0	ng/l	52915	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	47892	25.00	ng/l	ND	25.00	ng/l	ND
Carbamazepine	25.0	ng/l	970	5.0	ng/l	350	5.0	ng/l	340	5.0	ng/l	ND	65.0	ng/l	2860	5.00	ng/l	240	5.00	ng/l	ND
Carbaryl	50.0	ng/l	ND	50.0	ng/l	128	50.0	ng/l	184	50	ng/l	ND	50	ng/l	ND	50.00	ng/l	ND	50.00	ng/l	ND
Chlorpyrifos	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	ND	25.00	ng/l	ND
DEET	25.0	ng/l	2347	25.0	ng/l	334	25.0	ng/l	326	25	ng/l	ND	25	ng/l	2781	25.00	ng/l	156	25.00	ng/l	ND
Diazinon	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	ND	25.00	ng/l	ND
dieldrin	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	ND	25.00	ng/l	ND
Esterone	5.0	ng/l	540	1.0	ng/l	560	1.0	ng/l	600	1.0	ng/l	ND	13.0	ng/l	800	1.00	ng/l	480	1.00	ng/l	1.2
Estradiol	5.0	ng/l	15	1.0	ng/l	18	1.0	ng/l	ND	1.0	ng/l	ND	13.0	ng/l	16	1.00	ng/l	ND	1.00	ng/l	ND
Ethhynl estradiol-17	25.0	ng/l	ND	5.0	ng/l	37	5.0	ng/l	43	5.0	ng/l	ND	65.0	ng/l	ND	5.00	ng/l	39	5.00	ng/l	ND
Fluoxetine	5.0	ng/l	15	1.0	ng/l	29	1.0	ng/l	28	1.0	ng/l	ND	13.0	ng/l	21	1.00	ng/l	31	1.00	ng/l	ND
Gemfibrozil	50.0	ng/l	14800	1.0	ng/l	310	1.0	ng/l	370	1.0	ng/l	ND	13.0	ng/l	35600	1.00	ng/l	170	1.00	ng/l	ND
Ibuprofen	5.0	ng/l	120	1.0	ng/l	56	1.0	ng/l	120	1.0	ng/l	ND	13.0	ng/l	1900	1.00	ng/l	57	1.00	ng/l	ND
Iopromide	25.0	ng/l	ND	5.0	ng/l	ND	5.0	ng/l	ND	5.0	ng/l	ND	65.0	ng/l	ND	5.00	ng/l	100	5.00	ng/l	ND
Methyl parathion	25.0	ng/l	ND	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	ND	25.00	ng/l	ND
Methyl Tert-butyl ether (MTBE)	0.5	ug/l	ND	0.5	ug/l	ND	5.0	ug/l	ND	0.5	ug/l	ND	0.5	ug/l	ND	0.50	ug/l	ND	0.50	ug/l	ND
N-Nitroso Dimethylamine	2.0	ng/l	12	2.0	ng/l	4.8	2.0	ng/l	5.4	2.0	ng/l	2.8	2.0	ng/l	7.5	2.00	ng/l	4.5	2.00	ng/l	ND
Perchlorate	10.0	ug/l	ND	2.0	ug/l	ND	2.0	ug/l	ND	2.0	ug/l	ND	10.0	ug/l	ND	2.00	ug/L	ND	2.00	ug/l	ND
phenol	100.0	ng/l	9400	100.0	ng/l	ND	100.0	ng/l	ND	100	ng/l	ND	100	ng/l	9462	100.00	ng/l	ND	100.00	ng/l	118
Progesterone	5.0	ng/l	14	1.0	ng/l	2.8	1.0	ng/l	ND	1.0	ng/l	ND	13.0	ng/l	31	1.00	ng/l	ND	1.00	ug/l	ND
Sulfamethoxazole	5.0	ng/l	60	1.0	ng/l	480	1.0	ng/l	500	1.0	ng/l	ND	13.0	ng/l	3300	1.00	ng/l	390	1.00	ug/l	ND
TDCPP	25.0	ng/l	ND	25.0	ng/l	145	25.0	ng/l	151	25.0	ng/l	ND	25	ng/l	ND	25.00	ng/l	167	25.00	ng/l	ND
Testosterone	5.0	ng/l	ND	1.0	ng/l	ND	1.0	ng/l	ND	1.0	ng/l	ND	13.0	ng/l	ND	1.00	ng/l	ND	1.00	ng/l	ND
Triclosan - EDC screen LC-MS-MS	25.0	ng/l	200	5.0	ng/l	120	5.0	ng/l	120	5.0	ng/l	ND	65.0	ng/l	730	5.00	ng/l	100	5.00	ng/l	ND
Triclosan - EDC phenols waste parm	50.0	ng/l	6931	50.0	ng/l	169	50.0	ng/l	182	50	ng/l	ND	50	ng/l	4828	50.00	ng/l	197	50.00	ng/l	ND
Trimethoprim	5.0	ng/l	12800	1.0	ng/l	2700	1.0	ng/l	2800	1.0	ng/l	140	130.0	ng/l	14000	1.00	ng/l	2800	1.00	ng/l	140
triphenylphosphate	25.0	ng/l	100	25.0	ng/l	ND	25.0	ng/l	ND	25	ng/l	ND	25	ng/l	83	25.00	ng/l	ND	25.00	ng/l	ND
tris (2-butoxyethyl) phosphate (TBEP)	100.0	ng/l	ND	100.0	ng/l	316	100.0	ng/l	331	100	ng/l	ND	100	ng/l	1694	100.00	ng/l	351	100.00	ng/l	ND
tris (2-chloroethyl) phosphate (TCEP)	25.0	ng/l	ND	25.0	ng/l	100	25.0	ng/l	98	25	ng/l	ND	25	ng/l	ND	25.00	ng/l	120	25.00	ng/l	ND

City of Sunrise
Effect of Chemical Addition within MBR on Microconstituent Removal

Microconstituents	**Raw**	***MRL***	***units***	**MBRout**	***MRL***	***units***	**Raw**	***MRL***	***units***	**MBRout**	***MRL***	***units***
	10/9/2007			10/9/2007			10/11/2007			10/11/2007		
1,4-dioxane	ND	2.0	ug/L	ND	2	ug/L	ND	2.0	ug/L	ND	2	ug/L
2,6-di-tert-butylphenol	ND	100.0	ng/l	ND	10	ng/l	ND	100.0	ng/l	ND	10	ng/l
4-methylphenol	67000	6250.0	ng/l	102.0	25	ng/l	61000	6250.0	ng/l	95.0	25	ng/l
4-nonylphenol	ND	250.0	ng/l	ND	25	ng/l	ND	250.0	ng/l	ND	25	ng/l
Acetaminophen	3700	10.0	ng/l	345.0	1	ng/l	5620	10.0	ng/l	77.0	1	ng/l
alpha chlordane	ND	10.0	ng/l	ND	0.05	ug/l	ND	10.0	ng/l	ND	0.05	ug/l
Atrazine	ND	0.1	ug/L	ND	0.05	ug/l	ND	0.1	ug/L	0.2	0.05	ug/l
Bisphenol A (BPA)	251	250.0	ng/l	133.0	25	ng/l	ND	250.0	ng/l	104.0	25	ng/l
Caffeine by LC-MS-MS	1800	10.0	ng/l	490.0	1	ng/l	2630	10.0	ng/l	720.0	1	ng/l
Caffeine by GCMS LLE	64000	6250.0	ng/l	3000.0	250	ng/l	62000	6250.0	ng/l	5500.0	500	ng/l
Carbamazepine	14	5.0	ng/l	183.0	5	ng/l	220	5.0	ng/l	206.0	5	ng/l
Carbaryl	ND	50.0	ng/l	690.0	50	ng/l	ND	50.0	ng/l	ND	50	ng/l
Chlorpyrifos	ND	25.0	ng/l	ND	25	ng/l	ND	25.0	ng/l	ND	25	ng/l
DEET	779	250.0	ng/l	456.0	25	ng/l	923	250.0	ng/l	273.0	25	ng/l
Diazinon	ND	0.1	ug/L	ND	25	ng/l	ND	0.1	ug/L	ND	25	ng/l
dieldrin	ND	0.2	ug/L	ND	25	ng/l	ND	0.2	ug/L	ND	25	ng/l
Diethylphalate	15	0.5	ug/l	ND	0.5	ug/l	11	0.5	ug/l	ND	0.5	ug/l
Esterone	120	1.0	ng/l	15.0	1	ng/l	230	1.0	ng/l	67.0	1	ng/l
Estradiol	1.5	1.0	ng/l	ND	2	ng/l	14	1.0	ng/l	ND	2	ng/l
Ethhynl estradiol-17	ND	5.0	ng/l	ND	5	ng/l	45	5.0	ng/l	ND	5	ng/l
Fluoxetine	ND	1.0	ng/l	8.2	1	ng/l	ND	1.0	ng/l	14.0	1	ng/l
Gemfibrozil	5.3	1.0	ng/l	3.5	1	ng/l	ND	1.0	ng/l	12.0	1	ng/l
Ibuprofen	22	1.0	ng/l	2.6	1	ng/l	410	1.0	ng/l	410.0	1	ng/l
Iopromide	ND	5.0	ng/l	ND	5	ng/l	ND	5.0	ng/l	ND	5	ng/l
Methyl parathion	ND	250.0	ng/l	ND	25	ng/l	ND	250.0	ng/l	ND	25	ng/l
N-Nitroso Dimethylamine	11	4.0	ng/l	7.1	2	ng/l	11	4.0	ng/l	9.3	4	ng/l
phenol	18000	2000.0	ng/l	102.0	100	ng/l	12000	2000.0	ng/l	ND	100	ng/l
Progesterone	27	1.0	ng/l	ND	1	ng/l	67	1.0	ng/l	5.8	1	ng/l
Sulfamethoxazole	ND	5.0	ng/l	ND	1	ng/l	ND	5.0	ng/l	ND	1	ng/l
TDCPP	ND	25.0	ng/l	141.0	25	ng/l	ND	25.0	ng/l	140.0	25	ng/l
Testosterone	ND	5.0	ng/l	ND	1	ng/l	ND	5.0	ng/l	ND	1	ng/l
Triclosan - EDC screen LC-MS-MS	ND	25.0	ng/l	ND	5	ng/l	ND	25.0	ng/l	ND	5	ng/l
Triclosan - EDC phenols waste parm	4000	500.0	ng/l	422.0	50	ng/l	2400	500.0	ng/l	495.0	50	ng/l
Trimethoprim	ND	5.0	ng/l	ND	1	ng/l	ND	5.0	ng/l	ND	1	ng/l
triphenylphosphate	ND	25.0	ng/l	ND	25	ng/l	ND	25.0	ng/l	ND	25	ng/l
tris (2-butoxyethyl) phosphate (TBEP)	1500	1000.0	ng/l	1600.0	1000	ng/l	1100	1000.0	ng/l	1400.0	1000	ng/l
tris (2-chloroethyl) phosphate (TCEP)	ND	250.0	ng/l	174.0	25	ng/l	ND	250.0	ng/l	66.0	25	ng/l

APPENDIX P - SW WTP Raw Well Water Quality 10/17/07

PARAMETER	RESULTS	UNITS	MDL
Biochemical Oxygen Demand, Soluble	U	mg/L	2.0
SM5210B Carbonaceous BOD	U	mg/L	2.0
Coliform, Total	U	CFU100ml	1.0
Coliform, Fecal	U	CFU100ml	1.0
Temperature (Field)	25.5	Degree C	1.0
pH	6.53	units	0.1
Total Dissolved Solids (TDS)	516	mg/L	1.0
Total Suspended Soilds (TSS)	U	mg/L	1.3
Turbidity (lab)	21.7	NTU	0.1
Nitrate (as N)	0.455	mg/L	0.010
Ortho-Phosphate (as P)	U	mg/L	0.043
Ortho-Phosphate (as P) Filtered	U	mg/L	0.043
Alkalinity, Total (CaCO3) Endpoint 4.3	156	mg/L	0.1
Halogens, Total Organic	6.5	mg/L	0.110
Nitrogen (Ammonium, NH4+)	1.09	mg/L	0.02
Nitrogenn (Kjeldahl) as N	1.97	mg/L	0.045
Nitrogen, Total as "N"	2.43	mg/L	0.040
Phosphorus, Total as "P"	U	mg/L	0.031
Phosphorus, Total as "P" (Filered)	U	mg/L	0.031
Chemical Oxygen Demand	45.3	mg/L	4.09
Soluble Chemical Oxygen Demand	49.8	mg/L	1.980
Color (Lab)	120	Pt-Co	1.000
Organic Carbon, Total	13.9	mg/L	0.302
Iron	2.52	mg/L	0.001
Manganese	0.02	mg/L	0.000
Zinc	U	mg/L	0.000
Ultraviolet Absorption Method	0.493	1/cm	0.009