CITY OF TAMPA

HOWARD F. CURREN AWTP PHASE 2 MASTER PLAN REPORT

FINAL DRAFT—VOLUME 2 | RFQ 15-D-00013

JUNE 2018

McKIM&CREED

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Appendix A

Howard F. Curren AWTP Master Plan

Existing Systems Technical Memorandum of Findings

August 2016

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CITY OF TAMPA

HOWARD F. CURREN AWTP MASTER PLAN

RFQ 15-D-00013

EXISTING SYSTEMS TECHNICAL MEMORANDUM OF FINDINGS

August 2016
Final

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City of Tampa Howard F. Curren AWTP Master Plan
Howard F. Curren AWTP Master Plan

RFQ 15-D-00013

EXISTING SYSTEMS TECHNICAL MEMORANDUM OF FINDINGS

August 2016
Final

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1 Introduction

The City of Tampa (City) Howard F. Curren Advanced Wastewater Treatment Plant (HFC AWTP) is permitted to treat 96-MGD with a Type I two-stage, high rate (pure oxygen and fine bubble aeration) activated sludge biological nitrification/ denitrification domestic wastewater treatment plant. This plant is operated to discharge AWT, high-level disinfected and dechlorinated effluent to Hillsborough Bay. Residuals generated by this facility can be heat dried to meet Class AA standards for distribution and marketing or can be dewatered for land application as a Class B residual. Currently, annual average daily flows are 60 MGD with peak flows of 200 MGD.

The last master plan was completed in January 1989. The emphasis of the plan was to provide improvements to increase plant capacity while meeting new upcoming regulatory treatment requirements. Several of the improvements identified in the plan have been completed increasing the capacity of the plant to the current permit limits of 96 MGD annual average daily flow (AADF) and 200 MGD peak hourly flow (PHF). Based on current flow rates and estimated future flow rates, additional improvements to increase the capacity of the plant are not needed. Since the completion of the projects to increase plant capacity, the Wastewater Department (WWD) has also completed several additional system improvement and equipment replacement projects to maintain system reliability and improve operating efficiency. The WWD has also completed studies for specific treatment processes to identify other improvements to help maintain reliability and improve operational efficiency.

The WWD is now seeking to develop an overall facility master plan for the treatment plant to incorporate these studies, completed improvements, future improvements to maintain system reliability, address current and potential regulatory requirements, and to reduce the operating cost of the treatment plant. The City would like to complete the master plan in phases to observe and evaluate the overall facility, evaluate new technologies to enhance plant performance and further reduce operational costs, develop process enhancement alternatives, and prepare a new Wastewater Master Plan for the HFC AWTP. This approach will help to focus the effort on the areas that need the most evaluation and can provide the best return for the City.

2 General

2.1 Population Projections

HFC AWTP serves the population of the City of Tampa. In addition, the City of Temple Terrace is a bulk customer and portions of Hillsborough County are also served. A map of the HFC AWTP wastewater service area is provided in **Appendix A**. Population projections for the service area were estimated by ARCADIS in May 2015 for the "Updated Capacity Analysis Report" (2015 CAR). The report estimated population projections through 2025. Projections were calculated by adjusting the growth projections from the 2009 Tampa Comprehensive Plan based on the actual-to-projected rate of growth seen in 2010. These adjustments result in a smaller growth rate than those estimated for the City of Tampa in the Imagine 2040 Comprehensive Plan and the Bureau of Economic and Business Research (BEBR) Projections, as seen in **Table 2-1**. The smaller growth rate is more consistent with actual growth and was used to estimate flow projections in **Table 2-2**. The average per capita rate for 2011-2015 is 110 gallons per day per capita (gpdpc) and is used to calculate the flow projections in **Table 2-2**.

Table 2-1 – Validation of ARCADIS Population Estimates

Year	HFC AWTP Service Area Population	HFC AWTP Service Area Growth	Tampa Growth Projections Per Imagine 2040 Tampa Comprehensive Plan	Tampa Growth Per BEBR Projections
2011	533,944	-	-	-
2015	561,321	5%	-	-
2020	598,509	7%	8%	10%
2025	635,696	6%	7%	8%

Table 2-2 – Flow Projections

Year	Service Area Population	Projected Flow (MGD)
2015	561,321	61.7
2016	568,759	62.6
2017	576,196	63.4
2018	583,634	64.2
2019	591,071	65.0
2020	598,509	65.8
2021	605,946	66.7
2022	613,384	67.5
2023	620,821	68.3
2024	628,258	69.1
2025	635,696	69.9

2.2 Historic and Future Flow Data

The City provided historical hourly flow data for the plant from January 2010 to October 2015. The 2004 Recommended Standards for Wastewater Facilities (10 State Standards) suggest using a normal flow rate of 100 gpdpc when designing new wastewater facilities. This rate is intended to be used with a peaking factor calculated from the 10 State Standards to account for normal infiltration and inflow (I&I) expected in a collection system built with modern construction techniques. For the HFC AWTP service area, a peak hourly factor of 1.51 is expected as seen in **Appendix B**. The HFC AWTP historical flow rates were analyzed and a summary of the data is in **Table 2-3**. This rate may be higher than the 10 State Standards rates because it was calculated using the plant AADF, which is inclusive of system I&I. The AADF is approximately 62% of the 96 MGD design average daily flow (ADF) and the peak flows are approximately 68% of the 221 MGD design PHF. The average peaking factor for the last 5 years is 2.40 (58% higher than 1.51). This is an indication of very high I&I.

Table 2-3 – HFC AWTP Historical Influent Flow Data

Year	Service Area Population	AADF (MGD)	Per Capita Flow (gpdpc)	Maximum 3-MADF (MGD)	Peak Day (MGD)	95th Percentile Peak Day Flow (MGD)	95th Percentile Peak Hour Flow (MGD)	PHF (MGD)	Peak Hourly Flow Factor
2010	527,100	56.3	106.9	63.4	94.1	86.1	114.5	122.8	2.18
2011	533,944	57.5	107.7	66.8	91.9	91.8	154.0	156.3	2.72
2012	540,788	59.7	110.3	75.5	132.0	122.6	156.5	163.3	2.74
2013	547,633	60.8	111.1	75.9	105.1	101.2	132.2	132.5	2.18
2014	556,395	59.1	106.2	64.4	98.9	98.3	125.7	128.9	2.18
2015[(1)]	561,321	64.5	114.9	87.6	159.5	141.7	172.8	190.15	2.95

[(1)]Data provided only extended through October 26, 2015

2.2.1 Industrial Waste Loads

Based on discussions with City staff, the HFC AWTP receives industrial waste from contract haulers. Small waste loads (septage, grey water, etc.) are discharged into a concrete containment area and drained into the raw sewage pump station (RSPS) that then pumps raw sewage to Junction Chamber No. 1. Large waste loads (leachate from Pasco County and Tampa Bay Water desalination wash water), are discharged into a concrete containment area that connects to the main pump station by a series of drains. Trucks are allowed to discharge at the plant anytime during the plant's 24/7 operation. However, they are encouraged to operate during normal business hours. Leachate tanker loads average 6,000 gallons and the plant receives multiple trucks a day. Small waste trucks range from 100 - 2,000 gallons and average one trip per day. **Table 2-4** identifies the average daily loads received at the plant. Conversation with the Hillsborough County Department of Health (DOH) revealed that there is supposed to be a state ruling coming into effect July 1, 2016 that would ban the land application of septage. Currently, FAC 64E-6 allows the land application of qualifying septage. A majority of haulers in Hillsborough County are using this method of disposal. When the rule comes into effect, haulers will

have to dispose of septage waste at wastewater treatment plants. According to the Hillsborough County DOH, 8.7 MG of septage was spread by land application in 2015 and a considerable portion of this could potentially be sent to HFCAWTP. The volume of septage is not much of a concern. However, the strength of the waste could affect downstream biological processes and would be worth monitoring more closely. Currently, waste quality is reported by the haulers themselves and the City only samples on various occasions. Automating the industrial waste receiving stations could be investigated to better evaluate the impacts of industrial waste on the plant in the future.

Table 2-4 – Industrial Waste Loads to the HFCAWTP

Year	Septage	Portable Toilets	Grey Water	Ship and Marina	Food Processors	Leachate	Desal Plant Wash Water	Total
	GPD							
2011	3,341	7,881	7,401	610	3,888	21,452	1,768	46,341
2012	7,402	7,699	16,812	917	4,551	21,549	1,564	60,495
2013	5,865	8,481	2,484	351	4,912	25,712	6,096	53,901
2014	6,318	8,961	4,092	767	3,858	27,863	1,973	53,831
2015	6,221	8,258	3,144	1,150	3,733	23,704	2,137	48,347
Average	5,830	8,256	4,280[(1)]	759	4,188	24,056	2,708	50,076[(1)]

[(1)]Excludes the abnormal grey water load in 2012.

As seen in **Figure 2-1** and **Figure 2-2**, leachate is the largest load by volume, but is not the strongest load by quality.

Figure 2-1 – Industrial Waste Loads to the HFCAWTP

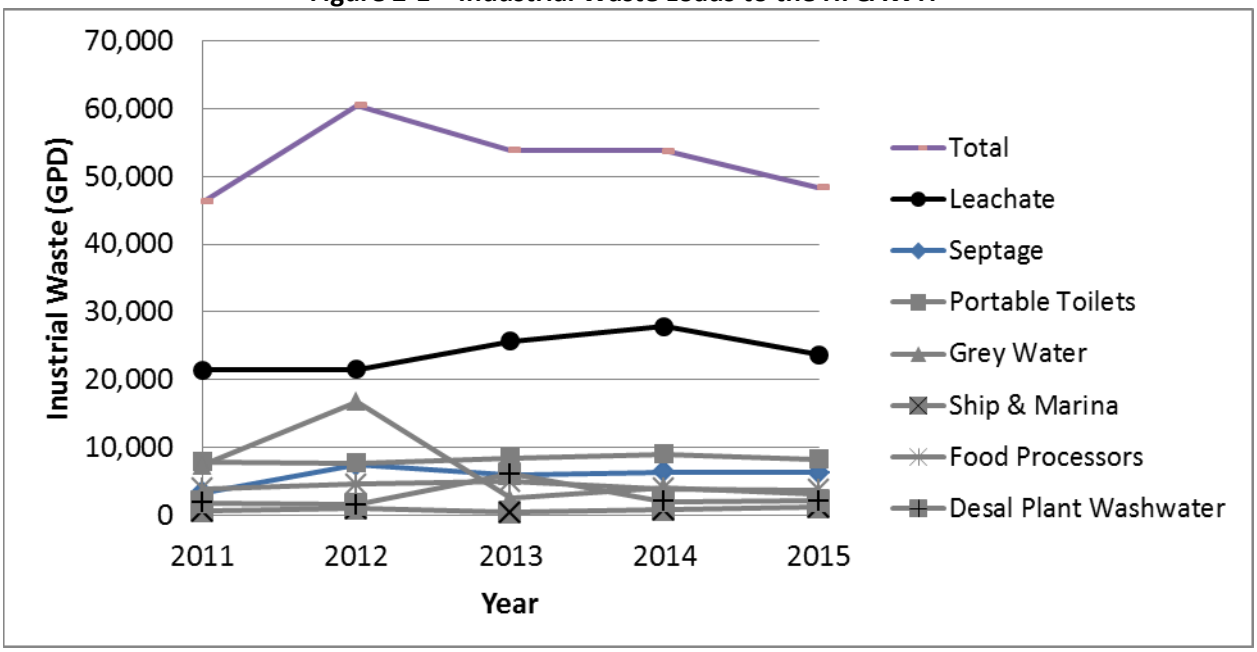
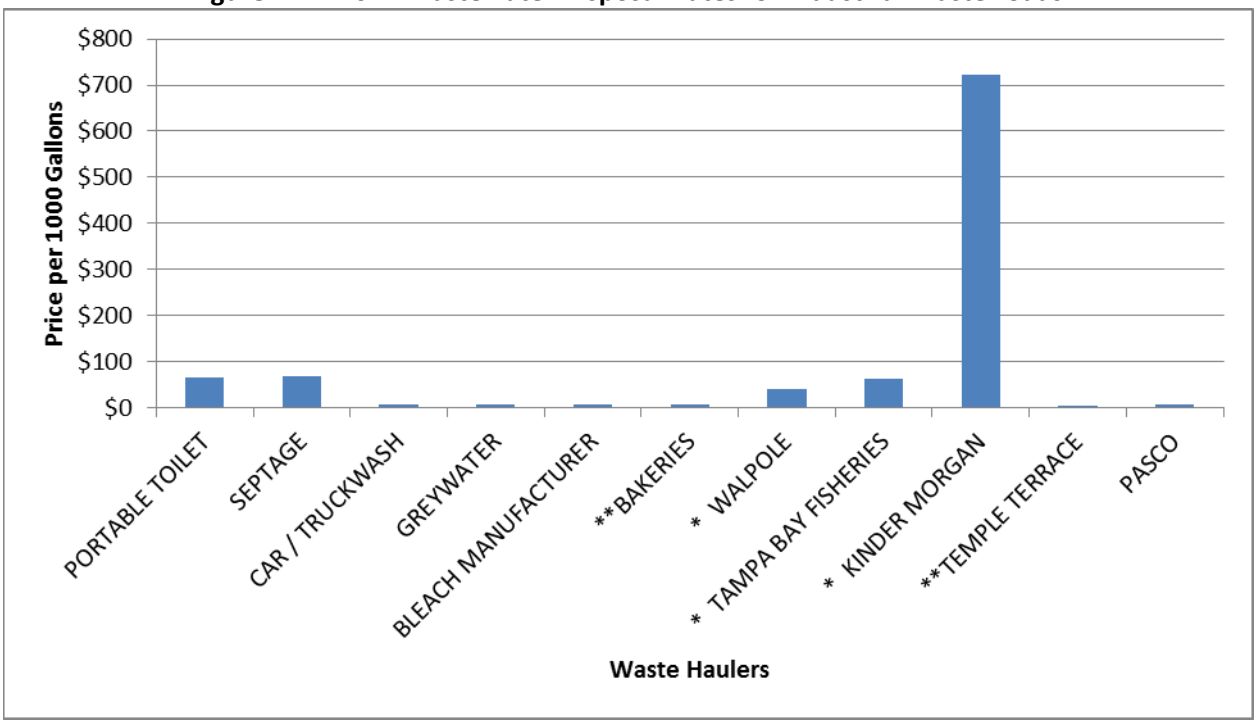


Figure 2-2 – 2012 Wastewater Disposal Rates for Industrial Waste Loads



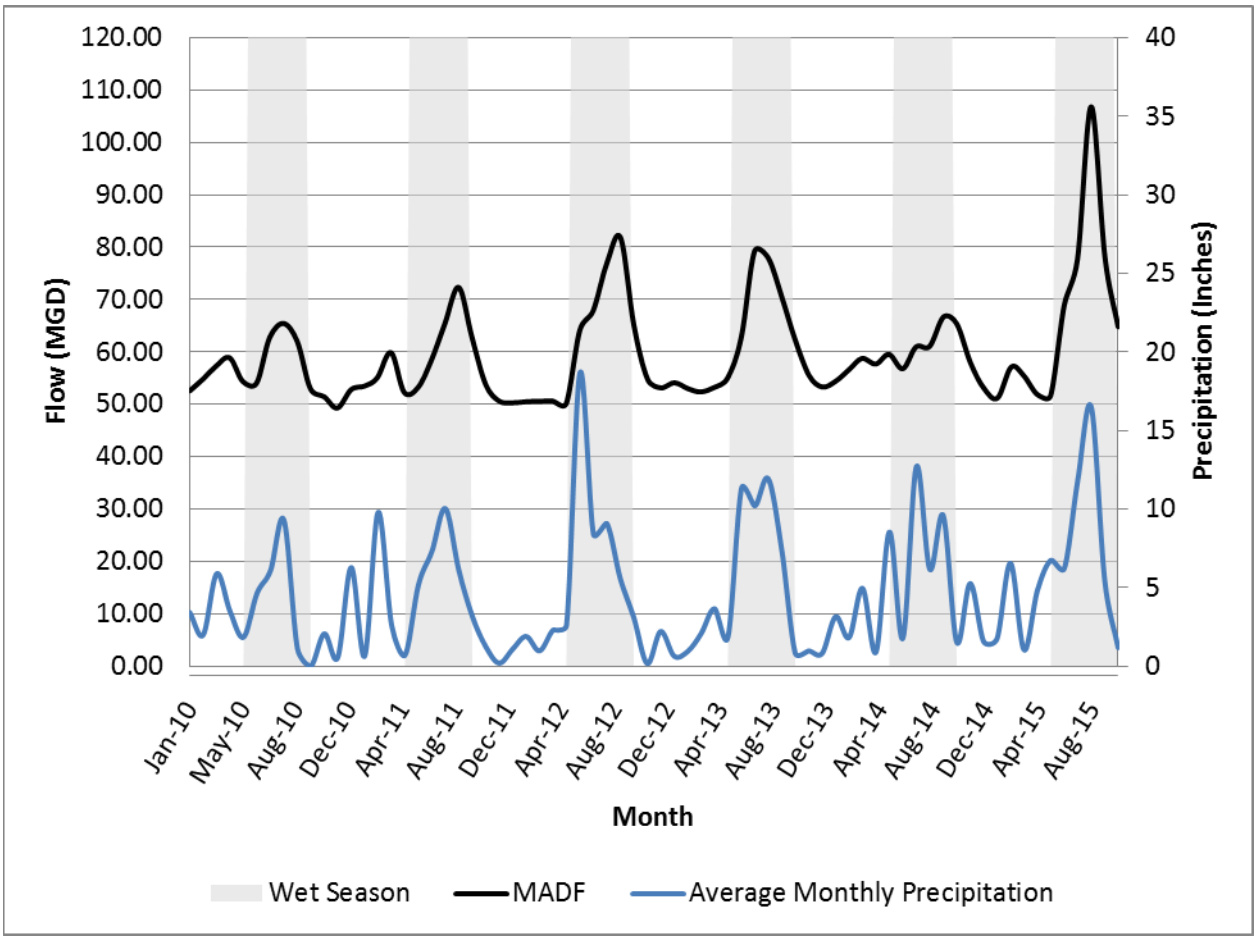
* SUBJECT TO PERIODIC ADJUSTMENT
** $/Per CCF

2.3 Wet Weather Determination

Monthly precipitation data at the Tampa Airport Station was obtained from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. As seen in **Figure 2-3**, the wet

weather months are May through September, while the dry weather months are October through April. The wet weather months can have very large rain events that appear to contribute to high peaks in plant flow – another indication of high I&I. According to the Guidelines for Preparation of Operation and Maintenance Performance Reports, I&I is considered excessive when domestic wastewater and infiltration received at the plant are greater than 120 gpdpc during seasons of high ground water. An indication for excessive I&I can be estimated using the maximum month average daily flow (MMADF). As seen in **Table 2-5**, this results in rates consistently at or above the 120 gpdpc threshold and the HFC AWTP collection system should be further investigated for excessive I&I. Further investigation would include calculations to more accurately estimate impacts of rainfall by finding the baseline dry weather flow then correlating inches of rainfall to additional flow to the plant, evaluate the cost effectiveness of I&I mitigation, followed by a series of investigations to identify the locations of I&I sources. After the source is identified, a rehabilitation strategy can be recommended.

Figure 2-3 – Influent Flow and Precipitation



Precipitation Source: NOAA National Climatic Data Center

Table 2-5 – Determination of Excessive Infiltration & Inflow

Year	Service Area Population	MMADF (MGD)	Capita Flow Rate during Seasonal High Groundwater (GPDPC)
2010	527,100	65.45	124.17
2011	533,944	72.32	135.45
2012	540,788	81.81	151.28
2013	547,633	79.24	144.69
2014	556,395	66.68	119.85
2015[(1)]	561,321	106.81	190.28

[(1)]Data provided only extended through October 26, 2015

2.4 Historic and Future Water Quality Data

2.4.1 Historic and Projected Influent Loading

Monitoring and sampling of the plant influent and effluent is performed daily at the HFC AWTP to comply with permit reporting requirements and for operational purposes. Influent and effluent characteristics monitored by the City are preserved in Monthly Operating Reports (MORs). Data was collected from MORs for the past five years, from January 2010 through September 2015, to determine the mass loading rates of key constituents to the treatment plant and to confirm treatment efficiency. The plant influent mass loading rate for 5-day Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), Total Kjeldahl Nitrogen (TKN), and Total Phosphorus (TP) was calculated for several conditions including annual average, maximum day, and minimum day. The historical influent mass loading rates for these scenarios are shown in **Table 2-6**.

Table 2-6 – Historical Influent Constituent Loading Rates

Year	Annual Average			
	BOD5	TSS	TKN	TP
	lb/day	lb/day	lb/day	lb/day
2010	64,013	55,435	14,183	2,057
2011	72,805	65,033	14,978	2,005
2012	88,777	80,053	16,726	2,381
2013	78,424	72,054	15,655	2,137
2014	86,069	73,933	16,707	2,362
2015	87,213	82,910	16,571	2,540
Year	Maximum Day			
	BOD_5	TSS	TKN	TP
	lb/day	lb/day	lb/day	lb/day
2010	122,836	205,139	18,501	6,567
2011	194,243	252,497	22,463	8,019
2012	201,102	227,680	26,128	7,358
2013	343,675	387,952	31,754	5,801
2014	170,807	171,833	31,108	4,754
2015	239,426	347,062	62,444	6,849
Year	Minimum Day			
	BOD_5	TSS	TKN	TP
	lb/day	lb/day	lb/day	lb/day
2010	24,311	11,676	9,926	1,269
2011	27,358	12,531	8,472	1,017
2012	39,729	30,282	8,761	1,144
2013	31,469	23,602	10,313	1,068
2014	27,364	15,212	8,300	1,309
2015	25,449	20,470	9,057	1,134

These mass loading rates were compared to the service area population to evaluate the per capita mass contribution for each constituent in order to validate the population information presented in the previous section. Industry standard texts have compiled average per capita mass loading contributions for typical wastewater constituents to aid in the planning, design, and evaluation of wastewater systems. **Table 2-7** presents the per capita contributions for the five year study period as well as a comparison to the industry standard values. The per capita mass loading rates to the HFC AWTP are almost identical to the United States typical per capita loading rates reported by industry standard text. This therefore provides some validation to the accuracy of the service area population data presented.

Table 2-7 – Historical Per Capita Contribution, Annual Average and Industry Standard Contributions

Year	Service Area Population	Annual Average			
		BOD_5 (lb/capita*d)	TSS (lb/capita*d)	TKN (lb/capita*d)	TP (lb/capita*d)
2010	527,100	0.1214	0.1052	0.0269	0.0039
2011	533,944	0.1364	0.1218	0.0281	0.0038
2012	540,788	0.1642	0.1480	0.0309	0.0044
2013	547,633	0.1432	0.1316	0.0286	0.0039
2014	556,395	0.1547	0.1329	0.0300	0.0042
2015[(1)]	561,321	0.1554	0.1477	0.0295	0.0045
2012-2014 Average		**0.1540**	**0.1375**	**0.0298**	**0.0042**
Industry Standard[(2)]		**0.15**	**0.15**	**0.029**	**0.0046**

[(1)]Data available through September 30th, 2015.

[(2)]Per Wastewater Engineering Treatment and Resource Recovery, Metcalf & Eddy/AECOM, 5th Ed.

The historical influent mass loading gathered from the MORs was also used to determine the influent load peaking factors for the maximum day and minimum day loading events. These values presented in **Table 2-8** were used, along with the annual average per capita mass loading values, to project the influent loading rates to the HFC AWTP through 2025. **Table 2-9**, **Table 2-10** and **Table 2-11** present the projected influent mass loading rates for each year through 2025.

Table 2-8 – Load Peaking Factors, 2010 – 2015 Average

Condition	BOD_5	TSS	TKN	TP
Maximum Day	2.66	3.72	2.00	2.95
Minimum Day	0.37	0.26	0.58	0.52

Table 2-9 – Projected Influent Loading Rates, Annual Average

Year	Service Area Population	Annual Average			
		BOD_5	TSS	TKN	TP
		lb/day	lb/day	lb/day	lb/day
2015	561,321	86,454	77,178	16,754	2,348
2016	568,759	87,600	78,201	16,976	2,379
2017	576,196	88,745	79,224	17,198	2,410
2018	583,634	89,891	80,246	17,420	2,442
2019	591,071	91,036	81,269	17,642	2,473
2020	598,509	92,182	82,291	17,864	2,504
2021	605,946	93,327	83,314	18,086	2,535
2022	613,384	94,473	84,337	18,308	2,566
2023	620,821	95,618	85,359	18,530	2,597
2024	628,258	96,764	86,382	18,752	2,628
2025	635,696	97,910	87,404	18,974	2,659

Table 2-10 – Projected Influent Loading Rates, Maximum Day

Year	Service Area Population	Maximum Day			
		BOD_5	TSS	TKN	TP
		lb/day	lb/day	lb/day	lb/day
2015	561,321	230,030	287,124	33,578	6,930
2016	568,759	233,078	290,929	34,023	7,021
2017	576,196	236,125	294,733	34,468	7,113
2018	583,634	239,173	298,537	34,913	7,205
2019	591,071	242,221	302,341	35,358	7,297
2020	598,509	245,269	306,146	35,803	7,389
2021	605,946	248,317	309,950	36,248	7,481
2022	613,384	251,365	313,755	36,692	7,572
2023	620,821	254,413	317,559	37,137	7,664
2024	628,258	257,460	321,363	37,582	7,756
2025	635,696	260,508	325,168	38,027	7,848

Table 2-11 – Projected Influent Loading Rates, Minimum Day

Year	Service Area Population	Minimum Day			
		BOD_5	TSS	TKN	TP
		lb/day	lb/day	lb/day	lb/day
2015	561,321	31,903	20,089	9,749	1,215
2016	568,759	32,325	20,356	9,878	1,231
2017	576,196	32,748	20,622	10,008	1,247
2018	583,634	33,171	20,888	10,137	1,264
2019	591,071	33,593	21,154	10,266	1,280
2020	598,509	34,016	21,420	10,395	1,296
2021	605,946	34,439	21,686	10,524	1,312
2022	613,384	34,862	21,953	10,654	1,328
2023	620,821	35,284	22,219	10,783	1,344
2024	628,258	35,707	22,485	10,912	1,360
2025	635,696	36,130	22,751	11,041	1,376

The historical influent concentrations for BOD_5, TSS, TKN, and TP over the past five years were graphed to validate the assumption that per capita mass loading would remain relatively constant. Influent concentrations are expected to remain relatively constant with a constant per capita mass loading because influent flow per capita is also expected to remain relatively constant. However, several factors such as inflow and infiltration, expanding use of low flow fixtures, and non-domestic wastewater sources influence the influent flow per capita as calculated based on the treatment plant influent flow. **Figure 2-4**, **Figure 2-5**, **Figure 2-6** and **Figure 2-7** show that the average concentrations have remained relatively constant, perhaps indicating little change in the source of wastewater in the HFC AWTP service area and little change in the average rate of inflow and infiltration.

Figure 2-4 – Historical Influent BOD_5 Concentration

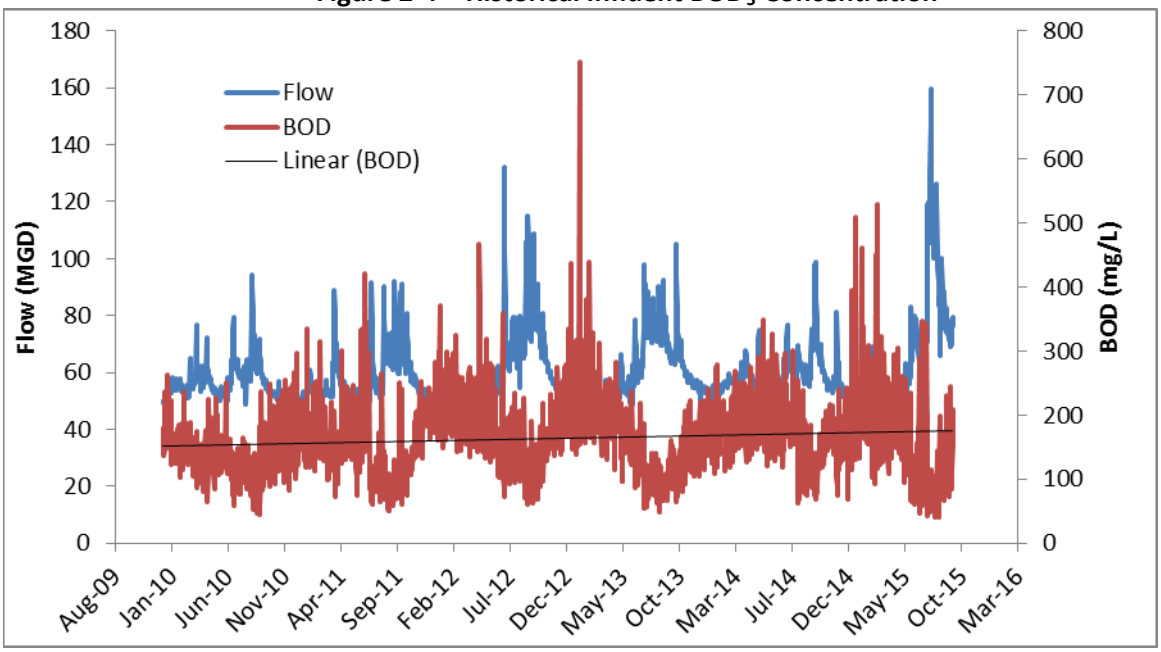


Figure 2-5 – Historical Influent TSS Concentration

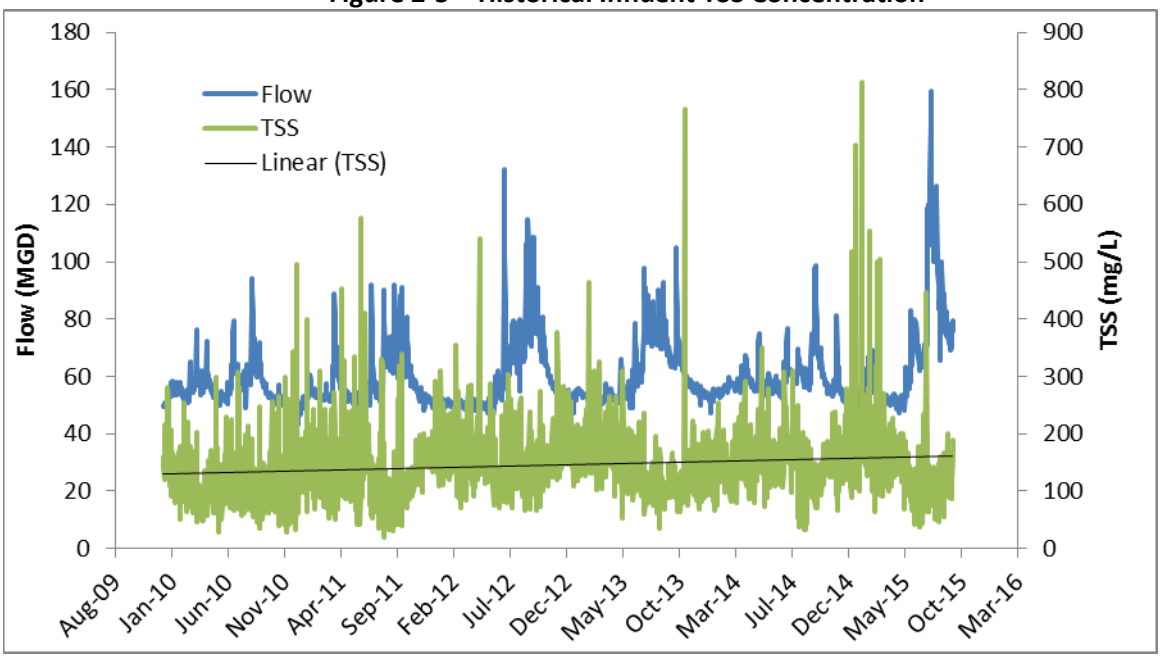


Figure 2-6 – Historical Influent TKN Concentration

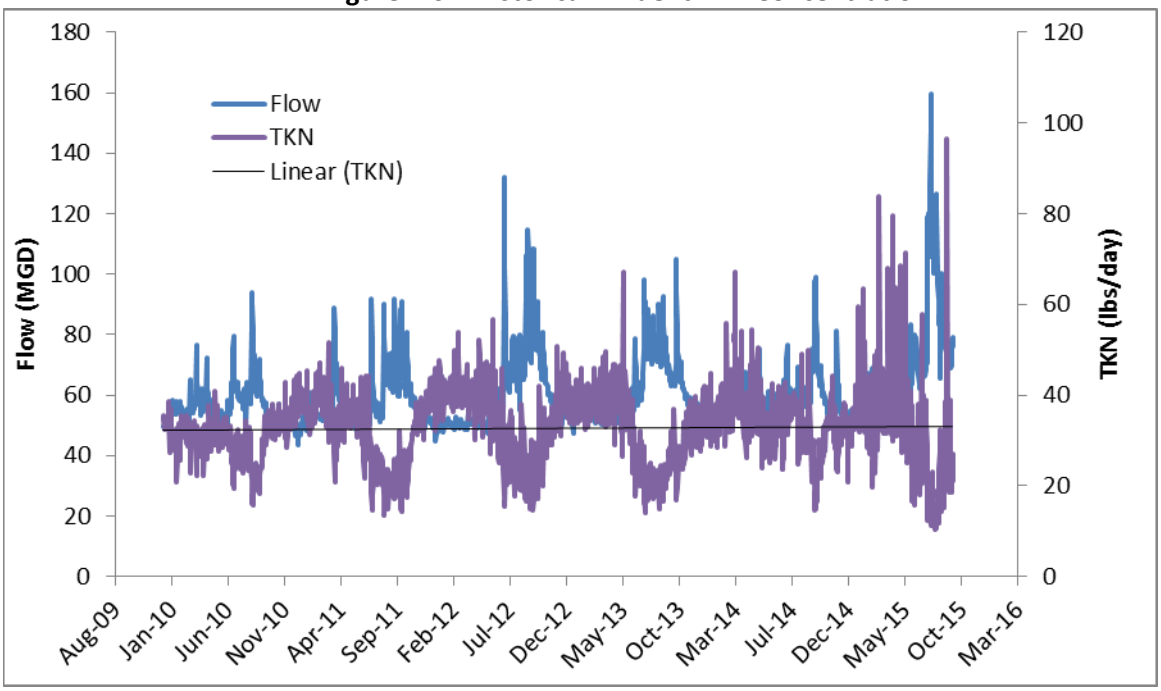
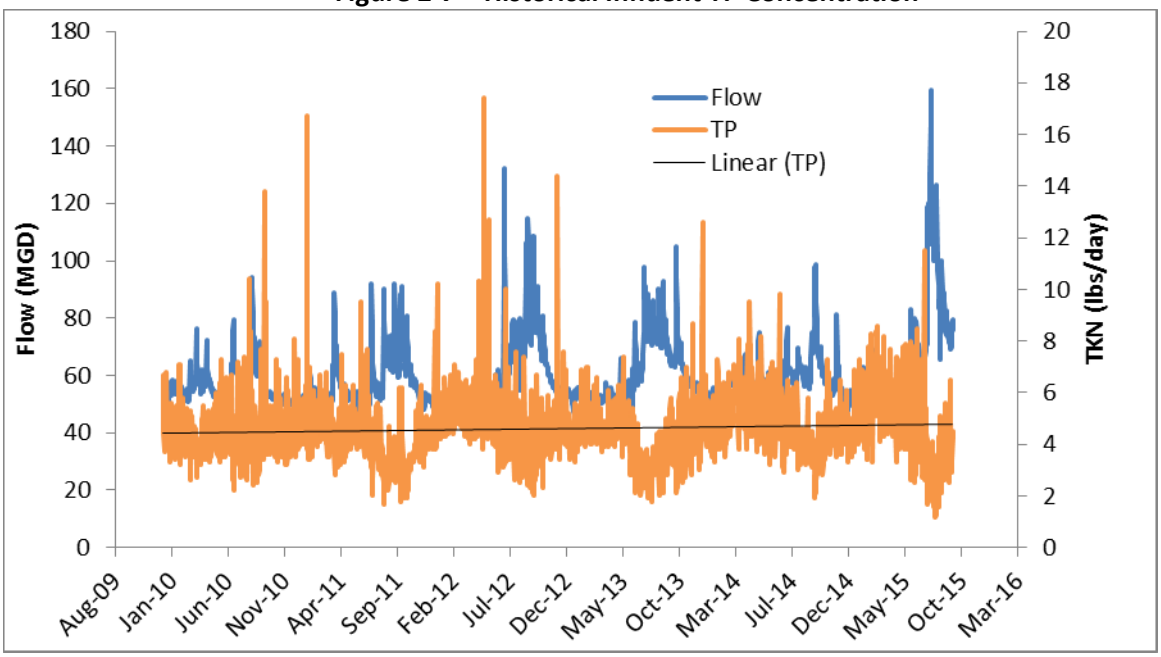


Figure 2-7 – Historical Influent TP Concentration



The projected influent mass loading rates to the HFC AWTP were then compared to the design loading rates. As seen in **Table 2-12**, the annual average mass loading rates are not expected to exceed the treatment plant's design loading rates in the near future. The current and projected maximum day

loading rates are exceeding the design loading rates; however this is acceptable as the biological processes are typically designed based on maximum month loading rates, which are inherently lower.

Table 2-12 – Comparison of Projected Loadings to Current Design Loadings

Condition	Basis	BOD_5 lb/day	TSS lb/day	TKN lb/day	TP lb/day
Current	Design[(1)]	211,369	162,530	24,019	-
2015	Annual Average	86,454	77,178	16,754	2,348
2020		92,182	82,291	17,864	2,504
2025		97,910	87,404	18,974	2,659
2015	Maximum Day	230,030	287,124	33,578	6,930
2020		245,269	306,146	35,803	7,389
2025		260,508	325,168	38,027	7,848
2015	Minimum Day	31,903	20,089	9,749	1,215
2020		34,016	21,420	10,395	1,296
2025		36,130	22,751	11,041	1,376

[(1)]No regulatory limit imposed on the HFC AWTP for Total Phosphorus removal.

Influent waste loads from landfill leachate from Pasco County and Tampa Bay Water desalination wash water is not included in this data evaluation as concentration data was not available. These waste loads are discharged into a concrete containment area near the heat drying facility. The drain for this containment area ultimately discharges to the Main Pumping Station and is directly treated by the biological treatment processes. The mass loading to the biological processes created by these discharges is not captured by the influent monitoring data and therefore was not able to be evaluated. Concentration monitoring in the Main Pumping Station does capture the total influent concentrations to the biological process including these waste loads. However, the mass loading from the leachate and wash water cannot be distinguished from the MPS monitoring data because the influent flows to the MPS are not all recorded. These waste loads should be investigated further in the next phase to determine projected volume, mass loading, and their effect on the wastewater treatment processes.

2.4.2 Hydrogen Sulfide

Hydrogen sulfide (H_2S) that develops in the collection system under anaerobic conditions is stripped from the influent wastewater in Junction Chamber No. 1 in order to reduce odors and prevent corrosion. Hydrogen sulfide production in the collection system appears to have increased over the past five years based on the data gathered from the MORs (**Figure 2-8**). Increased hydrogen sulfide in the influent may be caused by increased sulfate concentration in the wastewater, increased BOD, increased detention time in the wastewater collection system, lower pH, and increased temperature. The average influent pH at the HFC AWTP has decreased slightly over the past five years (**Figure 2-8** and **Table 2-13**) while the influent BOD_5 loading has increased as shown in **Table 2-7**.

Figure 2-8 – JC No. 1 Influent H_2S Concentration (PPM_V) and Influent Wastewater pH

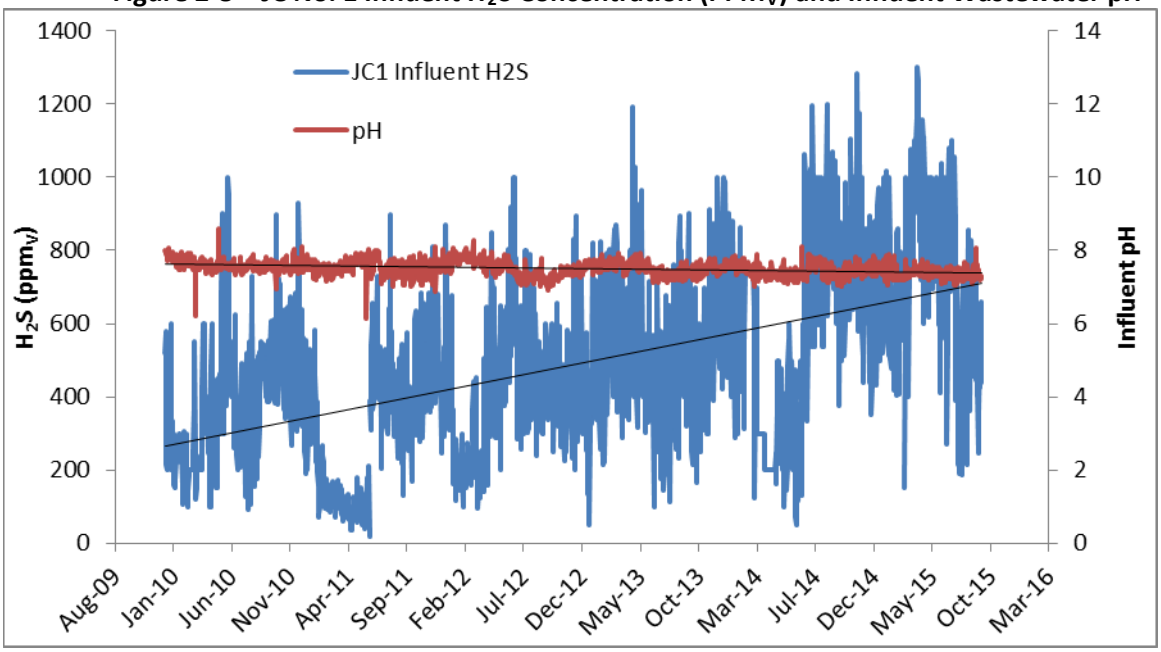


Table 2-13 – Annual Average Influent Wastewater pH and JC1 H_2S Concentration

Year	Influent pH	JC1 Influent H_2S (ppm_v)
2010	7.61	394.7
2011	7.54	314.5
2012	7.51	420.3
2013	7.51	540.9
2014	7.44	597.9
2015	7.38	717.1

2.4.3 Effluent Concentration Trends

The HFC AWTP has consistently met the permit limitations for major constituents for each of the past five years, as shown in **Table 2-14**. Annual average effluent concentrations have remained well below the permit limitations for both $cBOD_5$ and TSS, while effluent TN has remained at least approximately 0.5 mg/L below the permit limitation. TN is very difficult to remove below 2.0 mg/L due to refractory inert organic nitrogen compounds that cannot be significantly biologically degraded under the conditions present at wastewater treatment plants. As a result, the effluent concentrations achievable when accomplishing complete nitrification and denitrification will depend on the influent wastewater composition. TP is not regulated at the HFC AWTP by the FDEP; however it has also remained consistently low. The chlorine residual for disinfection has also reliably remained above permit limits, even during the minimum day events for each of the past five years.

Table 2-14 – Historical Effluent Concentrations

Year	Annual Average				
	$cBOD_5$	TSS	TN	TP	Cl_2 Residual
	mg/L	mg/L	mg/L	mg/L	mg/L
2010	1.20	0.53	2.20	2.30	3.27
2011	1.43	0.55	2.24	2.17	3.19
2012	1.20	0.73	2.31	2.17	3.10
2013	1.15	0.65	2.51	2.26	3.20
2014	1.22	0.68	2.09	2.82	3.15
2015	1.30	0.86	2.38	3.04	3.11
Year	Maximum Day				
	$cBOD_5$	TSS	TN	TP	Cl_2 Residual
	mg/L	mg/L	mg/L	mg/L	mg/L
2010	5.50	1.60	3.49	4.00	5.01
2011	4.60	4.30	5.22	3.30	5.07
2012	3.40	6.50	7.34	4.80	4.88
2013	4.90	3.60	3.50	4.80	6.16
2014	2.90	2.50	5.03	8.60	6.44
2015	5.40	14.20	6.03	7.50	6.33
Year	Minimum Day				
	$cBOD_5$	TSS	TN	TP	Cl_2 Residual
	mg/L	mg/L	mg/L	mg/L	mg/L
2010	1.00	0.40	1.41	1.20	1.87
2011	1.00	0.40	1.29	1.20	2.02
2012	1.00	0.40	1.52	1.10	1.70
2013	1.00	0.40	1.85	1.00	1.76
2014	1.00	0.40	1.40	1.40	1.68
2015	1.00	0.40	1.43	1.30	1.79

2.5 Plant Hydraulics

The hydraulic capacity through each structure in the facility was analyzed for the following influent flowrates: 58.7 MGD 2014 AADF, 96.0 MGD design AADF, 220.8 design peak hourly flow (PHF), and Class I Reliability for PHF. Recycle flows were added throughout the plant based on normal or peak operation. Dimensions and elevations of all structures were primarily based on record drawings. Current operating protocol and units in service were used for the analysis based on the High Flow Protocol, included as **Appendix C**, and discussions with the facility's staff. Weirs were analyzed by type, v-notch, sharp-created or broad-created. The Hazen-Williams formula was used for conduit losses with a C=100 for concrete and C=110 for ductile iron. All submerged ports were considered in analysis, and open channel losses were included where velocities were significant enough to indicate head loss using Manning's

formula. Cells were highlighted in the Existing Facility Hydraulic Tables for freeboard less than 18-inches, conduit velocity less than 1.5 fps, submerged weirs and any other finds of note.

The hydraulic analysis identified areas of the facility that cannot achieve the design PHF. See **Appendix D** for the Existing Facility Hydraulic Profile and Existing Facility Flow Diagram. At the surface water discharge, the primary and relief outfalls discharge into a tidal water body and tides directly affect the water level in the overflow structure. The mean tide level for nearby tide station is at an elevation of 1.69-feet and the mean higher high water (MHHW) elevation at 2.94-feet, according to the latest information from tide station 8726667 at the McKay Bay entrance. Tides higher than the highest astronomical tide of 3.94-feet have historically been from storm surge with the highest recording since 1983 of 7.25-feet. See information from this tide station in **Appendix E**. The MHHW tide was used for the hydraulic analysis. At this tide level all effluent flows from the overflow structure in the primary 78-inch outfall for flows up to 86 MGD. At flows high than this the water level in the overflow structure rises above the weir blocks and starts to overflow to the relief outfalls, see Final Effluent Disposal section for details on outfalls and overflow structure. The existing relief sluice gates in the overflow structure are currently not used and were assumed to be closed for the hydraulic analysis. At flows over 163 MGD the weirs in the Chlorine Contact Tanks become submerged due to the combination of the water level in the overflow and the head loss from the single 96-inch conduit between Junction Chamber No. 4 and the overflow structure. Opening the four sluice gates will drop the level downstream of the Chlorine Contact Tanks so that they are no longer surcharged at the design PHF. The addition of a redundant 84-inch conduit between Junction Chamber No. 4 and the overflow structure will reduce the head loss from 3.95-feet to 1.4-feet. There were no other hydraulic limitations found between Junction Chamber No. 4 and the denitrification filters, and even though the Chlorine Contact Tanks are surcharged at PHF they still have more than 2-feet of freeboard.

The denitrification filters have an observed max flow rate up to about 150 MGD with severe head loss experienced from 120 MGD on up based on discussions with the facility's staff and flow data from the previous five years. Although the Denitrification Filters were designed for flows up to the PHF of 220.8 MGD, the plant has only been able to operate them up to flows between 120 and 150 MGD. See Tertiary Treatment section for a complete analysis of the filters. For the purpose of the hydraulic analysis, the water level in the filters was set to 18.5-feet, which is the high level that the operators try to maintain during high flows according to the High Flow Protocol, at a flow of 245.8 MGD, which is PHF plus recycle stream and not currently possible. Since the filter effluent is a submerged discharge the surcharging of the Chlorine Contact Tanks also increases the water level in the filters. The maximum head loss through the effluent control valves on the old filters was estimated to be 2.7-feet at PHF.

The analysis shows that the high water level of 18.5-feet in the filters surcharges the Final Sedimentation Tanks downstream of the Diffused Air Reactors. However, the filters will overflow before this happens according to plant staff. There were no other hydraulic limitations found between the filters and the Diffused Air Reactors. Only three reactors were considered in the hydraulic model for the Diffused Air Reactors since the first reactor has been out of service for years. The influent channels of the Diffused Air Reactors were found to have a level as high as 26.76-feet. This very close to the top of

the reactors, but this channel has a top elevation of 29.75-feet. The level drops to less than 26-feet with all four reactors in service. There were no other hydraulic limitations found between the Diffused Air Reactors and the primary sedimentation tanks. A few conduits in this section are highlighted in the tables due to low velocities. The conduits between Junction Chamber No 5 and the Nitrification Pumping Station only achieve a flushing velocity of greater than 1.5 fps at flows over 110 MGD. The conduits between the High Purity Oxygen Reactors and the downstream Final Sedimentation Tanks only achieve a flushing velocity of greater than 1.5 fps at flows over 95 MGD. The 66-inch spike line to the Diffused Air Reactors is below flushing velocity at the current maintained flow of 18 MGD.

The influent channels for the old primary sedimentation tanks 1-4 have overflowed in the past at high flows. The hydraulic analysis shows that there is less than 18-inches of freeboard at flows over 38 MGD to these tanks, but 1-foot of freeboard is maintained at 80 MGD, which is the max design flow for these tanks. The analysis does show overflow of the influent channel at 100 MGD going to the old Primary Sedimentation Tanks. At 100 MGD the Grit Tanks in the old build become surcharged. Flows over 80 MGD should not be sent to either set of primary tanks. There were no other hydraulic limitations found from the Primary Sedimentation Tanks to the beginning of Junction Chamber No. 1. Conduits between Junction Chamber No. 2 and the Primary Sedimentation Tanks and one conduit from Screening and Grit Building 1 show low velocities at current AADF. Total plant flows of about 90 MGD or higher will flush these lines.

The location of HFC AWTP puts the facility at risk for storm surge. The highest recorded tide since 1983 was 7.25-feet in October of 1996 due to storm surge. Any storm surge will most likely cause the Chlorine Contact Tanks to be surcharged with the combination of higher than normal high tide and high plant flows due to rainfall. Opening the relief gates in the overflow structure will have no effect if Hillsborough Bay is over 6.5-feet. The 100-year flood elevation for the facility is 10-feet according to FIRM panel 0362H and 0366H dated 2008. Flooding of this level would overtop the Primary Sedimentation Tanks and the Overflow Structure. Storm surge from a Category 2 hurricane is predicted to flood the entire facility. An analysis of the damages to mechanical systems, backup power generation and structures at the facility from storm surge at different categories of hurricanes is in **Table 2-15**.

Table 2-15 – Evaluation Findings

- Chlorine Contact Tanks are surcharged at flows over 163 MGD.
- Surcharged Chlorine Contact Tanks increases the water level in the filters.
- The Denitrification Filters have excess head loss at flows between 120 and 150 MGD and water level is maintained up to 18.5-feet by backfilling into empty sedimentation tanks.
- High water levels are shown in the Diffused Air Reactors Influent Channel with only three reactors in service at PHF.
- Influent channels of old Primary Sedimentation Tanks 1-4 have only 1-foot of freeboard at 80 MGD to the tanks.
- Some conduits do not achieve 1.5 fps flushing velocity at current AADF.
- The location of the facility puts it at risk from storm surge. Further investigation into damage of critical systems from storm surge is recommended.

2.6 High Flow Protocol Evaluation

The consultant had multiple discussions with plant personnel regarding the current High Flow Protocol. These discussions provided the consultant with a good understanding of recent high flow events and the reasoning for many of these operational changes listed in the protocol document. The consultant also discussed possible solutions for some of the underlying problems that require changes in operations at different flows. The existence of the high flow protocol indicates that some of the existing treatment processes are unable to treat the design peak flows. Solutions to the underlying problems will eliminate the need for the high flow protocol and allow the treatment plant to operate as intended within the full range of design flows. After hydraulic limitations are addressed in the future it is recommended that the high flow protocol be eliminated rather than modified. The existing model provided to the consultant was intended to be used to evaluate the current operational changes mentioned in the high flow protocol. However, the consultant determined that the existing model was not calibrated for the current operation of the treatment plant and could not be used to predict the effect of operational changes with any degree of confidence. The inaccuracy of the model output for the existing conditions was determined to be caused in large part by the settling calibration, which in turn affected the solids retention time (SRT), mixed liquor suspended solids (MLSS), and wastage rate of the biological processes. Biomass kinetic and stoichiometric calibration was also determined to play a role in the model inaccuracy. A full description of the model calibration validation was discussed in the Process Model Calibration Validation section 2.7.

Regardless, the existing process model was utilized to simulate each high flow scenario to determine what could be inferred from the behavior of the model outputs. Model scenarios were created for the conditions listed below, and influent characterization for each scenario can be found in **Appendix F**.

1. Typical operation, flows less than 75 MGD
2. Influent flow between 75 and 80 MGD
3. Influent flow between 80 and 100 MGD
4. Influent flow between 100 and 120 MGD
5. Influent flow between 120 and 130 MGD
6. Influent flow between 130 and 140 MGD
7. Influent flow greater than 140 MGD

Despite the efforts, the model results were not adequate to make any assumptions of the effect of operational modifications and this effort was dismissed. The consultant determined a large amount of specifically calibrated model scenarios beyond those listed would be required to accurately describe the operational changes made according to the protocol because each modification should be evaluated separately to determine the benefit and drawbacks of each change. Data for influent characterization of each model scenario was increasingly scarce with increasing flow because the frequency of such events was very low. Additional data collection would be required to provide an adequate amount of data for characterization and this data collection would require a significant effort due to the frequency of such events. The scope of this project phase did not allow the consultant to perform these tasks.

Observations and recommendations to eliminate the high flow protocol are discussed below for each section of the document provided by the City.

2.6.1 Influent Flows Less Than or Equal to 75 MGD, Normal Operation

All eight primary sedimentation tanks should be operated unless one or multiple tanks must be taken out of service for maintenance. The current protocol requires the final settling tanks be operated to maintain a maximum of 20 MGD per tank, which corresponds to the maximum surface overflow rate (SOR) of 1,200 gpd/ft^2 for the 16,796 ft^2 tanks. This SOR is based on the design peak flow. It is acceptable and recommended to operate fewer FSTs at normal flows in order to maintain a high enough solids loading rate to achieve good settling. Typical practice is to operate FSTs to maintain approximately 75% of the design SOR during normal flow, which in this case is an SOR of 900 gpd/ft^2. This operation would result in an average flow per FST of approximately 15 MGD, for a total of 5 of FSTs 1 – 12. FSTs 13 – 20 cannot treat the design peak flow of the plant while still maintaining a maximum flow per tank of 20 MGD. The maximum SOR recommended by the 10 State Standards for two-stage nitrification should apply to FSTs 13 – 20. The recommended maximum SOR for this service is 800 gpd/ft^2. 75% of this maximum SOR would result in seven of FSTs 13 – 20 in service at approximately 10.7 MGD per tank. More FSTs are required for the DAR MLSS due to the reduced settleability of nitrification sludge.

2.6.2 Influent Flows Greater Than 75 MGD and up to 80 MGD

The Chlorine Contact Chamber Flow Formula should be eliminated. See the Tertiary Treatment section for details. Use one tank for flows up to 75 MGD and then open both gates on a second tank for flows between 75 and 150 MGD.

2.6.3 Influent Flows Greater Than 80 MGD and up to 100 MGD

The bar screen timers pertains to the old screens that are no longer in service, therefore the recommendation to reduce bar screen timers should be eliminated. As stated above, each final settling tank's SOR shall be maintained below the maximum SOR. The maximum SOR for FSTs 13 – 20 based on their intended purpose for separate nitrification is 800 gpd/ft^2. Six to eight FSTs would be required to be in service within this range of flows to maintain this maximum SOR. It is therefore best practice to operate all eight of FSTs 13 – 20 above 80 MGD, which is how the facility normally operates.

2.6.4 Influent Flows Greater Than 100 MGD and up to 120 MGD

Six FSTs out of FSTs 1 – 12 are required to be in service between influent flows of 100 to 120 MGD to maintain the SOR of the settling tanks in service below the maximum SOR of 1,200 gpd/ft^2. Effluent suspended solids have remained relatively low (with an average of 13.8 mg/L) on days within this flow range as a result of this operation.

Denitrification operation in the DARs cannot be maintained at increasing flow because it begins to limit the nitrification capacity, and effluent total nitrogen limits may not be met. Elimination of denitrification in the DARs at peak flows increases the nitrate/nitrite loading on the denitrification filters at the time when the filters experience the greatest headloss. The filters are most susceptible to overflow due to excessive headloss at this time and nitrate loading should be minimized to prevent excessive biomass

growth and increasing headloss across the filters. Denitrification in the DARs should be maintained at peak flows to reduce nitrate loading to the filters. Once upgrades are completed to DAR No. 1, all DARs should be operated at peak flows to maximize nitrification capacity while still providing denitrification. Options should be investigated to maintain denitrification upstream of the denitrification filters at all flows up to the design peak hour flow. Increased denitrification capacity and/or nitrification capacity should be investigated in the next phase.

2.6.5 Influent Flows Greater Than 120 MGD and up to 130 MGD

The influent boxes on the old primaries will have less than 18-inches of free board at flows over 38 MGD through meter MRC-1 in Junction Chamber No. 2. Hydraulic modeling does not show that these will overflow as long as the maximum design flow of 80 MGD through the meter is not exceeded. An investigation into control valves to automatically regulate the flow from Junction Chamber No. 2 may be evaluated in the next phase.

The step feed gates on the HPO reactors have been used to reduce mechanical loads on the aerators in the first zone in each reactor. The step feed will reduce the water level in the influent channel of these reactors, but it is not necessary to prevent overflow. The mechanical aerator motors in the first zone of the HPO reactors may need to be upgraded and should be investigated in the next phase of the project.

HPO reactor 3 may be required to be brought into service at flows above 120 MGD to increase the overall hydraulic retention time of the HPO reactors above 0.5 hours. Maintaining operation with only two HPO reactors may reduce energy usage from mixing and oxygen supply to some degree, however the hydraulic retention time will be less than 0.5 hours, while industry standard practice is to maintain an HRT of 1 hour in HPO activated sludge systems. Operating at reduced hydraulic retention times may have deleterious effects on the HPO system effluent BOD and SS concentrations due to inadequate contact time with the biomass in the reactors. It is recommended to maintain a minimum HRT of 0.5 hours in the HPO reactors, which will require operation of three HPO reactors at flows above 120 MGD. A minimum of four HPO reactors should be operable to maintain an HRT of 0.5 hours at the design peak hour flow. Mechanical aerators and other equipment in reactors 4 through 6 may require replacement or refurbishment to allow a minimum of four HPO reactors to be operable. Equipment replacement needs for reactors 4 through 6 should be evaluated in the next phase. The process of bringing reactors into service may be automated based on influent flow and the requirements to do so should be evaluated in the next phase. The minimum HRT of the HPO reactors and its effect on HPO effluent BOD, HPO effluent SS, oxygen requirements, and settling should be evaluated in the next phase.

2.6.6 Influent Flows Greater Than 130 MGD and up to 140 MGD

As stated above in this section, three HPO reactors should be in service at influent flows above 120 MGD and up to 183 MGD to maintain a minimum hydraulic retention time of 0.5 hours.

2.6.7 Influent Flows Greater Than 140 MGD and up to 150 MGD

See the previous note in this section about the primary influent boxes in Influent Flows 120 to 130 MGD section. As much flow should be run through the primary settling tanks as possible to reduce the

influent loading on the biological treatment system. This operation will improve the final effluent quality and reduce energy cost associated with oxygen generation, aeration, sludge pumping, and mechanical mixing. Primary settling shall be provided up to the maximum flow capacity of influent flow meters MRC-1 and MRC-2 in Junction Chamber No. 2.

Seven FSTs out of FSTs 1 – 12 shall be in operation to maintain the SOR below the maximum SOR of 1,200 gpd/ft^2.

Hydraulic modeling shows that the use of step feed gates on the DAR reactors have little effect on the water level upstream of the influent conduits. The influent conduits will not overflow without the use of the step feed gates based on the hydraulic modeling. This condition should be confirmed in the next phase and improvements to the influent conduits shall be considered if necessary. The step feed operation is also practiced to reduce solids loading on FSTs 13 – 20 to improve settling. However, this operation results in reduced hydraulic retention time in the DARs and may result in reduced nitrification capacity. Options to provide additional settling capacity for the DAR system should be evaluated in the next phase to eliminate the need for the step feed operation. This will ensure the maximum nitrification capacity of the DARs is available at all flows, and the SOR and solids loading rate (SLR) to the associated final settling tanks are within the industry standard ranges.

2.6.8 Influent Flows Greater Than 150 MGD and up to 160 MGD

See the previous note in this section regarding elimination of the Chlorine Contact Chamber Flow Formula. Use all three tanks with all six gates open in this scenario to ensure adequate contact time.

2.6.9 Influent Flows Greater Than 160 MGD

Influent flow meters MRC-1 and MRC-2 are currently programed for a maximum flowrate reading of 80 MGD each. The flow from each of these meters is directed to PSTs 1 – 4 and 5 – 8 respectively and influent flows greater than 160 MGD should bypass MRC-1 and MRC-2 through MRC-4 to the Main Pumping Station with the current plant configuration. These meters may need to be reprogrammed if more than 80 MGD through each is required for future improvements. PSTs 1 – 8 are limited hydraulically regardless of any modifications to MRC 1 and 2 to increase the meter capacities. Flows greater than 160 MGD results in significant headloss across the PSTs and may result in overflowing of the primary influent boxes. The treatment limitations of the PSTs are discussed in the Primary Treatment section. Modifications to the PSTs to prevent overflow, options to provide additional primary treatment and a new meter MRC-3, and replacement of MRC 1 and 2 with greater capacity meters should be evaluated in the next phase.

Flows over 160 MGD to the surface water outfalls cause the Chlorine Contact Tanks to be surcharged as discussed in the Plant Hydraulics and Tertiary Treatment sections. The use of the existing gates in the overflow structure will correct this issue, and an investigation into automation of this process should be included in the next phase.

2.6.10 Denitrification Filter and FSTs 1 – 12 Notes

The current hydraulic limitation of the denitrification filters is discussed in the Tertiary Treatment section. This portion of the high flow protocol can be eliminated once a solution for this problem is in place. In the meantime, this section of the high flow protocol is necessary. Investigation into one or multiple solutions should be included in the next phase. Methanol feed is controlled by FE-48 and/or FE-49 which are rated for flows of 70 and 150 MGD, respectively. However, the combined flow metering capacity of FE-48 and FE-49 is not capable of metering the true design PHF of the filters of 246 MDG. It is recommended to upgrade meter FE-48 to a metering capacity of 100 MGD to accomplish this. Upgrades to the open channel flow meter in the Final Effluent Channel to read up to 235 MGD are recommended and should be investigated in the next phase. Use Water Hog mode for NRCs, backfill into FSTs 1 – 12, and backwash as needed to prevent overflowing the filters. Notes regarding the backfilling and daily draining of FSTs 1 – 12 are appropriate until the hydraulic limitation in the filters is resolved. All FSTs shall be available for operation at the design peak hour flow to maintain SORs below the maximum SOR of 1,200 gpd/ft^2.

2.6.11 Chlorine Contact Chamber Flow Formula

It is recommended that this formula is no longer used for the following reasons. It causes detention times of less than 15 minutes in the highest flow tank when more than one is used, and excessive detention time in lower flow tanks. The consultant will provide recommendations for alternate operation or automation in the next phase.

2.7 Process Model Calibration Validation

The GPS-X biological model developed for the HFC AWTP was last calibrated by Tetra Tech and described in their November 2014 HFC AWTP Diffused Aeration Reactors Improvements – Phase I Draft PDR. The model was originally developed by Greeley and Hansen to evaluate process modifications to the HPO reactors to reduce or eliminate the cost of high purity oxygen generation. Greeley and Hansen originally calibrated the model based on three time periods from April 2009 – October 2009, October 2009 – April 2010, and January 2012 – June 2012. Monitoring and operational data from these time periods was used to build the model and calibrate the results to be representative of the monitored plant effluent concentrations. Calibration of the model consisted of adjusting biological process parameters, such as biomass stoichiometry and kinetics, and settling characteristics until the model output closely resembled the plant data. Tetra Tech later modified the original Greeley and Hansen model to develop the design criteria for a new diffuser system for DAR No. 1 and to evaluate improvements to the DAR operation for denitrification. Tetra Tech's later calibration was based upon further review of influent and effluent monitoring data from the past calibration periods, HPO MLSS, DAR SRT, and grab sampling of HPO effluent to validate and revise the monitoring data used to calibrate the HPO system.

The GPS-X model has two primary deficiencies that affect the validity of the calibration and the accuracy of the model output to the current operation. First, primary settling is not included in the model and the influent characterization for the model is based on the wastewater characteristics monitored at the Main Pumping Station. Flow to the Main Pumping Station includes primary effluent and DAR waste

activated sludge (WAS), primary bypass from Junction Chamber No. 2 (normally closed), and several residual recycle flows such as sludge thickening overflow and dewatering from tank drains. The total flow through the Main Pumping Station is not monitored and must be assumed in the model based on the total plant influent flow and some estimated recycle percentage. This results in inaccuracy of the model influent wastewater characterization and may result in significant differences between the model output and actual plant effluent. The recycle flows have been estimated based on past plant studies and design criteria, but recent changes in operation since 2012 is likely to have changed the recycle flow rates and render past estimates inaccurate. Correction of the residual recycle flows to the Main Pumping Station will provide accurate mass flow rates of the influent constituents to the biological process and allow a more accurate calibration of the biomass growth parameters. This problem will persist in all modeling efforts until an effort is made to monitor the residual recycle flows or the main pumping station effluent flow.

Secondly, the model was calibrated based on process operational parameters that are not representative of the current operation. This is not typically an issue when calibration is based on a long term sampling campaign to determine actual biomass stoichiometric and kinetic parameters; however it is an issue when calibration is based on matching plant effluent data. Metcalf & Eddy and AECOM state in the industry text Wastewater Engineering, Treatment and Resource Recovery that "Calibrations based only on comparing the model predictions to the plant effluent concentration are not necessarily valid. …kinetic models should not be applied outside of the range of the conditions used to develop model coefficients." Based on this observation, the model provided may accurately predict the effluent concentrations based on the past operation modeled, but its results may not be applicable to the current operation of the treatment plant. As stated above, the model was calibrated based on monitoring data from 2009, 2010 and 2012. Significant operational changes are known to have occurred beginning in 2013, the most significant change in operation being the start of denitrification in the DARs with increased spike flow from the MPS.

Validation of the process model was performed by modifying the influent concentrations, reactor volume/surface area, and operational parameters to match the current operation of the facility and the 2015 annual average MPS effluent. Influent fractionation, process stoichiometric data, process kinetic data, and settling parameters were not modified in order to evaluate their calibration via comparison of the model output and actual effluent data. No data was available to modify the HPO DO setpoint values for each stage as was noted previously by Tetra Tech. The HPO DO concentrations were assumed to be the same as those assumed by Tetra Tech, however input from plant staff indicates it should be 10 to 12 mg/L. The HPO DO concentrations in each stage of the reactors should be monitored to determine DO setpoints for model calibration in the next phase. **Table 2-16** lists the reactor volumes and surface areas used in the calibration validation to match the number of reactors and settling tanks that have typically been in service. **Table 2-17** lists the influent concentrations used which are based on the 2015 annual average MPS effluent values. **Table 2-18** summarizes some of the operational parameters for the current operation that were used in the validation of the model.

Table 2-16 – Typical Tank Volume and Surface Area for Current Operation

HPO Reactor	FSTs 1-12	DAR	FSTs 13-20
2.54 MG	83,980 Sq. Ft.	6.36 MG	117,572 Sq. Ft.
2 in service	5 in service	3 in service	7 in service

Table 2-17 – 2015 Annual Average MPS Effluent and Model Influent

Flow[(1)]	BOD_5	$cBOD_5/BOD_5$[(2)]	$cBOD_5$	TSS	TKN	Spike[(3)]
MGD	mg/L	(-)	mg/L	mg/L	mg/L	MGD
81.27	122.6	0.91	111.6	83.36	36.59	10.5

[(1)]Influent flow plus 26% residuals recycle flow

[(2)]cBOD/BOD ratio based on total plant influent data; MPS effluent monitoring data includes only BOD while the model input requires cBOD

[(3)]The spike flow has typically been set near 18 MGD recently, however the annual average was lower due to periods of full aeration in the DARs

Table 2-18 – Model Operational Parameters – 2015 Annual Average

Process	Parameter	Units	Value
HPO Reactors	RAS	MGD	17.06
	WAS	MGD	1.42
	DO – Zone 1	mg O_2/L	12
	DO – Zone 2	mg O_2/L	12
	DO – Zone 3	mg O_2/L	10
	DO – Zone 4	mg O_2/L	3
DARs	RAS	MGD	20.91
	WAS	MGD	0.11
	DO – Zone 1	mg O_2/L	0 (Anoxic)
	DO – Zone 2	mg O_2/L	0 (Anoxic)
	DO – Zone 3	mg O_2/L	2
	DO – Zone 4	mg O_2/L	2
	DO – Zone 5	mg O_2/L	2
	DO – Zone 6	mg O_2/L	2

Model output from the validation modeling was compared to the 2015 annual average MLSS, estimated SRT values calculated from the historical data, and effluent concentrations from the HPO reactors and DARs, shown in **Table 2-19** and **Table 2-20**. Average values from 2013 through 2015 are also shown for comparison.

Table 2-19 – Comparison of Model Output to Average Effluent Data (HPOs)

Source	HPOs				
	MLSS	SRT	BOD_5 [(1)]	SS	TKN
	mg/L	days	mg/L	mg/L	mg/L
Model	1,195	0.34	31.65	15.13	23.84
2015 Actual	1,378	0.47	14.73	8.42	14.36
2013-2015 Actual	1,365	0.51	21.85	10.97	14.77

[(1)]Model output is cBOD, which is a fraction of BOD

Table 2-20 – Comparison of Model Output to 2015 Annual Average Data (DARs)

Source	DARs					
	MLSS	SRT	SS	NH_3	TKN	NO_3+NO_2
	mg/L	Days	mg/L	mg/L	mg/L	mg/L
Model	2,859	7.36	12.14	0.64	2.17	20.49
2015 Actual	4,573	23.54	4.18	0.07	1.56	18.43
2013-2015 Actual	4,111	19.34	4.43	0.08	1.45	19.13

Significant differences were noted between the 2015 actual data and the model output for the HPO effluent BOD_5, SS, TKN; and DAR effluent SS, ammonia (NH_3), TKN, and nitrate/nitrite (NO_3/NO_2). In addition, significant differences were identified between the modeled MLSS concentrations and the actual concentrations determined from monitoring data. The output MLSS concentrations were both significantly lower than the actual concentrations from monitoring data. The model output SRT for both the HPO reactors and the DARs was also lower than those calculated from the monitoring data. There are several potential causes for the discrepancies in the modeled solids production.

Settling calibration appears to play a major factor. The model output effluent suspended solids shown above was two to three times greater than the actual effluent suspended solids concentrations from the HPO and DAR systems, respectively. This suggests that the settling parameters require recalibration. The calculation of the SRT and MLSS concentration dictate that a constant wastage rate with increased effluent suspended solids would result in a lower SRT due to an increased mass rate of solids leaving the system, and therefore a lower MLSS. Recalibration would not be unexpected as the settling parameters were originally calibrated based on actual Sludge Volume Index (SVI) data from the facility during the 2009, 2010, and 2012 time periods. The SVI for both systems will have undoubtedly changed from the time of the calibration due to the modifications to operations at the HPO reactors and DARs. SVI data should be gathered during the next phase of the master plan to recalibrate settling.

Data quality issues may have also skewed the results of the process model to indicate lower MLSS concentrations and SRT values. Return activated sludge (RAS) and WAS flow rates should be validated in the next phase of the master plan to confirm accurate data has been recorded for these values. DO data

was also lacking and should be confirmed for each stage of the HPO reactors and DARs in the next phase of the master plan. Concentration data was available for the model influent via the Main Pumping Station monitoring data, however the flow rate leaving the Main Pumping Station must be assumed due to a lack of monitoring of recycle streams. All recycle flows to the process should be monitored in the next phase of the master plan to confirm the mass rate of important wastewater constituents to the biological processes. The mass rate of influent constituents is directly related to the solids production predicted by the model.

In addition to settling, biomass stoichiometry and kinetics appears to require recalibration for BOD and TKN removal in the HPO reactors, and denitrification in the DARs. Heterotrophic biomass stoichiometry and kinetics are expected to be the main calibration needs in both cases while some calibration will be required for autotrophic biomass in the HPO reactors. **Figure 2-9**, **Figure 2-10**, **Figure 2-11** and **Figure 2-12** illustrate the kinetic and stoichiometric parameters used in the HPO reactors and DARs.

Figure 2-9 – HPO Reactor Kinetic Parameters

Kinetic --SIMULATION IS LOADED--

Active Heterotrophic Biomass		
[HPO_MLSS] heterotrophic maximum specific g...	3.7	1/d
[HPO_MLSS] readily biodegradable substrate h...	32.0	mgCOD/L
[HPO_MLSS] aerobic oxygen half saturation co...	0.2	mgO2/L
[HPO_MLSS] anoxic oxygen half saturation coe...	0.2	mgO2/L
[HPO_MLSS] anoxic growth factor	1.0	-
[HPO_MLSS] nitrate half saturation coefficient	1.0	mgN/L
[HPO_MLSS] ammonia (as nutrient) half satura...	0.04	mgN/L
[HPO_MLSS] heterotrophic decay rate	0.62	1/d
[HPO_MLSS] alkalinity half saturation coefficien...	5.0	mgCaCO...
Active Autotrophic Biomass		
[HPO_MLSS] autotrophic maximum specific gro...	0.65	1/d
[HPO_MLSS] ammonia (as substrate) half satur...	3.0	mgN/L
[HPO_MLSS] oxygen half saturation coefficient	0.5	mgO2/L
[HPO_MLSS] autotrophic decay rate	0.17	1/d
[HPO_MLSS] alkalinity half saturation coefficien...	25.0	mgCaCO...
Hydrolysis		
[HPO_MLSS] maximum specific hydrolysis rate	2.81	1/d
[HPO_MLSS] slowly biodegradable substrate h...	0.15	gCOD/gC...
[HPO_MLSS] anoxic hydrolysis factor	0.37	-
Ammonification		
[HPO_MLSS] ammonification rate	0.016	m3/gCOD/d
Temperature		
[HPO_MLSS] Temperature coefficient for muh	1.072	-
[HPO_MLSS] Temperature coefficient for bh	1.029	-
[HPO_MLSS] Temperature coefficient for mua	1.123	-
[HPO_MLSS] Temperature coefficient for ba	1.029	-
[HPO_MLSS] Temperature coefficient for kh	1.072	-
[HPO_MLSS] Temperature coefficient for ka	1.029	-

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Figure 2-10 – HPO Reactor Stoichiometric Parameters

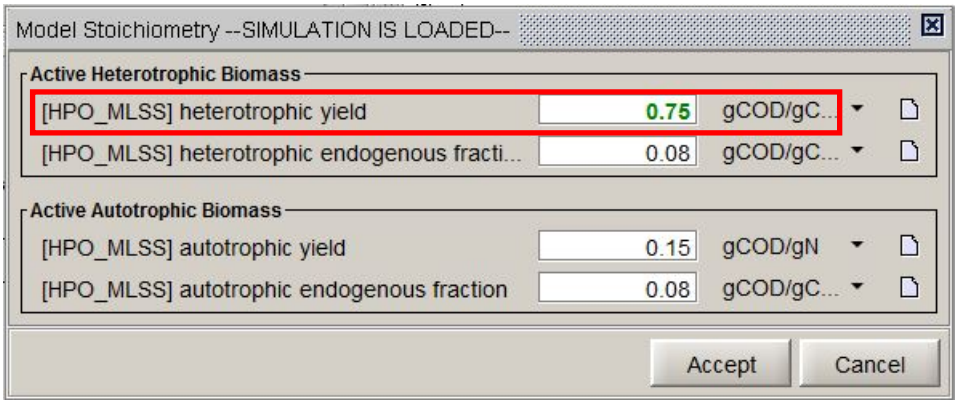

Figure 2-11 – DAR Kinetic Parameters

Kinetic --SIMULATION IS LOADED--

Active Heterotrophic Biomass		
[DAR234_MLSS] heterotrophic maximum specif...	3.2	1/d
[DAR234_MLSS] readily biodegradable substra...	28.0	mgCOD/L
[DAR234_MLSS] aerobic oxygen half saturatio...	0.2	mgO2/L
[DAR234_MLSS] anoxic oxygen half saturation ...	0.2	mgO2/L
[DAR234_MLSS] anoxic growth factor	0.8	-
[DAR234_MLSS] nitrate half saturation coeffici...	0.1	mgN/L
[DAR234_MLSS] ammonia (as nutrient) half sat...	0.05	mgN/L
[DAR234_MLSS] heterotrophic decay rate	0.62	1/d
[DAR234_MLSS] alkalinity half saturation coeffi...	5.0	mgCaCO...
Active Autotrophic Biomass		
[DAR234_MLSS] autotrophic maximum specific ...	0.7	1/d
[DAR234_MLSS] ammonia (as substrate) half s...	2.0	mgN/L
[DAR234_MLSS] oxygen half saturation coeffici...	0.3	mgO2/L
[DAR234_MLSS] autotrophic decay rate	0.17	1/d
[DAR234_MLSS] alkalinity half saturation coeffi...	25.0	mgCaCO...
Hydrolysis		
[DAR234_MLSS] maximum specific hydrolysis r...	3.0	1/d
[DAR234_MLSS] slowly biodegradable substrat...	0.1	gCOD/gC...
[DAR234_MLSS] anoxic hydrolysis factor	0.6	-
Ammonification		
[DAR234_MLSS] ammonification rate	0.08	m3/gCOD/d
TEMPERATURE		
[DAR234_MLSS] Temperature coefficient for m...	1.072	
[DAR234_MLSS] Temperature coefficient for bh	1.029	
[DAR234_MLSS] Temperature coefficient for m...	1.072	
[DAR234_MLSS] Temperature coefficient for ba	1.029	
[DAR234_MLSS] Temperature coefficient for kh	1.072	
[DAR234_MLSS] Temperature coefficient for ka	1.072	

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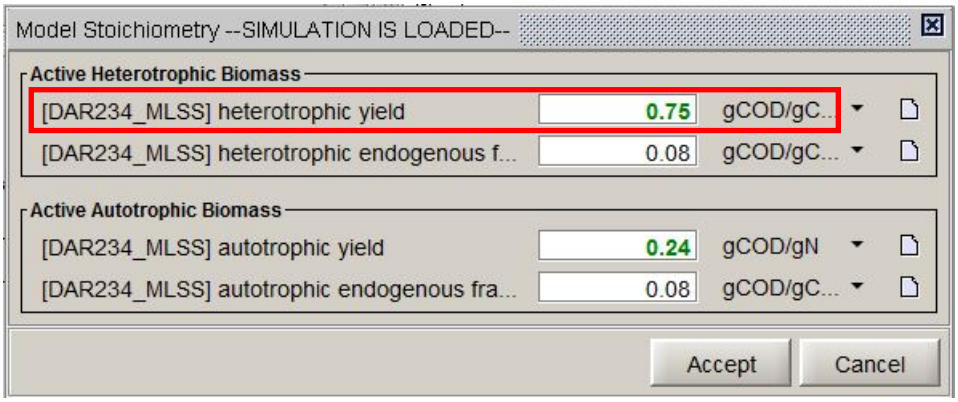
Figure 2-12 – DAR Stoichiometric Parameters



In the HPO reactors, both the "heterotrophic maximum specific growth rate" and the "readily biodegradable substrate half saturation coefficient" appear slightly exaggerated. Higher values for the maximum specific growth rate and the substrate half saturation coefficient result in higher effluent concentrations of BOD and SS because of a lower affinity to biodegradable substrate by the heterotrophic biomass. For autotrophs, the "ammonia (as substrate) half saturation coefficient" and "autotrophic decay rate" are higher than model default values and industry standard values. Reducing these values would increase the autotrophic affinity for ammonia and would increase the active autotrophic biomass in the HPO reactors, therefore reducing the HPO effluent TKN concentration. Tetra Tech previously noted some inaccuracy in the daily composite sampling the HPO TKN concentrations are based on, therefore grab samples of HPO effluent may be required to confirm the HPO effluent TKN reported in the MORs. The autotrophic "oxygen half saturation coefficient" is slightly lower than default and industry standard, and would result in a greater affinity to oxygen and improved competition with heterotrophs. Heterotrophic yield is also higher than default and industry standard, but no speculation can be made to the accuracy of this value at this time due to concerns with the settling calibration.

In the DARs, the "readily biodegradable substrate half saturation coefficient" for heterotrophs also appears exaggerated as it is significantly over the model default. Decreasing this value will result in a greater affinity for biodegradable substrate. This in turn would increase the amount of denitrification possible in the DARs as the amount of nitrate converted by heterotrophs under anoxic conditions is directly related to the availability and consumption of biodegradable substrate. The "nitrate half saturation coefficient" is in line with the model default and industry typical values, but it may require some calibration to meet the actual performance of the DARs. The denitrification operation of the DARs is affected by the operation of the HPO reactors and the greater than actual HPO effluent TKN concentration in the model does increase the amount of nitrate that may be formed in the DARs. Correction of the DAR effluent nitrate concentration will require concurrent correction of the HPO effluent TKN.

The GPS-X model provided will require further calibration to accurately simulate the current performance of the HFC AWTP and to project future performance with current and modified process configurations.

2.8 Regulatory Review

2.8.1 Tampa Bay Estuary Reasonable Assurance Plan and Tampa Bay Nitrogen Management Consortium (NMC)

Tampa Bay is Florida's largest open-water estuary, home to a diverse population of aquatic life and it is one of only 28 estuaries in the U.S. Environmental Protection Agency (EPA) National Estuary Program. It is also surrounded by the second largest metropolitan area in the state and used for commercial, industrial and recreational purposes. Public and private agencies have taken an interest in restoring Tampa Bay for more than 25 years. These agencies have provided water quality testing, seagrass and wildlife counts, analyzed the state of the Bay, reported the results and provided action plans for restoration. This research and testing indicated that a primary pollutant in the Bay was and still is nitrogen and causing of the decline of the aquatic habitat through eutrophication. In 1998 the EPA established a Total Maximum Daily Load (TMDL) for nitrogen for Tampa Bay. The Tampa Bay Estuary Program (TBEP), Florida's Department of Environmental Protection (FDEP) and the Southwest Florida Water Management District (SWFWMD) all played key roles in the establishment of the TMDL. The Tampa Bay Nitrogen Management Consortium (NMC) was born out of the TMDL process in 1996 and partially funded by the EPA to monitor water and quality and health of the estuary, research nitrogen loading to the Bay and provide recommendations to government agencies in an effort to restore Tampa Bay. The NMC and TBEP put together a Reasonable Assurance Program with FDEP oversight that continued restoration goals and nitrogen limits upon the expiration of the EPA TMDL. A Reasonable Assurance Program (RAP) is an alternative to a FDEP TMDL which is established and managed by local agencies. The RAP for Tampa Bay has been updated multiple times but maintained the same total nitrogen loading to the Bay. The original EPA TMDL and the RAP have shown a reduction in nitrogen concentrations, chlorophyll a and an increase in seagrass coverage in the Bay. The RAP limits the total nitrogen loading to Hillsborough Bay within Tampa Bay to 1451 tons/yr.

2.8.2 Tampa Bay Estuary Program (TBEP)

The TBEP was established in 1991 based on legislature by the U.S. congress due to the national significance of Tampa Bay. TBEP is a partnership of Hillsborough, Manatee and Pinellas counties; the cities of Tampa, St. Petersburg and Clearwater; the SWFWMD; the FDEP; and the EPA. "Charting The Course" was created in 1998 by TBEP and is a Comprehensive Conservation and Management Plan for Tampa Bay. The current version of "Charting The Course" includes specific measureable goals for improving the Bay contained in 38 action plans. A few findings in this document include, 63% of total nitrogen loading into Tampa Bay was from stormwater runoff, 21% from atmospheric deposition, 9% from municipal wastewater and that all have seen improvements due to successful nitrogen management programs. TBEP is currently in the process if updating "Charting The Course" from the last revision in 2006. This revision is not expected to recommend any changes that would affect HFC AWTP TN allocations.

2.8.3 FDEP NPDES Permit

The HFC AWTP is permitted to discharge of 96 MGD AADF of treated municipal and industrial wastewater to Tampa Bay and 12.6 MDG AADF to reuse water systems under the current National

Pollutant Discharge Elimination System (NPDES) permit issued by the FDEP on November 23, 2015 (FL0020940-019-DW1P/NR). This permit also authorizes the facility to produce Class A, AA and B biosolids. Biosolids permitting will be discussed in a following section. The facility is held to stringent effluent limits for surface water discharge into Hillsborough Bay. **Table 2-21** summarizes the effluent limits for surface water and reclaimed water discharges. A copy of the current permit can be found in **Appendix G**.

Table 2-21 – Summary of Current NPDES Permit Effluent Limitations

Constituent	Surface Water Discharge Limit (Annual Average)	Reclaimed Water Limit (Annual Average)
Carbonaceous 5 day BOD	5.0 mg/L (Max)	20 mg/L (Max)
Total Suspended Solids	5.0 mg/L (Max)	5.0 mg/L (Max)
Total Nitrogen	3.0 mg/L (Max)	-
Total Nitrogen	319.8 tons/yr (Max)	-
Total Nitrogen	213.2 tons/yr (5 year average) (Max)	-
Total Phosphorus*	None	-
pH	6.5-8.5	6.0-8.5
Total Chlorine Residual (for disinfection)	1.0 mg/L (Min)	1.0 mg/L (Min)
Total Chlorine Residual (for dechlorination)	0.01 mg/L (Max)	-
Dissolved Oxygen	5.0 mg/L (Min)	-
Fecal Coliform	75% less than detection (Min)	75% less than detection (Min)
Enterococci	35 #/100mL (monthly geometric mean)	-
Total Recoverable Copper	3.7 µg/L (single sample)	-
Dichlorobromomethane	33 µg/L	-
Dibromomonochloromethane	39 µg/L	-
Chronic Whole Effluent Toxicity (Ceriodaphina dubia)	100% (Min) (single sample)	-
Chronic Whole Effluent Toxicity (Pimephales promelas)	100% (Min) (single sample)	-

* The facility has maintained an exemption for phosphorous since nitrogen has been identified as the limiting nutrient in Tampa Bay and its subparts.

The NDPES permit also grants the facility mixing zones for surface water discharge into Hillsborough Bay for dichlorobromomethane and dibromomonochloromethane. These two mixing zones allow for higher

concentrations of the two trihalomethanes at the surface water discharge point due to dispersion and dilution in the mixing zone. The facility is currently under consent order for multiple exceedances over the 39 µg/L limit for dibromomonochloromethane. A mixing zone study for this parameter is currently under review by FDEP to address the consent order. The review of this study is expected to justify a minor permit revision for this parameter.

There were minimal changes to the effluent limits with the latest permit which are summarized in **Table 2-22**. Although the permit allows for an annual average concentration for Total Nitrogen (TN) of 3.0 mg/L and max single sample of 6.0 mg/L per day, the 5-year average of tons of TN per year limits the TN concentration to 2.38 mg/L based on the AADF of 58.7 MGD. As the AADF is expected to increase to 65 MGD this equates to a limit of 2.15 mg/L based on the current 5-year average limit for TN tons/yr. The average TN concentration for 2014 was 2.10 mg/L. The facility has the proven historical performance in nitrogen removal to meet this criteria for annual average TN concentration, but there is little margin for error to meet the criteria at higher flows.

Table 2-22 – Changes in Effluent Limits

Constituent	Previous Limit	New Limit	Change
TN (tons/yr – 5 yr avg.)	225.8	213.2	12.6 (6% reduction)
TN (tons/yr)	319.8	246.8	73 (30% increase)
Total Recoverable Nickel (µg/L)	8.3	**None – limit removed**	
Changes in Groundwater Monitoring Parameters			
Total Recoverable Cadmium (µg/L)	5.0	**None – limit removed**	
Total Recoverable Chromium (µg/L)	100	**None – limit removed**	
Total Recoverable Lead (µg/L)	15.0	**None – limit removed**	

Exceedances from the previous permit cycle are on pages 107-108 of the current NPDES permit in **Appendix G**. The following parameters had at least one exceedance: Chronic Toxicity (Ceriodapnia), pH, Total Recoverable Copper, Fecal Coliform, min and max Total Chlorine Residual and dibromomonochloromethane, with dibromomonochloromethane having the largest number of exceedances. The facility also exceeded the annual average for dichlorobromomethane recently in August of 2015. The annual average increased the following two months. All exceedances other than for dibromomonochloromethane and dichlorobromomethane were determined to be unlikely to reoccur and did not require further investigation. However, an investigation into disinfection alternatives and modifications would likely provide options to reduce risk for all disinfection related permit exceedances.

The consultant met with FDEP on January 12, 2016 to discuss possible future regulations that could affect the facility. FDEP indicated that there were no known future regulations that would have certain impact on this facility's future NDPES permits. They do not expect the TN limits to be reduced since total TN allocation to Tampa Bay has remained unchanged. FDEP is currently undergoing a triannual review of water quality standards, and there are additional constituents and changes to fecal bacteria in the proposed update for Class III marine waters. If any of these proposed changes make the final revision of FAC 62-302, FDEP recommended testing for these parameters to determine current effluent concentrations if any. However, any changes to water quality standards will not necessarily be reflected in the facility's NPDES future permits without investigation into each parameter. Regardless of the final outcome for fecal bacteria in the water quality standards, it will remain unchanged in the NDPES permitting. FDEP suggested the impending ban on landfilling septage could affect the facility by receiving additional septage in the future.

2.8.4 Title V Air Permit

There are currently seventeen (17) Emission Units (EU) on the plant site that are regulated under the Title V Air Permit No. 0570373-023-AV issued January 15, 2015 that will expire November 1, 2016. These seventeen EUs are described in **Table 2-23**.

Table 2-23 – Title V Air Permit Emission Units (EU)

EU No.	Description
Regulated Emissions Units	
001	Wastewater Treatment Plant Sludge Dryer Train No. 2
002	Wastewater Treatment Plant Sludge Dryer Train No. 3
005	Sludge Silo No. 2
006	Sludge Silo No. 3
007	Sludge Silo No. 4
008	Sludge Silo No. 5
009	Truck Loading Station No. 1
010	Truck Loading Station No. 2
011	Sludge Silo No. 6
012	Four Diesel Non-Emergency Generators controlled by Oxidation Catalysts
016	Silo No. 6 Truck Loading Spout
017	Engine 1 with Nominal 2.9 MW Generator (TECO)
018	Engine 2 with Nominal 2.9 MW Generator (TECO)
019	Methanol Storage Tank
020	Five Digester Gas Engines/Generators
Unregulated Emissions Units	
003	Building Fugitives and Odor Control System No. 1
004	Building Fugitives and Odor Control System No. 2

Source: Title V Air Permit No. 0570373-023-AV

The City received a Short Form Consent Order on November 3, 2014 for violating the maximum permitted digester gas limit of 78.8 MMCF/12-consecutive month period, beginning in March of 2012, and occurring every month thereafter, through March 2014. Digester gas generators are regulated under 40 CFR 63, Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines (RICE) as of August 22, 2011. They are not subject to 40 CFR 60, Subpart III or JJJJ since the engines were constructed between 1984 and 1987. The City revised their permit to limit the hours of operation of the digester gas generators to avoid triggering Prevention of Significant Deterioration (PSD) requirements. If triggered, these could entail extensive air pollution analysis, selection and implementation of best available technologies to mitigate pollution, and processing of a new permit.

On March 21st, NOVA Engineering and Environmental submitted a permit renewal to the EPC. The following changes were requested regarding the emission units that is pending approval:

- Remove EU003 and EU004 because they are not a source of air emissions

- Remove EU017 and EU018 because they are going to be removed from the plant site
- Add EU021 – Four digester gas boilers
- Add EU022 – Four digester gas flares

During discussions with NOVA, it was indicated that future NESHAP, Clean Power Plan, and Non-Attainment rules should not unfavorably affect the HFC AWTP in the next few years – though, they should be monitored.

2.8.5 Rail Car

HFC AWTP receives liquefied chlorine gas and liquefied sulfur dioxide gas in 90 ton rail cars. A leak from either one of the toxic gases could cause injury or death to affected personnel at the facility and others in the surrounding area. Due to the quantity of these chemicals stored onsite, the facility must have a registered Risk Management Plan with the EPA and submit updates every five years. This was last updated in September 22, 2014 according to the EPA facility information and an update must be submitted prior to the end of the five year anniversary date. The Risk Management Plan includes analysis of worst case scenario accidental releases as well as information about safety systems and operations to meet EPA's Accidental Release Prevention Rule and all other applicable federal and state regulations. Some of the additional requirements the facility must meet to receive and store these gases in rail cars include, rail cars must meet federal CFR guidelines, must own a private railway to receive and store cars, leak sensors and motoring system in rail car unloading area and chlorination room, cannot store more than 135 tons of either gas onsite or exceed an annual daily average of 57.5 tons, and staff must have Chlorine Institute training.

The use of these chemicals for disinfection and dechlorination in the form and quantity received poses health risks and adds to operational costs for special training for personnel and updating and maintaining the Risk Management Plan. Chlorine gas has historically been the lowest cost disinfectant used for wastewater per gallon of water treated, but many other facilities have switched to alternatives to chlorine gas to avoid the human health risks.

2.8.6 Biosolids

The Florida Department of Environmental Protection (FDEP) Facility Permit Number FL0020940 (Permit), issued in November 2015, allows the HFC AWTP to produce Class AA, A, or B biosolids. Disposal of Class B biosolids is limited to application in areas having restricted public access. Specific requirements, as outlined in Section II.10 and II.21 of the Permit, require that the HFC AWTP comply with Florida Administrative Code (FAC) Rule 62-640.600(1)(b) and (2)(a) requirements for Class AA or B pathogen and vector attraction reduction, respectively.

Table 2-24 presents a summary of the existing HFC AWTP Class B permit requirements.

Table 2-24 Existing HFC AWTP Class B Biosolids Permit Requirement

Parameter	Permit Criteria
Vector Attraction Reduction	• ≥ 38% VSR [(1)] demonstration; or • Incorporation of sewage sludge into soil
Pathogen Reduction	• Minimum Mean Cell Residence Time of 15 days, Minimum Temperature of 95°F; or • Fecal Coliform Most Probable Number (MPN) < 2,000,000 / gram of total solids
Monitoring Frequency	• Every 2 months (6 x per year)

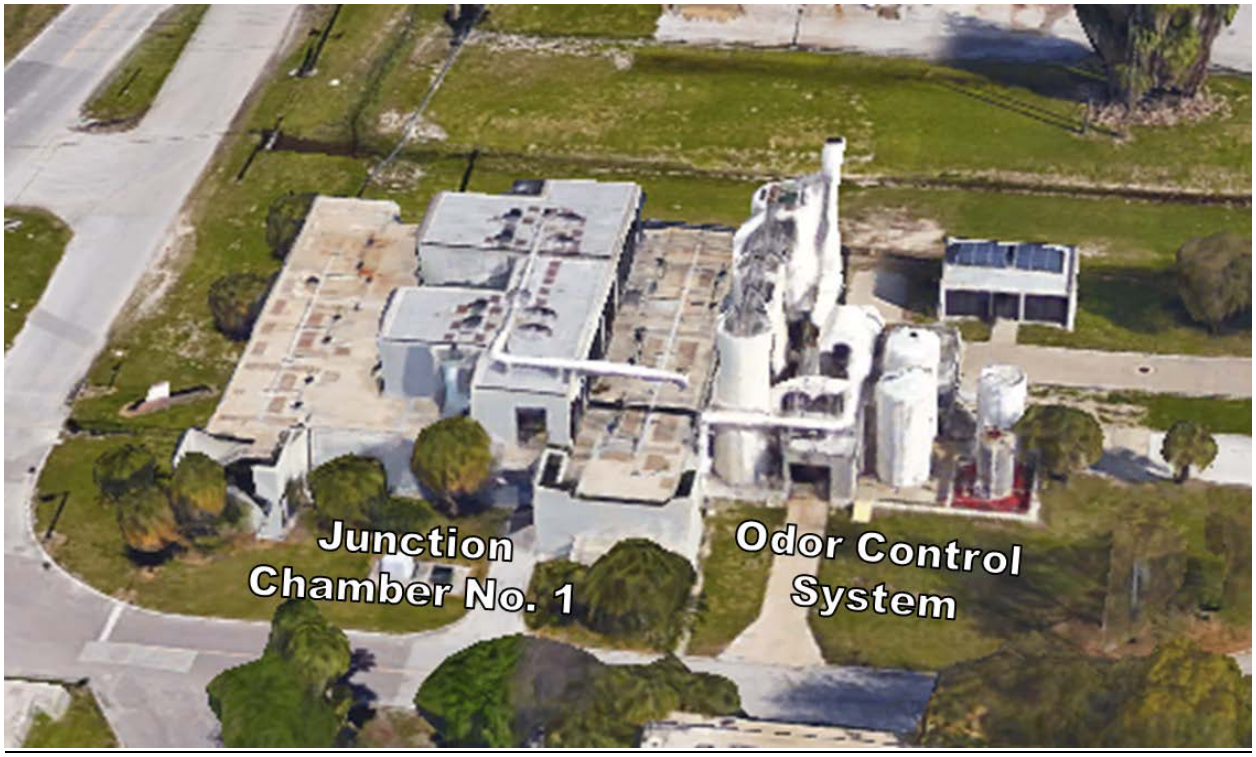
Notes:
[1] *Volatile Solids Reduction (VSR)*

Pathogen reduction at the HFC AWTP is achieved through an anaerobic digestion process whereby residual solids are treated in the absence of air at a minimum temperature of 95 Degrees Fahrenheit (°F) for a minimum solids retention time of 15 days. If the time or temperature requirement falls below the permitted limit, then the Permit allows for the analyses of fecal coliform MPN density to demonstrate the required pathogen reduction. Additionally, the Permit requires that the HFC AWTP decrease the mass of volatile solids in the digested sludge by a minimum of 38 percent to comply with vector attraction reduction requirements

3 Unit Process Evaluation

3.1 Preliminary Treatment

3.1.1 Pre-Aeration and Odor Control



3.1.1.1 Junction Chamber No. 1

HFC AWTP influent enters the plant at Junction Chamber No. 1 (JC1) through five force mains, as seen in **Figure 3-1**. The 54'' 26th Street FM conveys wastewater from the Ybor Pumping Station. The 48'' East Tampa FM conveys wastewater from the 42nd Street Trunk Sewer. The 48'' Interbay FM conveys wastewater from the San Carlos Pumping Station. The 54'' Seddon Island FM conveys wastewater from the Krause Street Pumping Station. The 36'' FM conveys wastewater from the onsite Raw Sewage Pumping Station, which receives wastewater from the Main Outlet Interceptor and light industrial waste loads. Light industrial waste includes septage, grey water, portable toilet waste, ship and marina waste, and food processor waste. The five force mains discharge into the enclosed influent chamber of the junction chamber, which is also where samples are taken of the influent for regulatory purposes. The influent sampling station is located in a small room adjacent to the influent chamber shown in **Figure 3-2**.

Figure 3-1 – JC1 Flow Diagram

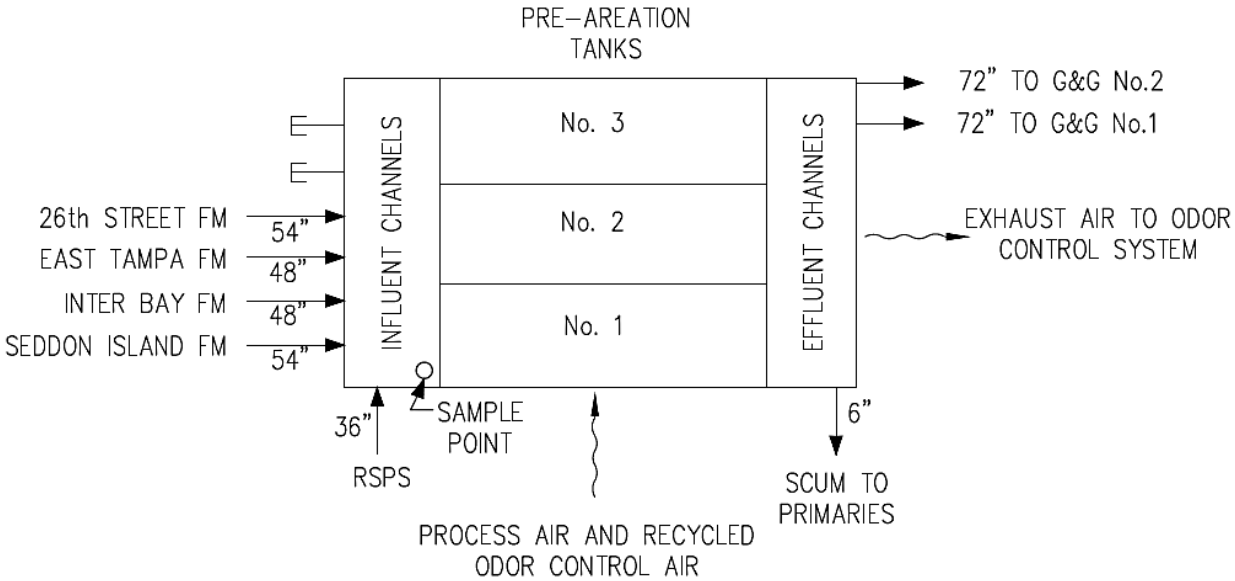


Figure 3-2 – Plant Influent Sampling Point INF-01 at JC1

The influent monitoring site (INF-01) for the plant is located at JC1. This site monitors influent BOD and TSS on a daily basis, pulling 24-hr flow proportion composite (FPC) type samples. City staff explained that Sonford Samplers automatically collect the same volume of influent samples at varying times then

store them either on ice or in refrigeration at all times. All samples are analyzed onsite. Record drawings do not show digester supernatant, return sludge or any other plant process recycled waters discharging into the same influent chamber that the influent sampler pulls from. This configuration is in compliance with the requirements in Permit No. FL0020940. Note that leachate from industrial waste haulers enter the wastewater process at the Main Pump Station and is not contained in samples from INF-01. Waste load water quality is reported by haulers when they enter the plant.

The main purpose of the junction chamber is to release H_2S from the influent wastewater by aeration. This occurs in the pre-aeration tanks that are separated by a common wall. Exhaust air collects in the enclosed head space and pulled into the Odor Control System. Aerating the water releases H_2S that would otherwise cause corrosion and objectionable odor problems downstream. When present in the atmosphere at high concentrations, the H_2S gas is harmful to inhale and can even be fatal in extreme conditions. H_2S is often released from the wastewater at locations in the plant where flow is turbulent. It is advantageous to release as much H_2S as feasible in the junction chamber so it may be stabilized into solution. Protective lining is installed in the interior air space of the tanks extending down to below the minimum water level and has recently been replaced. The lining prevents damage from hydrogen sulfide or other corrosive gases released from the influent wastewater. Air is vented out of the enclosed junction chamber through emergency exhaust fans if the odor control system is not operating. Pressure relief valves are in place should exhaust fans fail.

Table 3-1 – Design Criteria for Junction Chamber No. 1

Description	Criteria
Design Influent Flow Rates	96 MGD-Average 220.8 MGD-Peak
Design Detention Time	10.1 Minutes (at 96 MGD influent) 7.5 Minutes (at 128.6 MGD influent) 4.4 (at 220.8 MGD influent)
Tank Size	25’x66’ (Tank No. 1 & No. 2) 30’x66’ (Tank No. 3)
Design Volume Per Tank	89,760 CF 0.67 MG
Blower Capacity (JC-AB-1 & 2)	3,600 acfm (at discharge 8.9 psig)
Blower Capacity (JC-AB-3 & 4)	4,320 acfm (at discharge 8.7 psig)
Water Depth	16.25 Feet (Minimum) 17.00 Feet (Design) 19.91 Feet (Maximum)
Influent Sample Type	24-hr FPC
Influent Sampler Manufacturer	Sonford Products Co.
Influent Sampler Install Date	January 1978

3.1.1.2 Odor Control System

The Odor Control System only cleans air from JC1. For a theoretical three-stage system, the first stage is a pretreatment stage used to raise the pH so that a portion of the odorous gases (H_2S) is absorbed before oxidation with Sodium Hypochlorite in the second and third stages. In the case at HFCAWTP, the system has the ability to add sodium hypochlorite in the third stage. However, the third stage has not been used for many years and sodium hypochlorite is not used to treat the odorous air. Instead, only sodium hydroxide (caustic) is added through a spray system to the air stream in stages 1 and 2 then the treated air is diluted with atmospheric air and exhausted to the atmosphere. The spent caustic solution is discharged into the wastewater stream at the HPO reactors. The odor control process at the HFC AWTP is depicted in **Figure 3-3**.

Hydrogen sulfide concentrations are measured before and after treatment in the reaction chambers. The H_2S Concentration Out reading is taken from the exhaust stack after passing through the make-up air duct and exhaust fan. The inlet in the exhaust stack used to take the H_2S Concentration Out sample is over 20-feet high (see **Figure 3-4**). In order to access the inlet, a small diameter PVC pipe was connected to it and extends down to a reachable height off the ground for the operators to pull the air sample.

Table 3-2 – Design Criteria for Odor Control System

Description	Criteria
Install Date	Reaction Chamber No. 1 – October 1987 Reaction Chamber No. 2 – October 1987 Reaction Chamber No. 3 – January 1994
Reaction Chambers Quantity	3
Manufacturer	Quad Environmental Technologies Corp.
Operation	In series
Type	3-Stage Caustic Scrubbers
Size	12-ft Diameter (Chambers 1 & 2) 39-ft High
Chemical Scrubbers	Sodium Hydroxide (Caustic) Sodium Hypochlorite (Bleach)
Intake Air Flow Rate	15,000 cfm
Intake Air Design H_2S Concentration	1,200 ppm (Maximum) 600 ppm (Average) 100 ppm (Minimum)

Figure 3-3 – Odor Control System Flow Diagram

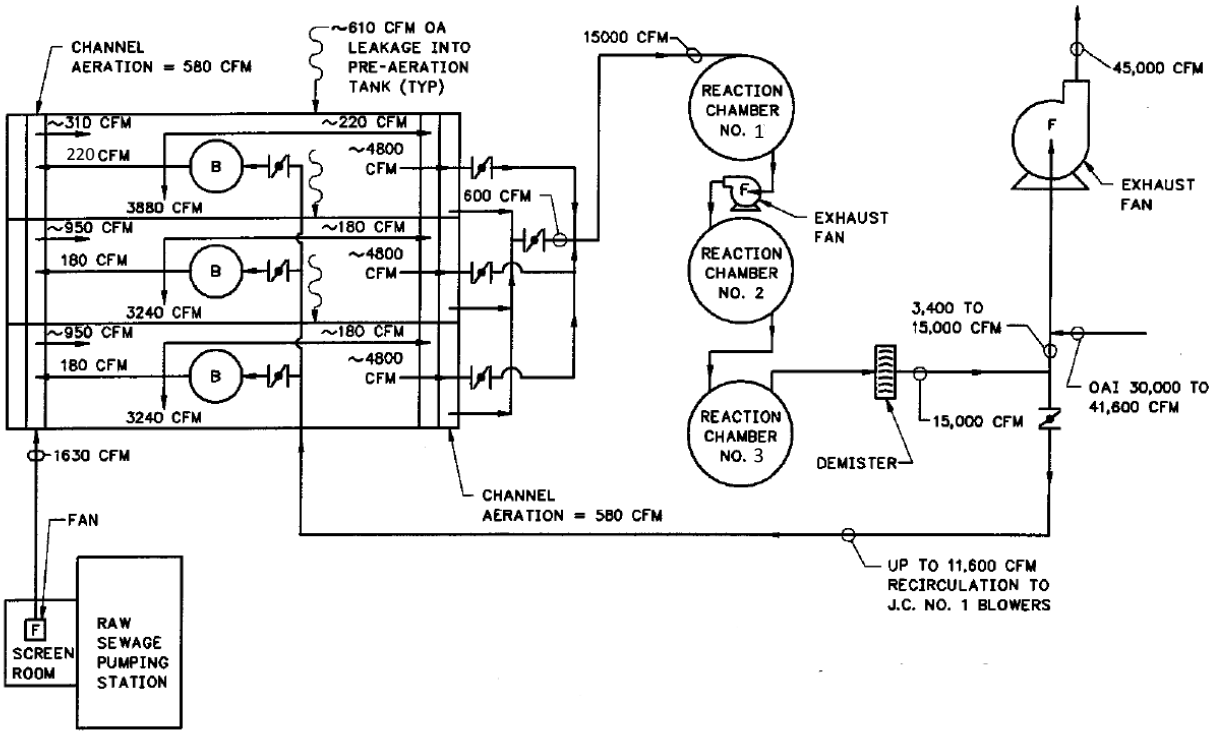


Figure 3-4 – Odor Control Exhaust Stack and H_2S Concentration Out Sampling Point

3.1.1.3 Process Evaluation

The air in the pre-aeration basins serves two purposes, to release H_2S from the raw sewage and to keep the solids in suspension. At least three blowers and all pre-aeration tanks must be in operation in order to achieve maximum H_2S removal. When diffusers are used for mixing, 10 State Standards recommend an air supply of 30 cfm/1000-CF of mixing tank volume in order to maintain solids in suspension. This is more than accomplished when one blower is operated per pre-aeration tank. The only time less than three blowers are operated is during maintenance or other rare circumstances. Water level is not monitored in JC1 and it is assumed to run full. Table 6.1 in the National Manual of Good Practice For Biosolids (2005) recommends that for enclosed headworks buildings, an air exchange rate of 12-20 changes per hour should be maintained to avoid build-up of corrosive gases inside the tanks. Assuming three blowers and three tanks are in service and water is at the minimum design elevation, the chamber is able to achieve 13 air changes/hour and thus meets standards. The only major issue identified in the pre-aeration tanks is solids settling. The City explained that solids settle significantly quickly in these tanks - possibly due to the configuration of the air diffusion system. Diffusers are currently laterally oriented and 24-inches off of the floor. Reconfiguring the orientation or method of air diffusion may help solve this problem and could be investigated further.

The junction chamber pre-aeration system appears to be adequately releasing a significant amount of H_2S from the raw sewage stream based on the high H_2S concentration readings taken by manual odor control system influent air sampling. The historical readings are summarized in **Table 3-3**. The average daily H_2S concentrations into the odor control system is equal to the design average and the peak H_2S concentrations are higher than the design maximum. With corrosion occurring in the screen and grit buildings, though, there may be opportunity here to release more H2S from the influent and help prevent the downstream corrosion.

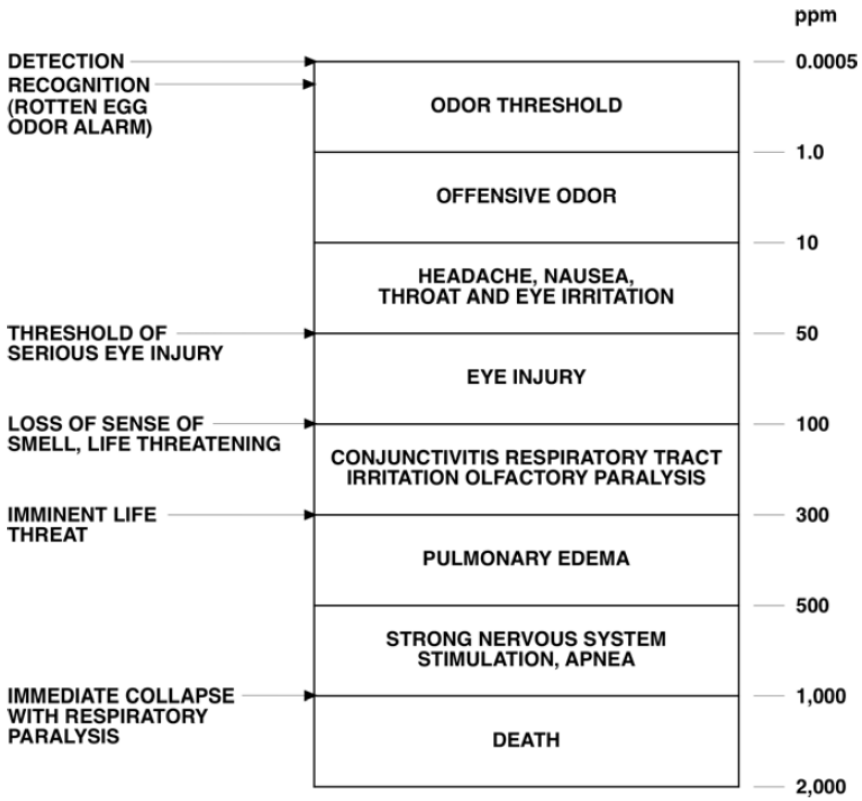
Table 3-3 – Hydrogen Sulfide

Year	Average Daily H_2S In (ppm-ADF)	Average Daily H_2S Out (ppm-ADF)	Average Daily Removal	Peak Hourly H_2S In (ppm)	Peak Hourly H_2S Out (ppm)	95th Percentile Removal	50th Percentile Removal
2010	395	66	82%	1200	300	95%	86%
2011	318	57	74%	1300	500	93%	83%
2012	421	55	85%	1050	500	97%	88%
2013	541	54	90%	1550	350	98%	91%
2014	598	33	93%	1800	160	100%	95%
2015*	707	55	92%	1300	500	97%	91%
2013-2015* Averages	600	50	92%	1600	300	98%	92%

*Data provided ended at October 26, 2015

Though the H_2S intake concentrations meet design criteria, it should be noted that they are extremely high. For perspective, OSHA qualifies concentrations above 100 ppm as "Immediately Dangerous to Life and Health." The peak hourly H_2S concentrations entering the odor control system could result in death if inhaled according to the **Figure 3-5**.

Figure 3-5 – Generally Accepted Toxicity Spectrum for Hydrogen Sulfide Gas



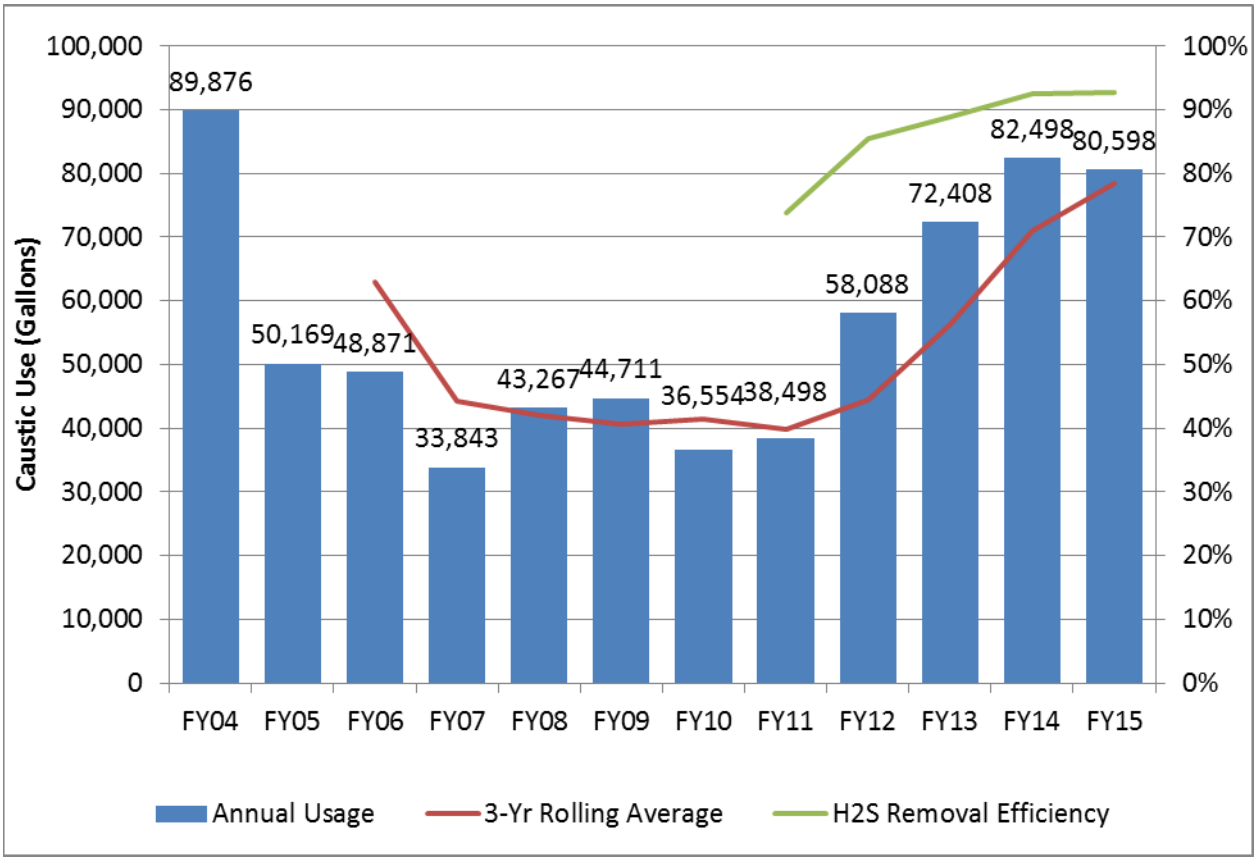
Source: WERF 2007 Minimization of Odors and Corrosion in Collection Systems, pg 2-8

Chemical scrubbing onsite is not the only form of odor control by the City. Bioxide and Thioguard are injected into the sewage at the lift stations that pump to the HFCAWTP. Bioxide is a biochemical solution that has been used since 1992 and is fed into 25 of the City's lift stations. Thioguard is an alkaline slurry that has been used sinced 2005 at 11 of the City's lift stations. Both solutions aim to prevent H_2S release from the transmission system. According to a performance comparison report prepared by the City, the sodium hydroxide usage for odor control at JC1 approximately doubled since Bioxide was used exclusively in the San Carlos basin. Sulfide readings and pH levels are recorded throughout the collection system for odor control at the lift stations, however, aqueous sulfide measurements are not taken immediately before sewage enters JC1 or after sewage leaves JC1. Therefore, we cannot conclude what percentage of aqueous sulfides are released in the pre-aeration tanks and what concentration continues through the plant.

The industry standard gaseous sulfide removal by multi-stage chemical scrubbers is greater than 90%, though it can be as high as 99.9% (WERF 2007). Considering this, the HFC AWTP data shows acceptable

removal efficiencies but there is room for improvement if greater odor control is needed at the plant. The rise in removal efficiency follows the pattern in caustic usage over the same timeframe as seen in **Figure 3-6**.

Figure 3-6 – HFC AWTP Caustic Usage



The removal efficiencies assume that the flow rate of air at both sample points is equal. However, this is not the case because make-up air is added to the air stream before entering the exhaust stack and therefore diluting the H2S out samples. If we assume no air is recirculated to the junction chamber, there is three times more air flowing throug the exhaust stack than then at the intake conduit. This means that the actual H_2S concentration leaving Reaction Chamber No. 3 is three times greater than what is read at the exhaust stake resulting in an average removal efficiency of 75%. This indicates an issue with the effectiveness of the caustic scrubbing process. Depending on the concentration of caustic entering the reaction chambers, there may not even be enough caustic solution used to achieve the 2:1 mole ratio needed to fully reduce H_2S.

Further investigation is needed to study the improvements needed to the system to resolve odor issues. It may be discovered that enough caustic is being added and the odor control process as a whole will need to be re-evaluated. Investigations may show that better H_2S removal can be achieved when bleach is added to the process. Bleach is used to oxidize the H_2S in solution so it does not re-release in

downstream processes. Improvements may even include replacing the outdated chemical scrubbing system with a more cost effective and efficient treatment system.

All of the issues at the junction chamber may be resolved if an equalization tank is implemented that was designed to accomplish the same objectives. An equalization tank may be found beneficial depending on what secondary treatment processes are recommended to resolve the issues identified in this memorandum. If it is, a variety of locations and configurations are possible. Including, replacing the junction chamber – though, this may not be likely since it is usually more preferable to put the equalization tank after screening and grit removal. Either way, an equalization tank will require mixing and odor control. Therefore, inclusion of an equalization tank should be considered with any changes recommended for JC1 and the odor control system in the next phase of the master planning.

Table 3-4 – Summary of Pre-Aeration and Odor Control Evaluation

Performance	
Design Performance Max H_2S Released from JC1: 1,200 ppm Avg H_2S Released from JC1: 600 ppm Removal Efficiency: 90-99% (prior to dilution, industry standard)	Actual Performance[(1)] Max H_2S Released from JC1: 1,600 ppm Avg H_2S Released from JC1: 600 ppm Estimated Efficiency: 75% (prior to dilution)
Evaluation Findings	
• Volume and characteristics of industrial waste are not measured by the City regularly. • Pre-aeration tanks experience a significant amount of solids settling. • H_2S Out Sample is obtained after dilution with make-up air. • H_2S removal efficiency may be as low as 75%, even though actual readings indicate efficiencies closer to 90%. • Sodium Hypochlorite is not utilized in the last reaction chamber for H_2S oxidation. • Equipment is aging and deterioration is starting to become a concern.	
Recommendations	
• Evaluate options for automating the industrial waste receiving stations. • Evaluate options for mitigating solids settling in the pre-aeration tanks. • Evaluate methods to improve the performance of the existing odor control system. • Evaluate alternative technologies to replace the odor control system. • Investigate whether a flow equalization tank is needed at the front of the plant based on downstream treatment process recommendations. Evaluate the addition of an equalization tank and impact to pre-aeration and odor control recommendations.	

[(1)]Based on data from last three years

3.1.2 Screening and Grit Removal

3.1.2.1 Purpose and Description

Effluent from Junction Chamber No. 1 flows through two 72-inch conduits that convey the raw wastewater to the Screen and Grit Buildings by gravity. Screens are used to remove large debris from the influent wastewater. Removing large debris and wasting it separately from the activated sludge prevents damage to downstream equipment and enhances the potential value of biosolids as fertilizer. Screen and Grit Building No. 1 has three screens and Screen and Grit Building No. 2 has two screens. The screens were sized to accommodate peak flows through a total of four screens. Therefore, one screen in Building No. 1 is redundant. The operators periodically rotate which screen serves for redundancy. The City has recently replaced their existing screens with new center flow band screens. As such, historical engineering and design documents have been reviewed, but there was no further evaluation of this unit process. The manufacturer and other performance data for this unit process are given in **Table 3-5**.

Table-3-5 – Screens

Description	Value
Quantity	3 (Building 1) 2 (Building 2)
Manufacturer	Hydro-Dyne
Model	Hydro-Flo/Great White Center Flow
Install Date	2014 (Building 2) 2015 (Building 1)
Design Flows (Total)	96 MGD Average 220.8 MGD Peak
Capacity (Each)	24 MGD Average 55 MGD Peak
Velocity Through Screens	5 fps (Maximum)
Type	Mechanical/Center Flow Band
General Condition	New/Excellent
Screen Openings	6 mm
Screenings Disposal	Incinerated at City owned facility
Head Loss	12-inches
Screenings Production	5 dumpsters per week

Sewage passes through the screens and into influent channels, pass flow deflectors that control uniform velocity across the width of the grit tanks, then sewage overflows into the effluent channel and into the conduits leading to Junction Chamber No. 2. The number of tanks in operation depends on influent rates. The operators aim to run each grit tank at 20 MGD. The tanks are not allowed to operate below 15 MGD. If flow rate through the grit tanks is too low, then organic solids may settle out of the wastewater. If the flow rate through the tanks is too high, than grit may remain suspended and carry over the weir to the downstream processes. Too much grit in the wastewater stream can wear down system equipment over time. The characteristics and operating details of the system is summarized in **Table 3-6**.

Table 3-6 – Grit Clarifier Tanks

Description	Value
Quantity	8 Total 4 Each Building
Manufacturer	DORRCLONE
Type	Velocity Controlled Settling Tanks
Install Date	1978 (Building 2) 1991 (Building 1)
Diameter	45 feet
Nominal Water Depth	6 feet
Capacity (Each)	15 MGD Minimum 27.6 MGD Design 30 MGD Maximum
Typical Target Flow	20 MGD
Operation	Continuous Day
Design Capture	90 % sg 2.65 150-mesh (100 microns)
Grit Removal	2.23 CF/MG 214 CF/Day 25.7 1000lbs/Day (assumes 120 lbs/CF)
Grit Rake Rate	0.14 revolutions/minute
Grit Disposal	Sent to Grit Washers

Grit production rates are not measured. Magnetic sensors on the grit tank discharge lines sense whether or not there is grit slurry flowing to the grit dewatering system. Grit pumps are intended to be operated continuously when a grit tank is in service. If grit is allowed to accumulate in the sumps, the solids concentration may exceed the 1% max allowable percentage to the cyclones; or the grit could become overly compacted into clumps that could disrupt downstream pumps and piping.

Table 3-7 – Grit Pumps

Description	Value
Quantity	8 (Each Building) (4 for redundancy)
Manufacturer	WEMCO – Old Building Warman International – New Building
Install Date	1989 – Old Building 1991 – New Building
Type	Horizontal solids handling
Rated Capacity (Each Pump)	200 GPM
Rated Head (Each Pump)	55 feet (at 1,282 rpm in Bldg 1) 55 feet (at 1,000 rpm in Bldg 2)

The grit dewatering system is used to dewater the grit before dumping it into trucks to be sent to landfill. The City operates three dewatering systems per building. These systems' operating characteristics are included in **Table 3-8**. Grit enters the grit cyclone separators, passes onto the grit

washers, then dumps into the trucks below or onto a belt that conveys the grit to one of the two discharge chutes.

Table-3-8 – Grit Dewatering System

Description	Value
Quantity	6 Grit Separators per Building 3 Grit Washers per Building
Grit Separator Type	Cyclones
Grit Separator Manufacturer	Dorr Oliver Inc.
Grit Separator Install Year	1978, 1991
Grit Washer Type	Reciprocating Rake (Old Style) Screw Conveyor (New Style)
Grit Washer Manufacturer	Dorr Oliver Inc. (Old Style) Regional MFG Special (New Style)
Grit Washer Install Year	1978, 1991, 2000 (Dorr Oliver Inc.) 1994 (Regional MFG Special)
Capacity (per separator)	260 GPM
Conveyor Belt Speed	50 fpm
Washed Grit (Design)	75% Solids 17.1 tons/Day (Wet Grit)
Percent Solids from tanks	1% Maximum Allowable
Grit Disposal	Class I Landfill

3.1.2.2 Process Evaluation

The screens in both screen and grit buildings are new and are working well. However, screens No. 1 and No. 5 are running more frequently than the other screens. After talking to the service rep, it is possible that a smaller pressure differential was programmed in these screens than the other screens. The City is working with them to resolve the issue. The screens run when sensors read a pressure differential upstream and downstream of the screens that exceeds a programmed design value. If it is determined not to be a programming issue than the hydraulics of the influent channels can be further investigated. This could be a possibility because operators have reported an influent flow imbalance to each building. Brief analysis of the channel structure indicates the possibility that hydraulic momentum can carry more solids into Screen No. 5. However, momentum does not seem to be an explanation for Screen No. 1.

Grit removal data was not available for this evaluation. Based on discussions for how grit clarifier tanks are operated, they function per design. The technology has acceptable grit removal characteristics and is assumed to be achieving this. The major concern in the screen and grit buildings is the grit dewatering systems. The age of the grit separators and washers was apparent when visually inspected. **Figure 3-7** and **Figure 3-8** show significant rust on the equipment. Replacing the old grit separators and grit washers is already identified in the City's fiscal year 2017 budget, but it is still recommended to investigate alternative replacement technologies in the next master planning phase to best select the most appropriate system for the plant. Systems can be selected based on a targeted grit size to be removed – this can be selected without a grit characterization study. Such a study, though, would

identify the typical characteristics of the grit entering the plant to specifically identify what size and type of grit needs to be removed.

Figure 3-7 – Grit Washing System Cyclone Separators

Figure 3-8 – Grit Washing System in Screen and Grit Bldg. No. 2

While touring the Screen and Grit Building No. 2, the hand held air monitor was reading high levels of H_2S more so than in Screen and Grit Building No. 1. Since Building No. 1 has a ventilation system, the City may want to investigate the benefits versus costs for installing a building ventilation system in Building No. 2. This could help reduce the exposure of the building equipment and gear to the corrosive effects of H2S.

Table 3-9 – Summary of Screen and Grit Removal Evaluation

Performance	
Design Performance Grit Tank Operating Flow = 15-30 MGD	Actual Performance Grit Tank Target Operating Flow = 20 MGD
Evaluation Findings	
• Operators report influent flow imbalance to screen and grit buildings. • Screens are new technology and are generally operating well. • Screens #1 and #5 have been running more frequently than the others. • Grit clarifier tanks are acceptable technology for grit removal and no issues reported. • Grit clarifier ancillary equipment is deteriorating. • Grit dewatering system is past its useful life.	
Recommendations	
• Investigate possible causes for hydraulic split to the screen and grit facilities and evaluate possible solutions. • Evaluate technologies to replace existing grit dewatering systems. • Investigate the need for building ventilation in Screen and Grit Building No. 2 to push H_2S gas out of the building.	

3.1.3 Junction Chamber No. 2 and Meter Vault No. 2

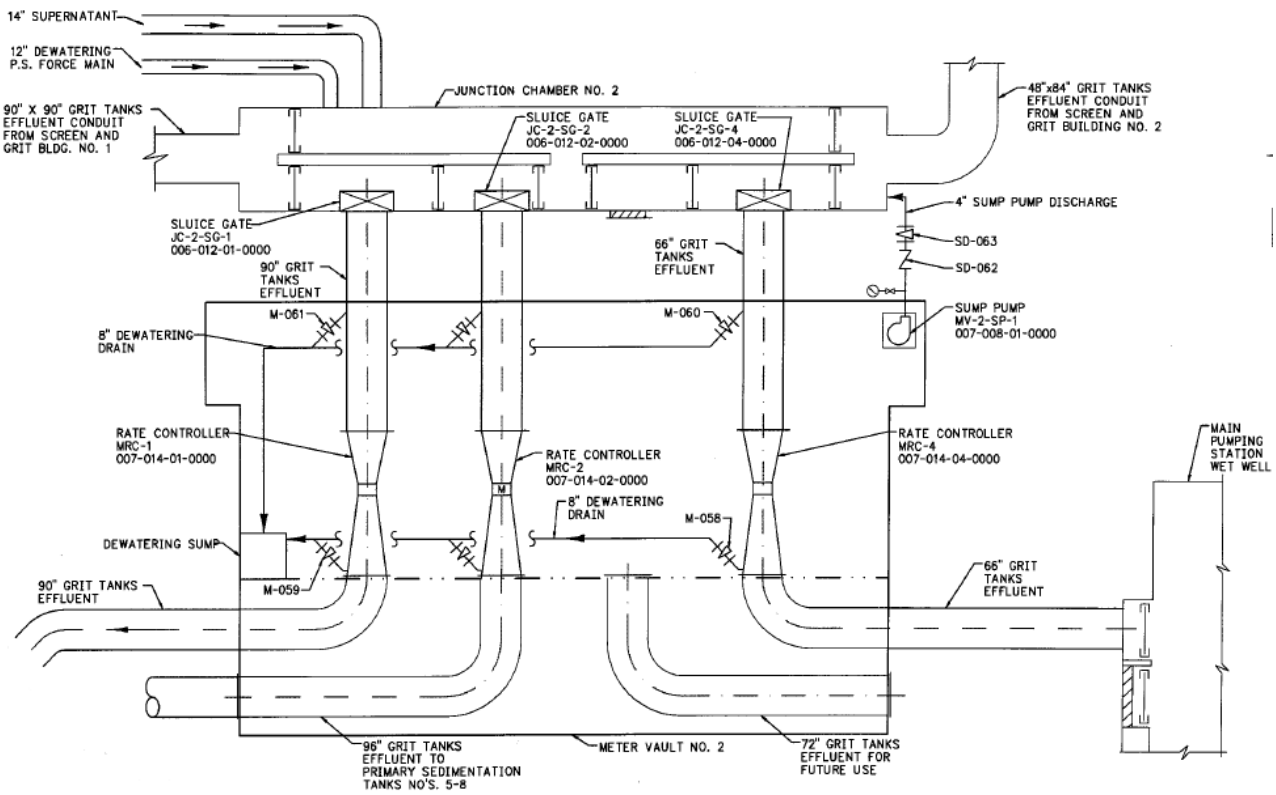
3.1.3.1 Purpose and Description

Effluent flow is split hydraulically between the 90-inch diameter conduit to JC3 and the 96-inch diameter conduit to Primary Sedimentation Tanks 5-8. Rate controller equipment can be used to direct flow through a 66-inch diameter conduit to the Main Pumping Station Wet Well to bypass the primary tanks. The mag meters in Meter Vault No. 2 are each 60-inch in diameter and are used to measure the total plant influent for reporting purposes. These are identified as MRC-1 on the 90-inch diameter conduit and MRC-2 on the 96-inch diameter conduit. There is a 12'' dewatering and 14'' supernatant line that discharge upstream of these mag meters. The 12'' dewatering line is only used periodically when the primary sludge pump station is dewatered. This is a relatively insignificant addition to the plant influent and should not affect the accuracy of the reported influent flow. The 14'' line is not a significant addition to plant influent either. There is a valve on the 14'' line upstream of JC2 that is normally closed and hardly ever opened. Meter Vault No. 2 is ventilated but JC2 is not.

Table 3-10 – Junction Chamber 2 and Meter Vault 2

Description	Value
JC2 – Tank Size	79’ x 11’-3’’ x 17’-3’’
MV2 – Meter Type	Magnetic Flow Meter
MV2 – Meter Manufacturer	ABB
MV2 – Meter Size	MRC-1, 2, & 4: 60-inch diameter
MV2 – Meter Install Date	MRC-1: May 1999 MRC-2: September 1988 MRC-4: May 1999
MV2 – Meter Transmitter Limit	MRC-1: 80 MGD MRC-2: 80 MGD MRC-4: 100 MGD

Figure 3-9 – Junction Chamber No. 2 and Meter Vault No. 2 Flow Diagram



3.1.3.2 Process Evaluation

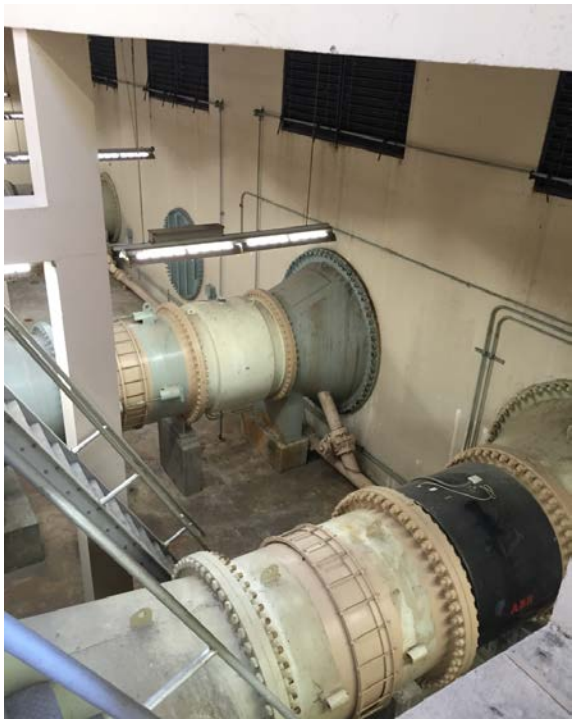
The sluice gates controlling flow to the primary sedimentation tanks have not been functioning, preventing operators from isolating one or the other set of primary tanks. These gates have already been identified by the City for repairs and are on the capital improvements plan dated March 10th, 2016. MRC-1 and MRC-2 have flow transmitters that are limited to reporting up to 80 MGD. When plant flow is greater than 160 MGD, the extra flow is directed into the 66’’ bypass line through MRC-4 that can report up to 100 MGD. Also, the primary sedimentation tanks may be limited to operating at

approximately 80 MGD as discussed in **Section 3.3**. Therefore, the 80 MGD transmitters may be sufficient for current operations. However, if more primary tanks are added, the MRC-1 and MRC-2 flow transmitters may need to be upgraded. This will require further investigation. Otherwise, there have been no other reported issues with Junction Chamber No. 2 and Meter Vault No. 2. Flow meters are shown in the **Figure 3-10**.

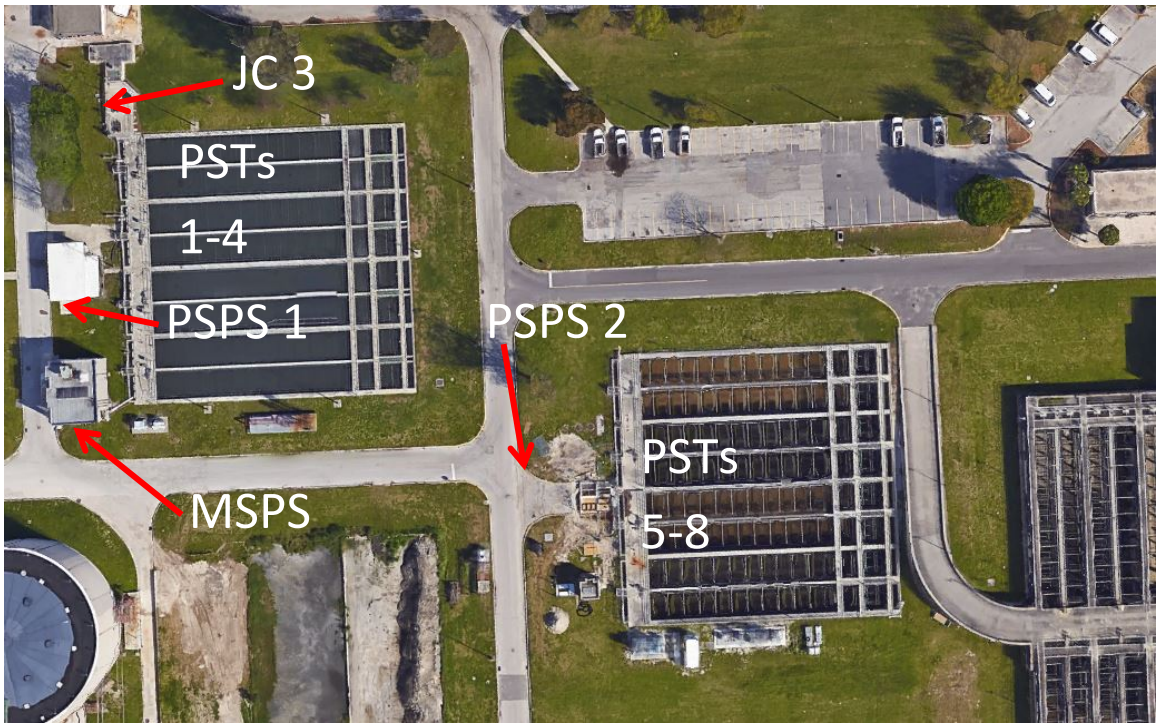
Table 3-11 – Summary of Existing Junction Chamber No. 2 and Meter Vault No. 2

Performance	
Design Performance	Actual Performance
Mag Meter MRC-1 Max Flow: 80 MGD	Mag Meter MRC-1 Max Flow: 80 MGD
Mag Meter MRC-2 Max Flow: 80 MGD	Mag Meter MRC-2 Max Flow: 80 MGD
Mag Meter MRC-4 Max Flow: 100 MGD	Mag Meter MRC-4 Max Flow: 100 MGD
Evaluation Findings	
• Generally, the condition is acceptable. However, nonfunctional sluice gates in JC2 are preventing the isolation of each primary sedimentation tanks. • Mainstream process mag meters transmitters limited to reading 160 MGD. • Flow over 160 MGD is diverted into bypass conduit.	
Recommendations	
• May need to upgrade or reprogram flow transmitters if primary settling tanks hydraulic capacity increases.	

Figure 3-10 – Inside Meter Vault No. 2



3.1.4 Primary Clarification



3.1.4.1 Purpose and Description

The City has 8 primary settling tanks (PSTs) following screening, grit removal, and flow metering. The PSTs are designed to reduce BOD and TSS loading to the secondary treatment process by settling out readily settleable suspended solids. Fats, oils, grease, and other floatables are also removed in the primary clarifiers by surface skimming and scum collection equipment. The primary settling tanks are rectangular with chain and flight longitudinal collectors and chain and flight cross collectors for sludge removal and surface skimming. Each PST has a surface area of approximately 6,308 ft^2 (50,464 ft^2 total) and a weir length of approximately 725.33 linear feet (5,802.64 linear feet total).

PSTs 1 – 4 and 5 – 8 are accompanied by Primary Sludge Pumping Stations No. 1 and No. 2, respectively. Primary Sludge Pumping Station No. 1 consists of a "sludge tank" wet well, a "scum tank" wet well which are interconnected, a scum overflow tank, and two 20 HP dry pit pumps connected to the sludge wet well to pump primary sludge and/or scum to the Mixed Sludge Pumping Station or Sludge Control Buildings. PSTs 1 – 4 and Primary Sludge Pumping Station No. 1 are dewatered by gravity to the Raw Sewage Pumping Station. Primary Sludge Pumping Station No. 2 is very similar to Primary Sludge Pumping Station No. 1 except it includes a dewatering wet well with two 35 HP submersible dewatering pumps and rather than dry pit sludge pumps, two 12.7 HP submersible sludge pumps are used. The dewatering pumps are used to drain PSTs 5 – 8 and the scum pit within Primary Sludge Pumping Station No. 2.

Currently, all eight PSTs receive raw wastewater from Meter Vault No. 2 at approximately equal rates. Several recycle streams are also returned to the primary clarifiers, including:

- Scum and grease from Final Settling Tanks 1 – 20 is returned to PSTs 1, 2, 5, and 6
- FBS thickening underflow is returned to PSTs 1 and 2
- Gravity and belt thickening overflow is returned to PSTs 1 and 2 or the effluent trough for PST's 1 – 4.
- Waste activated sludge from the DARs and dewatering flow from final sedimentation tanks 13 – 20 and the chlorine contact basins is returned to the effluent trough for PST's 5 – 8.

Under normal operation, the raw wastewater flow to each set of four primary settling tanks (1 – 4 and 5 – 8) from Meter Vault No. 2 does not exceed 80 MGD because the limitation of flow meters MRC-1 and MRC-2. Raw wastewater flow from the Screen and Grit Buildings to Meter Vault No. 2 that exceeds 160 MGD bypasses the primary settling tanks to the Main Pumping Station and is metered by MRC-4 due to flow measurement requirements for the NPDES discharge permit.

Figure 3-11 – PSTs 1 – 4 Flow Diagram

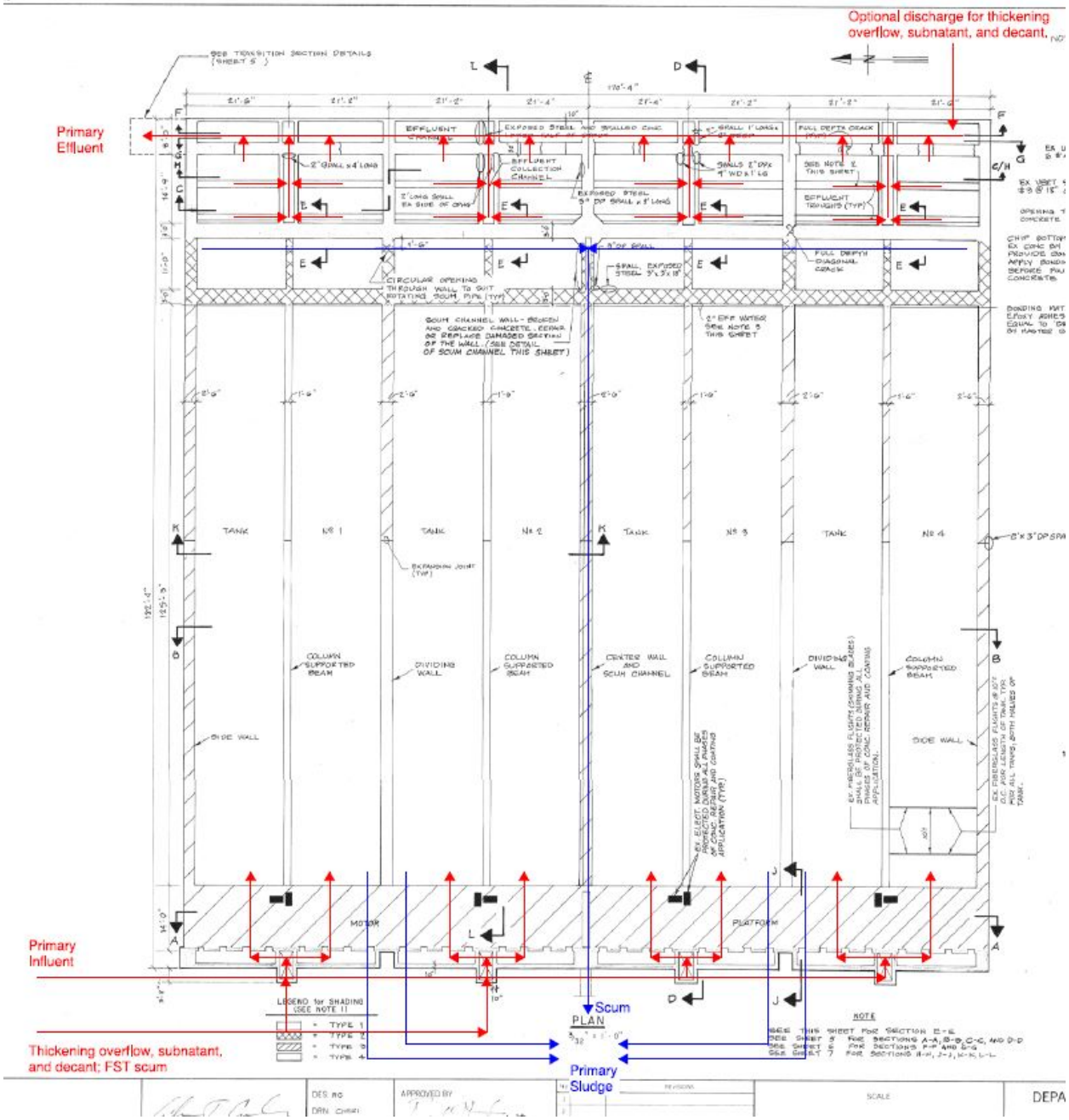
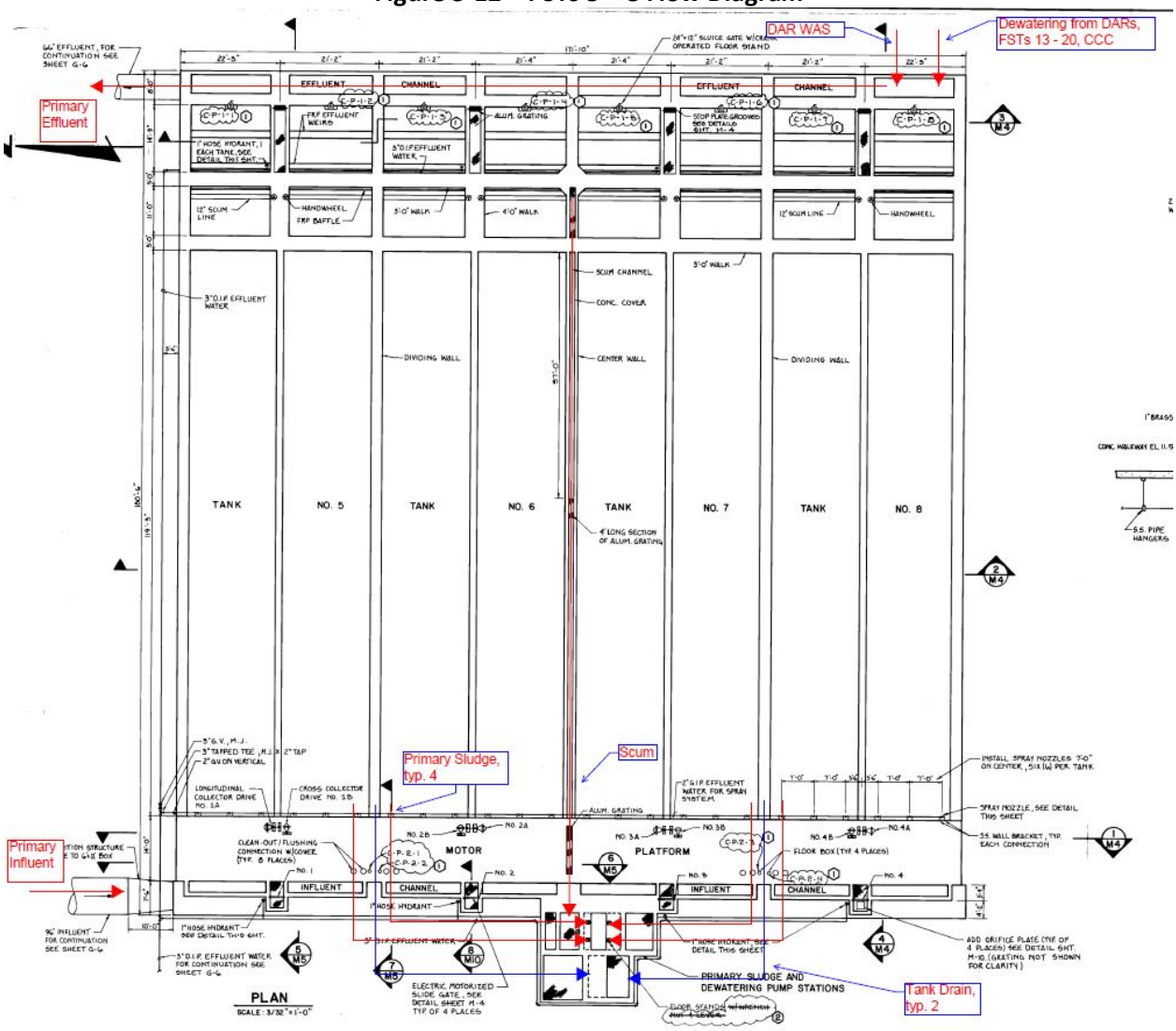


Figure 3-12 – PSTs 5 – 8 Flow Diagram



3.1.4.2 Process Evaluation

The 10 State Standards recommended maximum surface overflow rates for primary settling tanks are 1,000 gpd/ft^2 at the design AADF and between 1,500 and 2,000 gpd/ft^2 at the design PHF. In addition, Class I Reliability requires that 50% of the design flows must be treated with one unit out of service. **Table 3-12** summarizes the surface overflow rate (SOR) for the PSTs for several conditions.

Table 3-12 – Primary Settling Tanks Surface Overflow Rates

Flow Condition	Total Flow[1] (MGD)	No. of PSTs	Surface Area (ft^2)	SOR (gpd/ft^2)
Design AADF	121	8	50,464	2,398
Design PHF	245.8	8	50,464	4,871
Current AADF	81.3	8	50,464	1,611
Current Max Flow	185	8	50,464	3,666
Class I – Design AADF	60.5	7	44,156	1,370
Class I – Design PHF	122.9	7	44,156	2,783

[1]The flows reported represent total plant influent flow plus 26% residuals recycle flow.

The PSTs are undersized based on the SOR at all of these conditions. However, past engineering reports suggest the PSTs are still providing significant BOD and TSS removal at approximately 35% and 50% respectively. Historical monitoring data at the Main Pumping Station suggests the overall removal efficiencies are much lower than reported, as shown in **Table 3-13**.

Table 3-13 – Observed BOD and TSS Removal at Main Pumping Station

Year	Overall BOD Removal	Overall TSS Removal
2013	14%	25%
2014	16%	33%
2015	20%	40%
2013-2015 Average	17%	32%

Industry standard texts such as Metcalf & Eddy's Wastewater Engineering Treatment and Resource Recovery, 5th edition suggest that well-designed and well-operated primary settling tanks can expect removal percentages of 25 – 40% for BOD and 50 – 70% for TSS. Empirical relationships are also provided to estimate PST performance based on hydraulic retention time. The historical data used to determine the actual removal percentages above was collected at the Main Pumping Station, where PST bypass flow, denitrification filter backwash water, and sludge processing residual streams are mixed with the primary effluent. This would significantly skew the removal percentages for the PSTs below their actual performance. Expected removal percentages calculated from empirical relationships indicate that the existing PSTs are expected to perform at or very near to removal percentages for well-designed and well-operated PSTs up to the design AADF of 121 MGD, as shown in **Table 3-14**. This also validates the removal rates reported by Arcadis in their Operation and Maintenance Performance Report from May 2015.

Table 3-14 – Primary Settling Tanks Empirical BOD and TSS Removal

Flow Condition	Flow[1] (MGD)	No. of PSTs	Expected BOD Removal	Expected TSS Removal
2013 AADF	76.6	8	32%	54%
2014 AADF	74.5	8	33%	54%
2015 AADF	81.3	8	32%	53%
2013-2015 Average	77.5	8	32%	54%
Design AADF	121	8	27%	47%
Current Max Flow	185	8	22%	40%
Design PHF	245.8	8	18%	35%

[1]The flows reported represent total plant influent flow plus 26% residuals recycle flow.

Each PST has four effluent weir troughs and four weir openings at the end of each tank. Each effluent trough is approximately 18.5 feet long and each effluent weir opening is approximately 8.25 feet for a total weir length of approximately 181 feet per PST. The combined weir length for all PSTs is 1450.66 feet. The design peak hour weir loading for the existing PSTs is 169,440 gpd/linear ft at the peak hour flow of 245.8 MGD with recycle flows. This weir loading rate is 5.6 times greater than the maximum weir loading rate at design peak hour flow as suggested by the 10 State Standards. These loading rates may result in excess solids carried over the weirs due to high approach velocities. Additional primary treatment capacity would reduce the SOR and weir loading rates at the existing PSTs, in turn increasing the existing PSTs BOD and TSS removal efficiency, reduce loading to the biological treatment system, and reduce energy demands for oxygen generation, aeration, mixing, and pumping. Options to provide additional primary treatment capacity should be investigated in the next phase to bring the overall BOD and TSS removal rates back within the range for well operated primary treatment processes.

Scum from the Final Settling Tanks is returned to the PSTs. This scum may contain Nocardia and other bacteria that contribute to foaming problems in activated sludge processes and anaerobic digestion. Recycling of FST scum to the PSTs may reintroduce foam-causing bacteria to the activated sludge process and perpetuate foaming problems.

The 90-inch diameter influent conduit for PSTs 1 – 4 flows into Junction Chamber No. 3, which is adjacent to the Bypass Structure. Junction Chamber No. 3 and the Bypass Structure are currently separated by stop logs. Discussions with plant operations staff indicated the Bypass Structure is still in service receiving storm water from various locations around the facility. Plant staff noted PSTs 1 – 4 have overflowed the stop logs into the Bypass Structure, thus allowing raw wastewater to enter the treatment plant outfall structure, requiring it to be pumped back to the headworks to be treated. Further discussions with plant staff indicated that the stop logs separating Junction Chamber No. 3 and the Bypass structure now prevent this from occurring.

Table 3-15 – Summary of Evaluation of Primary Settling Tanks

Performance	
Performance Goals	Observed Performance[1]
Industry Standard BOD Removal: 25 – 40%[2]	Observed Average BOD Removal at MPS: 20%
Industry Standard TSS Removal: 50 – 70%[2]	Observed Average TSS Removal at MPS: 34%
Design BOD Removal: 36%	Observed Average TKN Removal at MPS: -13%
Design TSS Removal: 51%	2015 Empirical Average BOD Removal: 32%
Design TKN Removal: 20%	2015 Empirical Average TSS Removal: 53%
MPS Effluent Concentrations	MPS Effluent Concentrations[1]
Design Average BOD_5: 136 mg/L	Observed Average BOD_5: 125.9 mg/L
Design Average TSS: 145.7 mg/L	Observed Average TSS: 86.4 mg/L
Design Average TKN: 24.1 mg/L	Observed Average TKN: 36.6 mg/L

Evaluation Findings

- PSTs are undersized based on surface overflow rate and weir loading rate
- BOD and TSS removal rates reported by previous engineering reports were corroborated based on empirical removal rates; however expected removal rates at the design PHF are low.
- Overall BOD and TSS removal as calculated at the Main Pumping Station is significantly lower due to recycle flows.
- Negative TKN removal observed at the MPS based on mass balance is due to the TKN contribution from sludge thickening decant, sludge dewatering supernatant, and other recycle streams that discharge to the MPS.
- PSTs cannot be accurately evaluated based on monitoring data gathered from the MPS due to recycle stream contributions.
- Flows above 160 MGD sent to the PSTs cannot be read due to calibration limitations of the flow meters at Meter Vault No. 2, however it is currently not recommended to operate the PSTs above a combined flow of 160 MGD.
- Scum from Final Settling Tanks 1 – 20 discharged to PSTs
- PSTs 1 – 4 cannot be dewatered completely by gravity drains, approximately 85% dewatered by gravity.
- Majority of chain and flight collectors, collector motors and drives, scum equipment, and sluice gates are in excess of 25 years in age.
- Pumping equipment in Primary Sludge Pumping Station No. 1 in excess of 25 to 35 years in age, plug valves in excess of 65 years in age according to facility information. Plant staff has indicated that these valves have been replaced within the past 2 years with the possible exception of the drain valves.
- Majority of equipment in Primary Sludge Pumping Station No. 2 including the primary sludge pumps and dewatering pumps are in excess of 25 years in age.
- Sludge blanket level monitored manually.

Recommendations

- Test influent and effluent BOD and TSS at the PSTs to evaluate actual removal rates and need for improvements

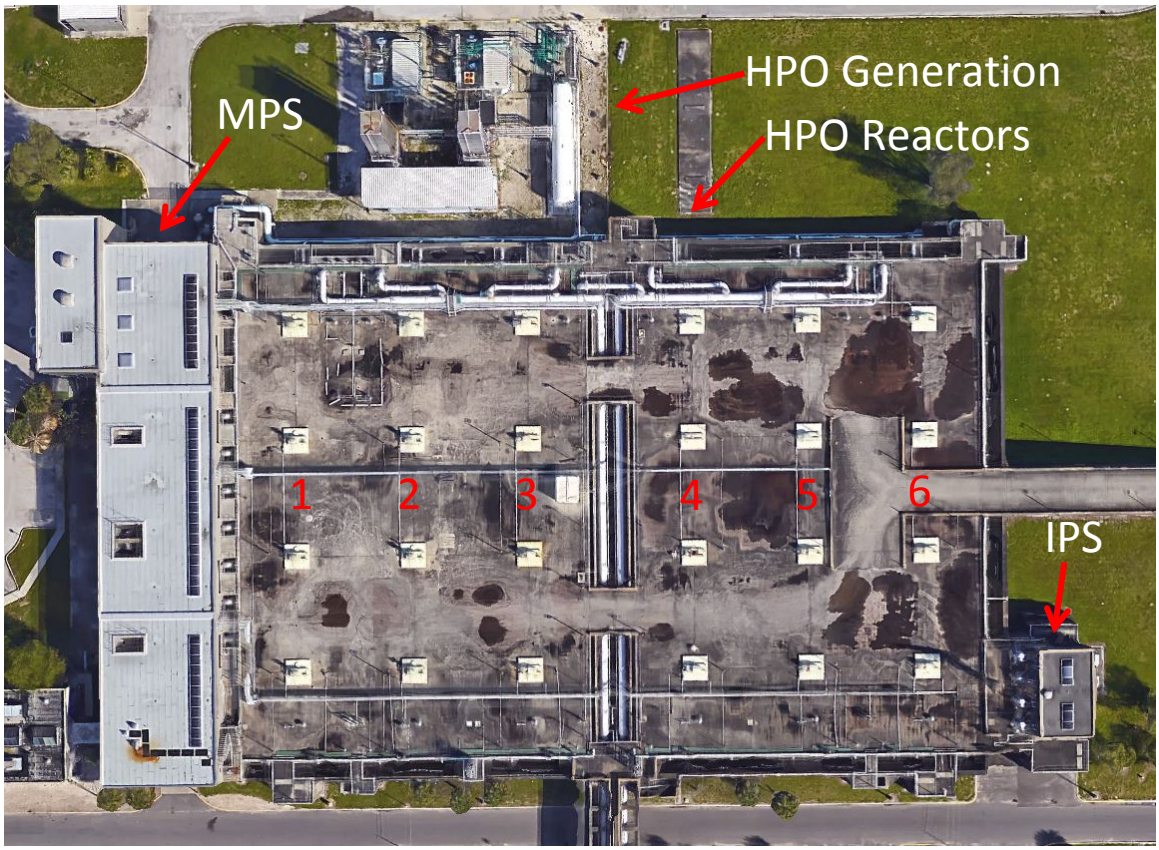
- Consider rerouting residuals recycle flows to the primary settling tanks to increase BOD and TSS removal rates
- Evaluate additional PSTs or other means of primary treatment to improve removal rates, weir loading rates, prevent overflow of the PSTs at high flows, and reduce loading on HPO reactors
- Eliminate the recycle of FST scum to the PSTs and redirect to digestion, or disposal.
- Consider replacing chain and flight equipment, sludge pumping equipment, and dewatering pumps with newer, more efficient equipment.
- Provide permanent means to completely drain PSTs 1 – 4
- Provide sludge blanket level monitors to improve operations
- Recalibrate flow meters MRC-1, MRC-2 to a minimum capacity of 115 MGD each

(1)Based on data from 5-year study period, observed average removals based on 2011 through 2015 data.

(2)Source: Wastewater Engineering, Treatment and Resource Recovery, 5th Ed., Metcalf & Eddy/AECOM

3.2 Secondary Treatment

3.2.1 HPO Reactors



3.2.1.1 Purpose and Description

The first stage of biological treatment at the HFC AWTP is accomplished by a High Purity Oxygen (HPO) activated sludge process. The HPO system consists of the Main Pumping Station (MPS), six HPO reactors, two 60 ton/day cryogenic HPO generation systems, and the intermediate pumping station. The MPS combines primary effluent, raw sewage, residual recycle and dewatering flow from the Main Drain to be pumped to the HPO reactors or DARs for carbonaceous BOD removal and nitrification. Seven main sewage pumps are located in the MPS to provide a firm pumping capacity of 250 MGD. The HPO system was designed to operate in three separate modes: carbonaceous BOD and suspended solids (SS) removal, two-stage nitrification, or single-stage nitrification. The six HPO reactors are grouped into stages to accomplish each of the three operational goals. HPO reactors 1 and 2 are designated for carbonaceous BOD and SS removal, reactor 3 is a swing tank to be used for either carbonaceous BOD and SS removal or nitrification, and reactors 4 – 6 are designated as nitrification reactors. Each reactor is completely covered, has a volume of 1.27 million gallons, and is separated into four zones by full height baffle walls with openings beneath water level and in the gas headspace to allow water and gas flow between zones. High purity oxygen provided by the cryogenic generation systems is fed into the first zone of each reactor at 95% oxygen. Mechanical surface aerators in each zone transfer oxygen from the reactor headspace into the wastewater to provide an oxygen rich environment for biological

carbonaceous BOD consumption and/or nitrification. Return sludge from FSTs 1 – 12 is pumped to the first zone of each reactor to maintain the population of active biomass.

The HPO reactors were originally designed to provide either two-stage nitrification or single-stage nitrification during high flow. When operating the HPO reactors for two-stage nitrification, influent from the MPS is treated by HPO reactors 1 and 2, passes through FSTs 1 – 6, and is returned to HPO reactors 3 through 6 for nitrification by the intermediate pumping station. The intermediate pumping station consists of four 40 MGD pumps for a firm pumping capacity of 120 MGD. HPO reactor 3 may be used in this operation for either carbonaceous BOD removal or nitrification. Influent wastewater to the reactors may also be fed directly from the MPS discharge channel into the nitrification reactors by the 48-inch supplemental nitrification stage conduit to the northeast corner of the HPO reactors. All nitrification stage effluent from reactors 4 – 6 then passes through FSTs 7 – 12 and on to the DARs. When single-stage nitrification is desired, all HPO reactors operate identically in parallel to remove carbonaceous constituents and to provide nitrification, and all HPO effluent is settled by FSTs 1 – 12. Following the construction of the DARs and FSTs 13 – 20, the HPO reactors could also be operated in fully carbonaceous BOD and SS removal mode. All HPO reactors and FSTs 1 – 12 are available to provide carbonaceous BOD and SS removal prior to separate stage nitrification in the DARs.

3.2.1.2 Process Evaluation

The HPO reactors have been used mainly for the removal of carbonaceous BOD since the addition of the DARs for separate stage nitrification. Reactors 1 and 2 have been used most often, with reactor 3 mainly being used in high flow situations for improved hydraulics and carbonaceous removal. Key process parameters for the HPO reactors have been calculated and determined from the 5 year historical monitoring data provided. These parameters are summarized in **Table 3-16** for 2013 through 2015. Data prior to 2013 is not shown because it does not accurately represent the current operation of the biological processes.

Table 3-16 – HPO Reactors Key Process Parameters

Year	MLSS (mg/L)	SRT[(1)] (days)	F/M Ratio[(1)] (mg BOD/mg MLSS*d)	BOD Reduction (% removed)[(2)]
2013	1,342	0.59	2.3	72.6%
2014	1,375	0.60	2.6	86.6%
2015	1,378	0.52	2.4	86.2%
2013-2015 Average	1,365	0.57	2.4	81.8%

[(1)]Values are calculated from historical monitoring data and therefore approximate.
[(2)]Based on MPS influent BOD and FST 1 – 12 effluent BOD.

Nitrification is not required in the HPO reactors because of the DARs, and as a result the two-stage nitrification operation of the HPO reactors is unnecessary to meet Class I reliability. Despite the minimal SRT, some nitrification has been observed in the HPO reactors due to the presence of nitrate in the HPO

effluent. Previous engineering reports have indicated this is most likely due to the wastage of DAR sludge to the HPO system, thereby introducing acclimated nitrifying organisms to the HPO activated sludge. This is a viable hypothesis and the most likely cause of this phenomenon because the nitrifying organisms contained in the DAR waste sludge have a significantly greater cell residence time compared to the heterotrophic organisms in the HPO reactors. Therefore, nitrification in the HPO reactors is somewhat detached from the HPO SRT and a direct function of DAR wastage to the HPO system.

The mechanical aerators in the first zone of reactors 1 and 2 are of greater capacity than those installed in the first zone of reactors 3 through 6. This results in variations in operation and treatment capacity when reactors 3 through 6 are used. Several of the mechanical aerator motors for reactors 4 through 6 have been removed. Also, treatment plant operations staff indicated to McKim & Creed that the motors for the mechanical aerators in the first zone of the reactors become overloaded at high flows. This is likely due to exceeding the maximum submergence of the impellers under high flow, and the age of the aerator motors. This issue may be alleviated by modifying the height of the impellers or by installing impellers with a greater submergence allowance. In addition, the step feed equipment installed in reactors 1 and 2 cannot be used to send all influent flow to the second zone of the HPO reactors because the oxygen requirement will exceed the oxygen transfer rate of the installed mechanical aerators in zone 2. As a result, the step feed equipment is currently used to send approximately 40% of the influent flow to the second zone of reactors 1 and 2.

The HPO generation plants were observed to be in poor overall condition as seen in **Figure 3-13** and **Figure 3-14** and as noted by Solutionwerks, Inc. in their June 2014 evaluation. A large majority of the oxygen generation equipment and piping is original to the facility and in need of repairs, replacement, and protective coatings. Oxygen Generation Plant No. 2 has been offline since around 2004 and construction for the rehabilitation of this plant is currently underway. Rehabilitation of Oxygen Generation Plant No. 2 is focused on major components and controls to return the plant to operation. However, many of the smaller components such as valves and piping remain original to the equipment and are not planned to be replaced as part of the rehabilitation. Failure of control valves or piping is likely to cause complete shutdown of the plant despite rehabilitation of major equipment. Previous studies by Solutionwerks, Inc. and Greeley and Hansen have indicated that the HPO generation at the HFC AWTP significantly outpaces the requirements of the HPO reactors at times. DO concentrations in the HPO reactors as high as 20 mg/L were consistently observed by Solutionwerks, Inc., and the observed oxygen demand during turndown testing was between 30 to 35 tons/day. A DO level of 20 mg/L is far above the basis of design concentration of 7.0 mg/L and above the recommended high DO alarm levels of 14 mg/L. Since the HPO generation system is one of the largest energy consuming processes at the facility, a significant cost savings can be realized by overhauling the controls of oxygen supply and mechanical aeration in the HPO reactors. Controls will be overhauled for Oxygen Generation Plant No. 2 to allow load following capability as part of the rehabilitation project. Solutionwerks, Inc. indicated that Oxygen Generation Plant No. 1 is capable of a turndown range from 60 tons/day to 28 tons/day.

Figure 3-13 – West Elevation View of HPO Generation System

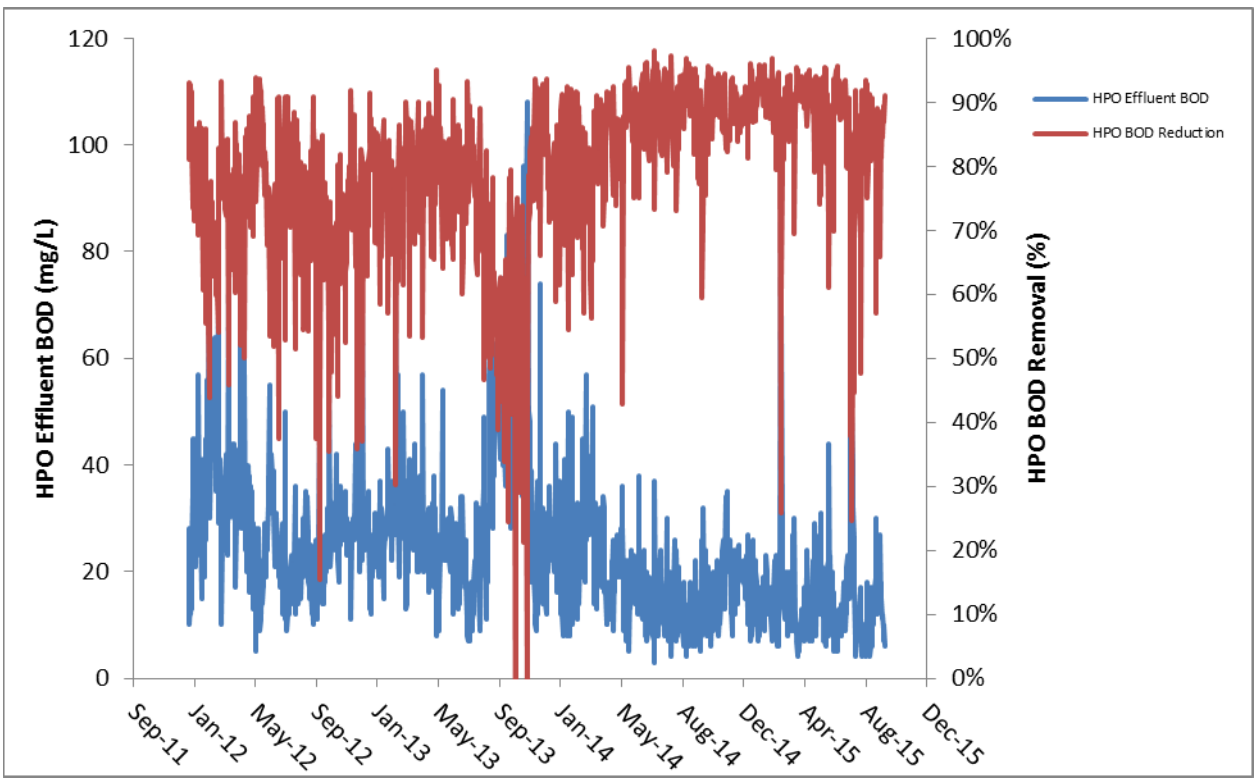
Figure 3-14 – LOX Storage Tank and Piping

Currently, DO is only monitored in the last zone (Zone 4) of each HPO reactor. The rate of HPO supplied is controlled based on the pressure in the headspace of the first zone of each HPO reactor, and the vent gas purity from the fourth zone of each reactor. Oxygen generation and supply is manually controlled for the most part and control in the HPO reactors is not directly linked to the DO concentration in each zone. Rather, the control scheme is based upon the fact that as oxygen demand increases the headspace gas pressure in the first zone of the reactors will decrease and the vent gas purity from the fourth zone of each reactor will decrease. This is corrected by increasing the oxygen supply and opening the vent gas valves gradually until headspace gas pressure and vent gas purity reach operator selected values. The opposite is true in response to decreased oxygen demand. Combustible gas and oxygen purity is also monitored in the first and fourth zones of each reactor by a combined system that monitors the HPO reactors in groups of reactors 1 – 3 and reactors 4 – 6. The combustible gas and oxygen purity analyzers are located centrally on the reactor deck and sample lines from each reactor are of considerable lengths. The length of the sample lines may result in inaccurate results due to sample degradation by biofilms within the sample lines and/or by dilution due to mixing within the sample piping. The result of

inaccuracy in these measurements may be unnecessarily high oxygen supply due to oxygen purity measured lower than actual purity, and late response to a build-up of combustible gases in the reactors.

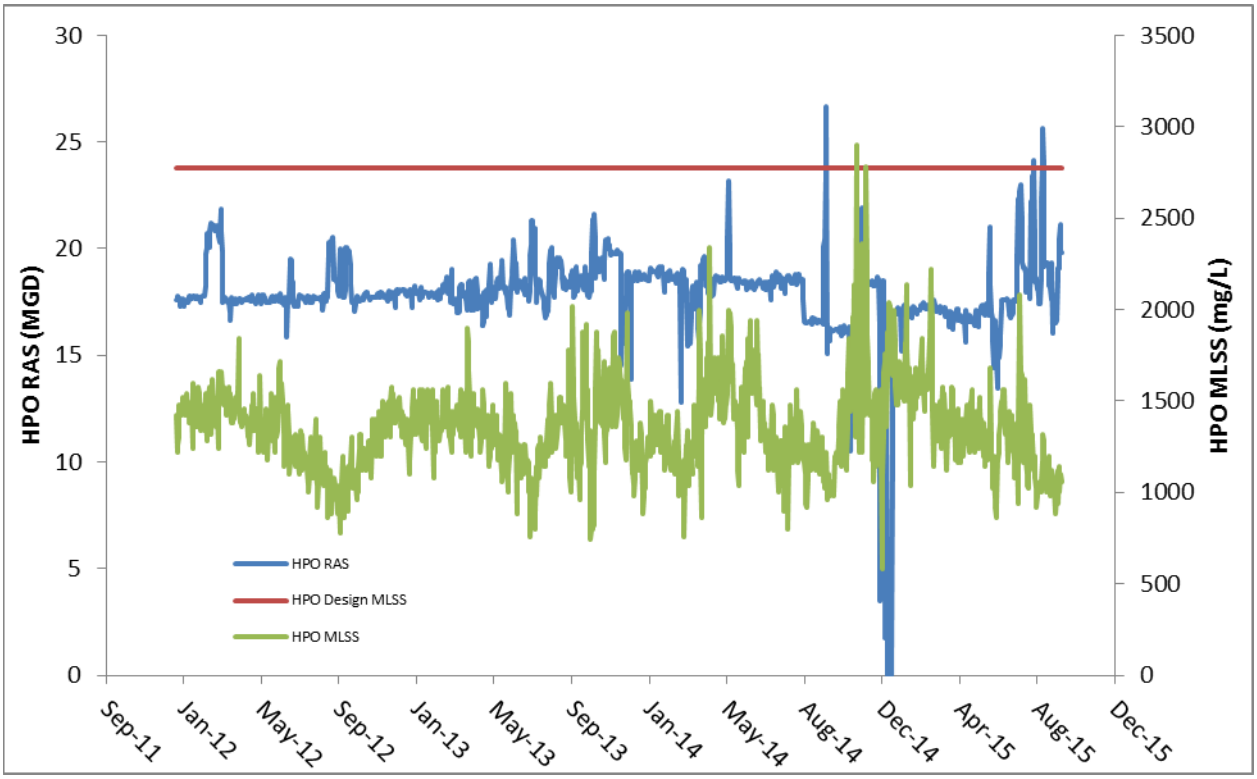
The basis of design for the HPO reactors reported by the 1999 Greeley and Hansen Operations & Maintenance Manual indicates that a maximum of four reactors are to be used at the design AADF of 96 MGD (121 MGD with residuals recycles) for carbonaceous BOD removal. Historical monitoring data and the modeling performed by Tetra Tech for the DAR evaluation and the Arcadis Operation and Maintenance Performance Report suggest that the existing HPO reactors are sufficiently sized to provide carbonaceous BOD removal at the current and design AADF. However, there has been significant variation in the BOD removal efficiency for the HPO reactors (**Figure 3-15**) and may indicate that the current operation should be evaluated for modifications to improve consistency.

Figure 3-15 – HPO Reactors Effluent BOD and BOD Removal Efficiency



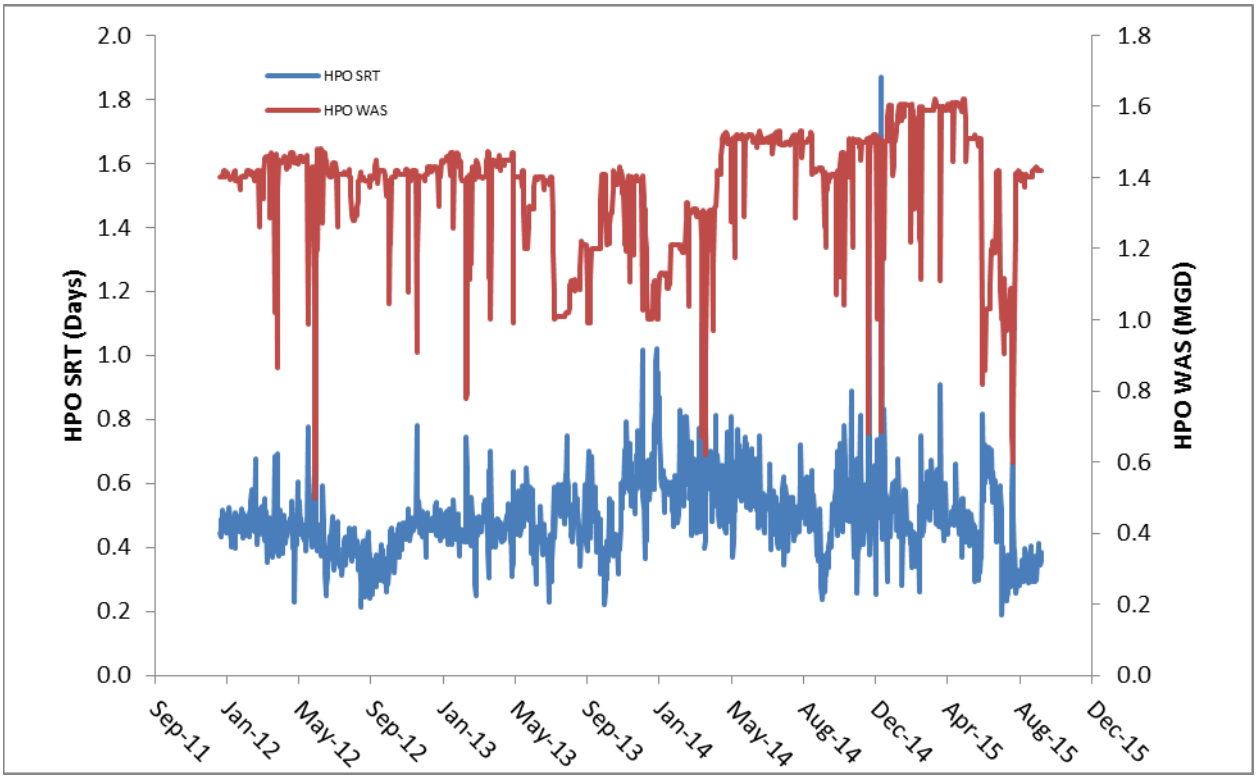
The basis of design reported by the Operations & Maintenance manual indicates a design HPO MLSS concentration of 2775 mg/L and a design SRT of 0.8 days. **Figure 3-16** illustrates the historical MLSS concentration data and RAS flow.

Figure 3-16 – Historical HPO MLSS Concentration and RAS Flow



The HPO reactors have been operated well below their design MLSS, which may contribute to the variability of the BOD removal efficiency. Operation at a greater MLSS will result in greater BOD removal and greater resiliency to shock organic loads. However, the influent BOD loading to the HPO reactors is less than that assumed by the basis of design, which accounts for some reduction in the biomass production because less carbonaceous substrate is available for growth. The operation of the HPO reactors at lower MLSS is also likely tied to the operation of the DARs for denitrification. This is because HPO effluent BOD will be greater at lower MLSS and provide more carbon for denitrifying organisms to convert nitrate and nitrite to nitrogen gas. As BOD removal and the HPO MLSS concentration has varied under the current operation, so has the HPO SRT. The HPO RAS flow rate has remained relatively constant while the WAS flow rate has experienced several short periods of significantly low flows. **Figure 3-17** shows the changes in the WAS flow rate and the resulting changes in the HPO SRT.

Figure 3-17 – HPO SRT and Wastage Flow



The variations in the HPO SRT as a result of the WAS flow rates, and the highly variable BOD removal and MLSS concentration appears to indicate insufficient monitoring information, controls, and automation available to the operators. These concerns should be evaluated further to determine their root causes and solutions to improve reliability in the HPO BOD removal efficiency.

Table 3-17 – Summary of Evaluation of High Purity Oxygen Reactors

Performance	
Performance Goals	Observed Performance[(1)]
Effluent BOD = 27 mg/L	Effluent BOD = Unavailable
Effluent SS = 16 mg/L	Effluent SS = 10.03 mg/L
Percent TKN Removal = 56%	Percent TKN Removal = 56.2%
Effluent TKN = 10.6 mg/L	Effluent TKN = 16.14 mg/L
Effluent NO_3 = 4.4 mg/L	Effluent NO_3 = 10.57 mg/L[(2)]
Percent Phosphorus Removal = 16.3%	Percent Phosphorus Removal = Unavailable
Effluent Phosphorus = 6.6 mg/L	Effluent Phosphorus = Unavailable
Design HPO Demand = 82.3 tons/day	2015 Average HPO Supply = 38.2 tons/day
	2015 Maximum HPO Supply = 58.3 tons/day
Design SRT = 0.8 days	2015 Average Estimated SRT = 0.47 days
Design Wastage Rate = 130,800 lbs/day	2015 Average Wastage Rate = 59,743 lbs/day

Evaluation Findings
• The main sewage pumps, motors, and drives at the MPS are in excess of 37 years of age • The air compressors in the MPS are aging and in need of replacement • The ventilation system in the MPS is in need of improvements. Ventilation Improvements are currently under design. • Current operation only uses HPO reactors 1 through 3 • Step feed equipment was installed in reactors 1 and 2 to alleviate hydraulics due to current operation, but step feed equipment cannot be used to full extent • Multiple mechanical aerators in reactors 4 – 6 have been removed or partially disassembled for parts. Some mechanical aerators have been replaced but many of the motors are the original motors and are in excess of 37 years of age. • HPO reactor oxygen and combustible gas sampling lines are too long to guarantee representative samples, sample dilution and biological degradation is likely to occur • Inadequate DO monitoring equipment to monitor and control oxygen transfer rate • Step feeding to zone two may result in oxygen demand exceeding the capacity of the installed mechanical aerators • Mechanical aerators in reactors 3, 4, 5, and 6 do not match the oxygen transfer capacity of those in 1 and 2. Motors and gearboxes for mechanical aerators in reactor 3 are currently being replaced to match the capacity of those installed in reactors 1 and 2. • Intermediate pumps are in excess of 37 years of age and have not been operated for quite some time due to the current operation of the HPO reactors for BOD removal only • Many components of the oxygen generation systems appear to be in poor condition and may pose a health and safety risk as well as an operational risk. Many of the original components to the Oxygen Generation Plants installed in 1978 are still in operation. Only Oxygen Generation Plant No. 1 is operable. Failure of control valves or piping original to the generation plants is likely to cause complete shutdown despite rehabilitation to major equipment. • Solutionwerks, Inc. noted dissolved oxygen concentration in the HPO reactors remained consistently near 20 mg/L, indicating significantly more oxygen production than needed. • HPO F/M ratio is consistent with a high rate activated sludge process for carbonaceous removal • HPO MLSS concentration and BOD removal efficiency has been highly variable, and may indicate a need for improved monitoring and control.
Recommendations
• Evaluate main sewage pumps, motors, and drives for repairs and replacement due to their age • Investigate the replacement of the process air blowers for channel mixing. Other air mixing systems used significantly less energy and are easier to operate. • Redirect scum from the HPO influent channel and FSTs 1 – 12 to gravity thickening, mixed sludge pumping station, or to disposal to prevent perpetual recirculation of foam inducing microorganisms such as Nocardia bacteria. • Consider a complete repair and replacement campaign of all oxygen generation system piping and equipment due to equipment age and condition. It is understood that Oxygen Generation Plant No. 2 is currently undergoing repairs to the major equipment based upon the recommendations of the

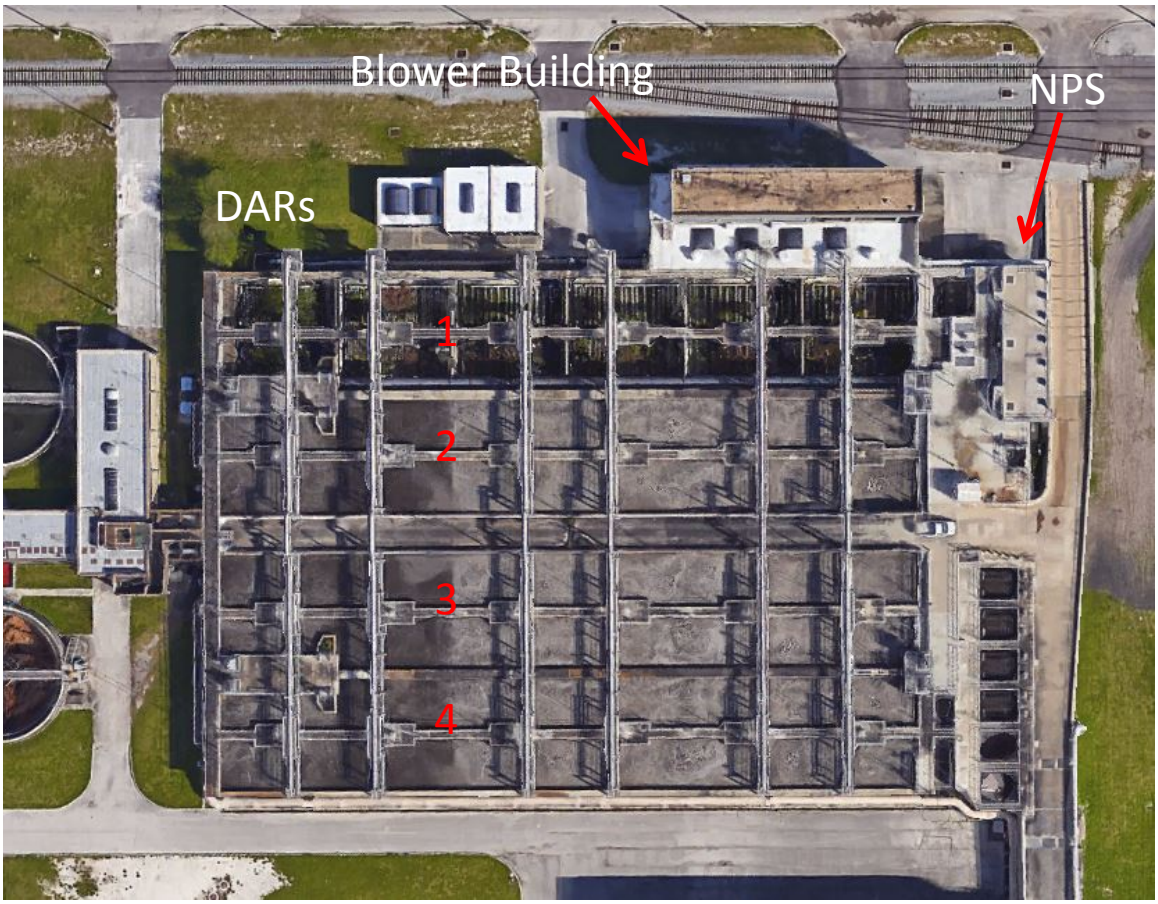
June 2014 report on site conditions by Solutionwerks, Inc. This is a high priority item due to the critical nature of oxygen generation at this facility.

- Investigate options to provide denitrification prior to denitrification filters. Most equipment and infrastructure required for process modifications may already be present, or require minor modifications. This recommendation shall be considered concurrently with repairs to the Oxygen Generation Plants to weigh the merit of a complete overhaul of the Oxygen Generation Plants. Modifications should be modeled to prove validity.
- Evaluate the intermediate pumping station in conjunction with process modifications as an option to provide internal recycle or other flows.
- Aging equipment should be investigated for replacement
- Consider replacing HPO mechanical aerators with newer, more efficient mixers and motors. Higher oxygen transfer rate/efficiency and higher mixer efficiency will reduce energy usage. Mechanical aerators should be of equivalent size and oxygen transfer rate/efficiency for each reactor to allow each reactor to be operated identically. There should not be variations in aerator capacity between reactors, but variation between zones is expected and recommended.
- Consider improving BOD, MLSS, DO monitoring
- Consider improving SCADA integration with operational controls
- Consider increasing the MLSS and SRT towards the design values to increase BOD removal efficiency and reliability.
- Model the HPO operation to determine more robust operational parameters to provide reliable and efficient BOD removal based on current operation.
- The mechanical aerator motors for reactors 4 through 6 should be placed back into operation or readily available and easily installed to enable the use of reactors 4 through 6 in the event of equipment failure in reactors 1 through 3.
- Consider purchasing additional gas analyzers and relocating existing analyzers adjacent to sampling locations to improve accuracy and oxygen generation control
- Consider redeveloping oxygen generation supply and control scheme to reduce oxygen production while maintaining necessary oxygen transfer rate. An automatic load following control system should be implemented to reduce energy usage. (To be completed for Oxygen Generation Plant No. 2 as part of rehabilitation project)
- Evaluate the replacement of oxygen supply and vent gas meters and valves due to age
- Replace 34 year old sample pumps
- Evaluate reactor sluice gates, weir gates, stop logs for replacement due to age

(1) Average values based on data from 5-year study period

(2) Previous studies have indicated inaccuracy in daily composite sample nitrate concentration

3.2.2 DARs



3.2.2.1 Purpose and Description

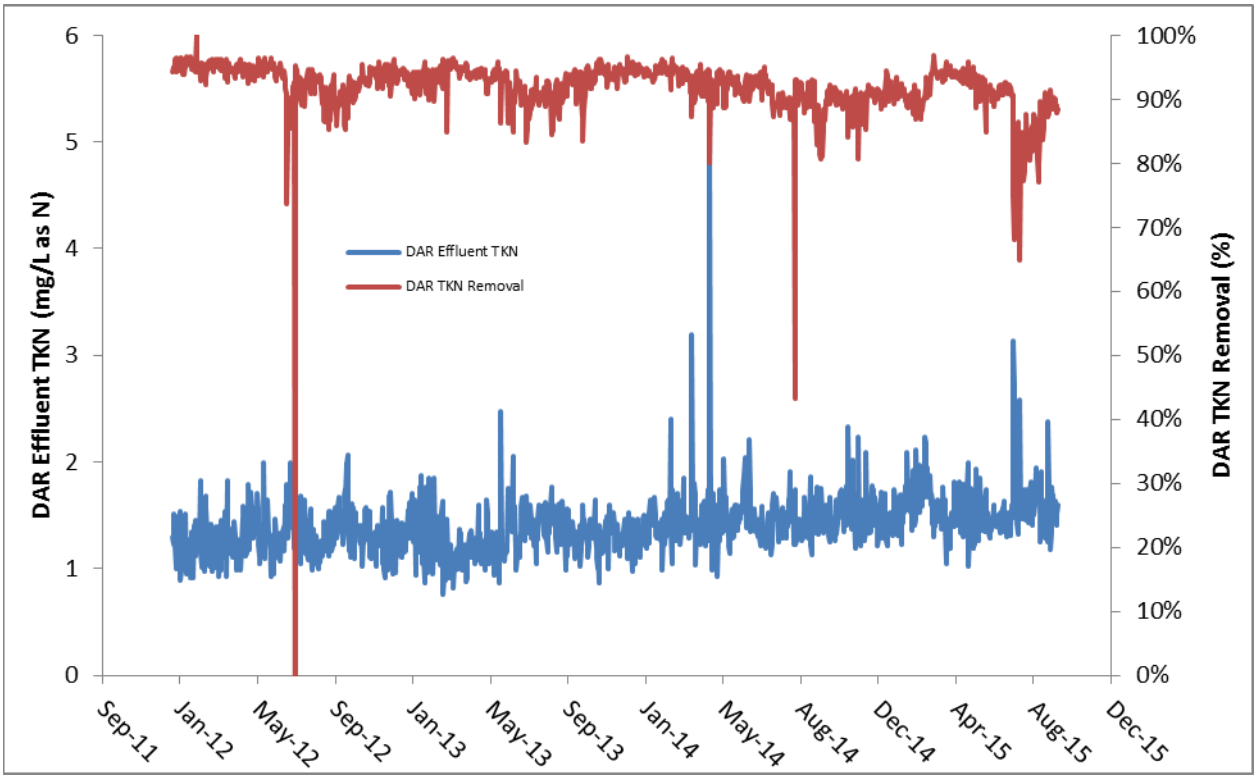
Separate stage nitrification is accomplished by the DAR system to biologically convert influent ammonia to nitrate and nitrite at the HFC AWTP. This step in the biological process is critical for the removal of nitrogen from the wastewater in order to meet effluent total nitrogen limits as the nitrate and nitrite produced in the DARs by autotrophic microorganisms is later converted to nitrogen gas. The four DARs were originally aerobic digesters that were later converted in 1997 under the Division 5H4 construction contract. Each DAR is approximately 2.12 MG for a total available volume of 8.48 MG and each reactor is divided into six zones by baffle walls. The DARs receive settled carbonaceous effluent from FSTs 1 – 12 and HPO bypass flow from the MPS discharge channel. Flow through the DARs may be either plug flow or step feed with the option to feed influent wastewater into zone two. The DAR system includes the Blower Building and the Nitrification Pumping Station. The main equipment in the Blower Building includes four 700 HP process air blowers (Hoffman multistage centrifugal type blowers), the Blower Building Control Panel which is the main control system for the DARs and the Nitrification Pumping Station, and power distribution equipment. The Nitrification Pumping Station lifts the influent wastewater and any internal recycle up to the influent elevation of the DARs and into the 72-inch diameter influent conduits for each reactor. The Nitrification Pumping Station consists of seven 43.2 MGD submersible pumps for a firm pumping capacity of 259.2 MGD.

The DARs were primarily designed to provide nitrification of the carbonaceous effluent from FSTs 1 – 12. Each zone of the DARs is provided with aeration equipment to aerobically convert ammonia and organic nitrogen to nitrate and nitrite. The aeration equipment utilized consists of a common process air header connected to the four blowers, six process air headers (each to serve one zone for all four reactors), six venturi air meters, six motor operated butterfly valves to control air flow to each zone, two diffuser grids per zone per reactor for a total of 48 grids, and 12 DO probes that are shared between each pair of reactors to monitor DO in each reactor zone. The DARs are also capable of providing denitrification along with nitrification by shutting off aeration in one or multiple zones of each reactor and operating in anoxic mode. When the DARs are operated for denitrification, primary effluent from the MPS must bypass the HPO reactors to the DARs to provide enough carbonaceous substrate for the growth of denitrifying heterotrophic microorganisms. A small amount of supplemental primary effluent flow to the DARs may also be needed at times during completely aerobic operation when the HPO reactor effluent is very low in BOD and SS.

3.2.2.2 Process Evaluation

Over the past three years the DARs have most often been operated with denitrification in zones 1 and 2 of each active reactor and the remaining four zones under complete aeration to achieve nitrification. Approximately 18 MGD of primary effluent bypasses the HPO reactors via the “spike” lines to serve as an additional carbon source for denitrification while approximately 15 MGD of internal recycle is provided via the recycle gate in the DAR effluent channel. According to the high flow protocol, fully aerobic operation has mainly been used during high flow periods above 100 MGD to meet permit limits. As stated in 3.7.1, some primary effluent from the MPS is bypassed to the DARs during completely aerobic operation to provide a small amount of carbonaceous substrate to offset low BOD and SS concentrations in the carbonaceous stage effluent from FSTs 1 – 12. This is presumably done to maintain a BOD/TKN ratio between 0.5 and 2 and an F/M ratio near 0.1 to allow enough heterotrophic growth for a good settling sludge. Operating the DARs at a BOD/TKN ratio greater than 2 will reduce the fraction of nitrifiers and reduce the nitrification rate. Overall, the DARs have provided reliable nitrification and a moderate degree of denitrification. However, a trend of increasing effluent TKN has been noticed, as seen in **Figure 3-18** and **Table 3-18**.

Figure 3-18 – DAR Effluent TKN and TKN Removal Efficiency



The basis of design for the DARs requires an effluent TKN concentration of 1.9 mg/L in order to meet the effluent total nitrogen limit of 3.0 mg/L. The basis of design also requires an SRT of 8 days, while historical data indicates approximate SRTs much higher than the design basis. Despite the higher SRT, solids production was on pace with the basis of design of 11,000 lb/day at the design AADF of 96 MGD prior to the modification to operations to include denitrification. Following the addition of denitrification, solids production increased dramatically and is currently above the basis of design of 11,000 lb/day. The DARs continue to meet the effluent TKN goal despite the fact that the DAR influent TKN is approximately 5 mg/L greater than the basis of design. However the increasing trend in effluent TKN indicates the DARs may be reaching nitrification capacity based on the current operation.

Table 3-19 – DAR Operating Parameters and Effluent TKN

Year	MLSS (mg/L)	SRT (days)	Solids Production (lbs/day)	F/M Ratio (mg BOD/mg MLSS*d)	DAR Effluent TKN (mg/L as N)	TKN Reduction (% removed)
2012	2,059	18.1	6,661	0.19	1.304	93.0%
2013	3,598	20.9	13,207	0.16	1.302	92.9%
2014	4,162	13.2	20,314	0.10	1.482	91.2%
2015	4,573	23.5	15,893	0.09	1.559	90.0%
2013-2015 Average	4,111	19.2	16,594	0.11	1.448	91.4%

Current operation of the DARs only uses three of the four reactors, as the fourth reactor has been out of service for more than 10 years and is inoperable (**Figure 3-19**). Zones 1 and 2 in the remaining three reactors are operated as anoxic zones for denitrification. Zone 1 of each reactor currently does not have a mechanical mixer to prevent solids deposition and short-circuiting of flow. Zone 2 of each reactor is also operated without mixing under anoxic operation because the existing mixers are oversized and may damage the process air diffusers and distribution piping. Examination of the DAR MLSS concentration and the effluent nitrate concentration gives a good indication of when the DAR operation was modified to provide denitrification as the MLSS was increased to a level much greater than the basis of design and effluent nitrate decreased (**Figure 3-20** and **Figure 3-21**).

Figure 3-19 – DAR No. 1 Condition

Figure 3-20 – DAR MLSS vs Basis of Design, and RAS Flow

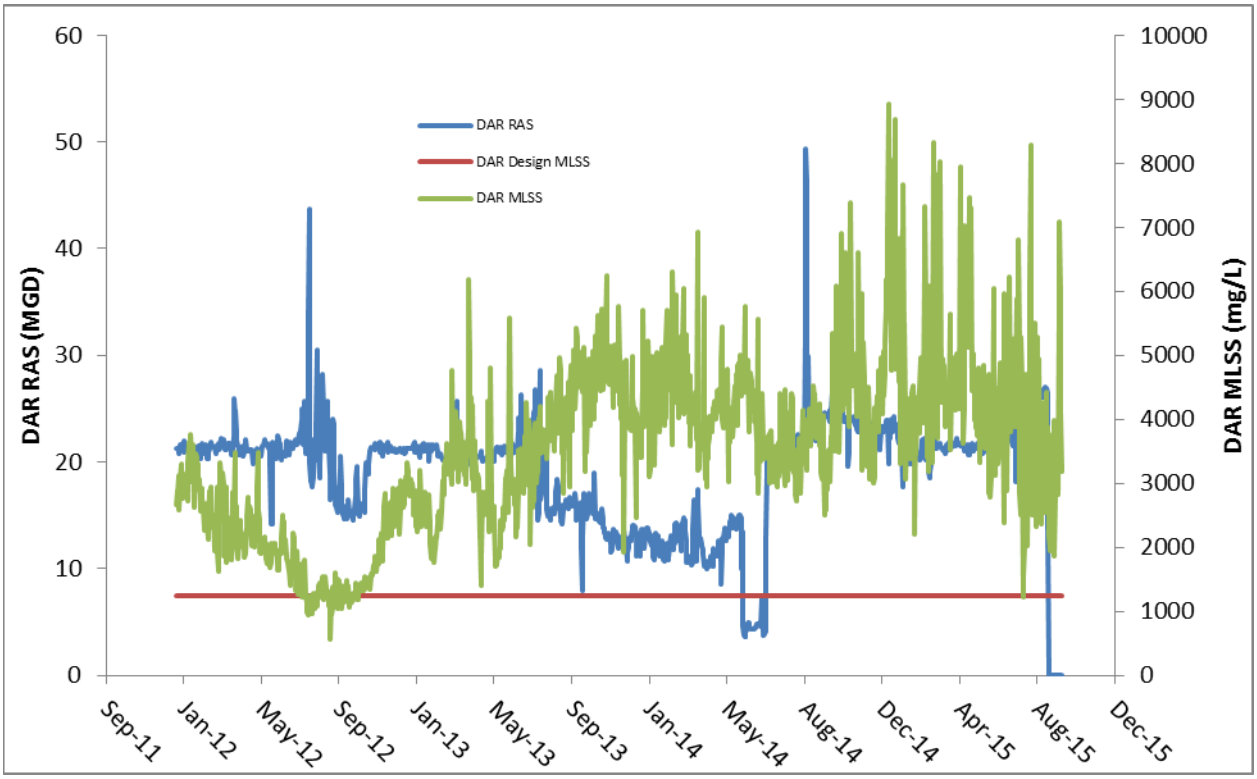
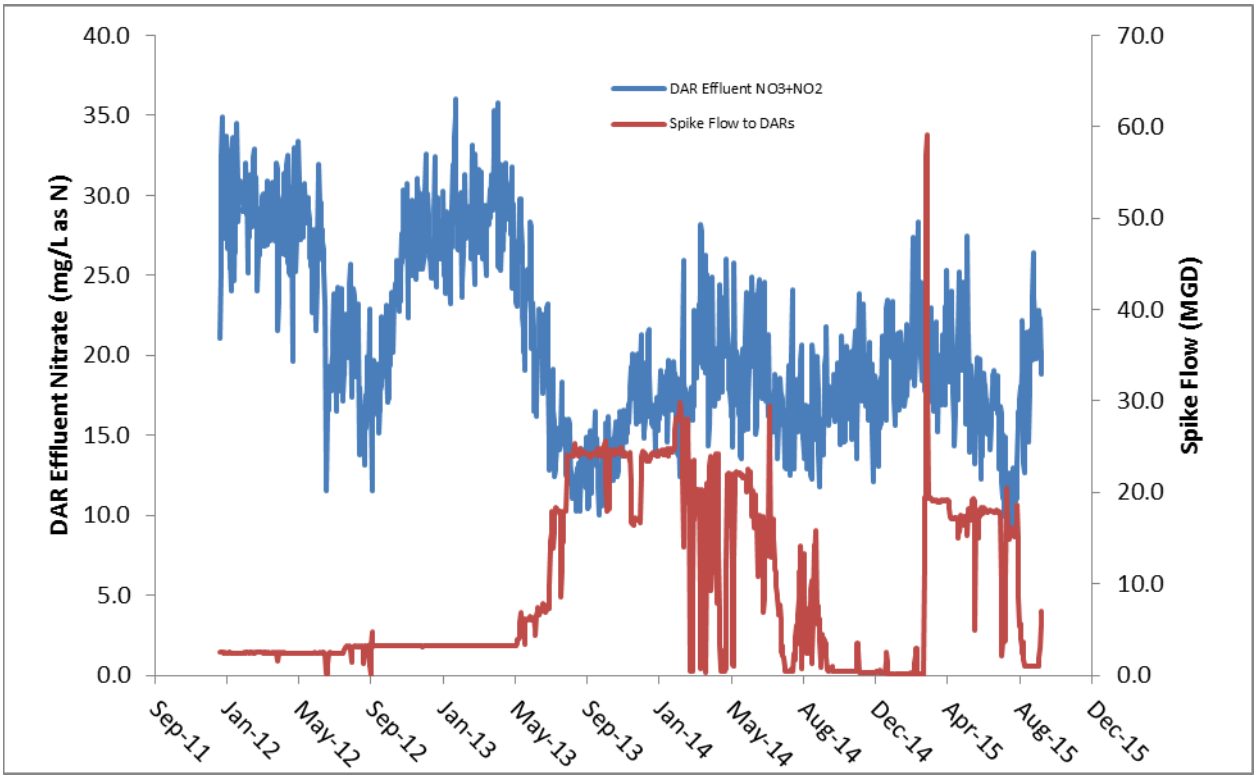


Figure 3-21 – DAR Effluent Nitrate and Internal Recycle Flow



Tetra Tech was hired by the City to evaluate and model the DAR operation in an effort to develop modifications to replace the air diffusers and increase denitrification capacity in the DARs while maintaining nitrification capacity. Generally, Tetra Tech has proposed to restore operation in DAR No. 1 by replacing equipment and improving operation controls. Tetra Tech's proposed improvements in DAR No. 1 include removal of the existing PVC diffuser equipment and light gauge stainless steel distribution piping to each zone, installation of new panel diffusers and distribution piping, installation of new mechanical mixers in zones 1 through 3 to allow mixing during anoxic operation, and installation of internal recycle pumps and piping dedicated to the reactor. These improvements are to be evaluated after construction to determine whether like-kind improvements are necessary in DAR No.'s 2, 3, and 4. Tetra Tech's designs would significantly increase the nitrification capacity at the HFC AWTP due to the increased reactor volume under aeration. These plans were advertised in December 2016, with a bid opening in March 2016, and construction contract awarded to Florida Design Contractors, Inc.

Denitrification in the DARs limits the nitrification rate and decreases the nitrifying capacity of the DARs significantly. Simply put, the volume of the DARs is too small to accommodate both denitrification and nitrification at the design AADF of 96 MGD while still meeting the DAR effluent TKN goal. Tetra Tech's modeling concluded that denitrification in the DARs should not be provided at plant influent flows greater the 72 MGD AADF and the new diffuser design for zones 3 through 6 should be based on this condition (**Figure 3-22** and **Figure 3-23**). Above this design point, effluent TKN from the DARs is expected to be greater than 2.5 mg/L which does not provide an adequate safety factor to meet the plant effluent TN limit of 3.0 mg/L consistently (**Figure 3-24**).

Figure 3-22 – Tetra Tech Simulation Cases

Steady-state Simulation Cases

Case	Plant Influent	Flow w/Recycles	Simulation
1	AADF = 57	67 MGD	Demo period, DAR 1 Zones 1 and 2 Anoxic
2	AADF = 62	72.85 MGD	Demo period, DAR 1 Zones 1 and 2 Anoxic
3	AADF = 67	78.73 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
4	AADF = 72	84.6 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
5	AADF = 77	90.48 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
6	AADF = 82	96.35 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
7	AADF = 87	102.23 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
8	AADF = 92	108.1 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
9	AADF = 96	112.8 MGD	Fully modified, All DARs Zone 1 and 2 Anoxic
10	AADF = 96	112.8 MGD	All Zones Aerated

Figure 3-23 – Tetra Tech DAR No. 1 Diffuser Design Conditions

Steady State DAR Oxygen Demand by Zone

Case	Total AOR	AOR by Zone, lbs/day					
	lbs/day	1	2	3	4	5	6
1*	94,152	0	0	7603	6346	4554	2505
2*	95,216	0	0	7643	6373	4657	2637
3	94,361	0	0	8486	7103	5174	2826
4	101,832	0	0	9114	7650	5622	3073
5	107,656	0	0	9620	8070	5961	3263
6	113,090	0	0	10112	8479	6268	3414
7	121,275	0	0	10869	9119	6726	3605
8	128,213	0	0	11511	9658	7114	3770
9	134,850	0	0	12137	10183	7480	3913
10	132,961	12091	10602	7344	3458	1621	1147

*AOR by zone shown for converted DAR1 only, AOR for other DARS is greater

Note: Actual Oxygen Demand (AOR)

Highlighted values indicate diffuser design points selected by Tetra Tech.

Case 3 and 4 correlate to annual average day treatment plant influent flows of 67 and 72 MGD respectively, while case 10 corresponds to the treatment plant's design annual average day influent flow of 96 MGD.

Figure 3-24 – Tetra Tech DAR Simulation Results

Steady-state Modeling Results Summary DARs

Case	SRT	MLSS	Spike %	Eff NOx-N	Eff TKN	Eff NH_3-N	DAR1 Eff NOx-N	DAR1 Eff NH_3-N	Eff BOD	Eff TSS
1	14	3494	26	29.7	1.87	0.33	25.65	0.68	8.31	12.05
2	13.5	3510	26	30.14	1.91	0.34	26.55	0.74	8.47	12.42
3	14.5	3485	20	26.12	2.38	0.73	-	-	8.9	12.7
4	14	3496	17.5	26.12	2.45	0.76	-	-	9.24	13.10
5	13.8	3496	17.5	26.47	2.51	0.78	-	-	9.47	13.48
6	13.75	3508	14	27.04	2.56	0.79	-	-	9.64	13.93
7	13.7	3499	11	27.14	2.59	0.79	-	-	9.9	14.31
8	13.7	3499	9	27.41	2.63	0.79	-	-	10.10	14.72
9	13.7	3505	7	27.56	2.66	0.78	-	-	10.3	15.08
10	15	2790	3	31.74	1.84	0.13	-	-	9.1	13.48

Providing additional carbon via the "spike" lines and operating for denitrification in the DARs increases the mass of heterotrophic biomass in the reactors, thereby decreasing the fraction of autotrophic biomass. This is because the heterotrophs out-compete nitrifiers (autotrophs) for oxygen because of their greater growth rate and biomass yield. The volume of the DARs dedicated for nitrification is therefore decreased physically by reducing the number of aerated zones, and kinetically because of increased competition for oxygen by heterotrophs. Increasing the amount of carbon provided for denitrification (via the "spike" lines) or increasing the nitrate recycled (via increasing the internal recycle) compounds this kinetic advantage for heterotrophs because more carbon or nitrate becomes available for heterotrophic growth. Conversely, maintaining anoxic operation in the DARs with an increasing mass rate of TKN to the reactors will reduce the nitrification efficiency and result in increased

effluent TKN. This is because the population of nitrifiers cannot increase to meet the increased nitrification requirements because they are out-competed by heterotrophs for oxygen in the aerated zones. This effect is witnessed in the historical data and model results above as effluent TKN increased and TKN removal efficiency (nitrification efficiency) decreased.

The DARs are not the most ideal location to provide denitrification due to these concerns. Industry standard practice is to provide denitrification at the head of the biological processes in "preanoxic" basins so that the influent carbonaceous BOD and SS can be utilized by denitrifying microorganisms. This is done to avoid supplying a supplemental carbon source such as methanol when denitrification is provided downstream of carbonaceous removal. The use of "preanoxic" reactors is most common with single-sludge systems, while fixed film anoxic processes such as denitrification filters are most common with two-sludge systems since they do not require additional settling tanks.

While denitrification in the DARs can be provided up to the influent AADF of 72 MGD, the existing internal recycle equipment does not allow the internal recycle to be monitored or accurately controlled. Internal recycle is currently controlled via a 72-inch sluice gate and 72-inch diameter internal recycle conduit to the nitrification pumping station. The internal recycle rate currently cannot be monitored separately from the DAR influent as all flow exiting the Nitrification Pumping Station is monitored by flow meters in the 72-inch diameter influent conduits to the DARs. The rate of internal recycle is assumed from the height of the recycle sluice gate. Improving the internal recycle equipment will provide data to monitor process flows and allow increased control over the amount of denitrification/nitrification occurring in the DARs. Isolating the internal recycle between each reactor by providing separate IR pumps for each reactor may also prove beneficial at higher flows as some denitrification may be provided in some reactors while others are operated for full nitrification. This was originally suggested by Tetra Tech in their DAR Evaluation PDR.

Table 3-19 – Summary of Evaluation of Diffused Air Reactors

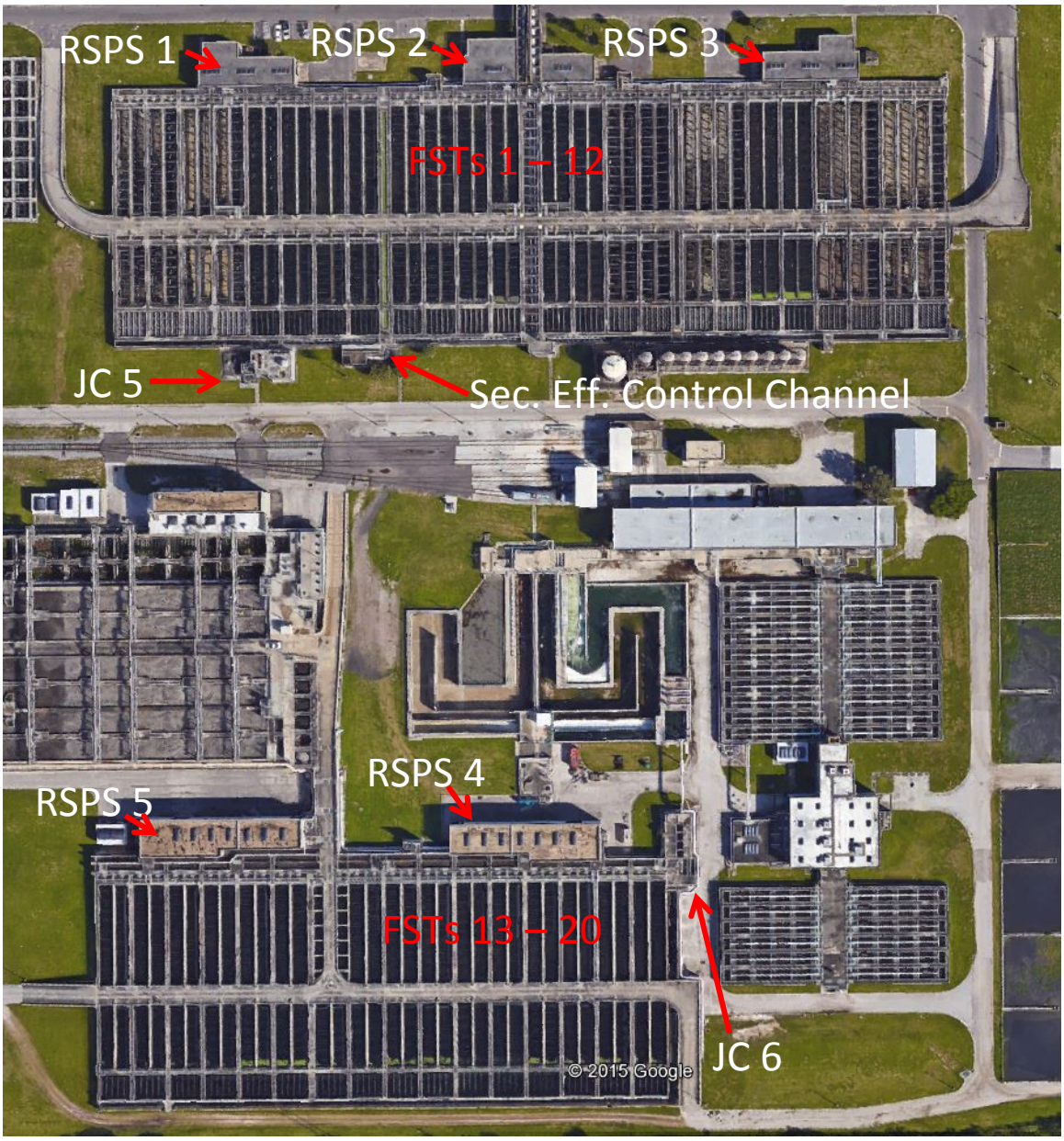
Performance	
Performance Goals	Observed Performance[1]
Effluent BOD: 5 mg/L	Effluent BOD: Unavailable
Effluent SS: 10.9 mg/L	Effluent SS: 5.98 mg/L
Effluent TKN: 1.9 mg/L	Effluent TKN: 1.36 mg/L
Effluent NO_3, Standard: 13.1 mg/L	Effluent NO_3: 22.35 mg/L
Effluent NO_3, Denite: 4.6 mg/L	
Percent TKN Removal: 82%	Percent TKN Removal: 92%[2]
Design SRT, with Denite: 8 days	2015 Average Estimated SRT: 23.5 days
Evaluation Findings	
• Current MLSS and SRT is well above the basis of design • Influent TKN is greater than that assumed by the basis of design • Solids production has increased due to anoxic operation as noted by consistent SRT and increased MLSS • The air diffuser equipment and distribution piping are approaching the typical 20 year design life for mechanical equipment. • Plant staff has indicated that the existing Hoffman blowers cannot be turned down enough. • Anoxic operation in the DARs is without mechanical mixing since zone 1 does not have mechanical mixers and mixers are oversized in zone 2. • Internal recycle via the recycle gate cannot be accurately monitored and controlled • The amount of denitrification available in the DARs is limited by the nitrification capacity due to the reactor volume. • The DARs are not the most effective location for denitrification due to limited carbon availability and hydraulic limitations • Reactor No. 1 has been unused for approximately 10 years and is currently being rehabilitated based upon Tetra Tech's recommendations • Leaks were noted in the process air pipes for the DARs	
Recommendations	
• Evaluate alternatives to alleviate hydraulic limitations; improved hydraulics will provide flexibility in operation for denitrification • Evaluate process alternatives to provide more complete denitrification prior to the denitrification filters, such as implementation of an anoxic zone in the HPO reactors with internal recycle from the DARs • Evaluate pump improvements or replacement for Nitrification Pumping Station to provide greater internal recycle • Recommend installing a magnetic flow meter on the 72-inch internal recycle conduit to monitor and control internal recycle. • Consider IFAS style retrofits to the DARs to improve nitrification capacity and therefore denitrification capacity. • Investigate and repair process air leaks to improve and maintain aeration efficiency. • Investigate mechanical issues with the existing Hoffman blowers and evaluate DAR aeration	

improvements and the resulting effect on DAR effluent quality to allow desired turndown operation.

(1)Average values based on data from 5-year study period

(2)Approximate value

3.2.3 Final Clarification



3.2.3.1 Purpose and Description

The Final Settling Tanks settle the effluent mixed liquor (MLSS) from the HPO reactors and DARs to clarify the process effluent to meet effluent suspended solids limits and to concentrate the activated sludge for recycle or wastage. The FSTs are rectangular chain and flight settling tanks. Each tank is equipped with eight sets of longitudinal collectors for sludge and scum collection, two sets of cross collectors in a center channel for sludge removal, and rotating scum pipes at the ends of each tank

immediately north of the effluent weirs to capture floating scum and floating biological solids. The FSTs are of common wall construction for groups of FSTs 1 – 12 and 13 – 20. Each FST has a surface area of approximately 16,796 ft^2, a water depth of approximately 12 feet, and a weir length of approximately 660 feet.

FSTs 1 – 12 receive the effluent mixed liquor from the HPO reactors and settle it to separate the biology of the HPO and DAR processes. Clarified effluent from FSTs 1 – 12 flows through Junction Chamber No. 5 to the Nitrification Pumping Station, where it will then be treated in the DARs. The clarified effluent from FSTs 1 – 12 may also bypass the DAR process and FSTs 13 – 20 via the Secondary Effluent Control Channel, which bypasses FST 1- 12 effluent to the post-aeration/chlorination tanks. The settled sludge from FSTs 1 – 12 is pumped by Return Sludge Pumping Station No.'s 1 – 3 back to the head of the HPO reactors to maintain the MLSS concentration in the HPO reactors. Some sludge is wasted from FSTs 1 – 12 by the waste sludge pumps in Return Sludge Pumping Station No. 2 in order to control the SRT of the MLSS in the HPO reactors. FSTs 1 – 12 were originally designed with the two-stage operation of the HPO system in mind. Under two-stage operation in the HPO reactors, carbonaceous effluent from reactors 1, 2, and occasionally 3 is settled by FSTs 1 – 4 or 1 – 6 if reactor 3 is operated as carbonaceous. The effluent from FSTs 1 – 4 or 1 – 6 is then returned to the intermediate pumping station to be treated in HPO reactors 3 – 6 or 4 – 6 for nitrification. The nitrified effluent would then be settled in FSTs 5 – 12 or 7 – 12. If the HPO reactors were operated for single-stage nitrification, all HPO effluent could be settled in any of FSTs 1 – 12. Following the construction of the DARs, the HPO reactors are almost exclusively used for carbonaceous removal only and any of FSTs 1 – 12 may be used to settle the HPO effluent.

FSTs 13 – 20 receive the effluent MLSS from the DARs and settle it to reduce the suspended solids in the effluent to near permit levels prior to being treated in the denitrification filters. The settled sludge from FSTs 13 – 20 is pumped by Return Sludge Pumping Station No.'s 4 and 5 back to the head of the DARs to maintain the MLSS concentration in the DARs. Some sludge is also wasted directly off the return sludge line to the effluent trough of PSTs 5 – 8 to control the SRT of the MLSS in the DARs.

Return Sludge Pumping Station No.'s 1, 2, 3, 4, and 5 each have five, 75 HP RAS pumps that pump into a common 36-inch RAS discharge header for each pump station. Each RAS pump is dedicated to a FST, with one standby RAS pump. The RAS pumps in RSPS No. 2 discharge into a 36-inch common discharge header that is also connected to the 36-inch RAS discharge headers from RSPS No.'s 1 and 3 from the west and east, respectively. The three 36-inch RAS discharge headers from RSPS No.'s 1, 2, and 3 combine into two 42-inch RAS headers that run to the head of the HPO reactors. Return Sludge Pumping Station No. 2 also houses three 50 HP WAS pumps that pump from the 42-inch RAS discharge headers to sludge thickening. The RAS pumps in Return Sludge Pumping Station No.'s 4 and 5 discharge into two common 36-inch RAS discharge headers. The two 36-inch RAS discharge headers then combine into a 48-inch RAS discharge header to the head of the DARs. A 6-inch WAS line is connected to the 48-inch RAS discharge header at the head of the DARs and is used to waste sludge from FSTs 13 – 20 to the effluent channel of Primary Settling Tanks 5 – 8.

3.2.3.2 Process Evaluation

The 10 States Standards recommended maximum SORs and peak SLRs for final settling tanks differ for FSTs 1 – 12 and FSTs 13 – 20 because they are linked to differently operating secondary treatment processes. The current operation of the HPO reactors as solely a high rate carbonaceous removal system allows for a maximum SOR of 1,200 gpd/ft^2 and a peak SLR of 40 lb/day/ft^2. Any of FSTs 1 – 12 may be used to settle the HPO effluent under the current operation. However, the HFC AWTP only uses a maximum of 7 of the 12 FSTs available at the current flows. The remaining 5 of FSTs 1 – 12 are reserved for flow equalization of clarified secondary effluent prior to the denitrification filters during high flow periods. This stored flow is then treated by the denitrification filters when plant influent flow has decreased and water level in the filters can be maintained below their maximum setpoint. This limits process flexibility and should be resolved for future settling capacity. **Table 3-20** summarizes the SOR for FSTs 1 – 12 under several operating conditions.

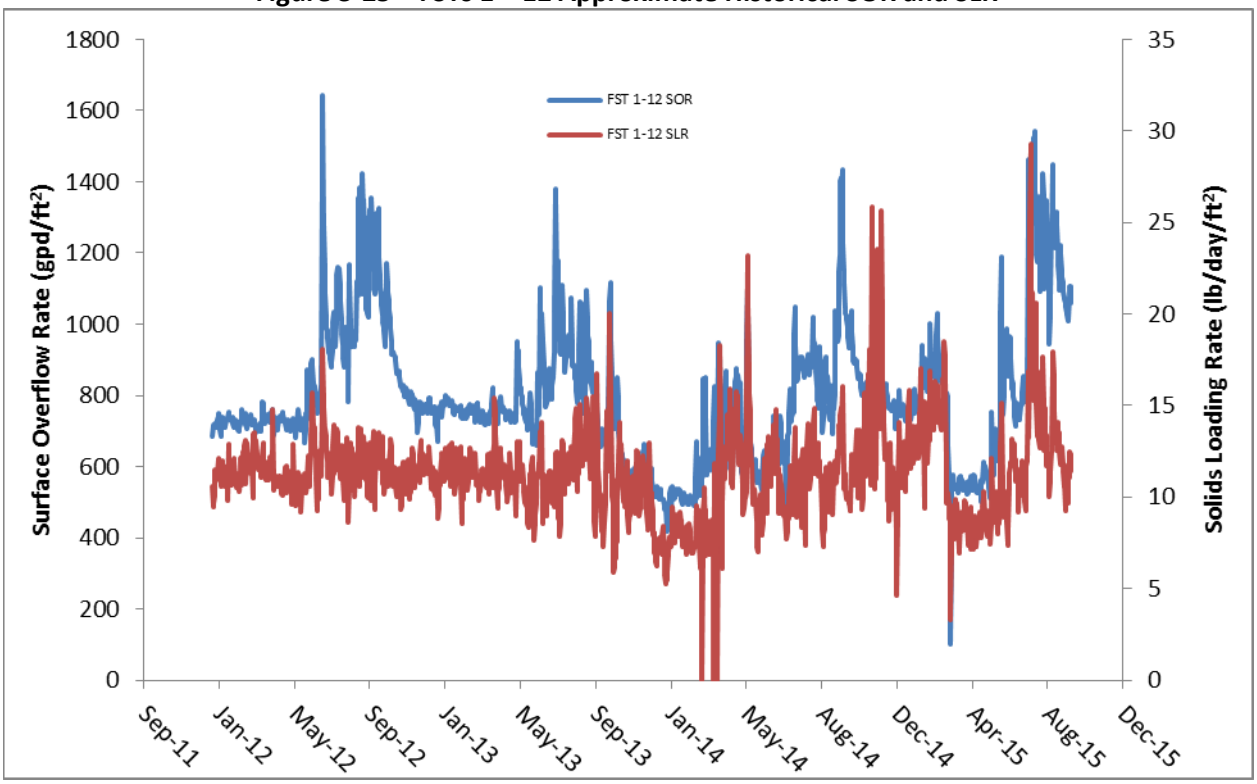
Table 3-20 – Final Settling Tanks 1 – 12 SORs

Flow Condition	Total Flow[(1)] (MGD)	No. of FSTs	Surface Area (ft^2)	SOR (gpd/ft^2)
Design AADF	121	12	201,552	600
Design PHF	245.8	12	201,552	1,220
Current AADF	81.27	5	83,980	968
Current PHF[(2)]	197.8	7	117,572	1,682
Class I – Design AADF	90.75	11	184,756	491
Class I – Design PHF	184.35	11	184,756	998

[(1)]Plant influent flow plus 26% residuals recycle up to maximum recycle flow of 25 MGD.
[(2)]2015 PHF was abnormally high; value used is the 95th percentile hourly flow.

Based on the data above, FSTs 1 – 12 are adequately sized for the design flows based on the surface overflow rate. However, the current operation due to plant hydraulics limitations will begin to hinder the settling capacity of FSTs 1 – 12. The solid loading rate is also a major consideration in the design of secondary settling tanks as it accounts for the return sludge flow rate and return sludge concentration in addition to the influent flow rate. **Figure 3-25** shows the approximate historical surface overflow rates and solids loading rates. The SOR and SLRs shown were calculated from the historical data from Monthly Operating Reports and the surface areas used were assumed from the high flow operating protocol.

Figure 3-25 – FSTs 1 – 12 Approximate Historical SOR and SLR



FSTs 1 – 12 are properly sized based on the solids loading rate as a SLR greater 30 lbs/day/ft^2 has not been observed and the average SLR to this group of FSTs is approximately 11.8 lb/day/ft^2.

As stated previously, FSTs 13 – 20 operate in conjunction with the DARs to remove suspended solids from the secondary effluent prior to the denitrification filters. The design requirements for FSTs 13 – 20 as recommended by the 10 State Standards should therefore be based on a two-stage nitrification system as the DARs would operate for nitrification alone at the 96 MGD plant design flow. The maximum SOR and SLR recommended for this type of system is 800 gpd/ft^2 and 35 lb/day/ft^2, respectively. However, current operation of the DARs to achieve some denitrification may allow the DARs to be characterized as a single-stage nitrification system to some degree. The maximum SOR and SLR recommended for FSTs 13 – 20 may then be assumed to be 1,000 gpd/ft^2 and 35 lb/day/ft^2 under the current operation for denitrification only. **Table 3-21** summarizes the SOR for FSTs 13 – 20 for several conditions.

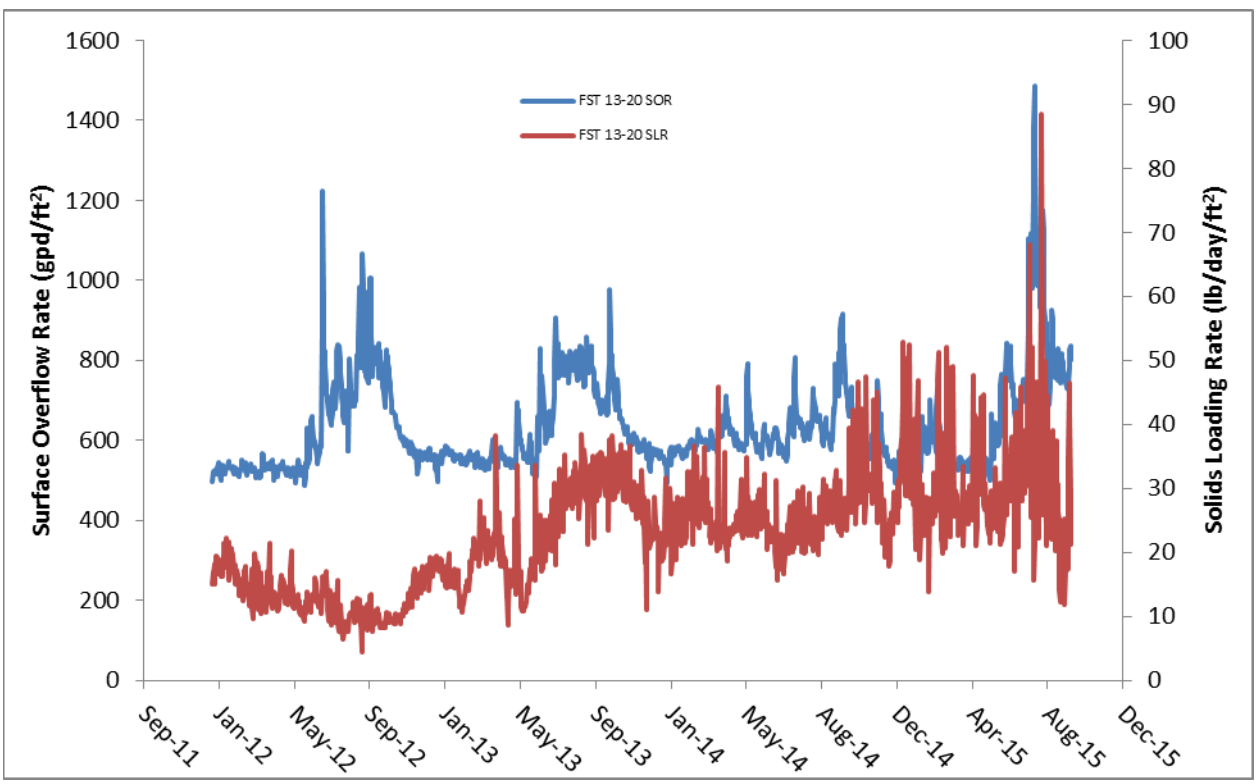
Table 3-21 – Final Settling Tanks 13 – 20 SORs

Flow Condition	Total Flow[1] (MGD)	No. of FSTs	Surface Area (ft^2)	SOR (gpd/ft^2)
Design AADF	121	8	134,368	901
Design PHF	245.8	8	134,368	1,829
Current AADF	81.27	7	117,572	691
Current PHF[2]	197.8	8	134,368	1,472
Class I – Design AADF	90.75	7	117,572	772
Class I – Design PHF	184.35	7	117,572	1,568

[1]Plant influent flow plus 26% residuals recycle up to maximum recycle flow of 25 MGD.
[2]2015 PHF was abnormally high; value used is the 95th percentile hourly flow.

Table 3-21 shows that FSTs 13 – 20 are significantly undersized at the design PHF, current PHF, Class I PHF, and even the design AADF based on the SOR. This may result in excessive solids exiting the FSTs to the denitrification filters which may contribute to premature filter plugging, increased requirement for filter backwashing, and filter bypassing. FSTs 13 – 20 have also struggled to meet the maximum recommended peak SLR of 35 $lb/day/ft^2$ as shown in **Figure 3-26**.

Figure 3-26 – FSTs 13 – 20 Approximate Historical SOR and SLR

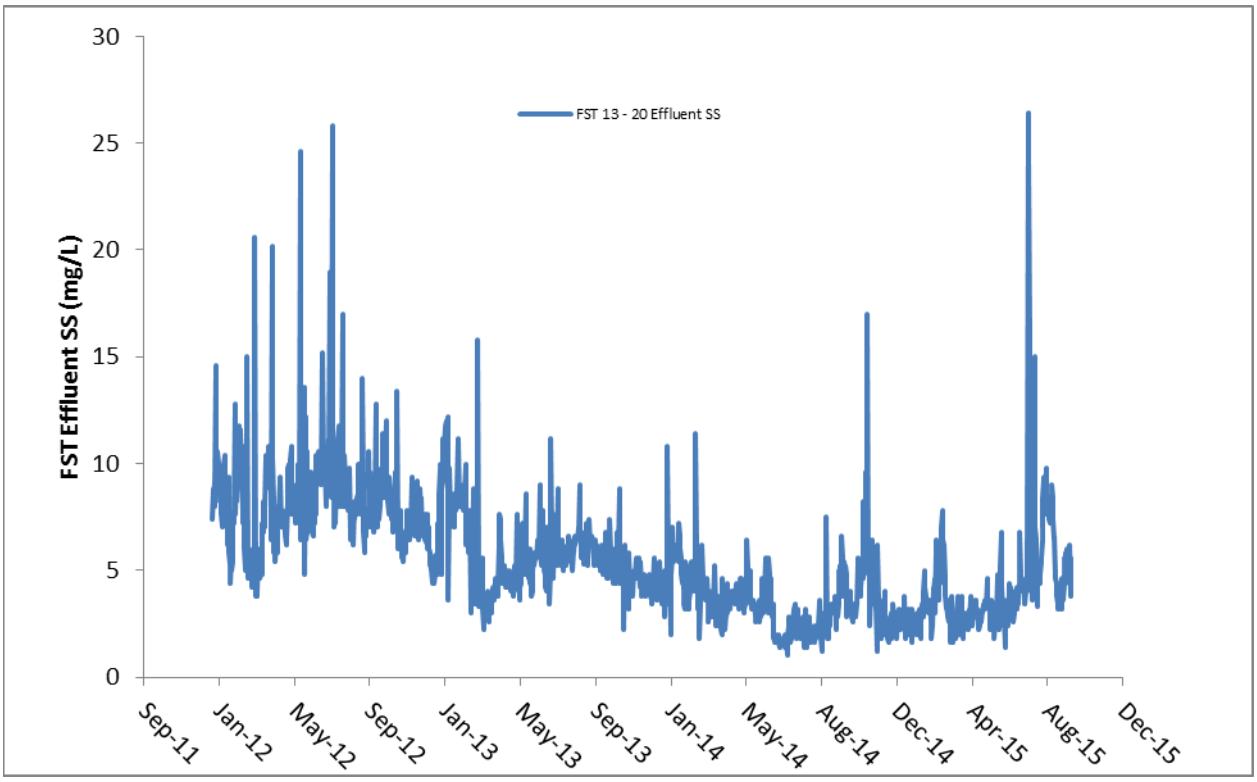


The troubles meeting the maximum SLR recommendation began at approximately the same time denitrification operation began in the DARs, which coincided with a significant increase in the DAR

MLSS. It is worth noting that any changes in operation that will modify the MLSS concentration or the return sludge flow rate in the HPO reactors or DARs will impact the solids loading rate and therefore determine whether the FSTs are properly sized. The denitrification operation in the DARs increased the MLSS and FST SLR because of an increase in heterotrophic growth on carbonaceous substrate from the "spike" line and the increased availability of a final electron acceptor in the form of the recycled nitrate. **Figure 3-26** shows that this increased MLSS due to the denitrification operation has increased solids loading on the already hydraulically overloaded clarifiers based on the SOR.

Effluent suspended solids from FSTs 13 – 20 did decrease after the start of the denitrification operation in the DARs as seen in **Figure 3-27**. This is also the result of the increased heterotrophic population in the DAR MLSS, which is known to improve sludge settleability. However, continued operation in this configuration as the plant AADF increases will result in effluent suspended solids exceeding the basis of design value of 10.9 mg/L. The SOR and SLR will continue to increase above the recommended values and will result in degrading effluent quality.

Figure 3-27 – FST 13 – 20 Effluent Suspended Solids



Operation of the FSTs and the Return Sludge Pumping Stations is primarily manually controlled with very little to no automation. The longitudinal and cross collectors, return sludge pumps, and waste sludge pumps are all locally controlled at the respective settling tanks or pumping stations. Return sludge pumping is controlled by manually adjusting the pump speed of each pump to reach a target return sludge flow rate. The operator must monitor the local readout from the flow indicating transmitter for the return sludge discharge while adjusting the pump speed manually. The sludge blanket level is also

manually measured every four hours in each tank to ensure a relatively uniform sludge blanket height across each tank, which therefore indicates the sludge pumps are pumping at approximately equal rates. The sludge blanket height is not automatically monitored throughout the day. Modifications to improve monitoring and automate sludge pumping controls may allow the HPO reactor and DAR MLSS concentrations to be more uniform and therefore result in more uniform solids loading on the FSTs. Enhancements to automate monitoring and sludge pumping operation generally results in more consistent treatment efficiency, especially when wastage is continuous for low SRT systems such as the HPO reactors and FSTs 1 – 12.

A large majority of the equipment associated with FSTs 1 – 12 and return sludge pumping stations 1, 2, and 3 is original to the 1978 construction. FSTs 7 – 12 are currently undergoing the replacement of the longitudinal and cross collector chain and flight systems, however the collector drives, motors, and gearboxes are not slated to be replaced. This equipment is greater than 37 years of age and has long out-lived the commonly anticipated 20 year lifespan of mechanical equipment. In addition, the Secondary Effluent Control Weir at FSTs 1 – 12 is inoperable and secondary effluent cannot be bypassed to the post-aeration/chlorination tanks in the event of an emergency. A large majority of the equipment associated with FSTs 13 – 20 and return sludge pumping stations 4 and 5 is also original to the 1996 construction, however this equipment is just now reaching the anticipated 20 year life for mechanical equipment. Most of this equipment for FSTs 13 – 20 and RSPS 4 and 5 may be expected to last for many more years based on the life span of the equipment for FSTs 1 – 12 ad RSPS's 1 – 3. Regardless, a replacement campaign for aging equipment is likely to reduce energy usage and increase monitoring functionality.

Table 3-22 – Summary of Evaluation of Final Settling Tanks

Performance	
Performance Goals For effluent concentrations, see HPO Reactors and DARs performance summaries.	Observed Performance[(1)] For effluent concentrations, see HPO Reactors and DARs performance summaries.
FSTs 1 – 12: SOR, Average = 600 gpd/ft^2 SOR, Peak = 1,219 gpd/ft^2 SLR, Max = 40 lb/day/ SF[(2)]	FSTs 1 – 12: SOR, Average = 808 gpd/ft^2 SOR, Peak = 1,644 gpd/ft^2 SLR, Max = 29.3 lb/day/ft^2
FSTs 13 – 20: SOR, Average = 900 gpd/ft^2 SOR, Peak = 1,829 gpd/ft^2 SLR, Max = 35 lb/day/SF[(2)]	FSTs 13 – 20: SOR, Average = 619 gpd/ft^2 SOR, Peak = 1,487 gpd/ft^2 SLR, Max = 88.5 lb/day/ft^2
Evaluation Findings	
• A maximum of 7 of the first 12 FSTs are used for the settling of HPO effluent • 5 of the first 12 FSTs are backfilled from the Denitrification filters during periods of high flow when the filter water level cannot be maintained at the setpoint value. • FSTs 1 – 12 have exceeded the 10 State Standards maximum recommended SOR on many occasions	

due to the current inability to utilize 5 of the 12 FSTs.

- The estimated SLR for FSTs 1 – 12 has never exceeded the recommended peak SLR.
- FSTs 13 – 20 have regularly exceeded the 10 State Standards maximum recommended SOR on many occasions of high flow regardless of whether the maximum recommended SOR is 800 or 1,000 gpd/ft^2
- FSTs 13 – 20 are undersized based on the SOR at the design AADF and PHF for a two-stage nitrification system, and the current PHF for the denitrification operation
- The estimated SLR for FSTs 13 – 20 has regularly exceeded the recommended peak SLR of 35 lbs/day/ft^2; the SLR to FSTs 13 – 20 increased significantly following the start of denitrification operation in the DARs due to significantly greater MLSS concentrations than the FSTs were designed to accommodate.
- Sludge blanket level is manually checked every four hours, however no online monitoring is available
- Motorized control of adjustable secondary effluent control channel weir at FSTs 1 – 12 is currently inoperable, gate must be manually operated to allow bypass to post-aeration/chlorination
- Return sludge pumps are manually controlled based on pump speed and the return sludge flow rate read-out on local flow indicated transmitters; monitoring and controls can be improved dramatically to improve ease of operation, consistent operation, and consistent sludge blanket level in the final settling tanks.
- Large majority of equipment for FSTs 1 - 12 and RSPSs 1 – 3 is in excess of 37 years of age according to facility records, however plant staff has indicated that a majority of this equipment is approximately 15 years old.
- Large majority of equipment for FSTs 13 – 20 and RSPSs 4 and 5 is reaching the 20 year design life for mechanical equipment
- Plant staff has indicated chains for the FSTs chain and flight systems have been replaced before the end of their expected life span.

Recommendations

- Evaluate alternatives for automatic sludge blanket monitoring
- Replace the rate controller equipment in the secondary effluent control channel including the secondary control weir, three motor operated gear boxes, and three gate operator motors.
- Investigate mechanical defects in chain and flight systems that would reduce the expected life span and evaluate alternatives if necessary.
- Evaluate options to automate return sludge pumping including SCADA integration with HPO and DAR MLSS monitoring equipment, automatic sludge blanket monitors, return sludge and waste sludge flow indicating transmitters, pump speed indication, and return sludge solids concentration monitoring.
- Operational and physical modifications should be considered to provide denitrification prior to the denitrification filters in a location other than the DARs to reduce solids loading on FSTs 13 – 20.
- Evaluate options to construct additional final settling surface area to handle the peak hour flows and to accommodate average daily flows as they increase towards the design AADF
- Evaluate options to convert the HFC AWTP to a single-sludge system to eliminate the need for

additional final settling surface area

(1) Based on data from 5-year study period, values are approximate due to assumed residual recycle

(2) Based on 10 State Standards Requirements for Final Settling Tanks

3.3 Tertiary Treatment

3.3.1 Filtration and Denitrification

3.3.1.1 Purpose and Description

Howard F. Curren AWTP is one of the largest facilities in the nation with denitrification filters. There are 32 coarse sand Denitrification Filters downstream of the suspended growth biological treatment processes. These filters were designed to reduce the TSS and TN to meet the surface water maximum permit limits of 5 mg/L and 3 mg/L. The Part III public access reclaimed water is also limited to a max of 5 mg/L of TSS. The basis of design for the filters states that they were designed for average influent concentrations up to 11 mg/L TSS and 12 mg/L nitrogen-as nitrate and effluent concentrations of 2.3 mg/L TSS and 1.0 mg/L nitrogen-as nitrate. Under normal operating protocol all the nitrified effluent flows from the Diffused Air Reactor's Final Sedimentation Tanks and enters Junction Chamber No. 6 where it is mixed with the appropriate dosage of methanol. The flow upstream of the filters is metered at FE-48 and FE-49 and directed to the four banks of Denitrification Filters. The groups of filters are shown in the aerial above with the old filters (installed 1978) numbered 1-20 to the north and new filters (installed 1991) 21-26 and 31-36 south of Filter Building 2. Pumps and blowers associated with filters 1-20 are in the older Filter Building 1 to the north that borders the Final Effluent Channel, and the pumps and blowers associated with filters 21-26 and 31-36 are located in the newer Filter Building 2 just east of Junction Chamber No. 6. The control room for all the filters is located in Filter Building 1. General purpose plant water pumps, strainers, chlorine solution pumps, sulfur dioxide solution pumps, Mosaic industrial reuse pumps, polymer dilution water pumps and lawn irrigation pumps are also located in Filter Building 1 and typically supplied from chlorinated strained or unstrained effluent. All of the filter backwash pumps in both filter buildings are supplied from pre-chlorinated effluent directly out of the Final Effluent Channel. Each filter has a surface area of 1,050 square feet for a total filtration area of 33,600 square feet. The filters have 4.5-feet of 2-3 mm coarse sand and 1.17-feet of gravel on top of TETRA filter underdrain blocks by Severn Trent Services. The facility is currently the replacing media and

filters underdrains for filters 21-36 with the Denitrification Filters Media Replacement project. The media and underdrains for the older filters 1-20 were replaced in 2008.

Figure 3-28 - Denitrification Filters

The nitrified effluent flows into channels down the center of the four banks of filters, and knife gate valves allow flow into the end of each filter gullet. The gullets split each filter into two sides with the filter media and underdrain systems below. Influent flows over triangular weirs on either side of the gullets, and flow in and out of the conduits below the filters is controlled by effluent valves and backwash valves in the filter galleries below the influent channels. The backwash drain valves control the flow from the gullets to filter to waste returned to the main pump station via the main drain. The filters were designed to maintain a constant water level by the use of modulating effluent valves and level control systems. The valve opens incrementally as the head loss through the filters increases until it is fully open to maintain the constant water level over the filter media. The design set point was 3-inches below the top of the weirs, in line with the bottom of the weirs, at an elevation of 15.75-feet. The current set point is below this at 14.0-feet.

Figure 3-29 – Filter Underdrain Control Valves

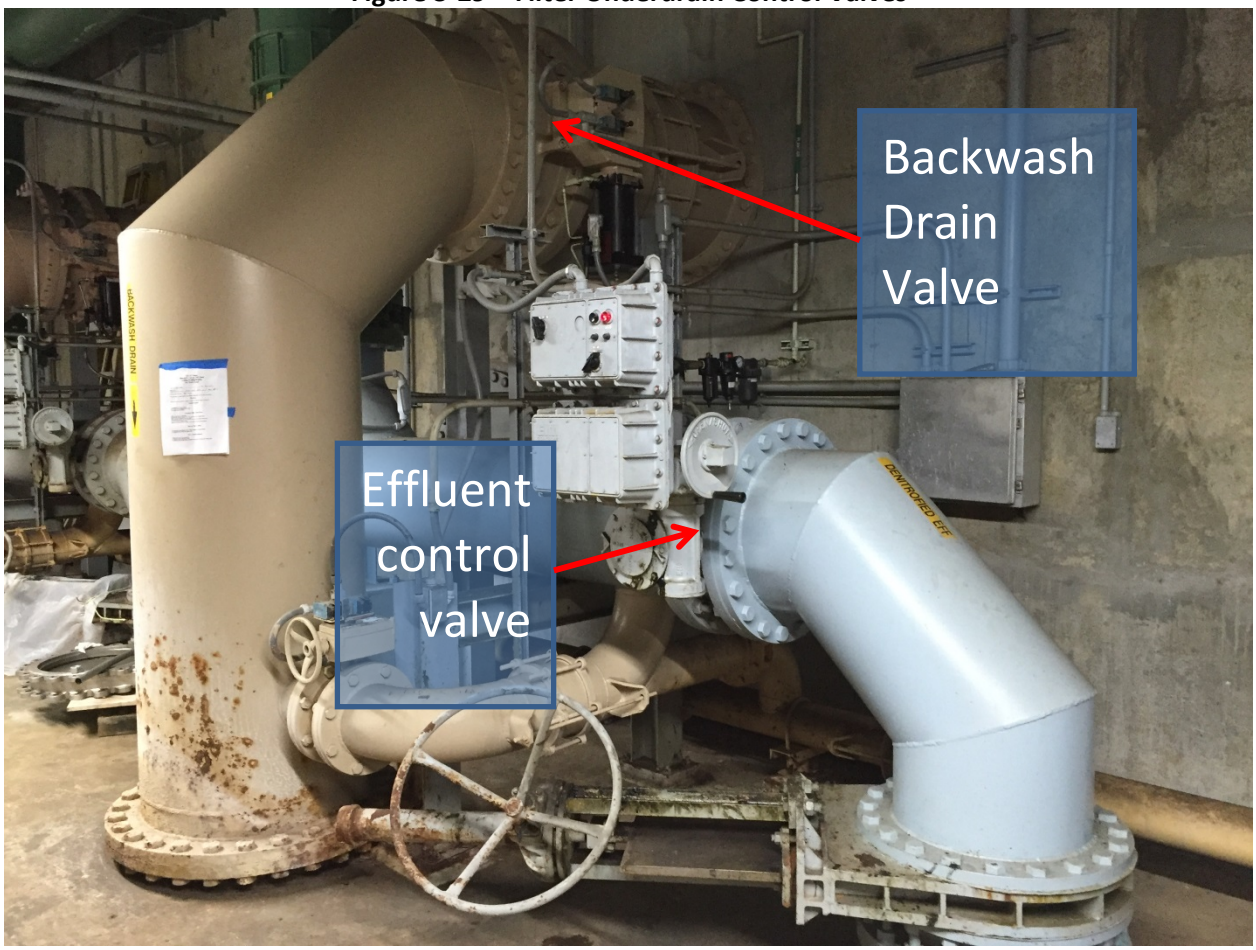
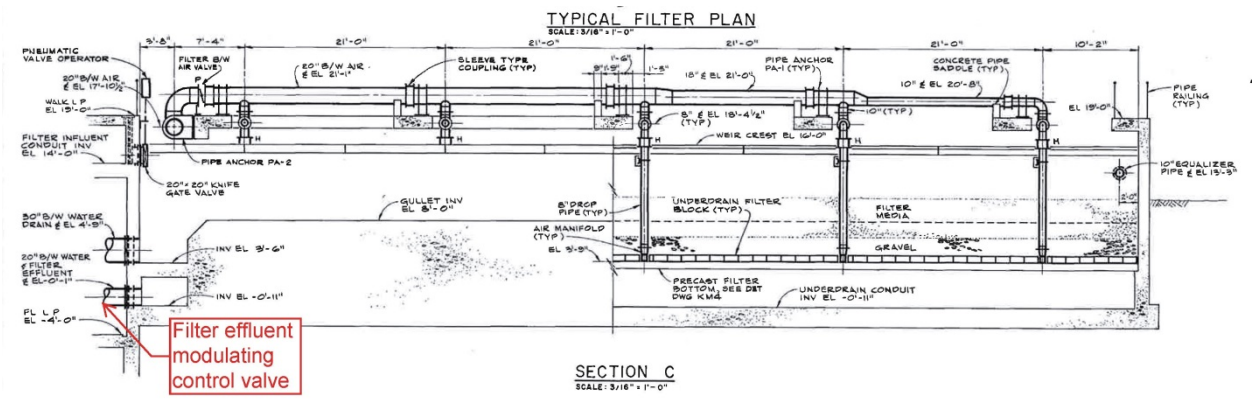


Figure 3-30 –Denitrification Filter Plan - Record Drawing of Filters 1 through 20 (1974)



The biofilm that accumulates in the filter media contains bacteria that biologically convert nitrate (NO_3) to nitrogen gas (N_2) in the absence of oxygen. The nitrogen gas is released into the atmosphere removing nitrogen from the wastewater. These denitrifiers require a carbon source for growth, and by this point in the treatment process almost all of the readily biodegradable carbon has been removed.

The facility uses methanol for an additional carbon source, and it is dosed at a ratio of 2.5 M/N (mg methanol/mg nitrate), which is controlled by flow and nitrate concentration upstream of the filters. The methanol is stored in a 100,000 gal tank, and the four methanol feed pumps, each with capacity of 557 gph at 175 psi with 100:1 turn-down are located to the north of Filter Building 1. The facility is currently replacing the methanol feed pumps and piping between the storage tank and pumps. The piping between the tank and the feed pumps will be in a trench for visual leak detection and accessibility. Combustible gas detection sensors monitor the area around the storage tank and feed pumps.

The filters physically separate the suspended solids from the clarified effluent to meet the TSS limit permit requirements. Solid separation is achieved through depth filtration in the 4.5-feet of coarse sand. The biofilm in the filter media improves filtration and also increases head loss through the filters. The backwash cycle is initiated once a day starting at 11PM one filter at a time lasting about 10 hours total. The backwash cycle for each filter consists of five minutes of air scour at 8600 CFM, followed by five minutes of air and water backwash at 8600 CFM and 8400 gpm, and then 10 minutes of water backwash only at 8400 gpm. During the entire backwash sequence the influent and effluent valve is closed and the drain valve is open. The backwashes are designed to dislodge solids trapped in the filter media, sluff excess biofilm and reduce the head loss through the filter back to its clean state. In addition to the solids accumulation and growth of biofilm, nitrogen gas becomes trapped in the filter media as the denitrification process occurs. The trapped gas also increases the head loss through the filters as it builds up. To release the trapped nitrogen from the media each filter has short backwash cycles called, Nitrogen Release Cycles (NRC). Each NRC is a three minute backwash at 8400 gpm which run throughout the day one filter at a time. The interval between NRCs for the same filter is about 96 minutes. After all 32 filters have performed an NRC the operators immediately start the sequence over again. The operators have two modes they can chose from for NRCs, water saver mode, which is used most of the time, and water hog mode. In water saver mode the influent valves stay open and none of the filter backwash produced is sent to the drain. In water hog mode the drain opens and the influent valves close. The water hog mode removes some of the solids and excess biofilm from the system but increases the backwash returned to the main pump station by as much as 12 MGD. This mode is typically only used during high flows and very low flows. It is used at high flows to try to keep the filters as clean as possible. However, the water hog mode increases the flow to the filters by recycling the backwash water to the main pump station. One backwash pump draws 12.1 MGD out of the Final Effluent Channel. At very low flows of less than 30 MGD the backwash pumps have a significant impact the flow in this channel and cause significant variations. The flow in this channel is used to pace the chlorine dosing and abrupt changes in flow cause improper dosing. Operators will use the water hog mode at low flows to increase the recycle flowrate and reduce the amplitude of the fluctuations in flow in the Final Effluent Channel.

3.3.1.2 Process Evaluation

The triangular weirs on either side of the gullets were designed to minimize air entrainment with a slope toward the filter media and a constant water level over the filters to minimize free fall. The denitrifiers require a low oxygen environment, and DO will also increase methanol demand. The current water level

set point is lower than the design set point at an elevation of 14.0-feet. The current set point does generate free fall over the weir, but the increase in DO is assumed to be minimal due to the short drop and minimal turbulence seen at the water surface. The actual water level in each filter is rarely at the set point elevation and often above the top of the weirs, even with effluent valve completely open as indicated in **Figure 3-31**. The following pictures also show the variation in the water level which were taken on January 11th, 2016 around noon at average daily flow. The level control system appears to be working and is regularly serviced by the facilities staff. The effluent control valve and actuators are inspected and replaced as need, which is as often as every four years. As the time since the last NRC increases for each filter, the water level rises typically above the top of the weirs, and then drops back below weirs after the next NRC. As the time increases since the last full backwash for each filter the water level no longer returns to the set point after an NRC. The rise in the water level in the filters is most likely not caused by the level control system and the discussion continues in this section.

Figure 3-31 – Denitrification Filter Section - Record drawing of Filter 1 through 20 (1974)

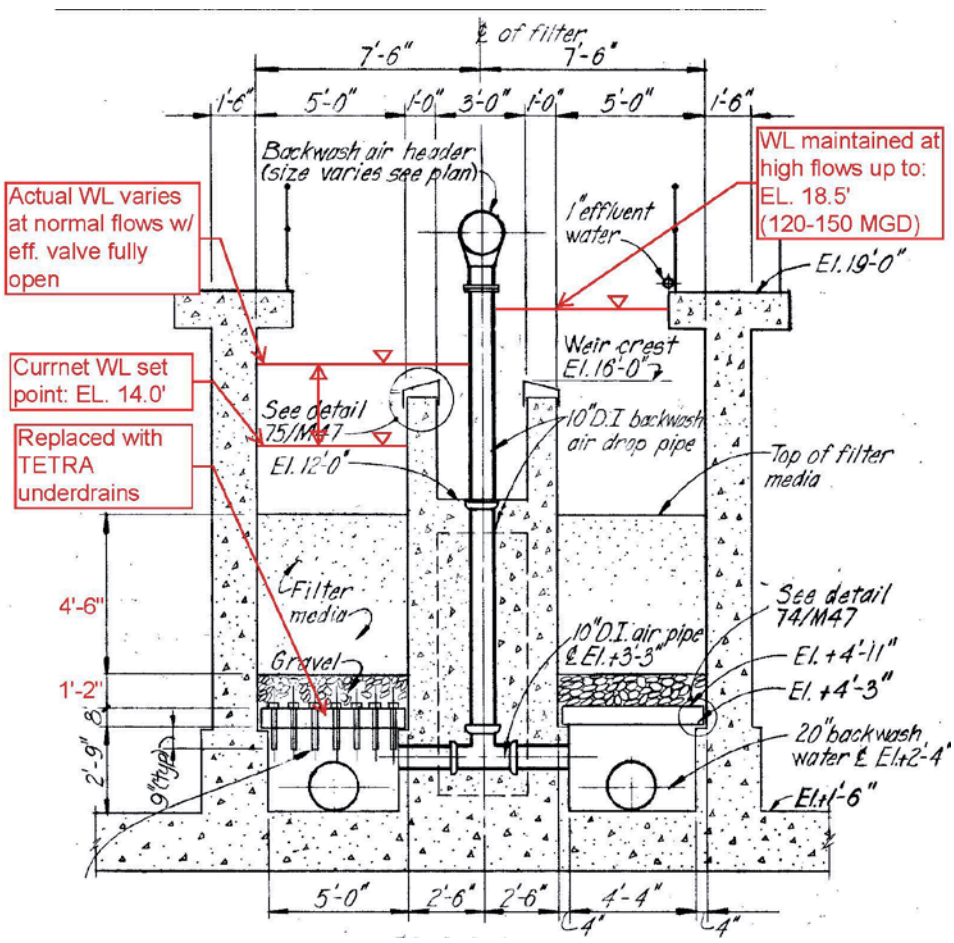


Figure 3-32 – Filter Water Level at Set Point

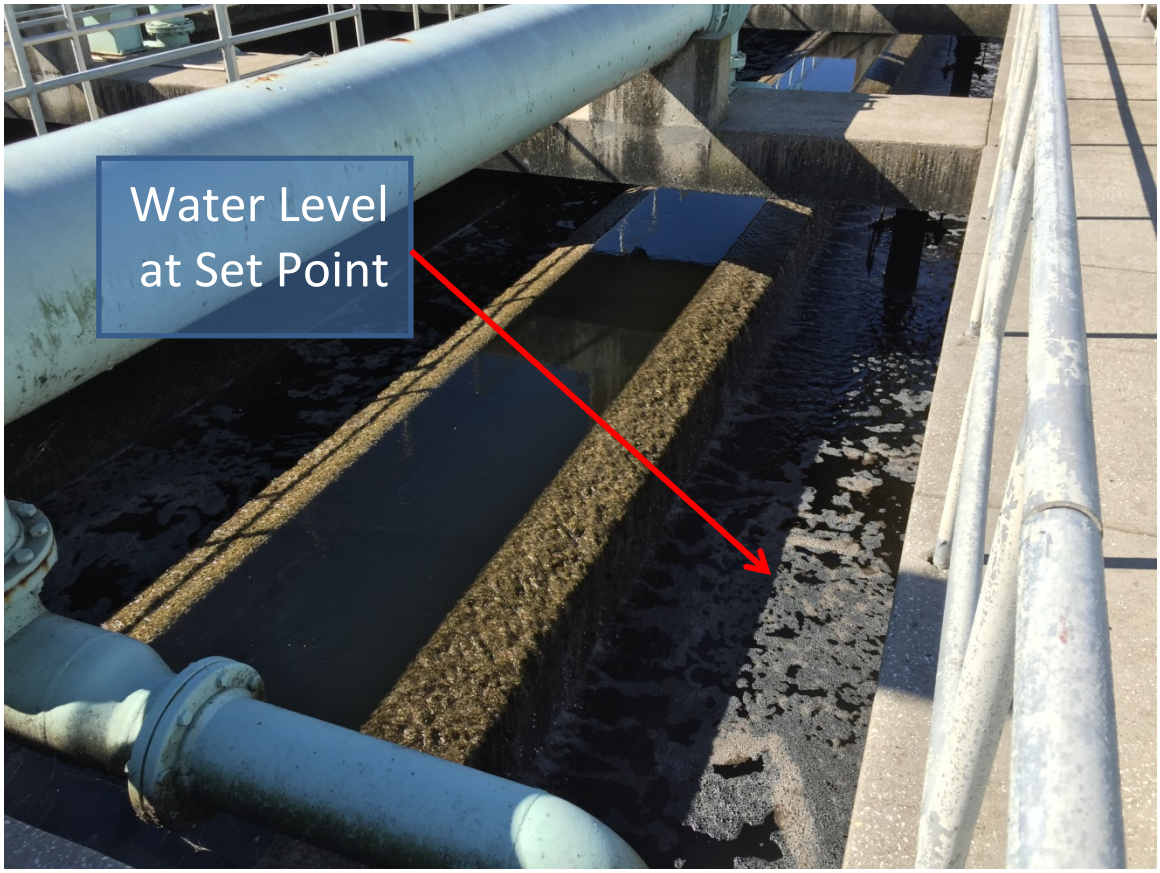


Figure 3-33 - Filter Water Level Above Set Point

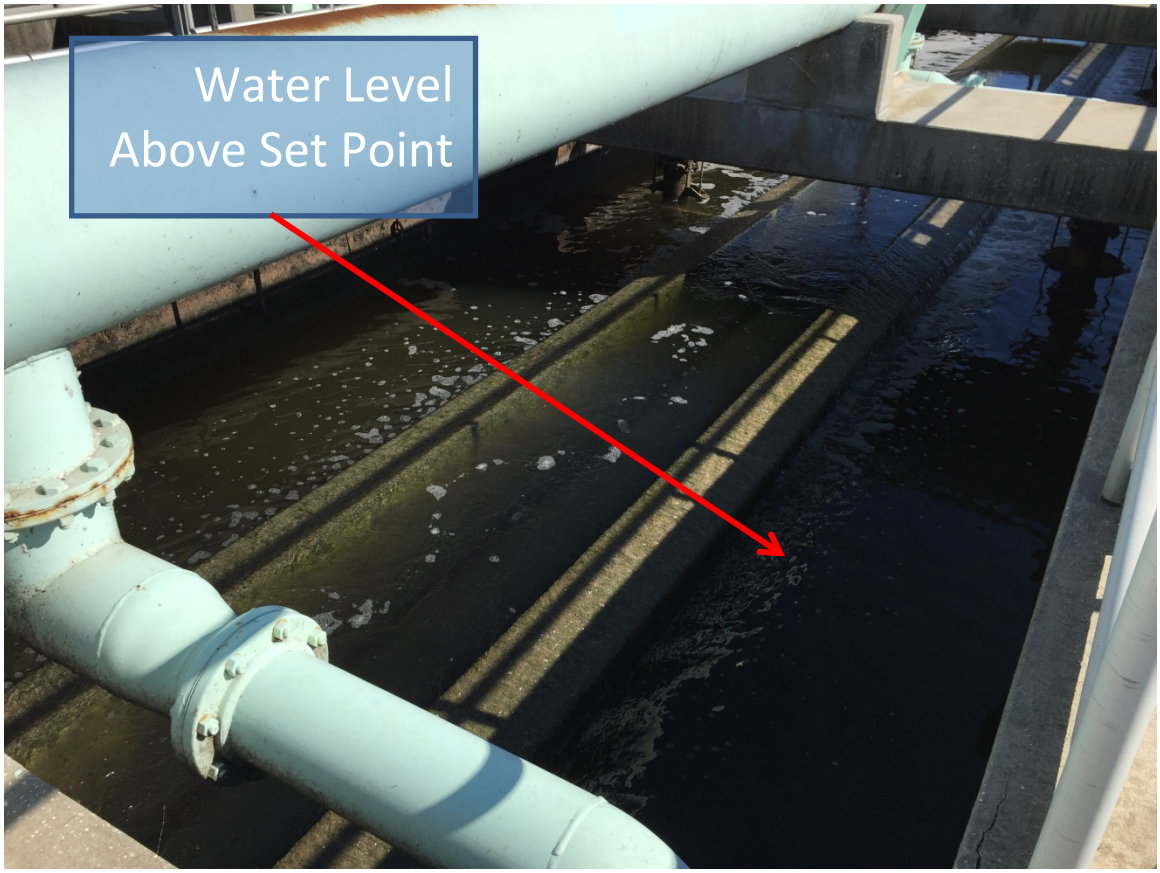


Figure 3-34 - Filter Water Level at Top of Weirs

Figure 3-35 - Filter Water Level Above Weirs

The filters were designed for hydraulic loading rates (HLR) of 2.5 gpm/ft^2 at 121 MGD and 5.1 gpm/ft^2 at peak flow of 249 MGD (design flows for AADF and PHF plus recycle streams). Industry references from EPA and WERF suggest that HLR should be 2-3.5 gpm/ft^2 at AADF and 3-7.5 gpm/ft^2 at PHF for denitrification filters. The manufacturer of the underdrain system used, Severn Trent Services, states that up to 5 gpm/ft^2 can be achieved in warmer waters. The filters are appropriately sized for the design flows based on this information. However, the facility has experienced such excessive head loss in the filters at flows from about 120 MGD to 150 MGD that the level in the filters has risen well above the weirs up to the top of the tanks at 19.0-feet. To maintain the level in the filters from exceeding 6-inches of freeboard at 18.5-feet the staff has sent a portion of the filter influent to empty Final Sedimentation Tanks downstream of the High Purity Oxygen Reactors through an old conduit, see the Flow Diagram for this connection. The tanks used for excess flow are drained at a time of lower flow to free up available volume for the next high flow event (a max of any seven of the twelve Final Sedimentation Tanks are used for clarification of the High Purity Oxygen Reactors effluent for this reason). The filters also experience excessive head loss at current average day flows which is well below the design HLR. The water level set point should be maintained throughout most of the day between NRCs and backwashes and certainly not exceed the top of the weirs. The filters have less freeboard available for peak flow events due to the high water levels at current average flows. The following reasons may be the cause of the excessive head loss. The level control system may be faulty and effluent vale may not open 100%. This is not likely due to regular maintenance but should be ruled out with testing. The solids loading to

the filter is lower than design criteria and low compared to industry average. Therefore, the solids loading is most likely not a contributing factor. The average influent concentration of and nitrate is almost double the design concentration. The result is most likely excessive biofilm accumulation in the filter media which increases the head loss. The influent TSS concentration is lower than design criteria and unlikely contributing to the head loss problem. Each backwash and NRC may not be effective, and the time between these may be too long for nitrate loading concentrations. It was also observed that a significant amount of sluffed biofilm was present in the water above the filters. Excess biofilm may not be removed from the system. Investigations into the level control system, backwash and NRC cycle, time between backwashes and NRCs should be included in the next phase. A variable level system with backwashes and NRCs initiated by level may be appropriate for this facility and should in included in the investigation in the next phase. Reducing the nitrate loading to the filters may be the best long term solution. The current filtration surface area should be sufficient for the design flows without consideration of nitrate loading. However, if further investigation determines that the head loss cannot be reduced, additional filters would be necessary to meet peak flows. Investigation into short term and long term solutions for the excessive head loss and hydraulic limitation should be included in the next phase.

The backwash water pumps and backwash blowers for filters 1-20 were installed in 1978 and exceeded their useful life. The City indicated that they have had constant problems with the backwash water valves and investigation into alternate technologies should be included in the next phase. The venturi meter for the backwash water indicates that the pumps can still produce the designed flow rate of 8,600 gpm. However, due to the age of this equipment it is possible that the metering is inaccurate and the pumps have lost some capacity. Replacement of these meters is already included in the budget in the near future. The pumps and blowers for filters 21-36 were installed in 1991 and most likely nearing the end of useful life. As previously mentioned, ineffective backwashing could also be a cause for the hydraulic limitations and further investigation is recommended.

Methanol is a DOT primary class flammable liquid with a low flash point temperature of 52 °F and low vapor pressure of 90 mm Hg at 68 °F according to the Methanol Institute. The vapor phase is the most dangerous since it is readily ignitable and can be inhaled into the lungs. At the warm year round temperatures in Tampa methanol vapors are present in the head space of tanks and can leak into the surrounding area during filling or failures in piping. Proper safeguards are imperative to prevent an accident. The combustible gas detention system at the facility meets safety regulations. However, more sophisticated detection and suppression systems are available. Methanol is fed at a ratio of 2.5 mg CH_3OH per mg of NO_3 which is within the industry recommended range of 2-3. The facility has recently been using about 1.74 MG of methanol at an annual cost of about $1,882,000. Methanol currently has the highest annual cost for any of the chemicals used at the plant. Reducing the concentration of nitrate in the filter influent by denitrification upstream could save hundreds of thousands of dollars per year in reduced methanol usage. Investigation into significant denitrification upstream in recommended. With a significant reduction in nitrate prior to the filters the methanol feed pumps may need to be replaced. If the turn down ratio on the current pumps is in fact 100:1, the pumps will be oversized for current daily flows and nitrate concentrations below 5 mg/L. The methanol pumps are currently being replaced, and

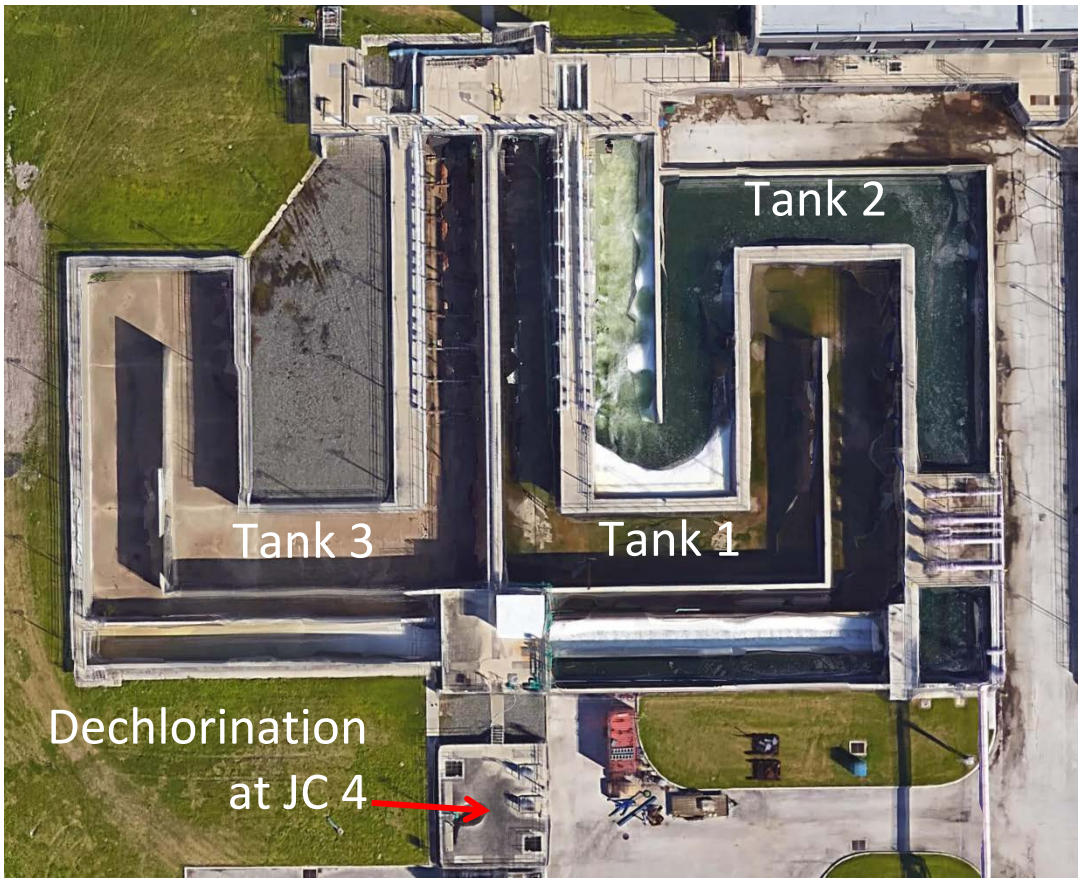
the sizing of these new pumps should be investigated in the next phase in conjunction with evaluation of denitrification upstream of the filters.

Table 3-23 – Summary of Evaluation of Denitrification Filters

Performance	
Performance Goals Design Average Influent TSS: 11 mg/L Design Average Influent Nitrate-N: 12 mg/L	Observed Performance[1] Observed Average Influent TSS: 3.8 mg/L Observed Average Influent Nitrate-N: 18.3 mg/L
Design Average Effluent TSS: 2.3 mg/L Design Maximum Effluent TSS: 3.0 mg/L	Observed Average Effluent TSS: <0.4 mg/L Observed Maximum Effluent TSS: 4.9 mg/L
Design Average Effluent Nitrate-N: 1.0 mg/L Design Maximum Effluent Nitrate-N: 3.0 mg/L	Observed Average Effluent Nitrate-N: 1.0 mg/L Observed Maximum Effluent Nitrate-N: 5.87 mg/L[2]
Design Filtration Rate: 2.5 gpm/ft^{2}at AADF 5.1 gpm/ft^2 at PHF	Observed Filtration Rate: Up to 2.5 gpm/SF[3]
Evaluation Findings	
• The filters have historically provided reliable nitrate and TSS removal required to meet stringent permit limits. • Methanol cost has been as high as $1,900,000 per year without over dosing. A significant reduction of the nitrate concentration upstream of the filters will provide significant cost savings in chemical cost. • Flows over 120 MGD have proven that the filters are experiencing excessive head loss and unable to maintain normal water level well below the peak design hydraulic loading rate. • Backwash valves have consistently been problematic and alternatives should be investigated. • Water level in the filters rises above the influent weirs during average daily flow in-between NRCs. • The level control system and effluent valve may be faulty. A variable level system also may be a better option. • The nitrate concentration in the filter influent is almost double the design concentration. • The TSS concentration in the filter influent is less than half of the design concentration. • Backwash and NRC cycles may be ineffective and time between these should be evaluated for nitrate loading conditions. • Backwash pumps and blowers are 38 years old for old filters and 24 years old for new filters. All may be at the end of their useful lives. • These meters read up to a combined flow of 220 MGD. This is less than the design PHF with recycle streams of 245 MGD.	
Recommendations	
• Investigate options to provide significant denitrification upstream of filters to reduce methanol costs and use filters as final polishing for nitrate removal in the next phase. The basis of design for the current Nitrification Reactors project expects only minor nitrate removal. • Investigate causes of the hydraulic limitations in filters, perform stress testing and investigate possible solutions in the next phase. • Investigate existing level control system in the next phase. • Investigate backwash effectiveness and whether pumps and blowers need to be replaced in the next phase. • Investigate changes to NRC and backwash cycle and interval between to improve hydraulic loading in the next phase.	

(1)Based on data from 5-year study period
(2)Two of these occurrences caused and exceedance of the TN single sample limit of 6.0 mg/L
(3)Estimated filtration rate based on 150 MGD flow rate with 30 filters in service

3.3.2 Disinfection and Dechlorination



3.3.2.1 Purpose and Description

HFC AWTP uses chlorine gas for primary disinfection and sulfur dioxide for dechlorination both supplied in rail cars. The liquefied chlorine gas from the rail car is heated through evaporators to convert the chlorine to the gas phase. Then, the chlorine gas is mixed with plant reuse water to create a solution of hypochlorous acid and hydrochloric acid. The hypochlorous acid serves as the primary disinfectant for inactivation of pathogens in the filtered effluent. The hypochlorous acid solution is injected into the Final Effluent Channel just upstream of the three Chlorine Contact Tanks through a diffuser and followed by a static mixer in the channel. Two sluice gates controlling the flow into the each of the three Chlorine Contact Tanks are located just downstream of the static mixer. The tanks were designed to provide 15 minutes of contact time at the design PHF of 220.8 MGD with all three in service or 73.6 MGD each to meet FAC requirements. FAC 62-600.440 states that 15 minutes of contact time for a total chlorine residual of 1.0 mg/L is required for high level disinfection. The disinfection also must meet limits for fecal bacteria, enterococci and effects effluent limits for dibromochloromethane, dichlorobromomethane, and chronic toxicity required by the facilities NPDES permit for surface water discharge. The Chlorine Contact Tanks are also used for the disinfection of the reclaimed water

produced by the facility and required to meet chlorine residual and fecal coliform limits. The tanks are rectangular with a serpentine path and discharge over a weir into a chlorinated channel just upstream of Junction Chamber No. 4. Each tank is approximately 425-feet long and 25-feet wide with a length to width ratio of 17:1 and volume of 0.79 MG. Tanks 1 and 3 are mirrors of each other and tank 2 borders and shares common walls with tank 1. The first 90-feet in each tank contains air diffusers for post aeration to meet 5.0 mg/L DO effluent limit for the surface water discharge. The reclaimed water pump station is located near the end of tanks 1 and 2 and is discussed in the effluent disposal section.

Figure 3-36 – Chlorine and Sulfur Dioxide Rail Cars and Unloading Station

Figure 3-37 – Existing Chlorinator

The chlorinated effluent flows under the sampling station just upstream of Junction Chamber No. 4 where a sulfur dioxide solution is injected. Sulfur dioxide is supplied as a liquefied gas in rail cars and undergoes a similar process to chlorine gas to get it into solution. The dechlorination building just to the north of Filter Building 1 contains evaporators and sulfonators. The liquefied gas is heated in the evaporators to the gas state. Then, the gas is mixed with plant use water in the sulfonators to produce a sulfurous acid solution (H_2SO_3). Sulfurous acid solution is rapidly mixed with the chlorinated effluent with mechanical mixers in Junction Chamber No. 4. The sulfurous acid is a strong reducing agent that reacts with the hypochlorite to produce chloride (Cl^-) and sulfate (SO_4^{2-}) ions. The sulfurous acid also reduces any chloramines present to chloride. The reaction happens seconds. The dechlorination process is designed to meet the surface water discharge maximum limit of 0.01 mg/L of total chlorine residual in the effluent.

3.3.2.2 Process Evaluation

The facility typically maintains a total chlorine residual in the CCTs around 3.0 mg/L, which is three times the permit limit for surface water discharge and reclaimed water. It is standard industry practice for a facility to maintain a higher residual than the limit to avoid any fluctuations below the limit. However, excess chlorination produces additional disinfection byproducts (DBP) and increases chemical costs for both chlorination and dechlorination. As discussed in the Regulatory Review section, HFC AWTP is

currently under a consent order for dibromochloromethane which is a disinfection byproduct associated with chlorination of water with bromides present. There have also been recent exceedances for dichlorobromomethane starting in August of 2015. Bromides may be entering the collections system by I&I due to the location of Tampa on Tampa Bay. Investigation into lowering the total chlorine residual and still to meet inactivation limits and upgrades to the control system for both chlorination and dechlorination should be included in the next phase.

The configuration of the Chlorine Contact Tanks is also contributing to reduce disinfection byproducts (DPB) production. Post aeration diffusers are located in the first 20% of the tanks, which reduces the effective contact time and cause excessive dispersion. The recommended length to width ratio for the design of contact tanks is a minimum of 20:1. The CCTs at the facility don't meet this minimum design criteria and also have sharp corners without baffles or flow vanes, see **Figure 3-34**. The plug flow performance of the tanks is expected to be poor due to these findings. The dispersion in the post aeration section of the tanks and dead zones very apparent (see pictures and aerials in this section. Eddies were also observed in the corners. Short circuiting in the tank leads to higher chlorine dosing required to meet inactivation limits. Dead zones cause excessive detention time and generate more DBPs. Moving the post aeration out of the tanks and adding baffles or flow vanes in the tank will improve the performance and decrease chlorination requirements. An investigation into improvements to improve plug flow performance and a tracer study should be included in the next phase.

Figure 3-38 – Chlorine Contact Tank Configuration - Record Drawing of Chlorine Contact Tanks 1 & 2 (1974)

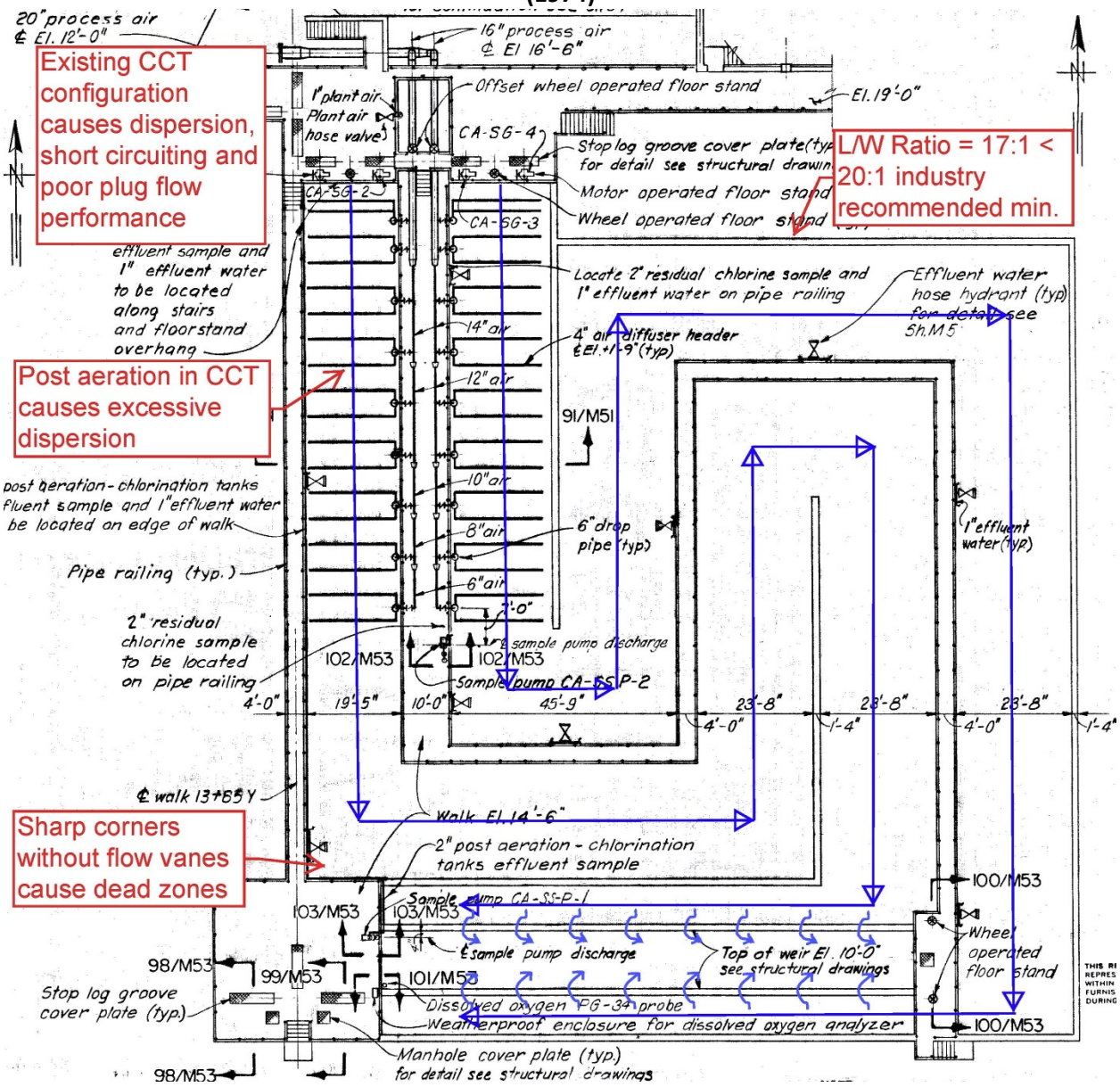


Figure 3-39– Chlorine Contact Tank 2

A trihalomethane (THM) study was conducted in 2005 to evaluate alternatives to reduce DPBs in the effluent. The study evaluated a variety of disinfection alternatives and recommended that a mixing zone study was conducted to solve the THM problem due to the high capital cost of other alternatives evaluated. The study did not include peracetic acid as a disinfection alternative, which has had recent success in the US as a solution for DPB problems for facilities with both surface water and reclaimed water discharges. A new investigation into disinfection alternatives including peracetic acid, sodium hypochlorite and others not included in the previous study should be included in the next phase.

The Chlorine Contact Chamber Formula in the facilities existing High Flow Protocol specifics the control of flow into the three tanks by the operation of sluice gates. The flows specified to transition from one tank to two (75 MGD) and two to three (150 MGD) are appropriate with the design criteria and permit requirements. However, the operation of the sluice gates specified causes unequal flow for the tanks in use. The formula states to use only one of the two gates on the additional tank put in service and open the single gate a certain percentage based on the formula. The hydraulic model was used to evaluate the flow in the tanks based on the formula. The analysis found that flows were as high as 99 MGD in the primary tanks used with both gates open. At this flow the HRT is 12.4 minutes, which is less than the required 15 minutes to meet high level disinfection requirements. The second or third tank showed flows ranging from <5 to 24 MGD. This creates excessive detention time in the low flow tanks and leads to additional DBP production. As stated in the High Flow Protocol Evaluation, this formula should be eliminated and both gates for each tank in use should be opened 100% to ensure equal distribution and flow. Automation of the influent sluice gate valves will be required to spit flow equally between the tanks in use and should be investigated in the next phase.

The use of chlorine gas and sulfur dioxide gas imposes additional regulations and requirements for the facility compared to the use of sodium hypochlorite, UV and other disinfection systems. The facility has a required chlorine gas detection system that is closely monitored. These rules and regulations add to yearly operating costs and are necessary to protect human health from the risk of a leak from chlorine or sulfur dioxide gas at the facility, the Tampa Bay port and downtown Tampa. Most of the existing chlorination equipment at the facility was replaced in 2007 for the Chlorine System Upgrade Phase II project with and average life expectancy of five to ten years. Investigating alternatives to chlorine gas and sulfur dioxide before the existing equipment requires replacement is recommended and should be included in the next phase.

Table 3-24 – Summary of Existing Chlorine Disinfection and Dechlorination Process

Performance	
Performance Goals Design Minimum Total Chlorine Residual (for Disinfection): 1.0 mg/L	Observed Performance[(1)] Observed Minimum Total Chlorine Residual (for Disinfection): 0.01 mg/L[(2)] Observed Average Total Chlorine Residual (for Disinfection): 3.17 mg/L
Design Maximum Total Chlorine Residual (for Dechlorination): 0.01 mg/L	Observed Maximum Total Chlorine Residual (for Dechlorination): 1 mg/L[(3)] Observed Average Total Chlorine Residual (for Dechlorination): 0.01 mg/L
Annual Average Maximum Dichlorobromomethane: 33.0 µg/L Annual Average Maximum Dibromomonchloromethane: 39.0 µg/L	Observed Maximum Dichlorobromomethane (monthly grab): 67.0 µg/L Observed Maximum Dichlorobromomethane (12 month rolling average): 37.8 µg/L[(4)] Observed Maximum Dibromomonchloromethane (monthly grab): 74.0 µg/L Observed Maximum Dibromomonchloromethane (12 month rolling average): 49.7 µg/L[(5)]
Evaluation Findings	
• Maintaining three times the required total chlorine residual which is contributing to DBP problems. • Configuration of chlorine contact tanks provides less than ideal plug flow reactor performance and increases chlorine residual necessary for disinfection. • Post aeration within the chlorine contact tanks reduces effective contact time. • Previous alternative disinfection evaluation did not consider peracetic Acid. Peracetic Acid as well as other disinfection alternatives should be evaluated to reduce THMs • CCC Formula in the High Flow Protocol should be eliminated. Automation of the influent gate valves to each tank may be required to equally split flow between tanks in use. • Chlorine and sulfur dioxide rail cars pose hazard to human health at the plant, Tampa Bay Port and downtown Tampa.	

Recommendations
• Investigate disinfection alternates including PAA to replace chlorine gas and sulfur dioxide. • Move post-aeration downstream of the CCTs. • Conduct tracer study and investigate modifications to CCTs to improve plug flow performance. • Investigate opportunities to resolve surcharging of CCTs at high flows. • Investigate possible overdosing of chlorine to save on chemical costs and reduce THMs • Revise CCT section of the High Flow Protocol.

(1)Based on data from 5-year study period

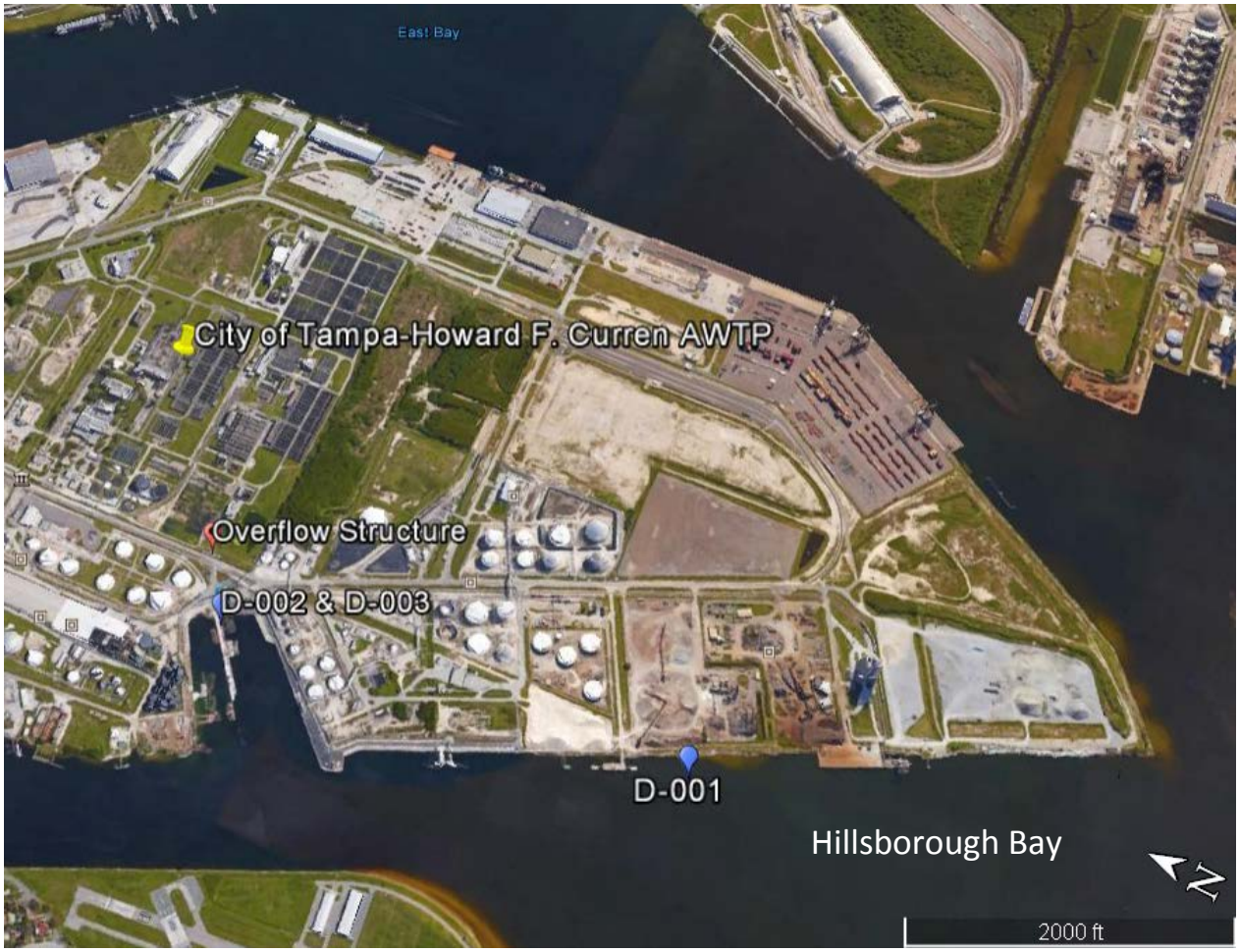
(2)Three occurrences under 1.0 due operator error/flow fluctuations in last permit cycle

(3)Three exceedances over 0.01 due to systems being offline or power failure in last permit cycle

(4)Twelve month rolling average recently exceeded annual average limit of 33.0 on August 2015 and increased since then

(5)Eighteen exceedances in last permit cycle. 12 month rolling average dropped and stayed below 39.0 since December 2014

3.3.3 Effluent Disposal



3.3.3.1 Purpose and Description

HFC AWTP is permitted to for the surface water discharge of 96 MGD AADF of treated wastewater into Hillsborough Bay at outfall D-001. The facility also has two relief outfalls, D-002 and D-003, permitted for intermittent discharge into the Ybor Drain water body directly west of the overflow structure for flows over 100 MGD and extreme high tides. Treated effluent flows from dechlorination at Junction Chamber No. 4 to the overflow structure at the southwest corner of the property by a single 96-inch conduit. Under normal flows and tides the effluent flows directly into a 78-inch primary outfall at the overflow structure that discharges into Hillsborough Bay 3,500-feet to the south. At high flows, extreme high tides or a combination of both, the water level in the overflow structure will rise above an elevation of 6.5-feet. At this elevation and higher some of the effluent spills over the weir slabs to the two secondary relief outfalls, see **Figure 3-35** and **Figure 3-36**. The mean higher high water tide elevation near the outfall locations is 2.94-feet, see Plant Hydraulics section for more information. This tide of 2.94-feet and flows greater than 86 MGD will generate elevations over 6.5-feet in the overflow structure. Mean tide level of 1.69-feet flows over 101 MGD generate elevations over 6.5-feet in the overflow structure. An active storm sewer also flows into the overflow structure from the north. This is an 84-inch pipe going back to storm water inlets in the pavement around the maintenance building connected through

the by-pass structure connection to Junction Chamber No. 3. A tide gate is in place on the storm sewer to prevent backflow. The water level in the overflow structure is typically at the top of the tide gate or higher.

Figure 3-40 – Normal Flow Through Overflow Structure - Record Drawing (1975)

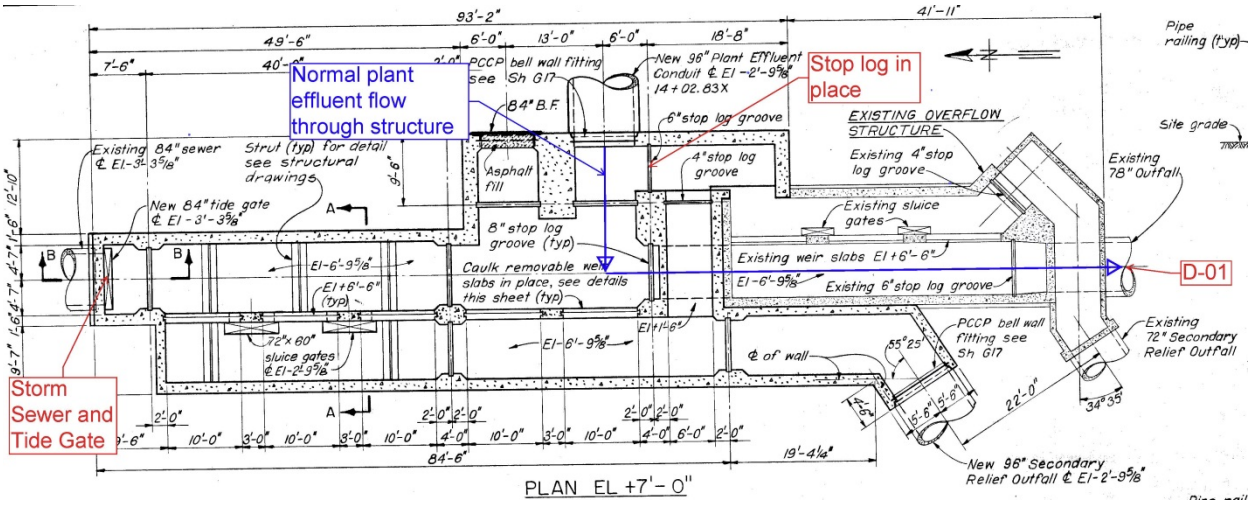
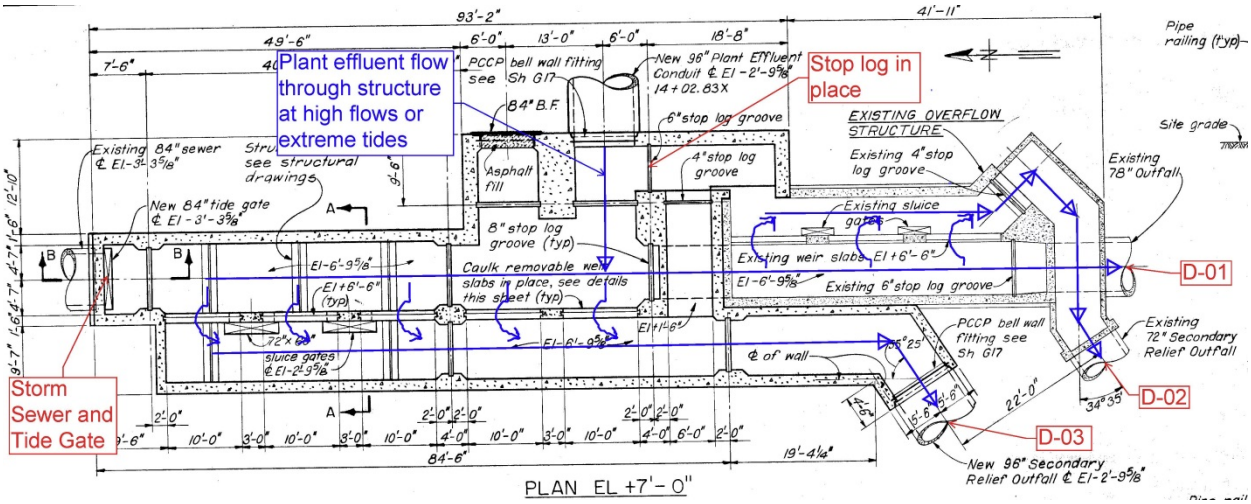


Figure 3-41 – Flow Through Overflow Structure at High Flows - Record Drawing (1975)



The facility is also permitted for 12.5 MGD AADF of Part III and Part VII reuse water. All reuse water that is sent off property for land application is pumped out of a wet well located at the end of Chlorine Contact Tank 2 where the reclaimed water pump station is located, see **Figure 3-37**. The reclaimed water pump station supplies the City of Tampa's reclaimed water system up to 6.0 MDG AADF and McKay Bay Refuse to Energy Facility up to 2.3 MGD AADF. Gates on the wet well allow chlorinated effluent to flow into the wet well from CCT 2 and CCT 1. CCT 3 is also connected to the reclaimed water pump station wet well through a 30-inch pipe. The pump station consists of four vertical turbine pumps with three typically used for the City of Tampa's reclaimed water system and the fourth for McKay Bay.

Industrial reuse water is also pumped to the Mosaic facility (previously CF Industries) for cooling water with separate horizontal split case pumps in Filter Building 1 that are supplied from the strained or unstrained chlorinated effluent. This is a closed loop at Mosaic and water is returned to the treatment plant in a parallel pipe that discharges into the unstrained water channel.

Figure 3-42 – Reclaimed Water Pump Station at the Chlorine Contact Tanks

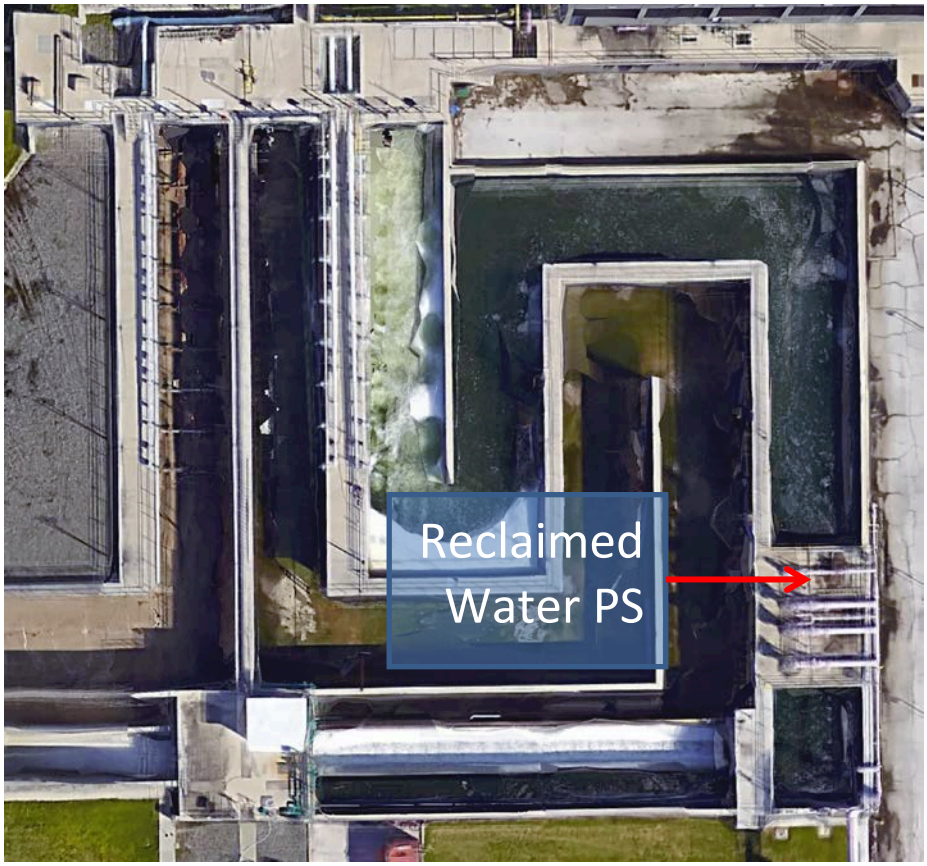
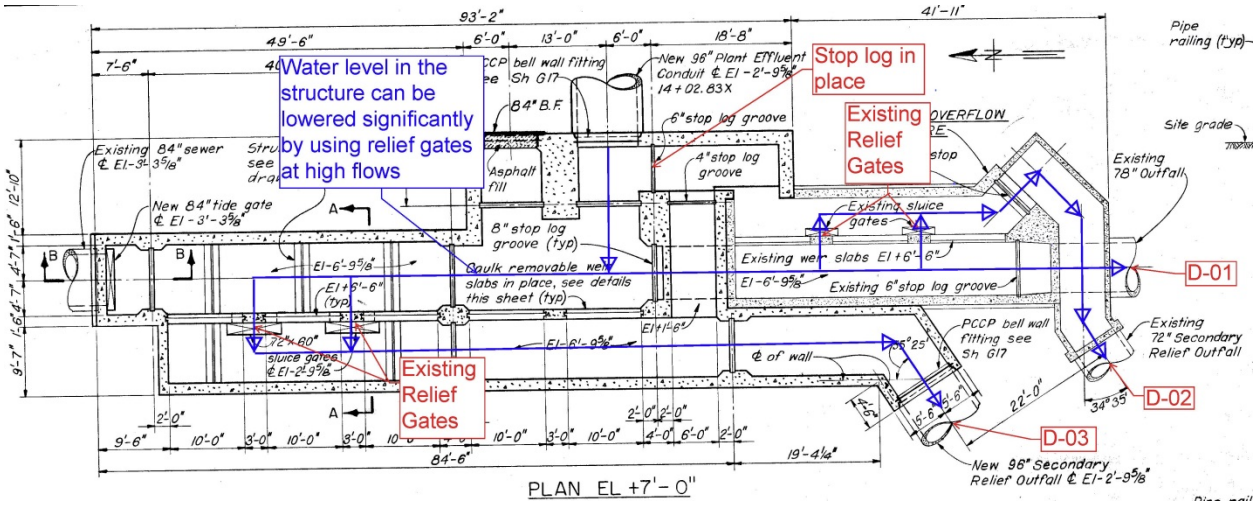


Figure 3-43 – Reclaimed Water Pump Station Discharge Header

3.3.3.2 Process Evaluation

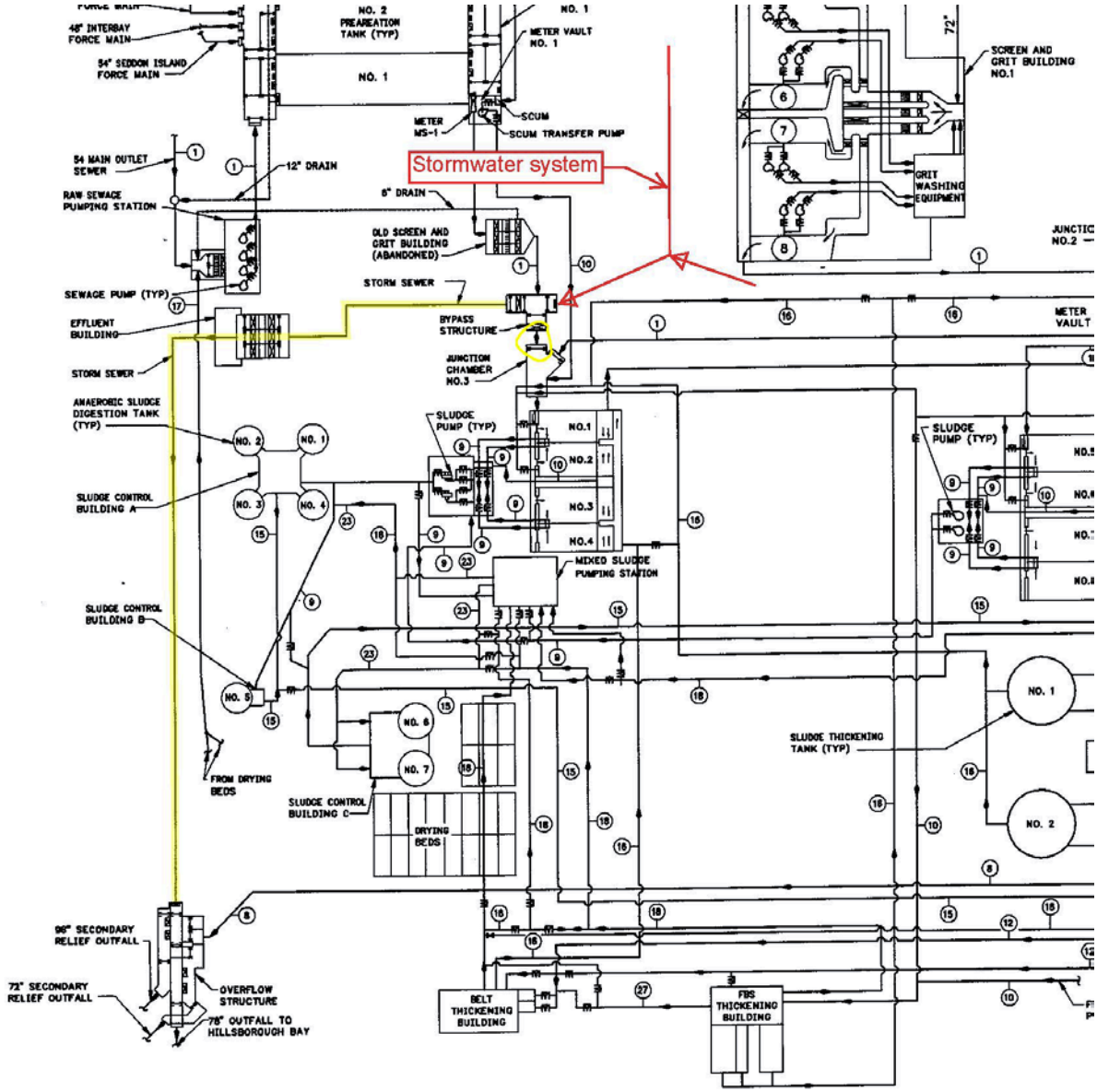
At the current average daily flow and normal tides all surface water discharge effluent flows into Hillsborough Bay through the 78" outfall without any adverse impacts upstream. At MHHW tide and flows over 163 MGD the Chlorine Contact Tank weirs become submerged. This is due to the water level in the overflow structure flowing over the relief discharge weirs, head loss through 78-inch outfall and head loss through the single 96-inch conduct to the overflow structure. There are four sluice gates in the overflow structure that allow flow into the relief outfalls without overflowing the weir plates as shown in **Figure 3-39**. These have not been used in many years and appear to be inoperable. Opening all four would eliminate the surcharging of the CCTs at flows up to the design PFH of 221 MGD for tides of 4-feet or less. Repairing or replacing these gates, installing motorized operators and automating through SCADA based on the water level in the overflow structure is recommended and should be investigated in the next phase. The CCTs could still become surcharged due to extreme tide events due to storm surge, see the Plant Hydraulics section for more information. There is a bulkhead in the overflow structure for a redundant 84-inch conduit to be installed connecting to Junction Chamber No. 4. Installing this conduit is recommended to provide a redundancy and a back to the 96-inch in case of failure.

Figure 3-44 – Sluice Gates in Overflow Structure - Record Drawing (1975)



The tide gate for the 84-inch storm water sewer causes the storm system upstream to back up. The normal water level in the overflow structure is at an elevation of 3.4-feet (+/- 1-foot tidal fluctuations). With the crown of the 84-inch at an elevation of 0.2-feet, the pipe is always submerged at the tide gate. The water level in the storm system upstream must back up and rise above the water level in the overflow structure for the tide gate to open, see **Figure 3-40** for 84-inch storm sewer route. The storm sewer should be un-comingled from the overflow structure and discharged elsewhere to alleviate the storm water system and eliminate any adverse effects to the effluent discharge. Investigation into alternative discharge locations for the storm sewer is recommended.

Figure 3-45 – 84" Storm Sewer Connection to Overflow Structure - From Flow Diagram (1999)



The reclaimed water pump station is positioned approximately 65-feet upstream of the end of the tank in CCT 1 or 2. At design peak hourly flows the chlorinated effluent at the pump station has not reached the required 15 minutes of detention time, falling short by 1.6 minutes. The reclaimed water is assumed to meet the alternate requirements of FAC 62-600.440 due to the high total chlorine residual maintained in the tanks. However, this could limit changes made to the disinfection process to meet reclaimed water disinfection requirements in the future. Further investigation into this is recommended in parallel to investigation into disinfection alternatives. The effluent limitations for surface water discharge are much more stringent than for reclaimed water at this facility (see Regulatory Review section for a comparison). Expansion of the reclaimed water system is recommended to reduce the dependency on the surface water discharge.

Sampling for final effluent water quality is located in a small building at the end of the Chlorine Contact Tanks. Water is drawn out of the tanks before the CCT weirs for both online analyzers and grab samples. This is referred to as the pre-dechlorinated water for used to test for surface water and reclaimed water parameters. Sample pumps also draw water from the end of Junction Chamber No. 4 after the dechlorination process. This post-dechlorinated water is tested for maximum chlorine going to the surface water discharge. The sampling protocol and equipment meet permit testing requirements and process control needs for surface water discharged to the Bay. As previously discussed, the reclaimed water pump station is upstream of the CCT weirs. Sampling down stream of this point does not accurately reflect the reclaimed water quality. Further investigation into this matter should be included in the next phase.

Table 3-25 – Summary of Existing Effluent Disposal Systems

Evaluation Findings
• Chlorine Contact Tanks are surcharged at flows over 163 MGD and MHHW tide. • A single conduit exists for surface water disposal from dechlorination to the overflow structure. • The existing sluice gates in the overflow structure have not been operated in years. These were designed to allow flow into the relief outfalls and relieve water level upstream by bypassing weirs. • 84-inch storm water sewer pipe sends storm water collected around the maintenance building and primary tanks 1-4 into the overflow structure. • Contact time is insufficient in the Chlorine Contact Tank for the Reclaimed Water Pump Station. • Current sampling protocol and equipment appears to meet process and permit requirements with the exception of reclaimed water.
Recommendations
• Upgrade sluice gates in overflow structure for motorized operation and automation. • Install redundant conduit from JC 4 to the overflow structure. • Un-comingle storm water from plant effluent. • Continue to look for opportunities to expand the reclaimed water program. • Investigate insufficient contact time and sampling location for reclaimed Water Pump Station

4 Biosolids

The biosolids treatment system at the Howard F. Curren AWTP processes the solids produced from the primary clarification and secondary clarification processes. Secondary waste activated sludge (WAS) is sent from the high purity oxygen system to gravity thickeners to be thickened prior to being pumped to the mixed sludge pump station where it is blended with the primary sludge. From the mixed sludge tank the biosolids are sent to anaerobic digestion tanks. Following digestion, the sludge is stored in holding tanks and then dewatered. After dewatering, the biosolids are either hauled away for land application or further processed in the heat drying facility. If the biosolids are sent to the heat dryer, a pelletized product is produced and then sold.

The figures below show recent historical solids production at the HFCAWTP. Figure 4-1 is the volumetric solids production, and Figure 4-2 shows the solids loading to the digestion process. As can be seen from these figures, solids production has remained fairly constant since 2012.

Figure 4-1 – Historical Volumetric Solids Production

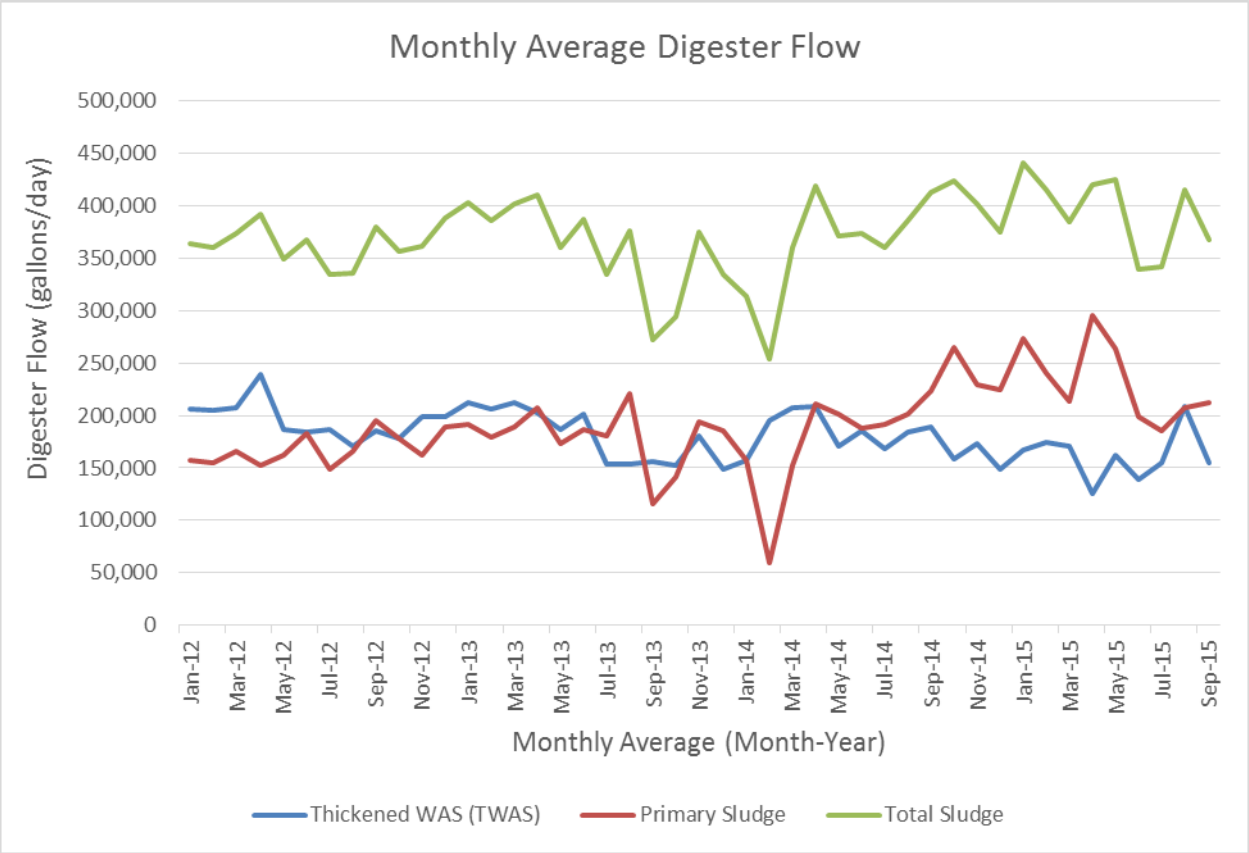
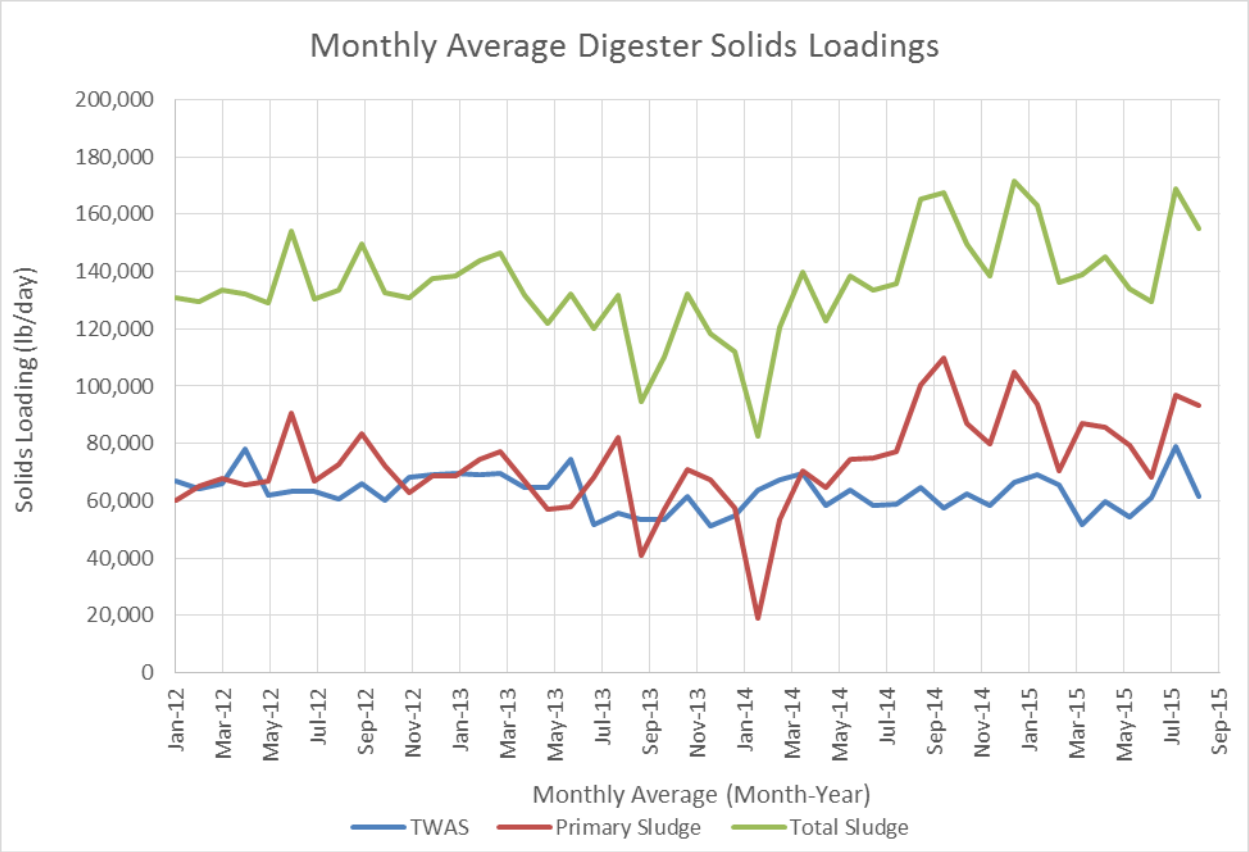


Figure 4-2 – Historical Mass Solids Production



Part of the intent of this evaluation is to use the City's calibrated process model to assess the biosolids digestion process. However, the model does not include primary clarifiers or other solids treatment facilities. The digestion performance has been evaluated based on solids mass balance spreadsheet calculations. We recommend that the model be updated to include all of the biosolids process as part of the next phase, which can then be used to check this evaluation.

4.1 Sludge Conditioning and Thickening

4.1.1 Purpose and Description

The sludge conditioning and thickening facilities at the HFC AWTP include two 55-ft diameter gravity thickener tanks that are used to thicken waste activated sludge from the high purity oxygen stage of the secondary process. Polymer is blended with the WAS to increase thickener performance. The WAS is thickened from about 0.5 percent to approximately five percent solids concentration and is transferred to the mixed sludge tank where it is blended with primary sludge (at approximately 5%) prior to entering the anaerobic digestion facilities.

Photo of Existing Gravity Thickeners. Typically, only one thickener is in operation.

4.1.2 Process Evaluation

A condition assessment of the gravity thickeners and thickened sludge pumps was performed in 2013. During this assessment, it became apparent that the majority of components were in need of repair or replacement. The gravity thickener internal mechanisms were replaced entirely in 2014 along with four new thickened sludge pumps. The two new thickeners were supplied by Ovivo and are the strip liner bearing type. The new thickened sludge pumps were Wemco-Hidrostal dry pit screw centrifugal 20 horsepower pumps with a rated capacity of 180 gpm at a differential head pressure of 82 feet. This project also included concrete repair and coating, new walkways and lighting, new piping, and new flow metering. In speaking with City staff, the new system is functioning satisfactorily. Upon review of the influent flow and loading data from January 2010 to October 2015, the thickeners were overloaded with respect to hydraulics and solids with only one in service as shown in Table 4.1. This table shows the comparison of recommended design parameters and actual plant conditions. Despite the hydraulic and solids loading rates being higher than typical design parameters, the actual performance of the gravity thickeners has not shown negative impacts as there is no significant loss of solids observed in the overflow.

Table 4-1 – Gravity Thickener Operating Conditions

Parameter	Typical Design Condition[1]	Actual Condition
Diameter (ft)	35-60	55
Side Water Depth (ft)	10-13	10
Floor Slope (in/in)	2 to 3 : 12	2.8:12
Hydraulic Retention Time (hr)	<18	3
Current Average Sludge Flow Rate (mgd)	NA	1.4
Overflow Rate (gph/SF)[2]	4-8	25
Solids Loading (ppd/SF)[2]	4-8	21

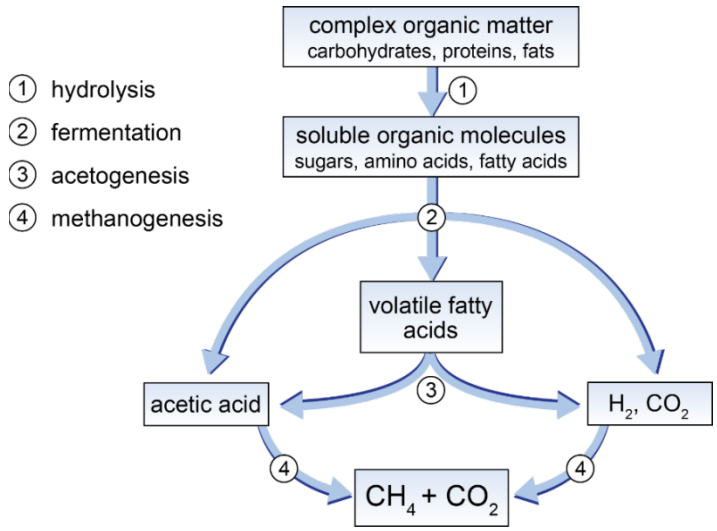
[1]Based on Manual of Practice 8 4th and 5th editions for combined primary and WAS sludge.
[2]Based on one thickener in operation per the current practice.

Since the thickener equipment was recently replaced and is reported to be functioning well, it is recommended that no additional improvements be made to the existing thickening system. However, a third thickener train is recommended to provide additional redundancy and improve loading rates. Additionally, any modifications to the treatment process may have impacts on the thickening system and will be considered as part of the next phase. Polymer usage data for the system was not available. It is recommended that the existing polymer system be evaluated for capacity and reliability in more detail as part of the next phase. Additional capacity of the polymer system will likely be required if a third thickener train is added.

4.2 Digestion

Anaerobic digestion is a process which reduces volatile solids mass by converting solids into biogas. As illustrated, in Figure 4-3, the anaerobic digestion process consists of four steps, namely: (1) hydrolysis, (2) fermentation, (3) acetogenesis, and (4) methanogenesis.

Figure 4-3 – Anaerobic Digestion Process



4.2.1 Purpose and Description

At the HFCAWTP, a blend of thickened primary sludge and thickened waste activated (secondary) sludge is typically pumped from Mixed Sludge Pumping Station to the anaerobic digesters. The purposes of the anaerobic digesters are to produce stabilized biosolids, reduce pathogens, reduce biosolids mass by volatile solids destruction, and generate biogas as a usable by-product. Residual solids in the digesters are designed to heat to a mesophilic (95°F to 100°F) range (utilizing an external heat source) with a minimum solids retention time (SRT) of 15 days to maintain a high rate of biological activity in the tanks. The tanks are constantly mixed to promote digestion by maintaining a uniform sludge mixture and heat distribution within the digesters. The digested solids are then pumped to holding tanks prior to the belt press dewatering facilities. The volatile content of the feed sludge is relatively high; the high volatile fraction can be attributed to the primary sludge component and low mean cell residence time (MCRT) of the activated sludge process.

The HFC AWTP anaerobic digestion process includes the following systems:

- Anaerobic Digesters
- Digester Gas Mixing Systems
- Digester Sludge Heating Systems
- Sludge Transfer Pumping Systems
- Waste Gas (Biogas) Handling System

The existing anaerobic digestion facilities at the HFC AWTP consist of seven (7) digesters (aggregate volume of 9.8 MG) and three (3) digester control buildings (A, B and C). Digester control buildings house heated sludge recirculation pumps, digested sludge transfer pumps, back-up boilers, sludge to hot water heat exchangers, and process piping and appurtenances.

Each digester is served by a dedicated sludge heating/recirculation pump and a paired heat exchanger (HEX) to maintain the digester contents at or above 95° F. Sludge is drawn from each digester, discharged through a dedicated HEX unit and the heated sludge is returned to the digester. Five (5) two-pass HEX units serve the HFCAWTP, with two located in Digester Control Building A to serve Digesters 1 through 4; one (1) located in Digester Control Building B to serve Digester 5; and two (2) located in Digester Control Building C to serve Digesters 6 and 7. Waste heat from the biogas combined heat and power (CHP) system is conveyed to the water-side of the existing heat exchangers. Backup boilers located in the digester control buildings provide hot water to the heat exchangers in the event the CHP system is not operating. However, due to limitations on the use of the CHP engines, the boilers are used on a regular basis.

Digester Nos. 1, 2, 3 and 4 have floating gasholder type covers. Digester Nos. 5, 6 and 7 have floating (not gasholder) covers. Digester gas is compressed, pre-treated and used as fuel at the existing combined heat and power system to generate electrical power and heat water for the digested sludge heating system. Excess digester gas is flared through waste gas burners. Table 4.2 is a summary of the design criteria for all of the existing digesters.

Table 4-2 – Anaerobic Digestion Design Criteria

Parameter	**Digesters 1 - 4**	**Digester 5**	**Digesters 6 - 7**
Diameter, feet	75	95	110
Design liquid elevation, feet (Design sidewater depth, feet)	18 (22.5)	21 (25.5)	46 (34.5)
Volume, each, gallons	837,760 (1-3) 860,000 (4)	1,600,000	2,450,000
Mixing tube diameter, inches	24	24	36
No. of mixing tubes per tank	4	6	6
No. of heat exchangers (HEX)	2	1	2
Number of passes per HEX	1	2	2
Number of passes per digester	1	2	2
Heat demand per digester, BTU/hour	1,000,000	2,000,000	2,000,000
Gas storage capacity, each, ft3	22,500	n/a	n/a
Gas storage capacity, total, ft3	90,000	n/a	n/a

4.2.2 Process Evaluation

The City's historical SCADA and laboratory data from January 2012 through September 2015 was compiled and analyzed to evaluate the performance of the existing anaerobic digestion process. Based on historical data, Digester 3 was out of service from November 2012 through April 2015; and Digester 7 has been out of service from December 2012 through present.

4.2.2.1 Volatile Solids Reduction

Actual volatile solids reduction (VSR) through a specific anaerobic digestion process is primarily a function of (1) the digester residence time, i.e. hydraulic retention time (HRT) within the digesters; and (2) the degradation rate, which varies based on the inherent plant-specific primary and secondary sludge characteristics. The following design and operating parameters impact digestion performance:

- Hydraulic Retention Time (HRT): The time and temperature method for pathogen reduction to achieve Class B biosolids requires a minimum HRT of 15 days. A minimum of 10 days is generally required to prevent upset conditions.
- Organic Loading Rate: The organic (volatile solids) loading rate to a digester must be controlled to avoid overloading the active biomass. This is analogous to the food to mass (F/M) ratio in an activated sludge process. Generally, daily volatile solids loading to a digester should not exceed 8 to 10 percent of the total inventory of volatile solids within that digester.
- Temperature: Sludge temperature for mesophilic digestion should be maintained between 95 and 100 ^{o}F. The "Time and Temperature" method for pathogen reduction to achieve Class B biosolids requires a minimum of 95 ^{o}F. Reduced temperatures decrease reaction rates and limit VSR_{ACTUAL}. Rapid variations in temperature may also lead to foaming or rapid volume expansion.
- Volatile Acids / Alkalinity (ALK) Ratio: Volatile fatty acids (VFA or VA) formed during the fermentation step are converted to acetic acid, H_2 and CO_2 (acetogenesis), which in turn are converted to methane and CO_2 (methanogenesis). A high VFA/ALK ratio can indicate that VFA production exceeds VFA consumption; and indicate a risk of organic overloading, reduced buffering capacity, a drop in pH and a drop in methane formation.
- Adequate Mixing: Effective mixing eliminates temperature stratification; maintains a homogeneous mixture; rapidly disperses raw feed sludge with the active biomass; mitigates the formation of excessive floating scum layers and the deposition of heavy silt, grit or inert solids to maximize available working volume for digestion. Effective mixing may also facilitate gas release from the sludge matrix and limit susceptibility to rapid volume expansion foaming.
- Gas Production: In a healthy digester, digester gas is produced in proportion to volatile solids destroyed. Gas production rates are typically monitored in relation to volatile solids reduction to assess digester health.

Figures 4-4 through 4-9 present calculated monthly average VSR values for each operational digester from Years 2012 through 2015. VSR values have typically ranged from 45 to 60%. VSR values have been relatively consistent between digesters, and there do not appear to be any clear performance patterns or seasonal variations.

Figure 4-4 – VSR Digester 1

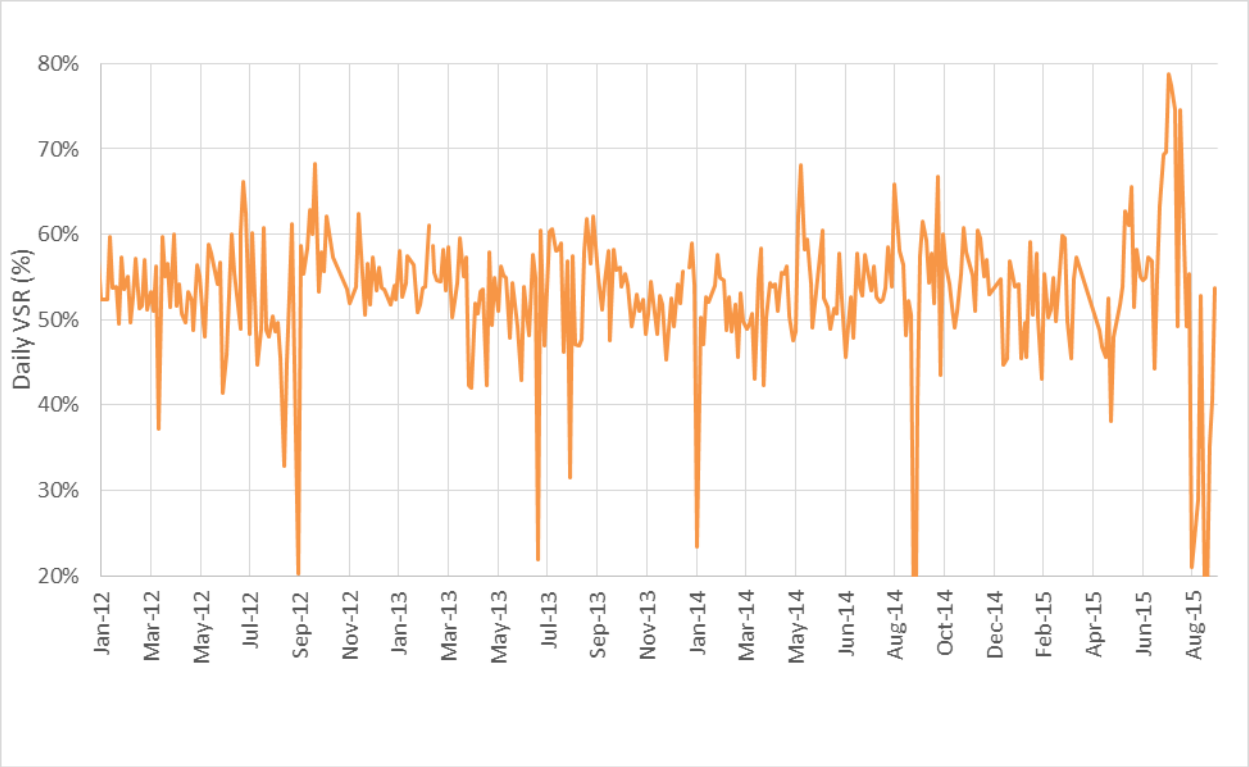


Figure 4-5 – VSR Digester 2

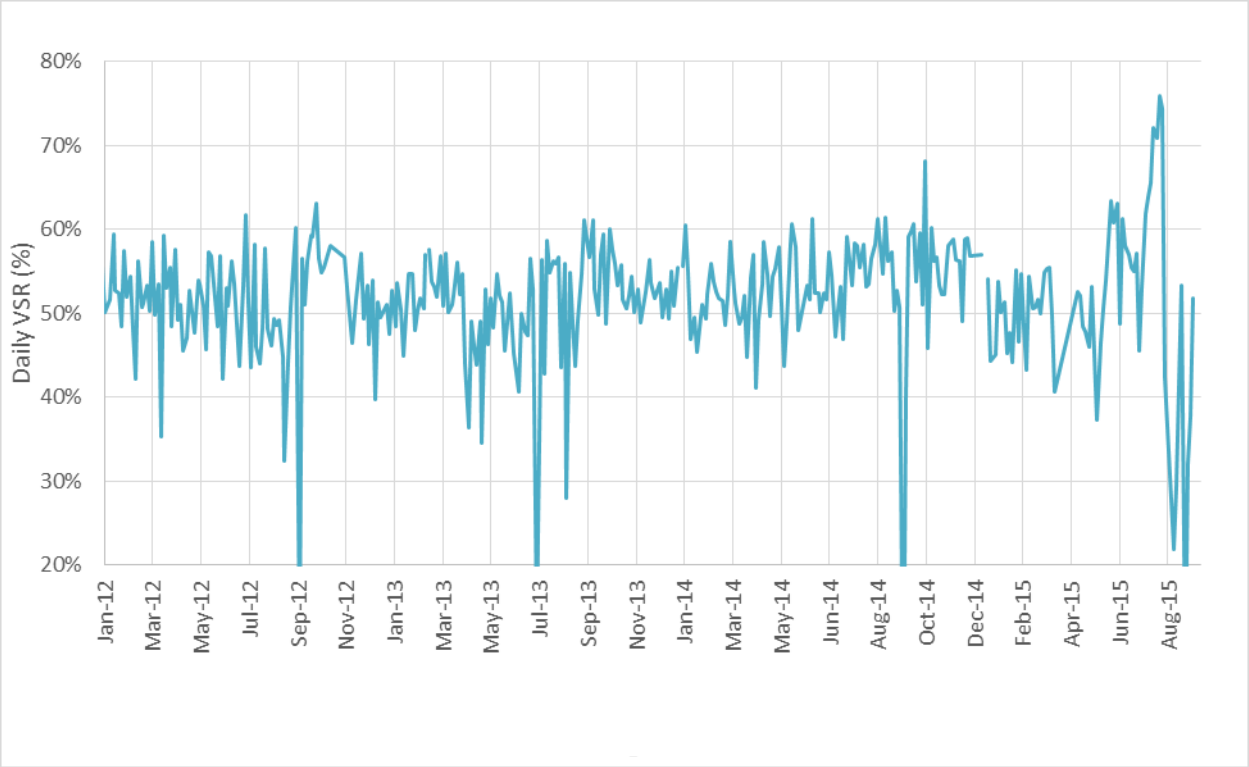


Figure 4-6 – VSR Digester 3

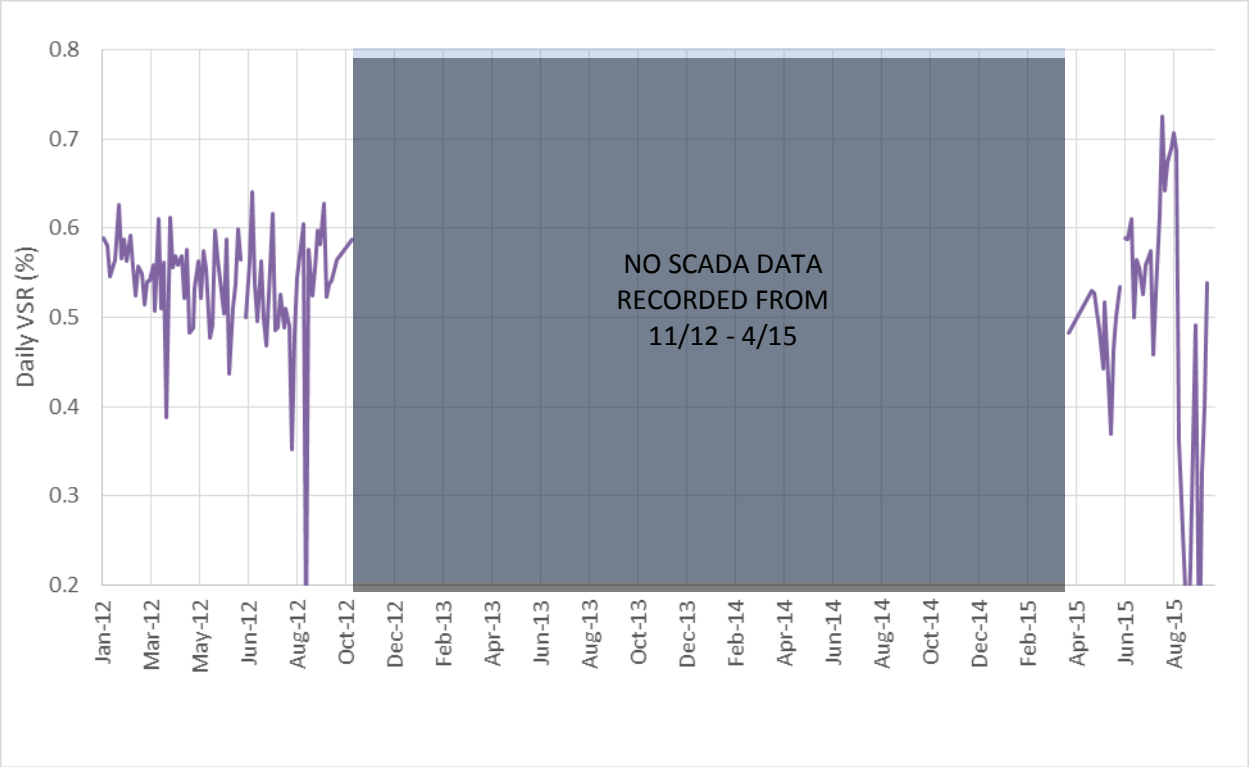


Figure 4-7 – VSR Digester 4

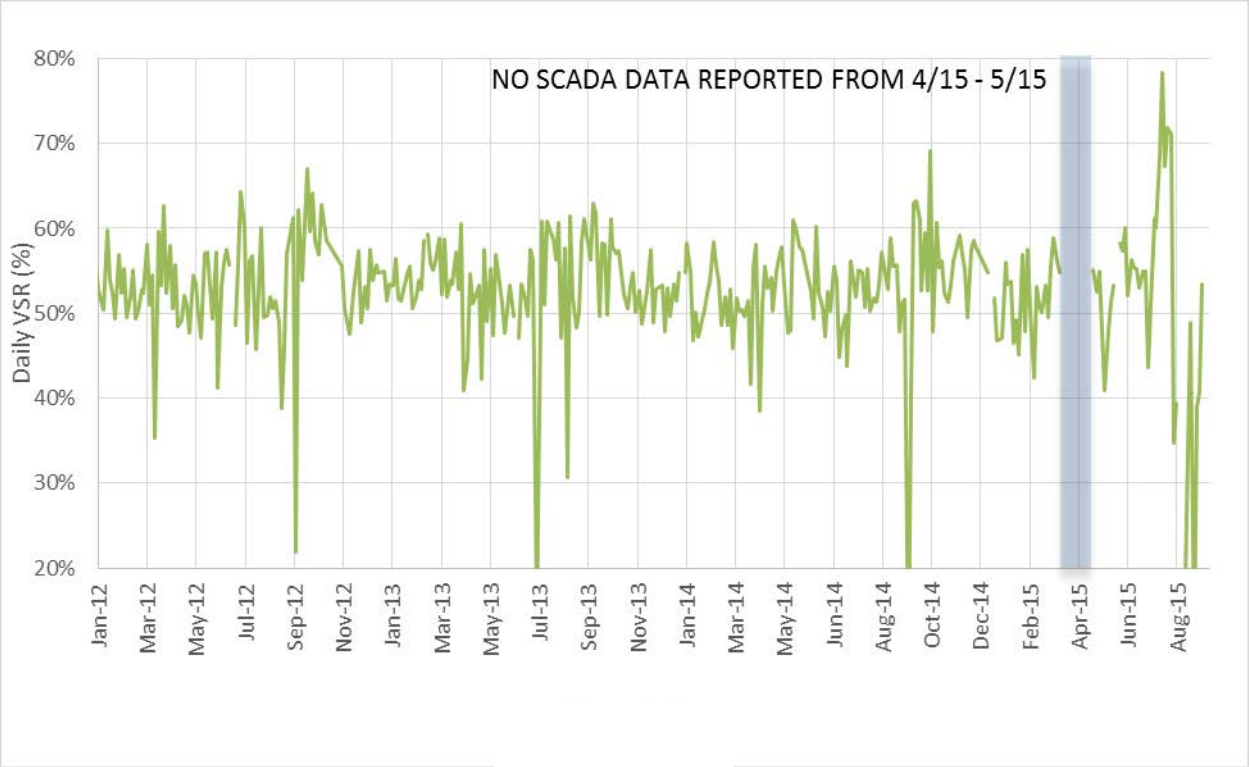


Figure 4-8 – VSR Digester 5

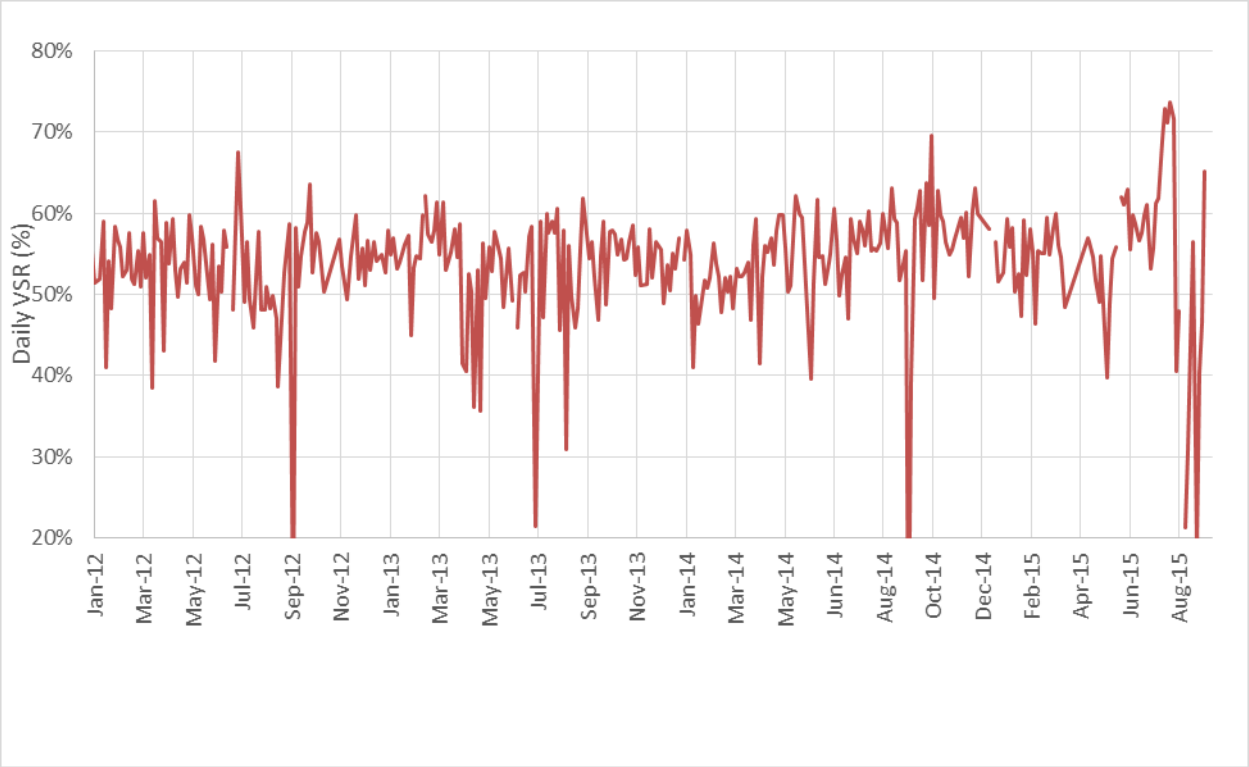
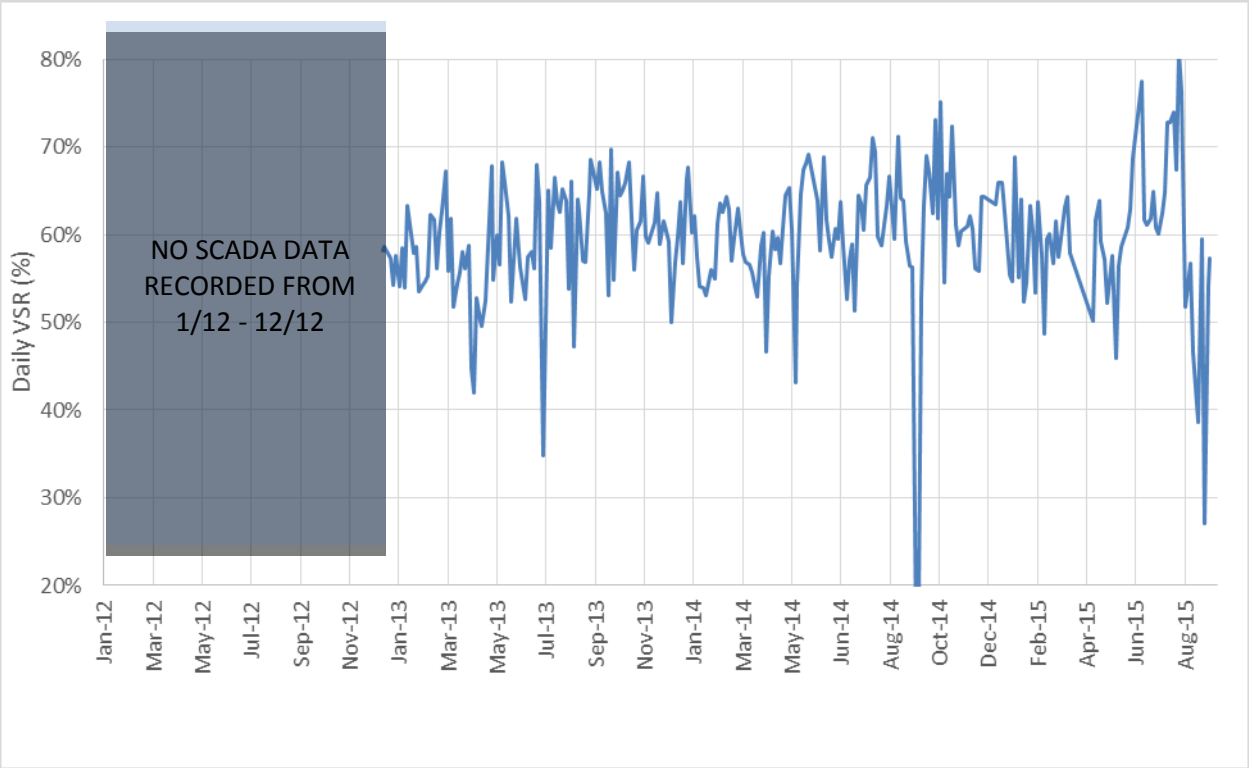


Figure 4-9 – VSR Digester 6



4.2.2.2 Hydraulic Retention Time (HRT)

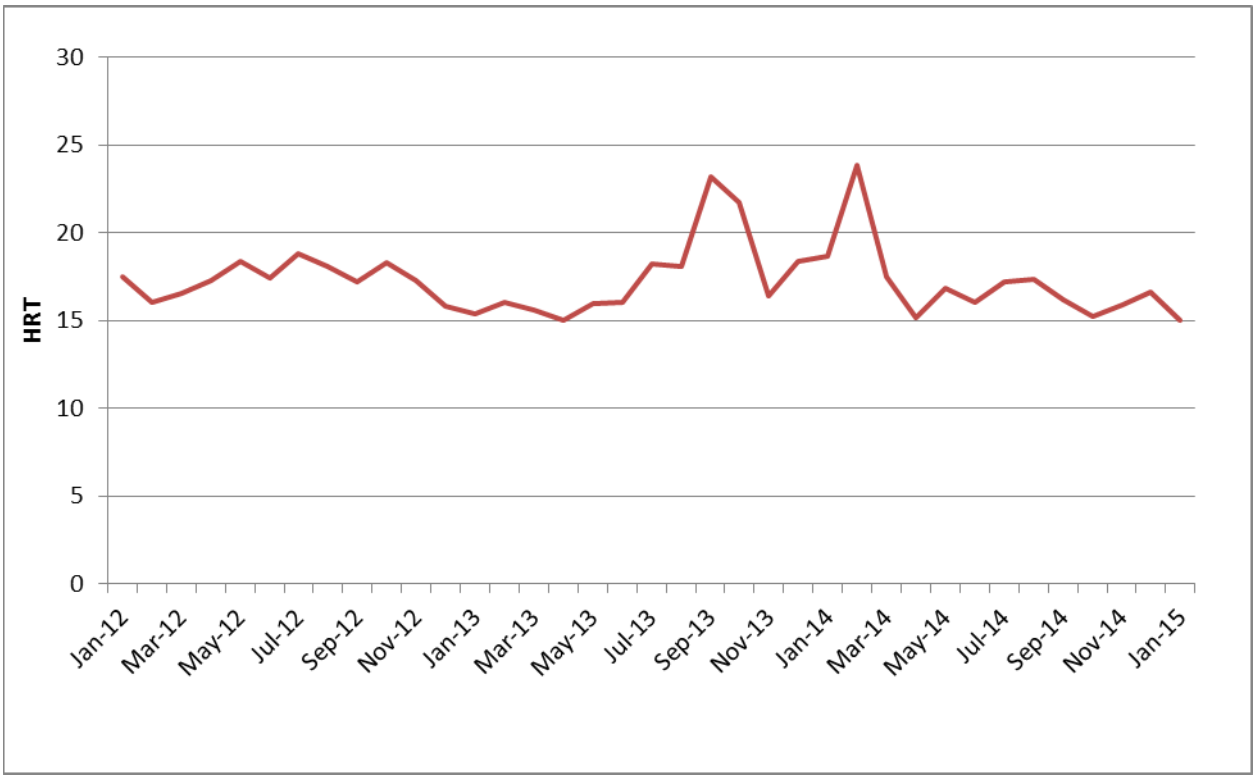
The historical HRT value for the digestion process is presented in the Figure 4-10. The HRT values were determined based on digester control set points. Actual side water depths have been 10% to 16% less than design depths; reportedly to provide additional freeboard for foam containment. Coupled with Digesters 3 and 7 being out of service for extended periods between late 2012 and 2015, over 37% (3.7 MG) of digester volume was unavailable during most of the evaluation period. The historical data shows that at these reduced side water depths, HRT values have been less than design values but still greater than or equal to the minimum standard of 15 days to meet Class B requirements. As loadings to digesters increase over time, operating digester volume must be increased to maintain the minimum 15-day HRT throughout the year, through operating at design liquid levels and/or through placing Digester 7 back into service.

Foam and rapid volume expansion in digesters can be caused by any of the following factors:

- Inherent properties of the feed sludge (e.g., Nocardia in the WAS)
- Inadequate or intermittent mixing
- Low or fluctuating sludge temperatures in the digester

Therefore, the performance of the heating and mixing systems and the inherent properties of feed sludge should be further investigated to eliminate or reduce foaming. Mixing performance should be verified through solids profile testing of each digester. This may prove difficult due to the lack of sample ports in some of the digester covers. Feed sludge should be inspected through microscopic analysis. Based on these investigations, corrective measures should be developed and implemented to place Digester 7 back into service and operate all digesters at design side water depths to maintain HRT values greater than 15 days as digester loading rates increase over time. HRT values greater than 15 days are recommended to maximize volatile solids reduction and gas production to the biogas recovery system.

Figure 4-10 – HRT



*HRT is based on monthly sludge volumetric data provided by City of Tampa and digester set points that are programed into the PLC

4.2.2.3 Organic (Volatile Solids) Loading Rate

Volatile solids loading rates (VSLR) to the digesters are presented in Figures 4-11 through 4-16. SCADA data for the liquid level within each digester was required in the calculation. However, SCADA data for this parameter begins in December of 2013, and prior liquid level data was not available. The needed sludge flow data (needed to calculate VSLR) was available through September of 2015.

VSLR are expressed in terms of F (pounds per day of volatile solids applied to digesters) to M (pounds of volatile solids under digestion). The actual VSLR values have generally exceeded the recommended F/M value of 0.10 (10% of volatile solids inventory under digestion). This can be attributed to Digesters 3 and 7 being out of service for extended periods and to operating all digesters at reduced liquid levels to provide additional freeboard for foam containment. As stated previously, foaming issues should be addressed so that liquid levels, hydraulic retention times and organic loading rates can be restored to design values.

Figure 4-11 – VSLR Digester 1

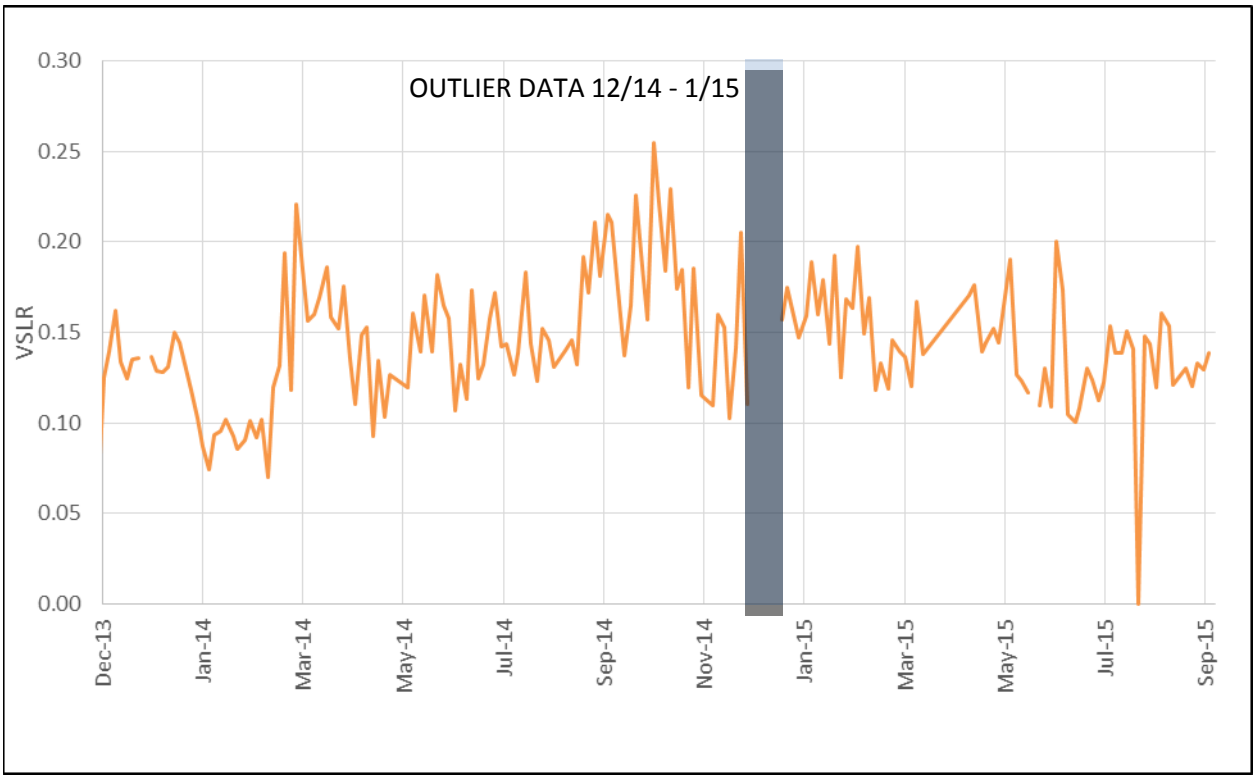


Figure 4-12 – VSLR Digester 2

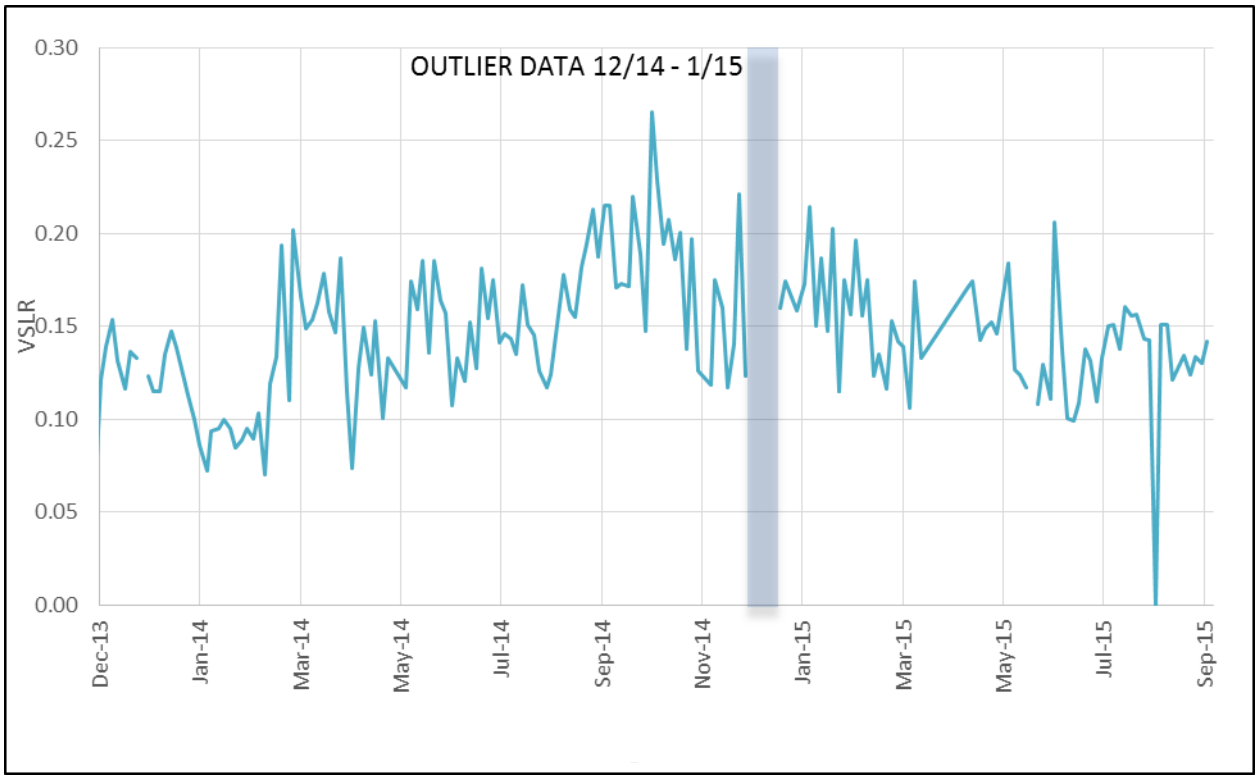


Figure 4-13 – VSLR Digester 3

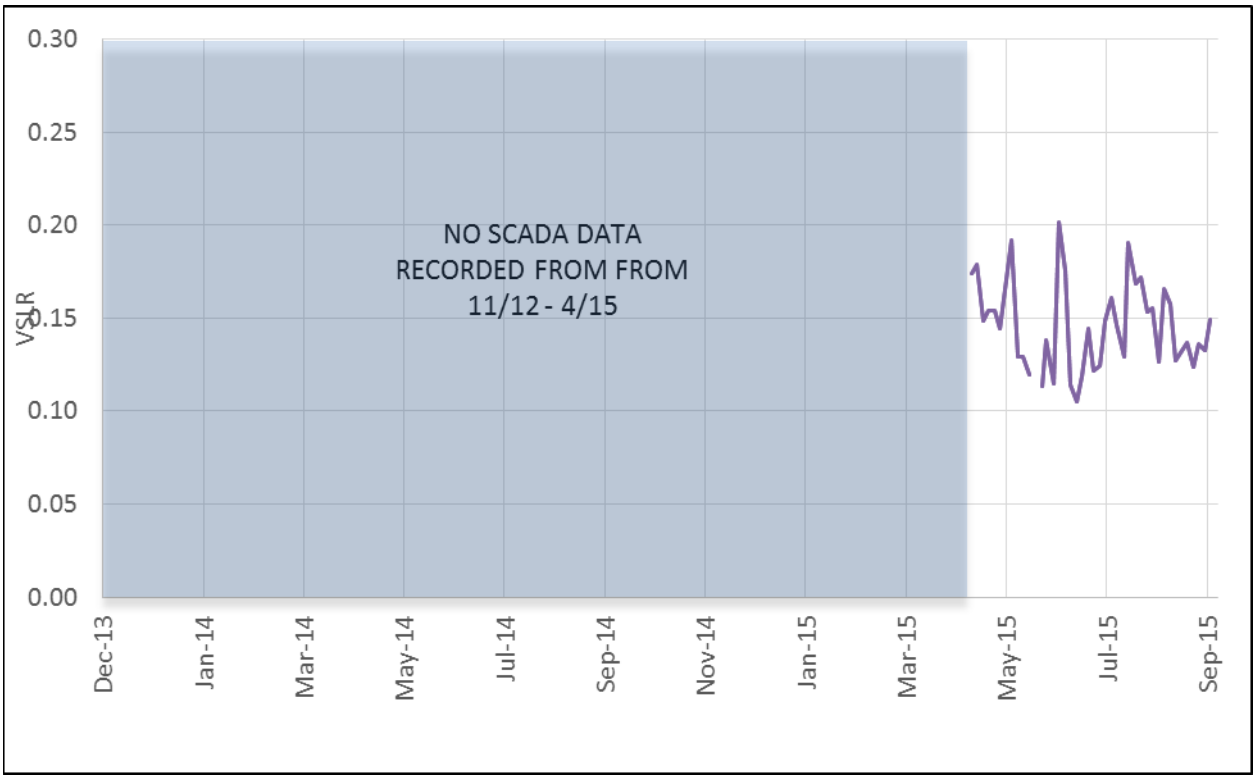


Figure 4-14 – VSLR Digester 4

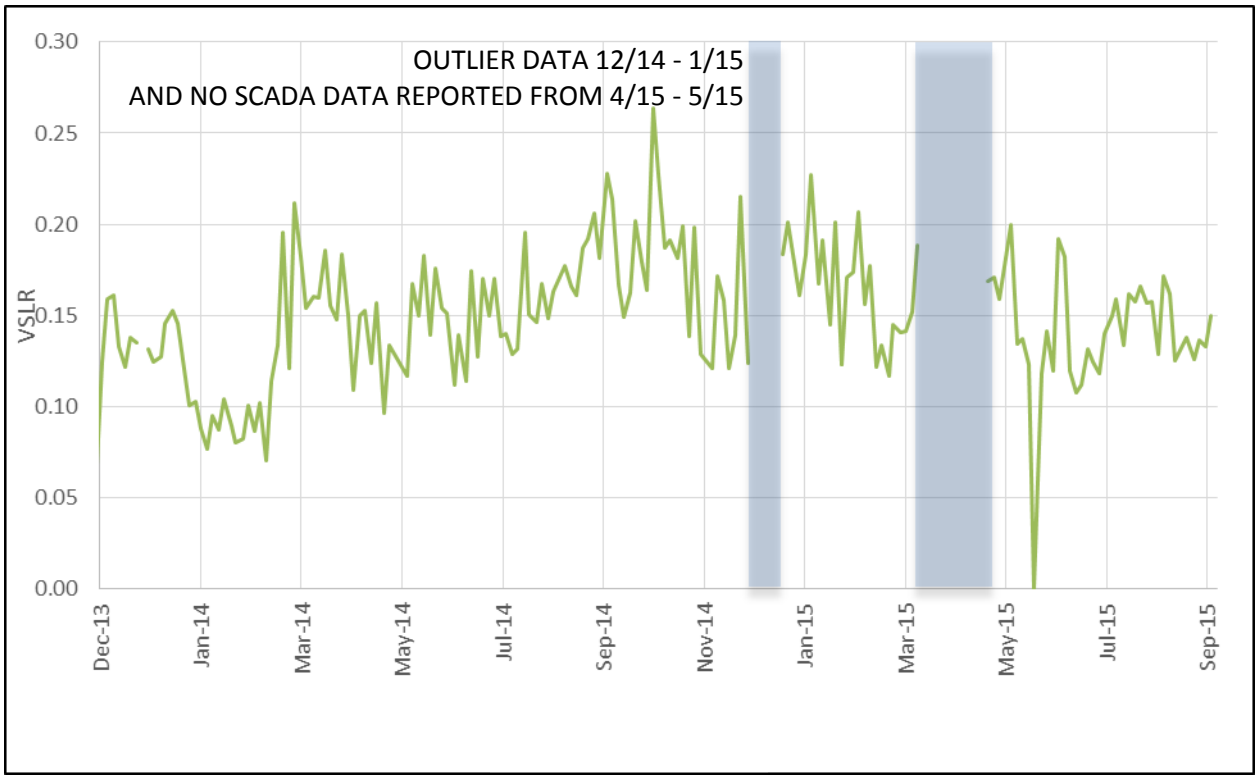


Figure 4-15 – VSLR Digester 5

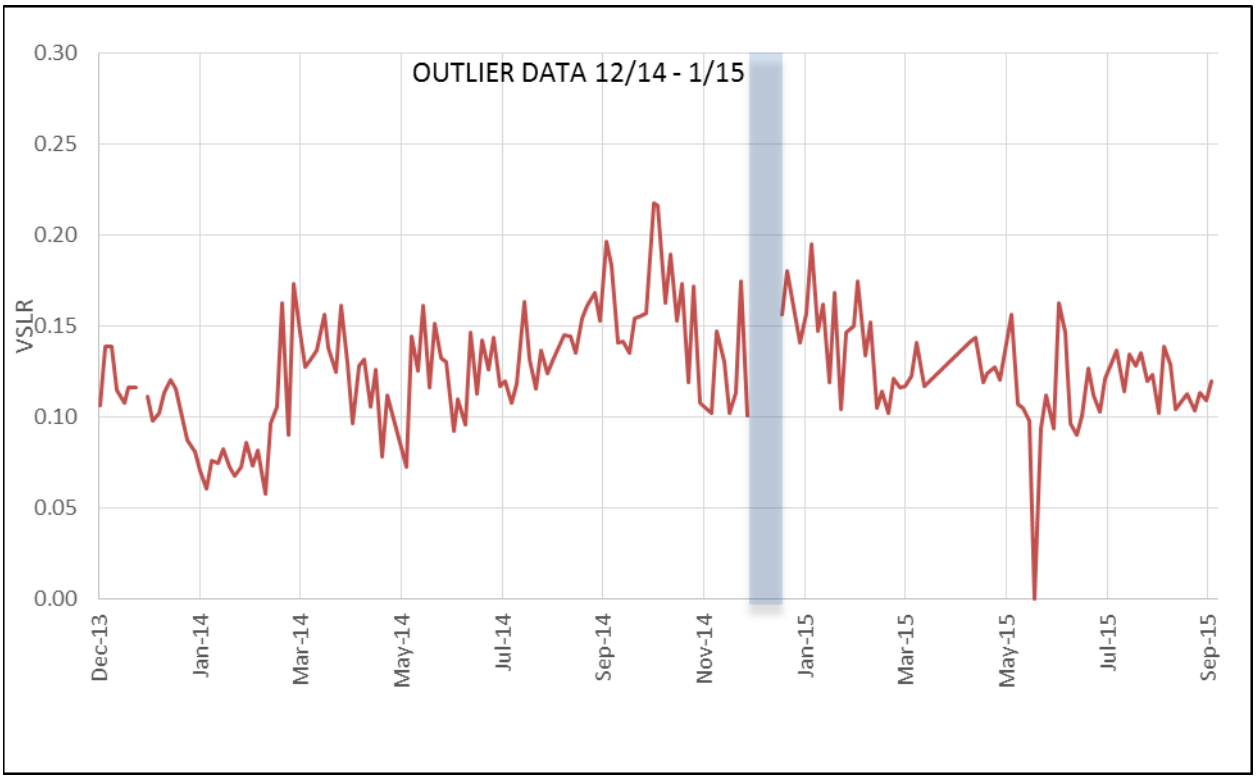
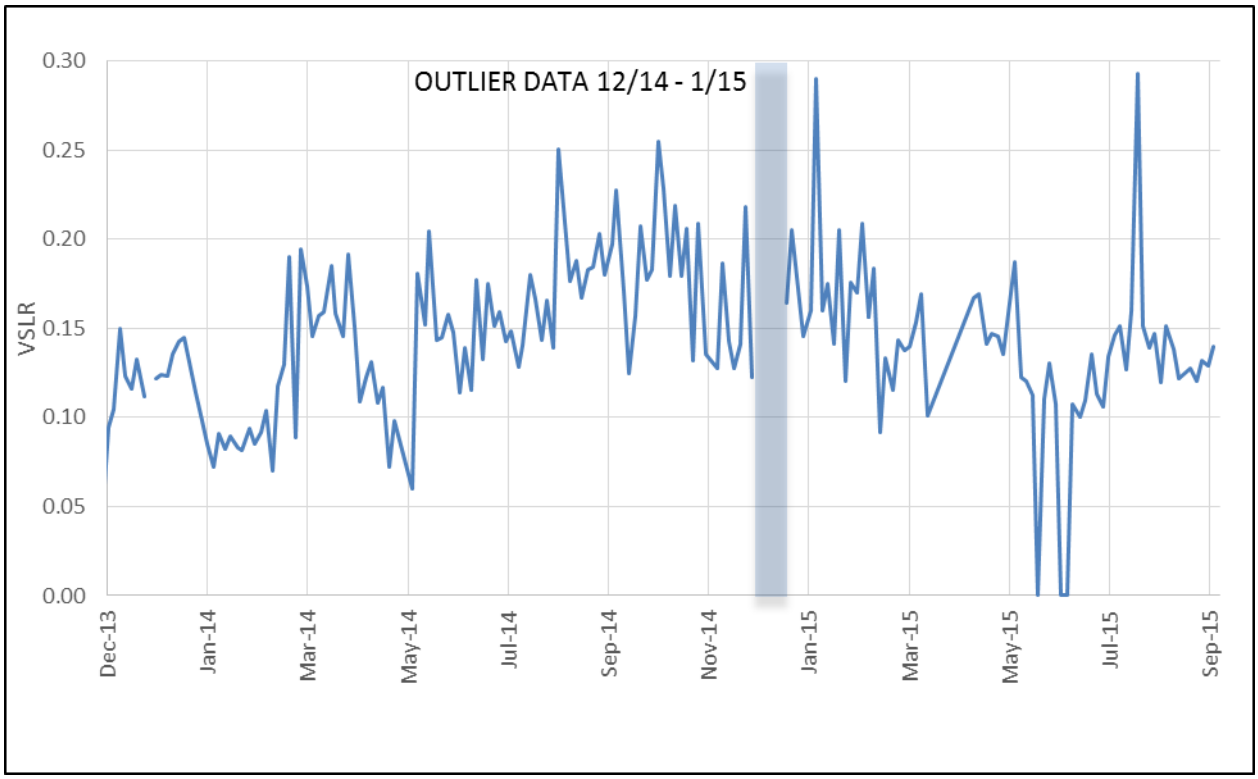


Figure 4-16 – VSLR Digester 6



4.2.2.4 Digester Temperature

Recorded digested sludge temperatures for the active digesters are presented in Figures 4-17 through 4-22. Digester temperature data was only available between December of 2013 and 2015. Historical SCADA data indicates that digested sludge temperature were generally maintained between the recommended range of 95 and 100°F for mesophilic digestion. However, there appear to be gaps in historical data, and plant staff indicates that there are seasonal periods where it has been more difficult to maintain digested sludge temperatures above 95°F due to the performance/condition of sludge heating equipment. It is recommended that the condition of the heating equipment be evaluated in detail in the next phase.

Figure 4-17 – Temperature Digester 1

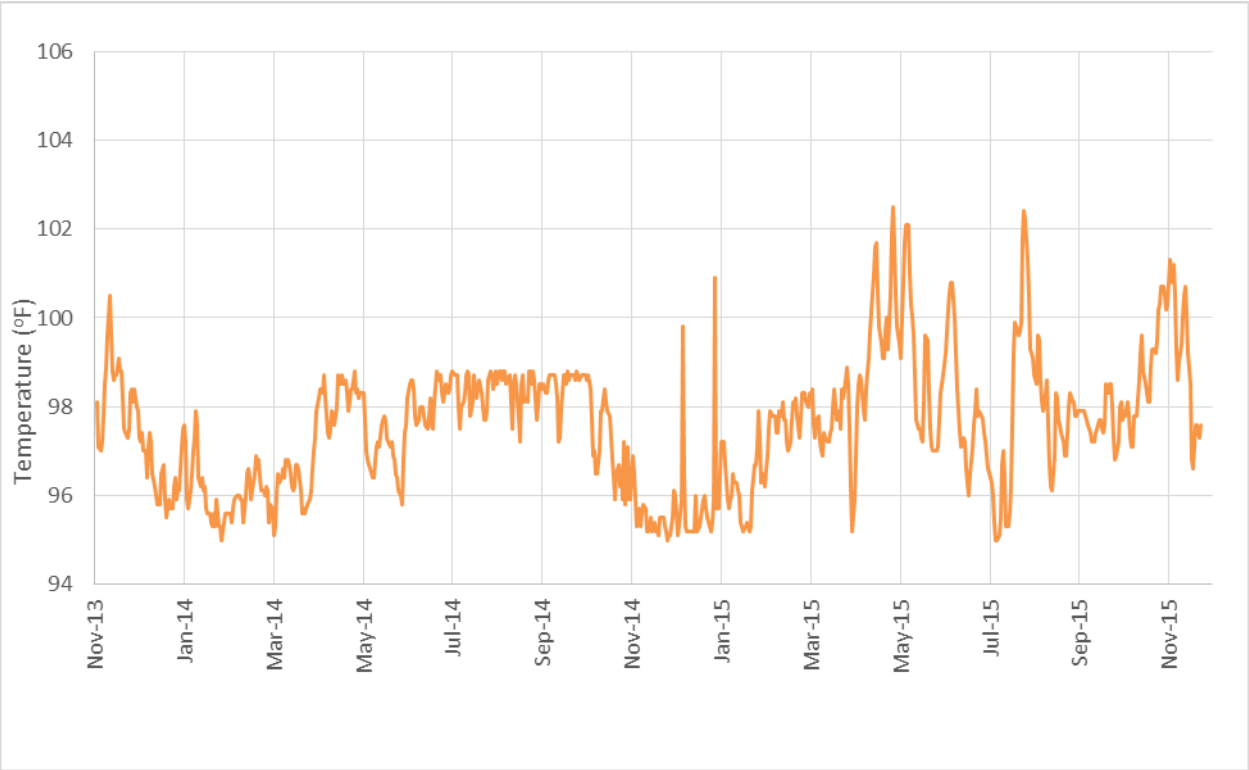


Figure 4-18 – Temperature Digester 2

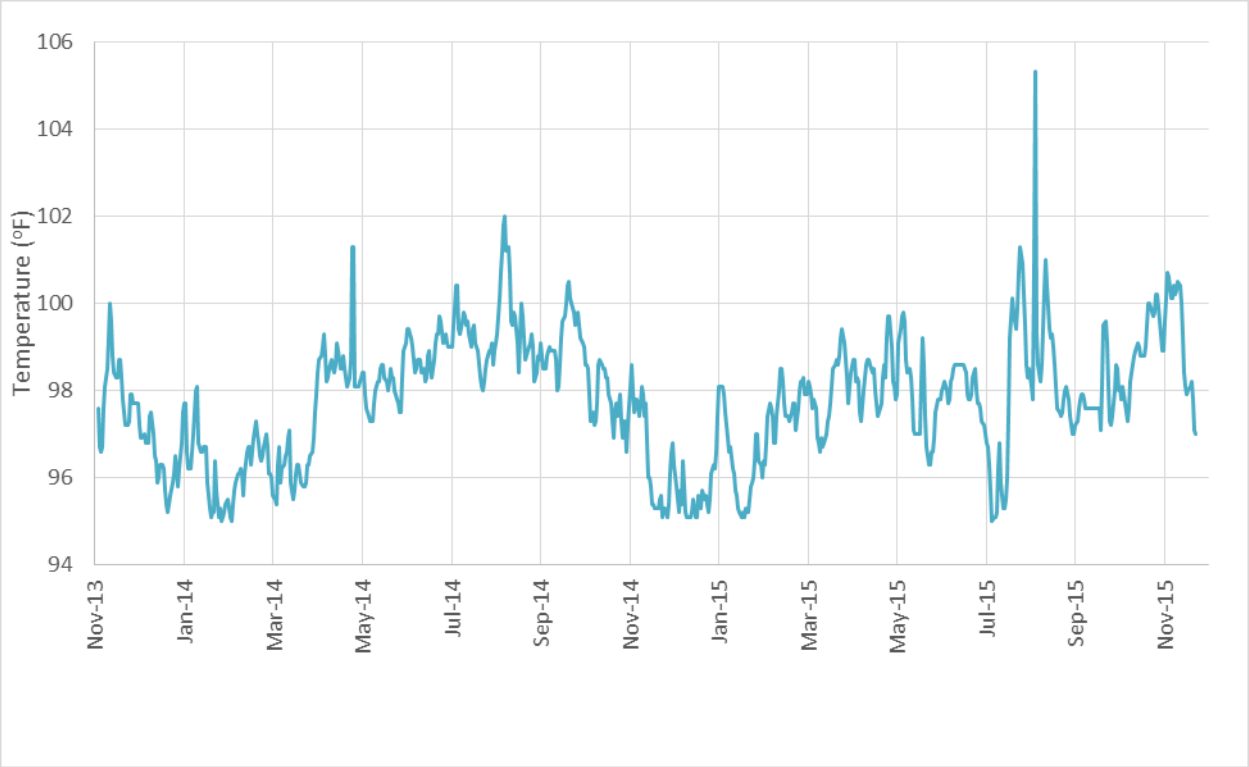


Figure 4-19 – Temperature Digester 3

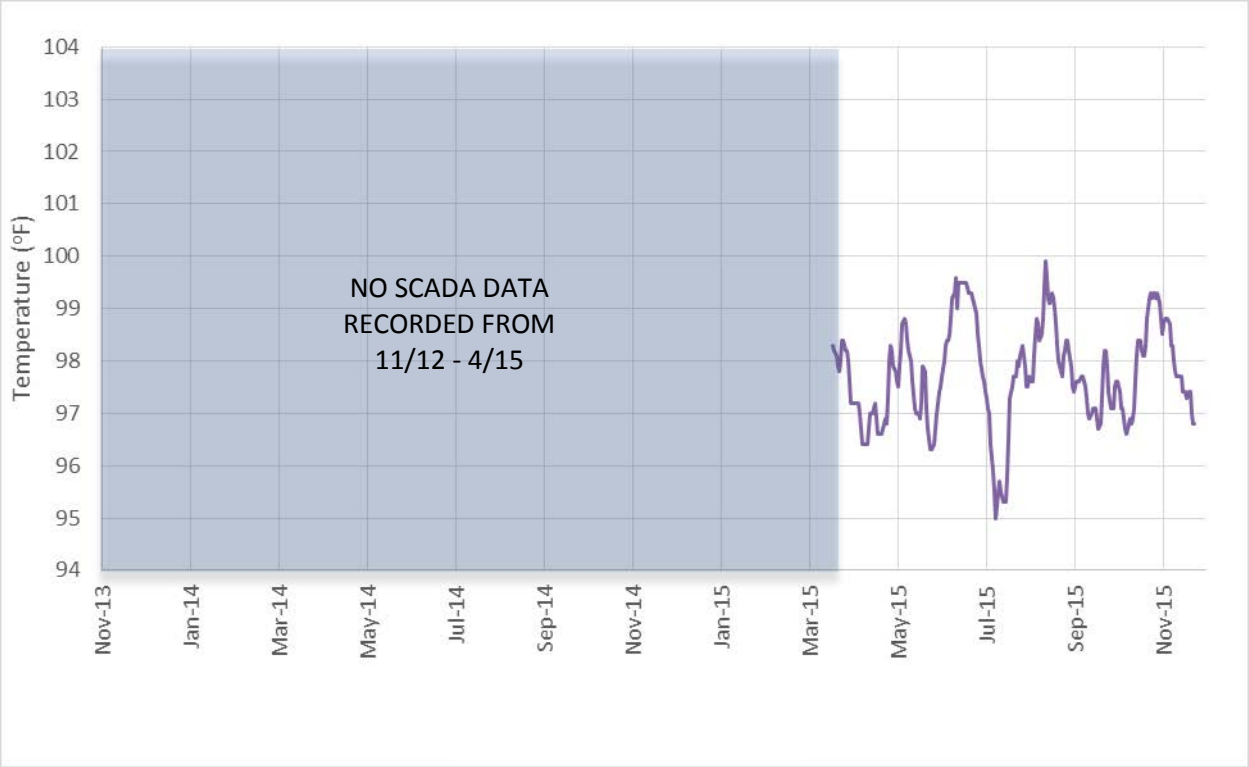


Figure 4-20 – Temperature Digester 4

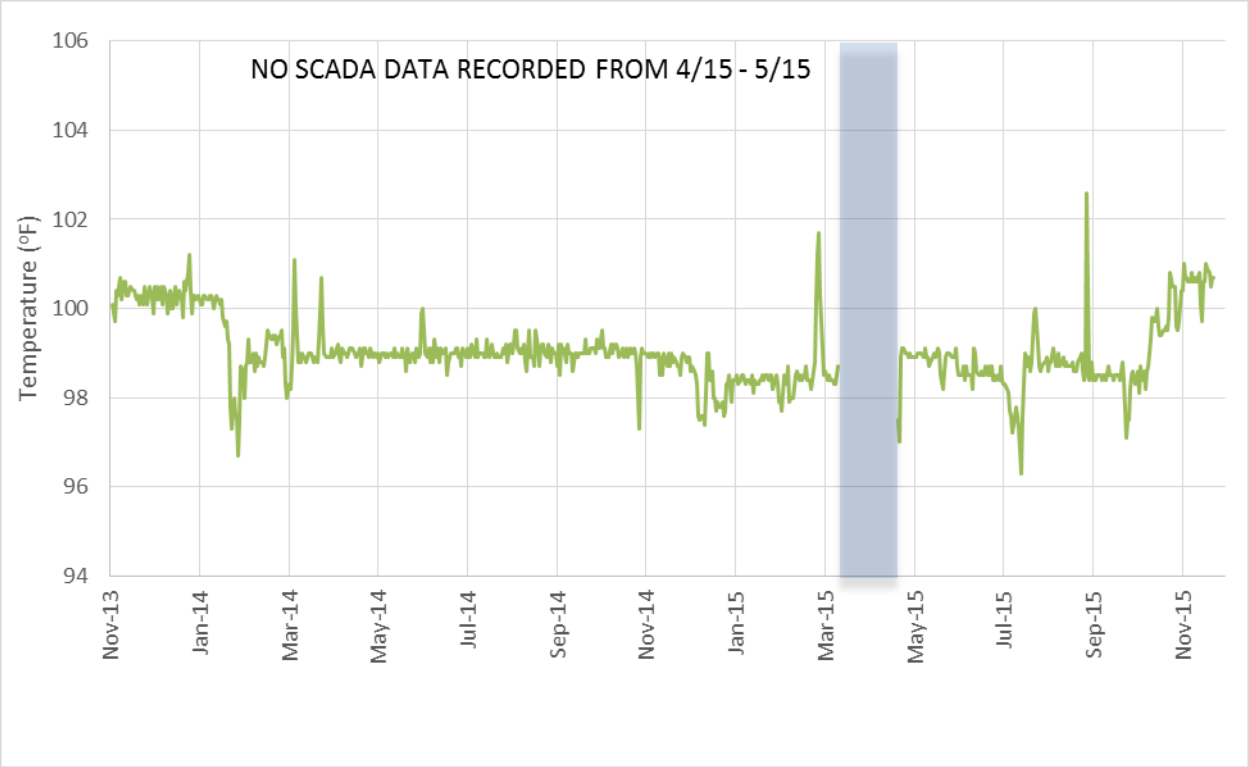


Figure 4-21 – Temperature Digester 5

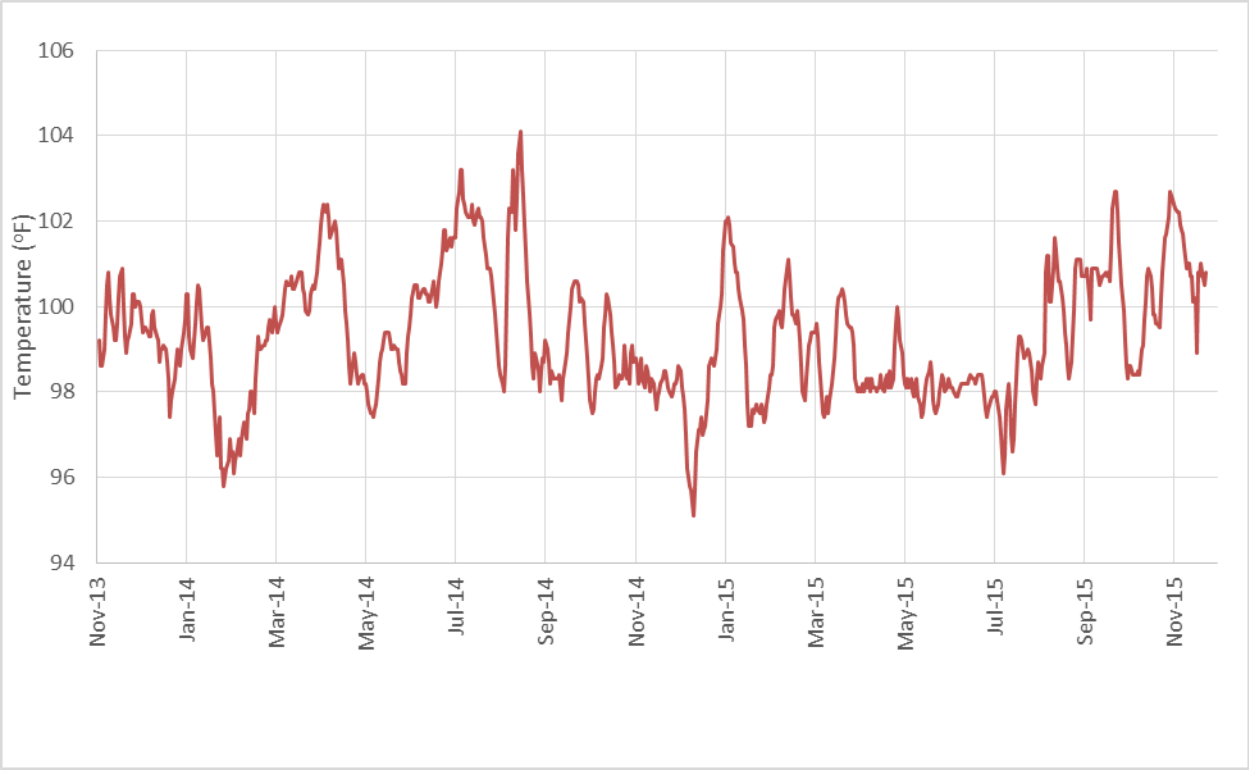
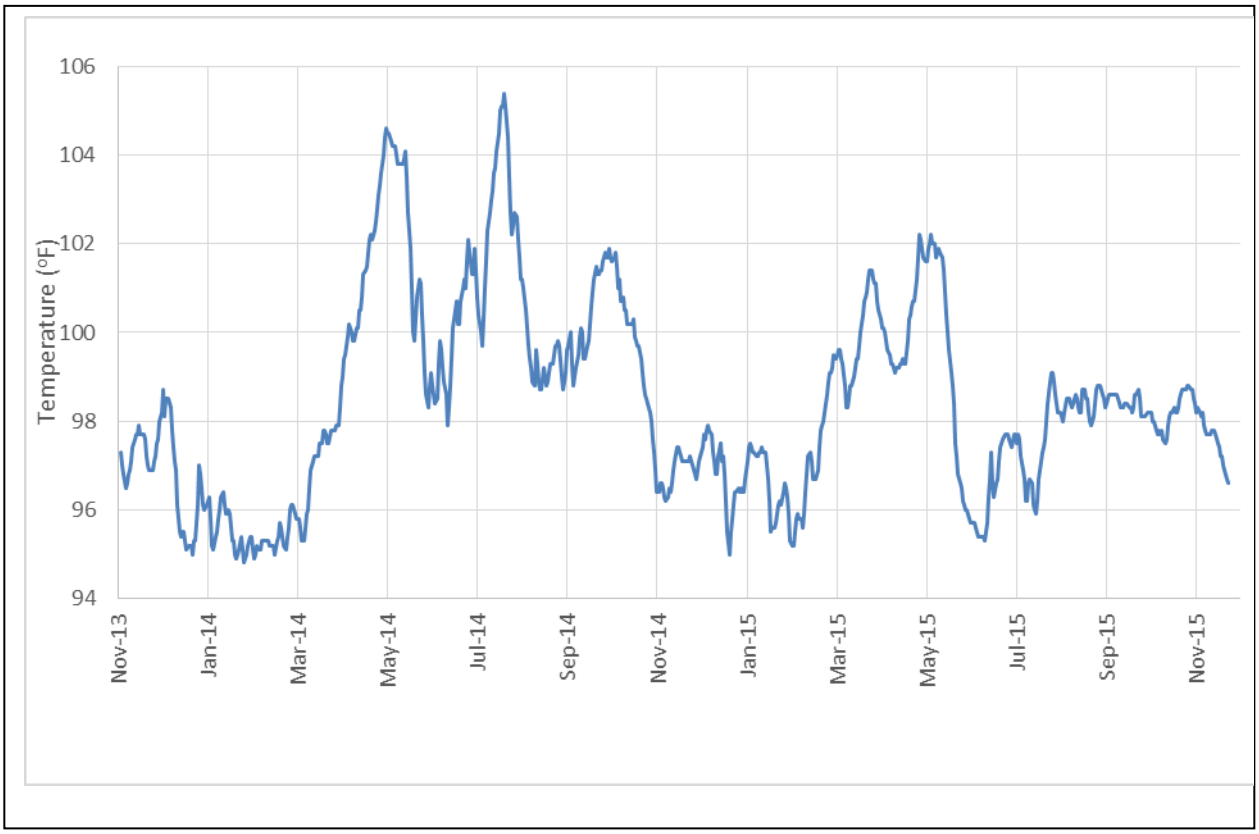


Figure 4-22 – Temperature Digester 6



4.2.2.5 Volatile Acids to Alkalinity Ratio

VFA/ALK ratios for the digesters are presented in Figure 4-23 through 4-28. The actual VFA/ALK values are consistently less than the maximum recommended value of 0.25 (refer to HFC AWTP O&M manual). These results indicate that volatile acids production is not exceeding volatile acids consumption and that digesters have adequate buffering capacities to maintain suitable pH levels to avoid upset conditions.

Figure 4-23 – Volatile Acid to Alkalinity Ratio Digester 1

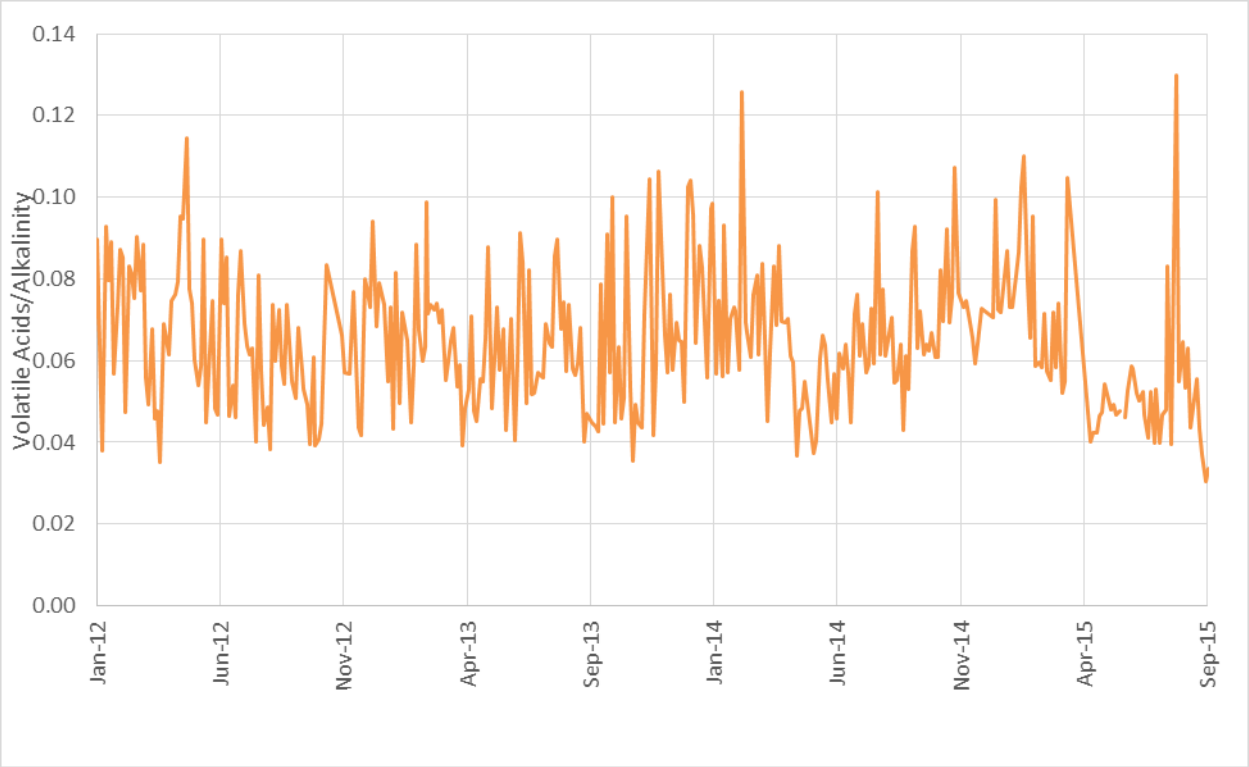


Figure 4-24 – Volatile Acid to Alkalinity Ratio Digester 2

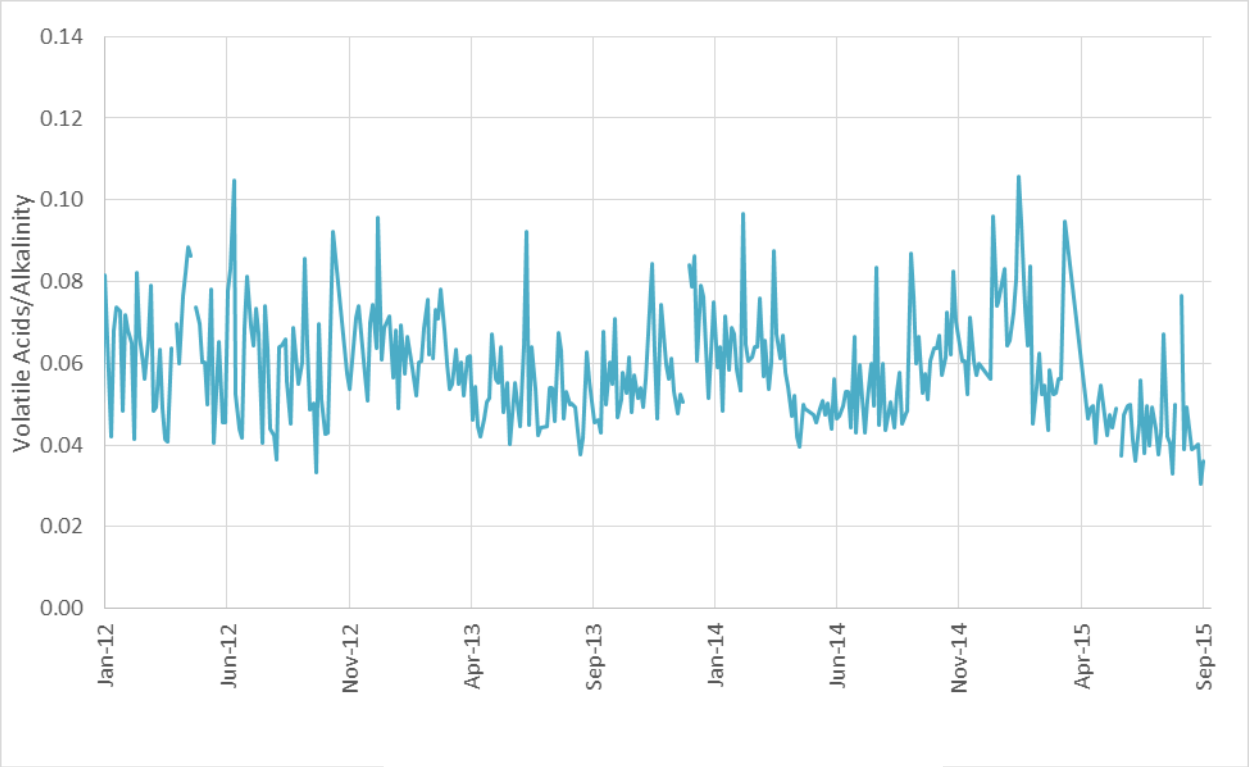


Figure 4-25 – Volatile Acid to Alkalinity Ratio Digester 3

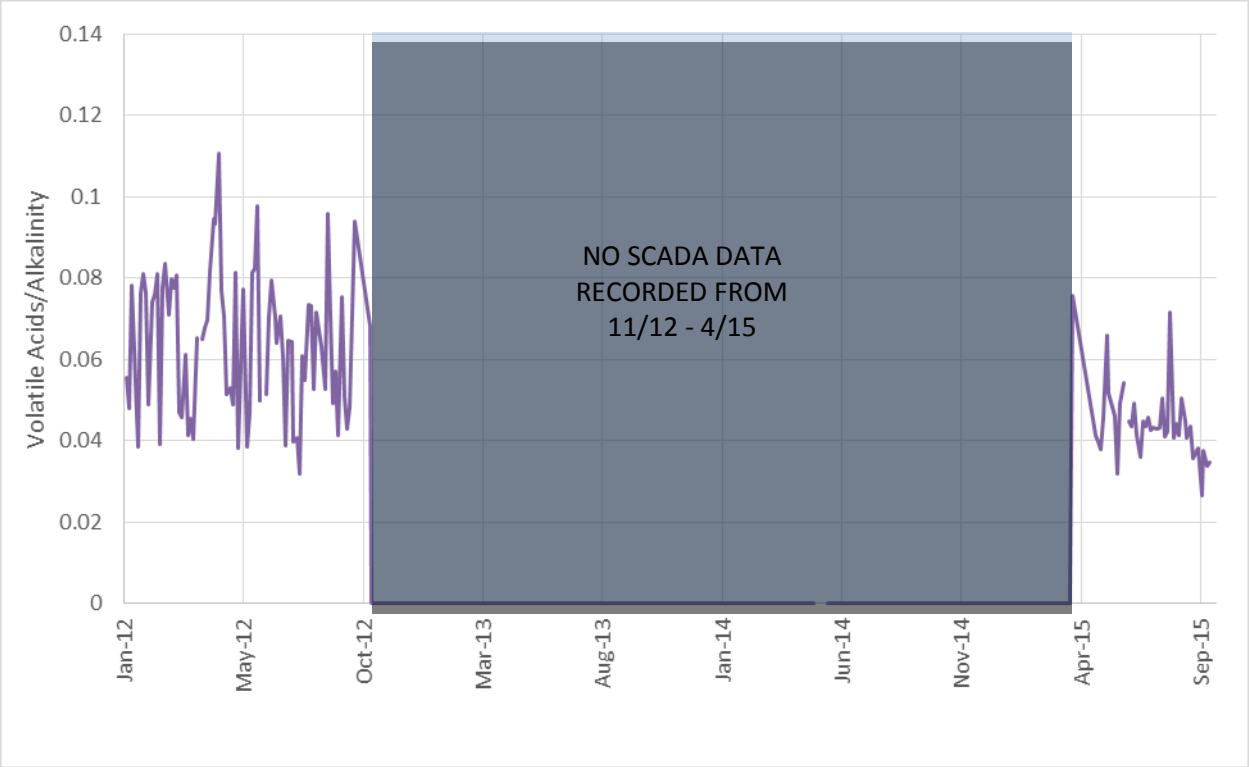


Figure 4-26 – Volatile Acid to Alkalinity Ratio Digester 4

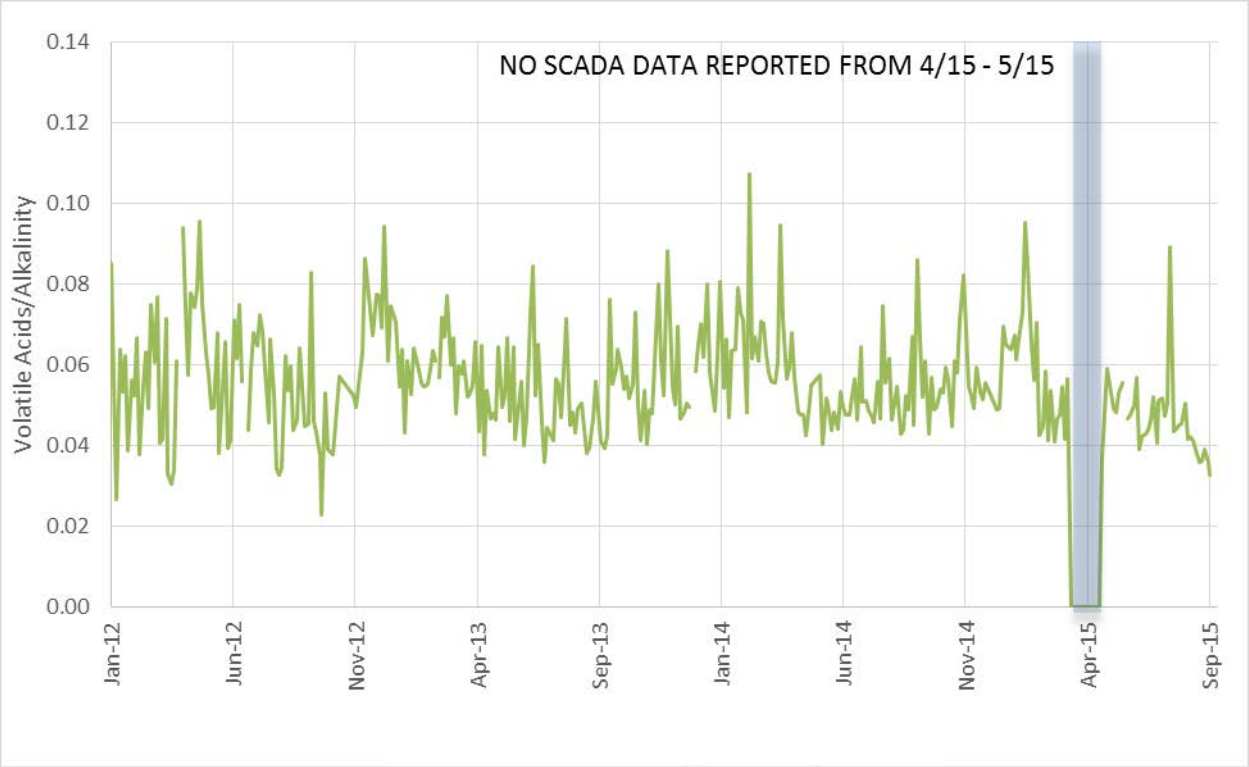


Figure 4-27 – Volatile Acid to Alkalinity Ratio Digester 5

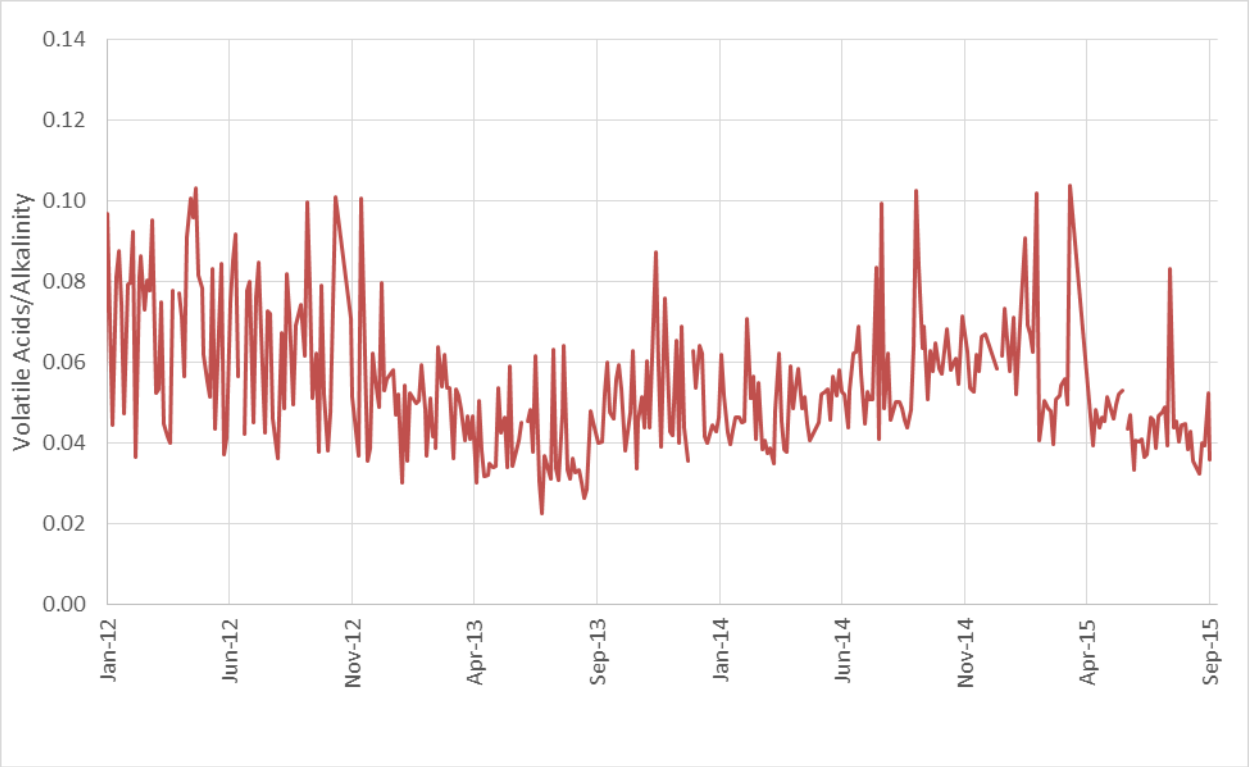
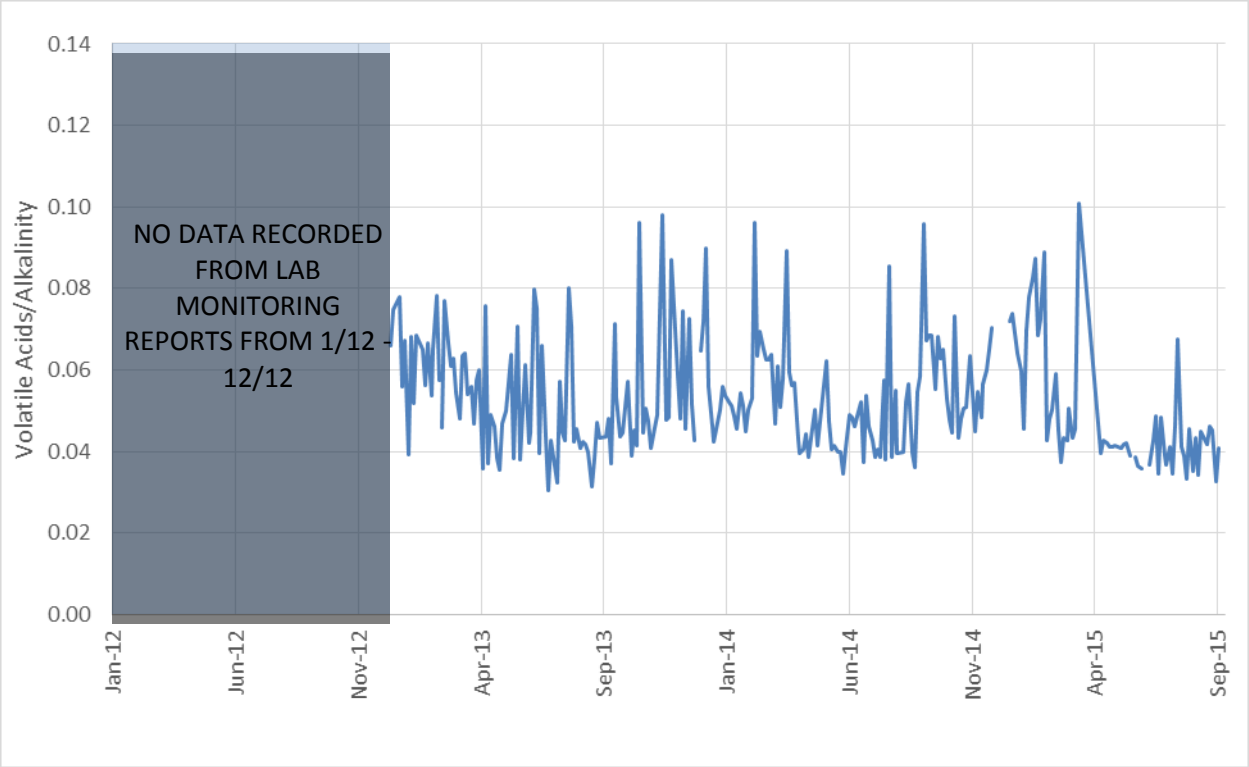


Figure 4-28 – Volatile Acid to Alkalinity Ratio Digester 6



4.2.2.6 Digester Mixing

Sludge mixing in each digester is achieved by a “bubble-gun” gas mixing system. Digester gas is withdrawn from under the floating cover and discharged by a compressor to multiple floor-mounted, vertical gas mixing guns spaced evenly throughout the digester. Gas collects in the bottom of each mixing gun in a bubble generator until a gas bubble reaches the required size. Then the gas bubble rises inside the mixing gun to the surface creating a pumping action which causes circulation within the zone influenced by the upward gas induced flow.

Effective mixing eliminates temperature stratification; maintains a homogeneous mixture; rapidly disperses raw feed sludge with the active biomass; mitigates the formation of excessive floating scum layers and the deposition of heavy silt, grit or inert solids to maximize available working volume for digestion. Effective mixing may also facilitate gas release from the sludge matrix and limit susceptibility to rapid volume expansion foaming.

Plant staff reports that 2 of the mixing guns are out of service in Digester 4. Plant staff also reports foaming, as discussed previously, has led to digester operation at reduced liquid levels and resulted in lower hydraulic retention times. Given the fact that some mixing tubes are out of service and that foaming is a significant operational issue, it is recommended that detailed solids profile sampling be conducted to identify total solids concentrations at various horizontal locations and depths to further assess mixing system performance at each digester.

4.2.2.7 Digester Gas Production

In a healthy digester, digester gas is produced in proportion to volatile solids destroyed. Gas production rates are typically monitored in relation to volatile solids reduction to assess digester health. During process upset methane production declines and the carbon dioxide fraction of the gas may increase. The total gas production rate may remain unchanged despite falling methane production rates because of increased carbon dioxide production. The rate of change in gas production is an indicator of digester health. During a toxic upset, the methane production rate declines immediately. During a hydraulic or organic overload, the methane production rate gradually declines, or during an organic overload, may first increase, then slowly decline.

Gas flow metering is currently not available at the individual digesters. Gas flowmeters with the ability to measure and trend methane content are now available from multiple manufacturers. It is recommended that gas flowmeters be installed at each digester to measure and trend digester gas production and methane content to enhance digestion process monitoring. Methane data would also be useful for operation and monitoring of the biogas recovery system.

The volatile acid concentrations in the digesters suggest that the digesters are healthy and producing optimal gas.

4.2.2.8 Summary of Digestion Performance

Based on the evaluation of historical data presented above, conclusions regarding past and current digestion performance are summarized as follows:

- Volatile solids reduction has averaged between 45% and 60% on a monthly basis. This level of volatile solids reduction represents reasonable digestion performance and can be attributed in large part to the relatively high volatile content of the primary sludge and waste activated sludge feed stocks.
- Existing digester tank volume provides adequate hydraulic retention time (HRT) at current loading rates. Operating digester volume should be increased through increased liquid levels or Digester 7 being returned to service to ensure that an aggregate HRT of 15 days or greater is maintained as plant flows and digester loadings increase over time.
- HFC AWTP Operations staff has maintained relatively equal feed distribution to all digesters.
- Organic (volatile solids) loading rates to digesters have been greater than the recommended F to M ratio of 0.10 due to operating at lower side water depths to manage foaming. However, the data shows that the digesters are adequately performing despite operating at higher than typical F to M ratios.
- Digester sludge temperatures have been consistently maintained above 95°F during this evaluation period, although plant staff reports seasonal difficulties in maintaining required temperatures due to performance/condition of sludge heating equipment
- VFA/ALK ratios have been well within acceptable ranges and indicate adequate buffering capacity and pH stability.
- Digester gas production data is not available. New digester gas flowmeters should be installed to monitor gas production from each digester as an indicator of digester performance and stability.
- Multiple gas mixing tubes are out of service. Solids profiles should be taken at each digester to physically evaluate current mixing system performance.

4.2.3 Condition Assessment

Based on the condition assessment recently conducted as part of this master plan, the condition of existing digester tanks, process control buildings and process equipment were analyzed. Some discussion on this are included below. It is recommended that some additional, more detailed inspections be performed as part of the next phase to determine which process equipment components need replacement. The previous work will assist in limiting the items that require more inspection.

Concrete tank structures for Digesters 1 through 5 are between 45 and 65 years old. With a remaining useful life of 10 – 15 years and considering the time required for design and construction of digestion upgrades, these tanks may have a useful remaining life of 5 years or less when upgrades are placed into service. Therefore, the replacement design process should start before the end of life span for the tanks. Digesters 6 and 7 may have significant remaining useful life. Based on Phase 1 review workshops, it has been mutually agreed by the City and the Consultant that Phase II of this project will provide physical structural testing, including petrographic analysis of core samples and Windsor Probe tests, to estimate the remaining useful service life of Digester Tanks 1 through 5.

The floating gasholder cover at Digester 3 was recently replaced in 2014. Floating gasholder covers at Digesters 1, 2, and 4 are between 30 and 65 years old; and the gasholder cover at Digester 4 has a hole that requires the cover to be maintained such that the outer edge is at the liquid level to minimize gas leaks. The floating cover for Digester 6 was replaced in 2012. The floating cover for Digester 7 is 30 years old. Rehabilitation or replacement of various covers are programmed in the next 5 years of the City's capital improvements plan.

The Phase 1 condition assessment indicates that sludge heat exchangers and heated sludge recirculation pumps in all three digestion process control buildings (A, B and C) are in "poor" condition and have a remaining useful service life of less than 5 years. The City indicates that all hot water boilers associated with digester heating systems were rehabilitated in Year 2015, including new refractory and tubes.

Based on the condition assessment, the remaining useful life of all pumps, gas compressors and heat exchangers is less than 5 years. Rehabilitation of pumps and heat exchangers are programmed in the next 5 years of the City's capital improvements plan.

Given a master planning horizon of 20 years, it is recommended that the following assumptions be used in evaluating upgrades and /or enhancements to digestion facilities:

1. Concrete tanks, digester covers and process equipment for Digesters 1 through 4 should be rehabilitated as needed or replaced with new infrastructure to be selected based on evaluation of potential digestion upgrades and/or enhancements.
2. Digester 5 should either be replaced or rehabilitated depending on the results of evaluations of digestion upgrade/enhancement alternatives discussed below.
3. Digesters 6 and 7 should be retained to operate throughout the planning period.
4. Digester 7 cover should be replaced and process equipment for Digesters 6 and 7 should be rehabilitated or replaced based on continuing condition assessments.

4.2.4 Digestion Upgrade/Enhancement Alternatives

Based on the assumption that Digesters 1 through 5 and their respective process buildings and process equipment may reach the end of their useful service life within the next 10 years (subject to structural integrity testing of tanks described above in the Condition Assessment subsection), the following technology alternatives were evaluated for improving anaerobic digestion performance by increasing volatile solids reduction and digester gas production:

<u>Alternative 1</u> - Maintain a conventional mesophilic anaerobic digestion process by constructing new digestion facilities to replace Digesters 1 through 5 and continuing to use Digesters 6 and 7

<u>Alternative 2</u> - Convert to an advanced temperature-phased (thermophilic-mesophilic) anaerobic digestion process by constructing a combination of new thermophilic and mesophilic digestion facilities to replace Digesters 1 through 5

Alternative 3 - Convert to an advanced acid-gas phased anaerobic digestion process by constructing new digestion facilities to replace Digesters 1 through 5

Alternative 4 - Convert to an advanced anaerobic digestion process by constructing a new thermal hydrolysis pretreatment (THP) system to replace Digesters 1 through 5

Addition of increased high-strength wastes (HSW) such as grease interceptor waste (GIW) from external sources as an additional digester feed stock; this option can be applied to any of the four (4) digestion alternatives listed above

Each of the technology options listed above should be evaluated on the basis of predicted performance, capital costs, life cycle cost projections and ease of operation and maintenance. Predicted performance for each of the process alternatives should be developed using the calibrated whole-plant GPS-X process model. The existing GPS-X model addresses the activated sludge process only and should be expanded to include primary treatment facilities, solids treatment facilities and sidestream/recycle flows. A calibrated whole-plant GPS-X model is recommended to facilitate sizing and predicted performance of the digestion upgrades/enhancement alternatives and develop associated capital and O&M cost projections for life-cycle cost analyses. The following sub-sections provide brief descriptions, cost factors and anticipated benefits for each of the process alternatives.

4.2.4.1 Maintaining Conventional Mesophilic Anaerobic Digestion

Digesters 1 through 5 would be replaced with fewer, larger mesophilic digesters to maintain adequate hydraulic residence time. A new common process equipment building and new process equipment would be constructed/installed to provide similar functionality to Digesters 6 and 7. Since process equipment in Digesters 6 and 7 have limited remaining useful life, various alternatives for sludge pumping, heating and mixing equipment will be evaluated. Potential examples are listed in Table 4.3.

Table 4-3 – Potential Options for Conventional Digestion Process Equipment

Pumping	Heating	Mixing
Rotary lobe	Tube-in-tube heat exchangers	Gas mixing/draft tubes
Progressive cavity	Spiral heat exchangers	Pump mixing
Centrifugal chopper	Direct steam injection	Mechanical mixing

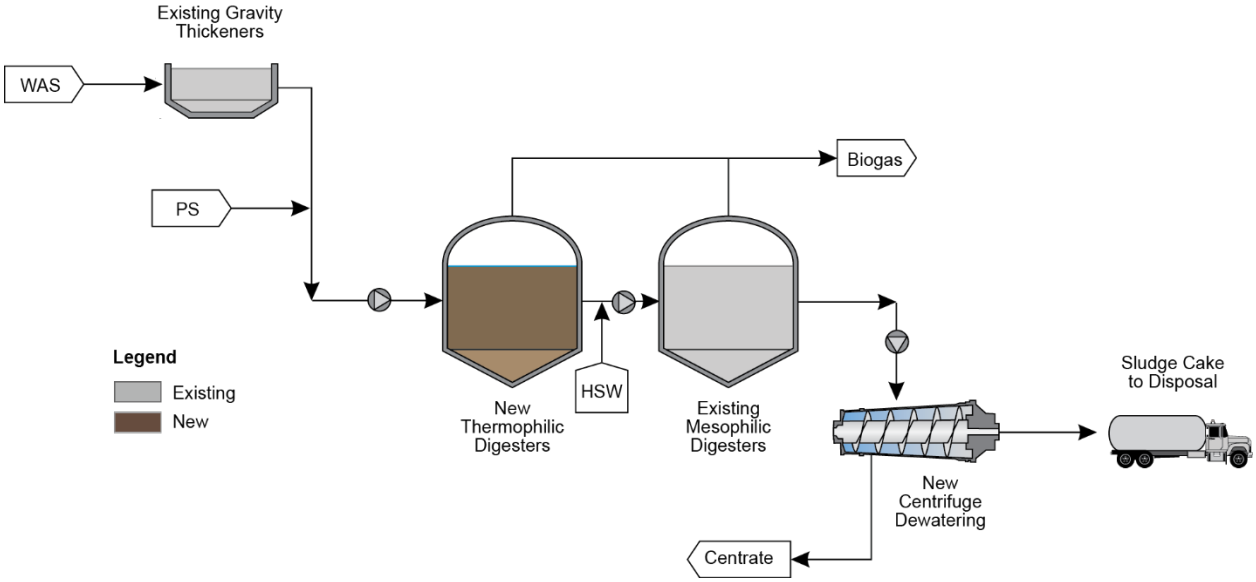
Under this conventional mesophilic digestion option, modest improvements in volatile solids reduction, digester gas production and energy consumption are possible through the implementation of new and improved equipment. With the addition of high-strength waste as an additional feedstock, digester gas production would be further enhanced.

4.2.4.2 Conversion to Temperature-Phased Anaerobic Digestion

Digesters 1 through 5 would be replaced with fewer, larger thermophilic and mesophilic digesters to maintain adequate hydraulic residence time in a temperature-phased configuration. A new common process equipment building and new process equipment would be constructed/installed.

Temperature-phased anaerobic digestion (TPAD) consists of thermophilic digestion (131°F to 140°F) followed in series by mesophilic digestion (95°F to 100°F). The potential conversion of the HCAWTP's digestion process to TPAD configuration is shown schematically in Figure 4-29.

Figure 4-29 – Solids Process Flow Schematic – Temperature-Phased Anaerobic Digestion



In temperature-phased mode, feed sludge would be fed to the thermophilic digesters. Partially digested sludge from the thermophilic digesters would be transferred through sludge-to-sludge heat exchangers to the mesophilic digesters. A sludge heat recovery system using sludge-to-sludge heat exchangers would allow thermophilic sludge to pre-heat incoming feed sludge; and incoming feed sludge to partially cool thermophilic sludge for downstream mesophilic digestion. This heat recovery process would reduce the required size of thermophilic heating equipment. Any external high-strength wastes would be routed directly to the second-phase mesophilic digesters. Digested sludge from the anaerobic digestion complex would be pumped to the dewatering facility.

When implemented in other facilities, temperature-phased operation has increased the degradable fraction of volatile solids and has also increased digestion reactions rates. These parameters indicate that thermophilic conditions promote faster and more complete degradation than mesophilic conditions, resulting in a 10 to 15 percent increase in both volatile solids reduction and digester gas production over conventional mesophilic digestion.

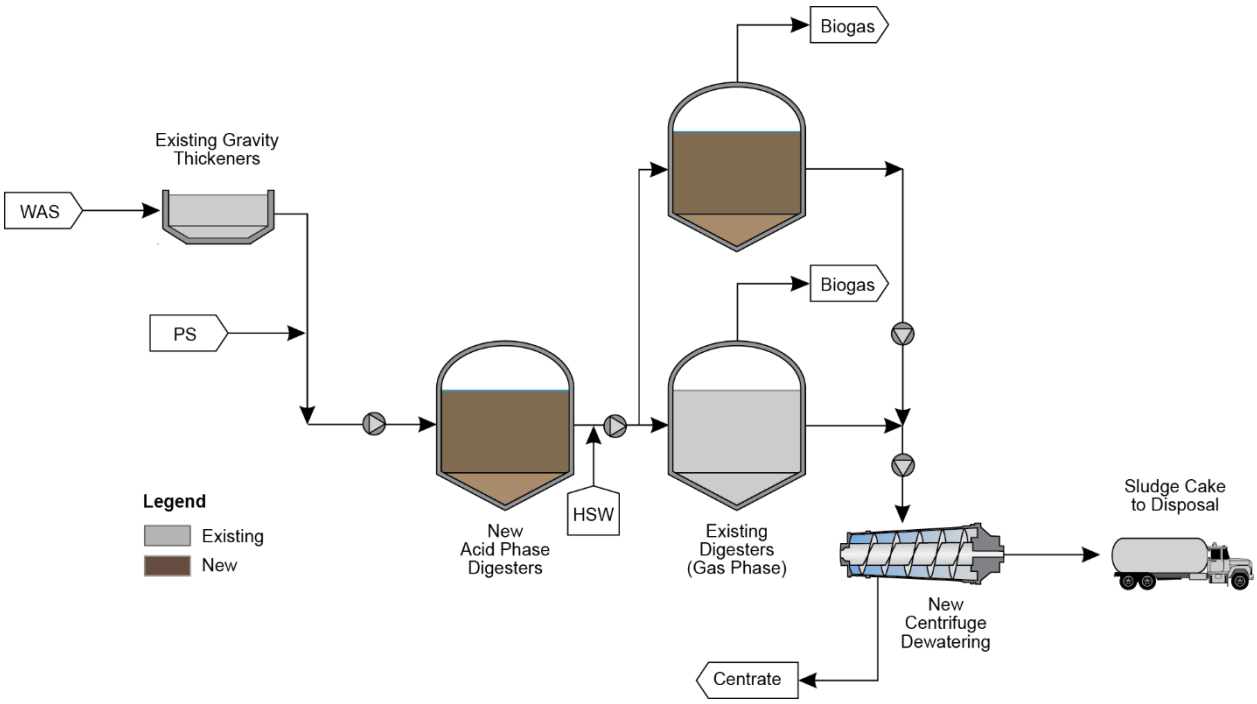
4.2.4.3 Conversion to Acid-Gas Phased Anaerobic Digestion

Digesters 1 through 5 would be replaced with separate acid-phase digester tanks and gas-phase digester tanks.

The two phase acid-gas digestion process was developed to provide ideal growth conditions for acid and gas producing organisms. Separation of acid and gas phases was found to improve volatile solids reduction while reducing retention time requirements. In phased digestion systems the first phase is designed as an acid phase where shorter detention times (approximately 2 days) favor the proliferation of acidogenic organisms producing volatile fatty acids, while suppressing methanogenic growth. Due to limited methanogenic activity, the pH remains in the weakly acidic range (5.0 to 6.0) favored by the acidogens. The second phase is designed for digester gas production where longer detention times

(greater than 15 days) allow the methanogenic organisms to grow and create ideal conditions for production of digester gas from the acid-phase digester effluent. By separating the acid and gas phases, greater stability can be provided for the change-sensitive methanogens in the gas-phase and to gain better control of foaming, which sometimes results from rapid changes made to digester temperature or feed rate. The potential conversion of the HCAWTP's digestion process to an acid/gas phased digestion configuration is shown schematically in Figure 4-30.

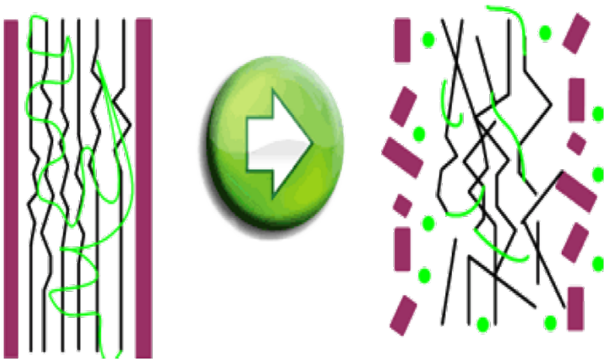
Figure 4-30 – Solids Process Flow Schematic – Acid-Gas Phased Anaerobic Digestion



4.2.4.4 Addition of Thermal Hydrolysis Pretreatment

Digesters 1 through 5 would be replaced with a new thermal hydrolysis pretreatment (THP) system.

Anaerobic digestion VSR and digester gas (DG) production can be increased through the addition of a waste activated sludge (WAS) pretreatment / cell lysis technology upstream of the anaerobic digesters. WAS pretreatment refers to a number of different technologies that disintegrate WAS flocs and lyse (burst) WAS cells.



The purpose of WAS floc disintegration and cell lysis is to increase the hydrolysis rate and/or increase the biodegradability of WAS in the anaerobic digestion process. WAS technologies have demonstrated various amounts of increased VSR and DG production, improved digested sludge dewaterability, and reduced dewatering polymer demand. WAS pretreatment / cell lysis technologies can be divided into five general process categories (thermal, mechanical, ultrasonic, electrical pulse, and chemical) based on the main mechanism for the floc disintegration and cell lysis. A few WAS pretreatment technologies utilize multiple mechanisms to achieve floc disintegration and cell lysis.

The thermal hydrolysis process (THP) has the most proven track record of the WAS pretreatment technologies and has been implemented at over 30 wastewater treatment plants (WWTPs) worldwide. CAMBI™ and Veolia Water (KRÜGER™) are the two main thermal hydrolysis technology vendors. CAMBI's THP is a batch process that uses a combination of high pressure and heat to cause cell lysis and increase both the rate of hydrolysis and the WAS degradability prior to anaerobic digestion. KRÜGER™ offers the BIOTHELYS™, which is a batch process similar to CAMBI's THP, in addition to a continuous flow-through thermal THP under the name EXELYS™. The EXELYS™ process uses the same principles and mechanisms of the batch thermal hydrolysis process but can be operated at a higher %DS ($\geq$25%) compared to the batch process (16-17%).

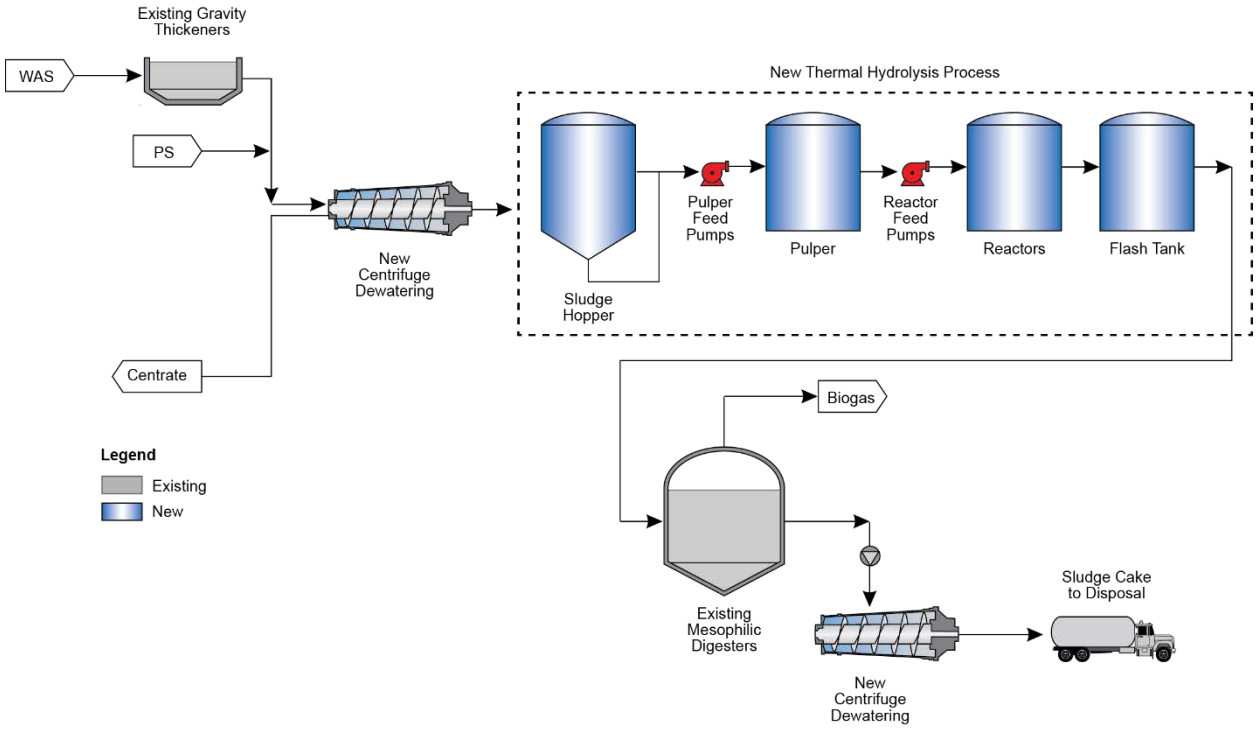
CAMBI's Thermal Hydrolysis Process (www.cambi.no)

The largest CAMBI™ THP was recently commissioned in Washington, D.C. at the Blue Plains Advanced Wastewater Treatment Plant. Presently, this is the only installation of CAMBI™ THP in the United States, although CAMBI™ has numerous full scale installations in the United Kingdom, Norway, and Sweden. Multiple CAMBI THP projects are under evaluation and/or early phase design in the United States at a number of utilities. KRÜGER™ currently does not have any installations in the United States. However, they have multiple installations in Europe and are actively promoting their process to the US market.

THP could be added prior to anaerobic digestion at the HFCAWTP. The process would increase volatile solids reduction across the digesters, reduce post digested sludge mass, and improve post digested sludge dewaterability resulting in lower hauling costs. Thermal hydrolysis reactors operate very efficiently at a high total solids concentration in the incoming sludge, generally from 14% to 25% depending on the specific parameters of the process. To increase the solids concentration of the feed sludge to a level suitable for introduction to a thermal hydrolysis process in a single stage, a centrifuge-based pre-dewatering facility is recommended.

Because THP reduces WAS viscosity it is expected that the anaerobic digesters could be operated with a feed concentration of 8-10% TS. Increasing the digester feed sludge concentration would allow anaerobic digestion to be consolidated to fewer digesters. Detailed evaluations will determine if Digesters 6 and 7 would be adequate, or if additional digestion tankage would be required. The potential conversion of the HCAWTP's digestion process to a thermal hydrolysis configuration is shown schematically in Figure 4-31.

Figure 4-31 – Solids Process Flow Schematic – Thermal Hydrolysis Pretreatment



The following table summarizes the anticipated infrastructure, costs and performance benefits for the alternatives to be evaluated:

Table 4-4 – Projected Costs and Benefits of Digestion Upgrades/Enhancement Alternatives

Alternative	Required Capital Infrastructure	Projected Operational Benefits	Ability to Produce Class A Biosolids?
1 – Maintain Conventional Mesophilic Digestion	New or rehabilitated mesophilic digesters and a process control building	Slightly improved performance due to new equipment; no process changes	No
2 – Convert to Temperature-Phased Digestion	New thermophilic and mesophilic digesters and a process control building	Improved volatile solids reduction and gas production; minor process changes	No
3 – Convert to Acid-Gas Phase Mesophilic Digestion	New acid and gas phase digesters and a process control building; variable sized tanks	Improved volatile solids reduction and gas production; better foam control; minor process changes	No
4 – Thermal Hydrolysis Pretreatment	New thermal hydrolysis pretreatment system with a new pre-dewatering system	Greatest increase in volatile solids reduction and gas production; improved dewatering	Yes

4.2.5 Conclusions, Recommendations, Next Steps

Based on the evaluations presented above, the following is a summary of conclusions, recommendations and next steps related to the anaerobic digestion process:

1. Return Digester 7 to service to increase available aggregate digester volume, which will increase hydraulic retention times and decrease organic loading rates.
2. Conduct solids profile analyses in each digester to assess the performance of the gas mixing systems; repair mixing tubes that are currently out of service; improved mixing will improve heat distribution and may help to reduce foaming.
3. Conduct microscopic analysis of digested sludge samples from each digester to investigate the possibility that WAS contains Nocardia or other microorganisms that may be contributing to foaming in the digesters.
4. Install gas flowmeters at each digester; gas flowmeters should include feature to measure methane content which will help to control/measure/monitor the performance of CHP engines or other biogas recovery options.

5. Complete short-term condition repairs to covers and pumping, mixing and heating equipment to allow all digesters to operate in accordance with design intent until long-term upgrades/enhancements can be implemented.
6. Update the GPS-X model to include primary treatment and solids treatment facilities and update calibration for use in evaluation of upgrade/enhancement alternatives.
7. Conduct evaluations of the digestion upgrades/enhancements as described above.

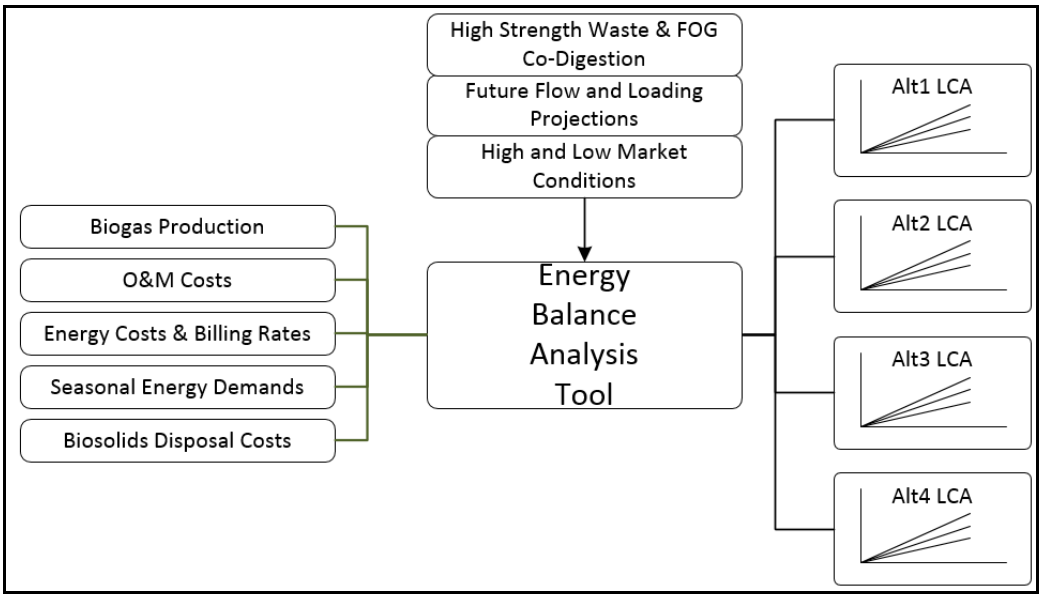
4.3 Biogas Utilization

4.3.1 Purpose and Description

The HFC AWTP currently utilizes biogas generated by the anaerobic digesters to fuel a combined heat and power (CHP) system using reciprocating internal combustion engines to offset the plant's energy demands. As a part of this biosolids master plan, a study was performed to determine if the City should maintain their current utilization strategy or consider a different long term biogas utilization strategy. This study evaluates the 20 year life cycle cost/benefits of multiple biogas utilization alternatives to identify economically feasible alternatives that warrant further detailed evaluations in the next phase of the biosolids master plan development.

The biogas utilization feasibility evaluations were performed using Hazen's Energy Balance & Analysis Tool (EBAT). EBAT is an energy analysis & modeling tool that models the complex relationship between energy production, energy demands & energy costs to provide accurate long term cost/benefit assessments for multiple biogas utilization alternatives. The EBAT model calculates 20 year life cycle costs for current market conditions as well as high and low market conditions so the full range of economic outcomes for the biogas utilization alternatives can be understood. Figure 4-32 illustrates inputs and outputs of the EBAT model.

Figure 4-32 – Energy Balance and Analysis Tool Diagram



The City hired MWH in 2013 to evaluate the economic feasibility of alternative biogas utilization strategies. The 2013 biogas utilization analysis (MWH report) evaluated the economic feasibility for the following utilization alternatives:

- MWH Report Alternative No. 1- New combined heat and power (CHP) engines with waste heat used to heat digesters
- MWH Report Alternative No. 2- New CHP engines with waste heat used to heat digesters and excess waste heat utilized in absorption chillers
- MWH Report Alternative No. 3- New CHP engines installed in TECO engine building, with waste heat to dryer to offset natural gas; and waste heat from dryer to heat digesters
- MWH Report Alternative No. 4- New CHP engines installed at existing engine building with waste heat to new dryer to offset natural gas; and waste heat from new dryer to heat digesters
- MWH Report Alternative No. 5- All biogas to existing dryer facility
- MWH Report Alternative No. 6- All biogas to new dryer facility and dryer waste heat used for digester heating

The MWH report concluded that Alternative 1 (new CHP engines) was the most cost effective utilization alternative. This alternative included the demolition of the 5 existing biogas fueled engines and the installation of 3 new 1000kW engines with exhaust heat recovery. The recommended alternative 1 also included new biogas treatment systems to remove siloxanes, moisture, and hydrogen sulfides. The capital investment for this alternative was estimated to be $8,600,000. The MWH report stated that the new engines would reduce labor costs by $151,822 annually and increase revenue generation by $750,839 annually.

4.3.2 Existing Conditions

A condition assessment was performed to determine the remaining useful life of the existing biogas utilization equipment and infrastructure. The condition assessment was based on a combination of field observations performed by Hazen, discussions with the plant staff, and the results from previous condition assessments performed under the previous biogas utilization study

Biogas Fueled Engines - The HFC AWTP currently utilizes biogas to fuel five (5) 500kW internal combustion engines configured in a Combined Heat and Power (CHP) configuration to produce electric and thermal energy. The electric energy is used to offset the plant purchased energy and thermal energy is recovered from the engine cooling system to provide digester heating. Based on discussions with the plant staff, Engine No.1 experienced a major internal failure and repair costs are likely to exceed the value of the existing unit. The remaining engines are in various states of repairs with two (2) engine currently in operation and a third engine under repairs. The existing engines were installed in 1984 and are 900 RPM Model L7042GU manufactured by Waukesha. The condition assessment concluded that all engines are in moderate to poor condition and are in need of refurbishment and repairs.

Biogas Handling and Pre-Treatment - Biogas is pressurized by five (5) positive displacement compressors which pump gas to the digester mixing system and to the existing gas conditioning equipment. The HFC AWTP currently treats the biogas to remove sulfur compounds using cellulosic fiber based filters.

Moisture and sediment are removed via condensate/sediment removal traps. Additional biogas moisture is removed, immediately upstream of the engines, by pressurized condensate units. A condition assessment performed by Hazen and under previous biogas utilization studies noted multiple leaks around pipe joints and concluded that much of the biogas handling system is in need of repairs. The plant staff noted that the existing gas cleaning was ineffective and excessive siloxane buildup and corrosion have been observed on the internal components of the engines. The majority of the biogas handling and treatment equipment is in poor condition and should be replaced or refurbished as a part of the biosolids process expansion

Heat Recovery Equipment – Heat is recovered from the engine jacket cooling system to provide heat to the digesters. Each engine is furnished with a shell-in-tube heat exchanger which transfer heat from the engine to a hot water digester heating loop. The heat recovery loop configuration includes two loops. One loop provides heat to digesters 1 and 5 from engines 1 and 2 while the other provides heat to digesters 6-7 from engines 3-5. During a site visit on 12/18/15, the plant staff noted that the two heat recovery loops do have a cross connection, however, digester temperature control is difficult when the cross connection is open. The heat recovery pumps, heat exchangers, and piping should be refurbished or replaced as a part of the biosolids process expansion.

4.3.3 Current Biogas Production and Heating Demands

Biogas production and heating requirements were estimated for current and future digester loadings by using:

- SCADA data
- Laboratory monthly reports
- Daily monitoring reports
- Process reports
- Design criteria obtained from as-built information

The collected data was averaged to obtain monthly statistical measures. Future growth was accounted for in the estimates by incorporating flow and load projections presented in the Updated Capacity Analysis Report, dated May 2015, which was provided by the City and produced to estimate HFCWTP's future capacity needs.

Desktop modeling estimated the biogas production by first calculating theoretical secondary and primary sludge production prior to digestion, which was then calibrated to fit the existing sludge SCADA data from 2015 monthly averages. Biogas production was then estimated by using the modeled sludge production, historical sludge characteristics from 2015 (monthly averages), and industry standard gas production rates to generate a low and high estimated range of digester gas production. The estimates projected gas production from 2015 to 2035, which is summarized in Table 4.5.

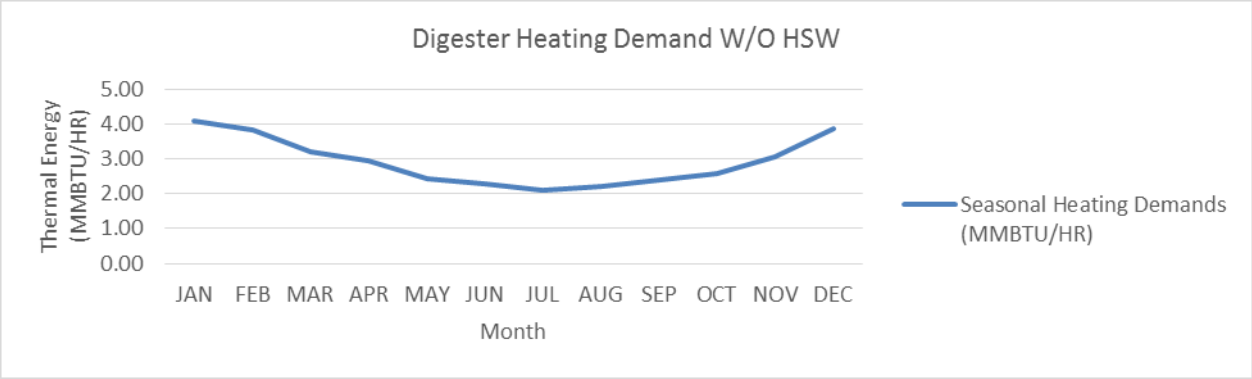
Table 4-5 – Biogas Production (Without HSW)

Year	Low (SCFM)	High (SCFM)	Average (SCFM)
2015	900	600	750
2016	913	609	761
2017	925	616	771
2018	936	624	780
2019	948	632	790
2020	960	640	800
2021	973	649	811
2022	985	656	820
2023	996	664	830
2024	1,008	672	840
2025	1,020	680	850
2026	1,027	684	856
2027	1,039	692	865
2028	1,050	700	875
2029	1,062	708	885
2030	1,074	716	895
2031	1,086	724	905
2032	1,098	732	915
2033	1,110	740	925
2034	1,122	748	935
2035	1,134	756	945

Biogas production is expected to increase ~1% per year. It is important to note that historical sludge production was used to calibrate the desktop model because the City does not currently measure gas production, and back calculation of the gas produced from engine consumption rates may be misleading due to flaring and system inefficiencies.

Digester heating requirements were estimated via desktop modeling. Heat losses were calculated by using standard heat transfer coefficients with digester characteristics that were identified in as-built information and collected during a site visit. Summer, winter, and extreme winter heating requirements were calculated with annual average and maximum month loadings to estimate a range for energy demand. The estimated seasonal heating demands for the current conditions are shown on Figure 4-33.

Figure 4-33 – Seasonal Digester Heating Demands



4.3.4 Current Biogas Utilization Benefit

The existing biogas fueled engines generates revenue by offsetting the plant's purchased electric energy and by providing thermal energy for digester heating. The City purchases electric energy from TECO under TECO's "Firm Standby and Supplemental Service Time-Of-Day" rate schedule. Under this schedule, the energy generated by the biogas fueled engines is metered separately and generates benefit by offsetting energy usage and demand charges during the on-peak and off-peak periods. The City staff performs a monthly "Cogeneration Analysis Report" to determine the actual revenue generated by the cogeneration system. Table 4.6 summarizes the City's cogeneration benefit analysis data for calendar year 2015.

Table 4-6 – 2015 Cogeneration System Benefit Analysis

Billing Month	Energy Used (kWh)	Energy Generated (kWh)	Energy Generated (%)	Utility Bill Savings ($)	Generated Energy Value (¢/kWh)	Estimated Demand (kW)	Average On-Peak Generation (kW)
Jan-2015	4,751,577	313,720	6.60%	$12,766.53	4.07 ¢/kWh	7,056	438
Feb-2015	4,386,189	299,309	6.82%	$12,432.72	4.15 ¢/kWh	7,015	450
Mar-2015	4,879,986	372,399	7.63%	$14,453.20	3.88 ¢/kWh	6,897	481
Apr-2015	4,463,178	354,949	7.95%	$15,417.93	4.34 ¢/kWh	6,792	499
May-2015	4,666,283	319,940	6.86%	$14,901.79	4.66 ¢/kWh	6,751	498
June-2015	4,956,602	716,459	14.45%	$15,894.47	2.22 ¢/kWh	6,755	497
July-2015	4,734,982	360,560	7.61%	$16,199.00	4.49 ¢/kWh	6,740	499
Aug-2015	5,365,220	349,019	6.51%	$16,104.75	4.61 ¢/kWh	6,728	453
Sept-2015	4,754,120	207,080	4.36%	$12,450.61	6.01 ¢/kWh	6,620	424
Octr-2015	4,561,923	370,800	8.13%	$18,748.50	5.06 ¢/kWh	6,550	481
Nov-2015	4,764,364	429,940	9.02%	$16,035.48	3.73 ¢/kWh	6,514	717
Dec-2015	4,654,699	443,520	9.53%	$19,409.60	4.38 ¢/kWh	12,983	875
Monthly Average:	**4,744,927**	**378,141**	**7.96%**	**$15,401.22**	**4.07 ¢/kWh**	**7,283**	**526**

Under current conditions, the average value of the energy generated by the cogeneration system is $0.0407/kWh which is significantly lower than the average cost of retail energy (~$0.0760/kWh). The

low benefit from the existing cogeneration can be attributed to the loss of demand charge offset from inconsistent operation of the existing engines. In addition to the loss of demand offset, the inconsistent engine operation also reduces the measured 12 month "normal generation" level which increases the metered supplemental demand resulting in higher overall energy costs.

During the year 2012, the HFC AWTP had 4 of the 5 cogenerates in operation and were able to consistently generate electric energy from the cogeneration system. An evaluation of the City's Cogeneration Analysis Report for the year 2012 shows an average benefit of $0.0720/kWh. The 2012 benefit increase can be attributed to the more consistent operations of the cogeneration engines

It is expected that the new engines will run more consistently than the 2015 operations of the existing engines, therefore, this study assumes $0.070 per KWH of electric energy offset by new cogeneration system engines. The thermal energy generated offsets the natural gas purchased for digester heating at the retail cost of ~$4.50/MMBTU.

4.3.5 Existing Air Permit and Cogeneration System Operations

To maintain compliance with the existing Title V air permit, the existing biogas fueled engines are limited to a total engine runtime of 12,700 hours/year. The City is in the process of renewing their air permit and stated that they are requesting the run time be increased to 17,520 hours. After a preliminary review of the existing air permit, it was noted that the existing TECO engines and dryer are listed as the primary source of emissions on the plant site. Since the TECO engines are not operable and will be removed in the near future, an adjustment to the permit could increase the allowable runtime for the biogas fueled engines which would increase the benefit from the biogas resource. This was discussed with the City's air permitting consultant (NOVA) and it was concluded that the TECO engines would likely be removed from the emissions inventory which would allow for increased runtime for the biogas fueled generators. For this study, it is assumed that allowable emission levels in the permit will be adjusted so that the cogeneration engines can fully utilize the available biogas.

4.3.6 Biogas Utilization Alternatives Evaluations

A review of the MWH report was completed by Hazen to better understand the utilization alternatives already evaluated as well as the exiting conditions and assumptions used in the study. Based on the review of the MWH report, Hazen has identified the following items included in the MWH report that warrant additional evaluations as a part of this biogas utilization study:

- **Re-evaluate the economic feasibility of the recommended CHP alternatives in the MWH report using updated energy cost data** - The MWH report assumed an economic benefit of $0.09/KWH (Table 6-1) for the electric energy generated by the CHP system. Hazen and Sawyer reviewed the 2014 thru 2015 electric utility billing data and concluded the average cost of energy was approximately $0.081/KWH which is well below the assumption used in the MWH report.
    - In addition, the MWH report also did not appear to account for the impact CHP system down time will have on the long term benefit from the electric energy offset benefit. As stated above, the realistic long term economic benefit for the electric energy generated will be approximately $0.070/KWH.

- Furthermore, the MWH report did not appear to account for the long term energy cost escalations projected by the Energy Information Administration (EIA). These escalations will have a significant impact on the life cycle benefit and economic feasibility and will be incorporated in this biogas utilization study to provide a realistic assessment of the economic benefit from the energy generated by the biogas fueled generators.

- **Further evaluate vehicle fleet fueling (rCNG)** – This option was not considered feasible by the MWH report due to the complex logistics and high gas treatment requirements. Given that the City of Tampa is currently developing a fleet of CNG capable vehicles (i.e. refuse trucks and busses) and CNG fueling stations, it is likely rCNG could be a viable biogas utilization alternative. With new developments in rCNG technology and markets for biogas derived CNG, the utilization strategy is gaining popularity in the water and wastewater industry. A conceptual level cost/benefit analysis for biogas as a vehicle fuel as included in this study to better understand the long term benefits compared to the other utilization alternatives.
- **Evaluate alternatives to re-furbish existing engines** – Alternatives that included refurbishing the existing Waukesha engines were not considered in the MWH report. Refurbishing the existing engines may result in a lower capital costs and O&M costs compared to new engines. As discussed herein, new engines use proprietary engine control systems that typically require factory technicians to troubleshoot and repair which could increase maintenance costs. The cost of refurbishing the existing engines will be compared to the long term life cycle costs/benefits of new engines. This analysis will include costs for all emissions treatment equipment required by the New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants.
- **Sensitivity to high/low market and growth conditions** – This study includes a sensitivity analysis to determine the impact high and low market conditions have on the 20 life cycle of the utilization alternatives so that a range of economic outcomes can be understood. This analysis will include sensitivity to high and low conditions for long term energy costs, biogas production, heating demands, and renewable energy markets.
- **Sensitivity to FOG/HSW co-digestion** –FOG/HSW (Fats Oils Grease/High Strength Waste) co-digestion will change the overall energy balance and economic feasibility of the biogas utilization alternatives. This study includes a sensitivity analysis to determine how the changes in biogas production and digester heating demands resulting from co-digesting FOG/HSW will impact the 20 life cycle of the biogas utilization alternatives.

After the review of the existing biogas utilization study and discussions with the City, it was determined the following biogas utilization alternatives are included in this study:

- **Alternative 0 – Flare all Biogas** – Alternative 0 assumes all biogas is flared and natural gas is purchased to provide digester heating.
- **Alternative 1 - Biogas to Boilers –** Utilize digester gas to provide digester heating and flare all unused gas.
- **Alternative 2a - Refurbish Existing Engines** - This alternative makes use of existing infrastructure by refurbishing the existing five 500 kW Waukesha CHP engines for re-use in lieu of purchasing new engines.

- **Alternative 2b - New CHP System Engines** – Remove the existing Waukesha engines and heat recovery equipment and install new engines furnished with engine jacket heat recovery.
- **Alternative 3 – Biogas to rCNG for Vehicle Fueling** – This alternative evaluates options to recover and condition/compress biogas to be used in the City's CNG capable vehicles.
- **Alternative 4 – Biogas to Dryers** – This alternative evaluates the costs/benefit from refurbishing the sludge dryers and using biogas to supplement the purchased natural gas to produce dried sludge pellets.

Receiving high strength organic waste (HSW) provides an additional source of readily biodegradable material that can increase biogas production. Current research indicates that HSW loading to digesters should range between 30 and 50% of the total volatile solids. A preliminary evaluation of the current digester loadings concluded that co-digesting HSW has the potential to increase digester gas production by approximately 25%. Based on Hazen's experience on previous HSW receiving projects, the acceptance of HSW would require a capital investment of $1,000,000 for a new HSW receiving facility and would increase the digester heating demands by ~15%. All utilization alternatives included in this study were modeled with and without co-digesting HSW to better understand if co-digesting HSW would result in a change in long term biogas utilization strategy. The paragraphs below include a detailed description of the utilization alternatives included in this study. It should be noted that this evaluation was based on mesophilic digestion.

4.3.6.1 Alternative 0 – Flare all biogas

Alternative 0 assumes all biogas is flared and natural gas is purchased to provide digester heating. The purpose of evaluating this alternative is to establish a "zero resource recovery" baseline to compare the revenue generation of the other biogas utilization alternatives. This alternative will eliminate the existing capital costs and O&M costs associated with biogas fueled engines and is the lowest capital cost scenario. The advantages, disadvantages and summary are described in Table 4.7.

Table 4-7 – Alternative 0 Summary

Summary	Advantages
• Remove all existing biogas fueled engines and appurtenances. • Remove existing gas treatment equipment. • Flare all biogas produced. • Purchase natural gas to meet heating demands.	• Lowest capital cost scenario • Lowest O&M cost scenario
	Disadvantages
	• No economic benefit from biogas energy recovery (all biogas flared)

4.3.6.2 Alternative 1 – Biogas Fueled Boilers

This alternative makes beneficial utilization of the biogas by fueling the existing boilers to provide digester heating. All unused biogas would be flared. This alternative eliminates the capital costs and O&M costs associated with biogas fueled engines. To prolong the life of the boiler, this scenario includes new biogas conditioning systems to remove sulfur compounds (H2S) and moisture. The advantages, disadvantages and summary are described in Table 4.8 below.

Table 4-8 – Alternative 1 Summary

Summary	Advantages
• Remove all existing biogas fueled engines and appurtenances. • Replace existing gas treatment equipment. • All digester heating demands provided by biogas fueled boilers with natural gas backup. • Digester heating offsets = ~$215,000/year in purchased natural gas savings	• Low capital costs • Low O&M costs • No purchased natural gas for digester heating • Less gas treatment required
	Disadvantages
	• Partial utilization of the biogas resource (majority of gas will be flared) • Moderate biogas treatment O&M costs for gas treatment equipment

4.3.6.3 Alternative 2 – Combined Heat and Power (CHP)

This alternative uses a biogas fueled engines to generate electric and thermal energy to offset the plant's energy demands. Two (2) CHP system alternatives are include:

- Alternative 2a - Refurbish the existing biogas fueled engines and heat recovery equipment
- Alternative 2b – Replace existing engines and heat recovery equipment.

Digester gas pretreatment equipment to remove hydrogen sulfide, moisture, and siloxanes will be included for all CHP alternatives examined in the analysis. The digester gas pretreatment equipment includes an iron-oxide based hydrogen sulfide removal system, chillers and condensate traps for moisture removal, and a fixed bed carbon media system to remove siloxanes compounds. Capital costs for the pretreatment system was the same for all CHP Alternatives estimated to be approximately $750,000. Digester gas pretreatment equipment O&M costs are included in the CHP system O&M costs and includes the time, labor, and materials for daily and media change-out operations and maintenance.

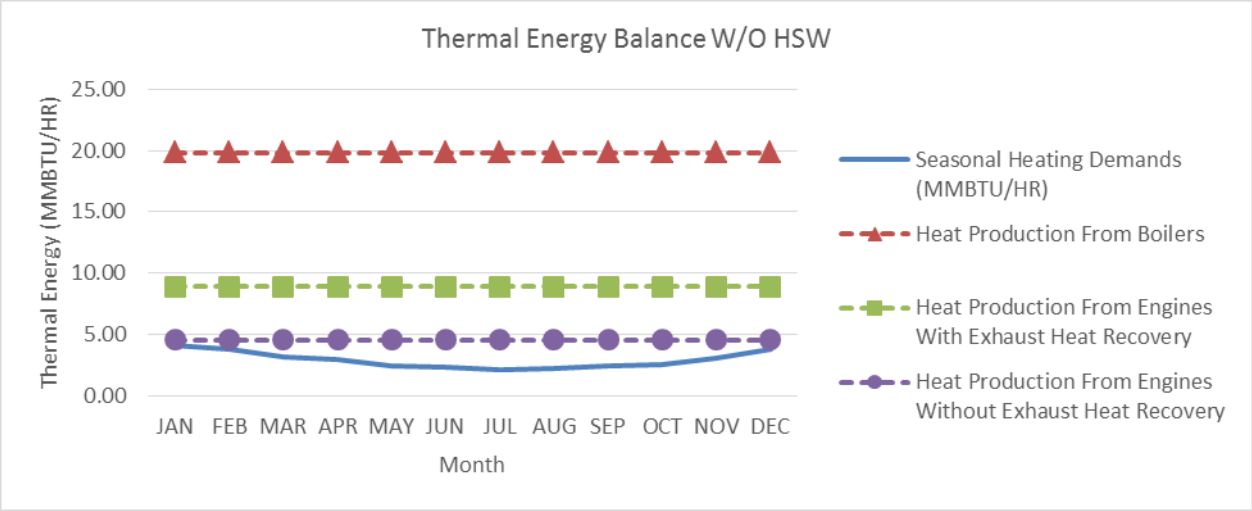
4.3.6.4 Alternative 2a – Refurbish Existing CHP Engines

This alternative refurbishes the existing five (5) 500 kW Waukesha CHP engines to like new condition. Refurbishing the existing engines will have lower capital costs, however the older engine technology is less efficient than modern engines. Engine No.1 would be replaced with a new unit if the damage to the engine block is too extensive to rebuild. Ancillary equipment associated with the existing engine system including heat recovery loop (pumps, heat exchangers, piping), digester gas trains, load sharing controls, and instrumentation and controls is assumed to all need replacement for the next phase of refurbished engine operations.

Based upon the existing average biogas production of 750 SCFM and an electrical efficiency of 30%, it is estimated that the existing engines would generate an average of 2000kW which would require 4 CHP units to operate at ~100% capacity. The fifth engine will be a standby unit for use while another engine is down to maintain production.

The existing CHP system recovers thermal energy for digester heating from the engine's cooling water jacked only. Based on the results of a digester heating evaluation, the thermal energy production from the engine cooling water jacket only should be sufficient to supply 100% of the digester heating demands during the warm weather months. A more detailed evaluation will be performed on the next phase of this biosolids master plan to determine if additional heat recovery is needed from the engine exhaust system to provide additional thermal energy to meet the digester heating demands. Figure 4-34 shows the estimated seasonal digester heating demands and the heat production capacity with and without exhaust heat recovery.

Figure 4-34 – CHP Thermal Energy Production



The costs of emissions treatment are included in this alternative if the cost of the engine re-builds exceeds 50% of the engine value per the EPA Subpart JJJJ and Subpart ZZZZ. The existing generator control switchgear is obsolete and will be upgraded with new generator control and load sharing control devices. The advantages, disadvantages and summary are described in Table 4.9 below.

Table 4-9 – Alternative 2a Summary

Summary	Advantages
• Refurbish all existing biogas fueled engines and heat recovery equipment. • Replace existing gas treatment equipment and generator control switchgear. • Replace existing boilers and other gas handling equipment near the end of its useful life. New boilers will have biogas and natural gas fueling capabilities. • Replace existing gas treatment equipment to remove siloxanes, sulfur compounds, and moisture. • Generate ~18,000,000 kWH/year of electric energy resulting in ~$1,200,000/year in electric energy savings. • Digester heating offsets = ~$215,000/year in purchased natural gas savings	• Lower capital cost compared to new engines • Plant staff already trained to perform engine repairs and troubleshooting on existing engines. • Existing engines do not utilize proprietary engine controls. • Established Technology
	Disadvantages
	• High level of biogas treatment to remove siloxanes, sulfur compounds, and moisture • Higher O&M costs compared to Alternatives 0 and 1. • Lower electrical efficiency compared to newer engines (30% vs. 35%). • Potential requirements for exhaust after treatment to meet EPA emission requirements for stationary internal combustion engines.

4.3.6.4.1 Alternative 2b – New Biogas Fueled Engines

This alternative removes the existing Waukesha engines and heat recovery equipment and installs new engines and heat recovery equipment. The new engines will operate at a higher electrical efficiency (~35%) than the existing engines (~30%) increasing the electric energy offset benefit.

Ancillary equipment associated with the existing engine system including heat recovery loop (pumps, heat exchangers, piping), digester gas trains, electrical generators, and instrumentation and controls is assumed to all need replacement.

Biogas production of 750 SCFM and an electrical efficiency of 35%, would provide an average of ~2500kW of electric power generation. This would support the installation of 2-1250kW – 1500kW units or 3-800kW to 3-1000kW rated engine/generator units. For the purposes of this evaluation, 2-1500kW engines are assumed. The next phase of this biosolids master plan will include a detailed evaluation of alternate engine sizes and quantities to identify the best value combination for the long term biosolids management strategies (i.e. THP, Mesophilic Digestion, Thermophilic Digestion, etc.).

Engines purchased after 2006 are required to meet the EPA's New Source Performance Standards (NSPS) emission requirements for the criteria pollutants such as carbon monoxide (CO), oxides of nitrogen (NOx) and oxides of sulfur (SOx). To meet the NSPS standards, new modern engines utilize turbo charging and intercooling as well as complex and proprietary engine control systems which require the engine supplier's certified technicians to troubleshoot and repair. This reliance on the engine supplier's support has the potential to increase the O&M costs and engine downtime between repairs

when compared to the City's ability to utilize plant staff to repair the existing engines. The advantages, disadvantages and summary are described in Table 4.10 below.

Table 4-10 – Alternative 2b Summary

Summary	Advantages
• Replace existing engines with new units. • Replace existing gas treatment equipment and generator control switchgear. • Replace existing gas treatment equipment to remove siloxanes, sulfur compounds, and moisture. • Replace existing boilers and other gas handling equipment near the end of its useful life. New boilers will have biogas and natural gas fueling capabilities. • Generate ~21,000,000 kWH/year of electric energy resulting in ~$1,500,000/year in electric energy savings. • Digester heating offsets = ~$215,000/year in purchased natural gas savings	• Higher electrical efficiency compared to the existing engines (35% vs. 30%). • New engines will meet the EPA's emission requirements for stationary internal combustion engines. • Established Technology **Disadvantages** • High level of biogas treatment to remove siloxanes, sulfur compounds, and moisture • Higher O&M costs compared to Alternatives 0 and 1. • Proprietary engine controls requires specialized manufacturer training and certifications to troubleshoot and repair engine problems. • EPA emission requirements results in more complex engine systems (i.e. turbo charging and intercooling, advanced engine controls).

4.3.6.5 Alternative 3 – rCNG Production for Vehicle Fueling

For this alternative, biogas will undergo advanced treatment and compression to produce renewable compressed natural gas (rCNG). The rCNG produced can be used in a number of applications including the following:

1. Fueling the City's CNG capable vehicle fleet such as refuse trucks to offset purchased liquid fuels (i.e. diesel and gasoline).
2. Selling the biogas rCNG to other agencies with CNG vehicles (such as the Hillsborough Area Regional Transient (HART) busses and vans) at the retail CNG prices.
3. Injecting the rCNG into the City's natural gas system.
4. Combination of 1-3 above.

Using the rCNG for vehicle fueling generates revenue by offsetting the City's purchased liquid fuels and/or CNG currently used for vehicle fueling. Fueling vehicles with rCNG also qualifies for the production of renewable transportation fuel credits known as "Renewable Identification Numbers" (RINs). RINs are tradable renewable fuel credits used for compliance with the EPA's "Renewable Fuel

Standards" (RFS2). Every gasoline gallon equivalent (GGE) of rCNG produced used for vehicle fueling qualifies as an "advanced biofuel" or "D5" RIN. The historical average price for D5 RINs is approximately $0.50/RIN or ~$6.00/MMBTU of biofuel produced (Average from September 2011 to June 2015). The production of the RINs provides an additional revenue stream for this alternative.

The evaluation of this alternative assumes biogas will be first used to meet digester heating demands with the remaining biogas used for rCNG production. The available biogas after digester heating will be sufficient to produce approximately 1,400,000 gasoline gallon equivalents (GGE) of rCNG per year. The economic feasibility for this alternative would be maximized if the City's CNG vehicle fleet could utilize all if the rCNG produced, however, at the time of this study it is assumed that the City's CNG capable fleet will support approximately 200,000 GGE per year. This would be enough rCNG to fuel approximately 25 refuse trucks for one year. The city's refuse collection division currently uses 238 refuse vehicles. At the time of this report, 22 refuse vehicles are CNG capable refuse vehicles and plans are in place to replace an additional 19 existing diesel refuse vehicles with new CNG capable units.

The rCNG would be stored on site and delivered to new and/or existing CNG vehicle fueling facilities using DOT approved CNG transport vessels. The City already owns and operates multiple CNG refuse trucks and a CNG fueling station which could significantly increase the feasibility of this alternative. Economic benefit for this alternative can also be realized by conditioning the biogas to pipeline quality and injecting the biogas into the City's natural gas supply system or by selling rCNG to outside customers at the retail CNG rate.

The capital costs for this alternative assumes all new rCNG storage and dispensing facilities which accounts for approximately $4,500,000 of the total cost for this alternative. It is possible that a significant part of this cost can be avoided for this alternative if the existing City owned CNG fueling stations and storage units can be used for the rCNG produced at the HFCAWTP. However, at the time of this report a detailed study of the City's CNG storage dispensing system has not been completed, therefore, the full cost of new rCNG storage and dispensing facilities are assumed in the capital cost estimates. A study of the City's CNG facilities is recommended if the City wishes to explore the alternative in further detail. The advantages, disadvantages and summary are described in Table 4.11 below.

Table 4-11 – Alternative 3 Summary

Summary	Advantages
• Remove all biogas fueled engines and heat recovery equipment • Install new biogas to rCNG treatment, compression, storage, transport, and dispensing equipment • Use biogas to provide digester heating. • Remaining biogas after digester heating is converted to rCNG for vehicle fueling. • Replace existing boilers and other gas handling equipment near the end of its useful life. New boilers will have biogas and natural gas fueling capabilities. • rCNG not used for vehicle fueling is sold at CNG retail pricing. • Digester heating offsets = ~$215,000/year in purchased natural gas savings • Offset ~200,000 gallons of purchased fuel = ~$418,000/Yr in purchased fuel savings • Sales of ~135,000 MMBTU/Yr of CNG = ~$1,200,000/Yr in revenue • RIN sales at $6.00/MMBTU = ~$940,000/Yr in revenue	• Higher benefit potential by offsetting purchased liquid fuels and by generating RIN credits. • City already has CNG capable vehicles and CNG dispensing • Vehicle fuel is used off-site and does not contribute to the plant's emissions inventory
	Disadvantages
	• Emerging technology • Long term benefit dependent on strength and stability of the RIN market • rCNG fuel storage, transport, and vehicle fueling logistics has the potential to be complex and labor intensive

4.3.7 Biogas to Dryers

The HFC AWTP currently has a rotary drum drying system that uses two natural gas fueled drying trains. The existing dryers are currently not in use and are in need of repair. An assessment performed by Hazen determined that an investment of approximately $9.0M would be needed to return the existing dryers to working order. An evaluation of using biogas to partially fuel the sludge drying system was performed to determine if the reduction in natural gas usage and sludge hauling costs would underwrite the capital expense of repairing the sludge drying system. A revenue stream of $25/dry ton for the sales of the dry sludge was also included in this evaluation. In addition, revenue would also be realized from the avoided costs of hauling dewatered sludge. This evaluation assumes the existing belt filter presses will be replaced with centrifuges and the dryer rehabilitation will include the addition of a dryer exhaust heat recovery system to increase the thermal efficiency of the system. It was assumed that the unused biogas after digester heating would be used for sludge drying.

Table 4-12 – Alternative 4 Summary

Summary	Advantages
• Remove all biogas fueled engines and heat recovery equipment • Biogas not used for digester heating will be combusted in the sludge dryers • Replace existing gas treatment equipment for biogas used for digester heating only • Replace existing boilers and other gas handling equipment near the end of its useful life. New boilers will have biogas and natural gas fueling capabilities. • Digester heating offsets = ~$215,000/year in purchased natural gas savings • Dried pellet sales = ~$292,000/year • Avoided Hauling Costs = ~$1,225,000/year	• Sludge hauling costs reduction • Revenue stream from the sales of dried sludge pellets. • Revenue from avoided hauling costs • Low biogas treatment requirements **Disadvantages** • High capital costs to refurbish the dryer system • High Dryer O&M costs ($1.7M/Yr) • High site emissions

4.3.8 Economic Evaluation

The biogas utilization feasibility evaluations were performed using Hazen's Energy Balance & Analysis Tool (EBAT). EBAT is an energy analysis & modeling tool that models the complex relationship between energy production, energy demands & energy costs to provide accurate long term cost/benefit assessments for multiple biogas utilization alternatives. The EBAT model was used to generate a 20 year Life Cycle Cost/Benefit Analysis (LCA) for each of the biogas utilization alternatives. The 20 year LCA incorporates capital cost debt service, the energy savings, and the O&M costs to calculate the true 20 year life cycle cost/benefit for each alternative. The EBAT model calculates 20 year life cycle costs for current market conditions as well as high and low market conditions so the full range of economic outcomes for the biogas utilization alternatives can be understood. Also, all utilization alternatives included in this study were modeled with and without co-digesting HSW to better understand if co-digesting HSW would result in a change in long term biogas utilization strategy.

The EBAT model calculates all costs/revenues for the year the cost was incurred (nominal dollars) over the 20 year life cycle. To simplify the 20 year lifecycle costs and to be consistent with previous studies, the revenue and cost data shown herein are shown in terms of "annualized" costs. The annualized costs represents the net present value of the 20 year lifecycle costs as an annual cost expressed in present day dollars (net present value) over a 20 year amortization period.

The assumptions used for the life cycle cost/benefit analysis are summarized in Table 4.13 below.

Table 4-13 - Assumption of Life Cycle Costs Benefit Analysis

	Base Conditions	High Market	Low Market	Units
Energy Costs				
Purchased Energy Costs (Annual Average)	$0.081	$0.081	$0.081	$/KWH
Purchased Energy Costs (Annual Average)	$23.74	$23.74	$23.74	$/MMBTU
Recovered Elec Energy Benefit (Annual Average)	$0.070	$0.070	$0.070	$/KWH
Recovered Elec Energy Benefit (Annual Average)	$20.52	$20.52	$20.52	$/MMBTU
Electricity Cost Escalation (Nominal)	2.0%	2.5%	1.5%	
Natural Gas Costs	$4.80	$4.80	$4.80	$/MMBTU
Natural Gas Cost Escalation (Nominal)	2.5%	3.0%	2.0%	
Renewable Energy Credit Benefit	$0.00	$0.00	$0.00	$/KWH
RIN Benefit	$6.00	$6.50	$5.00	$/MMBTU
Retail CNG	$9.00	$9.50	$8.50	$/MMBTU
Retail CNG (GGE Equivalent)	$0.99	$1.05	$0.94	$/Gal
Fuel Costs (Gas and Diesel)	$19.00	$19.00	$19.00	$/MMBTU
Fuel Costs (Gas and Diesel)	$2.09	$2.09	$2.09	$/Gal
Fuel Cost Escalation (Nominal)	3.0%	3.5%	2.0%	
Digester Gas Production				
Digester Gas Production W/O HSW	750	750	750	SCFM
Digester Gas Production W/ HSW	938	938	938	SCFM
Digester Gas Production Escalation	1.0%	1.1%	0.9%	
Digester Gas BTU Content	550	550	550	BTU/SCF
Boilers				
Boiler Efficiency	80%	80%	80%	
Boiler and Gas Treatment O&M	$0.50	$0.50	$0.50	$/MMBTU
CHP				
CHP Electrical Generation Efficiency (new engines)	35%	35%	35%	
CHP Thermal Efficiency (new engines water jacket only)	20%	20%	20%	
CHP Electrical Generation Efficiency (existing engines)	30%	30%	30%	
CHP Thermal Efficiency (existing engines water jacket only)	20%	20%	20%	
CHP O&M	$0.025	$0.025	$0.025	$/KWH
CHP O&M	$7.33	$7.33	$7.33	$/MMBTU
CHP Unit Availability	95%	95%	95%	
rCNG				
CNG Conversion Efficiency	85%	85%	85%	
CNG O&M	$2.00	$2.00	$2.00	$/MMBTU
CNG Vehicle Fuel Demand Escalation	2.0%	3.0%	1.0%	
Financials				
General Inflation	2.5%	2.5%	2.5%	
Cost of Capital (Interest Rate)	4.0%	4.0%	4.0%	

4.3.9 Estimated Capital Costs

Conceptual level capital cost estimates were developed for each alternative. The cost estimates include the costs for the major equipment and the supporting equipment and infrastructure. The capital costs include 20% contingencies and 15% for engineering. The additional facilities required to co-digest high strength waste are also included for the HSW scenarios. Table 4.14 shows the conceptual capital cost estimates for each of alternatives evaluated. A break-down of the capital costs are shown in **Appendix H** . The annualized capital costs represents the annual debt service at a 5% interest rate over a 20 year period in present day dollars.

Table 4-14 –Conceptual Level Capital Costs

Alternative	Capital Costs Without HSW	Capital Costs With HSW	Annualized Capital Costs Without HSW	Annualized Capital Costs With HSW
Alt 0 (Flare all Biogas)	$0	($1,000,000)	$0	($80,000)
Alt 1 (Biogas to Boilers)	($1,123,000)	($2,123,000)	($90,000)	($170,000)
Alt 2a (CHP w/ Refurbished Engines)	($4,225,000)	($5,225,000)	($310,000)	($384,000)
Alt 2b (CHP w/ new Engines)	($6,500,000)	($7,500,000)	($480,000)	($550,000)
Alt 3 (rCNG)	($14,677,000)	($15,677,000)	($1,080,000)	($1,153,000)
Alt 4 (Sludge Drying)	($8,941,000)	($9,941,000)	($717,000)	($797,000)

4.3.10 Operation and Maintenance (O&M) Costs

The operation and maintenance costs for each alternative include the labor, materials, and energy costs. The O&M costs were calculated using typical costs per unit of energy produced or consumed for the major equipment used in each alternative. The O&M costs are based on typical industry accepted costs as well as data provided by the City and data collected by Hazen for similar systems on other projects. The assumed O&M costs are summarized in Table 4.15.

Table 4-15 – O&M Costs

Equipment	O&M Costs	Notes
Digester Heating Boiler Operation	$0.50/MMBTU Produced	Includes biogas H2S and Moisture Treatment
CHP Engine Operation	$0.025/KWH Generated	Based on data collected from similar CHP systems. Includes heat recovery equipment & gas treatment
Biogas Treatment System	$50,000/Year	Data from MWH Report
rCNG Operation	$2.00/MMBTU Produced	Data from industry white papers
Parasitic Loads	$0.076/KWH used	Retail cost of electric energy

O&M costs for the current CHP system operation for years 2014 and 2015 was provided by City and was evaluated to confirm the existing CHP system O&M costs did not exceed the O&M costs included in the study. The data provided by the City shows an average CHP system O&M costs of $0.018/KWH which did not include the O&M for the gas treatment facilities.

The O&M costs were escalated over the 20 year life cycle at the rate of inflation to account for increases in labor rates, cost of materials and cost of energy. The annualized O&M costs for each alternative are summarized in Table 4.16 below. The annualized O&M costs represents the annual costs over a 20 year period in present day dollars.

Table 4-16 – Estimated O&M Costs (Base Conditions)

Alternative	Annualized O&M Costs Without HSW	Annualized O&M Costs With HSW
Alt 0 (Flare all Biogas)	($233,000)	($268,000)
Alt 1 (Biogas to Boilers)	($18,000)	($21,000)
Alt 2a (CHP w/ Refurbished Engines)	($629,000)	($660,000)
Alt 2b (CHP w/ new Engines)	($738,000)	($925,000)
Alt 3 (rCNG)	($961,000)	($1,215,000)
Alt 4 (Sludge Drying)	($1,850,000)	($2,051,000)

4.3.11 Net Operating Costs

The Net Operating Costs (NOC) accounts for the actual operating costs or "cash flow" for each alternative. The NOC includes the capital cost debt service, purchased energy costs, energy production revenue, and O&M costs over a 20 year life cycle.

It should be noted that the NOC represents the estimated operating costs for each scenario. The net revenue generation can be determined from the relative differences between the NOC for each scenario and the base case NOC (Base Case = Alternative 0). For reference Table 4.17 also includes the annualized revenue for each alternative using Alternative 0 as the base case.

Table 4-17 – Net Operating Costs and Revenue Generation (Base Conditions)

Alternative	Annualized NOC Without HSW	Annualized NOC With HSW	Annualized Revenue Without HSW	Annualized Net Revenue With HSW
Alt 0 (Flare all Biogas)	($232,000)	($341,000)	$0	$0
Alt 1 (Biogas to Boilers)	($100,000)	($176,000)	$132,000	$164,000
Alt 2a (CHP w/ Refurbished Engines)	$734,000	$714,000	$967,000	$1,055,000
Alt 2b (CHP w/ new Engines)	$752,000	$989,000	$985,000	$1,331,000
Alt 3 (rCNG)	$1,642,000	$2,217,000	$1,875,000	$2,558,000
Alt 4 (Sludge Drying)	($989,000)	($979,000)	($756,000)	($638,000)

4.3.12 Study Results

Figure 4-35 summarizes the annualized net operating costs for each alternative with and without co-digesting high strength waste. The study results show that the Alternative 2 (CHP) and Alternative 3 (Vehicle Fueling/rCNG) are the only two alternative that show a net positive operating cash flow.

Figure 4-35 – Annualized Net Operating Costs (Base Conditions)

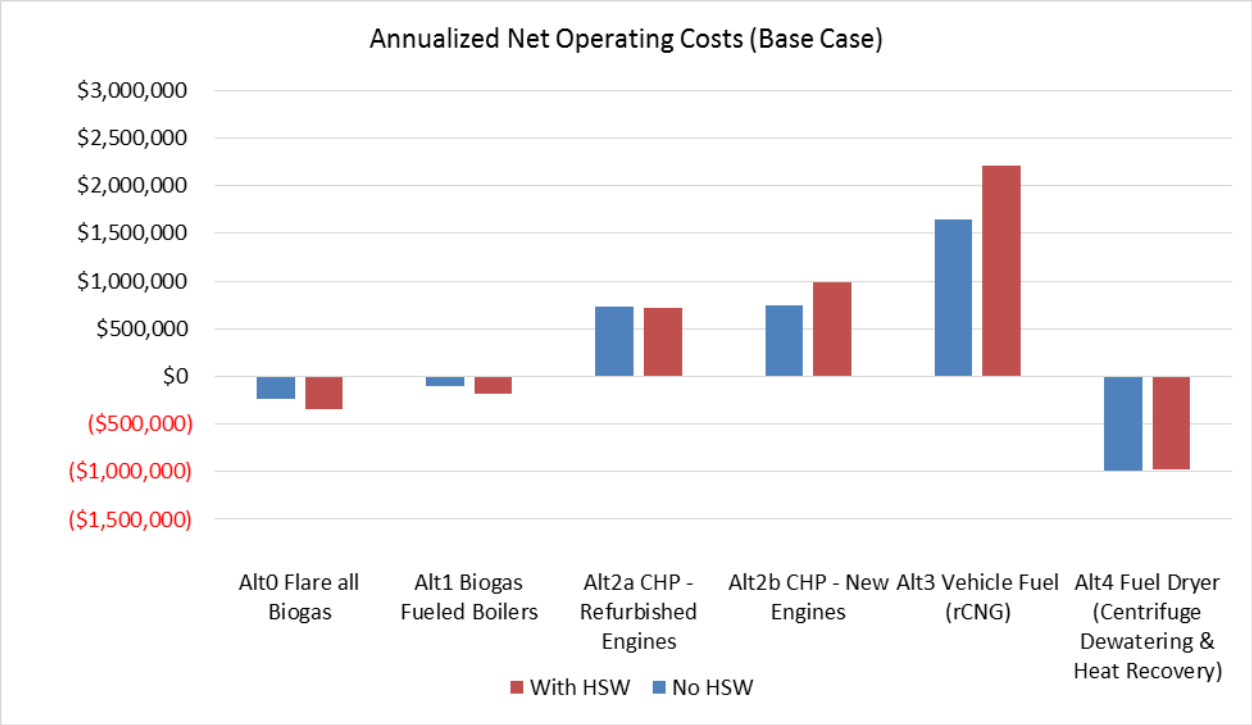


Figure 4-36 and Figure 4-37 below summarizes the sensitivity to the high and low market conditions for each alternative without and with co-digesting high strength waste.

Figure 4-36 – Sensitivity to High and Low Market Conditions (w/o HSW)

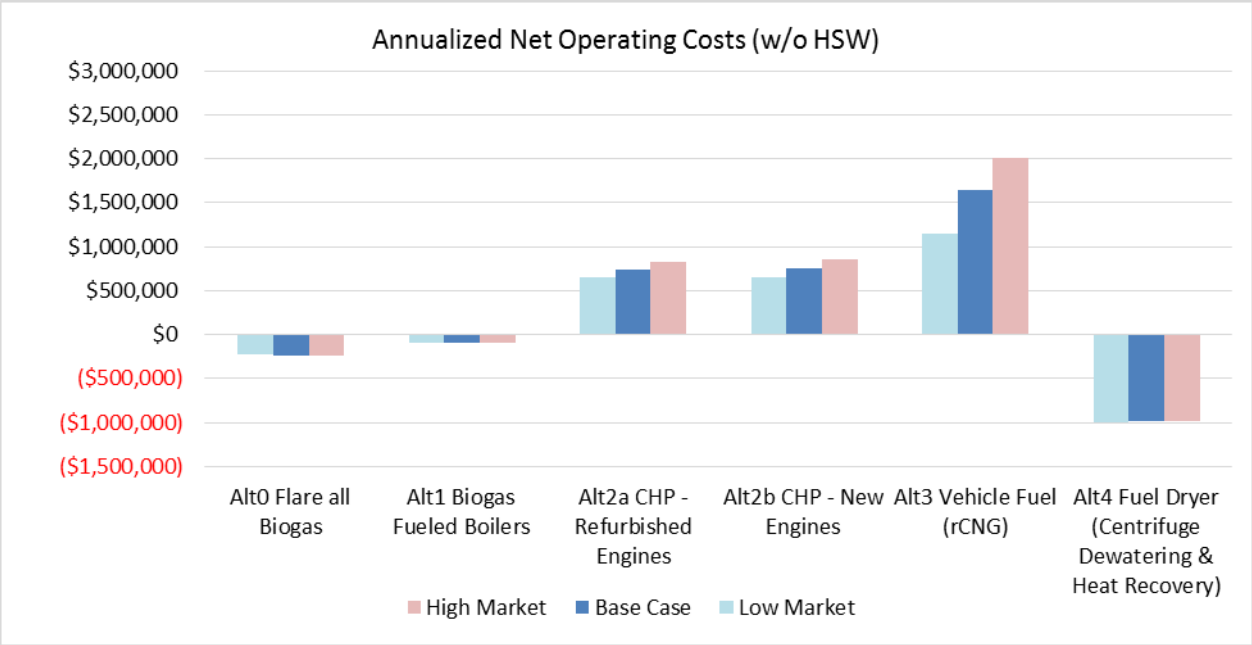
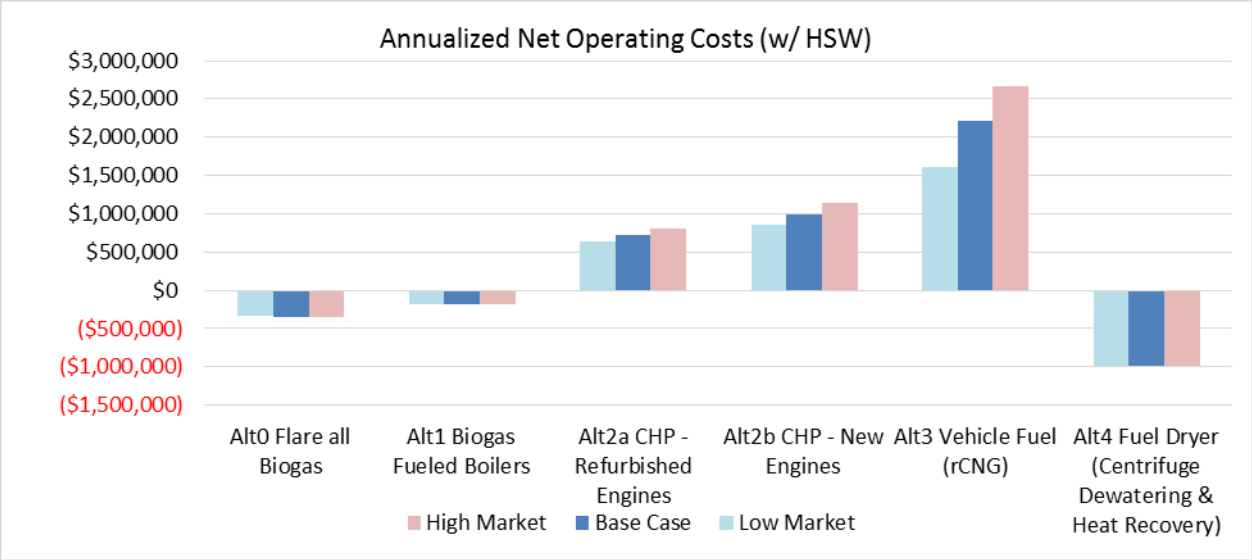


Figure 4-37 – Sensitivity to High and Low Market Conditions (w/ HSW)



4.3.12.1 Alternative 0 Cost/Benefit Analysis

The annualized cost/benefits for Alternative 0 are shown on Table 4.18

Table 4-18 – Alternative 0 Annualized Cost/Benefit Summary

	Without HSW			With HSW		
Alt 0 Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case w/ HSW**	**High Market w/ HSW**	**Low Market w/ HSW**
Boiler O&M	($17,000)	($18,000)	($17,000)	($20,000)	($20,000)	($20,000)
Purchased NG Costs	($215,000)	($228,000)	($202,000)	($247,000)	($262,000)	($232,000)
Alt 0 Capital Cost Debt Service	$0	$0	$0	($73,000)	($73,000)	($73,000)
Alt 0 Net Operating Cost	($232,000)	($246,000)	($220,000)	($341,000)	($357,000)	($326,000)
Alt 0 Net Revenue from Baseline Conditions	$0	$0	$0	$0	$0	$0

Alternative 0 returns a net 20 year lifecycle loss primarily due to the biogas resource not being recovered to offset the purchased natural gas. The increased biogas production from co-digesting HSW does not provided energy savings or revenue generation benefit. The benefit for the HSW scenario slightly decreased the net benefit since co-digesting HSW increased digester heating demands which increased the boiler O&M costs.

Alternative 1 Cost/Benefit Analysis

The annualized cost/benefits for Alternative 1 are shown on Table 4.19

Table 4-19 – Alternative 1 Annualized Cost/Benefit Summary

	Without HSW			With HSW		
Alt 1 Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case**	**High Market**	**Low Market**
Boiler O&M	($18,028)	($18,209)	($17,850)	($20,733)	($20,940)	($20,528)
Purchased NG Costs	$0	$0	$0	$0	$0	$0
Alt 1 Capital Cost Debt Service	($90,183)	($90,183)	($90,183)	($170,425)	($170,425)	($170,425)
Alt 1 Net Operating Cost	($108,211)	($108,391)	($108,033)	($191,158)	($191,365)	($190,953)
Alt 1 Net Revenue from Baseline Conditions	$126,158	$139,376	$113,883	$158,609	$173,810	$144,493

Alternative 1 improves the net operating cost by eliminating purchasing natural gas for digester heating. The capital costs includes modifications to the gas handling infrastructure and gas treatment to remove compounds of sulfur (H2S) and moisture. The increased biogas production from co-digesting HSW does not provided energy savings or revenue generation benefit since the current biogas production rate will meet the seasonal heating demands. The added capital costs for HSW receiving facilities and the added boiler O&M costs from the increased heating demands reduce the overall annualized operating costs compared to the no HSW scenario.

4.3.12.2 Alternative 2a and 2b Cost/Benefit Analysis

The annualized cost/benefits for Alternative 2a and 2b are shown on Table 4.20.

Table 4-20 – Alternative 2a & 2b Annualized Cost/Benefit Summary

	Without HSW			With HSW		
Alt 2a Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case**	**High Market**	**Low Market**
Boiler O&M	$0	$0	$0	$0	$0	$0
Purchased NG Costs	$0	$0	$0	$0	$0	$0
CHP O&M	($628,000)	($630,000)	($624,000)	($659,000)	($659,000)	($659,000)
Offset Purchased Power Revenue	$1,673,000	$1,766,000	$1,583,000	$1,757,000	$1,845,000	$1,675,000
REC Revenue	$0	$0	$0	$0	$0	$0
Alt 2a Capital Cost Debt Service	($310,000)	($310,000)	($310,000)	($384,000)	($384,000)	($384,000)
Alt 2a Net Operating Cost	$734,000	$824,000	$648,000	$714,000	$801,000	$631,000
Alt 2a Net Revenue from Baseline Conditions	$967,000	$1,071,000	$868,000	$1,055,000	$1,159,000	$958,000

	Without HSW			With HSW		
Alt 2b Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case**	**High Market**	**Low Market**
Boiler O&M	$0	$0	$0	$0	$0	$0
Purchased NG Costs	$0	$0	$0	$0	$0	$0
CHP O&M	($737,000)	($742,000)	($731,000)	($924,000)	($934,000)	($915,000)
Offset Purchased Power Revenue	$1,964,000	$2,078,000	$1,855,000	$2,463,000	$2,616,000	$2,320,000
REC Revenue	$0	$0	$0	$0	$0	$0
Alt 2b Capital Cost Debt Service	($474,000)	($474,000)	($474,000)	($548,000)	($548,000)	($548,000)
Alt 2b Net Operating Cost	$752,000	$861,000	$648,000	$989,000	$1,133,000	$856,000
Alt 2b Net Revenue from Baseline Conditions	$985,000	$1,108,000	$868,000	$1,331,000	$1,491,000	$1,183,000

The annualized operating costs for Alternative 2 provides a mostly positive annual cash flow and should be investigated further in the next phase of the biosolids master plan. Scenarios 2a and 2b have similar annualized net operating costs and should be investigated in more detail in the next phase of the biosolids master plan development. Refurbishing the existing engines will likely be a lower overall capital costs and will also may result in lower O&M costs. New engines will have a higher electrical efficiency resulting in more energy production, however, the overall O&M costs may be higher. New engines are required to meet the requirements of the EPA New Source Performance Standards (NSPS) for Stationary Internal Combustion Engines (Subpart JJJJ). To meet these requirements, modern engines use "lean burn" technology, turbocharging, and higher speed operation (i.e. 1800RPM vs 900RPM) to reduce the emissions and increase efficiency. While modern engine are 5%-10% more efficient, the mandated reduction in emissions requires complex and proprietary engine controls that operate the engine to very tight operating parameters. The combination or higher engine speed, higher pressures from turbocharging, and tight engine operation parameters results in a very low tolerance to changes in biogas quality and/or minor buildup of siloxane in the combustion chambers compared to the existing "rich burn" engines. Based on Hazen's experience and discussions with stationary engine manufacturers, the O&M costs for modern lean burn, EPA rated engines will likely be higher than the older technology for the following reasons:

- Lean burn engines require more frequent calibration to meet emission limits.
- Engine calibrations require changes to proprietary engine controls which have to be performed by a factory trained technician.
- Complexities from turbocharging and charge air intercooling add to the O&M costs.
- Modern engines are very susceptible to fuel pre-ignition or "knock" due to the higher engine pressures and speed. This results in more frequent engine internal cleaning costs and downtime.

The O&M costs for the new engines and gas cleaning system in Alternative 2a and 2b described herein are assumed to be $0.025/KWH. This O&M cost is based on historical O&M costs from wastewater utilities who own and operate modern "lean burn" EPA rated biogas fueled engines and data from

engine manufacturers. Based on the O&M data provided by the City and the data in the MWH report, the historical O&M costs for the existing engines is approximately $0.018/KWH

Increasing the gas production by 25% from co-digesting HSW increases the revenue generated for both scenarios. A 25% increase in biogas production would supply enough biogas to generate ~2300kW of electric power which exceeds the maximum output from the existing engines (2000kW max) thus limiting the HSW benefit under Alternative 2a.

4.3.12.3 Alternative 3 Cost/Benefit Analysis

The annualized cost/benefits for Alternative 3 are shown on Table 4.21

Table 4-21 – Alternative 3 Annualized Cost/Benefit Summary

	Without HSW			With HSW		
Alt 3 Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case**	**High Market**	**Low Market**
Purchased NG Costs	$0	$0	$0	$0	$0	$0
Boiler O&M	($22,000)	($22,000)	($22,000)	($25,000)	($26,000)	($25,000)
Vehicle rCNG Utilization Revenue	$617,000	$723,000	$530,000	$617,000	$723,000	$530,000
Vehicle rCNG Sales Revenue	$1,675,000	$1,753,000	$1,591,000	$2,205,000	$2,318,000	$2,087,000
Parasitic Loads ($)	($497,000)	($528,000)	($468,000)	($630,000)	($669,000)	($594,000)
CNG O&M	($440,000)	($445,000)	($436,000)	($558,000)	($564,000)	($552,000)
RIN Revenue	$1,390,000	$1,602,000	$1,037,000	$1,762,000	$2,031,000	$1,314,000
Alt 3 Capital Cost Debt Service	($1,080,000)	($1,080,000)	($1,080,000)	($1,153,000)	($1,153,000)	($1,153,000)
Alt 3 Net Operating Cost	$1,642,000	$2,003,000	$1,152,000	$2,217,000	$2,659,000	$1,606,000
Alt 3 Net Revenue from Baseline Conditions	$1,875,000	$2,249,000	$1,372,000	$2,558,000	$3,016,000	$1,933,000

Alternative 3 has the highest benefit potential of all of the alternatives included in the study. The primary reason for this is the combination of offsetting liquid fuels and CNG results in a higher value energy source than offsetting electric energy and natural gas (see Table 4-22). In addition, producing vehicle fuels decouples the digester heating process and energy production process allowing for a more efficient utilization of the biogas resource (80% vs 49%). Table 4.22 shows a comparison of the net energy offset benefit between the CHP alternatives the rCNG alternative.

Table 4-22 – Net Energy Offset Benefit Summary

Energy Source	Alt 2 (CHP)	Alt 3 (rCNG
Biogas Energy Available (MMBTU)	216691	216691
Electric Energy Offset (MMBTU)	53502	0
Natural Gas (MMBTU)	31926	31926
Liquid Fuels (MMBTU)	0	22000
CNG (MMBTU)	0	135050
Unused Energy (MMBTU)	131263	27715
Biogas Utilization Efficiency (%)	49%	80%
Net Energy Offset Benefit ($/MMBTU)	$6.08	$7.70

The production of RIN credits further enhances the revenue generated by Alternative 3. At the time of this report, the expected long term value for the RINs is $6.00/MMBTU for the base case and $6.50/MMBTU and $5.00/MMBTU for high and low market conditions respectively. It should be noted that the RIN and liquid fuels markets has historically shown a higher level of volatility than other energy sources

4.3.12.4 Alternative 4 Cost/Benefit Analysis

The annualized cost/benefits for Alternative 4 are shown on Table 4.23

Table 4-23 – Alternative 4 Annualized Cost/Benefit Summary

	Without HSW			With HSW		
Alt 4 Annualized Operating Costs	**Base Case**	**High Market**	**Low Market**	**Base Case**	**High Market**	**Low Market**
Purchased NG Costs	($138,000)	($132,000)	($144,000)	($19,000)	($18,000)	($21,000)
Boiler O&M	($17,000)	($18,000)	($17,000)	($20,000)	($20,000)	($20,000)
Dryer O&M	($1,692,000)	($1,692,000)	($1,692,000)	($2,010,000)	($2,010,000)	($2,010,000)
Avoided Hauling Costs	$1,225,000	$1,225,000	$1,225,000	$1,455,000	$1,455,000	$1,455,000
Dried Sludge Sales	$291,000	$291,000	$291,000	$346,000	$346,000	$346,000
Alt 4 Capital Cost Debt Service	($657,000)	($657,000)	($657,000)	($731,000)	($731,000)	($731,000)
Alt 4 Net Operating Cost	($989,000)	($983,000)	($995,000)	($979,000)	($978,000)	($981,000)
Alt 4 Net Revenue from Baseline Conditions	($756,000)	($736,000)	($774,000)	($638,000)	($621,000)	($654,000)

Alternative 4 has the lowest benefit potential of all of the alternatives included in the study. The high cost to rehabilitate the existing drying system ($9.0M), the high O&M costs ($145/Dry ton), and the high amount of purchased natural gas far exceed the benefit of the avoided hauling cost, dried sludge sales, and utilization of the biogas. Rehabilitating the dryers for the purposes of digester gas utilization is not an economically feasible alternative.

4.3.13 Summary and Recommendations

This study concludes that the CHP (Alternative 2) and rCNG (Alternative 3) biogas utilization strategies have the highest benefit potential. Alternative 1 (biogas to boilers) does not return a positive net operating cost, however, the low capital cost may make this alternative viable for the biosolids management alternatives developed in the next phase of this master plan.

Table 4.24 below summarizes the capital costs, O&M costs, revenue generation, and net operating costs of alternatives using the base case scenarios without co-digesting HSW.

Table 4-24 – Net Energy Offset Benefit Summary

	Capital Costs	Annualized Capital Costs	Annualized O&M Costs	Annualized Revenue Generation	Annualized Net Operating Cost	Annualized Revenue (Relative to Alt 0 Baseline)
Alt 0 (Flare all Biogas)	$0	$0	($232,000)	$0	($232,000)	$0
Alt 1 (Biogas to Boilers)	($1,123,000)	($82,000)	($17,000)	$0	($100,000)	$132,000
Alt 2a (CHP w/ Refurbished Engines)	($6,452,000)	($310,000)	($628,000)	$1,673,000	$734,000	$966,000
Alt 2b (CHP w/ new Engines)	($4,224,000)	($474,000)	($737,000)	$1,964,000	$752,000	$984,000
Alt 3 (rCNG)	($14,677,000)	($1,080,000)	($960,000)	$3,683,000	$1,642,000	$1,874,000
Alt 4 (Sludge Drying)	($8,941,000)	($657,000)	($1,849,000)	$1,517,000	($989,000)	($757,000)

This biogas utilization study confirms that Alternatives 1, 2 and 3 utilization strategies should be evaluated in detail with the biosolids management alternatives developed in the next phase of the biosolids master plan. The next phase of the biosolids master plan will investigate biosolids management alternatives that will incorporate different size and quantity of digesters and processes such as thermal hydrolysis (THP) and temperature phased anaerobic digestion (TPAD) that will all have unique energy balance and energy demand requirements. The cost/benefit analysis for the recommended biogas utilization alternatives will be re-evaluated with the evaluated biosolids management strategies in the next phase to identify the best value biogas utilization and biosolids management strategies. The next phase of the biogas utilization study will also investigate the following evaluations to identify opportunities to further increase the value gained from utilizing the HFCAWTP's biogas resource:

- Explore alternate rates from TECO that may better match the biogas utilization strategy and reduce the overall energy cost.
- Explore selling energy generated on-site directly to TECO under a separate PPA agreement in lieu of the existing energy offset under the supplemental TOU billing rate.
- Explore the feasibility of Organic Rankine Cycle Engines to generate electric energy from biogas.

- Perform process modeling to get a more accurate biogas production projections and identify the optimal biogas fueled engine size and combination for Alternative 2.
- Further explore opportunities to increase the benefit from Alternative 3 by integrating rCNG production with the City's existing CNG fueling infrastructure and vehicle fleets.
- Explore phased implementation solutions that evaluates a combination of biogas utilization alternatives and implementation timing that provide the best overall value utilization and implementation strategy.

4.4 Sludge Dewatering and Drying

4.4.1 Purpose and Description

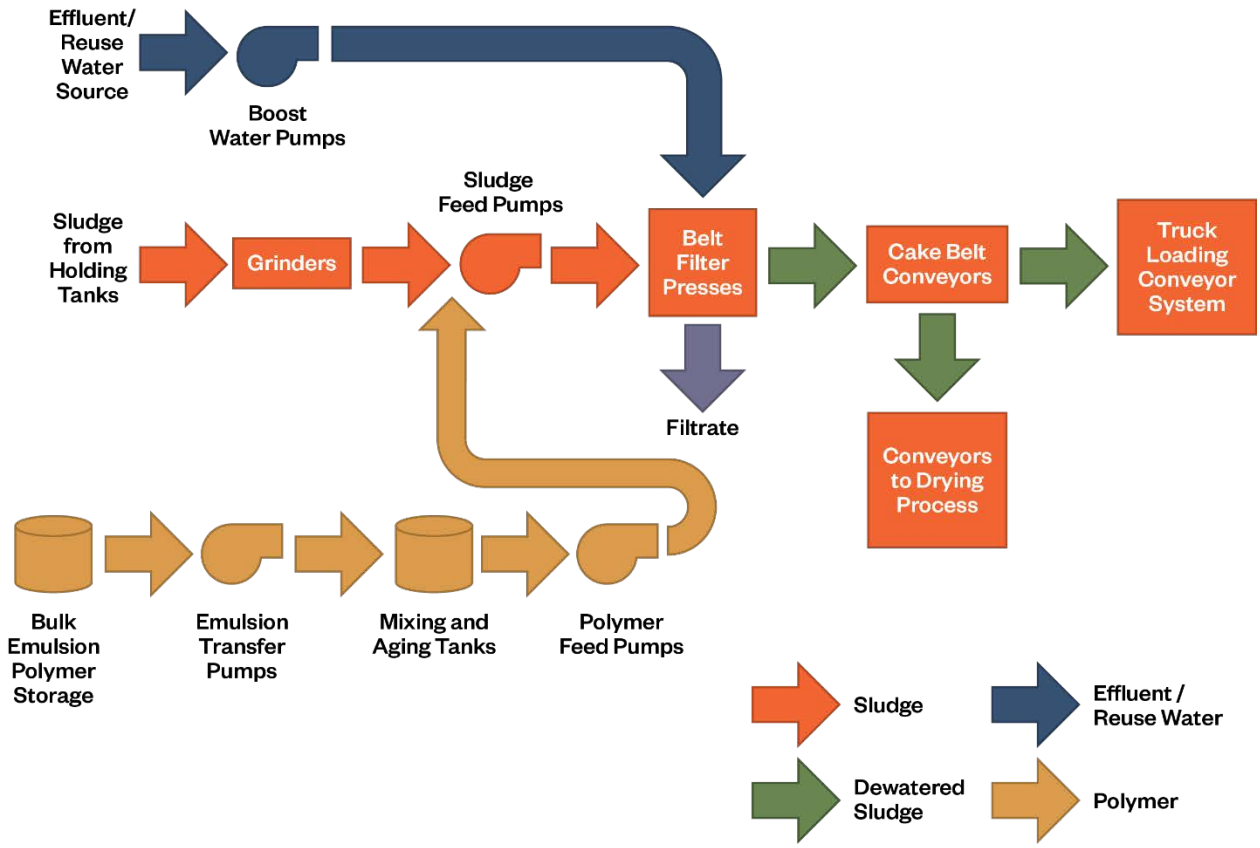
The dewatering facility contains eight (8) belt filter presses (BFPs). Each press has a design capacity of 140 gpm. Typically, only two to three presses are needed at any given time to process the amount of sludge produced at the facility. The digester sludge entering the dewatering facility has a solids content of about 2.0 percent. The BFPs are capable of producing a dewatered cake of about 14 to 18 percent solids. The stabilized solids meet Class B standards for land application or can be processed in the heat drying facility to produce a Class A/AA pellet.

The existing sludge dewatering process train includes the items listed below. Figure 4-38 is a schematic of the system.

- Ten sludge feed pumps
- Four grinders
- Eight belt filter presses (six are available as Presses 3 and 6 have been abandoned)
- Polymer storage tanks and mixers
- Ten polymer feed pumps
- Four boost water pumps
- Belt conveyors for dewatered cake
- A truck loading belt conveyor system
- Screw conveyors for sending dewatered cake to the drying process

Emulsion polymer is utilized for a conditioning agent and is aged and fed to the suction side of the belt filter press feed pumps by progressive cavity pumps. Wet cake conveyance at the treatment facility is predominantly conducted by belt conveyors from the dewatering building to the truck loading station and to the wet cake receiving bins for the thermal drying system. One pair of vertical screw conveyors is provided in the dewatering building to lift sludge cake from the belt conveyors in the dewatering building to the inclined and horizontal belt conveyors located in the thermal drying system.

Figure 4-38 – Current Dewatering System



The existing heat drying facility is a rotary drum thermal drying system consisting of two separate trains utilizing rotary kilns and RTOs (regenerative thermal oxidizers) for control and removal of volatile organic compounds (VOCs). Each train is designed to process 29.5 dry tons per day of dewatered sludge to produce more than 90 percent dry solids product for disposal. The rotary drum drying facility uses natural gas as the fuel source. Historical cost for maintenance parts, electricity, and labor for the heat dryer system have been on the order of $145 per dry ton. Assuming a natural gas cost of $5 per MMBTU (based on historical City costs), the natural gas cost has been on the order of $93 per dry ton.

The existing sludge drying process was installed in 1988 and includes two parallel trains consisting of the following components (see Figure 4-39 for a schematic of the system):

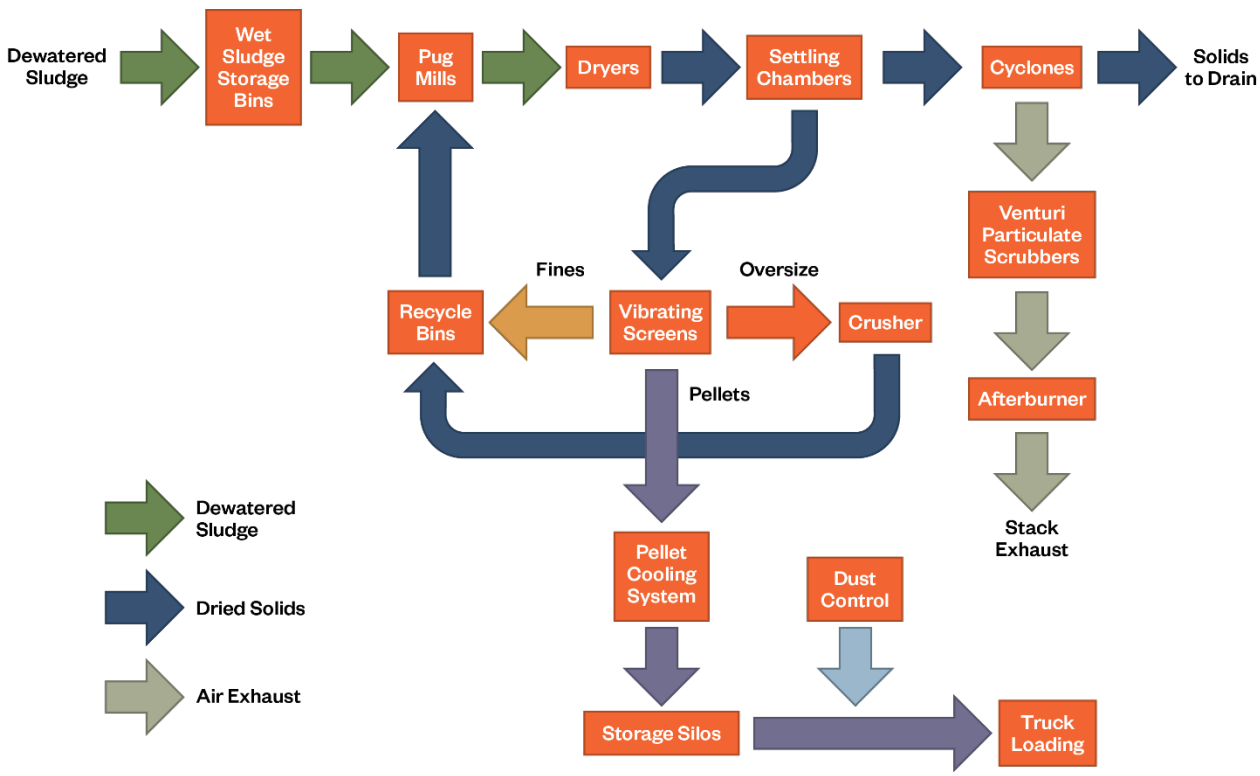
- Wet sludge storage bins
- Pug mills
- Rotating dryers
- Settling chambers
- Cyclones
- Vibrating screens
- Crushers

- Venturi particulate scrubbers

In addition, the facility includes:

- Two afterburners
- Product storage silos
- A pellet cooling system
- Odor control system
- Dust control system
- Product conveying systems

Figure 4-39 – Current Drying System



4.4.2 Process Evaluation

An assessment of the dewatering and drying systems was performed in 2012. As a result of this assessment, capital improvement projects were recommended for the near term. The first project recommended was to pilot test dewatering technologies. Pilot testing of four technologies was completed in 2013. This analysis concluded that the BFPs should be replaced with new centrifuges in a new dewatering building. This project will include a new polymer system, truck loading facility, cake to dryer transfer system, and ancillary components such as new sludge feed pumps and electrical equipment. The capital cost estimate for this project is $11.9 million with an estimated annual savings of $0.8 million as compared with current costs. It is recommended to explore location options for the new dewatering building with the overall biosolids alternatives to be evaluated in more detail.

Land application disposal of biosolids may be unreliable at times, and therefore it is beneficial to the City to continue to maintain the biosolids drying system in operational order. The assessment of the drying system in 2012 recommended several improvements to the drying system to restore reliability. These included repairs to train 2 and train 3 as well as components common to both trains. In addition, the assessment recommended consideration of an exhaust recycle system to improve system efficiency and reduce operating costs. The capital costs associated with these projects is $9 million. However, there is no annual savings since the dryer is not currently being used. If new dewatering equipment is added to the facility and a new dryer exhaust gas recycle, then the natural gas costs can be reduced to 50% of the current costs.

4.5 Dewatering Sidestream Treatment Options

4.5.1 Nitrogen Removal

It is recommended that biological nutrient removal systems be considered for the plant return flow (side stream) with the design of a new dewatering system. An analysis of the historical nutrient contribution to the plant influent from the dewatering side stream indicates that 17% or more of the nitrogen load to the plant is from the dewatering return flow.

It is recommended that a sidestream deammonification system such as DEMON™, Anitamox™, or Cleargreen™ be considered for nitrogen removal. The estimated capital cost for a deammonification equipment sized for the typical dewatering return flow is on the order of $2.7 million, and the total capital investment will be about $10.2 million. It is estimated that a DEMON™ sequencing batch reactor tank will need to be 1 million gallons in capacity. A deammonification system can achieve 75% – 90% removal of sidestream total nitrogen load. The predicted savings of sidestream treatment is primary in the saving of methanol usage if no other process changes are made that allow for increased nutrient removal in the activated sludge process. The predicted reduction in methanol usage is about 600,000 gallons per year. Historical methanol costs have been around $2 per gallon at times. This means that a deammonification system can potentially save over $1 million per year and have a payback period of 10-15 years depending on future methanol costs and potential treatment modifications within the mainstream process.

4.5.2 Phosphorus Removal

A phosphorus recovery system such as Ostara™ or Multiform Harvest can be considered for sidestream treatment as well. An analysis of the historical nutrient contribution to the plant influent from the dewatering side stream indicates that about 7% of the phosphorus load to the plant is from the dewatering return flow. This is a little lower than what is typically considered necessary to make sidestream phosphorus removal economically viable. However, if modifications in the upstream treatment processes occur, an increased phosphorus load in the dewatering return could occur. One example of this is if the plant loses the waiver on effluent phosphorus and it is decided that biological phosphorus removal is needed in the mainstream process.

The capital cost for a phosphorus sidestream treatment system is on the order of $2 - $5 million depending on the amount of phosphorus recovery desired. Currently, at an assumed struvite value of

$300 per dry ton and a struvite recovery of 200 dry ton per year, the economics are not favorable. In addition, the estimated annual cost for the system is near $300,000 to operate and maintain. It is estimated that a biological phosphorus removal is incorporated to the mainstream treatment process will increase the recovered struvite and carbon savings making the payback for the system in the range of 8 – 11 years.

4.6 Alternative Disposal Options

4.6.1 Class B Treatment Options

Class B is documented by the U.S. Environmental Protection Agency's (EPA) Part 503 Rule as a process that significantly reduces the level of pathogenic organisms in the biosolids. This is typically achieved through methods such as digestion, air drying using sludge drying beds, composting, or lime stabilization. Of these, composting and lime stabilization can also be used to achieve Class A biosolids. Since the City already has made significant investments into anaerobic digestion and air drying, it is recommended that only these options be considered if future treatment to Class B standards is considered. In addition, air drying treatment of the volume of sludge produced at the HFC AWTP is considered impractical on a sustained basis due to the intense labor required. An option that could be considered is an automatic and fully enclosed "greenhouse" type solar drying facility similar to those manufactured by Huber, Kruger, Degremont, and Parkson. Investigations for other facilities have shown an operating cost range of about $320 - $370 per dry ton for a solar drying system, which is considerably higher than current disposal costs. Therefore, only continued use of the anaerobic digestion system will be evaluated further for Class B.

4.6.2 Class A/AA Treatment Options

Class A/AA treatment technologies can generally be categorized in the following treatment approaches.

- Thermal Drying
- Chemical Stabilization
- Thermal Oxidation
- Biological Conversion
- Chemical Conversion
- Thermochemical Alteration
- Enhanced Anaerobic Digestion
- Others

4.6.2.1 Thermal Drying

Thermal drying of municipal sludge involves the application of heat to the material being dried to affect the evaporation of moisture contained in the sludge material. To meet regulations, the sludge must be dried to greater than 90%. Product can be dried completely, but drying beyond 95% solids content creates a product without sufficient moisture to bind product together thus producing a very dust-prone product.

Some dryer facilities, such as the HFCAWTP, produce a pelletized product of fairly uniform particle size distribution. This requires the use of dry product recycle as well as product screening equipment. The pelletized product can be marketed for use as a soil amendment, fertilizer bulking agent, an organic fertilizer, or as an energy source "secondary fuel" with a net calorific value of 8-16 MJ / kg of sewage sludge.

Drying facilities typically produce a dried product from mechanically dewatered sludge. This usually involves the use of dewatering equipment that produce a high percent solids in the dewatered product. The type of dewatering equipment can have a significant impact on the size of the dryer equipment.

Drying alternatives include direct drying, indirect drying, and carrier fluid drying. In the direct drying process, the drying mechanism being convection, the sludge is in contact with hot gases which affect the evaporation of moisture. Technologies which utilize the direct drying principle are the rotary drum drying process, flash dryers, Sassi process, spray dryers, and toroidal dryers.

With indirect drying, the primary drying mechanism being conduction, evaporation of moisture is accomplished when the sludge comes in contact with a hot surface. The surface upon which heat transfer occurs is usually heated with condensing steam or recirculating thermal oil. Among the technologies that utilize this process are jacketed hollow-flight batch dryers, vertical and horizontal thin film tray dryers, steam dryers, fluid bed dryers and belt dryers.

Technologies which utilize special carrier fluids to facilitate water evaporation fall into the category of special processes. The most notable technology which falls into this category is the Carver-Greenfield Process. In this process, sludge is combined with an oil carrier fluid and the water is evaporated in a multiple effect evaporator.

Since the HFC AWTP currently has an operable rotary drum dryer and is the technology familiar to plant staff, this technology will be the only thermal drying technology evaluated further.

4.6.2.2 Chemical Stabilization

Chemical stabilization involves processes in which a chemical agent is combined with sludge to produce a stabilized product. The principal purposes of chemical stabilization are to reduce pathogens, eliminate offensive odors and to control the potential for putrefaction of the organic material within the sludge. In some cases, these processes also bind heavy metals within the sludge. In recent years, chemical stabilization processes have been used to produce material which can be beneficially used in the environment.

There are several different chemical stabilization technologies available. Four of these technologies include; post lime stabilization as provided with the En-Vessel™ process marketed by RDP, the N-Viro™ soil process, the Bioset™ process, and a process marketed by RDP known as the "Hybrid Evaporator" which combines both lime stabilization with drying technology.

Lime addition to sludge reduces odors and pathogen levels by creating a high pH environment hostile to biological activity. When lime is added, the microorganisms involved in creating odors in sludge are

strongly inhibited or destroyed in the highly alkaline environment. Similarly, pathogens are inactivated or destroyed by lime addition.

High lime dosing of sludge also affects the chemical and physical characteristics of sludge. Although the complex chemical reactions between lime and sludge are not well understood, it is likely that mild reactions, such as the splitting of complex molecules by hydrolysis, saponification, and acid neutralization, occur in the high pH environments created in lime stabilization. These reactions reduce the fertilizer value of the stabilized sludge, improve its dewaterability, and change the character of the liquid sidestreams.

The EPA has approved lime stabilization and pasteurization as a Class A/PFRP process with the fulfillment of one of two requirements. The first requirement relates to time, temperature and pH such as the N-VIRO process in which the solids must reach a pH of 12.0 for a total of two hours and maintain a pH of 11.5 for an additional 22 hours. The second requirement relates to time and temperature such as En-Vessel and Bioset processes in which the solids must be kept at a temperature above 70°C (158°F) for a minimum of 30 minutes. The lime products most commonly used for pH adjustment are quicklime (CaO) and hydrated lime (Ca(OH)2).

A summary of lime stabilization technologies is given in Table 4.25 and a summary of the advantages and disadvantages of lime stabilization is given in Table 4.26.

Table 4-25 – Lime Stabilization Technology Summary

Process	Major Equipment Components	Description of Process
Post Lime Stabilization En-Vessel by RDP	Bulk chemical storage for lime, transfer equipment, pugmills, odor control equipment, conveyors, and pasteurization vessels	The pH of the biosolids is raised to 12 by the addition of lime, which inhibits biological activity. The pH is maintained at 12 or above for two hours and 11.5 for an additional 22 hours. Adding heat (70°C for 30 minutes) results in pasteurization of the lime biosolids mixture, providing PFRP stabilization.
N-Viro Soil Process	Bulk chemical storage for lime, transfer equipment, mixing unit, conveyors, heat pulse containers, and windrow storage	The pH of the biosolids is raised to 12 by addition of cement kiln dust. The mixture, at pH of 12, is maintained at 52 degrees Celsius or higher for a minimum of 12 hours. The pH is then maintained at 12 and the product is air dried for 72 hours or more until a solids content of 50 percent has been achieved to obtain PFRP stabilization.
Bioset Process	Bulk chemical storage for lime and solid acid, feed pumps, auger mixer, stabilization reactor, odor control equipment, and conveyors	Acid is added to reduce lime and heat requirements. The pH of the biosolids is raised to 11.5 by the addition of lime, which inhibits biological activity. The pH is maintained at 12 or above for two hours and 11.5 for an additional 22 hours. Adding heat (70°C for 30 minutes) [1] results in pasteurization of the lime biosolids mixture, providing PFRP stabilization.
RDP Hybrid Evaporator or N-Viro BioDry	Heating system, odor control equipment, evaporator reactor, conveyor, lime feed and storage equipment	Combines the lime additive systems described above with drying technology. RDP Hybrid Evaporator uses an indirect, batch, oil dryer. N-Viro uses a direct, continuous feed rotary dryer.

1. Potential to be run at lower temperatures and time then dictated by the 503 regulations with EPA PEC equivalency approval.

Table 4-26 – Advantages and Disadvantages of Lime Stabilization Technologies

Technology		Advantages	Disadvantages
1.	Post Lime Stabilization En-Vessel by RDP	• Simple Process • Consistently Achieves PFRP Status • Flexibility and Simplicity of Operation • Dilution of Heavy Metal Concentrations in Final Product	• Odor Problem Due to Ammonia Release • Material Handling Intensive • Subsequent Drying Required to Obtain Marketable Product • No Volume Reduction • Area Requirements are Relatively Large for Drying and Storage
2.	N-Viro Soil Process	• Numerous Facilities Operating in the U.S. • Consistently Achieves PFRP Status • Flexibility and Simplicity of Operation	• Dependence Upon Obtaining High Quality Alkaline Admixture • Odor Problems Due to Ammonia Release • Material Handling Intensive • No Volume Reduction • Aglime Product Market May Be Limited
3.	Bioset Process	• Reduces heating and lime addition requirements • Operates at lower temperature • Inexpensive Capital Cost	• Additional chemical to add (solid acid) • Proprietary process
4.	RDP Hybrid Evaporator or N-Viro BioDry	• Potential to reduce volume in end product • Can deliver both lime stabilized or dried end product • Allows operations to select desired solids concentration	• Little to no installations

Post lime stabilization and N-Viro Soil are very similar processes which have been demonstrated on numerous full-scale facilities throughout the United States. It is expected that a thermally dried product is far more likely to be affectively marketed in the Tampa bay area than a lime stabilized product, allowing a greater percentage of the end product to be beneficially re-used. Also, volume and mass of a thermally dried product is at least 20% of that expected from alkaline additive products. Therefore, chemical stabilization process are not recommended for further consideration.

4.6.2.3 Thermal Oxidation

Thermal oxidation is most commonly achieved through incineration. Thermal oxidation has been used as a disposal method for wastewater treatment for over sixty years. The first multiple hearth furnace for municipal biosolids was built in 1935 in Dearborn, Michigan. In the seventies, the fluid bed thermal oxidizer became the preferred thermal technique for biosolids disposal, primarily due to lower emission, reduced auxiliary fuel use and reduced operating and maintenance costs. There are over 125 fluid bed thermal oxidizers installed in North America, but none are currently operating in Florida.

Water is evaporated and organic materials are combusted, eliminating odors and reducing the biosolids volume to a much smaller quantity of inert ash, typically 20 to 40 percent of dry weight biosolids fed. The ash can be used as cover in a conventional landfill or may be used as road base or other construction material. If the biosolids are not digested, approximately 60 to 80 percent in weight of mass is volatile. The biosolids have a heating value of approximately 10,000 Btu per pound of volatile solids. The volatile material is a beneficial source of fuel that can be used in the thermal oxidation process. Depending on the water content of the biosolids, generally about 70 percent of the heat required by biosolids thermal oxidation can come from the biosolids.

Advantages for thermal oxidation processes in comparison to thermal drying include: significantly lower fuel usage, biomass energy recovery, biosolids are contained in a fully enclosed system resulting in a relatively odorless process, maximum volume reduction, and the end product is a sterile, odorless ash which is readily suited for landfill disposal. The high temperature fluid bed system can meet the most stringent federal and state air emission standards.

Permitting of a fluid bed system could be a significant obstacle since there are no operating installations in Florida and air pollution regulations have placed significant restrictions on the ability to permit a biosolids incineration process. Public perception may also present permitting difficulties. Lastly, capital and lifecycle costs for this technology are higher when compared with the different Class A/AA options. Therefore, thermal oxidation is not recommended for further consideration.

4.6.2.4 Biological Conversion

Biological conversion or composting is the biological decomposition and stabilization of organic substrate contained within a more concentrated or solid form (bulking agent). Similar to digestion, composting can take place in both aerobic and anaerobic conditions. Composting of municipal dewatered sludge cake, either by itself, or in combination with other wastes, is typically carried out under aerobic, thermophilic conditions. The main products of aerobic composting are carbon dioxide, water, and heat. In the process, organics are stabilized and pathogenic organisms destroyed, yielding a stable, humus-like end product suitable for use as a soil amendment, mulch, or other soil-like products, or for erosion control.

Based on other recently installed facilities in central Florida, it is expected that a site of 5-10 acres will be needed for composting. The sludge drying bed area south of the dewatering facility at the HFC AWTP is suitably sized for this requirement, but a new composting facility will likely use all of this area and require complete demolition of the drying beds. The capital cost for a new composting facility will be at least $5 million, and will depend heavily on the amount of covered area desired and the composting technology selected. Options for composting include aerated static piles, within-vessel options, and windrows. Annual costs will depend heavily on the technology selected and the associated level of automation.

To effectively compost the sludge, a bulking agent must be added to bring the solids content up to a minimum of 40 percent. One concern in the Tampa area is the availability of good quality green waste for the bulking agent. In general, composting is problematic with regard to odor containment and

control, and requires large land area for large-scale facilities such as the HFCAWTP. In addition, Florida facilities need sufficient covered space to store fully composted product prior to end use during the summer months due to frequent rain events and re-wetting of the product. Despite these challenges, other Florida utilities have recently constructed composting facilities. However, it is not recommended that this option be considered in more detail.

4.6.2.5 Chemical Conversion

A number of chemical conversion technologies exist for converting sludge to an inert product. These technologies utilize physico-chemical means to achieve pathogen reduction that may involve treatment by high temperature, pressure, or irradiation, in an oxygen rich or starved environment. Wet oxidation, sludge to oil, and irradiation are identified as three technologies which utilize chemical conversion of sludge. The primary disadvantage of chemical conversion technologies is a lack of significant experience in municipal wastewater treatment, and therefore are not recommended for further consideration.

4.6.2.6 Thermochemical Alteration

Thermochemical alteration refers to processes that use sub-stoichiometric oxygen supply at operating temperatures above thermal dryers. These processes include pyrolysis and gasification. Although these processes have been in existence for a long time, recent improvements have been made to make these technologies more attractive for the processing of wastewater biosolids. However, these recent improvements are very new and many of the operational challenges have not been resolved. Therefore, it is recommended that these processes not be included for further consideration.

4.6.2.7 Enhanced Anaerobic Digestion

Enhanced anaerobic digestion processes, such as thermophilic digestion, can more readily obtain Class A requirements than typical mesophilic digestion. These processes may be applied to the current HFC AWTP process and should be considered as options for achieving Class A biosolids. These processes are described in more detail in Section 4.2 Digestion.

4.6.2.8 Others

There are other biosolids treatment processes that do not exactly fit into any of the previously described categories. These include technologies such as Anuvia™, supercritical water oxidation, SlurryCarb, and others. Much of the information on many of these processes is proprietary and some of the processes are unproven for biosolids treatment. It is not recommended that these options be considered for further evaluation.

4.6.3 End Disposal Options

4.6.3.1 Land Application and Landfilling

Currently, the City's primary means of disposal is through a hauling contract to dispose of Class B biosolids through land application. The current cost for this method is on the order of $25 per wet ton. This calculates to a range of $110 to $180 per dry ton depending on the dewatered cake solids content.

It is recommended that continued Class B land application be considered as an option for further consideration.

Another option that could be considered with the current process is landfilling. Biosolids to be disposed of at a municipal solid waste landfill must not contain free liquid as defined by Method 9095, Paint Filters Liquid Test, as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" (EPA Pub. No. SW-846). Typically dewatered cake with a solids concentration of at least 15 percent meets the Paint Filter Test requirement. An advantage is that the biosolids do not have to meet Class B standards to be accepted at the landfill, therefore stabilization is not required. Tipping fees for landfill disposal in Florida are in the order of $40 per wet ton. The 2012 Biosolids Processing Report showed that the cost for landfilling is significantly higher than land application (on the order of $250 - $300 per dry ton), and that is still true in 2016 and for the foreseeable future. However, since landfilling does not require Class B treatment it is recommended that landfilling be considered as an option for disposal if Class B treatment is not continued.

4.6.3.2 Class A/AA Disposal

A Class A/AA product will have some nutrient value as a fertilizer with as much as 7 percent nitrogen content and up to 3 percent phosphorus content depending on the source supply of biosolids. End product uses include commercial fertilizer, agricultural and grazing use, nursery and sod farm industry, golf courses, land application use as a soil supplement, fuel supplement, and as a landfill daily cover or supplement for a landfill cap. Therefore, sale value is typically less than the cost of handling and hauling unless significant packaging and marketing efforts are made.

Capturing a thermally dried product's fuel value maybe a factor in off-setting the cost of purchased fuel used in drying. The end product could have a heating value of 6,000 to 7,000 BTU per pound dried biosolids product. As a biomass derived fuel product dried residuals may be worth approximately $3.00 per MMBTU or $36 per dry ton at 6,000 BTU per dry pound product. However, the City of Tampa has recently had difficulties in selling dried biosolids, and may not be able to find a buyer at a price above $25 per dry ton.

The 2012 Biosolids Processing Report showed that the cost for thermal drying is significantly higher than land application (on the order of $300 - $350 per dry ton), and that is still true in 2016 and for the foreseeable future. However, since the City has made the capital investment in the dryer, it is recommended that this option be considered further.

4.7 Summary of Biosolids Management Options

From the previous sections, several alternatives were recommended for each biosolids treatment process for further consideration and analysis as part of an evaluation of a larger list of potential options. Each of these recommendations cannot be considered as a stand-alone process. Rather, each recommended treatment process impacts the other systems and must be considered holistically. Table 4.27 summarizes the overall biosolids management options based on each of the recommendations for further consideration.

Table 4-27 – Biosolids Management Options

	Digestion					Biogas Use			Post Stabilization		Disposal		
	Mesophilic Anaerobic Digestion	Thermophilic Anaerobic Digestion	Acid/Gas Phased Digestion	Thermal Hydrolysis	FOG/HSW Receiving	Process Heating	CHP	Vehicle Fueling with rCNG	Dewatering	Heat Drying	Landfilling	Class B Land Application	Class A/AA Options
Options without fats, oils, and greases (FOG) and/or high strength waste (HSW) added for treatment													
1	☐	☐	☐	☐	☐	☐	☐	☐	✓	☐	✓	☐	☐
2	✓	☐	☐	☐	☐	✓	☐	☐	✓	☐	☐	✓	☐
3	✓	☐	☐	☐	☐	✓	☐	☐	✓	✓	☐	☐	✓
4	✓	☐	☐	☐	☐	✓	✓	☐	✓	☐	☐	✓	☐
5	✓	☐	☐	☐	☐	✓	☐	✓	✓	☐	☐	✓	☐
6	☐	✓	☐	☐	☐	✓	✓	☐	✓	☐	☐	☐	✓
7	✓	☐	☐	✓	☐	✓	✓	☐	✓	☐	☐	☐	✓
8	☐	✓	☐	☐	☐	✓	☐	✓	✓	☐	☐	☐	✓
9	✓	☐	☐	✓	☐	✓	☐	✓	✓	☐	☐	☐	✓
10	☐	✓	☐	☐	☐	✓	☐	☐	✓	☐	☐	☐	✓
11	✓	☐	☐	✓	☐	✓	☐	☐	✓	☐	☐	☐	✓
12	☐	☐	✓	☐	☐	✓	☐	☐	✓	☐	☐	✓	☐
13	☐	☐	✓	☐	☐	☐	✓	☐	✓	☐	☐	✓	☐
14	☐	☐	✓	☐	☐	☐	☐	✓	✓	☐	☐	✓	☐
Options with fats, oils, and greases (FOG) and/or high strength waste (HSW) added for treatment													
15	✓	☐	☐	☐	✓	✓	✓	☐	✓	☐	☐	✓	☐
16	✓	☐	☐	☐	✓	✓	☐	✓	✓	☐	☐	✓	☐
17	☐	✓	☐	☐	✓	✓	✓	☐	✓	☐	☐	☐	✓
18	✓	☐	☐	✓	✓	✓	✓	☐	✓	☐	☐	☐	✓
19	☐	✓	☐	☐	✓	✓	☐	✓	✓	☐	☐	☐	✓
20	✓	☐	☐	✓	✓	✓	☐	✓	✓	☐	☐	☐	✓
21	☐	✓	☐	☐	✓	✓	☐	☐	✓	☐	☐	☐	✓
22	✓	☐	☐	✓	✓	✓	☐	☐	✓	☐	☐	☐	✓
23	☐	☐	✓	☐	✓	✓	☐	☐	✓	☐	☐	✓	☐
24	☐	☐	✓	☐	✓	☐	✓	☐	✓	☐	☐	✓	☐
25	☐	☐	✓	☐	✓	☐	☐	✓	✓	☐	☐	✓	☐

*Check marks indicate what unit processes would be included in the associated option.

Option 1 is simply hauling dewatered sludge from the mixed sludge pump station to a landfill. Based on the Biosolids Processing Assessment Report prepared in May 2012, the disposal cost for this option was $277 per dry ton. At the current biosolids production rate of 32 dry tons per day, the yearly disposal cost of this option is about $3.24 million, and is about 20-25% higher when adjusted for current hauling costs. A new dewatering facility will be required to remove enough free liquid to pass a paint filters liquid test prior to disposal. This option is not likely to be an economically beneficial option due to the high disposal costs, but will serve as a good comparison for the other options.

Option 2 is the continued use of the existing process with improvements and without CHP. Rather the biogas will only be used to heat the digesters, and the remaining gas will be flared. This option may be advantageous in that there is lower capital investment than some of the other Options and low annual costs. Capital improvements would include modifications to the existing digestion system and dewatering.

Option 3 is similar to the existing process but sends the biogas to the dryer instead of the CHP system. This option is likely not advantageous from an economic standpoint. However, this option makes use of

the capital investment the City has made into the thermal drying system and provides flexibility in Class A/AA disposal.

Option 4 is the continued use of the existing process with improvements to the existing digestion process, a new or rehabilitated CHP system, and dewatering. This Option requires more capital investment and higher operation and maintenance costs, but does provide savings on electrical power costs as compared with Option 2.

Option 5 is similar to the existing process but utilizes the biogas for vehicle fueling rather than CHP. This option has a high potential benefit, but is a complex system that will be new to City staff. It is likely that for this option to be effective it needs to be implemented in a phased approach that allows the City more time to become familiar with the system and evaluate how it is performing for other utilities. If it is deemed that this process is cost effective and feasible, the City could start making capital investments a few years after the initial investments in the existing digestion system and dewatering processes are made.

Option 6 is similar to the existing process but involves changing the digestion process to a thermophilic process. This process has the advantage of improved solids reduction and increased digester gas with similar capital investment to Option 4.

Option 7 is similar to the existing process but involves adding thermal hydrolysis to the digestion process. This process has the advantage of improved solids reduction and increased digester gas. Capital investment as compared with other options will need to be investigated in more detail. Additionally, recent thermal hydrolysis projects have shown highly concentrated recycle streams that will have significant impacts on the mainstream liquid process.

Options 8 and 9 are exactly like Options 6 and 7 except the biogas is utilized for vehicle fueling rather than CHP.

Options 10 and 11 are exactly like Options 6 and 7 expect the biogas is only used for process heating.

Options 12 – 14 involve acid/gas phased digestion with various options for biogas use including digester heating only, CHP, and vehicle fueling with rCNG to determine the more economically beneficial use of biogas for the City.

Options 15 - 25 are exactly like Options 4 – 14 except that FOG/HSW receiving has been added.

It is recommended that all of these Options be investigated in more detail in the next phase of this master plan. These detailed investigations will be developed by first completing an updated calibrated process model for the entire plant that includes the biosolids process. This model will then be used to predict overall plant performance and provide sizing for the equipment associated with each Option. Once this effort is complete, planning level capital cost and annual cost estimates will be refined for each Option, and an economic assessment will be developed. This assessment will allow City staff to evaluate the key project drivers and costs, and develop a short-list of process Options for further evaluation.

Additional efforts/investigations to be included within these Option evaluations, or as a separate work effort, include the items listed in Table 4-28.

Table 4-28 – Summary of Existing Biosolids Treatment Process

Evaluation Findings
• Add a third thickener train to provide additional redundancy and improve loading rates. Additionally, any modifications to the treatment process may have impacts on the thickening system and should be evaluated. • Evaluate the existing thickening polymer system for capacity and reliability. Additional capacity of the polymer system will likely be required for a third thickener train. • Return Digester 7 to service to increase available aggregate digester volume, which will increase hydraulic retention times and decrease organic loading rates. • Conduct solids profile analyses in each digester to assess the performance of the gas mixing systems; repair mixing tubes that are currently out of service; improved mixing will improve heat distribution and may help to reduce foaming. • Conduct microscopic analysis of digested sludge samples from each digester to investigate the possibility that WAS contains Nocardia or other microorganisms that may be contributing to foaming in the digesters. • Install gas flowmeters at each digester; gas flowmeters should include feature to measure methane content which will help to control/measure/monitor the performance of CHP engines or other biogas recovery options. • Complete short-term condition repairs to covers and pumping, mixing and heating equipment to allow all digesters to operate in accordance with design intent until long-term upgrades/enhancements can be implemented. • Update the GPS-X model to include primary treatment and solids treatment facilities and update calibration for use in evaluation of upgrade/enhancement alternatives. • Conduct evaluations of the digestion upgrades/enhancements as described above. • Explore alternate rates from TECO that may better match the biogas utilization strategy and reduce the overall energy cost. • Explore selling energy generated on-site directly to TECO under a separate PPA agreement in lieu of the existing energy offset under the supplemental TOU billing rate. • Perform process modeling to get a more accurate biogas production projections and identify the optimal biogas fueled engine size and combination for Alternative 2. • Further explore opportunities to increase the benefit from Alternative 3 by integrating rCNG production with the City's existing CNG fueling infrastructure and vehicle fleets. • Explore phased implementation solutions that evaluates a combination of biogas utilization alternatives and implementation timing that provide the best overall value utilization and implementation strategy. • Evaluate sidestream treatment options • Evaluate option combinations for digestion, biogas use, and biosolids end disposal

5 Electrical Systems

5.1 Background

5.1.1 Corrosion

The combination of H_2S and humidity creates a low concentration of H_2SO_4 or sulfuric acid that even at low concentrations has a detrimental effect on electrical equipment even when coated. Relative humidity levels above 50% and concentrations of H_2S as low as 0.01ppm or less, on average, can cause extreme corrosion in a relative short time (<24months) and in metals such as carbon steel, copper, silver, and nickel in descendant order[1].

As much of the plants electrical systems are made of these metals one can see the exposure liability. It is interesting to note that those pieces of equipment that are mounted inside a room can be more susceptible to corrosion due to the salts that are formed, as part of the corrosion process, but are not periodically washed away as would occur with equipment in the same atmosphere that are mounted outside.

1) H_2S Pollution and Its Effect on Corrosion of Electronic Components - Benjamin Valdez Salas, Michael Schorr Wiener, Gustavo Lopez Badilla, Monica Carrillo Beltran, Roumen Zlatev, Margarita Stoycheva, Juan de Dios Ocampo Diaz, Lidia Vargas Osuna and Juan Terrazas Gaynor - 2012

5.1.2 Area Classification

NFPA 820 standard contains mandatory requirements for fire protection in wastewater treatment and collection facilities. It provides guidance when classifying areas that could be hazardous. The standard classifies an area as Class 1 Division 1 & 2 or unclassified depending on the process and ventilation of the area. During the review, it was noticed that in the Sludge Return Pump Station process areas there exists a combination of explosion and non-explosion proof electrical equipment present for the same location. All three Sludge Return Pump Stations contain NEMA 7 disconnects for their lightning transformers and all other equipment is NEMA 1.

5.1.3 Coordination and Arc Flash Study

An arc flash and coordination study has not been performed on the plant electrical equipment since their installation. An Arc Flash Assessment Study is included in the Treatment Plant CIP. NFPA-70E requires arc flash study or adherence to NFPA Tables for safe work practice. OSHA requires adherence to NFPA 70E as part of their standards. However state exemptions in Florida exempt municipalities from these requirements because they do not fall under OSHA's jurisdiction. Cities can elect to adhere separately if they chose. Clearwater is an example of one such City.

NEC states "Where an orderly shutdown is required to minimize the hazard(s) to personnel and equipment…coordinated circuit protection is permitted" A coordination study to ascertain the sequence of breaker tripping during a fault is essential to avoid shutdowns of unintended plant operations. This part of the study also identifies the magnitude of potential faults for equipment rating verification.

Having equipment not rated for the fault incurred could lead to explosions in the electrical equipment. The last fault current study was performed in 2002; however, this is only one aspect of a coordination and arc flash study.

5.1.4 Testing

The periodic testing of electrical equipment is vital to maintaining reliability and to help avoid catastrophic failure. Various testing measures are available and the choice should be a combination that best suits the goal and the type of equipment to be tested. Terminal connections are a common testing point; using a heat signature the condition of the connection point can be determined. This is done by the use of heat ranges with an elevated temperature being more problematic.

One of the more common tests for terminal connections is infrared (IR). It can also be used, though with more uncertainty, for the condition of relays or motor contactors. This method shows temperature differences of the part of the equipment that is being scanned.

One of the drawbacks to this method is access to the equipment. In order to get a complete scan, the live parts must be exposed. The person performing the scan will need to adhere to the arcflash potential and perform the scan using the proper personal protection equipment or (PPE). An option to mitigate this requirement is to statically locate IR windows on the equipment enclosure that allows for the IR camera equipment to see the area to be scanned without exposure to live parts. In most cases this can be utilized unless internal insulating barriers must be removed to expose the desired area.

For the testing insulation of exposed wiring or internal bus bar internal to equipment, another method for monitoring the health of electrical equipment is through the use of Partial Discharge.

Partial discharges are electrical sparks that occur within the insulation of low, medium and high voltage electrical assets. Each partial discharge is the result of a breakdown within air pockets in the insulation. These discharges could eventually erode the insulation and result in failure. While partial discharge testing has not been found effective on low voltage, it is recommended for medium and high voltage electrical assets.

According to the National Fire Protection Association (NFPA 70B), the leading cause of electrical failures is insulation breakdown. These partial discharges are the first indication of insulation deterioration. In addition to cables; switchgear and transformers also suffer the greatest losses from insulation failure.

5.1.5 Types of Partial Discharge testing are as follows:

- Portable PD Monitor used to perform continuous monitoring from one hour up to three months.
- Continuous Online Monitoring, for “hard to access areas” or areas that pose a safety concern, use permanently mounted sensors for online PD detection. Measurement and analysis of data of electrical assets with remote access, delivers continuous and accurate data on the condition and capability of the equipment.
- Ultrasonic; partial discharge and corona, produce sound waves that can be detected by Ultrasonic testing. This can be performed without disrupting plant or facility operations. Ultrasonic testing is a

non-destructive, noninvasive predictive maintenance tool. Because it maintains insulation integrity, it is commonly employed in applications such as cable terminations, switchgear, busbars, and transformers. Ultrasonic measurement is most powerful on a comparative basis and can significantly increase the reliability of partial discharge detection when used with other partial discharge testing technologies.

5.1.6 Breaker Testing

The individual testing of breakers is vital for maintaining the health of an electrical system. It is recommended by NETA that critical low and medium voltage breakers should be tested once every 1-3 years. Inspection of components, breaker trip settings and mechanical operation are also tested to ascertain performance. This requires the removal, bench testing and reinstallation of the breaker so coordination with process operations is critical. One method to mitigate undesirable shutdowns is to have a spare replacement breaker of the same frame size with adjustable trip on hand, to help in minimizing down time.

5.2. Electrical Equipment Assessment

5.2.1. Building 001 Plant Pump Station

5.2.1.1. General Condition

Ageing building with separate room for electrical equipment that is air conditioned. Switchgear 60A and MCC 64 & 65 are currently under contract to be replaced.

5.2.1.2. MCC-RSPS-61 (Eq. ID: MCC-001)

General Electric 8000 Series and not in air conditioned room. It is next to generator, a source of much heat when running. Enclosure showing signs of corrosion.

5.2.1.3. MCC-64 & 65 (Eq. ID: MCC-002 & 003)

A Westinghouse 2100 series Motor Control Center built in 1987. Supplies power to raw sewage pumping system. Enclosure condition is light corrosion, dust and dirt. Sections left open for repair or ventilation allowing for dust intrusion and corrosion creation. Missing or non-working pilot devices are noted. Metering is analog, some meters non-functional and lens discolored.

5.2.1.4. Lighting Panel LP-RSPS-61 (Eq. ID: ELP-047)

Panel is near generator and not in air-conditioned space. This panel & transformer (Eq. ID: TFS-089) were installed in 1978. On lower level of building a 208V lighting panel (Eq. ID: ELP-048) and transformer (Eq. ID: TFS-088) are located and also installed in 1978. Both are showing signs of corrosion on enclosure.

5.2.1.5. Miscellaneous

Pump motor starters replaced with Yaskawa P7 variable frequency drives. Not indicated on Asset Management file FAC-000001. Exposed conduit is still in good shape, outer paint coating peeling in

areas. Local control panel (Eq. ID: WLC-001) is showing signs of corrosion with pilot devices in need of repair.

5.2.2. Building 002 Junction Chamber #1

5.2.2.1. General Condition

MCC's are in enclosed rooms that are air conditioned, however entrance doors are left open to outside exposing equipment to outside atmosphere.

5.2.2.2. MCC-27 (Eq. ID: MCC-004)

Westinghouse Series 2100 MCC-27 is in good shape and was installed in 1995 and has minimal corrosion. MCC replacement parts are produced by Eaton and are available. MCC uses older style pilot devices and is missing annunciator panel.

5.2.2.3. MCC-27A (Eq. ID: MCC-005)

Westinghouse 2100 Series MCC-27A was also installed in 1995 and also has internal corrosion, this may be because MCC compartments are not fully closed allowing for corrosive atmosphere to further intrude.

5.2.2.4. Blower Soft Starts (Eq. ID: SFS-028 thru 031)

New Solcon soft starts with power correction have been recently installed for blowers. They are in NEMA 4X stainless steel enclosures that show little signs of corrosion. Installation date 2014.

5.2.2.5. Blower Motors (Eq. ID: MOT-001 thru 004)

Blower motors have an installation range of 1995 -2009, all are Open Drip Proof and not TEFC. Depending on exposure to corrosive atmospheres, life expectancy may be shortened. Conduit on east side is being replaced due to extensive corrosion.

5.2.2.6. Miscellaneous

The exposed aluminum conduit is in fair condition. Outer paint coating is peeling in areas though not extensive. Interior lighting is also in good shape with gasketed enclosures showing little signs of corrosion. Cleaning and re-lamping periodically is recommended.

5.2.3. Building 003 Meter Vault #1 - Not evaluated as there is no major equipment

5.2.4. Building 004 Lube Storage Building (Old Screen & Grit)

5.2.4.1. General Condition

Former screen and grit facility is now used for storage of lubricants. Original equipment not on inventory file abandoned in place. Entire building electrical should be replaced and redesigned for usage.

5.2.5. Building 005 Old Screen & Grit # 2

5.2.5.1. General Condition

The older of the two functioning grit buildings, ventilation design and location of the electrical room, downwind (prevailing winds) of the grit chambers, has caused significant corrosion of the enclosures and presumably the interiors of the equipment. Subsequent recoating of the exterior paint by maintenance crews has helped to retard the speed of corrosion. Ventilation is an issue with this room as it is negative pressured drawing air at ground level. Walls are louvered and doorways to room are left open.

5.2.5.2. Switchgear No. 20 (Eq. ID: SWG-00002)

Westinghouse switchgear No. 20 is in fair condition for its age. Install date is 1978. Some corrosion is noted between sections and along the bottom of the enclosure.

5.2.5.3. MCC- 21 (Eq. ID: MCC-00007)

Installed in 1978, this Westinghouse 2100 series motor control center is in fair condition. Entire gear has a mottled appearance. Light corrosion is also noted between sections and along the top and bottom of the enclosures.

5.2.5.4. Conduits

Conduits are aluminum and show minimal corrosion, but are supported by galvanized steel fittings that show, in some areas, heavy corrosion.

5.2.5.5. Miscellaneous

New telemetry equipment for water level control is in gasketed enclosures, providing much needed protection from the general environment. Local control and power distribution panels (LCP-22 and LP-21) are showing corrosion to enclosure corners and face. Indicator panels and associated seal offs show signs of corrosion due to age and exposure.

5.2.6. Building 006 – Junction Chamber #3 – Not evaluated; no major electrical gear.

5.2.7. Building 007 Meter Vault #2

5.2.7.1. General condition not evaluated; no major electrical equipment. Motors for sump pump and 2 supply fans not listed on inventory.

5.2.8. Building 008 Junction Chamber #3

5.2.8.1. General Condition.

Old construction open air outdoor location with actuators mounted between grated tank areas. Paint peeling on some electrical conduit, but overall in fair condition. Pipe strap for actuator electrical conduit is highly corroded due to exposure.

5.2.8.2. Mixer Motors M-1 & M-2 (Eq. ID: MOT-371 & 372)

Reliance Electric motors with install date of 1978 were not evaluated. Corrosion is apparent on motor cover. M-1 recently replaced.

5.2.9. Building 009 Old Primary Sedimentation Tanks General

5.2.9.1. General Condition.

Original construction medium-sized open air platform with equipment mounted outdoors next to open tanks. Several motor mounts and conduit fittings are corroded. Conduit fittings and pipe strap of steel construction is in poor condition, due to extreme corrosion. Aluminum conduit is in mostly fair condition.

5.2.9.2. Collector Motors (Eq. ID: MOT-249 thru 252 & MOT-295 thru 298)

Longitudinal collector drive motors LC-2 thru LC-4 (MOT-250, 251, 252), and longitudinal and cross collector drive motors CC-1, CC-2, & CC-4 (MOT 295, 296, & 298) are all 30 years old with an install date of 1985. LC-4 (MOT 252) is missing its ID tag. LC-1 & CC-3 (MOT-249 & 297) are relatively new and in good condition, with install dates of 2012 and 2013 respectively.

5.2.10. Building 010 Main Pump Station

5.2.10.1. General Condition

The main pump building electrical room is air conditioned and houses the MCC-30, 31, 32A, 32B, 32C and 32D as well as other equipment. Though much of the equipment was installed between 1978 and 1996, they are in reasonable condition for their age with little corrosion.
MCC's 33, 34, and 32S are installed in the process area upper floor mezzanine, and are of the same age as those above. These do show signs of corrosion.

MSP-1,2,3,4,5,6,7 All pump motors were not installed, as two were out for maintenance; however, installed pump motors MSP-1,2,5,6,7 are synchronous motors installed for power correction. They are showing their age and their service time indicates they are near their end of life. When they are replaced it should be with induction motors, such as MSP-3 &4, and their eddy drives be replaced with variable frequency drives, as MSP-3 &4 are, which perform their own power factor correction and that these new motors be premium efficient.

5.2.10.2. MCC-30 (Eq. ID: MCC-009)

This 1978 vintage MCC houses the motor controls for the main sewage lift pumps. The pumps are constant and variable speed. Those pumps that are speed adjustable use variable frequency and eddy current methods. The latter is the older technology of the two methods and controls two of the pumps. These motor controllers were part of the original construction in 1978. They are functional but parts are becoming difficult to obtain as well as service.

Eddy current drives are most efficient between 90-100% speed for centrifugal loads, such as pumps. Below this speed range, the efficiency drops dramatically. See Table 1 below.

Table 5-1 - Efficiency Versus Speed for an Eddy-Current-Coupled Centrifugal Load

Drive Speed, % of Full-Load Speed	Load %	Eddy-Current Drive Efficiency %
100	100	94.3 to 99.3
90	72.9	85.9 to 90.4
80	51.2	76.1 to 80.1
70	34.3	66.9 to 70.5
60	21.6	56.9 to 59.8
50	12.5	47.7 to 50.2
40	6.4	39.7 to 41.7
30	2.7	28.6 to 29.9

In 1996 pumps 3 & 4 were converted to variable frequency, these types of drives are highly efficient throughout the full range of speeds with most efficiency variance being within the motor at differing speeds. See Table 2 below.

Table 5-2 - Idealized VFD Efficiency Factor (Motor Plus VFD Controller) That Ignores Motor Duty-Point Movement (Derived from WallbomCarlson 1998)

Rated motor frequency in %	VFD efficiency (%) factor
100	0.97
90	0.945
80	0.92
70	0.90
60	0.875
50	0.85
40	0.825

5.2.10.3. MCC-31 (Eq. ID: MCC-010)

This MCC is a Main-Tie-Main and was installed in 1978. It is showing signs of wear with breakers and starters not being used or abandoned.

5.2.10.4. MCC-32A Thru D (Eq. ID: MCC-011)

These General Electric 8000 Series MCC's were installed in 1992, are in very good shape. MCC-32 A & B form a Main-Tie-Main distribution with additional breakers feeding MCC-32 C & D. Components are readily available.

5.2.10.5. MCC 33, 34 and 32S (Eq. ID: MCC-012 thru 013)

These MCC's were installed in 1978 and are on the process floor where exposed to the outside atmosphere. Each shows signs of corrosion and have motor controllers that are tagged out. Tags are faded, so therefore have been on equipment a while. Pilot devices are also missing on some with holes in the doors allowing the outside atmosphere easy access.

MCC 32S has a large breaker labeled 'OPS Building'. This breaker supplies power for air conditioning services. Because it and the MCC it feeds is on the process floor it is exposed to corrosive gases that settle in the lower areas. Failure of this breaker could cause a loss of climate controlled spaces in the operations building.

5.2.10.6. Miscellaneous

5.2.10.6.1. Alum Control System – Alum system not in service. Control panel (Eq. ID: COC-003) in need of cleaning and some pumps have been removed.

5.2.10.6.2. Dewatering & Transfer Scum Pumps – Control panel (Eq. ID: COC-004) functioning, pumps operational. System installed in 1978 with one pump replaced in 1990. Pump system shows signs of corrosion.

5.2.11. Building 011 Reactor Deck General

5.2.11.1. General Condition

Large open air platform with an assortment of large motors and gearboxes spaced evenly across the deck.

5.2.11.2. Mechanical Aerator Motors

5.2.11.2.1. Eq. ID: MOT-345, 347, & 348

Westinghouse 100Hp Mechanical Aerator (URMA-6 LAR-160AL) Motor (MOT-348), with install date of 1978, is in good condition. Protective coating is mostly intact, but conduit fittings and some hardware are extremely corroded. Motor (MOT-347) is of the same type as MOT-348; however, it is not connected for operation. Corrosion is apparent in area normally covered by connectors.

5.2.11.2.2. Eq. ID: MOT-355, 356, 361, & 362

General Electric 60Hp Mechanical Aerator 19 (High purity Oxygen) Motor (MOT-361), with install date of 1978, is in fair to poor condition. Heavy corrosion is noted on the bottom seal of the outer case.

5.2.11.2.3. MOT-357

Baldor 60Hp Mechanical Aerator (URMA-15 LAR-140AL) Motor (MOT-357), with install date of 1991 is in good condition. Protective coating, conduits and fittings have few blemishes. Corrosion is noted on and around mounting platform.

5.2.11.2.4. MOT-358, 359, 360, 363, 365, & 366

Westinghouse 60Hp Mechanical Aerator (URMA-21 LAR-140AL) Motor (MOT-363), with install date of 1978, is in fair condition. Protective coating has held up well, but fittings and mounting structure are badly corroded.

5.2.12. Building 012 Final Tanks General

5.2.12.1. General Condition

This long and narrow raised platform between the north and south set of final tanks contains an assortment of small motors for collector drives.

5.2.12.2. Collector Motors (Eq. ID: MOT-253 thru MOT-274)

Westinghouse ½ or ¾ Hp Longitudinal collector drive motors, with install date of 1978, are in fair-poor condition. Inventory file does not show replacement of MOT-265, which is now a 1Hp, 4pole, Hyundi Crown Triton Motor with the manufacture date of 05/2011. This motor, its associated tank, and gearbox were not yet connected for use at the time of inspection. Corrosion was noted at empty screw-hole next to ID plate.

5.2.13. Building 013 Intermediate Pumping Station

5.2.13.1. General Condition

Installed in 1978, this pump station is not in use and the door to electrical room is open to the outside. All electrical equipment is showing signs of corrosion and entire room is in need of general housekeeping.

5.2.13.2. IP-MCC-47 (Eq. ID: MCC-015)

Square D motor control center IP-MCC-47, with installation date of 1978, is missing indicators in the front panel. This allows the atmosphere inside the equipment where further corrosion is likely to have occurred.

5.2.14. Building 014 Denitrification Filters - Not Evaluated, no major electrical gear.

5.2.15. Building 015 Filter Building

5.2.15.1. General Condition.

Main breaker panel in small air conditioned control room, but overall building is large ageing structure. Main room appears impractical to implement proper climate control due to size. Doors to electrical rooms on North side of building left open to corrosive environment outside. Some conduit fitting and pipe-strap on building southern exterior is in need of immediate replacement due to corrosion.

5.2.15.2. Monorail Hoist (Eq. ID: MAH-006)

High voltage lines for Monorail Hoist are in close proximity to Chemical Analysis and Sample station. Lock-Out of the associated breaker is recommended for anytime the Hoist is not in use. Relocation of ChemScan and all associated equipment to another area in the plant may also be warranted.

5.2.15.3. MCC-57 (Eq. ID: MCC-016)

Federal Pacific Class 5310, MCC-57, with install date of 1978, is in closed climate controlled electrical room on Northside of building (door reads "South Face") and in fair condition.

5.2.15.4. MCC-58 (Eq. ID: MCC-017)

Westinghouse 2100 Series, MCC-58 in main room is in fair condition. Water staining is evident on wall behind equipment and rust developing on bottom corners. Install date is 1978. Conduit is in good condition.

5.2.15.5. MCC-58A (Eq. ID: MCC-018)

Federal Pacific Class 5310, MCC-58A in climate controlled Control Room is in good condition. Install date of 1978

5.2.15.6. MCC-59 (Eq. ID: MCC-019)

Federal Pacific Class 5320, MCC-59 in main room is in fair condition. Water stains on wall behind equipment and rust developing on bottom corners. Install date of 1978.

5.2.15.7. MCC-59A (Eq. ID: MCC-020)

Federal Pacific Class 5310, MCC-59A in electrical room on North side of building is in poor condition due to exposure to corrosive environment outside. Install date 1978. Equipment condition to be addressed in MCC Poor CIP FY17.

5.2.15.8. Chlorination and Dechlorination 120/240V Power Feeds

General Electric dry transformer (Eq. ID: TFS-71), lighting panel PP (Eq. ID: ELP-28), and Main Breaker for panel PP, in same electrical room as MCC-59A, are also in poor condition. Install date 1978.

5.2.15.9. Switchgear #56 (Eq. ID: SWG-005)

Federal Pacific Switchgear #56 in closed electrical room with install date of 1978 is in fair-poor condition. Room utilizes blowers only for climate control. Project to remove and replace switchgear "Denitrification Filter Building No. 1 Switchgear Replacement" is currently in design phase with Tricon Consulting Engineers.

5.2.15.10. Electrical Lighting panels (Eq. ID: ELP-024 thru 027)

Federal Pacific Lighting Panels LP-53, LP-54, LCP-55 and Square D lighting panel LP-53 are in closed climate controlled electrical room on Northside of building (door reads "South Face") and in fair condition. Install date is 1978.

5.2.15.11. LP-57 Panel and Transformer (Eq. ID: ELP-023 & TFS-072)

Federal Pacific dry transformer for lighting panel LP-57 is in HVAC room next to control room and in fair condition. LP-57 in climate-controlled control room was not evaluated. Install date is 1978 for both items.

5.2.15.12. Transfer Switches TS#1 & 2 (Eq. ID: TRS-003 & 004)

Eaton transfer switch TS#1 is in filter building main room, and in good condition. Eaton transfer switch TS#2 is in HVAC room next to control room and in good condition. Install date is 2012 for both items.

5.2.15.13. Backwash Air Blower Motors (Eq. ID: MOT-008 & 009)

Ideal Electric 350Hp backwash air blower motors are in good-fair condition. Support structure shows substantial corrosion, but protective coating on motor is in good condition. Install date 1978.

5.2.15.14. Backwash Water Pumps (Eq. ID: MOT-169 thru 171)

Ideal Electric 200Hp backwash effluent water pump BWP-3 motor (MOT-171) is in good condition for its age. Protective coating on exterior is multi-layered and intact. Install date is 1978.

5.2.15.15. General Purpose Water Pumps (Eq. ID: MOT-172 & 173)

US Electric 400Hp general purpose pump motors (MOT-172 & 173) are in fair condition. Protective coating is showing wear in places, allowing corrosion underneath. US Electric 150Hp general purpose pump motors (MOT-180 & 183) were not evaluated. Install date is 1998 and 1991, respectively.

5.2.15.16. Chlorine Solution Pump Motors (Eq. ID: MOT-176 & 177 and MOT-184 & 185)

Baldor 50Hp Chlorine solution pump motors (MOT-176), with install date of 1996 is in good condition. Reliance Electric 50Hp Chlorine solution pump motor (MOT-177) was not evaluated. Install dates of 1996 & 1978 respectively. 5.15.22. Baldor (unknown size) Chlorine solution supply pump motors (MOT-184 & 185) were not evaluated. Install date unknown.

5.2.15.17. Siemens and Reliance 20Hp thicken tank dilution pump motors (MOT-174 & 175) were not evaluated. Install date of 1978.

5.2.15.18. Lawn & Irrigation Pump Motors (Eq. ID: MOT-178 & 179)

Reliance Electric 100Hp LIP motors, with install date of 1978, and were not evaluated as not critical to plant operations.

5.2.15.19. Goulds 15Hp backwash strainer motors (Eq. ID: MOT-049 & 050) were not evaluated. Install date 1978.

5.2.16. Building 016 Post Aeration

5.2.16.1. General Condition

Building is an open air outdoor location, including open tanks. Motors for sample pumps not listed on inventory file. Electrical conduit is in fair condition.

5.2.16.2. Crane Sample Pump (Eq. ID: SAP-11 & SAP-12)

Crane Sample Pump Post Static Mix #1 & 2 has previously un-named Weg motor: 1Hp, 3 phase, 460V, 1.45A, 3470RPM.

5.2.16.3. Dewatering Pump (Eq. ID: DWP-002)

Unknown manufacture 33.5 Hp motor for ABS dewatering pump not evaluated. Motor is not listed on inventory file separate from pump.

5.2.17. Building 017 Junction Chamber #4

5.2.17.1. General Condition

Building is an open air outdoor location, pumps located next to open air pits. Motors for mechanical mixers are missing inventory tags. Sheet metal mounting plate shows strong corrosion.

5.2.17.2. Baldor 10HP motor (MOT-373) in fair condition (thick coated corrosion protection). Install date 1996.

5.2.17.3. Leeson 10HP motor (MOT-374) in fair-poor condition (worn through corrosion protection). Install date 1996.

5.2.18. Building 018 Outfall (Overflow) Structure

5.2.18.1. General Condition

Building is an open air outdoor location with sluice gates and flow recorders submerged. Pipe strap for telemetry panel needs replacement.

5.2.18.2. Miscellaneous

Freestanding Federal Pacific 480/240/120 dry transformer (not ID'd) is located on concrete slab in poor condition. Rust accumulation is noted on transformer and C-Channel supports.

5.2.19. Building 019 Warehouse

5.2.19.1. General Condition.

Large building is of newer construction, primarily used as a storage facility. Exposure levels vary for electrical equipment housed therein. Temporary storage for non-electrical equipment in electrical spaces is being addressed.

5.2.20. Building 020 Raw Sludge Pumping Station

5.2.20.1. General Condition.

Old building with outside door and windows left open to the elements is in need of repair or replacement. Project "Old Primary MCC Replacement" is currently in bidding process for demolition/removal and replacement of the existing Motor Control Center, two (2) three-phase transformers, a single phase and three-phase panel board, lighting fixtures and all associated conduit, conductors, and equipment.

5.2.20.2. Cutler Hammer MCC Primary Raw Sewage PS (Eq. ID: MCC-22)

This motor control center is in very poor condition with high corrosion. Install date is 1991.

5.2.20.3. Exhaust fan and sump pump motors (MOT-107, MOT-790), with install date of 1950. Due to poor condition, both in need of replacement if operation of the facility is expected to continue.

5.2.20.4. Raw sludge pump motors (MOT-602, MOT-603), with install date of 1980 are in fair-good condition. Protective coating has held up fairly well.

5.2.21. Building 021 Anaerobic Digester Tanks #1-5 – Not evaluated, no major electrical gear.

5.2.22. Building 022 Return Sludge Station #1

5.2.22.1. General Condition

Open building plan with roll up door opening at either end, which are generally left open. Process area on lower below grade floor with electrical equipment on at grade floor but open to process and outside atmosphere. Equipment installed in 1978 and shows signs of corrosion. Changes to variable frequency drives have been made over the years (after 2002), with change out of the eddy current drives to inverters using the existing enclosures. Outside ventilation is present but is partially ineffective due to doorways being left open.

5.2.22.2. MCC-41 (Eq. ID: MCC-024)

This MCC was installed in 1978 and shows signs of corrosion. Because of exposure to ambient air external rust and dust are present. Individual compartments are not sealed which allows corrosive gases to enter.

5.2.22.3. Variable Frequency Drives (Eq. ID: VFD-009 thru 013)

The existing eddy current drives were changed out starting in 2002. The newer drives are in good shape, however susceptible to corrosive gases because of the open air location of the enclosures. They are also exposed to the ambient air temperatures that can exceed 90^0 F in the summer. (Drives are rated for 104^0 F.) This can put undue stress on components.

5.2.22.4. Miscellaneous Equipment

Distribution panels were installed in 1978 and are NEMA 1 rated. Signs of corrosion are prevalent. Conduit is aluminum and is generally in good shape. Lower process area has exposed ductbank leaking water at junction box, due to the incorrect pitch of conducts from an exterior manhole. The continuous water has corroded the junction box and is causing spalling of the concrete area around it.

5.2.23. Building 023 Return Sludge Station #2

5.2.23.1. General Condition

Building layout and construction is similar to Return Sludge Station #1. Open building plan with roll up door opening at either end, which are generally left open. Process area on lower below grade floor with electrical equipment on at grade floor but open to process and outside atmosphere.

5.2.23.2. MCC-43 (Eq. ID: MCC-027 & 029)

Westinghouse motor control center, with install date of 1978, is in fair condition. Some corrosion is noted along the bottom of the gear and between bucket sections. All fasteners are also corroded.

5.2.23.3. VFD's (Eq. ID: VFD-019 thru 13)

Robicon variable frequency drives for Return sludge pumps 2A thru 2E were installed in 2004 are in good condition. Some corrosion is noted on the air vent on the bottom of the equipment. Yaskawa VFDs for waste sludge pumps were installed in 2003, but A-D replaced in 2015. Little to no corrosion is noted on these VFDs, which do not have vents on the front panel.

5.2.23.4. Switchgear No. 40 (Eq. ID: SWG-006)

Westinghouse switchgear which was installed in 1978 is in good condition for its age. Little to no corrosion is noted on enclosure.

5.2.23.5. Final Tank Skimming Control Console (Eq. ID: COC-015)

Installed in 1991, the NEMA 4X enclosure for this console is in good condition. However, one of the gauges is missing from the right front panel, exposing the inside of the equipment to the open-air environment.

5.2.23.6. Waste sludge pumps (Eq. ID: MOT-897 thru 899)

U.S. Electric 60Hp motors for waste sludge pumps 1 & 2, with install date of 1993 were in good to fair condition. Some flaking of the protective coating was noted on MOT-898 with subsequent corrosion of metal underneath. MOT-899 and associated waste sludge pump 3 have been removed from service.

5.2.23.7. Return sludge pumps (Eq. ID: MOT-582 thru 586)

Reliance electric 75Hp motors for the return sludge pumps 2A thru 2E were in good to fair condition. Original install date of 1978, and replaced in 2004 when ECC's removed. Thick layer of protective coating has held up well thus far. In the few places where pitting or flaking is noted, corrosion has occurred.

5.2.23.8. Miscellaneous

Transformers T-4A-1 and T-4B-1 in attached enclosure are listed as part of building 44: outdoor switchgear. Equipment is part of ongoing project and appears to have been replaced relatively recently.

5.2.24. Building 024 Return Sludge Station #3

5.2.24.1. General Condition

Building layout and construction is similar to Return Sludge Station #1. Open building plan with roll up door opening at either end, which are generally left open. Process area on lower below grade floor with electrical equipment on at grade floor but open to process and outside atmosphere. Water leakage from duct bank junction box adds to the general humidity on the lower floor.

5.2.24.2. MCC-45 (Eq. ID: MCC-030)

Manufacturer of this motor control center is not named on enclosure. Condition for this circa 1978 MCC is fair to poor, as significant corrosion is noted across bottom of gear and between sections. Several breakers, including the longitudinal and cross collectors 9A, are tagged for emergency use only.

5.2.24.3. MCC-46 (Eq. ID: MCC-032)

The backside of gear MCC-45 was previously labeled MCC-46, but is now also labeled MCC-45. Buckets in this section are newer additions to the MCC, with install dates of 2003 per the inventory excel file. Corrosion is mainly limited to fasteners in these sections.

5.2.24.4. VFD's (Eq. ID: VFD-021 thru 025)

Robicon 454GT series VFDs, with install date of 2003, are in good condition. Little corrosion is noted to enclosure. This model of VFD contains multiple vent plates similar to the ones installed in Return Sludge Pump Station #2.

5.2.24.5. Electrical lighting panels (Eq. ID: ELP-057 & 058)

Westinghouse 100A panels LP-44 and LP-45, with install date of 1978, are in fair condition. Corrosion is noted near corners of enclosure.

5.2.24.6. Return sludge pumps (Eq. ID: MOT-587 thru 591)

Reliance Electric 75Hp motors for return sludge pumps were installed in 1978 and replaced in 2003 when the eddy current clutches were removed. Motors are dirty, but otherwise in good condition, and protective coating is mostly intact.

5.2.25. Building 025 Diffused Air Reactors

5.2.25.1. General Condition

Building is a newer (1996) open air facility with an assortment of open air tanks, gates, and pumps.

5.2.25.2. Electrical conduit and fittings appears in fair condition. Flaking of paint with some other corrosion is noted. Part of the support structure for conduit between Building 030 and Building 025 is corroded and in need of replacing.

5.2.25.3. US Electrical motor, 50Hp, 460V, 58.9A, for mechanical mixer (MM-3D) of unknown age is in fair condition. There are multiple layers of protective coating which has flaked off in places. All motors and mechanical mixers left off inventory file.

5.2.25.4. Weg motor, 1Hp, 460V, 1.45A, for sample pump (SAP-20) is in fair-poor condition. All sample pump and scum transfer pump motors left off inventory excel file.

5.2.26. Building 026 Sludge Thickener Tank

5.2.26.1. General Condition

Middle aged outdoor facility has an overhang covering a control box with cover open. Motors for mixers and collector drivers installed in 2012 and 2014, were not evaluated.

5.2.27. Building 027 Primary Drying Beds 1-2 – Not evaluated, no major electrical gear.

5.2.28. Building 028 A Digester Control Building

5.2.28.1. General Condition

Building is of older construction. MCC to be replaced per on-going project "Building A MCC & I&C." Equipment is exposed to corrosive environment.

5.2.28.2. MCC-62 & 62B (Eq. ID: MCC-033 & 035)

Motor control centers MCC-62 & 62B are in good to fair condition. Minimal to some corrosion is noted on enclosure.

5.2.29. Building 029 B Digester Control Building – Not evaluated, no major electrical gear.

5.2.30. Building 030 Sludge Treatment Building

5.2.30.1. General Condition

Large building with doors propped open has pipe assembly with puddled moisture on the main floor near electrical equipment. Building was constructed in 1978 and part of upgrades from 1992-1996. Downstairs contains numerous pump motors and telemetry equipment in close proximity to polymer storage tanks. Moderate corrosion of some electrical conduit fittings and supports is noted throughout the facility.

5.2.30.2. MCC-51A thru 54A (Eq. ID: MCC-43 thru 46)

Westinghouse Series 2100 MCC-51A thru 54A, installed as part of Project 5H-4, is in fair condition. Manufacturer's ID plate lists date of Oct. 1993. Corrosion is apparent on the panel front, likely due to exposure.

5.2.30.3. MCC-50 thru 55 (Eq. ID: MCC-37 thru 42)

Federal Pacific MCC-50 thru 55, with install date of 1978, is in fair condition with a modest amount of corrosion apparent on the panel front, likely due to exposure. Some panel fronts are open, ajar, or missing fasteners, allowing further intrusion of corrosive conditions.

5.2.30.4. Variable Frequency Drives (Eq. ID: VFD-026 & 027 and VFD-028 thru 031)

Yaskawa VFD's for Waste Pump #1&2, with install date of 1996, are in fair condition. Corrosion on enclosure vent plate is likely due to exposure. Yaskawa VFD's for Thickened Sludge Pumps 1A, 1C, 2A, & 2C does not list an install date on the inventory excel file. Pumps have an install date of 2014. Condition is fair, with external corrosion limited to enclosure hardware and supports.

5.2.30.5. Freestanding Federal Pacific 480/208Y/120 30kVA Dry Transformer not listed on inventory excel file is in fair condition. Corrosion is apparent on outside case and electrical conduit fittings. This transformer connects to a no-label LP, which is also not listed on inventory excel file.

5.2.30.6. Panels LP-50, LP-51, and LCP-52 installed prior to Project 5H-4 on East wall are not listed on excel inventory file and in fair condition. Some corrosion is noted on enclosure.

5.2.30.7. Battery Pack (Eq. ID: EBB-9)

Battery pack and control station shown on master list was not evaluated, as it was not found. Install date is 1978.

5.2.31. Building 031 Filtrate Pumping Station

5.2.31.1. General Condition

This outdoor pump station consists of a NEMA _ control box located next to a large covered wet well with submersible sewage pumps P1 and P2 inside. MCC listed on excel inventory file was not located at this site.

5.2.32. Building 032 Sludge Dewatering Building

5.2.32.1. General Conditions

Building structure and process equipment exposed to high levels of corrosive gases, partially due to open and unventilated equipment process. (Belt filters). Main electrical equipment is in separate electrical room, but corrosion is evident on electrical equipment because of poor ventilation and outside atmospheric intrusion though leaking doorways.

5.2.32.2. MCC Sludge Feed Pump & Acc. (Eq. ID: MCC-054)

Installed in 1985 appears in good shape with minimal corrosion and evidence of recent service and repair.

5.2.32.3. MCC 503 (Eq. ID: MCC-048)

This equipment was installed in 1985 using NEMA 1 rated enclosure. Exterior show signs of moderate corrosion, possibly due to close proximity to exterior doorways.

5.2.32.4. MCC 502 (Eq. ID: MCC-050)

Also installed in 1985, this equipment is in good shape with minimal corrosion, presumably due to its location away from exterior doorways.

5.2.32.5. MCC 502A (Eq. ID: MCC-052)

This two section Siemens Tiastar MCC was installed in 1992. There is some corrosion noted around the bottom of the enclosure; otherwise it is in good condition.

5.2.32.6. Belt Filter Press Control Panels (Eq. ID: SFP-009)

Panels installed between 1991 and 2001 and are in good shape due to epoxy coating of panel and that it is gasketed. Panels not listed separately on inventory excel file

5.2.32.7. Polymer Blending Control Panel (Eq. ID: MCP-001)

Stainless Steel NEMA 4X panel located on process floor, shows signs of wear and corrosion but is functional. However because panel doors are left open, possibly because of heating issues, the interior components are exposed to highly corrosive gases from process area.

5.2.32.8. Miscellaneous

Local control stations, disconnects and motors are exposed to corrosive gases and dusts, and are showing signs of wear. Exterior coatings have not been kept up and therefore allow gases to attack carbon steel enclosures. Conduit is a combination of galvanized steel and aluminum, with aluminum faring better.

5.2.33. Building 033 Waste Gas Burners – Not evaluated, no major electrical gear.

5.2.34. Building 034 Primary Bed Polymer Building – Not evaluated, no major electrical gear.

5.2.35. Building 035 Sludge Heat Drying

5.2.35.1. General Conditions

Facility is shut down for evaluation of process costs. Exterior building skin shows signs of corrosion at base. Interior electrical systems for process are in reasonable condition for their age with minor corrosion. Main electrical equipment is housed in air conditioned room.

5.2.35.2. Switchgear (Eq. ID: SWG-008)

Main-Tie- Main configured, Westinghouse, installed in 1990 and is in good shape as it is installed in an air-conditioned space.

MCC-M and MCC for Trains 2 & 3 (Eq. ID: MCC-056 thru 058)
Westinghouse 2100 Series MCC's are housed in air-conditioned electrical room and show normal wear. Installation date 1990. Breakers are tagged off presumably because of shut down.

5.2.35.3. Miscellaneous Equipment

Lighting panels (1978), transformers (1991) and local control stations (1990) are in good condition for age.

5.2.36. Building 036 JC #1 Odor Control #1 Facility.

5.2.36.1. General Conditions

Building 036 and 037 are two sections of one facility. Constructed in 1987, Odor Control #1 is the older of the two sections.

5.2.37. Building 037 JC #2 Odor Control #2 Facility

5.2.37.1. General Conditions

Building interior is open to outside atmosphere as doors are left open and mechanical ventilation limited. Electrical equipment is also exposed though covered by building. Corrosion is apparent on some equipment.

5.2.37.2. MCC-27B (Eq. ID: MCC-059)

Westinghouse 2100 Series is circa 1994. MCC is exposed to direct outside atmosphere though in a building. MCC shows signs of corrosion

5.2.37.3. Odor Control Panel

This is a custom NEMA 4X Stainless Steel panel enclosure for odor control and compressor control. Panel exposed to outside atmosphere, though located in building. Enclosure shows signs of corrosion as well as pilot devices mounted on door. Panel not listed on excel inventory file.

Miscellaneous Equipment

Distribution transformer and distribution panel mounted in building, but exposed to outside atmosphere. Equipment shows signs of corrosion. Conduit and mounting hardware is in good shape with minor coating erosion. Lighting is functional though cleaning is recommended.

5.2.38. Building 038 Vehicle and Equipment Repairs – Not evaluated, no major electrical gear.

5.2.39. Building 039 Technical Services and Repair – Not evaluated, no major electrical gear.

5.2.40. Building 040 Operations and Maintenance Building

5.2.40.1. General Condition

O&M Building is of relatively new construction located adjacent to Screen & Grit #1.

5.2.40.2. Switchgear #23 (Eq. ID: SWG-009)

General Electric Powerbreak Series Switchgear #23, with install date of 1990 is in good condition. Corrosion on the enclosure is generally limited to fasteners.

5.2.40.3. MCC-27 & 28 (Eq. ID: MCC-063 & 064)

Federal Pacific Class 5320 motor control center MCC-27, with install date of 1978 is in good condition. Corrosion on the enclosure is generally limited to fasteners.

5.2.40.4. MCC-26 (Eq. ID: MCC-060)

General Electric MCC-26 is in fair condition. Some corrosion is noted between sections and along the bottom of the enclosure.

5.2.40.5. MCC-26A (Eq. ID: MCC-061)

Westinghouse 2100 Series motor control center MCC-26A is in good condition. Corrosion on the enclosure is generally limited to fasteners.

5.2.40.6. Miscellaneous

Electrical lighting and power distribution panels LP-28 & 27 are in fair to poor condition. Substantial corrosion to enclosure is noted. Other panels and associated transformers are in good to fair condition. Temporary storage for non-electrical equipment in electrical spaces should be addressed.

5.2.41. Building 041 Oxygen Generation and Storage Equipment

5.2.41.1. General Condition

Plant process equipment in need of complete overhaul, excessive corrosion and age of equipment is apparent. Electrical equipment in separate building not air-conditioned.

5.2.41.2. Switchgear (Eq. ID: MCC-336)

Medium voltage motor control center, equipment is in a separate building that is not air-conditioned. Gear was installed in 1998 and is in reasonable condition for its age.

5.2.41.3. MCC-10 & 11 (Eq. ID: MCC-065 & 067)

Equipment is in same building as switchgear. Westinghouse MCC's are Series 2100 and were manufactured in 1998. Gear is in reasonable condition for its age.

5.2.41.4. O2 Motor (Eq. ID: MOT-031)

Reliance Electric 1500Hp motor No. 2 shows numerous signs of external corrosion. Motor No. 1 was out for rebuild or replacement at the time of evaluation. Both motors installed in 1998. Parts readily available, however increases in time and cost required for major repair are expected to accelerate as equipment ages.

5.2.42. Building 042 Chemical Handling Equipment Platform

5.2.42.1. General Condition

Outdoor open air enclosure is in close proximity to corrosive substances. Enclosure for controls cabinet was found open, regardless of sign on door directing to keep it latched.

5.2.42.2. MCC 59B Chemical Handling Eq. (Eq. ID: MCC-069)

This MCC has an install date of 1978. Outer enclosure displays extreme corrosion. Equipment is currently under contract for replacement.

5.2.42.3. Methanol Feed Pumps (MOT-367 thru 370)

Baldor motors are from 1991 installation and in fair condition.

5.2.42.4. Methanol Transfer Pumps (MOT-452 & 453)

Westinghouse motors are from 1978 installation and in fair-poor condition. Corrosion on outer case is apparent.

5.2.43. Building 043 Chemical Storage Tanks

5.2.43.1. General Condition

Outdoor, open air arrangement of tanks with corrosion generally noted throughout. Full electrical inspection of facility not performed. Reliance Sump Pump motor (MOT-801) was not noted during evaluation. Install date of 1978.

5.2.44. Building 044 Outdoor Switch Gear

5.2.44.1. General Condition

The plant medium voltage (MV) distribution breakers are housed in an outdoor rated metal electrical enclosure. A supplementary steel roof structure was installed above the enclosure to prevent acidic condensate from pooling on the metal-clad switchgear roof.

MV breakers are lined up facing each other with rear access from the outside of the enclosure. Though rated for outdoor locations, the gear access enclosure is exposed to ambient plant gases and wind driven water. The metal-clad switchgear is not air-conditioned but has some ventilation with air being drawn from ground level and exhausted above. At the time of this visit, the temperature inside the enclosure was extremely warm.

5.2.44.2. MV Breakers A & B

The original medium voltage DHP Westinghouse air circuit breakers were converted in 2002 to vacuum bottle type by Pacific Coastal Breaker. Westinghouse designed a direct replacement vacuum breaker for the DHP. This breaker is a direct roll-in replacement. No modification is required for the switchboard.

5.2.44.3. Main 13.kV to 4160V Switchgear and Transformers A&B

The two HPO 13.2kV to 4160V transformers and disconnect switches are housed outside under the same metal roof structure as the main A & B switchgear. They show little signs of corrosion. All temperature and oil level gauges are clean and in working order. All transformers are tested annually. Dielectric oil was last checked January 2016.

5.2.45. Building 045 Filter Access Tunnel – Not evaluated, no major electrical gear

5.2.46. Building 046 Dechlorination

5.2.46.1. General Condition

Newer building with door left propped open in a highly corrosive environment. Mild to moderate corrosion to overall structure is apparent. Electrical conduit is noted to be in good-fair condition.

5.2.46.2. MCC D-CL2 (Eq. ID: MCC-71)

Unknown manufacturer MCC not located for. Evaluation is warranted, based on install date of 1989 and exposure levels.

5.2.46.3. De-Chlorination EF-1 &2 (Eq. ID: MOT-111 & 112)

Marathon ¼ & ½ Hp motors were not located for evaluation. Install date of 1989 and exposure level motivates replacement recommendation if facility is to remain in operation.

5.2.47. Building 047 New Filter Building #2 G

5.2.47.1. General Condition

Three story enclosed building of median age construction. Large rolling overhead door left open to the outside on ground level where primary electrical equipment is located. Conduit appears in good-fair condition overall.

5.2.47.2. Switchgear #84 (Eq. ID: SWG-015)

Westinghouse 480V Switchgear installed as part of project 5H-1 in 1991 is in fair condition. Minor amount of corrosion noted around vents and fasteners.

5.2.47.3. MCC #85 & 86 (Eq. ID: MCC-72 & 74)

Westinghouse Series 2100 MCCs, with install date of 1991, are in fair condition. Some corrosion is noted on the exterior panels and around all fasteners.

5.2.47.4. MCC-RW

Square D Model 6 MCC, installed in 2015, is in like-new condition but not listed on excel inventory file.

5.2.47.5. LP-85 & 86 (Eq. ID: ELP-019 & 020)

Westinghouse 480/277V LP-85 (ELP-19) installed in 1991 is in poor condition. Extensive corrosion on the exterior of this panel is noted.

Westinghouse 208/120V LP-86 (ELP-20) installed in 1991 is in fair condition. Mild corrosion on the exterior of this panel is noted, with moderate corrosion noted on fasteners.

5.2.47.6. VFD #2, 3, & 4 (Eq. ID: VFD-36 thru 38)

Yaskawa EWP VFD has installation date of 2003 and is in good condition. Minimal corrosion noted on outer case.

5.2.47.7. LT-86 (Eq. ID: TFS-067)

Installed in 1991, this Westinghouse 480/208Y/120 transformer is in fair condition. Minor corrosion noted to outer case.

5.2.47.8. Backwash Air Blowers 3, 4, and 5 (Eq. ID: MOT-10 thru 12)

Ideal Electric Co. motors with installation date of 1991 are in fair condition. Protective coating has worn through in places, allowing minor corrosion.

5.2.47.9. EWP Backwash Pumps (Eq. ID: MOT-186 thru 188)

Marathon 200 Hp motors actively running at time of inspection. Overall condition is fair. Assembly shows some corrosion. Install date 1991.

5.2.47.10. Miscellaneous

Solcon Softstarts on excel inventory file with install date of 2014 were not noted. Ongoing project listed as “Large Motors Soft Start Addition, Phase II.”

General Electric Power Distribution Panel 047 (PDP-2) was not noted during facility inspection. Installation date of 2002, per excel inventory file.

Unknown manufacturer ¾ Hp REF motor (MOT-536) was not noted on walk through. Marathon and Magnetek 7.5Hp to 1.5Hp supply fan motors (MOT-664 thru 671) were not noted on walk through. U.S. Electric 1Hp sump pump motors (MOT-848 thru 850) were not noted on walk through. Install dates for above listed motors are 1991.

5.2.48. Building 048 Denit Filters #21 thru #32 – Not evaluated, no major electrical gear.

5.2.49. Building 049 Junction Chamber #6 – Not evaluated, no major electrical gear.

5.2.50. Building 050 Junction Chamber #5 – Not evaluated, no major electrical gear.

5.2.51. Building 051 Carpenter Shop

5.2.51.1. General Condition

Medium sized building of original construction (1950) is also part of Effluent Building and Welding shop. Electrical equipment is kept in non-climate control room on north side of structure. Unknown age Square D 225A Power Distribution Panel and Westinghouse transformer are not on inventory excel file. Likewise, unknown manufacturer "Power Building 52" Lighting Panel and transformer are not listed on inventory. Telemetry equipment is partially wall mounted without a protective enclosure.

5.2.52. Building 052 Effluent Building and Welding Shop – Not evaluated, no major electrical gear.

5.2.53. Building 053 Former Carpenter Shop – Not evaluated, no major electrical gear.

5.2.54. Building 054 Sludge Control Building

5.2.54.1. General Condition

Building was installed in 1978-1980 and given an equipment upgrade in 1996. Electrical equipment is stored in a climate controlled room. Atmosphere outside this room is very corrosive, due to proximity to sludge dewatering, storing, and drying areas.

5.2.54.2. MCC-501 (Eq. ID: MCC-076)

Federal Pacific MCC-501, with install date of 1978, is in fair condition. Corrosion is noted to be most concerning in the bottom left corner of the MCC. At the time of inspection, a majority of breakers for this MCC were tripped or otherwise in the "off" position.

5.2.54.3. MCC-501A & 501B (Eq. ID: MCC-078 & 080)

Westinghouse Series 2100 MCC, with install date of 1978, is in good condition. Minimal to no corrosion noted. Many of the breakers on this MCC were locked out at the time of inspection.

5.2.54.4. VFDs (Eq. ID: VFD-039 & 040)

Yaskawa variable frequency drives, with install date of 1996, are in fair condition. Corrosion is noted on enclosure fan vent.

5.2.54.5. Electrical Lighting panels (Eq. ID: ELP-011 & 012)

Federal Pacific 480/277V 225A panel LP-501, and 208/120V 100A panel LP-502, with install date of 1978 are in good-fair condition. Minimal corrosion noted to enclosure.

5.2.54.6. Polymer Blending System (PBU-005 & 006)

Polymer Blending System control station is on a lower level of the building, and in a non-climate controlled room. System was installed in 1978, per inventory excel file. Gasketed NEMA 4X enclosure looks very good for its age, due to being of Aluminum construction.

5.2.54.7. Miscellaneous

Much of the conduit, fittings, and supports are showing signs of corrosion, including peeling, flaking paint and rust accumulation. Above ground conduit on the exterior of the building shows the greatest degree of corrosion. Painted aluminum conduit enters concrete wall without buffer.

5.2.55. Building 055 Secondary Drying Beds – Not evaluated, no major electrical gear.

5.2.56. Building 056 Belt Thickener Building

5.2.56.1. General Condition

Large building is of older construction and did not appear to be in use at the time of inspection. Existing facility flow diagram shows subnatant exiting from FBS Thickening entering the Primary Settling Tanks in the treatment train. Conduit supports and other supports throughout building are highly corroded. Rolling overhead doors are closed, but other doors propped open throughout building. Main electrical room contains multiple non-inventoried Control Panels, some of which appear gutted. A more detailed inspection of equipment with subsequent replacement of items is warranted prior to Belt Thickener facility resuming normal operation.

5.2.56.2. MCC-87

Westinghouse 2100 Series MCC, not listed on Excel inventory file for building, is in good-fair condition.

5.2.56.3. Miscellaneous

Westinghouse 30kVA 480/208Y/120V dry transformer LT-87 (Eq. ID: TFS-101) is in good-fair condition. Minimal corrosion noted around fasteners only. Westinghouse lighting panels 87A & 87B (Eq. ID: ELP-62 & ELP-63) are in poor and fair conditions respectively. ELP-62 shows substantial corrosion on case and around fasteners. Install date is 1978 for both panels and transformer.

5.2.57. Building 057 Nitrification Pumping Station IPS #2

5.2.57.1. General Condition

Building is an open air platform adjacent and to the East of the Diffused Air Reactors. A small enclosed structure of relatively new construction houses a sampling station on the SW corner of the platform. Motors for ABS nitrification pumps not evaluated. Outer enclosure is in fair condition. Install date is 1996.

5.2.58. Building 058 Blower Building (DARs)

5.2.58.1. General Condition

Large building is of newer construction adjacent to the North of the Diffused Air Reactors. Top floor with control and electrical rooms is closed off and climate controlled. Ground floor houses blowers and motors. Door trim on upper-level West-side is in need of repair or replacement. Electrical conduit is in good condition throughout.

5.2.58.2. MV-MCC-80 (Eq. ID: MCC-83)

Westinghouse 4160V Ampgard Medium Voltage MCC, with install date of 1996, is in good condition. Minimal corrosion is noted at the junction of some bucket sections. Testing, servicing, and calibration performed by Reliability Consulting Services, Inc. on 6/24/15. Plant operators last testing last performed 9/15/15 for line resistance only.

5.2.58.3. MCC-82 (Eq. ID: MCC-81)

Westinghouse Series 2100 MCC-82, with install date of 1996, is in very good condition. Corrosion to exterior limited to breaker fasteners.

5.2.58.4. Switchgear #81 (Eq. ID: SWG-016)

Westinghouse Switchgear #81, with install date of 1996, is in good condition.

5.2.58.5. VFDs (Eq. ID: VFD-041 thru 047)

Yaskawa VFDs NP #1 thru 7, with install dates of 2008, are in like new condition. No corrosion is noted. NP-4 was locked out at the time of inspection due to high temp alarm. Date on lock out tag is 2014. NP-2 was not locked out at the time of inspection; however, tag indicates that it is for emergency use only.

5.2.58.6. Transformers LT-82A & 82B (Eq. ID: TFS-99 & 100)

Westinghouse transformers LT-82A & 82B, with install dates of 1996, are in very good condition for their age. Mounted 6ft above the floor, the inventory listed rating was not confirmed at the time of inspection.

5.2.58.7. Blowers (Eq. ID: MOT-014 thru 016)

Siemens Allis 700Hp air blower motors, with install dates of 1996, are in good condition. Minimal corrosion noted to motor case.

5.2.59. Building 059 Screen & Grit #1

5.2.59.1. General Conditions

The newer of the two functioning screen and grit buildings, electrical equipment is exposed to corrosive gases from the grit chambers. Walls are louvered and doors left open to the outside. General corrosion is noted throughout the interior and exterior of the building.

5.2.59.2. Screen & Grit Switchgear #28 (Eq. ID: SWG-002)

This Westinghouse switchgear was installed in 1991. It is Main-Tie-Main configuration with Kirk Keyed interlocks. It shows some signs of exterior corrosion. Breaker status lighting is non-functional, though analog metering is. No recent testing of breakers was noticed.

5.2.59.3. MCC-28 & 29 (Eq. ID: MCC-000085 & 000086)

Installed in May 1990, this Westinghouse MCC shows signs of heavy H2S corrosion and subsequent exterior repair of paint covering. Several starter buckets show signs of arc flash, possibly due to corrosion, with one tagged 'Out-Of-Service'. A portion of this MCC is directly under the exhaust fan, and is where the heaviest corrosion occurs. This is probably due to the concentrated air flow that occurs in this area and water intrusion from the exhaust fan.

5.2.59.4. Miscellaneous Equipment

Electrical lighting panel (Eq. ID: ELP-055), with install date of 1991 is in poor condition. Corrosion is apparent inside and outside. Emergency battery banks were not noted at time of evaluation. Wall mounted panels with variable speed drives were installed in 2011 and are in good condition. These are installed in panels are stainless steel NEMA 4X rated. Bubbler control panel, with install date of 1981, is showing corrosion on the corners.

A control panel presumably installed in 1991 for slide gate control has been partially abandoned for use as a relay enclosure. All pilot devices have been removed for the face. This panel is not NEMA 4X rated and is painted steel. It shows signs of heavy corrosion. In addition, the door has not been kept closed and the interior electrical terminal connections also show signs of corrosion. The relays are sealed but their pin connections are not.

5.2.60. Building 060 New Admin & Lab Building

5.2.60.1. General Condition

This large building of newer construction is in the north east corner of the treatment plant. Incidence of corrosive gases in this area is the lowest, in comparison to the rest of physical buildings in the plant. Electrical equipment is housed in climate controlled spaces and in generally good condition.

5.2.60.2. MCC-91 & 91A (Eq. ID: MCC-087 & 088)

Square D Model 5 motor control centers MCC-91 & 91A installed in 2015 are in very good condition. No corrosion to joint enclosure is noted.

5.2.60.3. Uninterruptible Power Supply (Eq. ID: UPS-013)

UPS was replaced in 2016.

5.2.60.4. Miscellaneous

Electrical lighting and control panels are in good condition; however, temporary storage for non-electrical equipment in electrical spaces should be addressed. SWG-018 and MCC-089 from the excel inventory file were not noted during inspection.

5.2.61. Building 061 Final Sedimentation Tanks #13 thru #20

5.2.61.1. General Condition

Building is large open air platform with numerous open air sedimentation tanks on either side.

5.2.61.2. Collectors (Eq. ID: MOT-275 thru 290 & MOT-323 thru 338)

Calco 3/4Hp motors (MOT-275 thru 290) for longitudinal collector drives and (MOT-323 thru 338) for longitudinal and cross collector drives, which were installed in 1996, are in fair to poor condition. Rust pitting and flaking of protective coating apparent on most motors.

5.2.62. Building 062 Return Sludge Pumping Station #4

5.2.62.1. General Condition

Large building is of relatively new construction with rolling overhead door open to outside. Motor and pump assemblies in main room. Electrical equipment housed in climate controlled room with closed doors. Temporary equipment to the East of building is being powered from LP-812A, with a valid attempt made to reseal the electrical room's door around the power cable. Water staining noted inside electrical room warrants further investigation into possibility of a current/previous roof leak. Electrical conduit is noted to be in good to fair condition.

5.2.62.2. MCC-811 & 812 (Eq. ID: MCC-090 & 091)

Westinghouse 2100 Series MCC-811 & 812, with install dates of 1996, are in very good condition. Little to no corrosion is noted on enclosure.

5.2.62.3. Electrical Lighting & Power Distribution Panels (Eq. ID: ELP-015 & 016)

Westinghouse 208Y120V Lighting panel LP-812A with install date of 1996 is in fair condition. Some corrosion is noted on enclosure.

Westinghouse 480Y/277V Lighting panel LP-812B with install date of 1996 is in poor condition. Significant corrosion is noted on enclosure.

Lighting Contact Panel FT-LCP-4, is not listed on excel inventory file. Panel is in fair-good condition, with moderate corrosion to enclosure and fasteners.

5.2.62.4. Transformers (Eq. ID: TFS-064)

Westinghouse 45kVA 480D/480Y/277V Transformer for LT-812B (TFS-064) with install date 1996 is in good condition. Little corrosion is noted on enclosure.

Westinghouse 30kVA 480D/208Y/120V Transformer for LT-812A (TFS-065) with install date 1996 is in good condition. Little corrosion is noted on enclosure.

5.2.62.5. VFDs (Eq. ID: Yaskawa RSP VFD's 4A thru 4E (VFD-48 thru 052) with install date 2003 are in very good condition. Little to no corrosion noted on enclosure.

5.2.62.6. TECO American 75Hp RSP motors 4A thru 4E (MOT-592 thru 596), with install date of 1996, are in fair condition. Corrosion is apparent in places where the protective coating has eroded.

5.2.62.7. Magnetec 5Hp supply fan motors (MOT-686 & 687) were not evaluated.

5.2.63. Building 063 Return Sludge Pumping Station #5

5.2.63.1. General Condition

This large building was constructed at the same time as Return Sludge Pumping Station #4. Electrical equipment is housed in a climate controlled room. Main pumping room is a large open space with external doors closed and adjacent to electrical room. Pumps are located on the lower level of the main room.

5.2.63.2. MCC-814 & 815 (Eq. ID: MCC-092 & 093)

Westinghouse 2100 Series motor control centers, with install dates of 1996, are in good condition. Little to no corrosion is noted on enclosures.

5.2.63.3. Switchgear No. 810 (Eq. ID: SWG-019)

Westinghouse switchgear with listed install date of 1996 is in fair condition. Corrosion was noted on fasteners. Entire line of breakers was discharged and in need of servicing.

Electrical lighting panels and transformers (Eq. ID: ELP-013 & 014 and TFS-062 & 063)
Westinghouse panels LP-851A & B are in fair condition, with moderate corrosion on the outside. Transformers for panels are also in fair condition. Install date is 1996 for panels and transformers.

5.2.63.4. VFDs (Eq. ID: VFD-053 thru 057)

Yaskawa adjustable frequency drives, installed in old Westinghouse Accutrol 400 enclosures, for return sludge pumps 5A thru 5E, are in good condition. Install dates are 2011 and 1996 with manufacturer Yaskawa, per excel inventory file. The VFD for pump 5C was locked out at the time of evaluation.

5.2.63.5. Return Sludge Pumps (Eq. ID: MOT-597 thru 601)

TECO American 75Hp RSP motors 5A thru 5E (MOT-597 thru 601), with install date of 1996, are in fair condition. Pitting is noted in protective coating.

5.2.63.6. Supply Fans (Eq. ID: MOT-688 & 689)

Magnetec 5Hp supply fan motors, with install date of 1996, are in fair to poor condition. Significant corrosion is noted on vent along with pitting of motor surface.

5.2.63.7. Miscellaneous

Junction box on bottom level is significantly corroded. Open work order exists for this item.

5.2.64. Building 064 Vehicle Maintenance Facility Not Inspected

5.2.65. Building 065 AWT Annual Utilities Not Inspected

5.2.66. Building 066 Vehicle Maint. Facility Not Inspected

5.2.67. Building 067 Plant General (535037 only) Lift Stations Not Inspected

5.2.68. Building 068 Electric Vehicles Maint. Golf Carts Not Inspected

5.2.69. Building 069 Sludge Disposal Not Inspected

5.2.70. Building 070 Scum Thickener Facility

5.2.70.1. General Condition

Large building of older construction in poor condition is currently being used for storage and/or under repair. Outside door is propped open. Main electrical equipment is inside climate controllable room, but also with door propped open. Ductwork inside electrical room is precariously suspended from HVAC system. Overall poor condition of building and equipment contained on and therein.

5.2.70.2. General Electric 8000 Line MCC-43 in poor-fair condition is not listed on excel inventory file. Significant corrosion to enclosure is noted.

5.2.70.3. U.S. Electrical motor for scum equalization pump, in poor-fair condition, not listed on excel inventory file.

5.2.70.4. Sterling Electric motors for tank mechanism in very poor condition and not on excel inventory list.

5.2.70.5. Unlisted motor for sump pump STF SP-1 (SUP-42) on excel inventory list with install date of 1986 not identified during inspection.

5.2.71. Building 071 Mixed Sludge Pumping Station

5.2.71.1. General Condition

Small building is of relatively older construction. Electrical equipment housed in control room with climate control and doors closed off from pump room is in good condition. However, severe water staining and corrosion to wall and junction box is noted in SW corner of pump room. Front cover of box is open, displaying water damage to conduit terminations and cables in junction box. Similar water staining and corrosion to conduit, fittings, and mounting hardware is noted on the NW corner above sump pumps. Missing some covers for conduit bodies.

5.2.71.2. General Electric Switchgear MS-40 and 41 (SWG-20) with install date 1986 is in fair condition. Some corrosion to enclosure is noted.

5.2.71.3. General Electric 8000 Line MCC-40 & 41 (MCC-94 & 95) with install date of 1986 is in fair condition. ID labels for both MCCs are incorrectly placed on Switchgear feeder breakers. Some corrosion to enclosure is noted.

5.2.71.4. Westinghouse lighting panel A (ELP-18) with install date of 1986 is in fair condition. Minimal corrosion noted to enclosure.

5.2.71.5. Reliance Electric 60Hp motor MSP-2 (MOT-450) with install date of 2009 is in good-fair condition. Some rust spots were protective coating has been chipped are noted.

5.2.71.6. Baldor 60Hp motor MSP-3 (MOT-451) with install date of 1993 is in fair condition. Several small chips in protective coating show rust spots on motor case.

5.2.71.7. Baldor 5Hp grinder motors MM-2 & 3 (MOT-762 & 763) were not evaluated. Install date 1991 & 1993 respectively.

5.2.71.8. Submersible 7.5Hp sump pump motors SS-1 & 2 (MOT-807 & 808) were not evaluated. Install date of 1986.

5.2.72. Building 072 Anaerobic Digestion Tanks 6 & 7 Not evaluated no major electrical equipment

5.2.73. Building 073 Hold for Future Digester Tanks 8 & 9 Not evaluated no major electrical equipment

5.2.74. Building 074 Digester "C" Control Building

5.2.74.1. General Condition

Built in 1986, this is the newest of the three digester control buildings. Electrical equipment is housed in a climate controlled room separate from the main pump area.

5.2.74.2. MCC-44 & 45 (Eq. ID: MCC-096 & 097)

General Electric 8000 Line motor control centers, with install date of 1986, are in good condition. Little to no corrosion is noted on enclosure. MCC-44 was not in use at the time of evaluation.

5.2.74.3. Digested Sludge Pumps and Sludge Recirculation Pumps (Eq. ID: MOT-097 thru 100 and MOT-857 thru 860)

5.2.74.4.

Various manufacturer 30Hp and 15Hp TEFC coated motors located in main pump room are in good to fair condition. Some pitting of protective coating is noted.

5.2.74.5. Sludge Gas Mixing Compensator (Eq. ID: MOT-211 thru 213)

Reliance Electric 60Hp TEFC coated motors located on the outside of the building are in fair to poor condition. Protective coating has pitted and completely worn through in places. C-channel support structure, seal-offs, conduit fittings, and associated hardware are extremely corroded.

5.2.74.6. Miscellaneous

Annunciator and control panel located inside climate controlled room is in good condition. Panel is not listed on excel inventory file. Conduits and fittings inside building are in generally good condition.

5.2.75. Building 075 - Not Evaluated no major electrical equipment

5.2.76. Building 076 - Not Evaluated no major electrical equipment

5.2.77. Building 077 - TECO Partnership Station Not Evaluated not used

5.2.78. Building 078 Standby Power

5.2.78.1. General Condition

Large stand-alone building with rollup doors, which generally remain closed. Constructed in 1995, the building is ventilated with cooling towers on the roof of the building for the generator. Primary electrical equipment is in a separate climate controlled room from generators and medium voltage gear.

5.2.78.2. Generators

Four Caterpillar engines with 2000kW 13,200kV Kato alternators are paralleled to provide standby power to the treatment plant. These are tested regularly for reliability and maintenance.

5.2.78.3. Generator Control and Parallel system

This custom paralleling and transfer system looks to be in good condition. We did not see it function, however we were there to notice the generators were running. The solid state relay protection devices used on the breaker and paralleling controls, are not the latest technology, but are in service widely throughout the world.

5.2.78.4. Transfer System

Located in a metal building that is ventilated but not air-conditioned, built also in 1995. Transfer equipment shows little sign of corrosion, though dust build up is evident. Entrance door does not close properly leaving the equipment possibly exposed to the outside elements. System not observed operating.

5.2.79. Building 079 Waste Gas Burner Pad for 6-7 Digesters - Not Evaluated no major electrical equipment

5.2.80. Building 080 Generator Building

5.2.80.1. General Condition

Large building is of newer construction. Main generator room has roll-up doors and louvered walls. Primary electrical equipment is in a climate controlled room separate from generators.

5.2.80.2. Engine Generators 3, 4, & 5 (Eq. ID: EGR-001 thru 005)

Waukesha 500kW Sludge Gas electric generators were in operation at the time of inspection. Generator 3 was installed in the 1980s as part of Project 4H-12. Install date for generators 4 & 5 is unknown.

5.2.80.3. MCC-47A (Eq. ID: MCC-335)

General Electric motor control center MCC-47A, with install date of 1986 is in good condition for its age. Little to no corrosion noted on enclosure.

5.2.81. Building 081 Engine Generator Building

5.2.81.1. General Condition

Generator Equipment is inside Building No. 01 and control panels inside Building No. 85.

5.2.81.2. Engine Generators 1 & 2 (Eq. ID: EGR-001 & 002)

Waukesha 500kW Sludge Gas electric generators were installed in the early 1980s as part of Project 4H-10. Both generators were out of service for repair at the time of inspection.

5.2.82. Building 082 New Primary Tanks General

5.2.82.1. General Condition.

Medium sized open air platform with equipment mounted outdoors next to open tanks. Several motor mounts, seal-offs, and conduit fittings are rusted and in need of replacement.

5.2.82.2. Collectors (MOT-291 thru 294 & MOT-339 thru 342)

Longitudinal Collector (LC-1 thru 4) motors and Cross Collector (CC-1-4) motors, with install date of 1986, are in good condition. Protective coating has held up well on most of the motors, but appears to have worn thin in places. All of the motors were missing ID tags at the time of inspection and appear to have been switched out, as the manufacturer information is inaccurate. Motors found were multiple Baldor 0.5-1.5Hp motors, one US. Motors 0.5Hp motor, and one Leeson 1Hp motor, instead of 7 Siemens Allis and one Emerson 0.5-1Hp motors).

5.2.82.3. Miscellaneous

"MCC-49 Sump Pumps" motors were not evaluated as they are not major equipment. Neither sump pumps nor motors appear on excel inventory sheet. Conduit terminates at an old concrete slab on the south side of tanks without an access hatch.

5.2.83. Building 083 Primary Sludge and Dewatering Pumping Station

5.2.83.1. General Condition

This small older single room building has an air conditioner and a concrete slab where 2 sump pumps used to be. There is significant staining and corrosion on the outside and doorframe. Receptacles inside require attention: one for replacement of the receptacle and the other for replacement of the cover.

5.2.83.2. Westinghouse Five Star MCC-48 & 49 (MCC-101 & 102) with install date of 1986, is in fair condition. Corrosion is evident on bottom of enclosure and around fasteners.

5.2.83.3. Emergency Battery Bank (EBB-030) not noted. Install date of 1987 warrants further investigation.

5.2.83.4. Unknown manufacturer 208Y/120V "Panel A" not noted on excel inventory file is in very good condition. Minimal to no corrosion evident.

5.2.83.5. Unknown manufacturer 480V "Panel PT" not noted on excel inventory file in fair condition. Moderate corrosion noted on enclosure front.

5.2.83.6. Westinghouse 480D/208Y/120V Transformer not listed on excel inventory file is in good condition.

5.2.84. Building 084 Not Inspected

5.2.85. Building 085 Switchgear 60

5.2.85.1. General Condition

This facility is just north of Building 80, Generator Building. Switchgear 60 was originally installed in 1986 as part of project 4H-12; however, gear has been upgraded since that time. Physical building and existing gear were added during a later upgrade project 4L8B in 2001.

5.2.85.2. Isolating Switches T-6A-1 & T-6B-1 (Eq. ID: DCS-007 & 008)

These medium voltage distribution and control isolation switches by General Electric are housed within the superstructure of the Generator building and are located just north of the associated distribution transformers. Gear was installed as part of project 4L8B in 2001.

5.2.85.3. Switchgear 60 (Eq. ID: SWG-023)

Switchgear is made by General Electric: GE AKD-10. Install date and manufacturer information is missing from excel inventory file. Condition is good with little to no corrosion noted on enclosure. Gear was installed as part of project 4L8B in 2001.

5.2.85.4. MCC-48

General Electric Spectra Series Motor Control Center, not listed on inventory excel file, is in good condition. Gear was installed as part of project 4L8B in 2001. This is a separate gear from the MCC-48 inside building 83.

5.2.85.5. Generator Control and Monitoring Panels (GCP-009 & 010, GMP-002)

The Waukesha 480V control and monitoring panels for Generators 1 & 2 were installed as part of project 4H-10. Control panel #1 is missing several gauges on the front panel, but is overall in good condition. Equipment is located inside a climate controlled space, where corrosive gases are less of a concern than in open-air buildings.

5.2.86. Building 086 Reclaimed Water Station (STAR Facility – Public Access Reuse)

5.2.86.1. General Condition

Water Department Revenue Source operated and maintained by Wastewater Personnel. Facility outside of scope of current project; not inspected.

5.2.87. Building 087 Pilot Reuse Plant Building

5.2.87.1. General Condition

Median-aged Building is no longer in use. Pilot plant electrical equipment (not on excel inventory file) is in fair to poor condition. Corrosion is evident on enclosures, conduit, fittings and supports. Salvage of

transformer, panel P1, motors and pump assemblies may be an option for additional cost recovery in completed project.

5.2.88. Building 088 Warrantee Work - Not Inspected

5.2.89. Building 089 Fuel Station Facility - Not Inspected

5.3 Recommendations

5.3.1 Area Classification

A review of the plant electrical equipment for the different process facilities is recommended for compliance to NFPA-820. Part of this review will address the ventilation requirements.

5.3.2 Ventilation

Proper ventilation is critical for equipment cleanliness and to retain area classification. Many of the areas reviewed had ventilation, but because of open doorways or non-operational equipment, were causing short circuit of ventilation, and thereby adding too excessive dust, ambient exposure and corrosion of electrical equipment. As part of this review, an air flow discussion of positive or negative air pressure of rooms and enclosures, the pros and cons of each, and how it can reduce the impact of H_2S gas should be begun.

5.3.3 Housekeeping

Electrical areas have not always been maintained with storage of items, some of which flammable, near to electrical equipment. In addition, equipment enclosures and pilot devices not kept clean from dust buildup. Dust and dirt holds moisture that accelerates corrosion. It also is food and water for insects.

5.3.4 Coordination and Arcflash Study

It is recommended that a coordination and arcflash study be performed on the entire plant. Breaker coordination is an essential element for plant operations in the event of an electrical fault. For maintenance and operational safety an Arcflash study should also be performed to ascertain risk liability when performing maintenance on equipment and recommendations to limit it.

5.3.5 Premium Efficiency Motors

Many of the motors reviewed were not premium efficiency. Since 2012 motor manufacturers are required to only build motors with nominal efficiencies above 85.5% for 200hp and less (@1800rpm). As the horsepower increases these efficiencies increase to 96.2% for motors between 200 and 500 horsepower (@1800rpm). Previously motors were greater than 0.5% less efficient. These were labeled “energy efficient” which is the bulk of the motors reviewed. It can be shown that with this little change of efficiency over the life of the motor; it can more than offset the cost of replacing that motor with a premium efficiency type. In most cases, upgrading to premium efficiency motors has no noticeable impact on the electrical system. However, in rare cases nuisance trips can occur during start-up. Therefore adjustments to motor protection may be needed.

It is recommended that the City embark on a program to replace motors that have reached the end of their useful life or are about to be rebuilt. New criteria will need to be developed which directly outlines when to repair and when to replace motors.

5.3.6 Medium Voltage (MV) Distribution Building

As this is the primary electrical supply for the entire plant, the building has been repaired several times and it is at the end of its useful life; it is recommended that a CIP be developed to replace the entire medium voltage feeder distribution system, with a redundant configuration, in separate hardened buildings at elevations above flood stage. The project would also include replacing the MV feeders to their respective transformers. In some instances, new ductbanks paralleling the existing may be needed to keep parts of the plant powered during the upgrades. It is also recommended this upgrade be performed before or during the other major plant restoration projects as plant electrical loads will be diminished during those times.

6 Instrumentation & Control

6.1 Plant SCADA Overview and Introduction

The HFC AWTP SCADA system provides monitoring and some control capability for in-plant equipment and instrumentation as well as off-site facilities such as master pump stations and sewer lift stations.

The following paragraphs under this section provide a narrative describing SCADA hardware and HMI software systems utilized at the plant for both in-plant and off-site remote control and monitoring, in addition to the existing plant PLCs, and communications network systems.

A variety of observations and some discussions with the City's Staff and were taken during the site visits which are also included in the paragraphs below.

The City provided the HFC AWTP Asset List for the Master Plan to McKim & Creed, during a site visit, which is an inventory spreadsheet of the equipment and instruments currently installed at the AWTP. This inventory spreadsheet, however, does not include any of the noted SCADA hardware or software documented during the site visit.

6.2 SCADA Server and Computer Systems

A server rack located in the Administration building, shown in **Figure 6-1**, consist of servers for both in-plant and off-site remote stations control and monitoring.

Figure 6-1 – Administration Building Network Rack

HSQ software is installed on five HP servers where each of these servers have HSQ software and operating system (HSQ MISER 6.08, OS: Open VMS 8.3-1H1) with the exception of one server which has an older verion of the operating system (OS: VMS 7.3-2) to support older applications. The four other servers on this rack are client, development, and two application servers, where one is redundant to the other.

The off-site facilities are monitored and controlled through the VTSCADA HMI SCADA software which is currently installed on two servers, where one server provides redundancy to the other server.

During the site visits, the City stated that the Plant HSQ SCADA system stability is excellent such that the VMS operating system does not require nuisance reboots caused by the computer locking up or crashing. Since the City's experience has been positive so far they are hesitant to move to a newer system. However, the plant's existing HSQ system is under phone support only and the current HSQ software version is outdated and will require a maintenance visit from the manufacturer personnel to upgrade the software to the latest version (HSQ MISER 6.14), which includes several improvements to the software within the last 10 years.

The City also stated that the current VTSCADA HMI software system is very unstable causing the City to often reboot and resynchronise the servers and address communications issues which are related to the current software.

A project is planned for the upcoming year to upgrade the VTSCADA software application and hardware and it is anticipated these upgrades will alleviate the problems. If the VTSCADA system performance improves with these upgrades to the City's expectations, then the City may consider moving the in-plant processes over to the VTSCADA system. Combining the the two SCADA systems to operate uniformaly on one SCADA system HMI software will eliminate the requirement for utilizing separate servers, dedicated to the HSQ SCADA system, and also allow the City to view and operate both off-site and in-plant processes on the same computer system.

The SCADA HMI computers are located inside various buildings throughout the plant, for plant monitoring and some remote control capability. Each computer has the OpenText Exceed 15.0 X-Windows Client software installed on it with a Windows 7 Pro 64 bit operating system

6.3 Programmable Logic Controllers (PLCs)

The programmable logic controllers (PLCs) throughout the plant are mostly manufactured by GE, with exception of the Chemscan PLC, which is Automation Direct, and Motorolla Moscad PLCs. GE PLC equipment life status is categorized in three different stages, which are defined in **Figure 6-2**.

Figure 6-2 – GE PLC Life Status Stage Definition

The majority GE PLC control systems model type is the PACSystems RX3i which has an active life cycle status, where both hardware and software are currently supported by the manufacturer. The remaining

GE PLCs are either the 90-30, 90-70, or Genius I/O, where these have limited or no support and their hardware production has been discontinued or will be in the near future.

The older PLCs are utilized in a few areas of the plant as a stand-alone PLC system, with or without remote I/O, or as remote I/O to the newer PLC platform, PACSystems RX3i PLC. **Figure 6-3** and **Figure 6-4** show two typical PLC panel installations with remote I/O utilizing these older PLC platforms.

Figure 6-3 – PLC-15: GE PACSystems RX3i PLC with GE 90-30 Remote I/O

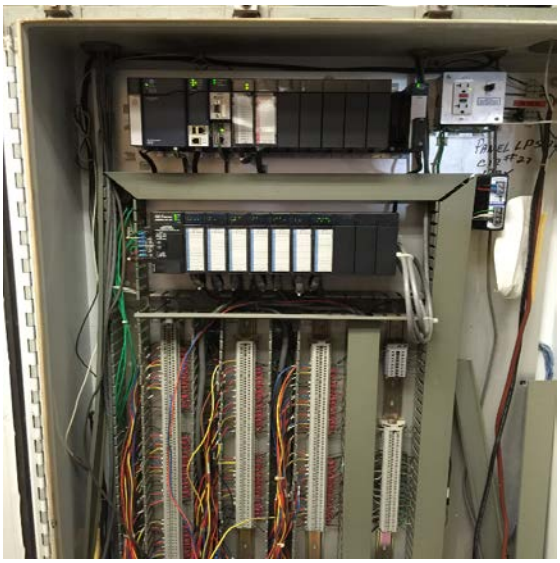
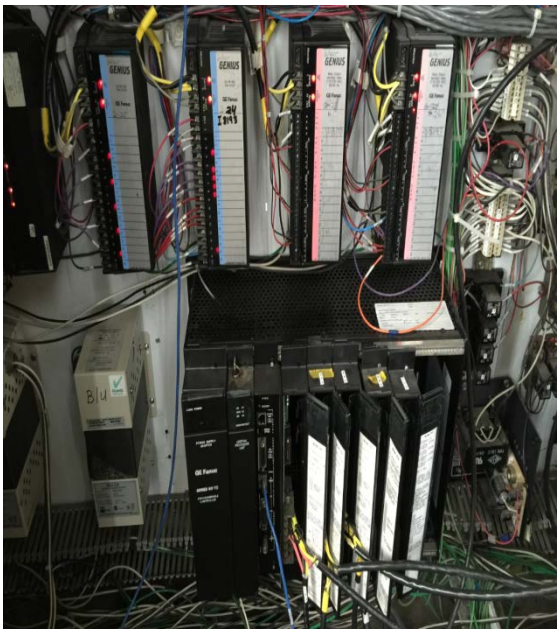


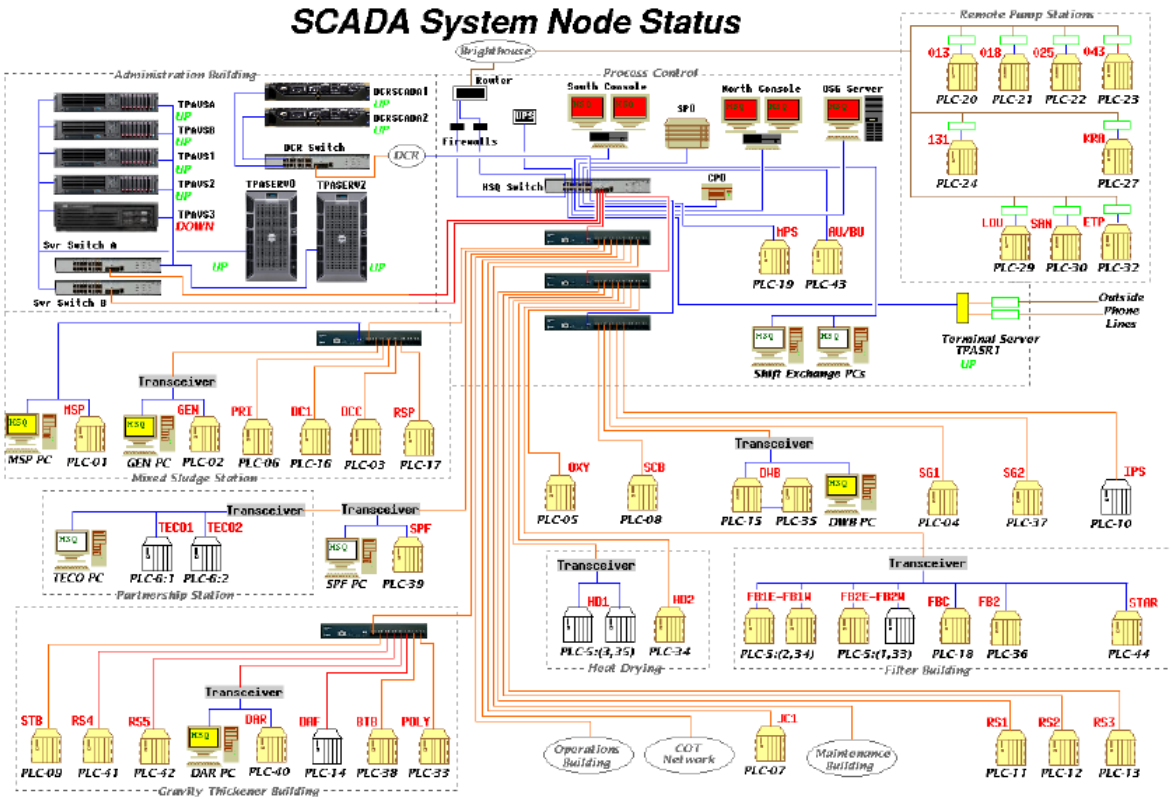
Figure 6-4 – PLC-5:33: GE 90-70 PLC with GE Genius I/O



6.4 Communications Network Systems

The current in-plant communications network is all Ethernet-based and consists of servers, network switches, hubs, fiber optic cable, patch panels, and Cat 5e cable. Network switches are located inside the Administration building network rack and also throughout the plant in other buildings for fiber optic communications network connections to the in-plant SCADA system and City's off-site remote stations via internet connection. The topology of the fiber optic network is a Star-type configuration where a direct connection is provided between the network switch and area hubs or to remote-mounted PLCs. The area hubs have a direct connection to local PLCs. **Figure 6-5** shows the current in-plant and off-site SCADA communications network diagram with the exception of some missing information such as additional PLC systems.

Figure 6-5 – Fiber Optic & Off-Site Communications Network



The in-plant network speed is one gigabit between the servers and area hubs and 100mb/s between the area hubs and PLCs.

Other documentation such as the panel and wiring diagram drawings are mostly accurate, according to the City. The Instrument Techs indicated they know what the inaccuracies are and where they are located.

6.5 Plant SCADA System Projects, Control Philosophies and Improvements Considerations

The following table provides a list of ongoing and future SCADA system projects.

Table 6-1 – Ongoing & Future SCADA System Projects

AWTP PROJECTS		
PROJECT	SCOPE OF WORK / DESCRIPTION	PROJECT TIMELINE (% COMPLETE)
VT SCADA Software Upgrade	Hazen & Sawyer is contracted to develop an RFP to upgrade the VTSCADA software to the latest version.	Ongoing, a bid package is currently being prepared
MOSCAD L Processors Upgrade	Final implementation will be by wastewater design engineers.	Ongoing
Magnetic Flow Meter Upgrade	City is replacing magnetic flow meters which are 20+ years old.	Ongoing
Raw Sewage Pumps (Qty. of 5) Improvements	Pump VFD replacement and addition of PLC control system (GE RX3i) and connect to Plant SCADA system.	Ongoing (25% Complete)
Return Sludge Pumps (Qty. of 25) Improvements	Pump VFD replacement and addition of PLC control system (GE Versamax) and Maple OIT (Current plan is to connect to the Plant SCADA system and automate).	Ongoing (25% Complete)
Polymer PLC Panels (Qty. of 2) SCADA System Network Connection	Connect Polymer PLC control systems, located inside Buildings 032 and 054, to the SCADA system.	Future
Digester Gas Mass Flow Meter Addition	Install mass flow meters on digester gas lines.	Future

Control philosophies and standardizations, which the City desires to be implemented for this plant, are discussed.

Mobility throughout the plant is required for the plant operators, such that they can perform testing and maintenance on field equipment and instruments, while having the capability to monitor and control the plant remotely from the control room SCADA computer. The City is currently testing a few industrial tablets to control and monitor the plant remotely, via a cellular 4G air card. The City stated that the industrial tablets will function as portable HMI computers eliminating the requirement to install additional OITs in the future.

Some of the existing processes and equipment require local-manual control for operation. The City discussed making provisions for automation and remote control capability, which includes some of the following processes and equipment:

- Plant Influent Flow Control
- Return Sludge Flow Control & Return Pump Station Control speed control based on flowrate for both stages of treatment.
- Oxygen Plant Control
- Main Pump Station Control
- Nitrification Pump Station Control Remote Restart Control for Selected Equipment (After a power outage)
- SO2 Control

7 Structural

The Site Condition Assessment (report) prepared by Master Consulting Engineers, Inc., dated October 12, 2015, for the HFC AWTP was reviewed as part of this evaluation. The report, included as **Appendix I**, is based on photos taken during a walkthrough at the plant site. Findings, recommendations and repair procedures were not included in the report. Based on the report and photos, it is apparent that there are the following two common problems at the facility:

- Concrete spalling and exposed reinforcement
- Embedded railing post are cracking the concrete around them

In addition, few locations had expansion joint sealant deterioration and one location appeared to be an expansion joint with a leaking waterstop.

Based on the review of the report and photos, the following two structural elements may be of concern and require immediate attention:

- Corroded steel column base plate in the sludge heat drying facility
- Cracked concrete corbel in the stand-by generator facility

These elements should be further investigated to determine their damage extent and rule out the possibility of a sudden failure.

It is recommended a repair program be developed to address the above issues. The program should include detailed repair instructions with appropriate repair materials. It should be noted that structures with exposed exterior concrete surfaces are more prone to deterioration during their service life. Typically, coated concrete surfaces experience less deterioration. For railing post attachment, top mounted post bases with a proper edge distance are recommended in order to eliminate concrete cracking around the embedded part of the railing post. It is suspected that thermal expansion may have caused the cracking and spalling.

8 Summary

8.1 Recommendations for Future Investigation

8.1.1 Process Recommendations

GPS-X Process Model
• Monitor Main Pumping Station effluent flow to provide accurate data for model calibration and use. • Monitor the DO concentration in each stage of the HPO reactors, will provide more accurate data for model calibration • The process model should be recalibrated based on the current operational data and minimal additional testing or monitoring. Testing and monitoring to be considered should include oxygen uptake rates, nitrification rates, grab and composite sampling from intermediate stages of the HPO reactors and DARs (to be analyzed for cBOD, TSS, NH_3, NO_3+NO_2), and SVI testing of mixed liquor.
Junction Chamber No. 1 and Odor Control System
• Evaluate options for automating the industrial waste receiving stations. • Evaluate options for mitigating solids settling in the pre-aeration tanks. • Evaluate methods to improve the performance of the existing odor control system. • Evaluate alternative technologies to replace the odor control system. • Investigate whether a flow equalization tank is needed at the front of the plant based on downstream treatment process recommendations. Evaluate the addition of an equalization tank and impact to pre-aeration and odor control recommendations.
Grit Removal
• Investigate possible causes for hydraulic split to the screen and grit facilities and evaluate possible solutions. • Evaluate technologies to replace existing grit dewatering systems. • Investigate the need for building ventilation in Screen and Grit Building No. 2 to push H_2S gas out of the building.
Meter Vault No. 2
• Flow transmitters will need to be reprogrammed if primary settling tanks hydraulic capacity increases.
Primary Clarification
• Test influent and effluent BOD and TSS at the PSTs to evaluate actual removal rates and need for improvements • Consider rerouting residuals recycle flows to the primary settling tanks to increase BOD and TSS removal rates • Evaluate additional PSTs or other means of primary treatment to improve removal rates, weir loading rates, prevent overflow of the PSTs at high flows, and reduce loading on HPO reactors • Eliminate the recycle of FST scum to the PSTs and redirect to digestion, or disposal. • Consider replacing chain and flight equipment, sludge pumping equipment, and dewatering

pumps with newer, more efficient equipment.

- Provide permanent means to completely drain PSTs 1 – 4
- Provide sludge blanket level monitors to improve operations
- Recalibrate flow meters MRC-1, MRC-2 to a minimum capacity of 115 MGD each

HPO Reactors

- Evaluate main sewage pumps, motors, and drives for repairs and replacement due to their age
- Investigate the replacement of the process air blowers for channel mixing. Other air mixing systems used significantly less energy and are easier to operate.
- Redirect scum from the HPO influent channel and FSTs 1 – 12 to gravity thickening, mixed sludge pumping station, or to disposal to prevent perpetual recirculation of foam inducing microorganisms such as Nocardia bacteria.
- Consider a complete repair and replacement campaign of all oxygen generation system piping and equipment due to equipment age and condition. It is understood that Oxygen Generation Plant No. 2 is currently undergoing repairs to the major equipment based upon the recommendations of the June 2014 report on site conditions by Solutionwerks, Inc. This is a high priority item due to the critical nature of oxygen generation at this facility.
- Investigate options to provide denitrification prior to denitrification filters. Most equipment and infrastructure required for process modifications may already be present, or require minor modifications. This recommendation shall be considered concurrently with repairs to the Oxygen Generation Plants to weigh the merit of a complete overhaul of the Oxygen Generation Plants. Modifications should be modeled to prove validity.
- Evaluate the intermediate pumping station in conjunction with process modifications as an option to provide internal recycle or other flows.
- Aging equipment should be investigated for replacement
- Consider replacing HPO mechanical aerators with newer, more efficient mixers and motors. Higher oxygen transfer rate/efficiency and higher mixer efficiency will reduce energy usage. Mechanical aerators should be of equivalent size and oxygen transfer rate/efficiency for each reactor to allow each reactor to be operated identically. There should not be variations in aerator capacity between reactors, but variation between zones is expected and recommended.
- Consider improving BOD, MLSS, DO monitoring
- Consider improving SCADA integration with operational controls
- Consider increasing the MLSS and SRT towards the design values to increase BOD removal efficiency and reliability.
- Model the HPO operation to determine more robust operational parameters to provide reliable and efficient BOD removal based on current operation.
- The mechanical aerator motors for reactors 4 through 6 should be placed back into operation or readily available and easily installed to enable the use of reactors 4 through 6 in the event of equipment failure in reactors 1 through 3.
- Consider purchasing additional gas analyzers and relocating existing analyzers adjacent to sampling locations to improve accuracy and oxygen generation control
- Consider redeveloping oxygen generation supply and control scheme to reduce oxygen

production while maintaining necessary oxygen transfer rate. An automatic load following control system should be implemented to reduce energy usage. • Evaluate the replacement of oxygen supply and vent gas meters and valves due to age • Replace 34 year old sample pumps • Evaluate reactor sluice gates, weir gates, stop logs for replacement due to age
DARs
• Evaluate alternatives to alleviate hydraulic limitations; improved hydraulics will provide flexibility in operation for denitrification • Evaluate process alternatives to provide more complete denitrification prior to the denitrification filters, such as implementation of an anoxic zone in the HPO reactors with internal recycle from the DARs • Evaluate pump improvements or replacement for Nitrification Pumping Station to provide greater internal recycle • Recommend installing a magnetic flow meter on the 72-inch internal recycle conduit to monitor and control internal recycle. • Consider IFAS style retrofits to the DARs to improve nitrification capacity and therefore denitrification capacity. • Investigate and repair process air leaks to improve and maintain aeration efficiency.
Final Settling Tanks
• Evaluate alternatives for automatic sludge blanket monitoring • Replace the rate controller equipment in the secondary effluent control channel including the secondary control weir, three motor operated gear boxes, and three gate operator motors. • Evaluate options to automate return sludge pumping including SCADA integration with HPO and DAR MLSS monitoring equipment, automatic sludge blanket monitors, return sludge and waste sludge flow indicating transmitters, pump speed indication, and return sludge solids concentration monitoring. • Operational and physical modifications should be considered to provide denitrification prior to the denitrification filters in a location other than the DARs to reduce solids loading on FSTs 13 – 20. • Evaluate options to construct additional final settling surface area to handle the peak hour flows and to accommodate average daily flows as they increase towards the design AADF • Evaluate options to convert the HFC AWTP to a single-sludge system to eliminate the need for additional final settling surface area
Denitrification Filters
• Investigate options to provide significant denitrification upstream of filters to reduce methanol costs and use filters as final polishing for nitrate removal in the next phase. The basis of design for the current Nitrification Reactors project expects only minor nitrate removal. • Investigate causes of the hydraulic limitations in filters, perform stress testing and investigate possible solutions in the next phase. • Investigate existing level control system in the next phase.

• Investigate backwash effectiveness and whether pumps and blowers need to be replaced in the next phase. • Investigate changes to NRC and backwash cycle and interval between to improve hydraulic loading in the next phase.
Disinfection and Dechlorination
• Investigate disinfection alternates including PAA to replace chlorine gas and sulfur dioxide. • Move post-aeration downstream of the CCTs. • Conduct tracer study and investigate modifications to CCTs to improve plug flow performance. • Investigate opportunities to resolve surcharging of CCTs at high flows. • Investigate possible overdosing of chlorine to save on chemical costs and reduce THMs • Revise CCT section of the High Flow Protocol.
Effluent Disposal
• Upgrade sluice gates in overflow structure for motorized operation and automation. • Install redundant conduit from JC 4 to the overflow structure. • Un-comingle storm water from plant effluent. • Continue to look for opportunities to expand the reclaimed water program. • Investigate insufficient contact time and sampling location for reclaimed Water Pump Station
Biosolids
• Add a third thickener train to provide additional redundancy and improve loading rates. Additionally, any modifications to the treatment process may have impacts on the thickening system and should be evaluated. • Evaluate the existing thickening polymer system for capacity and reliability. Additional capacity of the polymer system will likely be required for a third thickener train. • Return Digester 7 to service to increase available aggregate digester volume, which will increase hydraulic retention times and decrease organic loading rates. • Conduct solids profile analyses in each digester to assess the performance of the gas mixing systems; repair mixing tubes that are currently out of service; improved mixing will improve heat distribution and may help to reduce foaming. • Conduct microscopic analysis of digested sludge samples from each digester to investigate the possibility that WAS contains Nocardia or other microorganisms that may be contributing to foaming in the digesters. • Install gas flowmeters at each digester; gas flowmeters should include feature to measure methane content which will help to control/measure/monitor the performance of CHP engines or other biogas recovery options. • Complete short-term condition repairs to covers and pumping, mixing and heating equipment to allow all digesters to operate in accordance with design intent until long-term upgrades/enhancements can be implemented. • Update the GPS-X model to include primary treatment and solids treatment facilities and update calibration for use in evaluation of upgrade/enhancement alternatives. • Conduct evaluations of the digestion upgrades/enhancements as described above.

- Explore alternate rates from TECO that may better match the biogas utilization strategy and reduce the overall energy cost.
- Explore selling energy generated on-site directly to TECO under a separate PPA agreement in lieu of the existing energy offset under the supplemental TOU billing rate.
- Perform process modeling to get a more accurate biogas production projections and identify the optimal biogas fueled engine size and combination for Alternative 2.
- Further explore opportunities to increase the benefit from Alternative 3 by integrating rCNG production with the City's existing CNG fueling infrastructure and vehicle fleets.
- Explore phased implementation solutions that evaluates a combination of biogas utilization alternatives and implementation timing that provide the best overall value utilization and implementation strategy.
- Evaluate sidestream treatment options.
- Evaluate option combinations for digestion, biogas use, and biosolids end disposal.

8.1.2 Electrical Recommendations

General Electrical Recommendations

Item #	Process Area	Equipment Location	Description	Recommendations
1	All	General	Area Classification	Review Area Classification including ventilation requirements for process facilities.
2	All	General	Ventilation	See above
3	All	General	Housekeeping	General maintenance and removal of storage items from electrical equipment areas.
4	All	General	Coordination and Arc Flash Study	Entire plant Coordination and Arc Flash Study
5	All	General	Motors	Replace motors that have reached the end of their useful life or are about to be rebuilt with premium efficiency motors.
6	Outdoor Switchgear	Building 44	Medium Voltage Distribution System	Replace the entire medium voltage feeder distribution system with a redundant configuration in hardened structure above flood stage.
7	Outdoor Switchgear	Building 44	Partial Discharge Testing	Portable PD Monitor or Continuous Online Monitoring in addition to Ultrasonic testing for Medium Voltage Distribution System

Electrical Recommendations by Process Area

Item #	Process Area	Equipment Location	Description	Recommendations
1	Plant Pump Station & JC#1	Buildings 1,2	MCC-RSPS-61 MCC-64 & 65	Proceed with gear replacement for PPS as planned. Secure JC#1 entrance to mitigate corrosion.
2	Odor Control	Buildings 36,37	MCC-27B Odor Control Panels	Creation of CIP for gear replacement <10y. Positive-pressure ventilation and secure entrance to mitigate corrosion.
3	Screen & Grit	Buildings 5,59	Switchgear No. 20 & 28 MCC-21 MCC-28 & 29	Creation of CIP for gear replacement <10y for both. Positive-pressure ventilation and secure entrance to mitigate corrosion for both.
5	Primary Clarification	Buildings 8,9,20,71, 82,83	Mixer/Collector Motors Raw sludge pump motors MCC Primary RSPS JB in MSPS	Replace end-of-life motors with premium efficiency. Proceed with gear replacement for RSPS as planned. Replace & rewire water-damaged JB.
6	HPO Reactors	Buildings 41,10,11,13	O2 Switchgear & Motors MCC-10 & 11 MCC-30,31,33,34,32S IP-MCC-47 MSP Motors 1,2,5,6,7	Creation of CIP for gear replacement <10y for O2, MPS, and IPS. Replace end-of-life motors with premium efficiency induction motors. Replace eddy-current drives with VFD.
7	DARs	Buildings 25,58,57	Mechanical Mixer Sample Pump Scum Transfer Pump	Creation of CIP to replace end-of-life motors with premium efficiency <10y.
8	Final Clarification	Buildings 12,22,23,24, 50,61,62,63	Collector Motors RSP Motors MCC-41, 43, 45 RSS#1 & RSS#3 JBs Switchgear No. 810	Creation of CIP to replace end-of-life motors with premium efficiency <10y. Creation of CIP for gear replacement <10y for RSS#1 thru #3 and secure entrances to mitigate corrosion. Replace & rewire water-damaged JBs. Investigate RSS#4 possible roof leak and service SWG breakers.
9	Filtration & Denitrification	Buildings 15,47	FB Monorail Hoist Switchgear #56 /MCC-59A MCC-58,59,&59A LP-85	Proceed with gear replacement for SWG#56/MCC-59A and associated equipment as planned. Creation of CIP for gear replacement <10y for MCC-58,59,59A. Creation of CIP to replace end-of-life motors with premium efficiency <10y. Lock-out Hoist breaker when not in use.
10	Disinfection & Dechlorination	16,17,42,46	MCC-59B Mechanical Mixer motors Methanol Transfer Pumps	Proceed with gear replacement for MCC-59B as planned. Creation of CIP to replace end-of-life motors with premium efficiency <10y. Positive-pressure ventilation and secure entrance to mitigate corrosion.
11	Effluent Disposal	Buildings 18,86	Outfall Str. Transformer	Replace corroded equipment and weather proof.

8.1.3 Instrumentation & Controls Recommendations

HMI Software Upgrade for SCADA Servers and Computer Systems

SCADA Servers:

Item #	DEVICE NAME / LOCATION	MANF. & MODEL #	SOFTWARE	RECOMMENDATIONS
1	DCRSCADA 1 Network Rack	Dell PowerEdge R610	VTSCADA 9.1.20 (32 bit) OS: Windows 2008 R2 SP1 Server 64 bit (VTS License: 100K tags; 11 clients; 6 GB RAM)	Migrate the in-plant SCADA system HSQ HMI software over to VTSCADA HMI software after the VTSCADA software upgrade has been sucessfully implemented for the off-site operations.
2	DCRSCADA 2 Network Rack	Dell PowerEdge R610	VTSCADA 9.1.20 (32 bit) OS: Windows 2008 R2 SP1 Server 64 bit (VTS License: 100K tags; 11 clients; 6 GB RAM)	Migrate the in-plant SCADA system HSQ HMI software over to VTSCADA HMI software after the VTSCADA software upgrade has been sucessfully implemented for the off-site operations.
3	TPAVSA Network Rack	HP Office Server	HSQ MISER 6.08. OS: Open VMS 8.3-1H1 (App Server)	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
4	TPAVSB Network Rack	HP Office Server	HSQ MISER 6.08. OS: Open VMS 8.3-1H1 (App Server - Redundant)	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
5	TPAVS1 Network Rack	HP Office Server	HSQ MISER 6.08 OS: Open VMS 8.3-1H1 (Client Server)	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
6	TPAVS2 Network Rack	HP Office Server	HSQ MISER 6.08 OS: Open VMS 8.3-1H1 (Development Server)	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
7	TPAVS3 Network Rack	HP AlphaStation DS15	HSQ MISER 6.08 OS: Open VMS 7.3-2 (Old version of OS to support older apps)	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.

Computer Systems:

Item #	DEVICE NAME / LOCATION	SOFTWARE	RECOMMENDATIONS
1	Process Control HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
2	Process Control HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
3	Process Control HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
4	Process Control HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
5	Filter Bldg. 15 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
6	Filter Bldg. 15 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
7	Filter Bldg. 15 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
8	DAR Bldg. 25 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
9	Mixed Sludge Bldg. 31 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
10	Generator Bldg. 80 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
11	Bldg. 78 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.
12	Dewatering Bldg. 32 HMI Console	Open Text Exceed 15.0 X-Windows Client OS: Windows 7 Pro 64 bit	The successful performance of VTSCADA HMI software, utilized for both in-plant and off-site operations, will alleviate the need to upgrade the current version of the HSQ HMI software.

PLC Replacement Recommendations

Item #	LOCATION/PROCESS BLDG #	PLC/RIO TAG #	MANUFACTURER & MODEL	PLC LIFE CYCLE STATUS	RECOMMENDATIONS
1	Mixed Sludge Bldg. 31	PLC 1	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
2	Generator Bldg. 80	PLC 2	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
3	Generator Bldg. 80	PLC 17	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
4	Generator Bldg. 80	PLC 17 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
5	Digester Control Area C Bldg. 74	PLC 3	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
6	Bldg. 41	PLC 5	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
7	Bldg. 41	PLC 5 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
8	Junction Chamber #1 Bldg. 2	PLC 7	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
9	Filter Bldg. 2	PLC 44	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
10	Filter Bldg.15	PLC 36	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
11	Filter Bldg.15	PLC 5:1	GE 90-70	DISCONTINUED Date: 3/31/2011	PLC status is Discontinued - Recommend replacing with PACSystems RX3i platform immediately.
12	Filter Bldg.15	PLC 5:1 RIO	GE Genius I/O	DISCONTINUED Date: 1/1/2013	PLC I/O status is Discontinued - Recommend replacing with __ platform immediately.

13	Filter Bldg.15	PLC 5:33	GE 90-70	DISCONTINUED Date: 3/31/2011	PLC status is Discontinued - Recommend replacing with PACSystems RX3i platform immediately.
14	Filter Bldg.15	PLC 5:33 RIO	GE Genius I/O	DISCONTINUED Date: 1/1/2013	PLC I/O status is Discontinued - Recommend replacing with__ platform immediately.
15	Filter Bldg.15	PLC 49	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.

Item #	LOCATION/PROCESS BLDG #	PLC/RIO TAG #	MANUFACTURER & MODEL	PLC LIFE CYCLE STATUS	RECOMMENDATIONS
16	Filter Bldg.15	PLC 5:2	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
17	Filter Bldg.15	PLC 5:34	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
18	Filter Bldg.15	PLC 18	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
19	Filter Bldg.15	PLC 18 RIO-1	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
20	SO2 Bldg.	PLC 18 RIO-2	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
21	Sludge Heat Drying Bldg. 35	PLC 5:3	GE 90-70	DISCONTINUED Date: 3/31/2011	Out of Service (Redundant to 5:35).
22	Sludge Heat Drying Bldg. 35	PLC 5:35	GE 90-70	DISCONTINUED Date: 3/31/2011	PLC status is Discontinued - Recommend replacing with PACSystems RX3i platform immediately.

23	Sludge Heat Drying Bldg. 35	PLC 34	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
24	Raw Sludge Station Bldg. 83	PLC 6	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
25	Sludge Control Bldg. 54	PLC 8	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
26	Sludge Control Bldg. 54	PLC 8 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
27	Sludge Treatment Bldg. 30	PLC 9	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
28	Intermediate Pump Station	PLC 10	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
29	Return Sludge Bldg. #4	PLC 41	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
30	Return Sludge Bldg. 4	PLC 41 RIO	GE 90-30	Mature Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).

Item #	LOCATION/PROCESS BLDG #	PLC/RIO TAG #	MANUFACTURER & MODEL	PLC LIFE CYCLE STATUS	RECOMMENDATIONS
31	Return Sludge PS #1 Bldg. 21	PLC 11	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
32	Return Sludge PS #1 Bldg. 21	PLC 11 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
33	Return Sludge PS #2 Bldg. 23	PLC 12	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
34	Return Sludge PS #2 Bldg. 23	PLC 12 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
35	Return Sludge PS #3 Bldg. 24	PLC 13	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
36	Return Sludge PS #3 Bldg. 24	PLC 13 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
37	DAF Thickening Bldg. 70	PLC 14	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
38	Dewatering Bldg. 32	PLC 15	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.

39	Dewatering Bldg. 32	PLC 15 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
40	Dewatering Bldg. 32	PLC 15 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
41	Digester Control Areas A&B Bldg. 28	PLC 16	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
42	Digester Control Areas A&B Bldg. 28	PLC 16 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
43	Bldg. 10	PLC 19	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
44	Bldg. 10	PLC 19 RIOs	GE 90-30 (Typ. of 2)	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
45	Bldg. 10	PLC 19 RIO-1	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).

Item #	LOCATION/PROCESS BLDG #	PLC/RIO TAG #	MANUFACTURER & MODEL	PLC LIFE CYCLE STATUS	RECOMMENDATIONS
46	Bldg. 10	PLC 19 RIO-2	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
47	Bldg. 10	PLC 43	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
48	Methanol Station	PLC 35	NA	NA - Not installed yet.	Not installed yet. Identified as for Methanol station on HMI screen
49	Screen & Grit #1 Bldg. 5	PLC 4	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
50	Screen & Grit Bldg. 59	PLC 37	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
51	Screen & Grit Bldg. 59	PLC 37 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
52	Belt Thickener Bldg.	PLC 38	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
53	Bldg. 78	PLC 39	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
54	Polymer Bldg. 30	PLC 33	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.

55	DAR Bldg. 25	PLC 40	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
56	DAR Bldg. 25	PLC 40 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).
57	DAR Bldg. 25	Alkalinity PLC	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
58	DAR Bldg. 25	Chemscan PLC	Automation Direct		
59	Mixed Sludge Bldg. 63	PLC 42	GE PACSystems RX3i	ACTIVE	PLC status is Active - No action required.
60	Mixed Sludge Bldg. No. 63	PLC 42 RIO	GE 90-30	MATURE Date:10/1/2015	PLC status is Mature - Recommend migrating to the PACSystems RX3i platform in the near future (Up to 2 years).

HMI Software Upgrade for SCADA Servers and Computer Systems

The VTSCADA software upgrade is scheduled for later this year. Once this software upgrade is completed and and has been sucessfully impletmented for the off-site operations, it is recommended to migrate the in-plant SCADA system HSQ HMI software over to VTSCADA HMI software since the current HSQ software version is outdated and requires an upgrade to the latest version. As part of the design of the VTSCADA HMI system, it is recommended to take advantage of server virtualization to minimize server hardware and facilitate better backup and restore procedures. As part of the HMI upgrade, the use of ISA High Performance Graphics should be researched. ISA High Performance Graphcs is a new way to design HMI screens that promotes easy identification of process parameters and alarm recognition.

Replacement Recommendations

Some of the Plant's PLC panels have discontinued components such as PLC communication and I/O modules, power supplies, and CPUs. These PLC systems need to be replaced in their entirety with the PACSystems RX3i PLC platform. The inventory spreadsheet includes a list of the Plant's PLC panels which are labeled as good, fair, or in poor condition. The PLCs labeled as fair or poor are recommended to be replaced, where the PLCs labeled as poor should have the highest priority for replacement due to discontinuation in manufacturing and limited or no support. The PLCs labeled in fair condition are recommended to be replaced within the next two years.

Communications Network Systems Recommendations

The City did not indicate any issues with the current network such as slowness or excessive noise interference or disturbances due to electrical systems or nearby lightning strikes. It is recommended to use fiber optic cable as the communications media for future installations that may be potentially susceptible to these problems. The existing fiber optic cable should be inspected for degradation and

damage. Furthermore, a review of the controls network should be conducted with the goal of determining the star configuration benefits versus a self-healing ring topology for redundancy. The security and separation of the network will be included in this review including designing air gaps between the controls network and any other network.

Documentation & Development of Standards

The City stated that the Plant's panel and wiring diagrams are 75% accurate and complete. It is recommended to update the existing SCADA system documentation for planning purposes for future expansion, upgrades, and improvements of the existing Plant SCADA system. The development of the SCADA system standards will provide guidelines to consultants and contractors such that the plant can be designed and constructed in accordance with the SCADA standards, ensuring a uniform and consistent SCADA system throughout the plant.

Further evaluation which includes an extensive investigation will be required to develop this documentation. The following is a list of tasks for developing these standards and documentation:

- PLC Panel Hardware & Software Inventory & Documentation – Develop panel drawings and PLC code for each PLC panel based on field investigations and staff interviews. Research the addition of an asset management program to store, track, check-in and check-out software.
- Communication Analysis & Network Diagram – Update the current network diagram based on field investigations and staff interviews. Determine the current plant network's vulnerabilities and capacity for future expansion. Also evaluate remote site communications for reliability and data acquisition.
- SCADA System Security – Review existing SCADA system security management policies and guidelines and provide recommendations for improvement. Implement a customized backup and restore procedure including off-site storage of backups.
- SCADA System Backup Power – Evaluate existing power back-up systems. Review/determine what actions are required during abnormalities which includes disaster recovery during a catastrophic occurrence.
- Hardware Redundancy - Evaluate the current hardware redundancy, such as PLCs and servers, for critical processes and the plant SCADA system, and determine if additional redundant systems would be beneficial or required for plant operations.
- Alarm Management – Evaluate current alarm handling and management of the existing SCADA system.

Control Philosophies Upgrades of Existing Equipment

The City has the desire to automate and provide remote control capability to as much of the plant as possible and the current SCADA infrastructure is well positioned to support the addition of automated

control. Modifications will be necessary to the existing PLCs for additional input and output signals but the processors are sized to handle the increased processing load. With all the PLCs on the same controls network, communication between PLCs is available for coordination and intelligent process control between process areas.

It is recommended to identify this equipment, listing them in a prioritized order, and determine whether it is feasible to make these modifications to the existing equipment. Field investigations will be required along with discussions with the City to determine this and the parameters to automate the equipment, such as flow or water quality analysis for pacing chemical equipment.

As part of the automation, pan-tilt-zoom cameras should be installed to remotely monitor the process. These cameras can be displayed in the control rooms via the fiber optic network.

Training

The City should include training as part of the improvement and replacement of their SCADA system. As more processes become automated, the plant will more heavily rely on a running SCADA system for operations. Maintaining and troubleshooting that system will be the responsibility of the plant instrument techs and they need to be trained on the system to perform their work at a high level. Training is recommended for the HMI system, PLC systems, analyzers, instruments and networking equipment. Training should focus on maintenance and troubleshooting as well as basic configuration and modifications.

8.2 Next Steps

This document concludes the initial work for the HFC AWTP Wastewater Master Plan and Phase 1 is complete. Additional work that was identified under in the Master Plan will be completed in Phase 2. The following section identifies the proposed work.

8.2.1 Calibrated Process Model

A calibrated process model for the HFC AWTP will be developed. The purpose of the process model is to develop a model for use in future planning for wet weather and nutrient removal, evaluation of digestion and biogas recovery alternatives, operations assistance, and design. Calibrated process model work will include:

- Preliminary Process Model Development
- Process Supplemental Sampling
- Process Model Development and Calibration
- Process Model Report
- Model Training
- Operations Tool Development

8.2.2 Technology Review

The following unit processes will be further evaluated at the HFC AWTP:

- Storm Surge Evaluation
- Flow Equalization
- Hydraulic Split to the Screen and Grit Facilities
- Primary Treatment
- BNR Process
- Clarification
- Filtration
- Disinfection
- Effluent Disposal
- Biosolids System – Detailed Condition Assessments and Evaluation
    - Sludge Thickening

- Structural Testing of Existing Digestion Tanks
- Detailed Digester Equipment Condition Assessment
- City CNG Vehicle Fleet Assessment for rCNG Production Feasibility
- Air Permit Modifications
- Sidestream Treatment Evaluation
- High Strength Waste Evaluation

- Biosolids System – Alternatives Evaluation
  - Anaerobic Digestion
    - Continuing Mesophilic Digestion
    - Temperature Phased Digestion
    - Acid-Gas Phased Digestion
    - Thermal Hydrolysis
  - Biogas Utilization
    - All Biogas to Boilers
    - Refurbishing the Existing CHP Engines
    - New CHP Engines
    - Creating rCNG/RNG for Vehicle Fueling
    - Organic Rankine Cycle (ORC) Engines
- Electrical
  - Medium Voltage Distribution System Replacement
  - Partial Discharge Testing
- Instrumentation and Controls
  - Review Control Network
  - Develop Custom Backup and Restore Procedure

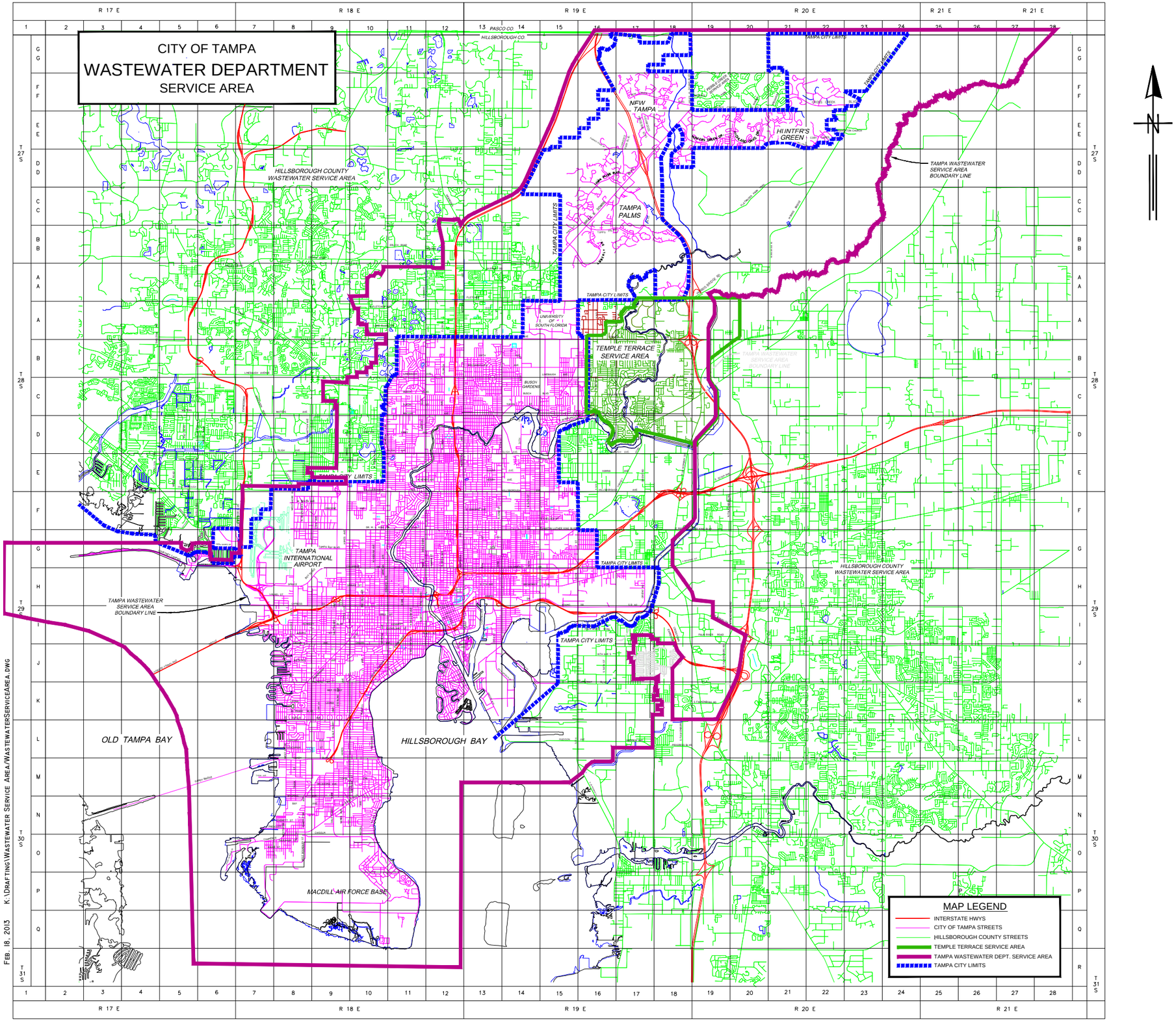
8.2.3 Financial Planning

A conceptual level cost estimate will be prepared for the work identified. Each cost estimate will include a detailed breakdown. Development of a preliminary list of Capital Improvement Program (CIP) Projects will take place under Phase 2 or Phase 3. Individual projects will either include individual improvements or larger programs of multiple improvements under one contract. Based on the cost estimates and the CIP project list, a proposed phasing plan to implement the proposed projects will be developed. This phasing plan will include estimating the duration of each project, the cost of each project and development of a phased implementation plan in 5 year increments that provides the City with a consistent cash flow over a 20 year planning period. Additional work under this item may include a rate evaluation, CIP sensitivity analysis, identification of funding opportunities, evaluation of regionalization options, and contract delivery methods.

8.2.4 Phase 2 Report

At the completion of Phase 2, the Consultant will summarize the findings of the selected overall process alternative results in a Phase 2 Report. The findings of the regionalization task will also be included. The Consultant will submit a draft Phase 2 Report for City review. The Consultant will conduct one (1), 4-hour workshop with the lead project team members and key City staff to discuss the findings of the draft Phase 2 Report. Based on the discussions and comments at the draft Phase 2 Report Review Meeting, the Consultant will revise Phase 2 Report to produce a final Phase 2 Report.

APPENDIX A


CITY OF TAMPA
WASTEWATER DEPARTMENT
SERVICE AREA
R 17 E
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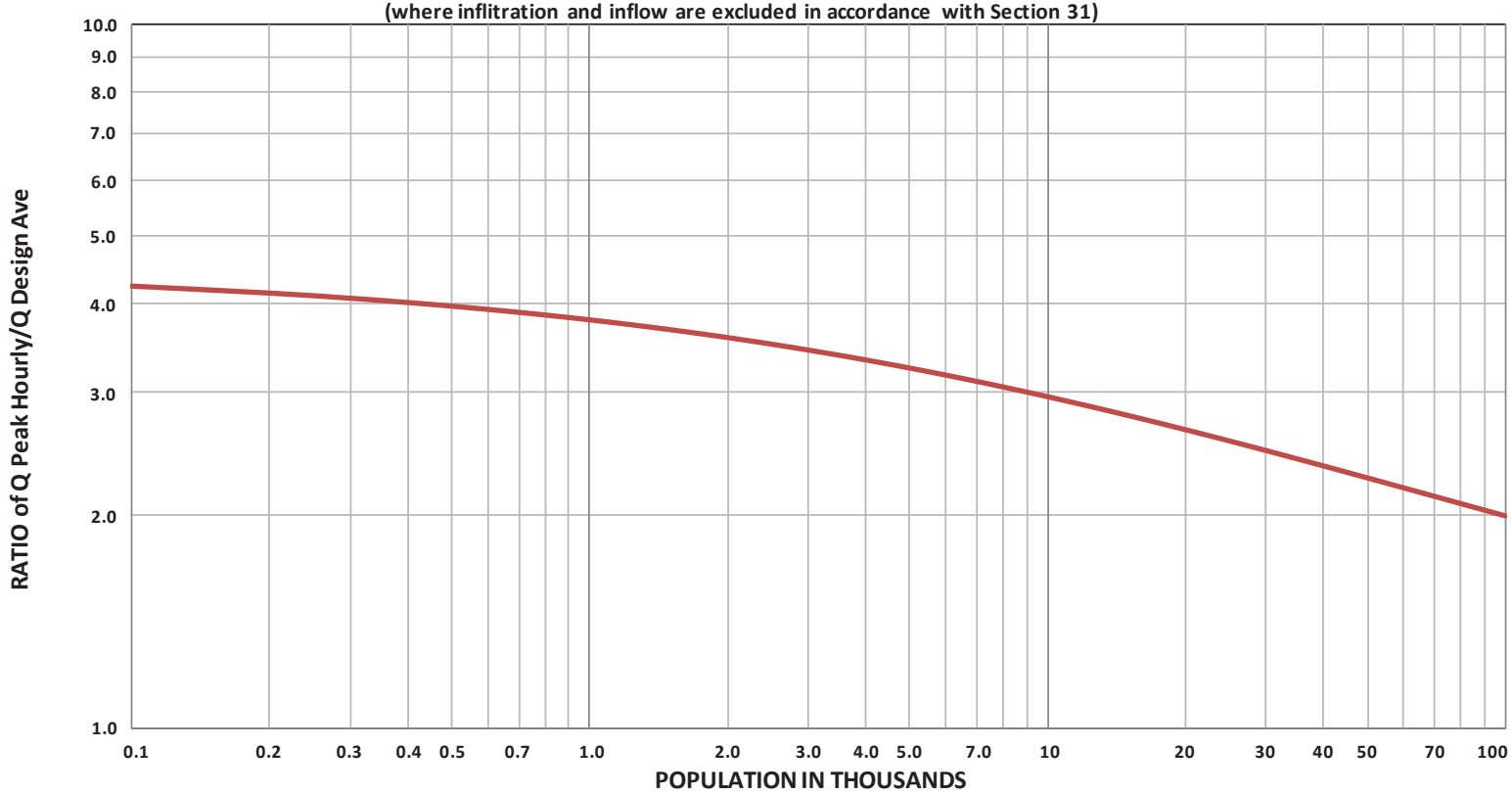
T 27 S
T 28 S
T 29 S
T 30 S
T 31 S
PASCO CO.
HILLSBOROUGH CO.
TAMPA CITY LIMITS
NEW TAMPA
HUNTER'S GREEN
TAMPA WASTEWATER SERVICE AREA BOUNDARY LINE
HILLSBOROUGH COUNTY WASTEWATER SERVICE AREA
TAMPA PALMS
UNIVERSITY OF SOUTH FLORIDA
TEMPLE TERRACE SERVICE AREA
BUSCH GARDENS
TAMPA INTERNATIONAL AIRPORT
OLD TAMPA BAY
HILLSBOROUGH BAY
MACDILL AIR FORCE BASE
MAP LEGEND
INTERSTATE HWYS
CITY OF TAMPA STREETS
HILLSBOROUGH COUNTY STREETS
TEMPLE TERRACE SERVICE AREA
TAMPA WASTEWATER DEPT. SERVICE AREA
TAMPA CITY LIMITS
FEB. 18, 2013 K:\DRAFTING\WASTEWATER SERVICE AREA/WASTEWATERSERVICEAREA.DWG

APPENDIX B

FIGURE 1
RATIO OF PEAK HOURLY FLOW TO DESIGN AVERAGE FLOW
(where inflitration and inflow are excluded in accordance with Section 31)



Q peak hourly: **Maximum Rate of Wastewater Flow (Peak Hourly Flow)**
Q design ave: **Design Average Daily Wastewater Flow**

Source: **Q Peak Hourly/Q Design Ave** $= \frac{18+\sqrt{P}}{4+\sqrt{P}}$ **(P= population in thousands)**

Fair, G. M. and Geyer, J. C., "Water Supply and Waste-water Disposal"
1 st Ed., John Wiley & Sons, Inc., New York (1954), p. 136

2014 HFCAWTP Service Area Population = 556,395

$$Peaking\ Factor = \frac{18+\sqrt{556395}}{4+\sqrt{556395}} = 1.51$$

Source: *Recommended Standards for Wastewater Facilities*, 2014 Edition

APPENDIX C

High Flow Protocol with 2 Carb and 3 Nit Reactors in service

Influent flows of 75 or less MGD, Normal Operation

- 9 MGD/Primary tank.
- 15-20 MGD/Grit Tank.
- 20 MGD/Carb or Nit final tanks.

Influent flows over 75 MGD

- Start filling 2nd Contact Chamber. See the "Chlorine Contact Chamber (CCC) Flow Formula".

Influent Flows over 80 MGD

- Have 6 grit tanks in service.
- Start reducing Bar Screen timers.
- Put 8th Nit final tank in service. Don't forget to prime pump.

Influent flows over 100 MGD, <u>Call Ops Specialists</u>

- Have (8) all operational grit tanks in service.
- **Fill a 6th Carb Final Tank (if only 5 tanks are in service)**
- **Return to Full Aeration Mode at the DAR's.**
    - **Close Super-Spike Gate**
    - **Close Internal Recycle Gate**
    - **Re-aerate Zone's 1&2 , 2 Blowers at 100% and a 3rd Blower as needed (for example- Zone 6 NH3)**

Influent flows over 120 MGD,

- Keep eye on primary influent boxes.
- Main pump Station Discharge alarm will toggle, critical level is at Gator gate between reactors 3 & 4. Do not let the level rise above the Gator Gate.
- Open step feed gates 2' equally on Carb reactors in service.
- Consider putting 3rd Carb reactor in service.
- Filter Flows of 150 and lower
    - Use FE-49 (max flow is 150mgd). Must stay below 150 mgd so Methanol Feed System operates properly.

Influent flows over 130 MGD

- Put 3rd Carb reactor in service.

Influent flows over 140 MGD

- Open MRC-4, only if primary tank influent boxes get close to overflowing. Put as much flow through Primary as possible.
- Put 7th Carb final tank in service.
- Nit influent conduit High alarm, Crack open Step feed gates on Nit Reactors equally, starting with 2'.

Influent flows over 150 MGD

- Start putting in 3rd Contact Chamber. See the "Chlorine Contact Chamber (CCC) Flow Formula".

Influent flows over 160 MGD

- Open MRC-4, because MRC 1 & 2 only read up to a total of 160 mgd, need MRC- 4 for accurate flow measurement. Only open it the minimum amount needed to keep MRC 1 & 2 at a readable, but maximum value.

Denitrification Filter Notes

- ➢ Filter Flows of 150 and lower
- ➢ Use FE-49 (max flow is 150 mgd). Must stay below 150 mgd so Methanol Feed System operates properly.
- Filter Flows over 150
  - FE-48 Max flow is 70 mgd. Must have Ops Specialist here for assistance.
- Open Channel flow meter Max Flow is 160 mgd.
  - Anything over 160 mgd needs to have manual CL2 fed. Need to have Ops Specialist here for assistance.
- Filter control strategy
  - Go to Water Hog NRC's when Filter levels go above 17.5' before NRC starts. When on Hog maintain 18.5' filter levels before allowing back filling into Carb finals.
  - **Start back filling Carb final tanks when the levels get to 18.0' on the Old Filters and 18.5 on the New Filters. Call Ops Specialists.**
  - Maintain filter minimum levels of 18.5' while back filling the Carb Final Tanks. Regulate the Nit Pump Station to accomplish this.
  - **Maintain the NRCs, do not stop.**
  - **Backwash as directed per Ops Specialist/Shift Supervisor**

Carb Final Tank (CFT) Notes

- Any water that is back filled in to the CFTs must be drained during the daily low flow period (2 am to 7 am) to prepare for the next day. Close the drains when finished.
- Verify that all CFT drains are closed before starting to backfill the CFTs.
- Maintain minimum Filter Levels of 18.5' during CFT backfilling operations.

<u>When to call Operations Specialist</u>

- **Influent flow 100 mgd or higher.**
- Unable to put full plant flow through filters and back filling Carb tanks.
- **Major equipment failures. (i.e Screens, Chlorinators, Analyzers, tanks)**
- NH_3 breaking through Nit Reactors.
- Before opening bypass gates.
- Filter flows over 150 mgd.
- Plant is running on Standby Power (CATs). No matter when (high flows or not).
- Abnormal equipment failures.

Chlorine Contact Chamber (CCC) Flow Formula

0 to 75 mgd

- One tank with both gates wide open.
- Drain closed.

75 mgd to 150 mgd

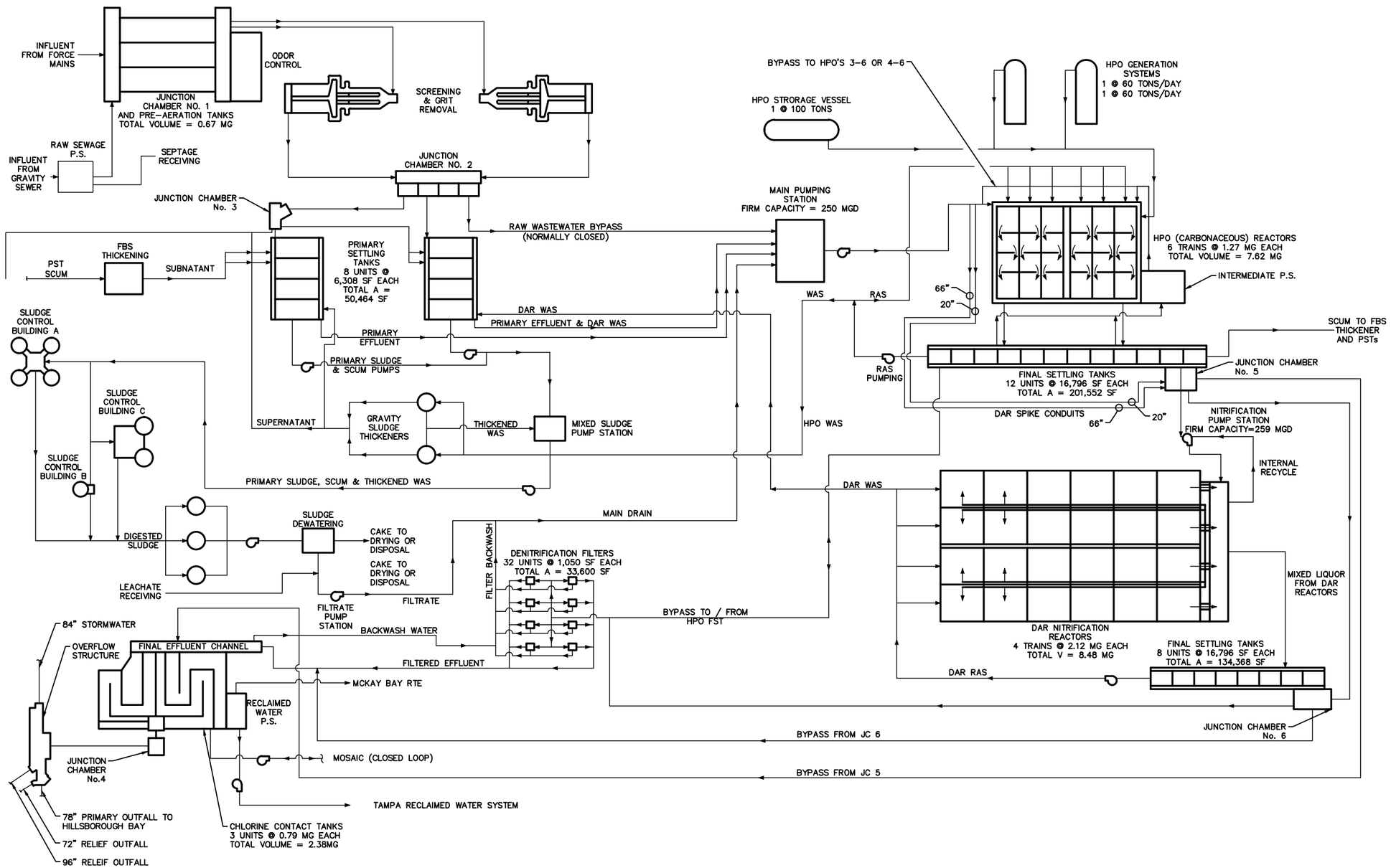
- $\frac{\text{(Flow @ JC-2) -75}}{75}$ = 2nd CCC Influent Gate position as a decimal (x 100 to get % open). Only open 1 gate, the other gate stays closed.

150 mgd to 225 mgd

- $\frac{\text{(Flow @ JC-2) -150}}{75}$ = 3rd CCC Influent Gate position as a decimal (x 100 to get % open). Only open 1 gate, the other gate stays closed.

These formulas assume there are no backfilling (storing water) or mass tank draining operations in progress. If there are, then the flow rate of the Open Channel Flow Meter (Marsh McBurny) or other more accurate meter (ISCO) is to be used in place of the JC-2 flow.

APPENDIX D



JUNCTION CHAMBER No. 1

INFLUENT FLOW (AADF)	96 MGD
NUMBER OF TANKS	3
TOTAL VOLUME	0.67 MGD

SCREEN AND GRIT FACILITIES

MECHANICAL SCREENS	5
MECHANICAL SCREENS CAPACITY	55 MGD
GRIT TANKS	8
SURFACE AREA OF EACH TANK	2025 SF

PRIMARY SETTLING TANKS (PST)

NUMBER OF TANKS	8
SURFACE AREA OF EACH TANK	6308 SF
TOTAL SURFACE AREA	50,464 SF

MAIN PUMPING STATION

PUMPS	7
TOTAL PUMP CAPACITY	300 MGD

HIGH PURITY OXYGEN (HPO) REACTORS

NUMBER OF REACTORS	6
VOLUME OF REACTORS	1.27 MG
TOTAL REACTOR VOLUME	7.62 MG

FINAL SETTLING TANKS (FST)

NUMBER OF TANKS	12
SURFACE AREA OF EACH TANKS	16,796 SF
TOTAL SURFACE AREA	201,552 SF

NITRIFICATION P.S.

PUMPS	7
TOTAL CAPACITY	302.4 MGD

DIFFUSED AIR REACTORS (DAR)

NUMBER OF REACTORS	4
VOLUME OF REACTOR	2.12 MG
TOTAL REACTOR VOLUME	8.48 MG

FINAL SETTLING TANKS (FST)

NUMBER OF REACTORS	8
VOLUME OF REACTOR	16,796 SF
TOTAL SURFACE AREA	134,368

DENITRIFICATION FILTERS

NUMBER OF FILTERS	32
SURFACE AREA OF EACH FILTER	1,050 SF
TOTAL SURFACE AREA	33,600 SF

CHLORINE CONTACT TANKS

NUMBER OF TANKS	3
TANK VOLUME	.79 MGD
TOTAL TANK VOLUME	2.38 MG

GRAVITY THICKENERS

NUMBERS OF TANKS	2
THICKENING AREA OF EACH TANK	2,376 SF
TOTAL THICKENING AREA	4,752 SF

ANAEROBIC DIGESTERS

NUMBER OF DIGESTERS	7
TOTAL VOLUME OF DIGESTERS	9.87 MG

SLUDGE DEWATERING BUILDING

NUMBER OF DEWATERING UNITS	8
FLOW RATE PER DEWATERING UNIT	62 GPM

HEAT DRYING FACILITY

NUMBER OF HEAT DRYING TRAINS	2
SLUDGE APPLIED	676,300 LB / DAY

RECLAIMED WATER PS.

PUMPS	4
TOTAL PUMP CAPACITY	17.3 MGD

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HOWARD F. CURREN AWTP MASTER PLAN DESIGN-PHASE 1

EXISTING FACILITY FLOW DIAGRAM

City of Tampa Florida

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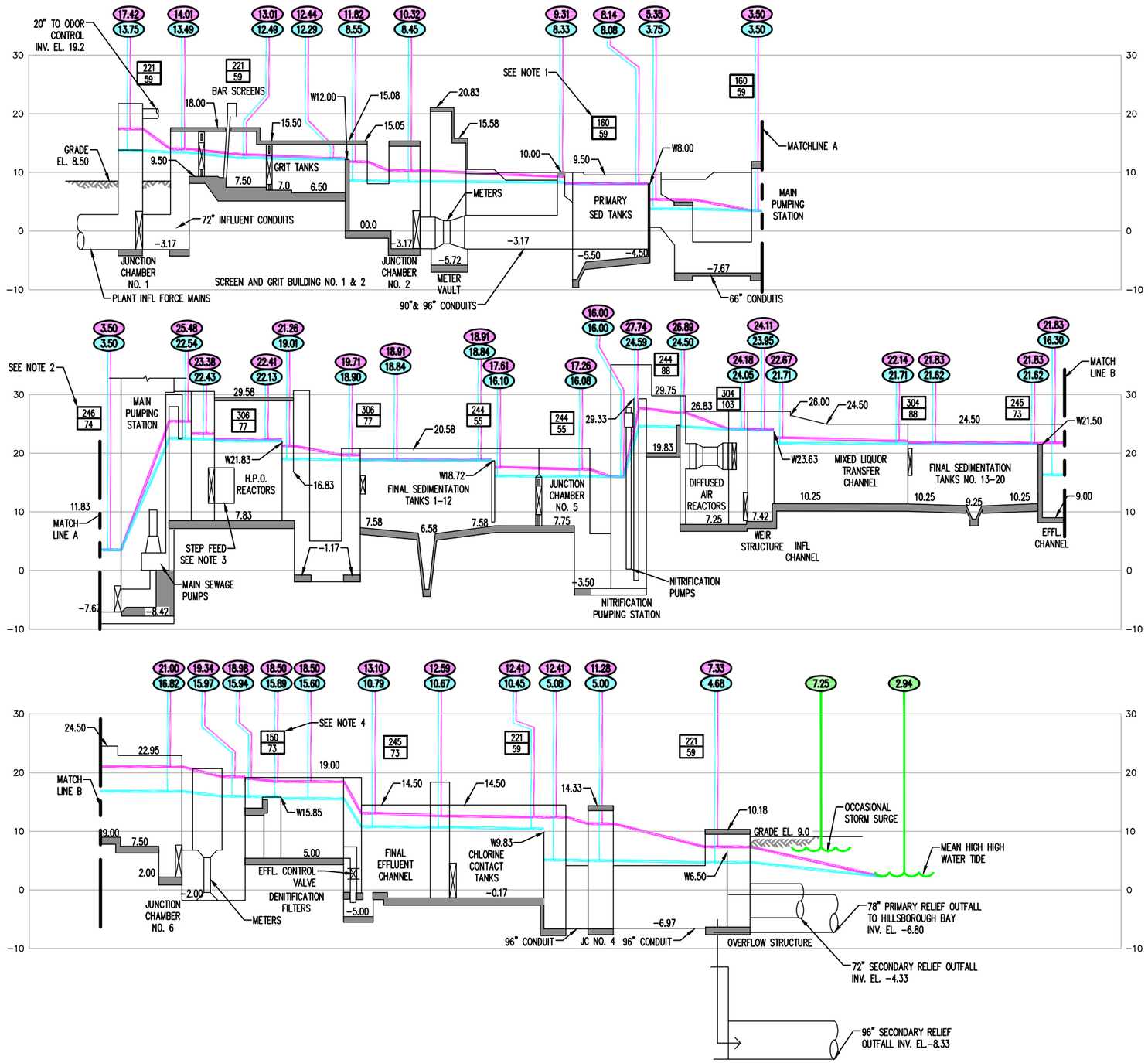

NOTES:

1. FLOW TO EACH SET OF PRIMARIES AT PEAK FLOW, 61MGD MUST BYPASS DIRECTLY TO MAIN PUMPING STATION.
2. INCLUDES 26% RECYCLE FROM BACKWASH, FILTRATE AND OTHER RETURN STREAMS.
3. STEP FEED FOR HPO'S USED AT PEAK FLOWS.
4. OBSERVED MAX FLOW THROUGH FILTERS IS CURRENTLY ABOUT 150 MGD DUE TO EXCESSIVE HEADLOSS.

LEGEND

- 8.40 — HYDRAULIC GRADE LINE AT DESIGN PEAK HOURLY FLOW
- 7.90 — HYDRAULIC GRADE LINE AT 2014 ANNUAL AVG. DAILY FLOW
- 221 / 59 — DESIGN PEAK HOURLY FLOW / 2014 ANNUAL AVG. FLOW DAILY FLOW

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HOWARD F. CURREN AWTP MASTER PLAN DESIGN-PHASE 1

EXISTING FACILITY HYDRAULIC PROFILE

City of Tampa Florida

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Client:	**City of Tampa**	**Job No:**	**2848-0038**	**Notes**
Project:	**Howard F. Curren AWTP Master Plan Phase I**	**Edited:**	**1/15/2016**	
Subject:	**Existing Facility Hydraulics**	**By:**	**MDN**	

Actual and Design Influent Flows

2014 AADF	**59.1**	**MGD**	41,042	gpm
Design AADF	**96**	**MGD**	66,667	gpm
PF_{Design}	**2.3**	**Design Peaking Factor**		
Design PHF	**220.8**	**MGD**	153,333	gpm

Influent Flows Analyzed

System Influent		
2014 AADF	58.70	MGD
Design AADF	96.00	MGD
Design PHF	220.80	MGD
PHF Class I	220.80	MGD

Junction Chamber No. 1 and Pre-Aeration Tanks

Pre-Aeration Tanks 1 & 2 (Original)						
	Flow Split (per tank)	Flow (MGD) (per tank)	Flow (gpm) (per tank)	Headloss (ft) (per tank)	WL (ft)	To HWL (ft) (to 19.2)
2014 AADF	33.33%	19.57	13,588	0.02	13.75	5.45
Design AADF	33.33%	32.00	22,222	0.05	14.21	4.99
Design PHF	33.33%	73.60	51,111	0.26	17.42	1.78
PHF Class I	50.00%	110.40	76,667	0.59	17.95	1.25
Pre-Aeration Tank 3 (Expansion, North)						
	Flow Split	Flow (MGD)	Flow (gpm)	Headloss (ft)	WL (ft)	To HWL (ft) (to 19.2)
2014 AADF	33.33%	19.57	13,588	0.02	13.75	5.45
Design AADF	33.33%	32.00	22,222	0.05	14.21	4.99
Design PHF	33.33%	73.60	51,111	0.26	17.42	1.78
PHF Class I	0.00%	0.00	0	0.59	0.00	-

Invert of 20" pipe to odor control at EL. 19.2

Class I Reliability: 100% of PHF w/ largest out of service (tank 3)

Conduits to Screening and Grit Buildings

72" Conduit to Screening and Grit Building 1 (New)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	51.00%	29.94	20,790	1.6	0.25
Design AADF	51.20%	49.15	34,133	2.7	0.64
Design PHF	51.15%	112.94	78,430	6.2	3.17
PHF Class I	51.15%	112.94	78,430	6.2	3.17
72" Conduit to Screening and Grit Building 2 (Old)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	49.00%	28.76	19,974	1.6	0.25
Design AADF	48.80%	46.85	32,533	2.6	0.64
Design PHF	48.85%	107.86	74,903	5.9	3.17
PHF Class I	48.85%	107.86	74,903	5.9	3.17

Screening and Grit Buildings

Screening and Grit Building 1 (New, West)											
	Flow Split	Flow (MGD)	Flow (gpm)	# of Screens in Use	# of Grit Tanks in Use	Headloss (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Grit Tank Freeboard (ft) (to 15.50)	Weir Drop (ft) (from 12.00)
2014 AADF	51.00%	29.94	20,790	2	2	1.08	29.94	0.29	12.29	3.21	3.50
Design AADF	51.20%	49.15	34,133	2	3	1.08	49.15	0.31	12.31	3.19	2.79
Design PHF	51.15%	112.94	78,430	3	4	1.17	112.94	0.44	12.44	3.06	1.04
PHF Class I	51.15%	112.94	78,430	2	3	1.17	112.94	0.53	12.53	3.06	1.39
Screening and Grit Building 2 (Old, East)											
	Flow Split	Flow (MGD)	Flow (gpm)	# of Screens in Use	# of Grit Tanks in Use	Headloss (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Grit Tank Freeboard (ft) (to 15.50)	Weir Drop (ft) (from 12.00)
2014 AADF	49.00%	28.76	19,974	2	2	1.08	28.76	0.28	12.28	3.22	3.45
Design AADF	48.80%	46.85	32,533	2	3	1.08	46.85	0.30	12.30	3.20	2.63
Design PHF	48.85%	107.86	74,903	2	4	1.17	107.86	0.43	12.43	3.07	0.18
PHF Class I	48.85%	107.86	74,903	2	4	1.17	107.86	0.43	12.43	3.07	0.53

Class I Reliability: 100% of PHF w/ largest out of service

Conduits to Junction Chamber No. 2

81"x81" Conduit from S&G Bldg. 1 (New, West)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	51.00%	29.94	20,790	1.0	0.05
Design AADF	51.20%	49.15	34,133	1.7	0.13
Design PHF	51.15%	112.94	78,430	3.8	0.63
PHF Class I	51.15%	112.94	78,430	3.8	0.63
48"x84" Conduit from S&G Bldg. 2 (Old, East)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	49.00%	28.76	19,974	1.6	0.11
Design AADF	48.80%	46.85	32,533	2.6	0.28
Design PHF	48.85%	107.86	74,903	6.0	1.49
PHF Class I	48.85%	107.86	74,903	6.0	1.49

Achieves adequate flushing velocity at > 45 MGD

Conduits to Primary Sedimentation Tanks and Bypass to Main Pumping Station

90" Conduit to PSTs 1-4							
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Conduit Headloss (ft)	Total Headloss into PSTs (ft)	
2014 AADF	48.50%	28.47	19,770	1.0	0.14	0.31	Achieves adequate flushing velocity at > 43 MGD
Design AADF	48.50%	46.56	32,333	1.6	0.35	0.82	
Design PHF	36.23%	80.00	55,556	2.8	1.01	1.79	Assume flow split can be achieved by sluice gate adjustments
PHF Class I	36.23%	80.00	55,556	2.8	1.01	1.67	80 MGD is max flow for PSTs 1-4
96" Conduit to PSTs 5-8							
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Conduit Headloss (ft)	Total Headloss into PSTs (ft)	
2014 AADF	51.50%	30.23	20,993	0.9	0.11	0.31	Achieves adequate flushing velocity at > 50 MGD
Design AADF	51.50%	49.44	34,333	1.5	0.29	0.82	
Design PHF	36.23%	80.00	55,556	2.5	0.76	1.53	80 MGD is max flow for PSTs 5-8
PHF Class I	36.23%	80.00	55,556	2.5	0.76	1.12	

66" Bypass To Main Pumping Station					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	0.00%	0.00	0	-	-
Design AADF	0.00%	0.00	0	-	-
Design PHF	27.54%	60.80	42,222	4.0	0.67
PHF Class I	27.54%	60.80	42,222	4.0	0.67

Primary Sedimentation Tanks

PSTs 1-4 (Old, North)													
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	Underflow (MGD)	# of PSTs in Use	SOR (gpd/ft^2)	Inf. Channel Freeboard (ft) (to 10.0)	Headloss Into PSTs (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Freeboard (ft) (to 9.5)	Weir Drop (ft) (from 8.00)
2014 AADF	48.50%	28.47	19,770	0.17	3	1504	1.70	0.17	28.29	0.08	8.08	1.42	4.25
Design AADF	48.50%	46.56	32,333	0.17	3	2460	1.29	0.47	46.39	0.11	8.11	1.39	3.85
Design PHF	36.23%	80.00	55,556	0.18	4	3171	0.69	0.77	79.82	0.14	8.14	1.36	2.65
PHF Class I	25.00%	55.20	38,333	0.18	3	2917	1.04	0.66	55.02	0.12	8.12	1.38	3.59
PSTs 5-8 (New, South)													
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	Underflow (MGD)	# of PSTs in Use	SOR (gpd/ft^2)	Inf. Channel Freeboard (ft) (to 12.0)	Headloss Into PSTs (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Freeboard (ft) (to 11.5)	Weir Drop (ft) (from 8.00)
2014 AADF	51.50%	30.23	20,993	0.19	3	1597	3.67	0.20	30.05	0.08	8.08	3.42	4.30
Design AADF	51.50%	49.44	34,333	0.19	3	2613	3.21	0.53	49.25	0.11	8.11	3.39	3.97
Design PHF	36.23%	80.00	55,556	0.18	4	3171	2.69	0.77	79.82	0.14	8.14	3.36	3.15
PHF Class I	25.00%	55.20	38,333	0.18	4	2188	3.35	0.37	55.02	0.10	8.10	3.40	3.85

Conduits from Primary Sedimentation Tanks

66" Conduit From PSTs 1-4					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	48.20%	28.29	19,649	1.8	0.25
Design AADF	48.32%	46.39	32,212	3.0	0.65
Design PHF	36.15%	79.82	55,431	5.2	1.85
PHF Class I	24.92%	55.02	38,208	3.6	0.91

66" Conduit From PSTs 5-8						
	DAR WAS (MGD)	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	0.10	51.35%	30.15	20,934	2.0	0.20
Design AADF	0.10	51.41%	49.35	34,274	3.2	0.53
Design PHF	0.00	36.15%	79.82	55,431	5.2	1.35
PHF Class I	0.00	24.92%	55.02	38,208	3.6	0.65

Main Pumping Station

Main Pumping Station (250 MGD Design Capacity)					
	Flow Split	Flow (MGD)	Flow (gpm)	Design Pump Head (ft)	Estimated TDH (ft)
2014 AADF	126.04%	73.99	51,379	33.00	25.79
Design AADF	126.04%	121.00	84,027		26.97
Design PHF	111.32%	245.80	170,694		32.48
PHF Class I	113.22%	250.00	173,611		32.56

25 MGD of recycle flows added from filter backwash, filtrate, etc.

Class I Reliability: 100% of PHF w/ largest out of service **(design capacity)**

Super Spike to Diffused Air Reactors via Junction Chamber No. 5

Spike 66" Conduit to JC 5					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	30.66%	18.00	12,500	1.2	1.18
Design AADF	18.75%	18.00	12,500	1.2	0.49
Design PHF	0.00%	0.00	0	0.0	0.00
PHF Class I	0.00%	0.00	0	0.0	0.00

Never achieves adequate flushing velocity

Not used at high flows per High Flow Protocol

High Purity Oxygen Reactors

HPOs 1-3												
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	RAS (MGD)	# of HPOs in Use	Inf. Channel Freeboard (ft) (to 30.5)	Headloss Into Reactors (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Freeboard (ft) (to 29.58)	Weir Drop (ft) (from 21.83)
2014 AADF	95.38%	55.99	38,879	21.00	2	7.96	0.41	76.99	0.30	22.13	7.45	2.82
Design AADF	107.29%	103.00	71,527	60.00	2	6.77	1.40	163.00	0.50	22.33	7.25	2.31
Design PHF	111.32%	245.80	170,694	60.00	3	5.02	3.07	305.80	0.58	22.41	7.17	0.57
PHF Class I	113.22%	250.00	173,611	60.00	3	4.94	3.15	310.00	0.58	22.41	7.17	1.21
HPOs 4-6 (NOT USED)												

Step feed gates open 2'

Step feed gates open 2'

Conduits to HPO Final Sedimentation Tanks

Two 96"x72" Conduits from HPOs					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	131.15%	76.99	53,462	1.2	0.11
Design AADF	169.79%	163.00	113,193	2.6	0.46
Design PHF	138.50%	305.80	212,361	4.9	1.55
PHF Class I	140.40%	310.00	215,278	5.0	1.59
From HPOs 4-6 (NOT USED)					

Achieves adequate flushing velocity at > 95 MGD

High Purity Oxygen Final Sedimentation Tanks

Currently only 5 to 7 tanks used at one time

HPO FSTs 1-12													
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	WAS (MGD)	# of FSTs in Use	SOR (gpd/ft^2)	Inf. Channel Freeboard (ft) (to 20.58)	Headloss Into FSTs (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Freeboard (ft) (to 20.58)	Weir Drop (ft) (from 18.72)
2014 AADF	131.15%	76.99	53,462	1.40	5	917	1.68	0.06	54.59	0.12	18.84	1.74	2.62
Design AADF	169.79%	163.00	113,193	1.40	6	1617	1.52	0.20	101.60	0.14	18.86	1.72	2.42
Design PHF	138.50%	305.80	212,361	1.40	7	2601	0.87	0.56	244.40	0.19	18.91	1.67	1.11
PHF Class I	105.30%	232.50	161,458	1.40	11	1258	1.54	0.18	171.10	0.14	18.86	1.72	1.91

Junction Chamber No. 5 and Conduits to Nitrification Pumping Station

JC 5 and Two 90"x90" Conduits to Nitrification Pumping Station					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	92.99%	54.59	37,907	0.75	0.10
Design AADF	105.83%	101.60	70,554	1.40	0.30
Design PHF	110.69%	244.40	169,722	3.36	1.61
PHF Class I	77.49%	171.10	118,819	2.35	0.81

Achieves adequate flushing velocity at > 110 MGD

Nitrification Pumping Station

Nitrification Pumping Station (259 MGD Design Capacity)						
	NO_3 Internal Recycle (MGD)	Flow Split	Flow (MGD)	Flow (gpm)	Design Pump Head (ft)	Estimated TDH (ft)
2014 AADF	15.00	149.21%	87.59	60,823	15.50	9.60
Design AADF	15.00	140.21%	134.60	93,471		10.11
Design PHF	0.00	110.69%	244.40	169,722		12.62
PHF Class I	0.00	117.30%	259.00	179,861		13.05

Internal recycle gate closed per high flow protocol

Diffused Air Reactors

Reactor 1 is currently inoperable pending upgrades

DARs 2-4													
	RAS (MGD)	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	# of DARs in Use	Inf. Channel Freeboard (ft) (to 26.83)	72" Reactor Inf. Velocity (fps)	Headloss (ft)	Weir Flow (MGD)	Weir Head (ft)	WL @ Weir (ft)	Freeboard (ft) (to 26.83)	Weir Drop (ft) (from 23.63)
2014 AADF	15.00	174.76%	102.59	71,240	2	2.24	2.40	0.22	87.59	0.12	23.95	2.88	1.92
Design AADF	60.00	202.71%	194.60	135,138	3	1.90	2.46	0.35	179.60	0.19	24.02	2.81	1.70
Design PHF	60.00	137.86%	304.40	211,389	3	0.07	4.46	0.86	304.40	0.28	24.11	2.72	0.96
PHF Class I	60.00	144.47%	319.00	221,528	3	-0.25	4.72	0.95	319.00	0.28	24.11	2.72	1.15

Top of reactors is at 26.83', but the top of the channel is at 29.75'

Will overflow into reactors but not over top of channel

MLSS Channel to Final Sedimentation Tanks

MLSS Channel					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
Design AADF	149.22%	87.59	60,826	0.9	0.04
2014 AADF	187.08%	179.60	124,722	1.9	0.18
Design PHF	137.86%	304.40	211,389	3.2	0.53
PHF Class I	144.47%	319.00	221,528	3.4	0.58

Diffused Air Reactors Final Sedimentation Tanks

DAR FSTs 13-20												
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	# of FSTs in Use	SOR (gpd/ft^2)	Inf. Channel Freeboard (ft) (to 24.5)	Headloss Into FSTs (ft)	Weir Flow (MGD)	Weir Head (ft)	WL (ft)	Freeboard (ft) (to 24.5)	Weir Drop (ft) (from 21.5)
2014 AADF	149.21%	87.59	60,823	6	869	2.83	0.05	72.59	0.12	21.62	2.88	5.20
Design AADF	187.08%	179.60	124,721	8	1337	2.76	0.11	119.60	0.13	21.63	2.87	4.39
Design PHF	137.86%	304.40	211,389	8	2265	2.36	0.32	244.40	0.18	21.83	2.67	-0.33
PHF Class I	103.40%	228.30	158,542	7	1942	2.61	0.23	168.30	0.16	21.66	2.84	0.92

Conduit From Junction Chamber No. 6 to Denitrification Filters

102" Conduit to Denitrification Filters (72" FE-49 150 MGD Max)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	123.66%	72.59	50,410	2.0	0.26
Design AADF	124.58%	119.60	83,056	3.3	0.71
Design PHF	72.74%	160.61	111,535	4.4	1.27
PHF Class I	50.10%	110.62	76,820	3.0	0.61
102" Conduit to Denitrification Filters (48" FE-48 70 MGD Max)					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	0.00%	0.00	0	0.0	0.00
Design AADF	0.00%	0.00	0	0.0	0.00
Design PHF	37.95%	83.79	58,188	2.3	1.27
PHF Class I	26.12%	57.68	40,055	1.6	0.61

Exceeds max flow for meter

Exceeds max flow for meter

Denitrification Filters

Denitrification Filters 1-32												
	Flow Split	Influent Flow (MGD)	Influent Flow (gpm)	# of Filters in Use	Headloss Into Filters (ft)	Weir Flow (MGD)	Weir Head (ft)	WL required @ Weir (ft)	Filter WL (ft)	Freeboard (ft) (to 19.0)	Weir Drop (ft) (from 15.85)	Filtration Rate (gpm/ft^2)
2014 AADF	123.66%	72.59	50,410	30	0.07	72.59	0.04	15.89	15.60	3.40	0.25	1.60
Design AADF	124.58%	119.60	83,056	30	0.20	119.60	0.06	15.91	15.60	3.40	0.25	2.64
Design PHF	110.69%	244.40	169,722	30	0.84	244.40	0.10	18.50	18.50	0.50	-2.65	5.39
PHF Class I	83.02%	183.30	127,292	31	0.46	183.30	0.08	18.50	18.50	0.50	-2.65	3.91

Final Effluent Channel

Final Effluent Channel						
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)	Freeboard (ft) (to 14.5)
2014 AADF	123.66%	72.59	50,410	1.3	0.04	3.95
Design AADF	124.58%	119.60	83,056	2.2	0.12	3.71
Design PHF	110.69%	244.40	169,722	4.5	0.48	1.40
PHF Class I	83.02%	183.30	127,292	3.4	0.27	1.40

Chlorine Contact Tanks

Chlorine Contact Tanks 1-3													
	Total Flow Split	Total Flow (MGD)	# of CCTs in Use	Flow CCT 1 (MGD)	Flow CCT 2 (MGD)	Flow CCT 3 (MGD)	HRT (in highest flow CCT) (min)	Headloss (ft)	Weir Flow (CCT 1) (MGD)	Weir Head (CCT 1) (ft)	WL (CCT 1) (ft)	Freeboard (ft) (CCT 1) (to 14.5)	Weir Drop (ft) (from 9.83)
2014 AADF	100.00%	58.70	1	58.70	0.00	0.00	20.71	0.05	66.49	0.62	10.45	4.05	4.75
Design AADF	100.00%	96.00	2	84.25	11.75	0.00	13.83	0.11	84.25	0.73	10.56	3.94	2.17
Design PHF	100.00%	220.80	3	98.70	98.70	23.40	12.36	0.18	98.70	0.81	12.41	2.09	-2.58
PHF Class I	50.00%	110.40	2	89.30	21.10	0.00	13.33	0.15	89.30	0.76	12.41	2.09	-2.58

8.3 MGD to reclaimed water pumps ignored for analysis

All plant water use flows removed before CCTs

Flow split based on High Flow Protocol CCT Formula

All plant recycle flows removed before weir

Class I Reliability: 50% of PHF w/ 1 tank out of service

Conduit to Overflow Structure

Junction Chamber No. 4 and 96" Conduit to Overflow Structure					
	Flow Split	Flow (MGD)	Flow (gpm)	Velocity (fps)	Headloss (ft)
2014 AADF	100.00%	58.70	40,764	1.8	0.10
Design AADF	100.00%	96.00	66,667	3.0	0.26
Design PHF	100.00%	220.80	153,333	6.8	3.95
PHF Class I	100.00%	220.80	153,333	6.8	3.95

Headloss reduced to 1.4' by adding a second 84" pipe

Overflow Structure

Overflow Structure									
	Flow Split	Total Flow (MGD)	Total Flow (gpm)	78" Primary Outfall Flow (D-001) (MGD)	78" Primary Headloss (ft)	WL (w/ MHHW Tide - 2.94')	Overflow Weirs Flow (at 6.5') (MGD)	Weir Head (ft)	Freeboard (ft) (to 10.16)
2014 AADF	100.00%	58.70	40,764	58.70	1.74	4.68	0.00	0.00	5.48
Design AADF	91.45%	96.00	66,667	87.79	3.70	6.64	8.17	0.14	3.52
Design PHF	43.60%	220.80	153,333	96.26	4.39	7.33	124.50	0.83	2.83
PHF Class I	43.60%	220.80	153,333	96.26	4.39	7.33	124.50	0.83	2.83

APPENDIX E

Datums for 8726667, Mckay Bay Entrance FL

Elevations on Station Datum

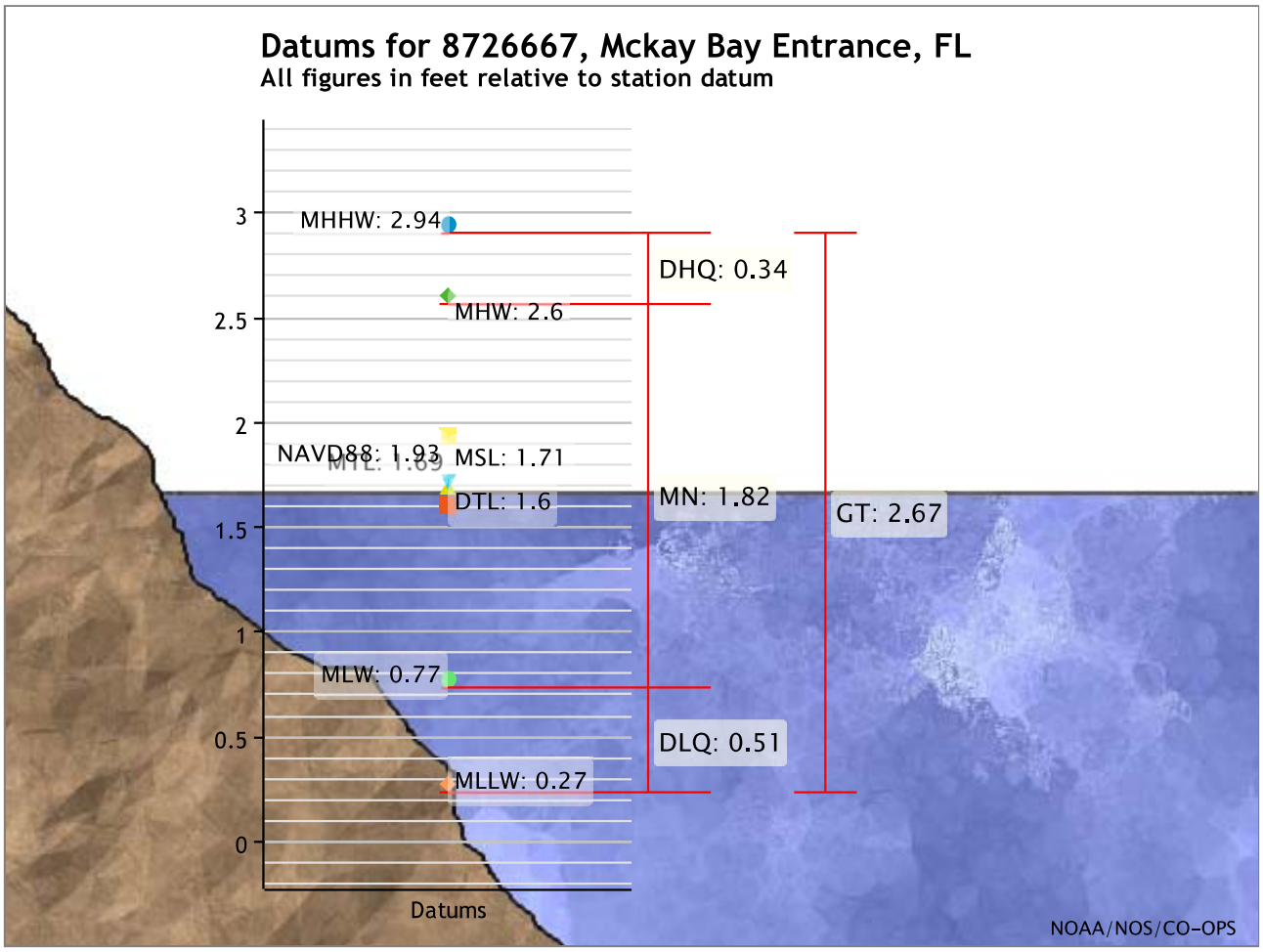
Station: 8726667, Mckay Bay Entrance, FL
Status: Accepted (Sep 7 2010)
Units: Feet
T.M.: 75
Epoch: (/datum_options.html#NTDE) 1983-2001
Datum: STND

Datum	Value	Description
MHHW (/datum_options.html#MHHW)	2.94	Mean Higher-High Water
MHW (/datum_options.html#MHW)	2.60	Mean High Water
MTL (/datum_options.html#MTL)	1.69	Mean Tide Level
MSL (/datum_options.html#MSL)	1.71	Mean Sea Level
DTL (/datum_options.html#DTL)	1.60	Mean Diurnal Tide Level
MLW (/datum_options.html#MLW)	0.77	Mean Low Water
MLLW (/datum_options.html#MLLW)	0.27	Mean Lower-Low Water
NAVD88 (/datum_options.html)	1.93	North American Vertical Datum of 1988
STND (/datum_options.html#STND)	0.00	Station Datum
GT (/datum_options.html#GT)	2.67	Great Diurnal Range
MN (/datum_options.html#MN)	1.82	Mean Range of Tide

DHQ (/datum_options.html#DHQ)	0.34	Mean Diurnal High Water Inequality
DLQ (/datum_options.html#DLQ)	0.51	Mean Diurnal Low Water Inequality
HWI (/datum_options.html#HWI)		Greenwich High Water Interval (in hours)
LWI (/datum_options.html#LWI)		Greenwich Low Water Interval (in hours)
Maximum	7.25	Highest Observed Water Level
Max Date & Time	10/08/1996 05:36	Highest Observed Water Level Date and Time
Minimum	-2.17	Lowest Observed Water Level
Min Date & Time	01/03/2008 12:00	Lowest Observed Water Level Date and Time
HAT (/datum_options.html#HAT)	3.94	Highest Astronomical Tide
HAT Date & Time	06/22/1986 17:42	HAT Date and Time
LAT (/datum_options.html#LAT)	-1.04	Lowest Astronomical Tide
LAT Date & Time	01/28/1987 13:00	LAT Date and Time

Tidal Datum Analysis Periods

01/01/1999 - 12/31/2007



Showing datums for

8726667 Mckay Bay Entranc…

Data Units
- (•) Feet
- ( ) Meters

Epoch
- (•) Present (1983-2001)
- ( ) Superseded (1960-1978)

Submit

Show nearby stations

Products available at 8726667 Mckay Bay Entrance, FL

TIDES/WATER LEVELS

Water Levels (/waterlevels.html?id=8726667)

NOAA Tide Predictions (/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8726667)

Harmonic Constituents (/harcon.html?id=8726667)

Sea Level Trends

Datums (/datums.html?id=8726667)

Bench Mark Sheets (/benchmarks.html?id=8726667)

Extreme Water Levels

Reports (/reports.html?id=8726667)

METEOROLOGICAL/OTHER

Meteorological Observations (/met.html?id=8726667)

Water Temp/Conductivity

PORTS®

Tampa Bay PORTS® (/ports/index.html?port=tb)

PORTS® product page for Mckay Bay Entrance (/ports/ports.html?id=8726667)

OPERATIONAL FORECAST SYSTEMS

Tampa Bay (/ofs/tbofs/tbofs.html)

OFS product page for Mckay Bay Entrance (/ofs/ofs_station.shtml?stname=Mckay Bay

Entrance&ofs=tb&stnid=8726667&subdomain=0)

INFORMATION

Station Home Page (/stationhome.html?id=8726667)

Data Inventory (/inventory.html?id=8726667)

Measurement Specifications (/measure.html)

Information

About CO-OPS (/about.html)
Disclaimers (/disclaimers.html)
Contact Us (/contact.html)
Privacy Policy (/privacy.html)

Products

PORTS (/ports.html)
OFS (/models.html)
Tide Predictions (/tide_predictions.html)
Currents (/cdata/StationList?type=Current+Data&filter=active)
More about products... (/products.html)

Programs

Mapping and Charting Support (/mapping.html)
Maritime Services (/maritime.html)
COASTAL (/coastal.html)
More about programs... (/programs.html)

Partners

Hydrographic Survey Support (/hydro.html)
Marsh Restoration (/marsh.html)
GoMOOS (/gomoos.html)
TCOON (/tcoon.html)

Revised: 10/15/2013
NOAA (http://www.noaa.gov) / National Ocean Service (http://oceanservice.noaa.gov)
Web site owner: Center for Operational Oceanographic Products and Services

APPENDIX F

Normal Operation: Flows <= 75 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality				DAR FST Effluent			
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1-Jan-2010	49.97	181	168	0.93	77	147	41.53	136.44	0.04	1.12	24.02	6.8
2-Jan-2010	49.36	136	118	0.87	83	128	42.45	111.06	0.14	1.59	32.79	6.8
3-Jan-2010	49.50	146	158	1.08	148	190	45.07	205.62	0.03	1.01	28.19	7.8
4-Jan-2010	50.74	192	157	0.82	88	143	38.74	116.93	0.15	1.59	26.65	9
5-Jan-2010	50.62	237	181	0.76	92	137	44.59	104.63	0.04	1.36	29.47	6.4
6-Jan-2010	50.13	201	183	0.91	79	127	43.64	115.63	0.02	1.1	31.29	6.8
7-Jan-2010	50.87	205	148	0.72	90	146	42.44	105.40	0.03	1.34	27.71	7.6
8-Jan-2010	49.91	192	177	0.92	80	136	43.01	125.38	0.06	0.98	28.73	6.6
9-Jan-2010	48.90	160	147	0.92	250	181	55.99	166.29	0.06	0.96	31.56	6.8
10-Jan-2010	48.98	149	136	0.91	116	146	45.25	133.26	0.03	1.06	31.54	6.2
11-Jan-2010	49.83	171	104	0.61	105	193	40.33	117.38	0.12	0.97	27.62	6
12-Jan-2010	50.03	262	216	0.82	108	161	42.25	132.73	0.04	1.19	25.5	6.2
13-Jan-2010	50.65	210	181	0.86	100	166	44.69	143.08	0.04	1.3	27.93	7
14-Jan-2010	50.87	237	221	0.93	126	199	45.11	185.57	0.04	1.55	28.69	7.6
15-Jan-2010	50.63	208	201	0.97	105	191	46.86	184.57	0.03	1.23	25.8	6.8
16-Jan-2010	51.61	170	156	0.92	94	161	43.74	147.74	0.03	0.96	26.94	6.4
17-Jan-2010	56.42	153	149	0.97	91	145	38.15	141.21	0.03	1.06	24.51	6.2
18-Jan-2010	54.37	151	155	1.03	79	180	42.22	184.77	0.03	0.96	28.24	6.2
19-Jan-2010	53.88	200	187	0.94	83	171	42.3	159.89	0.01	1.23	22.75	6.2
20-Jan-2010	52.87	161	153	0.95	98	171	42.81	162.50	0.04	1.19	28.07	6
21-Jan-2010	53.38	222	214	0.96	126	193	46.41	186.05	0.04	1.46	27.01	6.8
22-Jan-2010	57.97	189	168	0.89	117	158	40.14	140.44	0.03	1.3	27.04	7.4
23-Jan-2010	54.61	123	107	0.87	73	148	37.33	128.75	0.07	1.37	27.48	7.6
24-Jan-2010	54.96	141	137	0.97	81	145	38.82	140.89	0.03	1.16	27.86	6.6
25-Jan-2010	58.22	129	132	1.02	111	180	39.15	184.19	0.05	1.44	24.92	7.2
26-Jan-2010	55.82	169	163	0.96	90	160	37.95	154.32	0.06	1.5	26.03	6.8
27-Jan-2010	55.63	167	147	0.88	98	170	39.42	149.64	0.05	1.45	26.37	7.2
28-Jan-2010	54.82	146	144	0.99	99	176	38.25	173.59	0.01	1.39	25.74	7.8
29-Jan-2010	54.70	134	114	0.85	110	161	40.24	136.97	0.04	1.17	24.78	6.8
30-Jan-2010	54.87	137	125	0.91	123	170	41.56	155.11	0.03	0.79	22.47	7.6
31-Jan-2010	54.34	125	117	0.94	103	112	41.16	104.83	0.04	1.07	28.04	6
1-Feb-2010	53.64	170	154	0.91	103	171	39.33	154.91	0.02	1.17	23.18	5.8
2-Feb-2010	55.26	127	123	0.97	100	192	39.85	185.95	0.04	1.38	28.31	5.8
3-Feb-2010	54.24	135	121	0.90	123	153	43.55	137.13	0.07	1.26	28.13	6.2
4-Feb-2010	53.58	172	152	0.88	105	169	44.16	149.35	0.06	1.35	26.98	6.2
5-Feb-2010	57.95	131	121	0.92	106	175	40.94	161.64	0.05	1.32	27.34	6.4
6-Feb-2010	57.35	124	106	0.85	101	160	37.2	136.77	0.06	1.08	26.02	6.6
7-Feb-2010	56.99	179	152	0.85	95	173	40.23	146.91	0.06	1.22	25.75	8
8-Feb-2010	55.76	159	144	0.91	112	172	40.47	155.77	0.03	1.38	27.59	8
9-Feb-2010	56.39	175	161	0.92	103	154	39.88	141.68	0.06	1.3	25.19	6.6
10-Feb-2010	56.56	184	168	0.91	122	161	42.58	147.00	0.04	1.4	29.14	7.4
11-Feb-2010	56.17	168	132	0.79	117	161	43.71	126.50	0.06	1.24	29.45	7.8
12-Feb-2010	57.52	169	158	0.93	89	170	41	158.93	0.03	1.07	29.76	8
13-Feb-2010	57.91	112	92	0.82	89	150	38.64	123.21	0.03	1.44	27.65	6.8
14-Feb-2010	56.62	102	96	0.94	79	150	37.83	141.18	0.03	1.4	27.49	7.8
15-Feb-2010	57.15	185	176	0.95	91	136	38.16	129.38	0.04	1.19	25.11	8.8
16-Feb-2010	54.15	147	134	0.91	143	164	46.11	149.50	0.06	1.49	27.78	7
17-Feb-2010	56.11	157	149	0.95	102	198	43.52	187.91	0.04	1.31	29.74	7.4
18-Feb-2010	54.46	183	163	0.89	102	180	43.1	160.33	0.04	1.1	28.35	7.6
19-Feb-2010	53.48	187	154	0.82	91	141	44.41	116.12	0.01	1.35	26	6.6
20-Feb-2010	53.27	130	103	0.79	103	152	41.92	120.43	0.02	1.3	28.64	7.2
21-Feb-2010	52.81	114	104	0.91	104	163	44.41	148.70	0.02	1.13	29.37	8.6
22-Feb-2010	53.57	182	148	0.81	91	176	40.71	143.12	0.06	1.09	26.84	7.8
23-Feb-2010	53.72	148	145	0.98	92	155	42.76	151.86	0.06	1.26	28.05	7.6
24-Feb-2010	53.88	237	221	0.93	91	178	43.32	165.98	0.03	1.26	25.97	6.8
25-Feb-2010	53.01	184	185	1.01	83	160	43.34	160.87	0.04	1.23	26.14	7.8
26-Feb-2010	51.95	183	169	0.92	96	147	44.72	135.75	0.01	1.22	29.73	6.6
27-Feb-2010	51.48	188	166	0.88	94	185	44.37	163.35	0.02	1.19	29.96	5.2
28-Feb-2010	52.02	153	145	0.95	94	150	41	142.16	0.02	1.23	26.82	5.2
1-Mar-2010	51.79	170	157	0.92	102	157	42.68	144.99	0.02	1.2	29.05	6.8
2-Mar-2010	55.35	187	175	0.94	87	148	41.79	138.50	0.04	1.36	29	6.4
3-Mar-2010	54.23	164	149	0.91	103	166	42.3	150.82	0.03	1.34	28.03	4.8
4-Mar-2010	53.39	135	130	0.96	84	149	40.33	143.48	0.03	1.55	28.6	4.2
5-Mar-2010	52.15	186	170	0.91	129	167	47.92	152.63		1.2	28.2	4.6
6-Mar-2010	51.14	167	148	0.89	98	166	45.39	147.11		1.44	27.46	3.4
7-Mar-2010	50.96	123	108	0.88	89	145	41.75	127.32	0.01	1.34	27.33	4.2
8-Mar-2010	51.42	177	157	0.89	97	173	42.16	153.45	0.08	1.09	28.65	4.4
9-Mar-2010	51.32	138	126	0.91	70	145	41	132.39	0.03	1.05	27.4	4.2
10-Mar-2010	51.52	163	141	0.87	101	161	45.53	139.27	0.05	1.12	30.08	4.6
11-Mar-2010	52.76	142	130	0.92	93	174	43.41	159.30	0.06	1.12	25.53	4.2
12-Mar-2010	65.03	189	164	0.87	95	142	38.09	123.22	0.11	1.22	24.89	5.2
13-Mar-2010	62.46	127	128	1.01	95	188	35.91	189.48	0.03	1.03	20.42	5
14-Mar-2010	60.16	126	93	0.74	89	150	36.88	110.71	0.06	1.05	23.55	3.2
15-Mar-2010	59.41	125	109	0.87	83	156	36.06	136.03	0.03	1.09	24.51	3.2
16-Mar-2010	58.13	143	133	0.93	81	161	37.14	149.74		1.22	24.59	3.6
17-Mar-2010	57.10	166	156	0.94	89	177	42.5	166.34	0.06	1.23	25.09	3.4
18-Mar-2010	56.46	166	166	1.00	87	167	41.98	167.00	0.04	1.36	23.91	3.4
19-Mar-2010	55.52	163	142	0.87	87	161	42.44	140.26	0.05	1.22	28.48	3.8
20-Mar-2010	54.25	135	124	0.92	86	159	41.04	146.04	0.06	1.18	24.87	4.2

21-Mar-2010	56.80	105	102	0.97	93	150	40.53	145.71	0.05	1.29	26.01	5.4
22-Mar-2010	58.25	126	107	0.85	85	162	38.09	137.57	0.02	1.16	25.92	4.2
23-Mar-2010	56.47	153	132	0.86	74	165	37.72	142.35		1.12	22.94	4.8
24-Mar-2010	55.52	137	136	0.99	83	167	42.38	165.78	0.02	1.19	25.15	4.4
25-Mar-2010	55.96	154	155	1.01	112	194	43.92	195.26	0.05	1.21	23.96	4
26-Mar-2010	60.04	118	113	0.96	85	169	39.69	161.84	0.03	1.26	20.36	3.7
27-Mar-2010	56.55	115	99	0.86	83	171	40.11	147.21	0.03	1.34	21.18	4.2
28-Mar-2010	59.74	102	91	0.89	99	156	41.8	139.18	0.04	1.41	26.03	3.8
30-Mar-2010	68.06	86	91	1.06	106	192	37.05	203.16	0.05	1.17	19.21	3.6
31-Mar-2010	65.90	175	148	0.85	124	191	39.21	161.53	0.02	1.16	23.56	3.6
1-Apr-2010	63.78	116	109	0.94	66	172	36.76	161.62	0.03	1.31	22.69	3
2-Apr-2010	61.28	103	98	0.95	72	166	37.52	157.94	0.01	1.36	23.29	3
3-Apr-2010	59.14	112	86	0.77	72	138	36.86	105.96	0.03	1.48	22.34	3.2
4-Apr-2010	57.13	112	90	0.80	65	143	37.66	114.91	0.03	1.32	23.06	2.2
5-Apr-2010	58.02	130	116	0.89	59	140	33.62	124.92	0.04	0.8	22.68	2.4
6-Apr-2010	57.90	100	87	0.87	86	153	37.38	133.11	0.02	1.16	22.1	3.6
7-Apr-2010	57.84	117	108	0.92	87	171	38.44	157.85	0.03	1.22	23.46	2.8
8-Apr-2010	57.73	114	107	0.94	90	153	39.25	143.61	0.02	1.09	22.93	2.6
9-Apr-2010	56.96	154	134	0.87	75	143	38.51	124.43	0.02	1.15	22.34	3.8
10-Apr-2010	54.75	96	92	0.96	109	144	41.04	138.00	0.03	1.09	21	2.2
11-Apr-2010	53.45	95	87	0.92	98	148	40.33	135.54	0.05	1.19	22.96	2.8
12-Apr-2010	62.16	92	87	0.95	62	124	36.07	117.26	0.03	1.02	24.92	3.2
13-Apr-2010	58.52	141	143	1.01	83	157	38.36	159.23	0.02	1.19	24.01	2.6
14-Apr-2010	55.59	133	121	0.91	69	133	39.15	121.00	0.03	1.22	27.03	2.8
15-Apr-2010	55.47	138	120	0.87	161	196	49.36	170.43	0.03	1.09	26.06	3.4
16-Apr-2010	55.50	109	109	1.00	78	155	37.6	155.00	0.07	1.19	22.99	3.8
17-Apr-2010	54.51	120	107	0.89	79	151	39.41	134.64	0.05	1.18	24.13	4.2
18-Apr-2010	59.35	81	64	0.79	79	151	39.67	119.31	0.07	1.09	28.54	5
19-Apr-2010	60.48	100	93	0.93	81	141	35.65	131.13	0.04	1.29	23.94	5.4
20-Apr-2010	59.67	147	129	0.88	80	150	35.46	131.63	0.04	1.12	20.24	5.2
21-Apr-2010	58.85	152	118	0.78	85	167	36.76	129.64	0.04	1.17	19.33	6.2
22-Apr-2010	57.65	176	156	0.89	94	179	40.52	158.66	0.02	1.28	23.61	5.8
23-Apr-2010	56.30	141	116	0.82	80	150	40.11	123.40	0.06	1	27.17	5
24-Apr-2010	56.30	164	165	1.01	103	152	39.33	152.93	0.06	0.97	25.94	4.2
25-Apr-2010	59.15	131	111	0.85	79	143	37.86	121.17	0.08	1.13	24.13	6.2
26-Apr-2010	72.31	120	105	0.88	220	192	40.94	168.00	0.48	1.32	22.65	5.4
27-Apr-2010	64.71	118	103	0.87	82	124	33.89	108.24	0.02	1.08	22.79	2.6
28-Apr-2010	61.82	65	59	0.91	83		34.99		0.03	0.98	21.91	4.6
29-Apr-2010	60.32	117	90	0.77	86	136	39.54	104.62	0.06	1.19	23.2	2.8
30-Apr-2010	59.94	152	142	0.93	111	156	39.21	145.74	0.03	0.94	23.2	3.2
1-May-2010	58.60	224	200	0.89	88	151	37.86	134.82	0.04	0.94	22.1	2.8
2-May-2010	57.94	113	122	1.08	86	162	37.1	174.90	0.03	0.95	23.47	3
3-May-2010	58.36	164	131	0.80	93	152	37.95	121.41	0.04	0.94	24.83	3
4-May-2010	58.70	137	145	1.06	98	154	38.64	162.99	0.04	1.18	24.29	2.6
5-May-2010	57.85	170	134	0.79	94	156	39.77	122.96	0.05	1.1	23.37	2.6
6-May-2010	57.73	196	173	0.88	97	147	39.21	129.75	0.03	1.26	22.82	2.8
7-May-2010	56.36	146	153	1.05	86	137	40.47	143.57	0.04	1.17	25.86	7.2
8-May-2010	55.37	118	107	0.91	87	116	38.51	105.19	0.06	1.01	24.44	3.8
9-May-2010	53.88	149	148	0.99	92	128	37.44	127.14	0.06	1.16	25.77	2.8
10-May-2010	55.70	128	120	0.94	97	134	37.8	125.63	0.03	1.46	24.73	3.6
11-May-2010	55.32	111	113	1.02	92	138	41.44	140.49	0.02	1.08	26.15	3.6
12-May-2010	55.12	132	130	0.98	94	136	43.36	133.94	0.06	1.32	26.65	3.4
13-May-2010	54.69	134	129	0.96	115	144	44.83	138.63	0.03	1.12	27.29	3.8
14-May-2010	53.37	162	149	0.92	101	146	43.67	134.28	0.02	1.26	27.44	6.2
15-May-2010	52.81	106	88	0.83	106	143	41.46	118.72		1.3	26.44	5.2
16-May-2010	53.06	85	76	0.89	100	127	38.23	113.55	0.02	1.32	25.84	4.8
17-May-2010	54.45	171	163	0.95	107	135	40.56	128.68	0.05	1.34	26.24	5
18-May-2010	54.26	168	155	0.92	85	144	39.13	132.86	0.07	1.41	26.87	6.2
19-May-2010	53.77	122	110	0.90	84	138	41.26	124.43	0.06	1.58	27.84	8.2
20-May-2010	53.18	162	172	1.06	91	147	40.3	156.07	0.04	1.48	26.46	6.6
21-May-2010	53.32	226	233	1.03	87	145	38.92	149.49	0.02	1.3	21.91	6.2
22-May-2010	51.66	139	170	1.22	90	134	42.08	163.88	0.01	1.29	25.14	5.2
23-May-2010	51.39	116	107	0.92	86	113	38.85	104.23	0.03	1.52	22.71	6
24-May-2010	52.36	201	204	1.01	86	122	39.98	123.82	0.03	1.21	27.05	7.2
25-May-2010	53.57	160	148	0.93	71	132	39.59	122.10		1.26	25.85	6.2
26-May-2010	53.19	110	101	0.92	90	151	40	138.65		1.03	26.67	9.8
27-May-2010	53.80	132	127	0.96	79	125	42.19	120.27	0.03	1.46	29.91	6.8
28-May-2010	52.61	109	97	0.89	59	104	39.56	92.55	0.05	1.34	25.99	7.8
29-May-2010	51.17	106	100	0.94	93	87	41.68	82.08	0.06	1.16	25.96	6.8
30-May-2010	49.97	118	116	0.98	135	137	42.86	134.68	0.06	1.29	25.06	7
31-May-2010	51.64	144	139	0.97	76	111	35.98	107.15	0.06	1.41	25.17	6.4
1-Jun-2010	53.22	152	157	1.03	67	130	34.83	134.28	0.06	1.3	24.94	7.4
2-Jun-2010	53.37	169	166	0.98	87	147	40.33	144.39	0.04	1.19	26.63	7.6
3-Jun-2010	54.28	161	159	0.99	76	122	38.64	120.48	0.03	1.51	28.72	7.6
4-Jun-2010	54.87	124	115	0.93	73	121	34.9	112.22	0.02	1.43	23.88	7.2
5-Jun-2010	53.12	110	103	0.94	80	128	40.67	119.85	0.02	1.41	25.8	6.6
6-Jun-2010	52.82	118	118	1.00	66	94	35.14	94.00	0.02	1.27	25.97	6.6
7-Jun-2010	53.87	139	139	1.00	85	110	38.49	110.00	0.04	1.08	26.13	7
8-Jun-2010	54.14	158	144	0.91	75	150	39.9	136.71	0.03	1.41	27.12	6.6
9-Jun-2010	53.20	162	146	0.90	92	135	43.29	121.67	0.01	1.1	28.06	7.2
10-Jun-2010	53.00	154	159	1.03	100	139	42.51	143.51	0.06	1.16	26.22	6.8
11-Jun-2010	52.69	151	151	1.00	83	137	41.82	137.00	0.05	1.48	25.74	6.2
12-Jun-2010	51.67	146	137	0.94	73	126	43.61	118.23	0.08	0.91	27.2	9.4

13-Jun-2010	51.10	154	127	0.82	85	113	42.16	93.19	0.07	1.05	28.78	5.4
14-Jun-2010	53.03	157	138	0.88	77	103	38.09	90.54				6.2
15-Jun-2010	53.50	135	118	0.87	77	131	40.72	114.50	0.04	1.15	24.57	6.2
16-Jun-2010	53.74	251	205	0.82	82	121	40.9	98.82	0.06	1.36	24.36	9.6
17-Jun-2010	54.08	119	112	0.94	67	116	39.14	109.18	0.04	1.36	23.69	12.8
18-Jun-2010	53.44	169	149	0.88	86	132	40.43	116.38	0.02	1.26	24.84	8.6
19-Jun-2010	51.61	120	94	0.78	66	93	39.55	72.85	0.03	1.26	26.78	6.4
20-Jun-2010	50.30	128	123	0.96	114	130	43.57	124.92	0.03	1.05	26.84	7.8
21-Jun-2010	58.10	140	120	0.86	107	110	38.91	94.29	0.32	1.56	24.78	9
22-Jun-2010	58.17	108	91	0.84	78	117	35.19	98.58	0.26	2.02	19.47	8
23-Jun-2010	56.61	133	126	0.95	93	135	39.58	127.89	0.07	1.32	25.13	7.4
24-Jun-2010	54.50	143	138	0.97	82	130	39.73	125.45	0.06	1.35	24.75	7
25-Jun-2010	54.74	140	123	0.88	87	131	39.07	115.09	0.06	1.49	24.82	6.8
26-Jun-2010	54.01	163	138	0.85	86	121	38.85	102.44	0.04	1.41	26.69	6.4
27-Jun-2010	53.77	119	92	0.77	75	92	39.35	71.13	0.07	1.64	27.54	7.4
28-Jun-2010	56.02	116	109	0.94	87	88	35.36	82.69	0.05	1.41	26.2	7.2
29-Jun-2010	55.90	102	87	0.85	78	112	36.26	95.53	0.05	1.93	25.16	6.6
30-Jun-2010	57.57	98	91	0.93	76	97	36.29	90.07	0.03	1.54	23.83	8
1-Jul-2010	61.93	144	116	0.81	114	108	37.28	87.00	0.22	1.77	21.07	6.8
2-Jul-2010	64.35	111	95	0.86	67	82	30.08	70.18	0.73	1.71	17.87	6.2
3-Jul-2010	62.09	141	104	0.74	171	131	40.57	96.62	0.03	1.18	20.82	7.8
4-Jul-2010	65.93	82	72	0.88	91	80	29.14	70.24	0.03	0.94	22.55	5.2
8-Jul-2010	70.31	62	59	0.95	65	73	26.14	69.47	0.03	1.71	18.67	7.2
9-Jul-2010	66.14	94	73	0.78	110	134	31.83	104.06		1.39	18.8	7.2
10-Jul-2010	62.55	130	106	0.82	76	89	30.24	72.57	0.05	1.48	19.35	6.4
11-Jul-2010	61.33	93	84	0.90	92	80	30.15	72.26		1.46	21.31	6.8
12-Jul-2010	61.72	118	106	0.90	79	96	29.23	86.24	0.05	1.41	18.8	6
13-Jul-2010	60.79	140	136	0.97	80	107	31.4	103.94	0.06	1.7	20.45	7.2
14-Jul-2010	61.23	111	93	0.84	91	112	33.51	93.84	0.03	1.81	20.91	7.6
15-Jul-2010	63.60	108	85	0.79	87	96	32.75	75.56	0.03	1.73	21.35	7
16-Jul-2010	64.47	120	99	0.83	62	85	31.48	70.13	0.03	1.29	18.35	8
17-Jul-2010	60.53	78	58	0.74	74	103	32.36	76.59	0.01	1.26	23.01	8
18-Jul-2010	59.39	149	122	0.82	68	78	30.95	63.87	0.02	1.59	23.58	6.8
19-Jul-2010	61.74	89	80	0.90	62	85	29.85	76.40	0.01	1.63	22.44	3.6
20-Jul-2010	60.40	148	124	0.84	63	86	30.84	72.05	0.04	1.61	20.56	8.8
21-Jul-2010	59.21	77	83	1.08	85	95	34.04	102.40	0.04	1.23	21.79	7.4
22-Jul-2010	58.35	84	91	1.08	106	102	39.81	110.50	0.16	1.72	25.83	9.8
23-Jul-2010	59.07	141	124	0.88	56	118	34.18	103.77	0.06	1.17	21.14	6.4
24-Jul-2010	58.58	114	103	0.90	88	102	35.49	92.16	0.06	1.34	21.07	6.2
25-Jul-2010	57.88	76	71	0.93	65	62	31.48	57.92	0.06	1.48	23.49	8.2
26-Jul-2010	58.87	136	138	1.01	72	82	31.12	83.21	0.03	1.51	23.86	6.6
27-Jul-2010	58.75	104	102	0.98	83	86	33.03	84.35	0.04	1.58	23.43	7
28-Jul-2010	59.87	104	104	1.00	94	107	34.85	107.00	0.04	1.37	23.58	7
29-Jul-2010	60.33	100	99	0.99	85	81	32.4	80.19	0.04	1.52	23.49	8.2
30-Jul-2010	58.14	164	133	0.81	82	84	31.58	68.12	0.04	1.04	23.53	7.4
31-Jul-2010	56.26	102	90	0.88	108	106	34.85	93.53	0.04	1.03	24.16	6.4
1-Aug-2010	55.25	140	125	0.89	91	98	33.3	87.50	0.04	1.26	25.4	6
2-Aug-2010	59.29	101	86	0.85	93	88	31.42	74.93	0.04	1.33	24.75	6.2
3-Aug-2010	59.97	95	81	0.85	84	102	31.1	86.97	0.04	1.47	21.94	6.8
4-Aug-2010	61.24	103	79	0.77	83	94	30.36	72.10	0.06	1.5	21.75	6.2
5-Aug-2010	62.18	159	126	0.79	89	102	28.39	80.83	0.03	1.36	21.13	7.2
6-Aug-2010	59.79	111	83	0.75	96	105	31	78.51	0.03	1.44	25.24	5.4
7-Aug-2010	58.20	134	127	0.95	95	104	31.99	98.57	0.03	1.4	24.98	6.2
8-Aug-2010	48.86	120	96	0.80	124	96	29.65	76.80	0.03	0.93	24.45	7.4
9-Aug-2010	61.10	109	86	0.79	85	82	26.89	64.70	0.03	1.03	20.16	6.8
10-Aug-2010	61.99	104	95	0.91	91	104	30.87	95.00	0.04	0.98	21.41	7
11-Aug-2010	64.27	110	79	0.72	81	109	29.13	78.28	0.01	1.52	21.87	7.6
12-Aug-2010	64.34	84	74	0.88	98	111	27.87	97.79	0.04	1.37	18.03	7
13-Aug-2010	62.00	153	121	0.79	118	114	31.34	90.16	0.04	1.3	21.04	6.4
14-Aug-2010	59.12	146	130	0.89	92	90	30.64	80.14	0.06	1.22	23.18	4.6
15-Aug-2010	57.89				98	92	31.66		0.03	1.02	24.07	6.6
16-Aug-2010	58.89	105	82	0.78	71	84	29.51	65.60	0.06	1	23.56	6.8
17-Aug-2010	59.02	84	66	0.79	89	94	30.53	73.86	0.04	1.37	25.34	7.4
18-Aug-2010	60.12	103	89	0.86	98	105	32.09	90.73	0.05	1.38	23.53	6.8
19-Aug-2010	58.78	104	91	0.88	107	96	32.46	84.00	0.06	1.31	24.74	5.4
20-Aug-2010	57.39	118	91	0.77	81	100	30.83	77.12	0.07	1.16	20.56	4.2
21-Aug-2010	56.89	134	110	0.82	68	100	34.24	82.09	0.08	0.95	24.58	5
22-Aug-2010	60.62	74	64	0.86	95	107	29.28	92.54	0.07	1.25	23.9	5.8
29-Aug-2010	73.92	66	56	0.85	124	92	27.06	78.06	0.03	1.45	18.68	7
30-Aug-2010	73.11	87	62	0.71	123	98	27.41	69.84	0.04	1.48	19.36	9
31-Aug-2010	69.16	140	103	0.74	138	113	28.65	83.14	0.04	1.5	18.49	6.2
1-Sep-2010	68.03	98	87	0.89	160	122	30.72	108.31	0.04	1.69	19.89	8
2-Sep-2010	66.05	114	113	0.99	79	121	26.8	119.94	0.05	1.62	19.09	6.8
3-Sep-2010	63.45	116	104	0.90	84	98	28.45	87.86	0.06	1.41	19.29	8.2
4-Sep-2010	60.81	65	66	1.02	81	77	27.69	78.18	0.04	1.19	21.12	7.2
5-Sep-2010	59.56	59	51	0.86	84	69	27.26	59.64	0.06	1.5	22.83	6.4
6-Sep-2010	60.81	74	35	0.47	82	65	27.21	30.74	0.06	1.41	23.68	7.8
7-Sep-2010	61.98	47	39	0.83	95	77	28.67	63.89	0.04	1.33	20.37	8.4
8-Sep-2010	66.59	68	67	0.99	89	100	29.05	98.53	0.35	1.99	20.37	8.2
9-Sep-2010	69.68	61	49	0.80	91	77	26	61.85	0.32	1.85	16.24	7.4
10-Sep-2010	65.73	82	76	0.93	87	107	28.37	99.17	0.06	1.4	18.46	7.4
11-Sep-2010	64.29	87	69	0.79	89	96	29.12	76.14	0.06	1.43	21.35	6.8
12-Sep-2010	71.75	44	37	0.84	90	75	24.16	63.07	0.06	1.39	20.55	10.2

13-Sep-2010	70.98	96	84	0.88	76	72	22.97	63.00	0.04	1.47	15.63	7
14-Sep-2010	67.86	183	143	0.78	68	89	25.53	69.55	0.05	1.29	16.35	6
15-Sep-2010	65.73	60	58	0.97	74	94	28	90.87	0.03	1.41	20.4	6.6
16-Sep-2010	64.16	101	67	0.66	88	101	31.9	67.00	0.02	1.67	27.2	5.8
17-Sep-2010	62.02	84	71	0.85	77	116	29.56	98.05	0.03	1.45	23.17	6.8
18-Sep-2010	59.71	236	207	0.88	86	83	28.3	72.80	0.03	1.31	23.03	7.8
19-Sep-2010	59.38	83	66	0.80	78	77	28.21	61.23	0.03	1.26	25.73	5.2
20-Sep-2010	57.81	116	101	0.87	78	94	30.09	81.84	0.04	1.26	24.71	6
21-Sep-2010	59.37	99	92	0.93	80	109	30.14	101.29	0.04	1.37	21.92	7
22-Sep-2010	58.84	95	94	0.99	73	124	31.33	122.69	0.06	1.29	21.38	6
23-Sep-2010	58.38	113	86	0.76	72	100	31.41	76.11	0.03	1.51	23.61	6.2
24-Sep-2010	57.26	180	162	0.90	81	93	31.37	83.70	0.04	1.24	23.96	5.4
25-Sep-2010	56.17	88	78	0.89	156	102	37.18	90.41	0.06	1.24	24.82	5.6
26-Sep-2010	57.02	188	186	0.99	172	140	38.87	138.51	0.06	1.35	24.69	8.2
27-Sep-2010	55.70	135	127	0.94	125	147	33.59	138.29	0.03	1.52	24.77	5
28-Sep-2010	56.98	123	106	0.86	82	116	30.84	99.97	0.03	1.39	23.25	5.4
29-Sep-2010	56.77	112	126	1.13	79	106	32.6	119.25	0.06	1.55	24.11	6
30-Sep-2010	57.33	122	122	1.00	74	114	31.34	114.00	0.06	1.11	17.9	6.2
1-Oct-2010	55.77	143	116	0.81	81	122	30.5	98.97	0.04	1.29	27.33	6
2-Oct-2010	54.05	112	93	0.83	81	113	30.78	93.83	0.04	1.29	26.96	5.9
3-Oct-2010	54.03	129	116	0.90	109	108	32.52	97.12	0.04	1.22	29.88	5.8
4-Oct-2010	54.50	135	130	0.96	89	133	34.62	128.07	0.07	1.26	28.72	5.8
5-Oct-2010	54.52	133	140	1.05	74	145	36.97	152.63	0.06	1.58	28.49	6.8
6-Oct-2010	52.93	113	120	1.06	76	139	38.98	147.61	0.04	1.3	29.14	6.2
7-Oct-2010	54.13	155	152	0.98	99	146	39.55	143.17	0.04	1.66	29.33	6.6
8-Oct-2010	53.63	100	91	0.91	78	124	39.22	112.84		1.44	29	7.2
9-Oct-2010	52.66	135	125	0.93	76	133	39.13	123.15		1.25	29.64	7.6
10-Oct-2010	52.66	88	82	0.93	188	163	50.58	151.89		1.28	26.85	12
11-Oct-2010	54.21	249	193	0.78	78	116	37.48	89.91	0.05	1.23	23.68	6.6
12-Oct-2010	53.49	156	166	1.06	136	169	40.9	179.83	0.05	1.29	26.16	6.6
13-Oct-2010	53.66	106	103	0.97	104	135	40.13	131.18	0.04	1.3	26.58	6.8
14-Oct-2010	53.78	141	140	0.99	83	113	40.62	112.20	0.03	1.32	27.54	6.4
15-Oct-2010	52.85	156	155	0.99	94	138	44.35	137.12	0.02	1.36	28.8	7
16-Oct-2010	51.69	199	186	0.93	44	92	38.79	85.99	0.01	1.22	30.87	6.6
17-Oct-2010	52.28	130	111	0.85	76	123	38.61	105.02	0.02	1.43	31.75	6.2
18-Oct-2010	52.91	141	130	0.92	38	94	38.23	86.67		1.23	29.68	6.2
19-Oct-2010	52.99	200	188	0.94	83	89	40.33	83.66	0.06	1.36	26.36	9.8
20-Oct-2010	52.99	129	133	1.03	85	145	38.99	149.50	0.04	1.19	27.27	8.4
21-Oct-2010	53.22	214	198	0.93	88	143	40.32	132.31	0.04	1.42	27.98	8.4
22-Oct-2010	52.12	121	109	0.90	75	107	39.35	96.39	0.03	1.39	29.48	10.8
23-Oct-2010	51.48	92	88	0.96	108	146	43.48	139.65	0.03	1.27	30.76	8
24-Oct-2010	51.91	133	134	1.01	81	108	39.4	108.81	0.03	1.26	30.79	8.2
25-Oct-2010	52.70	158	146	0.92	110	129	40.14	119.20	0.05	1.22	29.33	8.8
26-Oct-2010	52.91	184	171	0.93	83	140	40.48	130.11	0.05	1.41	27	8.6
27-Oct-2010	52.63	122	133	1.09	84	156	40.15	170.07	0.06	1.19	28.95	8.6
28-Oct-2010	53.29	138	131	0.95	102	145	40.33	137.64	0.04	1.22	27.89	9.8
29-Oct-2010	51.56	154	136	0.88	53	124	38.69	109.51	0.04	1.16	25.42	7.2
30-Oct-2010	50.27	155	148	0.95	80	88	39.67	84.03	0.03	1.23	27.71	8.2
31-Oct-2010	49.90	136	115	0.85	119	119	43.18	100.63	0.03	1.1	30.03	7.6
1-Nov-2010	51.68	112	102	0.91	331	200	61.11	182.14	0.05	1.05	29.17	7
2-Nov-2010	52.11	224	228	1.02	508	268	78.17	272.79	0.05	1.29	29.25	7
3-Nov-2010	52.73	147	140	0.95	540	283	79	269.52	0.04	1.31	27.46	7.4
4-Nov-2010	56.88	114	90	0.79	260	172	54.35	135.79	0.05	1.23	27.66	6.4
5-Nov-2010	53.62	113	107	0.95	131	154	40.47	145.82	0.06	1.24	28.06	8.4
6-Nov-2010	50.46	164	158	0.96	96	78	39.91	75.15	0.04	1.24	25.43	6.2
7-Nov-2010	50.92	156	142	0.91	110	118	41.74	107.41	0.03	1.17	28.12	7.6
8-Nov-2010	51.56	116	106	0.91	128	123	44.27	112.40	0.04	1.51	27.42	7.4
9-Nov-2010	51.65	122	117	0.96	76	124	39.7	118.92	0.11	1.26	26.86	7.4
10-Nov-2010	51.86	190	178	0.94	106	128	41.49	119.92	0.04	1.48	28.21	7.8
11-Nov-2010	52.27	149	128	0.86	62	116	38.49	99.65	0.04	1.38	27.08	8
12-Nov-2010	51.50	175	159	0.91	131	150	41.6	136.29	0.06	1.1	26.34	7.6
13-Nov-2010	50.44	238	222	0.93	69	162	39.16	151.11	0.06	1.24	27.39	7.4
14-Nov-2010	51.00	163	152	0.93	46	96	36.73	89.52	0.04	1.43	29.52	8.6
15-Nov-2010	50.01	148	130	0.88	296	139	44.78	122.09	0.03	1.16	27.9	7.6
16-Nov-2010	53.23	139	128	0.92	105	145	39.38	133.53	0.04	0.98	27.15	8.2
17-Nov-2010	53.52	94	88	0.94	73	100	36.54	93.62	0.01	1.24	25.92	7.8
18-Nov-2010	52.84	120	104	0.87	175	164	49.05	142.13	0.06	0.84	28.03	7.4
19-Nov-2010	51.72	137	121	0.88	79	162	45.92	143.08	0.06	0.75	31.62	7.4
20-Nov-2010	50.95	136	115	0.85	122	110	40.44	93.01	0.08	1.13	30.88	7.1
21-Nov-2010	50.62	255	228	0.89	117	139	44	124.28	0.06	1	29.09	9.6
22-Nov-2010	51.89	109	98	0.90	85	130	40.05	116.88	0.04	1.19	28.75	7.8
23-Nov-2010	51.93	131	119	0.91	86	136	40.04	123.54	0.03	1.11	28.94	8.4
24-Nov-2010	52.15	188	179	0.95	105	141	41.04	134.25	0.03	1.11	26.32	6.4
25-Nov-2010	48.25	106	96	0.91	72	123	37.59	111.40	0.03	1.14	24.57	7.2
26-Nov-2010	47.05	168	150	0.89	77	120	36.38	107.14	0.01	1.01	25.64	8
27-Nov-2010	48.16	97	98	1.01	39	83	37.43	83.86	0.01	0.93	27.07	6.4
28-Nov-2010	49.14	219	215	0.98	182	202	53.83	198.31	0.02	1.01	28.53	8
29-Nov-2010	51.43	121	92	0.76	43	69	35.92	52.46	0.04	0.94	28.77	7.8
30-Nov-2010	51.50	95	86	0.91	36	99	35.37	89.62	0.05	0.96	27.55	8.2
1-Dec-2010	51.76	83	84	1.01	123	166	43.48	168.00	0.03	1.02	28.09	6.6
2-Dec-2010	51.32	130	131	1.01	42	80	37.98	80.62	0.04	1.03	29.33	7
3-Dec-2010	50.03	242	170	0.70	76	124	41.83	87.11	0.04	0.92	28.47	5.6
4-Dec-2010	49.77	194	190	0.98	37	69	41.43	67.58	0.04	1.27	30.66	6.6

5-Dec-2010	50.74	174	207	1.19	58	84	41.37	99.93	0.05	1.13	34.32	7.6
6-Dec-2010	50.53	128	116	0.91	43	93	38.52	84.28	0.02	1.04	31.14	6.4
7-Dec-2010	50.27	142	128	0.90	41	95	39.6	85.63	0.06	1.12	29.95	5.2
8-Dec-2010	50.57	120	114	0.95	133	180	49.47	171.00	0.06	1.04	31.72	5.6
9-Dec-2010	49.94	153	138	0.90	84	147	42.72	132.59	0.01	1.07	29.19	7
10-Dec-2010	49.28	173	155	0.90	102	158	45.62	141.56	0.07	1.26	28.19	6.2
11-Dec-2010	49.42	248	239	0.96	37	99	37.52	95.41	0.06	0.98	28.93	7
12-Dec-2010	50.81	119	100	0.84	101	152	43.66	127.73	0.06	1.1	30.14	6
13-Dec-2010	49.88	113	103	0.91	44	86	41.32	78.39	0.05	0.96	34.72	4.8
14-Dec-2010	49.51	148	136	0.92	37	116	43.52	106.59	0.05	1.34	33.61	5.2
15-Dec-2010	50.02	138	133	0.96	39	104	42.4	100.23	0.05	1.57	31.7	7.2
16-Dec-2010	49.73	267	256	0.96	38	102	36.41	97.80	0.05	1.76	30.43	7.6
17-Dec-2010	46.55	170	145	0.85	25	100	40.19	85.29	0.06	1.41	28.14	7.6
18-Dec-2010	48.93	147	134	0.91	152	182	52.67	165.90	0.05	0.84	30.23	6.8
19-Dec-2010	48.52	100	91	0.91	27	89	37.57	80.99	0.05	1.23	30.73	6
20-Dec-2010	49.58	140	171	1.22	87	144	42.94	175.89	0.06	1.41	29.7	7.2
21-Dec-2010	49.66	222	190	0.86	29	99	36.77	84.73	0.05	1.16	28.21	6
22-Dec-2010	49.56	297	258	0.87	42	102	39.33	88.61	0.07	0.83	28.43	6.4
23-Dec-2010	49.10	202	198	0.98	59	114	41.94	111.74		1.05	27.8	6.6
24-Dec-2010	47.52	153	136	0.89	220	206	51.78	183.11		0.98	27.63	10
25-Dec-2010	43.42	168	141	0.84	48	86	32.85	72.18	0.03	0.84	23.95	6.8
26-Dec-2010	45.41	122	119	0.98	56	105	38.87	102.42	0.03	1.17	28.21	6.8
27-Dec-2010	47.64	192	195	1.02	80	125	45.02	126.95	0.03	1.09	31.68	6.4
28-Dec-2010	48.66	166	155	0.93	47	118	42.57	110.18		0.84	31.95	6.6
29-Dec-2010	49.10	158	153	0.97	74	130	43.15	125.89	0.09	0.89	28.97	7.6
30-Dec-2010	49.64	200	188	0.94	59	121	42.3	113.74	0.04	0.81	27.81	7.4
31-Dec-2010	50.82	160	149	0.93	39	93	39.63	86.61	0.06	0.94	27.57	7.6
1-Jan-2011	46.88	160	141	0.88	116	134	46.8	118.09	0.03	0.95	28.34	6.8
2-Jan-2011	48.06	177	178	1.01	73	112	46.98	112.63	0.04	0.94	32.03	8
3-Jan-2011	49.76	222	207	0.93	32	88	40.62	82.05	0.04	0.87	32.89	6.4
4-Jan-2011	49.83	193	188	0.97	322	297	59.8	289.31	0.06	0.85	29.59	7
5-Jan-2011	50.38	190	180	0.95	106	175	45.82	165.79	0.05	0.9	31.04	6.6
6-Jan-2011	53.10	174	166	0.95	90	138	40.83	131.66	0.06	1.3	27.62	9.6
7-Jan-2011	51.19	197	159	0.81	76	131	41.92	105.73	0.07	1.02	27.09	7.4
8-Jan-2011	49.74	206	201	0.98	153	171	50.54	166.85	0.06	1.41	28.4	7
9-Jan-2011	49.69	144	126	0.88	79	120	36.99	105.00	0.07	1.42	29.67	6
10-Jan-2011	50.72	157	140	0.89	81	168	37.36	149.81	0.06	0.84	27.26	5.6
11-Jan-2011	50.58	129	126	0.98	81	134	40.19	130.88	0.06	1.62	27.92	6
12-Jan-2011	50.36	169	155	0.92	78	140	41.96	128.40	0.06	1.43	28.86	6.6
13-Jan-2011	49.48	119	113	0.95	89	122	46.15	115.85	0.05	1.41	33.35	8.2
14-Jan-2011	49.49	173	166	0.96	43	123	44.33	118.02	0.03	1.26	33.12	7.4
15-Jan-2011	48.58	181	191	1.06	150	174	48.68	183.61	0.03	1.44	32.94	7.4
16-Jan-2011	48.03	122	110	0.90	71	128	42.97	115.41	0.06	1.26	30.17	7.6
17-Jan-2011	57.54	335	273	0.81	120	157	40.53	127.94	0.22	1.59	29.32	10.4
18-Jan-2011	53.88	166	149	0.90	88	156	37.86	140.02	0.07	1.26	24.07	7
19-Jan-2011	53.90	204	191	0.94	49	124	36.19	116.10	0.06	1.33	25.71	6
20-Jan-2011	52.77	177	166	0.94	94	141	38.56	132.24	0.06	1.02	24.02	4.6
21-Jan-2011	58.82	161	148	0.92	121	147	41.41	135.13	0.06	1.86	27.89	9
22-Jan-2011	54.99	184	173	0.94	56	124	40.38	116.59	0.04	1.17	28.91	5.8
23-Jan-2011	53.54	119	117	0.98	44	80	39.07	78.66	0.06	1.12	29.79	6
24-Jan-2011	53.72	179	174	0.97	168	203	45.34	197.33	0.04	1.19	28.04	6.4
25-Jan-2011	59.52	202	208	1.03	103	214	44.27	220.36	0.08	1.51	27.36	8
26-Jan-2011	60.74	138	118	0.86	94	148	34.2	126.55	0.07	1.49	25.31	9.2
27-Jan-2011	58.87	139	135	0.97	103	163	39.82	158.31	0.02	1.29	28.09	5.8
28-Jan-2011	56.80	135	124	0.92	94	160	38.58	146.96		1.38	25.71	6.6
29-Jan-2011	55.73	128	122	0.95	53	144	37.45	137.25	0.04	1.12	28.06	2.8
30-Jan-2011	55.56	135	124	0.92	88	161	39.38	147.88	0.04	1.15	29.06	5.2
31-Jan-2011	55.07	170	158	0.93	118	195	44.2	181.24		1.18	28.02	6.2
1-Feb-2011	54.79	167	162	0.97	116	164	42.14	159.09	0.03	1.19	28.69	7.6
2-Feb-2011	55.75	182	179	0.98	78	169	35.82	166.21	0.02	1.19	24.31	6.8
3-Feb-2011	55.32	246	236	0.96	126	216	47.34	207.22	0.04	1.33	26.87	8
4-Feb-2011	53.62	145	150	1.03	93	203	37.1	210.00	0.04	1.19	28.06	6.8
5-Feb-2011	53.37	161	176	1.09	112	176	48.95	192.40	0.04	1.19	28.38	6.8
6-Feb-2011	53.02	166	157	0.95	87	156	41.08	147.54	0.04	1.39	32.78	7.8
7-Feb-2011	55.61	113	107	0.95	107	179	41.58	169.50	0.04	1.29	27.27	9.6
8-Feb-2011	55.29	143	133	0.93	92	190	44.9	176.71	0.07	1.02	24.15	5.6
9-Feb-2011	54.77	155	153	0.99	37	120	46.09	118.45	0.03	1.3	31.46	6
10-Feb-2011	54.48	146	153	1.05	45	138	40.6	144.62	0.06	1.36	27.77	5.6
11-Feb-2011	53.86	209	206	0.99	67	156	44.11	153.76	0.03	1.37	28.94	5.6
12-Feb-2011	52.68	252	249	0.99	51	161	42	159.08	0.03	1.4	30	5.8
13-Feb-2011	52.64	170	156	0.92	71	166	41.16	152.33	0.03	1.31	29	4.4
14-Feb-2011	53.28	190	173	0.91	71	193	43.17	175.73	0.06	1.27	27.43	5
15-Feb-2011	53.07	161	158	0.98	78	171	42.42	167.81	0.06	0.94	27.27	4.6
16-Feb-2011	53.01	135	127	0.94	30	102	41.08	95.96	0.07	1.23	28.82	5.8
17-Feb-2011	53.34	168	155	0.92	24	107	41.09	98.72	0.04	1.17	28.26	5.6
18-Feb-2011	53.50	193	170	0.88	46	139	41.72	122.44	0.03	1.22	29.23	4.2
19-Feb-2011	52.60	134	137	1.02	35	104	39.33	106.33	0.03	1.09	28.14	4.6
20-Feb-2011	52.09	132	115	0.87	73	150	41.58	130.68	0.03	1.05	28.4	7.8
21-Feb-2011	53.56	263	266	1.01	49	150	41.43	151.71	0.03	0.93	28.61	4.2
22-Feb-2011	53.36	314	270	0.86	48	166	42.75	142.74	0.04	1.03	28.8	4.2
23-Feb-2011	53.18	159	162	1.02	54	154	42.7	156.91	0.05	1.19	30.74	4.2
24-Feb-2011	53.21	177	163	0.92	70	157	42.38	144.58	0.05	1.03	27.82	5.8
25-Feb-2011	52.65	178	153	0.86	49	123	40.88	105.72	0.04	1.12	27.88	4

26-Feb-2011	51.73	156	136	0.87	142	204	48.42	177.85	0.03	1.08	29.01	3.6
27-Feb-2011	51.93	140	112	0.80	78	115	41.16	92.00	0.03	0.98	29.12	3.8
28-Feb-2011	52.38	226	183	0.81	43	105	37.24	85.02	0.06	1.04	27.59	4.4
1-Mar-2011	53.61	196	155	0.79	94	176	42.98	139.18	0.03	1.11	27.11	4
2-Mar-2011	53.28	128	124	0.97	42	121	40.81	117.22	0.05	1.05	28.29	3.8
3-Mar-2011	53.11	214	191	0.89	54	154	44.43	137.45	0.06	1.12	29.07	4.2
4-Mar-2011	52.74	211	192	0.91	49	112	43.62	101.91	0.04	1.22	32.46	3.8
5-Mar-2011	51.75	213	187	0.88	37	100	38.07	87.79	0.03	1.15	31.03	4
6-Mar-2011	52.19	151	147	0.97	41	99	37.65	96.38	0.04	1.38	29.59	2.4
7-Mar-2011	53.22	169	148	0.88	70	138	40.45	120.85	0.05	1.26	26.36	4.2
8-Mar-2011	52.52	157	140	0.89	97	176	43.69	156.94	0.04	1.19	28.18	4
9-Mar-2011	53.12	166	180	1.08	46	110	37.72	119.28	0.06	1.16	27.76	5.2
10-Mar-2011	57.55	133	131	0.98	45	110	35.82	108.35	0.06	1.05	25.95	4.8
11-Mar-2011	54.92	172	137	0.80	50	98	36.94	78.06	0.06	1.26	25.26	4.8
12-Mar-2011	52.65	120	114	0.95	68	114	40.45	108.30	0.06	0.98	26.11	5
13-Mar-2011	53.16	98	88	0.90	130	167	46.07	149.96	0.04	1.03	31.6	5
14-Mar-2011	53.88	137	115	0.84	115	180	40.39	151.09	0.06	1.12	27.25	5.4
15-Mar-2011	52.22	127	123	0.97	143	136	43.97	131.72	0.06	1.12	26.65	6.2
16-Mar-2011	52.14	136	117	0.86	77	178	41.16	153.13	0.05	1.09	28.78	6.8
17-Mar-2011	52.15	101	100	0.99	61	132	39.28	130.69	0.04	1.22	29.16	7.2
18-Mar-2011	53.56	110	97	0.88	110	174	42.88	153.44	0.04	1.01	29.53	6
19-Mar-2011	51.59	132	134	1.02	99	189	42.3	191.86	0.03	1.55	27.66	5.8
20-Mar-2011	51.50	112	97	0.87	44	82	37.94	71.02	0.03	1.33	30.02	7.4
21-Mar-2011	52.96	164	162	0.99	33	80	36.11	79.02	0.06	0.96	28.03	7.2
22-Mar-2011	53.08	220	206	0.94	55	132	38.07	123.60	0.06	1.19	25.7	7.2
23-Mar-2011	53.62	171	162	0.95	46	112	37.46	106.11	0.06	1.03	25.3	7
24-Mar-2011	54.12	150	137	0.91	85	184	40.98	168.05	0.06	1.07	26.15	7.8
25-Mar-2011	52.69	116	101	0.87	76	157	39.67	136.70	0.08	0.93	25.72	7.2
26-Mar-2011	51.29	162	148	0.91	91	200	40.72	182.72	0.06	1.37	25.57	8.6
27-Mar-2011	51.63	116	106	0.91	77	132	39.59	120.62	0.05	1.14	28.31	7.8
28-Mar-2011	63.63	134	124	0.93	107	161	38.63	148.99	0.06	1.16	28.88	8.4
29-Mar-2011	62.74	120	118	0.98	91	135	35.4	132.75	0.07	1.37	21.08	11.2
30-Mar-2011	61.05	126	121	0.96	110	162	40.45	155.57	0.05	1.55	27.04	8
2-Apr-2011	70.54	72	57	0.79	59	60	22.9	47.50	0.06	1.23	18.63	6.4
3-Apr-2011	66.87	109	93	0.85	84	116	29.69	98.97	0.06	1.5	21.52	8
4-Apr-2011	65.56	90	72	0.80	68	140	32.41	112.00	0.05	1.43	24.59	7.4
5-Apr-2011	70.56	153	134	0.88	88	155	32.1	135.75	0.06	1.31	24.55	7.4
6-Apr-2011	67.91	96	100	1.04	33	84	28.48	87.50	0.06	1.49	20.86	8.2
7-Apr-2011	65.96	138	108	0.78	50	120	32.2	93.91	0.08	1.33	22.38	6.4
8-Apr-2011	63.74	92	80	0.87	47	112	34.31	97.39	0.04	1.34	23.35	5
9-Apr-2011	61.17	171	154	0.90	79	141	38.24	126.98	0.04	1.26	27.59	6.4
10-Apr-2011	59.86	111	92	0.83	113	178	37.05	147.53	0.04	1.32	25.86	5.6
11-Apr-2011	59.94	161	135	0.84	70	128	33.25	107.33	0.08	1.09	23.95	6.6
12-Apr-2011	59.75	148	137	0.93	71	137	35.31	126.82	0.06	1.4	24.72	7
13-Apr-2011	58.92	175	164	0.94	88	139	39.66	130.26	0.06	1.19	27.38	6.6
14-Apr-2011	58.39	128	136	1.06	122	174	46.35	184.88	0.06	1.5	26.19	6.6
15-Apr-2011	57.65	159	123	0.77	81	163	39.62	126.09	0.03	1.09	28.72	8
16-Apr-2011	56.29	161	141	0.88	108	107	46.26	93.71	0.31	1.67	40.6	7.6
17-Apr-2011	55.59	158	142	0.90	74	128	36.24	115.04	0.03	1.44	25.08	7.8
18-Apr-2011	56.37	124	113	0.91	97	150	38.24	136.69	0.06	1.57	26.17	6.8
19-Apr-2011	56.13	301	334	1.11	99	167	38.14	185.31	0.1	1.26	24.54	7
20-Apr-2011	55.71	155	132	0.85	109	168	39.47	143.07	0.06	1.37	25.55	6.2
21-Apr-2011	54.78	174	173	0.99	73	159	40.26	158.09	0.06	1.4	26.49	5.6
22-Apr-2011	54.20	177	158	0.89	50	125	36.8	111.58	0.06	1.12	27.27	5.6
23-Apr-2011	52.04	152	178	1.17	69	142	38.85	166.29	0.07	1.14	23.43	5.2
24-Apr-2011	51.05	136	115	0.85	72	147	36.52	124.30	0.06	1.13	24.63	5.8
25-Apr-2011	56.58	181	159	0.88	61	145	36.03	127.38	0.04	1.33	26.2	5.4
26-Apr-2011	56.88	224	212	0.95	133	156	39.41	147.64	0.05	1.46	23.18	6.2
27-Apr-2011	57.03	240	237	0.99	100	140	37.79	138.25	0.06	1.52	24.19	6.2
28-Apr-2011	56.32	155	136	0.88	79	132	36.17	115.82	0.05	1.23	20.88	9.4
29-Apr-2011	54.79	172	162	0.94	57	113	36.75	106.43		1.26	22.61	7.4
30-Apr-2011	53.55	158	146	0.92	70	129	38.28	119.20		1.12	23.79	6.2
1-May-2011	53.72	131	120	0.92	88	150	38.91	137.40		1.33	25.1	6.6
2-May-2011	54.31	180	154	0.86	37	79	39.38	67.59	0.07	1.11	26.75	7.4
3-May-2011	54.18	244	239	0.98	71	129	40.71	126.36	0.05	1.24	26	6.4
4-May-2011	54.81	146	181	1.24	51	131	38.63	162.40	0.06	1.55	24.44	6.4
5-May-2011	54.23	171	158	0.92	60	161	38.59	148.76	0.06	1.37	21.89	6
6-May-2011	54.09	201	156	0.78	115	189	42.8	146.69	0.05	0.91	27.34	5.4
7-May-2011	52.17	142	131	0.92	90	143	42.9	131.92	0.05	0.98	27.78	5
8-May-2011	51.07	142	114	0.80	111	150	36.65	120.42	0.05	1.12	27.07	5.6
9-May-2011	53.36	182	158	0.87	80	164	36.45	142.37	0.05	1.23	27.04	5.2
10-May-2011	53.29	220	220	1.00	228	227	48.25	227.00	0.06	1.29	25.59	5.6
11-May-2011	53.30	137	151	1.10	367	269	62.5	296.49	0.04	1.05	24.47	5.6
12-May-2011	52.78	196	165	0.84	276	230	56.56	193.62	0.06	1.32	28.52	6.6
13-May-2011	52.76	168	155	0.92	263	179	60.12	165.15	0.06	1.23	26.89	5.2
14-May-2011	51.98	148	136	0.92	312	267	64.4	245.35	0.06	1.33	28.59	6
15-May-2011	53.62	140	114	0.81	303	224	56.82	182.40	0.05	1.41	26.5	5.8
16-May-2011	53.31	234	182	0.78	416	228	66.02	177.33	0.03	1.26	24.03	6.2
17-May-2011	52.71	225	215	0.96	392	277	63.46	264.69	0.07	1.11	26	6.6
18-May-2011	52.65	130	130	1.00	342	230	63.6	230.00		1.09	27.22	6.8
19-May-2011	52.65	171	159	0.93	194	229	63.74	212.93		0.95	29.98	7.4
20-May-2011	51.77	247	239	0.97	364	260	64.12	251.58		1.23	27.91	6.8
21-May-2011	50.45	201	163	0.81	304	235	59.7	190.57		0.9	26.42	6.8

22-May-2011	50.46	194	166	0.86	69	112	32.66	95.84	0.28	1.16	25.69	7.4
23-May-2011	51.64	158	199	1.26	130	146	43.26	183.89		1.37	26.56	7.6
24-May-2011	51.53	223	278	1.25	45	97	33.74	120.92	0.03	1.2	27	8
25-May-2011	52.12	159	242	1.52	98	146	41.52	222.21	0.03	1.12	25.38	8
26-May-2011	52.05	136	128	0.94	118	161	46.02	151.53	0.05	1.17	27.84	11.4
27-May-2011	51.83	229	231	1.01	81	142	42.24	143.24	0.04	1.33	29.64	6.8
28-May-2011	48.88	116	106	0.91	76	113	39.39	103.26	0.07	1.12	30.34	8.8
29-May-2011	47.56	103	98	0.95	120	126	35.75	119.88	0.06	1.05	27.04	8.2
30-May-2011	49.21	75	63	0.84	85	131	33.65	110.04	0.05	1.32	23.47	8.2
31-May-2011	51.85	115	90	0.78	95	136	40.14	106.43	0.04	1.19	26.86	8.4
1-Jun-2011	54.26	128	144	1.13	77	135	39.7	151.88	0.06	1.1	31.3	8.6
2-Jun-2011	52.78	144	133	0.92	55	119	40.18	109.91	0.04	1.44	32	7.4
3-Jun-2011	51.64	162	148	0.91	65	112	39.66	102.32	0.06	1.21	29.35	7.8
4-Jun-2011	50.23	149	133	0.89	81	130	41.34	116.04	0.06	1.02	27.11	7.4
5-Jun-2011	50.59	138	111	0.80	30	86	35.88	69.17	0.05	1.26	25.87	7.4
6-Jun-2011	51.72	133	120	0.90	106	112	39.7	101.05	0.05	1.4	25.44	7.4
7-Jun-2011	51.95	110	99	0.90	105	150	42.36	135.00	0.04	1.68	28.12	7.8
8-Jun-2011	52.32	209	157	0.75	48	131	44.63	98.41	0.06	1.24	29.57	8
9-Jun-2011	52.65	278	295	1.06	34	100	39.48	106.12	0.03	1.33	28.78	7.4
10-Jun-2011	52.53	333	256	0.77	67	144	40.18	110.70	0.06	1.72	30.72	8.8
11-Jun-2011	51.12	157	124	0.79	75	147	40.32	116.10	0.06	1.14	27.28	8.2
12-Jun-2011	50.72	126	123	0.98	77	136	36.91	132.76	0.04	1.11	26.24	7.6
13-Jun-2011	52.72	190	170	0.89	76	131	38.54	117.21	0.04	1.33	23.68	9
14-Jun-2011	52.51	334	289	0.87	79	167	40.68	144.50	0.05	1.42	28.6	10.4
15-Jun-2011	53.50	145	141	0.97	52	130	39.36	126.41	0.06	1.28	26.09	12.6
16-Jun-2011	55.15	235	201	0.86	41	88	35.93	75.27	0.03	1.4	24.06	10
17-Jun-2011	52.79	282	244	0.87	97	157	40.92	135.84	0.06	0.94	26.49	9.4
18-Jun-2011	51.32	152	143	0.94	91	130	41.4	122.30	0.06	1.08	25.26	8.4
19-Jun-2011	51.45	143	119	0.83	48	122	34.53	101.52	0.06	1.29	25.89	9
20-Jun-2011	55.98	228	191	0.84	85	121	38.3	101.36	0.01	1.13	24.87	8.6
21-Jun-2011	55.16	422	320	0.76	80	108	40.83	81.90	0.03	1.19	25.59	13
22-Jun-2011	54.47	216	248	1.15	88	111	39.48	127.44	0.04	1.22	27.19	8.6
23-Jun-2011	54.71	346	254	0.73	115	136	44.37	99.84	0.02	1.26	28	14
24-Jun-2011	56.03	331	287	0.87	240	224	54.74	194.22	0.14	1.31	28.78	9.2
25-Jun-2011	53.89	214	219	1.02	80	85	37.59	86.99	0.04	0.93	26.37	7.4
26-Jun-2011	53.18	218	189	0.87	136	117	36.9	101.44	0.03	0.95	26.26	7.6
27-Jun-2011	54.56	246	221	0.90	46	90	33.65	80.85	0.04	1.19	22.07	7.4
28-Jun-2011	54.05	256	237	0.93	59	107	36.87	99.06	0.04	1.1	24.65	7.4
29-Jun-2011	54.23	255	299	1.17	69	96	36.61	112.56	0.06	1.14	23.87	7.4
30-Jun-2011	57.98	277	256	0.92	94	120	40.38	110.90	0.03	1.34	26.27	8
1-Jul-2011	57.01	296	238	0.80	115	112	37.8	90.05	0.04	1.51	24.23	6.8
2-Jul-2011	51.78	106	102	0.96	163	149	43.36	143.38	0.04	1.2	25.57	6.4
3-Jul-2011	50.09	84	69	0.82	120	78	35.94	64.07	0.03	1.06	25.65	8.6
4-Jul-2011	52.14	102	80	0.78	92	101	33.41	79.22	0.04	1.25	27.44	5.2
5-Jul-2011	55.10	113	101	0.89	65	72	33.97	64.35	0.04	1.33	24.28	6
6-Jul-2011	54.64	111	114	1.03	97	100	36.03	102.70	0.03	1.33	23.02	8.2
7-Jul-2011	57.35	65	61	0.94	116	110	38.6	103.23	0.04	1.58	24.56	8.8
10-Jul-2011	69.72	61	56	0.92	99	92	27.16	84.46	0.04	1.35	19.35	5.8
11-Jul-2011	67.92	105	80	0.76	47	73	25.62	55.62	0.02	1.23	18.31	7.6
12-Jul-2011	64.10	75	66	0.88	55	100	32.97	88.00	0.03	1.33	23.7	6.8
13-Jul-2011	60.84	120	105	0.88	65	112	24.08	98.00	0.01	1.25	18.81	8
14-Jul-2011	59.82	104	97	0.93	64	139	31.55	129.64	0.04	1.02	19.88	6.6
15-Jul-2011	58.93	102	89	0.87	69	108	30.24	94.24		1.43	22.32	6.4
16-Jul-2011	58.52	87	75	0.86	57	94	31.07	81.03	0.01	1.42	23.77	7
17-Jul-2011	58.10	80	69	0.86	42	73	28.09	62.96	0.01	1.5	23.56	8
18-Jul-2011	56.74	98	76	0.78	70	108	29.46	83.76		1.36	23.83	7.2
19-Jul-2011	54.55	119	104	0.87	100	166	36.9	145.08	0.03	1.37	24.17	8.4
20-Jul-2011	54.40	116	101	0.87	46	97	35.5	84.46	0.03	1.45	25.34	11
21-Jul-2011	52.80	135	105	0.78	52	99	33.9	77.00	0.02	1.47	26.08	9
22-Jul-2011	53.01	98	94	0.96	109	138	37.94	132.37	0.05	1.73	24.32	9.6
23-Jul-2011	53.60	130	106	0.82	80	118	33.32	96.22	0.14	1.29	22.85	11.8
24-Jul-2011	57.23	81	73	0.90	92	109	27.02	98.23	0.08	1.87	18.53	9
25-Jul-2011	57.69	109	91	0.83	81	104	29.54	86.83	0.01	1.68	19.44	9
26-Jul-2011	56.05	114	83	0.73	43	84	30.1	61.16		1.66	22.68	9.4
27-Jul-2011	55.61	173	105	0.61	64	96	31.01	58.27	0.03	1.47	19.45	9.6
28-Jul-2011	54.80	90	76	0.84	60	86	30.89	72.62	0.03	1.35	23.93	8.4
29-Jul-2011	53.68	149	131	0.88	117	153	34.67	134.52	0.02	1.39	22.26	8.2
30-Jul-2011	51.22	64	54	0.84	56	74	27.86	62.44	0.03	1.36	22.67	8
31-Jul-2011	51.21	148	98	0.66	34	60	30.02	39.73	0.01	1.6	23.81	8.8
1-Aug-2011	52.96	101	80	0.79	127	85	36.26	67.33	0.03	1.52	23.91	7.4
2-Aug-2011	52.98	110	87	0.79	54	95	32.16	75.14		1.54	22.28	7
3-Aug-2011	53.09	68	68	1.00	53	113	31.43	113.00	0.04	1.47	22.4	7.4
4-Aug-2011	52.62	265	208	0.78	71	119	34.12	93.40	0.02	1.61	24.64	7.6
5-Aug-2011	52.40	120	90	0.75	102	94	37.43	70.50	0.06	1.29	24.04	7.6
6-Aug-2011	53.84	82	70	0.85	69	92	33.04	78.54	0.02	1.26	24.61	7.2
7-Aug-2011	52.81	86	74	0.86	85	111	32.67	95.51	0.02	1.42	23.98	7.2
8-Aug-2011	55.03	122	95	0.78	48	104	35.88	80.98	0.01	1.47	22.43	7
12-Aug-2011	70.94	136	112	0.82	32	55	26.9	45.29		1.38	17.36	8
13-Aug-2011	65.63	103	84	0.82	38	69	23.51	56.27		1.38	18.4	7.8
14-Aug-2011	64.06	88	88	1.00	59	53	25.85	53.00		1.15	19.85	6.4
15-Aug-2011	64.11	81	65	0.80	34	62	24.6	49.75		1.19	17.33	6.4
16-Aug-2011	63.24	86	68	0.79	98	124	30.52	98.05	0.04	1.36	19.79	6.4
17-Aug-2011	64.37	103	94	0.91	99	134	35.56	122.29	0.03	1.51	20.19	4.6

18-Aug-2011	64.90	103	106	1.03	44	77	28.48	79.24	0.03	1.19	20.1	7.4
19-Aug-2011	63.89	103	103	1.00	58	87	33.16	87.00	0.05	1.36	29.09	6.2
20-Aug-2011	67.91	88	83	0.94	73	74	28.04	69.80	0.06	1.33	20.82	6.8
21-Aug-2011	72.39	52	58	1.12	44	57	20.56	63.58	0.02	1.37	16.12	5.4
22-Aug-2011	70.55	50	61	1.22	55	78	25.75	95.16	0.01	1.29	17.82	6.2
23-Aug-2011	71.15	87	63	0.72	45	76	24.94	55.03	0.01	1.45	18.92	7.4
24-Aug-2011	73.47	95	90	0.95	69	99	27.16	93.79	0.03	1.44	18.32	7.2
25-Aug-2011	68.53	108	98	0.91	208	140	36.42	127.04		1.58	21.16	7
26-Aug-2011	64.70	78	75	0.96	29	76	27.29	73.08		1.52	19.67	6.4
27-Aug-2011	62.19	98	84	0.86	39	67	27.34	57.43		1.59	21.97	6.2
28-Aug-2011	64.95	95	88	0.93	84	102	29.77	94.48		1.36	21.22	6.6
29-Aug-2011	70.79	85	65	0.76	39	69	24.64	52.76	0.02	1.47	19.78	7.6
30-Aug-2011	74.21	69	68	0.99	66	76	24.22	74.90	0.03	1.53	18.15	6.2
31-Aug-2011	71.55	91	78	0.86	42	62	24.45	53.14		1.37	17.26	5.8
1-Sep-2011	69.77	80	73	0.91	59	82	27.12	74.83	0.02	1.38	18.99	6
2-Sep-2011	69.19	75	75	1.00	39	78	26.6	78.00	0.02	1.54	18.75	5.4
3-Sep-2011	63.80	58	60	1.03	37	72	26.65	74.48		1.35	21.17	6.4
4-Sep-2011	61.07	60	60	1.00	47	78	27.27	78.00	0.01	1.3	20	6.2
5-Sep-2011	62.30	90	78	0.87	47	74	24.96	64.13		1.33	21.28	6.4
6-Sep-2011	73.90	131	121	0.92	67	94	25.9	86.82	0.02	1.51	21.51	7.8
10-Sep-2011	74.13	70	58	0.83	71	70	23.99	58.00	0.01	1.23	20.84	6.2
11-Sep-2011	71.68	68	61	0.90	96	86	27.02	77.15	0.01	1.41	18.95	5.8
12-Sep-2011	68.70	87	76	0.87	82	74	27.37	64.64	0.04	1.08	24.68	7.4
13-Sep-2011	66.69	101	82	0.81	71	77	27.62	62.51		1.53	20.05	9.8
14-Sep-2011	65.01	78	60	0.77	70	112	31.13	86.15		1.38	23.56	7.4
15-Sep-2011	63.68	92	78	0.85	67	96	31.01	81.39		1.5	25.2	7.6
16-Sep-2011	62.04	115	92	0.80	39	73	28.09	58.40		1.22	24	8.6
17-Sep-2011	59.72	89	67	0.75	77	94	32.01	70.76	0.01	1.29	21.99	5.2
18-Sep-2011	59.54	70	55	0.79	34	60	26.41	47.14		1.22	21.21	6
19-Sep-2011	59.73	78	59	0.76	42	70	29.26	52.95		1.21	22.23	6.2
20-Sep-2011	60.32	95	79	0.83	42	81	31.58	67.36	0.01	1.26	24.33	7.8
21-Sep-2011	68.80	250	201	0.80	33	66	24.36	53.06	0.02	1.46	18.62	8.4
30-Sep-2011	71.19	113	94	0.83	36	54	24.64	44.92	0.01	1.26	14.7	8.8
1-Oct-2011	68.20	100	78	0.78	48	52	25.52	40.56		1.23	20.47	9.2
2-Oct-2011	64.78	99	91	0.92	20	46	24.74	42.28		1.54	17.58	9.2
3-Oct-2011	64.14	118	110	0.93	32	64	26.24	59.66		1.4	24.05	11.6
4-Oct-2011	63.10	117	111	0.95	50	76	27.77	72.10		1.38	18.41	9.4
5-Oct-2011	62.19	127	105	0.83	29	67	28.38	55.39	0.01	1.45	20.84	7.8
6-Oct-2011	61.70	110	101	0.92	41	83	29.58	76.21	0.21	1.48	24.55	9
7-Oct-2011	60.57	145	136	0.94	37	78	28.91	73.16	0.11	1.54	21.66	7.5
8-Oct-2011	59.65	105	93	0.89	67	60	28.76	53.14		1.34	23.06	7.6
11-Oct-2011	72.92	107	82	0.77	73	88	27.72	67.44	0.02	1.36	15.96	7.8
12-Oct-2011	69.49	133	103	0.77	43	62	26.5	48.02	0.04	1.54	20.63	5
13-Oct-2011	67.94	117	104	0.89	34	70	24.16	62.22	0.03	1.22	19.15	5.8
14-Oct-2011	65.55	114	92	0.81	46	77	25.66	62.14	0.01	1.49	18.12	8.6
15-Oct-2011	62.22	115	99	0.86	50	79	25.66	68.01	0.01	1.45	17.52	7.2
16-Oct-2011	62.01	135	119	0.88	58	83	27.14	73.16	0.01	1.56	18.85	8.6
17-Oct-2011	62.03	136	123	0.90	36	90	28.38	81.40	0.01	1.54	19.75	8.2
18-Oct-2011	61.67	128	111	0.87	61	98	30.67	84.98		1.67	21.03	9.8
19-Oct-2011	63.80	107	87	0.81	59	124	30.64	100.82	0.01	1.32	16.92	8.6
20-Oct-2011	59.25	124	116	0.94	24	87	29.4	81.39		1.45	22.24	10.8
21-Oct-2011	59.48	134	126	0.94	68	113	33.6	106.25	0.01	1.66	22.93	11
22-Oct-2011	56.81	125	112	0.90	113	168	38.5	150.53	0.01	1.26	24.56	7.4
23-Oct-2011	56.55	150	135	0.90	24	62	30.24	55.80	0.06	1.45	27.33	8
24-Oct-2011	60.15	115	109	0.95	43	88	31.63	83.41	0.04	1.26	24.93	8
25-Oct-2011	58.29	125	119	0.95	90	116	36.5	110.43	0.03	1.4	24.29	9.4
26-Oct-2011	58.24	132	117	0.89	51	117	36.87	103.70		1.61	25.37	9.8
27-Oct-2011	58.40	151	137	0.91	88	153	37.55	138.81		1.33	23.73	9.8
28-Oct-2011	57.44	133	123	0.92	67	109	36.21	100.80		1.33	24.06	9.4
29-Oct-2011	56.17	148	133	0.90	31		34.1			1.23	26.02	8.9
30-Oct-2011	55.67	132	125	0.95	82	109	34.16	103.22		1.3	23.98	9.2
31-Oct-2011	59.03	191	140	0.73	45	88	30.44	64.50		1.29	22.91	9.6
1-Nov-2011	58.61	141	118	0.84	48	85	33.95	71.13	0.01	1.44	24.43	9.6
2-Nov-2011	57.85	147	127	0.86	314	182	55.06	157.24	0.03	1.42	23.3	9.8
3-Nov-2011	57.40	172	154	0.90	119	125	39.16	111.92	0.01	1.5	26.51	10.6
4-Nov-2011	56.68	204	178	0.87	54	108	36.68	94.24		1.37	22.87	9
5-Nov-2011	54.57	179	161	0.90	92	143	40.74	128.62		1.33	27.03	9.6
6-Nov-2011	54.84	137	145	1.06	45	86	35	91.02		1.79	25.36	10.4
7-Nov-2011	55.87	154	140	0.91	71	123	39.72	111.82	0.04	1.65	30.02	9.8
8-Nov-2011	56.19	207	169	0.82	93	122	37.84	99.60	0.04	1.77	26.87	10.8
9-Nov-2011	55.42	176	146	0.83	100	132	39.55	109.50	0.04	1.33	23.75	8.4
10-Nov-2011	53.80	190	158	0.83	112	155	42.1	128.89	0.03	1.41	24.52	8.4
11-Nov-2011	53.13	173	159	0.92	34	106	35.18	97.42	0.04	1.24	23.95	9.2
12-Nov-2011	51.46	234	166	0.71	106	146	41.3	103.57	0.03	1.27	29.42	9.8
13-Nov-2011	52.30	154	138	0.90	47	88	30.98	78.86	0.03	1.31	27.81	8
14-Nov-2011	53.39	227	190	0.84	101	127	42.05	106.30	0.03	1.39	26.6	6
15-Nov-2011	52.19	160	152	0.95	103	132	42.7	125.40	0.03	1.44	28.42	6.8
16-Nov-2011	54.35	163	122	0.75	155	157	47.1	117.51	0.06	1.29	28.78	8.2
17-Nov-2011	56.22	252	176	0.70	45	103	37.62	71.94	0.03	1.68	27.71	9
18-Nov-2011	54.30	159	143	0.90	63	78	37.11	70.15	0.03	1.56	28.5	8.6
19-Nov-2011	53.14	166	156	0.94	60	98	39.61	92.10	0.03	1.47	22.55	8.6
20-Nov-2011	52.22	132	130	0.98	55	99	38.49	97.50	0.03	1.26	26.87	7.2
21-Nov-2011	53.94	173	165	0.95	68	93	36.73	88.70	0.02	1.47	23.18	7.4

22-Nov-2011	53.61	192	168	0.88	76	94	43.26	82.25	0.04	1.47	25.95	7.2
23-Nov-2011	53.34	224	160	0.71	63	104	35.92	74.29	0.03	1.26	28.44	7.8
24-Nov-2011	49.49	222	214	0.96	72	90	31.86	86.76	0.04	1.23	18.2	8
25-Nov-2011	48.02	183	167	0.91	100	122	43.53	111.33	0.06	1.02	26.33	8.6
26-Nov-2011	49.49	203	184	0.91	62	143	41.93	129.62	0.05	1.19	27.56	9
27-Nov-2011	50.81	194	183	0.94	62	134	39.83	126.40	0.05	1.4	27.72	9.2
28-Nov-2011	53.98	199	172	0.86	46	127	36.43	109.77	0.03	1.43	23.99	7.4
29-Nov-2011	53.69	209	179	0.86	40	118	36.21	101.06	0.02	1.42	24.13	8.4
30-Nov-2011	52.91	206	201	0.98	87	152	43.4	148.31		1.5	29.23	8.4
1-Dec-2011	52.99	198	188	0.95	70	148	41.4	140.53	0.02	1.52	31.59	8.8
2-Dec-2011	52.35	222	198	0.89	70	149	39.85	132.89	0.01	1.07	25.01	12.6
3-Dec-2011	51.42	219	186	0.85	65	150	41.5	127.40	0.01	1	24.24	9
4-Dec-2011	52.07	182	174	0.96	59	128	37.66	122.37	0.01	1.32	24.06	9
5-Dec-2011	52.80	200	188	0.94	146	153	45.92	143.82	0.01	1.36	28.36	8.6
6-Dec-2011	52.76	191	167	0.87	236	233	60.95	203.72		1.33	27.63	9.2
7-Dec-2011	53.01	200	150	0.75	62	148	39.86	111.00	0.01	1.58	23.23	8
8-Dec-2011	51.92	242	194	0.80	58	152	41.34	121.85	0.01	1.51	25.47	8
9-Dec-2011	51.90	189	185	0.98	68	145	42.28	141.93	0.04	1.04	29.41	10.2
10-Dec-2011	51.06	208	164	0.79	84	130	38.08	102.50	0.03	1.18	26.85	10.2
11-Dec-2011	50.81	162	190	1.17	61	141	39.26	165.37	0.04	1.34	27.24	11.6
12-Dec-2011	51.69	179	161	0.90	35	94	33.4	84.55	0.02	1.15	27.18	8.6
13-Dec-2011	52.30	204	162	0.79	49	113	37.14	89.74	0.03	1.34	31.45	10
14-Dec-2011	51.22	204	160	0.78	59	146	37.72	114.51	0.03	1.6	29.31	8.8
15-Dec-2011	51.29	209	185	0.89	109	167	45.17	147.82	0.02	1.3	29.6	8.4
16-Dec-2011	50.72	219	182	0.83	104	182	45.4	151.25	0.02	1.16	26.4	9
17-Dec-2011	50.02	202	174	0.86	74	126	39.06	108.53	0.02	1.17	26.47	9.8
18-Dec-2011	49.05	221	210	0.95	63	148	39.9	140.63	0.03	1.23	25.57	7.4
19-Dec-2011	49.85	196	165	0.84	58	135	38.92	113.65		1.09	25.59	8.1
20-Dec-2011	49.85	210	188	0.90	82	162	42.28	145.03	0.03	1.29	26.97	8.2
21-Dec-2011	49.94	172	151	0.88	69	162	38.66	142.22	0.03	1.29	27.77	9.6
22-Dec-2011	51.42	224	198	0.88	82	153	40.45	135.24		1.14	24.38	9.6
23-Dec-2011	50.25	248	229	0.92	120	162	46.6	149.59		1.28	27.87	10.6
24-Dec-2011	48.17	212	195	0.92	138	168	44.24	154.53	0.02	1.33	26.96	10.4
25-Dec-2011	44.60	282	265	0.94	81	154	36.36	144.72	0.02	1.05	24.13	9.6
26-Dec-2011	47.33	223	203	0.91	79	142	42.16	129.26		1.17	24.16	8.6
27-Dec-2011	49.87	223	208	0.93	80	138	40.88	128.72	0.02	1.36	30.34	8.6
28-Dec-2011	49.34	244	204	0.84	40	116	35.89	96.98		1.34	27.38	9.8
29-Dec-2011	49.61	253	240	0.95	90	119	32.25	112.89	0.04	1.09	27.4	6.6
30-Dec-2011	49.48	280	246	0.88	123	186	40.13	163.41	0.01	1.37	23.55	8
31-Dec-2011	50.52	188	172	0.91	92	191	40.12	174.74	0.01	1.23	19.73	8.4
1-Jan-2012	47.69	161	156	0.97	92	144	36.68	139.53	0.03	1.3	21.07	7.4
2-Jan-2012	49.92	175	176	1.01	91	148	39.62	148.85		1.23	25.33	8.8
3-Jan-2012	49.43	236	224	0.95	62	146	43.4	138.58	0.04	1.51	32.63	8.4
4-Jan-2012	49.99	301	272	0.90	82	204	44.61	184.35	0.04	1.37	34.9	9.2
5-Jan-2012	50.12	242	220	0.91	71	155	40.18	140.91	0.01	1.21	32.11	8
6-Jan-2012	49.67	371	236	0.64	91	146	41.72	92.87	0.03	1	28.42	8.8
7-Jan-2012	49.45	203	147	0.72	87	157	37.48	113.69	0.03	1.49	30.04	14.6
8-Jan-2012	49.62	250	250	1.00	71	146	36.82	146.00	0.03	1.01	27.34	8.8
9-Jan-2012	50.82	256	229	0.89	66	132	41.21	118.08	0.03	1.34	31.49	9.6
10-Jan-2012	50.73	239	203	0.85	99	184	43.96	156.28	0.06	1.19	32.55	10.6
11-Jan-2012	51.62	230	238	1.03	55	138	41.4	142.80	0.02	1.29	32.2	10
12-Jan-2012	52.03	238	228	0.96	98	158	46.72	151.36	0.03	1.54	33.73	9
13-Jan-2012	50.73	198	185	0.93	95	153	42.49	142.95		0.89	28.05	8.4
14-Jan-2012	48.93	268	213	0.79	73	148	44.59	117.63		0.98	26.7	8.2
15-Jan-2012	47.78	148	174	1.18	78	166	43.49	195.16		1.2	30.44	8.4
16-Jan-2012	49.51	210	186	0.89	87	128	41.71	113.37		1.26	29.72	7.6
17-Jan-2012	50.30	270	291	1.08	131	208	43.35	224.18		1.47	25.35	7
18-Jan-2012	51.40	253	224	0.89	75	164	42.73	145.20	0.03	1.35	26.2	9.4
19-Jan-2012	50.59	228	240	1.05	112	178	43.26	187.37	0.04	1.44	24.02	9.4
20-Jan-2012	50.03	247	244	0.99	105	186	50.12	183.74	0.03	1.51	32.69	10
21-Jan-2012	49.32	180	156	0.87	45	91	40.74	78.87	0.03	0.95	33.64	10.4
22-Jan-2012	49.65	161	161	1.00	130	175	45.86	175.00	0.03	1.28	29.53	8.6
23-Jan-2012	50.81	223	191	0.86	86	160	37.58	137.04	0.02	1.02	27.17	8.2
24-Jan-2012	50.94	226	214	0.95	92	160	42.87	151.50	0.04	1.02	24.67	8.4
25-Jan-2012	51.03	299	269	0.90	143	202	49.1	181.73	0.04	1.13	30.93	8.2
26-Jan-2012	51.06	198	184	0.93	38	106	39.9	98.51	0.03	1.14	26.44	6.2
27-Jan-2012	52.24	204	178	0.87	108	175	44.51	152.70	0.03	1.01	29.79	9.4
28-Jan-2012	50.89	185	187	1.01	109	173	45.13	174.87	0.03	0.91	31.89	5.8
29-Jan-2012	50.82	196	160	0.82	29	104	39.11	84.90	0.03	1.29	34.48	5.2
30-Jan-2012	50.79	220	182	0.83	149	204	49.96	168.76	0.01	1.35	30.81	4.4
31-Jan-2012	50.68	173	155	0.90	97	162	45.08	145.14	0.03	1.29	28.38	5.6
1-Feb-2012	50.94	238	196	0.82	88	133	42.14	109.53	0.01	0.91	29.77	5
2-Feb-2012	51.28	287	272	0.95	59	138	41.72	130.79	0.03	1.4	29.47	5.4
3-Feb-2012	50.16	182	178	0.98	70	184	48.16	179.96		1.33	30.86	7.4
4-Feb-2012	49.43	195	153	0.78	32	101	38.92	79.25	0.03	1.45	30.89	7.2
5-Feb-2012	49.72	166	162	0.98	58	107	37.52	104.42	0.01	1.12	29.89	7.8
6-Feb-2012	50.89	197	166	0.84	83	156	43.32	131.45				12.8
7-Feb-2012	50.49	204	174	0.85	57	152	42.72	129.65	0.04	1.37	29.13	7.6
8-Feb-2012	50.61	222	199	0.90	86	160	43.68	143.42	0.05	1.43	28.98	9.6
9-Feb-2012	50.00	240	222	0.93	40	118	39.4	109.15		1.26	29.08	8.2
10-Feb-2012	49.87	296	301	1.02	59	128	42.78	130.16		1.4	30.52	9.8
11-Feb-2012	48.93	224	188	0.84	77	149	43.28	125.05		1.23	31.01	11.2
12-Feb-2012	48.72	202	202	1.00	40	110	40.4	110.00		1.82	30.59	11.8

13-Feb-2012	49.52	189	182	0.96	143	188	49.22	181.04	0.03	1.14	32.03	9.8
14-Feb-2012	50.19	240	206	0.86	93	162	44.62	139.05	0.03	1.01	28.75	11.6
15-Feb-2012	50.59	284	238	0.84	98	164	43.75	137.44	0.04	1.09	31.33	11.4
16-Feb-2012	50.47	252	201	0.80	82	156	43.58	124.43	0.03	1.54	25.12	9.4
17-Feb-2012	52.74	258	199	0.77	84	140	42.7	107.98	0.31	1.31	29.67	9.8
18-Feb-2012	51.10	324	284	0.88	70	132	41.16	115.70		0.97	27.41	7.6
19-Feb-2012	51.10	143	163	1.14	74	140	40.78	159.58		1.24	30.7	7.2
20-Feb-2012	51.66	258	208	0.81	72	138	41.35	111.26	0.11	1.68	31.31	10.8
21-Feb-2012	51.02	222	196	0.88	39	126	43.12	111.24	0.02	1.56	31.34	6
22-Feb-2012	51.60	214	178	0.83	145	212	47.88	176.34	0.03	1.33	30.06	5
23-Feb-2012	52.09	254	213	0.84	118	166	46.21	139.20	0.03	1.28	27.99	6.2
24-Feb-2012	49.95	255	241	0.95	80	164	45.24	155.00	0.08	1.3	30.59	6.4
25-Feb-2012	49.48	261	238	0.91	41	87	42.3	79.33	0.03	1.09	32.46	6.8
26-Feb-2012	49.06	185	200	1.08	78	120	45.52	129.73	0.02	1.02	32.94	15
27-Feb-2012	50.67	190	158	0.83	86	141	42.64	117.25		1.16	28.18	4.8
28-Feb-2012	51.10	162	134	0.83	84	150	44.53	124.07		1.14	30.2	4.6
29-Feb-2012	51.16	170	156	0.92	100	144	44.73	132.14	0.03	1.42	29.44	6
1-Mar-2012	50.85	187	172	0.92	172	175	50.68	160.96	0.03	1.03	31.18	5.6
2-Mar-2012	51.84	145	151	1.04	84	174	49.52	181.20	0.01	0.97	27.46	5.4
3-Mar-2012	51.75	163	145	0.89	60	163	41.75	145.00	0.02	1.33	24.02	5.6
4-Mar-2012	50.31	199	176	0.88	95	151	41.69	133.55	0.02	1.04	26.38	5.2
5-Mar-2012	49.96	258	224	0.87	44	106	38.57	92.03		1.25	26.68	4.2
6-Mar-2012	50.02	210	183	0.87	123	147	46.2	128.10		1.2	26.27	4.8
7-Mar-2012	50.46	242	198	0.82	36	114	40.26	93.27		1.01	26.81	5.2
8-Mar-2012	50.90	248	213	0.86	55	121	44.77	103.92	0.02	1.39	27.14	5.6
9-Mar-2012	50.59	161	155	0.96	72	149	44.33	143.45	0.14	1.19	29.25	20.6
10-Mar-2012	48.91	188	155	0.82	104	142	46.62	117.07	0.03	1.19	27.84	4.3
11-Mar-2012	48.49	162	161	0.99	115	158	43.96	157.02	0.04	1	29.91	3.8
12-Mar-2012	49.53	206	182	0.88	48	90	38.85	79.51	0.01	0.93	30.1	3.8
13-Mar-2012	49.22	215	188	0.87	58	135	40.36	118.05	0.03	1.16	26.84	4
14-Mar-2012	49.55	238	204	0.86	79	152	43.64	130.29	0.28	1.4	27.71	5.6
15-Mar-2012	49.99	200	165	0.83	79	145	42.29	119.63	0.02	0.98	26.82	6
16-Mar-2012	49.88	155	150	0.97	70	134	42.85	129.68	0.01	1.45	27.31	5.6
17-Mar-2012	48.52	220	199	0.90	89	147	44.2	132.97	0.01	1.19	29.51	4.6
18-Mar-2012	48.73	211	196	0.93	86	144	41.36	133.76		1.17	27	4.8
19-Mar-2012	50.33	210	180	0.86	82	144	43.96	123.43	0.01	1.1	26.94	5.4
20-Mar-2012	50.25	220	198	0.90	73	138	42.7	124.20	0.07	1.19	30.93	4.8
21-Mar-2012	54.36	209	217	1.04	63	122	43.67	126.67	0.21	1.54	28.41	7.2
22-Mar-2012	53.89	216	208	0.96	53	100	37	96.30	0.02	1.52	28.38	6.8
23-Mar-2012	51.72	265	217	0.82	88	118	40.93	96.63	0.01	1.3	27.76	8.2
24-Mar-2012	50.19	274	176	0.64	161	169	51.42	108.55	0.02	0.92	27.15	7
25-Mar-2012	50.28	135	150	1.11	94	119	43.68	132.22	0.01	1.82	29	8
26-Mar-2012	51.11	160	153	0.96	73	132	40.18	126.23	0.11	1.31	29.49	10.4
27-Mar-2012	51.13	208	197	0.95	169	198	52.22	187.53	0.02	1.14	30.83	8.8
28-Mar-2012	51.22	260	260	1.00	85	146	42.69	146.00	0.04	1.38	30.06	9.6
29-Mar-2012	51.66	212	219	1.03	42	105	41.79	108.47	0.03	1.21	30.42	10.2
30-Mar-2012	51.37	232	199	0.86	87	164	42.08	140.67	0.03	1.29	30.13	9.6
31-Mar-2012	50.58	154	152	0.99	77	158	48.95	155.95	0.01	1.26	29.64	10.8
1-Apr-2012	50.37	150	156	1.04	66	108	38.57	112.32	0.02	1.22	27.16	8.8
2-Apr-2012	51.96	188	187	0.99	99	130	41.56	129.31		1.1	29.32	8.8
3-Apr-2012	51.74	188	186	0.99	80	124	43.86	122.68		1.31	31.16	9.4
4-Apr-2012	51.93	150	132	0.88	159	230	60.65	202.40	0.03	1.33	32.01	6.4
5-Apr-2012	52.23	208	200	0.96	108	133	43.04	127.88	0.05	1.44	31.61	20.2
6-Apr-2012	51.68	237	215	0.91	87	134	37.19	121.56	0.07	1.31	21.53	10.2
7-Apr-2012	49.40	179	162	0.91	63	117	37.09	105.89	0.06	1.14	23.4	8.2
8-Apr-2012	47.97	152	139	0.91	46	96	38.59	87.79	0.06	1.12	27.4	5.8
9-Apr-2012	50.63	224	191	0.85	108	176	44.8	150.07	0.04	0.98	27.27	6
10-Apr-2012	51.23	202	184	0.91	90	151	45.19	137.54	0.06	1.27	27.48	5.4
11-Apr-2012	50.80	197	170	0.86	85	136	43.54	117.36	0.07	1.23	28.42	6.4
12-Apr-2012	50.67	258	244	0.95	91	150	44.7	141.86	0.04	1.16	26.32	6.4
13-Apr-2012	50.03	246	218	0.89	90	282	45.16	249.90	0.01	1.03	28.4	7
14-Apr-2012	48.88	162	161	0.99	83	130	45.65	129.20	0.01	1.03	29.81	5.8
15-Apr-2012	49.36	143	142	0.99	74	89	41.94	88.38	0.01	0.99	30.09	8
16-Apr-2012	50.47	203	166	0.82	94	117	44.24	95.67	0.01	1.19	29.61	7.2
17-Apr-2012	50.25	234	202	0.86	99	154	44.72	132.94	0.02	1.24	31.35	7.8
18-Apr-2012	51.42	398	280	0.70	100	158	46.48	111.16	0.11	1.49	28.65	9.2
19-Apr-2012	51.49	468	453	0.97	98	150	42.08	145.19	0.02	1.58	26.3	9.4
20-Apr-2012	50.52	385	325	0.84	50	114	42.31	96.23	0.05	1.15	28.67	7
21-Apr-2012	50.72	292	260	0.89	118	157	47.02	139.79	0.03	1.26	31.96	7.4
22-Apr-2012	52.24	190	180	0.95	80	124	41.08	117.47	0.04	1.12	32.54	7.6
23-Apr-2012	51.80	226	208	0.92	82	131	40.74	120.57	0.01	1.13	25.8	7.8
24-Apr-2012	50.76	254	238	0.94	83	141	41.81	132.12		1.14	25.62	7.2
25-Apr-2012	50.53	270	253	0.94	98	146	44.19	136.81	0.02	1.33	25.14	7.6
26-Apr-2012	50.73	232	222	0.96	106	150	46.9	143.53	0.06	1.59	27.91	6.6
27-Apr-2012	50.10	230	224	0.97	88	152	45.08	148.03	0.44	1.79	24.99	6.6
28-Apr-2012	49.21	157	144	0.92	132	126	43.4	115.57	0.01	1.18	29.88	6.2
29-Apr-2012	48.96	142	154	1.08	84	136	38.27	147.49	0.01	1.25	28.41	6.6
30-Apr-2012	50.15	275	240	0.87	81	131	41.3	114.33	0.03	1.45	19.64	8.2
1-May-2012	50.79	219	214	0.98	77	115	42.76	112.37	0.14	1.72	30.69	9.8
2-May-2012	50.67	208	198	0.95	83	134	45.36	127.56	0.05	1.56	30.34	10
3-May-2012	50.59	276	234	0.85	160	174	52.08	147.52		1.58	32.99	9.8
4-May-2012	48.78	210	210	1.00	61	126	45.59	126.00	0.02	1.28	29.11	9.6
5-May-2012	49.97	187	151	0.81	118	152	46.43	122.74	0.01	1.5	30.92	10.2

6-May-2012	49.57	132	136	1.03	83	110	36.67	113.33	0.01	1.37	25.2	10.8
7-May-2012	50.63	240	170	0.71	37	94	36.54	66.58	0.01	1.33	27.36	7.6
8-May-2012	50.23	199	198	0.99	118	142	44.24	141.29		1.34	28.01	9
9-May-2012	50.94	319	251	0.79	95	136	41.48	107.01	0.01	1.57	28.18	8.8
10-May-2012	50.37	198	190	0.96	106	124	42.7	118.99		1.7	33.4	7.6
11-May-2012	49.53	195	186	0.95	90	133	41.72	126.86	0.03	1.55	30.91	8.8
12-May-2012	47.83	212	176	0.83	62	82	40.1	68.08	0.07	1.23	29.63	7.2
13-May-2012	47.39	144	144	1.00	81	110	37.04	110.00		1.11	27.2	8.6
14-May-2012	50.89	182	146	0.80	129	135	42.64	108.30		1.04	27.39	7.8
15-May-2012	50.09	206	171	0.83	92	118	41.4	97.95	0.04	1.42	29.83	8.8
16-May-2012	52.72	243	186	0.77	103	128	44.01	97.98	0.03	1.25	29.21	9.2
17-May-2012	52.55	168	146	0.87	153	146	44.06	126.88	0.03	1.38	30.12	10
18-May-2012	51.06	280	226	0.81	113	146	40.67	117.84	0.01	1.12	27.36	7.4
19-May-2012	49.31	214	178	0.83	155	177	50.49	147.22	0.03	1.29	28.92	7.2
20-May-2012	48.94	127	120	0.94	100	130	42.14	122.83	0.03	1.99	30.76	24.6
21-May-2012	50.42	184	172	0.93	106	127	41.61	118.72		1.09	30.44	6.4
22-May-2012	50.56	194	178	0.92	45	94	37.71	86.25		1.19	29.1	7.2
23-May-2012	50.83	276	176	0.64	137	148	44.86	94.38	0.04	1.34	28.28	7.6
24-May-2012	51.04	272	254	0.93	85	110	39.97	102.72	0.2	1.43	29.05	6.4
25-May-2012	50.33	254	202	0.80	120	130	44.34	103.39	0.07	1.57	28.44	6.9
26-May-2012	47.80	183	153	0.84	93	114	40.14	95.31	0.09	1.65	29.84	13.6
27-May-2012	46.58	135	122	0.90	93	128	41.26	115.67		1.32	29.17	4.8
28-May-2012	48.87	163	139	0.85	88	112	37.85	95.51		1.34	28.54	12.2
29-May-2012	51.92	188	177	0.94	78	118	36.22	111.10	0.07	1.29	26.14	6.4
30-May-2012	51.17	177	173	0.98	92	136	39.65	132.93	0.08	1.32	25.92	6.8
31-May-2012	50.78	240	230	0.96	86	124	39.22	118.83		0.93	25.53	10.6
1-Jun-2012	60.28	178	158	0.89	82	98	36.38	86.99	0.04	1.11	27.27	8.2
2-Jun-2012	52.43	162	130	0.80	106	124	36.89	99.51	0.04	1.15	22.69	7.6
3-Jun-2012	51.68	138	125	0.91	52	74	30.98	67.03	0.01	1.09	26.25	8.2
4-Jun-2012	52.83	179	158	0.88	88	112	38.6	98.86	0.03	0.95	24.46	7.4
5-Jun-2012	54.91	161	147	0.91	110	142	42.35	129.65	0.05	1.18	27.89	8
6-Jun-2012	55.89	180	150	0.83	71	114	36.26	95.00		1.24	25.76	8.6
7-Jun-2012	61.33	158	142	0.90	129	138	37.26	124.03		1.47	25.69	9.6
8-Jun-2012	62.22	130	119	0.92	88	134	30.5	122.66	0.08	1.28	21.56	8.2
9-Jun-2012	60.90	104	89	0.86	85	88	31.51	75.31	0.04	1.25	21.95	6.8
10-Jun-2012	57.65	103	100	0.97	109	108	34.78	104.85	0.04	1.11	24.53	6.6
11-Jun-2012	57.60	132	124	0.94	100	111	33.73	104.27		1.13	26.98	8.2
12-Jun-2012	56.97	171	152	0.89	97	144	39.93	128.00	0.07	1.09	31.36	7.2
13-Jun-2012	56.36	172	137	0.80	76	135	36.41	107.53	0.05	1.16	31.97	7.8
14-Jun-2012	55.31	151	157	1.04	97	132	39.35	137.25	0.09	1.33	29.47	7.6
15-Jun-2012	55.13	156	164	1.05	98	131	40.38	137.72	0.02	1.07	29.56	10.4
16-Jun-2012	53.07	118	119	1.01	57	81	37.51	81.69	0.05	1.32	29.57	9.4
17-Jun-2012	51.91	146	139	0.95	108	126	35.61	119.96		1.28	27.36	9
18-Jun-2012	53.89	188	162	0.86	47	92	33.09	79.28	0.04	1.33	25.91	10.6
19-Jun-2012	53.49	226	224	0.99	49	113	34.89	112.00	0.04	1.34	27.84	10
20-Jun-2012	54.40	207	192	0.93	64	112	35.64	103.88	0.03	1.39	27.1	10.4
21-Jun-2012	55.65	358	200	0.56	36	86	32.92	48.04	0.03	1.17	26.59	10.6
22-Jun-2012	57.45	187	179	0.96	63	84	32.59	80.41	0.09	1.52	25.22	10
23-Jun-2012	55.75	101	113	1.12	64	97	29.82	108.52	0.02	1.6	23.21	9
29-Jun-2012	74.41	122	117	0.96	31	59	21.23	56.58		1.78	16.54	10
30-Jun-2012	70.08	105	85	0.81	105	122	29.77	98.76	0.04	1.5	19.28	8
1-Jul-2012	67.76	98	80	0.82	33	64	24.21	52.24	0.04	1.99	19.32	8.4
2-Jul-2012	67.55	126	138	1.10	67	87	25.57	95.29		1.68	18.73	9.6
3-Jul-2012	66.00	191	191	1.00	87	132	28.33	132.00	0.03	1.57	17.92	9.4
4-Jul-2012	63.21	110	78	0.71	37	70	25.11	49.64	0.05	1.41	17.79	11.2
5-Jul-2012	65.60	197	180	0.91	88	120	31.59	109.64	0.06	1.38	19.13	10
6-Jul-2012	64.74	194	172	0.89	85	101	28.28	89.55	0.03	1.75	20.08	19
7-Jul-2012	62.13	196	168	0.86	59	84	27.58	72.00		1.19	21.31	12
8-Jul-2012	60.68	93	73	0.78	87	133	29.46	104.40		1.29	23.84	9.6
9-Jul-2012	61.64	197	163	0.83	62	106	27.51	87.71	0.04	1.25	23.1	8.4
10-Jul-2012	63.71	131	129	0.98	89	120	31	118.17	0.06	1.55	21.33	25.8
11-Jul-2012	69.06	203	162	0.80	76	116	28.37	92.57	0.05	1.22	22.96	10
12-Jul-2012	71.05	146	117	0.80	65	99	26.39	79.34	0.05	1.52	16.46	8.8
13-Jul-2012	68.44	138	117	0.85	62	132	27.07	111.91	0.04	1.44	20.05	7
14-Jul-2012	64.62	140	105	0.75	78	89	29.56	66.75	0.01	1.39	24.25	8.2
15-Jul-2012	64.57	112	81	0.72	59	81	27.68	58.58	0.01	1.26	23.76	7.2
16-Jul-2012	69.13	212	194	0.92	54	78	23.21	71.38		1.05	20.25	9.6
19-Jul-2012	74.66	130	92	0.71	81	94	26.4	66.52		1.6	18.14	8
20-Jul-2012	70.18	140	122	0.87	97	71	24.5	61.87	0.02	1.49	20.95	11.2
21-Jul-2012	69.68	235	196	0.83	44	118	32.67	98.42	0.01	1.4	24.19	11.8
24-Jul-2012	72.91	188	158	0.84	79	106	27.1	89.09	0.03	1.14	17.52	8.8
25-Jul-2012	69.88	177	153	0.86	83	104	26.46	89.90	0.07	1.4	19.01	9
26-Jul-2012	67.30	182	145	0.80	76	130	27.86	103.57		1.27	18.75	10
27-Jul-2012	65.21	169	152	0.90	73	120	28.09	107.93		1.14	22.58	17
28-Jul-2012	62.84	135	102	0.76	50	74	27.44	55.91		1.08	22.24	8
29-Jul-2012	61.30	118	100	0.85	63	90	27.61	76.27	0.01	1.3	22.13	8
30-Jul-2012	62.24	192	200	1.04	65	86	27.97	89.58	0.07	1.12	22.41	10.4
31-Jul-2012	64.75	204	172	0.84	78	126	30.5	106.24	0.02	1.47	20.68	9.2
1-Aug-2012	68.71	150	124	0.83	76	78	25.65	64.48	0.04	1.56	19.86	8
2-Aug-2012	67.97	181	142	0.78	98	98	29.13	76.88	0.05	1.16	20.47	8.6
3-Aug-2012	64.10	124	122	0.98	68	87	28.49	85.60		0.98	24.44	8.4
4-Aug-2012	61.99	96	88	0.92	40	50	26.57	45.83	0.02	1.14	25.67	9.6
5-Aug-2012	54.85	117	122	1.04	56	64	26	66.74	0.03	1.37	24.11	7.8

8-Aug-2012	69.47	174	155	0.89	65	90	25.76	80.17	0.01	1.1	21.95	6.6
9-Aug-2012	66.16	164	153	0.93	57	78	25.45	72.77	0.05	1.05	18.95	6.4
10-Aug-2012	66.37	134	105	0.78	82	94	28.63	73.66	0.04	1.31	24.18	6.8
11-Aug-2012	65.07	123	108	0.88	64	70	27.37	61.46	0.05	1.16	23.7	6.4
12-Aug-2012	66.26	106	90	0.85	42	53	23.76	45.00	0.05	1.05	23.65	7.4
13-Aug-2012	68.01	110	89	0.81	57	51	23.54	41.26	0.01	1	21.42	6.2
14-Aug-2012	65.16	149	135	0.91	37	66	31	59.80	0.01	1.11	18.67	8.2
15-Aug-2012	65.79	145	129	0.89	89	115	31.78	102.31		1.13	21.87	7.4
16-Aug-2012	67.61	227	158	0.70	66	102	27.02	71.00	0.01	1.06	20.24	8.2
17-Aug-2012	66.29	124	103	0.83	77	108	28.09	89.71	0.06	1.16	23.22	7.8
20-Aug-2012	74.78	146	133	0.91	58	81	24.85	73.79	0.02	1.12	18.02	8.6
2-Sep-2012	71.98	115	57	0.50	36	47	22.21	23.30	0.06	1.17	19.92	7.2
3-Sep-2012	71.56	86	70	0.81	79	92	21	74.88	0.07	1.21	18.39	7
4-Sep-2012	71.36	112	99	0.88	62	64	23.51	56.57	0.06	1.24	17.9	7.4
5-Sep-2012	70.63	164	131	0.80	32	56	24.33	44.73	0.06	1.22	22.63	8
26-Sep-2012	74.54	122	93	0.76	70	90	30.24	68.61	0.04	1.98	22.43	9.8
27-Sep-2012	72.87	183	157	0.86	51	81	27.43	69.49	0.08	2.07	19.75	9.4
28-Sep-2012	70.78	148	119	0.80	72	92	29.72	73.97	0.04	1.57	20.02	8.4
29-Sep-2012	69.66	88	81	0.92	42	61	27.69	56.15	0.04	1.17	21.85	11.4
30-Sep-2012	68.61	114	103	0.90	82	88	28.32	79.51	0.04	1.35	21.75	9.6
1-Oct-2012	68.07	163	153	0.94	95	101	29.87	94.80	0.04	1.19	20.58	8.4
2-Oct-2012	65.06	159	141	0.89	55	67	27.97	59.42	0.06	1.1	18.65	9
3-Oct-2012	72.63	163	150	0.92	75	82	30.38	75.46	0.04	1.61	23.14	10
8-Oct-2012	73.79	145	139	0.96	71	90	27.52	86.28	0.04	1.49	17.33	7.6
9-Oct-2012	71.86	130	130	1.00	31	56	25.16	56.00	0.04	1.53	21.63	9.4
10-Oct-2012	70.32	179	166	0.93	82	97	29.12	89.96	0.04	1.36	19.37	8.6
11-Oct-2012	68.58	160	137	0.86	60	88	30.18	75.35	0.03	1.33	23.09	8
12-Oct-2012	66.08	159	137	0.86	53	98	30.38	84.44	0.03	1.33	22.33	7.4
13-Oct-2012	63.66	150	124	0.83	73	78	31.04	64.48	0.04	1.39	23.95	8.6
14-Oct-2012	63.98	129	140	1.09	42	59	26.52	64.03	0.03	1.4	22.89	8.2
15-Oct-2012	64.05	156	140	0.90	42	80	27.81	71.79	0.04	1.29	20.16	6.8
16-Oct-2012	63.32	178	153	0.86	39	82	31.14	70.48	0.03	1.26	23.54	7.2
17-Oct-2012	63.41	173	150	0.87	57	96	32.11	83.24	0.09	1.22	23.41	7.4
18-Oct-2012	63.11	156	137	0.88	77	108	34.3	94.85	0.06	1.4	24.47	9.6
19-Oct-2012	62.59	139	120	0.86	32	59	29.76	50.94	0.04	1.12	23.26	9.4
20-Oct-2012	60.00	141	124	0.88	62	80	35.14	70.35	0.04	1.02	23.13	8
21-Oct-2012	59.93	152	151	0.99	114	112	34.49	111.26	0.04	1.28	25.94	13.4
22-Oct-2012	60.11	160	152	0.95	66	82	31.64	77.90	0.04	1.23	24.17	6.6
23-Oct-2012	60.16	169	150	0.89	63	92	33.92	81.66	0.03	1.4	24.35	6
24-Oct-2012	59.97	175	145	0.83	56	86	32.84	71.26	0.13	1.55	23.39	6.4
25-Oct-2012	60.42	176	164	0.93	147	138	43.82	128.59	0.08	1.57	22.74	6.6
26-Oct-2012	59.09	232	172	0.74	65	102	33.88	75.62	0.26	1.4	24.24	7.8
27-Oct-2012	57.71	168	138	0.82	77	94	33.46	77.21	0.15	1.38	23.36	7.8
28-Oct-2012	57.58	149	142	0.95	57	80	33.18	76.24	0.03	1.4	25.25	6.4
29-Oct-2012	57.85	157	135	0.86	53	86	33.03	73.95	0.04	1.26	27.62	6.2
30-Oct-2012	57.20	207	182	0.88	42	101	33.29	88.80		1.54	25.78	5.6
31-Oct-2012	56.76	220	184	0.84	61	119	35.63	99.53	0.05	1.54	27.05	6
1-Nov-2012	57.93	149	138	0.93	81	96	40.04	88.91	0.07	1.1	30.33	5.4
2-Nov-2012	56.68	196	170	0.87	66	96	36.59	83.27	0.05	1.1	26.38	6.8
3-Nov-2012	55.87	194	165	0.85	55	86	37.38	73.14	0.05	1.09	26.81	6
4-Nov-2012	56.41	136	116	0.85	61	63	33.24	53.74	0.04	1.14	26.21	5.8
5-Nov-2012	57.34	189	167	0.88	32	80	32.62	70.69	0.06	1.1	26.75	6.8
6-Nov-2012	57.06	193	166	0.86	54	86	36.08	73.97	0.04	1.12	27.54	7
7-Nov-2012	56.51	184	159	0.86	39	80	36.08	69.13	0.05	1.28	30.78	7.8
8-Nov-2012	56.23	175	167	0.95	68	98	36.95	93.52	0.03	1.35	22.37	7
9-Nov-2012	55.30	217	183	0.84	63	118	35.33	99.51	0.02	1.21	26.35	6.4
10-Nov-2012	54.24	165	144	0.87	49	80	33.65	69.82		1.02	27.06	6.4
11-Nov-2012	54.72	159	144	0.91	140	121	42.63	109.58		1.33	26.87	6.8
12-Nov-2012	56.77	202	185	0.92	69	109	34.3	99.83		1.22	29.34	7.8
13-Nov-2012	56.15	274	240	0.88	90	122	36.09	106.86	0.02	1.41	27.23	7
14-Nov-2012	56.25	233	199	0.85	105	126	39.52	107.61	0.05	1.21	28.91	9.4
15-Nov-2012	55.92	221	210	0.95	72	136	37.72	129.23	0.07	1.29	29.72	7
16-Nov-2012	55.25	242	222	0.92	116	153	41.4	140.36	0.03	1.35	24.95	7
17-Nov-2012	54.02	180	164	0.91	68	97	35.14	88.38	0.03	1.36	26.12	8.8
18-Nov-2012	53.22	147	146	0.99	82	95	36.16	94.35	0.03	1.28	26.6	6.6
19-Nov-2012	55.14	188	171	0.91	121	135	39.1	122.79	0.1	1.21	26.89	6.6
20-Nov-2012	54.85	237	202	0.85	79	139	37.3	118.47	0.04	1.57	25.51	7.8
21-Nov-2012	54.38	212	184	0.87	87	236	36.75	204.83	0.06	1.04	28.42	7.4
22-Nov-2012	50.28	139	122	0.88	70	119	37.42	104.45	0.05	1.17	24.72	9.2
23-Nov-2012	49.02	178	173	0.97	75	136	40	132.18	0.06	0.99	28.41	7.6
24-Nov-2012	50.90	186	170	0.91	71	123	40.6	112.42		0.91	31.03	6.4
25-Nov-2012	52.31	145	143	0.99	54	96	35.88	94.68		1.44	30.63	8
26-Nov-2012	54.75	216	196	0.91	88	116	38.59	105.26	0.03	1.33	30.09	7.8
27-Nov-2012	54.28	239	230	0.96	99	127	37.56	122.22	0.05	1.17	26.2	8.8
28-Nov-2012	54.54	254	225	0.89	65	95	37.45	84.15	0.06	1.06	25.41	7.4
29-Nov-2012	53.96	208	208	1.00	140	148	44.45	148.00		0.98	28.8	8.4
30-Nov-2012	53.61	242	203	0.84	100	137	42.73	114.92	0.01	1.21	27.23	6.6
1-Dec-2012	52.66	211	193	0.91	30	74	36.31	67.69	0.02	1.68	29.45	6.8
2-Dec-2012	53.41	233	171	0.73	94	102	37.8	74.86	0.02	1.54	30.08	7.4
3-Dec-2012	53.93	183	194	1.06	35	76	34.44	80.57	0.06	1.72	25.37	7
4-Dec-2012	54.42	274	257	0.94	133	162	41.58	151.95	0.03	1.42	25.97	7.6
5-Dec-2012	54.27	268	222	0.83	92	162	37.8	134.19	0.07	1.47	26.32	6.4
6-Dec-2012	54.23	279	274	0.98	73	118	40.21	115.89	0.04	1.25	29.05	7.6

7-Dec-2012	53.51	256	216	0.84	90	116	41.63	97.88	0.04	0.95	30.45	6.3
8-Dec-2012	52.71	238	218	0.92	76	108	41.01	98.92	0.02	0.99	32.57	7.6
9-Dec-2012	53.33	167	157	0.94	75	118	36.8	110.93	0.04	1.02	28.64	6
10-Dec-2012	54.68	229	209	0.91	65	120	38.14	109.52	0.04	1.39	29.07	7
11-Dec-2012	55.40	227	200	0.88	34	77	34.03	67.84	0.04	0.96	29.28	6
12-Dec-2012	55.41	334	253	0.76	58	110	38.13	83.32	0.24	1.45	30.07	5.8
13-Dec-2012	55.08	233	204	0.88	114	127	38.36	111.19	0.03	1.4	28.69	5.2
14-Dec-2012	52.94	286	244	0.85	75	132	38.89	112.62	0.07	1.25	26.19	5.4
15-Dec-2012	52.63	200	165	0.83	89	121	38.61	99.83	0.19	1.16	25.91	5
16-Dec-2012	52.98	179	179	1.00	114	145	41.68	145.00	0.04	1.29	26.07	5
17-Dec-2012	53.89	236	237	1.00	41	86	36.85	86.36	0.02	1.24	24.8	4.4
18-Dec-2012	53.83	281	221	0.79	71	126	37.38	99.10	0.01	1.12	27.1	5.2
19-Dec-2012	52.55	301	268	0.89	85	119	39.04	105.95	0.01	1.11	27.22	4.8
20-Dec-2012	53.85	438	410	0.94	83	148	45.15	138.54		1.43	26.45	4.4
21-Dec-2012	53.81	254	232	0.91	38	98	40.04	89.51		1.26	27.34	4.8
22-Dec-2012	50.56	175	142	0.81	136	152	36.04	123.34		1.39	28.89	5.7
23-Dec-2012	50.00	146	147	1.01	84	104	34.25	104.71		1.15	32.46	5.2
24-Dec-2012	50.78	194	162	0.84	114	96	40.62	80.16		1.29	24.73	5.4
25-Dec-2012	47.45	152	133	0.88	142	132	34.02	115.50		1.16	26.7	4.8
26-Dec-2012	52.38	212	185	0.87	94	134	38.73	116.93		1.23	24.28	7.2
27-Dec-2012	52.08	241	212	0.88	70	132	38.63	116.12	0.03	1.43	27.9	6.8
28-Dec-2012	53.03	215	191	0.89	93	141	44.15	125.26	0.04	1.37	29.86	8.6
29-Dec-2012	53.98	183	205	1.12	111	162	52.91	181.48	0.04	1.55	28.15	9.8
30-Dec-2012	52.80	150	131	0.87	140	160	48.36	139.73	0.03	1.36	27.45	10
31-Dec-2012	54.72	208	159	0.76	78	141	42.39	107.78		1.62	28.41	4.8
1-Jan-2013	51.87	139	153	1.10	90	128	39.37	140.89	0.03	1.28	26.05	8.8
2-Jan-2013	54.12	316	275	0.87	45	97	35.84	84.41	0.06	1.44	27.79	9.2
3-Jan-2013	54.05	255	254	1.00	39	125	36.96	124.51	0.04	1.45	26.06	11.2
4-Jan-2013	55.06	286	274	0.96	83	169	35.76	161.91	0.02	1.71	26.26	11
5-Jan-2013	54.00	183	165	0.90	138	171	41.68	154.18	0.02	1.5	28.01	10.8
6-Jan-2013	54.61	150	139	0.93	90	90	35.1	83.40	0.01	1.25	30.27	11.8
7-Jan-2013	55.88	198	180	0.91	59	98	35.84	89.09	0.03	1.44	25	11.8
8-Jan-2013	55.61	250	219	0.88	77	115	37.8	100.74		1.52	25.77	12
9-Jan-2013	55.55	238	210	0.88	82	132	34.5	116.47	0.03	1.64	26.07	11.4
10-Jan-2013	55.54	208	191	0.92	54	82	34.13	75.30	0.06	0.94	23.86	12.2
11-Jan-2013	54.84	751	735	0.98	98	114	41.72	111.57	0.04	1.32	29.02	3.6
12-Jan-2013	54.30	154	128	0.83	91	98	41.3	81.45	0.04	1.41	26.12	8.2
13-Jan-2013	53.97	160	143	0.89	68	91	40.88	81.33	0.07	1.3	28.26	9.8
14-Jan-2013	54.69	184	169	0.92	55	94	36.28	86.34	0.04	1.15	26.93	7.6
15-Jan-2013	54.68	259	227	0.88	56	115	33.99	100.79		1.36	27.5	7
16-Jan-2013	54.82	293	250	0.85	114	163	38.93	139.08	0.18	1.51	24.14	7.8
17-Jan-2013	54.95	220	212	0.96	96	148	37.26	142.62	0.06	1.77	24.52	7.2
18-Jan-2013	53.25	230	210	0.91	55	118	36.98	107.74	0.05	1.51	23.19	7.4
19-Jan-2013	52.62	161	160	0.99	55	111	41.77	110.31	0.02	1.87	28.72	7.2
20-Jan-2013	52.41	170	162	0.95	89	103	41.63	98.15	0.02	1.22	26.77	7
21-Jan-2013	54.07	174	166	0.95	94	118	36.89	112.57	0.05	1.05	29.37	8.6
22-Jan-2013	53.92	317	275	0.87	70	141	39.54	122.32	0.04	1.11	31.94	8
23-Jan-2013	53.36	312	268	0.86	53	125	39.41	107.37	0.07	1.1	28.3	7.8
24-Jan-2013	53.51	306	279	0.91	65	144	42.18	131.29	0.07	0.86	30.6	8
25-Jan-2013	53.18	200	152	0.76	53	110	42.04	83.60	0.03	1.53	33.72	8.8
26-Jan-2013	53.19	156	131	0.84	166	164	47.34	137.72	0.06	1.28	35.04	11.2
27-Jan-2013	53.62	179	157	0.88	61	100	39.38	87.71	0.05	1.76	36.06	11
28-Jan-2013	53.88	249	230	0.92	83	140	39.35	129.32	0.04	0.96	29.8	8
29-Jan-2013	53.93	382	316	0.83	145	220	42.28	181.99	0.05	1.16	28.1	8.2
30-Jan-2013	54.08	252	204	0.81	44	108	33.15	87.43	0.04	1.02	26.77	8.6
31-Jan-2013	53.86	195	176	0.90	66	110	36.96	99.28	0.05	1.85	26.57	8.2
1-Feb-2013	51.95	217	200	0.92	70	144	38.3	132.72	0.02	1.76	27.59	8.6
2-Feb-2013	51.87	232	159	0.69	41	77	37.48	52.77		1.4	29.92	8.8
3-Feb-2013	51.73	197	166	0.84	53	120	35.93	101.12	0.01	1.77	29.27	8.2
4-Feb-2013	53.08	293	266	0.91	42	115	38.37	104.40	0.01	1.13	30.17	7.8
5-Feb-2013	51.70	439	433	0.99	54	132	39.04	130.20	0.13	1.21	29.01	9
6-Feb-2013	52.97	437	402	0.92	50	142	36.4	130.63	0.04	0.95	23.66	9
7-Feb-2013	53.10	268	256	0.96	79	149	40.67	142.33	0.03	1.29	24.66	8.8
8-Feb-2013	53.28	246	209	0.85	54	118	36.98	100.25	0.42	1.85	26.27	10
9-Feb-2013	51.59	197	157	0.80	72	110	41.28	87.66	0.03	1.23	26.2	6.2
10-Feb-2013	52.14	164	158	0.96	117	127	44.88	122.35	0.05	1.14	30.55	6.6
11-Feb-2013	53.16	190	184	0.97	36	106	38.62	102.65	0.05	1.13	31.27	7.2
12-Feb-2013	53.21	226	194	0.86	83	148	39.35	127.04	0.08	1.08	27.33	7.2
13-Feb-2013	53.78	312	287	0.92	62	150	40.61	137.98	0.04	1.49	27.38	5.8
14-Feb-2013	54.23	328	276	0.84	121	162	44.41	136.32	0.13	1.37	27.94	5.8
15-Feb-2013	53.42	206	194	0.94	82	150	42.05	141.26	0.05	1.22	29.18	7.8
16-Feb-2013	52.57	202	167	0.83	122	140	43.95	115.74	0.05	1.22	28.39	3
17-Feb-2013	52.53	156	145	0.93	129	140	44.17	130.13	0.05	1.03	29.3	3.6
18-Feb-2013	53.62	212	188	0.89	59	129	41.5	114.40	0.06	1.36	28.97	3.6
19-Feb-2013	53.29	244	220	0.90	57	130	40.13	117.21	0.06	1.11	28.19	4.4
20-Feb-2013	54.04	268	306	1.14	70	148	42	168.99		1.54	29	8.8
21-Feb-2013	53.90	200	173	0.87	94	138	41.08	119.37	0.03	1.63	28.78	3.6
22-Feb-2013	52.90	188	159	0.85	39	124	42.48	104.87	0.01	0.76	26.01	3.8
23-Feb-2013	50.86	182	170	0.93	72	104	44.46	97.14	0.02	0.93	33.17	3.4
24-Feb-2013	53.01	172	163	0.95	152	143	44.18	135.52	0.01	0.9	30.88	4.4
25-Feb-2013	53.75	260	228	0.88	73	107	36.64	93.83	0.01	0.89	26.75	3.4
26-Feb-2013	54.54	221	208	0.94	48	130	39.15	122.35	0.01	1.26	26.92	3.8
27-Feb-2013	53.80	212	199	0.94	168	159	49.47	149.25	0.06	1.13	24.39	15.8

28-Feb-2013	53.01	262	228	0.87	76	154	45	134.02		1.47	30.24	4.2
1-Mar-2013	52.00	226	180	0.80	71	162	44.72	129.03	0.08	1.12	32.57	3.3
2-Mar-2013	50.93	221	182	0.82	55	118	39.42	97.18	0.07	0.91	29.25	3.8
3-Mar-2013	51.01	175	159	0.91	70	131	41.51	119.02	0.06	1.23	31.33	4.6
4-Mar-2013	52.38	217	177	0.82	69	102	40.27	83.20	0.06	0.91	30.18	3.6
5-Mar-2013	52.71	313	278	0.89	116	194	44.79	172.31	0.06	1.07	30.52	3.6
6-Mar-2013	53.10	185	172	0.93	82	172	45.66	159.91	0.04	1.23	26.45	5.6
7-Mar-2013	52.78	201	192	0.96	115	161	48.04	153.79	0.04	0.91	31.66	3.2
8-Mar-2013	51.94	191	172	0.90	147	191	49.06	172.00	0.13	1.15	30.07	2.2
9-Mar-2013	50.59	177	169	0.95	58	130	42.7	124.12	0.07	0.98	30.46	2.6
10-Mar-2013	50.33	137	131	0.96	30	88	41.26	84.15	0.03	0.82	31.49	3
11-Mar-2013	51.62	225	194	0.86	85	163	41.3	140.54	0.03	1.05	29.12	3.4
12-Mar-2013	52.31	216	177	0.82	60	137	38.51	112.26	0.04	1.01	25.99	3.4
13-Mar-2013	51.59	232	199	0.86	182	216	55.55	185.28	0.03	0.98	27.72	2.8
14-Mar-2013	51.26	210	188	0.90	95	136	42.98	121.75	0.06	1.05	28.84	4
15-Mar-2013	51.24	214	208	0.97	107	180	43.74	174.95	0.01	1.19	26.52	3.4
16-Mar-2013	50.66	175	156	0.89	67	146	42.98	130.15	0.03	1.15	28.02	2.6
17-Mar-2013	51.48	155	144	0.93	58	137	40.75	127.28	0.02	1.08	29.4	3.4
18-Mar-2013	53.13	212	196	0.92	75	156	34.27	144.23	0.04	1	26.43	3.4
19-Mar-2013	52.84	203	193	0.95	59	154	37.84	146.41	0.03	1.37	24.98	3.6
20-Mar-2013	53.01	248	222	0.90	52	137	41.5	122.64	0.03	1.05	27.97	3
21-Mar-2013	52.44	247	226	0.91	37	134	40.19	122.61	0.34	1.33	28.19	3
22-Mar-2013	54.68	204	181	0.89	71	142	38.6	125.99	0.11	1.07	28.62	3.4
23-Mar-2013	57.47	152	130	0.86	58	102	35.95	87.24	0.03	0.98	28.19	4.2
24-Mar-2013	54.39	131	120	0.92	40	94	36.86	86.11	0.04	1.02	29.17	4
25-Mar-2013	54.39	219	212	0.97	52	113	36.46	109.39	0.01	0.98	30.39	3.6
26-Mar-2013	53.29	201	170	0.85	59	120	40.19	101.49	0.01	1.06	28.59	4.2
27-Mar-2013	53.05	207	196	0.95	126	200	47.79	189.37	0.06	1.22	31.32	4.4
28-Mar-2013	52.48	207	191	0.92	75	158	41.72	145.79	0.06	1.23	30.03	4.6
29-Mar-2013	52.36	236	212	0.90	78	154	42.03	138.34	0.03	1.01	30.51	3.8
30-Mar-2013	51.29	176	160	0.91	97	152	40.35	138.18	0.04	0.88	29.1	4.2
31-Mar-2013	50.84	205	188	0.92	48	125	36.78	114.63	0.03	0.91	32.76	3.8
1-Apr-2013	52.49	212	189	0.89	67	102	38.37	90.93	0.05	1.21	29.59	4.4
2-Apr-2013	53.71	256	238	0.93	103	132	42.98	122.72	0.04	1.23	35.35	6.2
3-Apr-2013	54.95	218	188	0.86	78	114	40.12	98.31	0.02	1.33	34.68	7.6
4-Apr-2013	54.93	229	214	0.93	91	114	35.16	106.53	0.11	1.28	30.2	7.4
5-Apr-2013	55.91	176	160	0.91	82	122	37.11	110.91	0.04	1.11	31.45	6.4
6-Apr-2013	53.36	251	221	0.88	71	116	40.75	102.14	0.1	1.36	33.85	5.6
7-Apr-2013	53.51	186	168	0.90	53	106	35.72	95.74	0.03	1.2	35.78	4.4
8-Apr-2013	53.83	163	154	0.94	71	139	39.63	131.33	0.03	1.1	25.51	5
9-Apr-2013	52.95	210	182	0.87	90	166	41.45	143.87	0.06	1.15	25.46	4.8
10-Apr-2013	52.89	179	176	0.98	60	118	44.12	116.02	0.04	1.26	31.24	5.2
11-Apr-2013	53.50	208	196	0.94	151	209	45.82	196.94	0.04	1.28	31.95	5
12-Apr-2013	53.12	220	204	0.93	83	157	39.79	145.58	0.04	1.05	25.34	4.5
13-Apr-2013	51.50	178	165	0.93	113	158	40	146.46	0.04	1.24	27.55	4.2
14-Apr-2013	51.62	114	110	0.96	140	143	45.4	137.98	0.03	1.19	27.56	5
15-Apr-2013	52.35	220	200	0.91	59	119	37.02	108.18	0.03	1.08	28.36	4.2
16-Apr-2013	52.57	202	170	0.84	97	157	42.82	132.13	0.03	1.19	26.61	4.4
17-Apr-2013	52.48	181	176	0.97	102	144	43.54	140.02	0.43	1.6	30.66	4.4
18-Apr-2013	52.57	206	214	1.04	110	158	40.47	164.14	0.03	1.19	27.82	5
19-Apr-2013	53.12	282	228	0.81	97	143	41.73	115.62	0.05	1.33	29.17	4.2
20-Apr-2013	50.86	174	166	0.95	129	165	42.42	157.41	0.04	1.1	32.01	4.2
21-Apr-2013	51.43	180	175	0.97	37	76	37.95	73.89	0.05	1.05	31.01	4
22-Apr-2013	52.49	187	188	1.01	184	200	46.96	201.07	0.04	1.2	30.7	4
23-Apr-2013	52.40	216	177	0.82	268	162	57.14	132.75	0.03	1.23	29.18	4.8
24-Apr-2013	52.47	236	218	0.92	46	98	37.95	90.53	0.03	1.19	29.37	3.8
25-Apr-2013	52.73	196	182	0.93	106	164	43.54	152.29	0.05	1.26	28.49	4.4
26-Apr-2013	52.15	199	178	0.89	98	139	39.07	124.33	0.03	1.13	29.64	4.2
27-Apr-2013	51.01	186	164	0.88	69	110	39.35	96.99	0.03	0.99	29.93	5.2
28-Apr-2013	51.10	175	155	0.89	102	124	39.23	109.83	0.03	1.21	29.61	4.4
29-Apr-2013	52.43	173	162	0.94	135	164	45.97	153.57		1.31	27.52	4.6
30-Apr-2013	66.23	218	202	0.93	62	108	36.49	100.07	0.22	1.65	31.79	7.6
1-May-2013	63.24	153	139	0.91	76	122	36.93	110.84	0.03	1.51	24.16	4.6
2-May-2013	64.28	132	132	1.00	53	82	32.99	82.00	0.03	1.33	29.49	4
3-May-2013	61.39	129	108	0.84	220	166	47.26	138.98	0.01	1.15	25.29	4.6
4-May-2013	58.91	101	88	0.87	78	98	33.66	85.39	0.01	1.05	25.35	3.6
5-May-2013	57.26	97	86	0.89	71	110	35.38	97.53	0.01	1.12	25.77	4.2
6-May-2013	57.34	208	181	0.87	91	122	37	106.16	0.04	1.12	25.79	4.4
7-May-2013	56.57	191	192	1.01	116	138	38.23	138.72	0.05	1.21	23.75	6.2
8-May-2013	56.30	142	127	0.89	60	94	37.23	84.07	0.03	1.35	23.27	6
9-May-2013	56.00	156	143	0.92	77	108	37.17	99.00	0.03	1.23	23.09	7.2
10-May-2013	55.02	192	148	0.77	166	187	47.47	144.15		1.11	27.15	7
11-May-2013	54.14	140	124	0.89	74	129	37.66	114.26	0.06	1.08	25.89	6.4
12-May-2013	52.93	152	124	0.82	85	120	34.58	97.89	0.01	0.94	26.04	7.2
13-May-2013	54.19	189	167	0.88	60	86	33.49	75.99	0.05	1.2	29.81	4.8
14-May-2013	53.90	210	179	0.85	106	150	40.56	127.86	0.03	1.26	27.64	5.8
15-May-2013	54.02	187	167	0.89	110	145	46.05	129.49	0.1	1.34	29.8	8.6
16-May-2013	53.96	173	150	0.87	79	114	41.67	98.84	0.03	1.19	28.08	6.2
17-May-2013	53.44	175	152	0.87	99	136	48.91	118.13	0.04	0.98	26.76	5.4
18-May-2013	52.07	151	127	0.84	166	103	35.84	86.63	0.02	1.12	22.45	5.2
19-May-2013	52.16	151	130	0.86	33	75	28.73	64.57	0.04	0.86	21.55	4.6
20-May-2013	54.50	169	154	0.91	112	128	38.2	116.64	0.05	1.25	20.2	5.4
21-May-2013	58.66	188	166	0.88	49	83	34.74	73.29	0.03	1.21	23.06	6

22-May-2013	56.61	172	152	0.88	61	86	34.47	76.00	1.57	2.47	19.02	4.4
23-May-2013	56.61	180	161	0.89	79	87	34.88	77.82	0.04	1.21	22.68	5.6
24-May-2013	53.33	129	114	0.88	127	141	40.86	124.60	0.05	1.13	23.82	3.8
25-May-2013	51.52	166	135	0.81	104	135	37.06	109.79	0.04	1.21	23.52	4
26-May-2013	49.16	138	129	0.93	113	123	37.68	114.98	0.04	1.09	25.38	5
27-May-2013	50.39	123	113	0.92	67	98	33.77	90.03	0.04	1.19	24.07	5.8
28-May-2013	52.36	147	136	0.93	222	140	43.65	129.52	0.04	1.07	23.56	5.2
29-May-2013	52.74	184	166	0.90	64	110	37.12	99.24	0.04	1.22	24.01	5.6
30-May-2013	51.70	236	186	0.79	79	110	39.21	86.69		1.14	25.15	5.8
31-May-2013	51.10	162	164	1.01	106	137	40.83	138.69	0.04	1.17	28.36	5.8
1-Jun-2013	48.89	127	122	0.96	65	93	36.14	89.34	0.05	1.24	28.03	5.6
2-Jun-2013	62.65	124	90	0.73	73	72	27.49	52.26	0.45	1.75	20.42	6.4
3-Jun-2013	57.89	127	124	0.98	61	84	31.31	82.02	0.03	1.62	21.99	5.8
4-Jun-2013	56.18	152	133	0.88	58	92	32.34	80.50	0.05	1.41	22.5	6.2
5-Jun-2013	54.91	175	152	0.87	107	127	38.23	110.31	0.05	1.44	23.32	6
7-Jun-2013	67.54	122	98	0.80	92	97	27.07	77.92	0.17	1.42	16.53	5.8
8-Jun-2013	66.15	96	87	0.91	88	107	30.14	96.97	0.14	1.35	17.72	5.2
9-Jun-2013	72.24	87	82	0.94	86	73	23.3	68.80	0.06	1.49	17.29	7.2
10-Jun-2013	68.92	111	103	0.93	81	94	26.72	87.23	0.47	2.05	16.16	7.8
11-Jun-2013	68.82	102	84	0.82	54	70	25.12	57.65	0.02	1.5	17.04	6.6
12-Jun-2013	64.92	125	123	0.98	68	86	29.9	84.62	0.07	1.58	20.16	5.4
13-Jun-2013	62.04	123	122	0.99	100	96	30.09	95.22	0.04	1.57	19.82	5
14-Jun-2013	59.62	115	105	0.91	87	96	30.1	87.65	0.03	1.15	20.48	4.8
15-Jun-2013	56.49	140	123	0.88	97	98	34.29	86.10	0.02	0.98	22.89	4.2
16-Jun-2013	57.65	90	84	0.93	83	98	29.74	91.47	0.02	1.1	20.35	4
17-Jun-2013	60.44	122	113	0.93	42	70	28.05	64.84	0.02	1.22	22	7
18-Jun-2013	58.05	137	124	0.91	104	126	33.41	114.04	0.06	1.19	22.09	4.4
19-Jun-2013	63.20	176	157	0.89	77	93	30.77	82.96	0.05	1.19	22.57	5
20-Jun-2013	64.07	125	110	0.88	93	105	28.43	92.40	0.04	1.11	19.59	5
21-Jun-2013	63.83	132	114	0.86	86	105	32.28	90.68	0.03	1.24	20.05	3.4
22-Jun-2013	63.99	219	115	0.53	87	85	26.18	44.63	0.02	1.35	17.59	5
23-Jun-2013	61.31	108	84	0.78	48	71	26.28	55.22	0.03	1.58	19.85	11.2
24-Jun-2013	59.88	107	92	0.86	106	81	32.73	69.64	0.06	1.67	20.75	6.8
25-Jun-2013	58.21	133	111	0.83	104	101	33.85	84.29	0.04	1.52	21.07	6.4
26-Jun-2013	60.77	123	116	0.94	89	118	33.24	111.28	0.07	1.47	22.58	5.2
27-Jun-2013	62.39	136	112	0.82	83	100	30.28	82.35		1.39	21	5.6
28-Jun-2013	62.70	132	113	0.86	85	112	30.56	95.88	0.06	1.26	23.01	4.6
29-Jun-2013	67.66	120	116	0.97	53	91	26.84	87.97	0.06	1.47	23.26	7
9-Jul-2013	72.07	113	88	0.78	76	83	26.51	64.64	0.01	1.28	16.6	5.2
10-Jul-2013	73.53	122	114	0.93	68	85	28.21	79.43	0.03	1.47	15.84	5.4
15-Jul-2013	74.89	104	87	0.84	86	80	26	66.92	0.04	1.4	15.32	5.4
16-Jul-2013	72.06	102	91	0.89	82	89	26.27	79.40	0.08	1.05	15.44	5.6
17-Jul-2013	74.42	108	111	1.03	83	82	26.08	84.28	0.07	1.43	14.86	5.2
20-Jul-2013	74.98	80	74	0.93	66	95	23.81	87.88	0.06	1.6	14.44	5.4
21-Jul-2013	71.65	77	65	0.84	75	76	25.41	64.16	0.06	1.53	15.49	5.8
22-Jul-2013	70.36	111	103	0.93	72	78	25.32	72.38	0.05	1.47	18.36	6.6
23-Jul-2013	74.59	141	122	0.87	116	108	27.71	93.45	0.06	1.58	16.35	5.8
28-Jul-2013	73.32	74	67	0.91	72	78	23.33	70.62	0.04	1.53	16.03	5
29-Jul-2013	73.53	109	100	0.92	66	88	23.79	80.73	0.05	1.28	15.82	6
30-Jul-2013	73.54	119	102	0.86	82	87	23.72	74.57	0.03	1.62	12.47	5.8
3-Aug-2013	73.12	93	75	0.81	83	92	26.21	74.19	0.04	1.32	16.02	6.4
4-Aug-2013	71.14	63	53	0.84	88	82	24.83	68.98	0.04	1.33	15.7	6.4
5-Aug-2013	71.00	97	76	0.78	79	64	23.46	50.14	0.03	1.43	14.98	6.4
6-Aug-2013	72.86	128	104	0.81	111	84	25.46	68.25		1.51	11.9	7
13-Aug-2013	72.98	123	114	0.93	92	95	25.25	88.05	0.04	1.4	12.09	5.8
14-Aug-2013	73.13	118	98	0.83	103	112	24.76	93.02	0.06	1.53	12.3	6
15-Aug-2013	72.10	90	85	0.94	96	149	24.95	140.72	0.03	1.28	12.32	5.8
16-Aug-2013	69.47	77	70	0.91	100	124	25.12	112.73	0.04	1.15	10.28	5.3
17-Aug-2013	69.61	91	77	0.85	99	96	26.37	81.23	0.05	1.3	12.95	6.6
18-Aug-2013	73.52	80	66	0.83	111	103	26.88	84.98	0.03	1.37	12.4	6.8
28-Aug-2013	74.79	108	95	0.88	90	136	28.22	119.63	0.04	1.4	12.78	6.6
29-Aug-2013	73.15	109	111	1.02	88	120	28.75	122.20	0.02	1.35	13.59	6.4
30-Aug-2013	74.11	109	95	0.87	68	123	27.12	107.20	0.03	0.98	11.82	6.4
31-Aug-2013	72.66	89	78	0.88	101	128	26.74	112.18	0.03	1.03	11.78	5.2
1-Sep-2013	68.45	67	67	1.00	79	98	25.55	98.00	0.03	1.56	11.71	5.8
2-Sep-2013	67.19	70	84	1.20	116	134	27.58	160.80	0.03	1.12	14.92	6.4
3-Sep-2013	69.77	120	111	0.93	157	118	33.42	109.15	0.03	1.55	12.11	5.4
4-Sep-2013	70.07	130	122	0.94	86	110	29.02	103.23	0.03	1.42	10.41	5.8
5-Sep-2013	70.33	115	120	1.04	106	127	30.17	132.52	0.05	1.35	10.59	6.2
6-Sep-2013	67.62	131	117	0.89	106	132	30.09	117.89	0.04	1.22	13.38	5.5
7-Sep-2013	65.77	99	98	0.99	114	145	30.47	143.54	0.04	1.4	13.77	5.2
8-Sep-2013	64.79	93	98	1.05	103	125	29.25	131.72	0.04	1.34	15.33	5.8
9-Sep-2013	64.89	124	129	1.04	122	136	30.22	141.48	0.02	1.32	13.75	6
10-Sep-2013	63.97	160	153	0.96	73	96	27.25	91.80	0.04	1.44	11.36	5.6
11-Sep-2013	63.16	134	122	0.91	76	112	29.11	101.97	0.04	1.33	13.03	5
12-Sep-2013	64.82	135	122	0.90	86	118	31.29	106.64	0.04	1.36	13.66	5.6
13-Sep-2013	66.61	152	150	0.99	46	65	26.69	64.14	0.02	1.09	15.04	6.2
14-Sep-2013	65.07	85	87	1.02	56	71	27.15	72.67	0.03	1.3	13.82	4.8
15-Sep-2013	65.37	85	81	0.95	108	110	31.16	104.82	0.03	1.16	14.55	4.8
16-Sep-2013	65.11	123	126	1.02					0.03	1.35	16.48	5.8
17-Sep-2013	63.95	147	154	1.05	62	125	28.86	130.95	0.05	1.31	14.77	6
18-Sep-2013	63.58	146	151	1.03	122	168	31.91	173.75	0.04	1.25	13.03	4.8
19-Sep-2013	64.78	144	142	0.99	163	192	36.28	189.33	0.06	1.3	14.79	6.8

20-Sep-2013	67.52	122	124	1.02	66	90	29.12	91.48	0.04	1.13	13.08	5.4
21-Sep-2013	62.94	100	89	0.89	82	138	30.06	122.82	0.03	1.41	11.83	4.6
22-Sep-2013	63.60	109	97	0.89	103	152	31.03	135.27	0.03	1.02	10.04	4.8
23-Sep-2013	70.24	127	124	0.98	206	176	40.68	171.84	0.03	1.19	12.94	4.6
29-Sep-2013	74.01	73	72	0.99	80	114	27.07	112.44	0.03	1.4	13.59	5.2
30-Sep-2013	72.33	96	93	0.97	57	99	24.98	95.91	0.02	1.4	12.59	5.2
1-Oct-2013	70.70	93	95	1.02	273	189	44.61	193.06	0.03	1.28	13.03	4.4
2-Oct-2013	68.93	132	120	0.91	244	178	41.44	161.82	0.04	1.27	12.97	4.8
3-Oct-2013	67.55	123	115	0.93	180	158	35.5	147.72	0.06	1.21	13.6	4.6
4-Oct-2013	66.37	147	138	0.94	173	52	37.54	48.82	0.05	1.1	15.77	6
5-Oct-2013	64.24	90	84	0.93	233	197	38.58	183.87	0.05	1.21	15.13	4.4
6-Oct-2013	64.08	97	92	0.95	320	207	45.69	196.33	0.06	1.26	14.3	5.6
7-Oct-2013	71.02	116	119	1.03	294	225	46.55	230.82	0.14	1.35	14.11	5.6
8-Oct-2013	71.20	166	164	0.99	203	172	38.37	169.93	0.1	1.47	16.17	6.8
9-Oct-2013	67.43	143	128	0.90	126	120	31.97	107.41	0.06	1.4	12.81	5.8
10-Oct-2013	64.18	132	131	0.99	88	105	30.22	104.20	0.03	1.32	14.38	6
11-Oct-2013	64.06	132	129	0.98	99	108	33.07	105.55	0.06	1.36	12.89	8.8
12-Oct-2013	62.03	81	81	1.00	108	93	31.6	93.00	0.06	1.29	14.72	4.4
13-Oct-2013	62.40	87	85	0.98	96	135	30.37	131.90	0.04	1.36	14.22	4.8
14-Oct-2013	62.30	183	198	1.08	134	184	36.14	199.08	0.03	1.42	13.28	5.2
15-Oct-2013	61.90	143	138	0.97	95	141	33.69	136.07	0.06	1.64	12.85	5
16-Oct-2013	61.28	147	130	0.88	109	156	34.05	137.96	0.01	1.31	12.16	4.6
17-Oct-2013	60.69	206	180	0.87	119	197	38.04	172.14	0.03	1.19	14.47	4.6
18-Oct-2013	60.12	151	148	0.98	120	189	37.79	185.25	0.04	1.1	14.98	2.2
19-Oct-2013	58.82	93	86	0.92	94	130	34.08	120.22	0.02	1	14.89	6.2
20-Oct-2013	58.63	102	101	0.99	102	140	32.82	138.63	0.04	1.21	15.71	3.6
21-Oct-2013	59.84	144	135	0.94	82	122	32.08	114.38	0.03	0.86	15.88	3.8
22-Oct-2013	60.21	182	166	0.91	98	166	36.09	151.41	0.03	1.4	13.7	3.8
23-Oct-2013	60.40	188	164	0.87	115	189	36.32	164.87	0.03	1.26	12.41	3.6
24-Oct-2013	58.58	170	154	0.91	255	186	49.34	168.49	0.06	1.23	12.79	4
25-Oct-2013	58.75	159	148	0.93	69	108	33.95	100.53	0.06	1.14	15.16	3.2
26-Oct-2013	56.60	129	117	0.91	79	142	34.37	128.79	0.05	1.24	16.1	5.8
27-Oct-2013	56.81	114	102	0.89	58	101	31.72	90.37	0.05	1.31	16.39	4.2
28-Oct-2013	57.22	217	198	0.91	129	180	36.63	164.24	0.04	1.15	16.48	4.2
29-Oct-2013	58.06	165	160	0.97	106	173	38.07	167.76	0.03	1.26	14.67	4.2
30-Oct-2013	58.08	154	149	0.97	137	206	39.35	199.31	0.04	1.3	14.67	4
31-Oct-2013	56.38	223	205	0.92	121	175	39.87	160.87	0.23	1.45	15.59	4.2
1-Nov-2013	56.46	148	147	0.99	124	177	38.03	175.80	0.1	1.26	13.72	3.8
2-Nov-2013	59.02	114	113	0.99	99	163	36.28	161.57	0.06	1.37	16.36	4.9
3-Nov-2013	57.79	111	112	1.01	98	172	33.77	173.55	0.05	1.49	16.58	5
4-Nov-2013	57.50	148	141	0.95	120	118	37.85	112.42	0.04	1.4	15.4	5
5-Nov-2013	57.88	166	163	0.98	128	153	39.68	150.23	0.05	1	16.17	4.8
6-Nov-2013	58.00	166	149	0.90	143	187	41.16	167.85	0.06	1.6	14.59	5.6
7-Nov-2013	57.48	155	151	0.97	129	209	40.61	203.61	0.04	1.33	15.64	4.6
8-Nov-2013	56.76	150	148	0.99	110	158	37.68	155.89	0.04	1.4	15.14	5.4
9-Nov-2013	54.83	138	153	1.11	53	107	33.91	118.63	0.05	1.33	16.2	5
10-Nov-2013	54.40	105	97	0.92	85	130	35.5	120.10	0.05	1.4	16.95	5.6
11-Nov-2013	56.53	125	139	1.11	128	188	38.84	209.06	0.05	1.53	16.77	5
12-Nov-2013	56.49	182	178	0.98	116	154	39.63	150.62	0.05	1.53	15.75	4.2
13-Nov-2013	55.14	147	144	0.98	114	156	38.87	152.82		1.4	17.56	5.4
14-Nov-2013	54.90	183	188	1.03	47	104	35.5	106.84	0.06	1.17	18.04	4.2
15-Nov-2013	54.78	189	186	0.98	119	161	41.02	158.44	0.06	1.31	19.28	3.8
16-Nov-2013	55.27	153	144	0.94	111	161	39.87	151.53	0.05	1.38	17.55	4.6
17-Nov-2013	56.04	108	113	1.05	115	156	36.98	163.22	0.06	1.33	19.84	4.6
18-Nov-2013	56.50	158	158	1.00	51	102	34.74	102.00	0.06	1.42	20.06	4.8
19-Nov-2013	57.39	173	169	0.98	298	269	53.92	262.78	0.04	1.26	19.59	4.8
20-Nov-2013	55.89	144	134	0.93	79	132	40.17	122.83	0.06	1.33	17.28	4.4
21-Nov-2013	55.91	149	147	0.99	141	176	44.4	173.64	0.05	1.12	18.52	4.6
22-Nov-2013	55.22	160	158	0.99	205	218	50.27	215.28	0.06	1.25	18.33	3.8
23-Nov-2013	54.14	132	123	0.93	208	83	48.63	77.34	0.04	1.32	15.69	4.2
24-Nov-2013	52.97	105	101	0.96	196	220	47.72	211.62	0.05	1.22	18.75	4.6
25-Nov-2013	53.87	161	164	1.02	178	226	47.62	230.21	0.04	1.29	20.12	4
26-Nov-2013	55.24	188	172	0.91	147	213	44.63	194.87	0.04	1.21	17.92	4.6
27-Nov-2013	56.44	220	192	0.87	168	234	46.88	204.22	0.08	1.35	15.89	4.8
28-Nov-2013	50.78	147	149	1.01	107	198	41.78	200.69	0.08	1.36	15.83	4.4
29-Nov-2013	50.00	147	150	1.02	113	179	40.94	182.65	0.06	1.47	19.49	3.8
30-Nov-2013	51.68	124	120	0.97	74	138	40.27	133.55	0.03	1.44	18.62	3.8
1-Dec-2013	53.19	124	122	0.98	71	144	38.37	141.68	0.05	1.36	19.14	3.6
2-Dec-2013	54.63	194	173	0.89	121	155	44.37	138.22	0.08	1.4	21.33	3.4
3-Dec-2013	55.00	200	186	0.93	79	158	41.94	146.94	0.06	1.4	17.14	4
4-Dec-2013	55.17	193	174	0.90	300	190	62.61	171.30	0.04	1.09	18.34	4.2
5-Dec-2013	55.05	193	182	0.94	105	170	43.34	160.31	0.08	1.53	18.2	5.6
6-Dec-2013	54.80	189	173	0.92	93	133	41.39	121.74	0.08	1.3	14.82	4.8
7-Dec-2013	53.95	114	113	0.99	64	124	39.99	122.91	0.06	1.37	15.25	5
8-Dec-2013	54.38	130	119	0.92	102	119	39.92	108.93	0.06	1.44	15.93	4.2
9-Dec-2013	55.04	178	174	0.98	81	114	38.98	111.44	0.07	1.4	19.55	3.6
10-Dec-2013	54.93	222	210	0.95	61	125	39.76	118.24	0.06	1.18	17.95	3.8
11-Dec-2013	54.40	202	186	0.92	72	133	37.68	122.47	0.08	0.97	17.96	4.2
12-Dec-2013	53.30	184	180	0.98	58	128	40.56	125.22	0.04	1.47	16.17	5
13-Dec-2013	52.78	207	199	0.96	52	126	38.16	121.13	0.06	1.25	19.33	4.4
14-Dec-2013	53.66	136	132	0.97	57	116	37.59	112.59	0.04	1.35	21.35	5.4
15-Dec-2013	54.44	144	140	0.97	33	78	33.77	75.83	0.04	1.44	21.59	3.8
16-Dec-2013	53.32	190	189	0.99	50	129	35.72	128.32	0.04	1.05	18.71	3.8

17-Dec-2013	52.85	192	180	0.94	43	122	37.06	114.38	0.06	1.35	16.56	3.4
18-Dec-2013	53.22	225	190	0.84	56	126	36.5	106.40	0.06	1.42	16.92	3.6
19-Dec-2013	53.10	218	225	1.03	47	123	37.36	126.95	0.06	1.47	15.72	3.8
20-Dec-2013	53.25	240	232	0.97	65	134	39.11	129.53	0.06	1.22	16.9	3.8
21-Dec-2013	52.21	163	155	0.95	95	128	42.4	121.72	0.06	1.16	16.15	5
22-Dec-2013	51.50	157	149	0.95	87	124	41.69	117.68	0.06	1.19	15.57	2.8
23-Dec-2013	52.37	199	188	0.94	45	107	35.36	101.09	0.07	1.11	15.77	4.6
24-Dec-2013	51.47	192	187	0.97	110	111	39.13	108.11	0.08	1.39	16.92	5
25-Dec-2013	47.08	136	125	0.92	84	118	35.17	108.46	0.06	1.36	13.82	3.4
26-Dec-2013	51.17	215	205	0.95	58	110	36.98	104.88	0.06	1.21	15.31	10.8
27-Dec-2013	51.82	182	185	1.02	87	148	40.48	150.44	0.06	1.37	17.41	5.4
28-Dec-2013	51.40	166	158	0.95	35	98	33.94	93.28	0.06	1.47	16.18	5.2
29-Dec-2013	53.23	125	112	0.90	87	115	36.33	103.04	0.06	1.5	15.26	4.6
30-Dec-2013	54.38	145	137	0.94	50	104	34.88	98.26	0.04	1.29	17.41	5.6
31-Dec-2013	55.34	155	149	0.96	43	96	35.06	92.28	0.06	1.35	16.64	2
1-Jan-2014	51.15	130	116	0.89	49	111	34.88	99.05	0.06	1.44	16	4.8
2-Jan-2014	55.56	182	187	1.03	56	108	36.84	110.97	0.06	1.19	16.78	5.6
3-Jan-2014	54.63	220	214	0.97	105	138	41.02	134.24	0.07	1.49	19.03	7
4-Jan-2014	53.24	111	108	0.97	77	114	39.28	110.92	0.07	1.4	17.5	5.6
5-Jan-2014	54.51	109	102	0.94	59	91	35.86	85.16	0.07	1.47	18.77	5.4
6-Jan-2014	54.70	144	137	0.95	37	78	33.58	74.21	0.04	1.24	17.09	5.6
7-Jan-2014	53.56	164	143	0.87	48	103	39.31	89.81	0.07	1.53	17.17	6.2
8-Jan-2014	53.92	275	250	0.91	87	138	41.12	125.45	0.05	1.65	17.48	5.6
9-Jan-2014	55.22	224	202	0.90	45	127	38.51	114.53	0.04	1.57	17.05	5.6
10-Jan-2014	55.39	278	272	0.98	53	123	37.4	120.35	0.06	1.44	16.33	6.2
11-Jan-2014	54.80	164	151	0.92	54	105	37.34	96.68	0.06	1.55	17.86	5.8
12-Jan-2014	54.57	119	111	0.93	75	109	33.49	101.67	0.06	1.51	16.93	5.6
13-Jan-2014	54.88	202	174	0.86	34	76	34.68	65.47	0.03	1.41	16.8	5.4
14-Jan-2014	55.62	229	210	0.92	59	106	38.59	97.21	0.04	1.63	19.09	7.2
15-Jan-2014	54.76	176	194	1.10	59	102	38.55	112.43	0.04	1.67	14.6	6.6
16-Jan-2014	54.81	169	171	1.01	57	110	39.01	111.30	0.04	1.5	17.44	6
17-Jan-2014	54.04	215	207	0.96	54	100	41.86	96.28	0.04	1.31	19.7	5.6
18-Jan-2014	53.50	178	168	0.94	89	100	41.96	94.38	0.07	1.29	18.73	4.8
19-Jan-2014	52.52	139	140	1.01	121	138	40.99	138.99	0.06	1.36	19.09	4.4
20-Jan-2014	54.06	173	169	0.98	39	102	36.15	99.64	0.06	1.43	16.86	5.2
21-Jan-2014	54.91	188	175	0.93	44	122	39.71	113.56	0.04	1.34	18.65	4
22-Jan-2014	52.99	212	179	0.84	65	139	40.88	117.36	0.03	1.37	16.59	3.4
23-Jan-2014	54.27	184	185	1.01	85	133	43.06	133.72	0.05	1.4	18.32	3.2
24-Jan-2014	54.27	172	166	0.97	74	98	42.08	94.58	0.06	1.26	19.25	5.4
25-Jan-2014	53.85	206	197	0.96	61	117	40.53	111.89	0.06	1.3	19.61	5.2
26-Jan-2014	53.37	169	162	0.96	71	137	38.23	131.33	0.2	1.47	17.87	3.8
27-Jan-2014	55.75	181	175	0.97	68	155	40.11	149.86	0.01	0.98	18.89	3.8
28-Jan-2014	55.25	222	216	0.97	97	134	41.38	130.38	0.04	1.31	16.43	3.2
29-Jan-2014	55.28	201	172	0.86	55	120	40.05	102.69	0.06	1.36	14.68	3.2
30-Jan-2014	55.61	200	180	0.90	60	114	42.7	102.60	0.25	1.53	15.3	3.6
31-Jan-2014	56.94	178	171	0.96	66	127	41.02	122.01	0.12	1.23	18.57	4
1-Feb-2014	56.68	148	150	1.01	74	170	37.34	172.30	0.06	1.4	13.89	4
2-Feb-2014	56.35	112	115	1.03	65	106	38.37	108.84	0.06	1.3	13.7	5.4
3-Feb-2014	57.06	149	155	1.04	117	130	40.75	135.23	0.07	1.42	15.73	4.8
4-Feb-2014	56.60	184	173	0.94	52	119	40.12	111.89	0.39	1.62	12.4	4.4
5-Feb-2014	56.82	188	166	0.88	98	136	41.3	120.09	0.29	1.65	15.29	5.4
6-Feb-2014	56.09	203	175	0.86	67	131	42.57	112.93	0.17	1.47	14.78	4
7-Feb-2014	54.57	188	178	0.95	51	114	36.23	107.94	0.26	1.4	15.85	4.4
8-Feb-2014	54.61	178	171	0.96	43	115	38.65	110.48	0.08	1.33	15.05	4.4
9-Feb-2014	55.39	127	120	0.94	44	85	42.84	80.31	1.2	2.4	20.32	11.4
10-Feb-2014	55.84	171	159	0.93	84	125	43.03	116.23	0.1	1.33	25.93	6
11-Feb-2014	55.78	171	177	1.04	49	133	44.37	137.67	0.12	1.05	18.23	4.4
12-Feb-2014	58.99	197	182	0.92	79	136	43.81	125.64	0.22	1.74	17.32	6
13-Feb-2014	59.62	202	177	0.88	86	137	43.65	120.04	0.24	1.53	17.94	3.2
14-Feb-2014	58.00	180	172	0.96	85	136	42.84	129.96	0.09	1.28	16.17	3.4
15-Feb-2014	56.86	143	127	0.89	91	86	39.44	76.38	0.08	1.35	15.02	1.8
16-Feb-2014	56.99	119	112	0.94	31	80	35.76	75.29	0.07	1.33	14.01	3.4
17-Feb-2014	57.92	182	181	0.99	81	113	39.39	112.38	0.07	1.26	15.12	4.2
18-Feb-2014	56.90	187	190	1.02	54	127	42.23	129.04	0.08	1.5	15.19	4
19-Feb-2014	56.60	226	226	1.00	173	218	58.68	218.00	0.24	1.51	17.34	6.2
20-Feb-2014	56.98	200	198	0.99	210	216	54.74	213.84	0.28	1.7	17.1	4.6
21-Feb-2014	56.83	230	214	0.93	79	128	40.54	119.10	0.08	1.4	16.1	3.7
22-Feb-2014	56.77	127	127	1.00	68		42.1		0.11	1.49	17.6	4.4
23-Feb-2014	56.68	151	151	1.00	80	106	39.07	106.00	0.07	1.3	18.04	4
24-Feb-2014	56.96				134	117	41.72		0.08	1.23	16.44	3.6
25-Feb-2014	56.69	232	229	0.99	170	148	48.84	146.09	0.14	1.36	15.97	4.2
26-Feb-2014	57.37	227	220	0.97	90	131	45.35	126.96	0.34	1.64	17.84	3.6
27-Feb-2014	57.14	268	270	1.01	88	158	44.18	159.18	0.07	1.36	16.85	3.8
28-Feb-2014	55.61	244	216	0.89	176	142	52.19	125.70	0.6	1.85	22.85	4.6
1-Mar-2014	54.76	181	187	1.03	43	103	40.05	106.41	0.09	1.4	22.74	3.4
2-Mar-2014	55.30	145	146	1.01	47	96	37.54	96.66	0.08	1.33	22.49	2.6
3-Mar-2014	56.33	205	178	0.87	93	126	38.56	109.40	0.08	1.36	18.57	3.2
4-Mar-2014	56.35	202	196	0.97	41	134	39.63	130.02	0.11	1.49	19.08	4
5-Mar-2014	56.18	196	174	0.89	72	147	42.35	130.50	0.11	1.33	20.04	3.4
6-Mar-2014	59.37	232	216	0.93	81	148	45.35	137.79	0.09	1.4	22.06	3.6
7-Mar-2014	58.29	190	173	0.91	102	140	43.08	127.47	0.09	1.41	21.48	3.2
8-Mar-2014	55.77	174	165	0.95	78	124	40.05	117.59	0.06	1.46	23.21	2.8
9-Mar-2014	55.20	149	140	0.94	57	112	38.28	105.23	0.06	1.28	20.58	3.2

10-Mar-2014	55.77	248	232	0.94	186	174	49.08	162.77	0.37	1.43	24.22	3.4
11-Mar-2014	55.53	242	230	0.95	156	193	47.84	183.43	0.09	1.41	28.15	5
12-Mar-2014	56.87	225	168	0.75	127	152	41.89	113.49	0.1	1.36	27.67	5.2
13-Mar-2014	55.85	251	242	0.96	133	146	49.16	140.76	1.8	3.19	19.42	3.2
14-Mar-2014	55.13	221	202	0.91	130	121	46.72	110.60	0.2	1.58	22.98	2.4
15-Mar-2014	54.46	191	180	0.94	108	123	39.8	115.92	0.07	1.38	19.24	2.6
16-Mar-2014	55.44	161	141	0.88	118	131	44.13	114.73	0.07	1.46	19.8	2.4
17-Mar-2014	61.25	180	176	0.98	162	150	48.32	146.67	0.59	1.8	19.45	3.8
18-Mar-2014	63.68	190	189	0.99	114	132	41.12	131.31	0.31	1.69	26.23	3.6
19-Mar-2014	61.26	180	158	0.88	84	118	35.79	103.58	0.09	1.03	18.93	2.6
20-Mar-2014	60.52	213	194	0.91	202	229	55.26	208.57	0.14	1.4	19.51	3
21-Mar-2014	59.51	220	216	0.98	266	233	62.9	228.76	0.31	1.47	25.03	2.2
22-Mar-2014	57.93	152	149	0.98	190	153	48.42	149.98	0.07	1.41	23.88	2.2
23-Mar-2014	58.30	165	177	1.07	158	140	47.14	150.18	0.08	1.36	22.07	2
24-Mar-2014	60.33	189	178	0.94	194	166	48.73	156.34	0.18	1.3	14.37	4.6
25-Mar-2014	63.17	250	244	0.98	128	150	44.87	146.40	0.17	1.4	15.52	3
26-Mar-2014	61.39	244	220	0.90	69	116	39.44	104.59	0.08	1.47	15.6	2.4
27-Mar-2014	60.57	198	196	0.99	72	132	44.37	130.67	0.06	1.23	20.03	2.4
28-Mar-2014	60.15	202	178	0.88	64	126	36.49	111.03	0.15	1.6	19.07	2.2
29-Mar-2014	67.51	151	137	0.91	82	110	38.09	99.80	0.17	1.53	22.27	3
30-Mar-2014	65.74	127	111	0.87	38	67	35.86	58.56	0.06	1.6	24.9	2.8
31-Mar-2014	63.79	156	146	0.94	71	100	34.33	93.59	0.03	1.33	18.75	4.4
1-Apr-2014	62.44	196	176	0.90	43	111	37.16	99.67	0.07	1.39	17.53	3
2-Apr-2014	62.54	179	152	0.85	37	106	36.19	90.01	0.06	1.63	17.12	4
3-Apr-2014	61.38	174	171	0.98	53	120	38.02	117.93	0.06	1.21	16.79	3.2
4-Apr-2014	60.36	219	204	0.93	79	140	39.21	130.41	0.08	1.61	18.11	3.8
5-Apr-2014	58.63	180	175	0.97	103	128	40.56	124.44	0.07	1.47	17.73	3.2
6-Apr-2014	58.55	131	120	0.92	84	110	38.93	100.76	0.07	1.44	20.46	4
7-Apr-2014	59.25	230	217	0.94	56	104	37.81	98.12	0.18	1.74	20.1	3.8
8-Apr-2014	59.96	197	177	0.90	82	126	41.88	113.21	0.19	1.26	19.36	3.8
9-Apr-2014	59.35	171	162	0.95	76	128	41.64	121.26	0.06	1.35	20.44	4
10-Apr-2014	58.43	263	263	1.00	112	154	47.16	154.00	3.87	4.99	17.32	3.8
11-Apr-2014	57.58	274	271	0.99	41	104	38.06	102.86	0.13	1.42	24.44	3.6
12-Apr-2014	56.09	138	134	0.97	150	137	47.39	133.03	0.06	1.53	20.97	3.4
13-Apr-2014	56.46	163	139	0.85	106	102	41.86	86.98	0.04	1.47	22.19	3.6
14-Apr-2014	57.50	216	198	0.92	52	106	40.51	97.17	0.07	0.98	23.33	4.4
15-Apr-2014	58.96	185	177	0.96	87	121	44.79	115.77	0.1	1.7	17.72	4.2
16-Apr-2014	57.16	205	174	0.85	49	130	40.98	110.34	0.07	1.53	21.94	4
17-Apr-2014	57.03	208	192	0.92	77	128	44.17	118.15	0.14	1.35	23.6	3.6
18-Apr-2014	57.52	166	160	0.96	79	126	43.23	121.45	0.08	1.51	22.71	4
19-Apr-2014	55.86	151	142	0.94	160	142	50.1	133.54	0.07	1.38	20.27	3.2
20-Apr-2014	55.01	148	145	0.98	80	92	41.02	90.14	0.07	1.41	22.13	3.2
21-Apr-2014	55.87	157	144	0.92	138	134	45	122.90	0.07	1.6	19.97	4.4
22-Apr-2014	56.42	192	170	0.89	246	152	45.21	134.58	0.09	0.93	24.81	4.6
23-Apr-2014	56.85	211	189	0.90	92	154	42.47	137.94	0.07	1.33	25.99	4.6
24-Apr-2014	56.32	238	230	0.97	113	163	46.88	157.52	0.13	1.49	21.16	3.6
25-Apr-2014	55.97	206	182	0.88	64	137	41.67	121.04	0.07	1.26	21.57	3.8
26-Apr-2014	55.23	147	141	0.96	107	139	45.03	133.33	0.04	1.74	20.54	3.6
27-Apr-2014	54.98	188	164	0.87	146	150	43.63	130.85	0.04	1.36	17.87	3
28-Apr-2014	56.13	162	148	0.91	73	114	37.02	104.15	0.04	1.38	20.4	3.2
29-Apr-2014	56.48	190	159	0.84	98	148	44.02	123.85	0.09	1.74	17.65	3.4
30-Apr-2014	56.41	291	280	0.96	90	179	42.49	172.23	0.07	1.33	16.72	4.2
1-May-2014	56.18	192	182	0.95	96	161	45.73	152.61	0.11	1.71	16.15	4
2-May-2014	72.31	252	236	0.94	160	190	40.95	177.94	0.36	2.03	16.93	6.4
4-May-2014	68.91	155	158	1.02	110	101	33.98	102.95	0.01	1.36	21.27	4.8
5-May-2014	66.57	208	190	0.91	75	74	33.1	67.60	0.3	1.67	25.75	5
6-May-2014	64.59	218	231	1.06	62	115	34.94	121.86	0.07	1.57	19.19	4.4
7-May-2014	63.23	236	207	0.88	67	106	33.07	92.97	0.12	1.49	16.87	5
8-May-2014	62.13	215	205	0.95	104	141	41.86	134.44	0.14	1.46	17.27	3.4
9-May-2014	60.86	245	240	0.98	124	157	40.43	153.80	0.12	1.28	18.25	3.4
10-May-2014	58.66	176	157	0.89	84	104	39.76	92.77	0.03	1.21	20.3	3.2
11-May-2014	57.79	161	148	0.92	104	118	38.07	108.47	0.04	1.14	19.86	3.2
12-May-2014	58.89	182	174	0.96	50	96	34.19	91.78	0.06	1.33	19.8	3.6
13-May-2014	58.70	249	246	0.99	53	133	36.23	131.40	0.08	1.48	16.57	3.4
14-May-2014	58.65	349	313	0.90	111	164	39.82	147.08	0.09	1.33	16.31	3.4
15-May-2014	59.05	242	236	0.98	117	184	39.92	179.44	0.11	1.56	16.09	2.8
16-May-2014	56.70	183	170	0.93	49	113	34.11	104.97	0.12	1.28	13.67	2.6
17-May-2014	54.59	156	140	0.90	174	185	42.59	166.03	0.06	1.4	13.5	3
18-May-2014	54.94	142	113	0.80	142	151	41.02	120.16	0.08	1.3	15.25	3.2
19-May-2014	56.40	232	218	0.94	86	182	37.94	171.02	0.39	1.6	20.46	3.4
20-May-2014	55.86	226	212	0.94	89	185	31.12	173.54	0.37	1.58	16.07	3
21-May-2014	56.14	250	242	0.97	138	217	48.94	210.06	0.09	1.54	17.66	3.6
22-May-2014	56.33	230	251	1.09	53	136	40.95	148.42	0.11	1.6	15.3	2.6
23-May-2014	55.66	181	167	0.92	126	179	43.88	165.15	0.07	1.36	18.88	3.4
24-May-2014	54.15	149	143	0.96	102	138	42.14	132.44	0.07	1.48	19.14	2.8
25-May-2014	52.94	147	136	0.93	50	92	39.16	85.12	0.08	1.43	21.26	3.2
26-May-2014	54.80	120	111	0.93	38	88	36.13	81.40	0.08	1.5	23.92	4.6
27-May-2014	58.03	230	197	0.86	113	182	39.26	155.89	0.07	1.47	18.43	3
28-May-2014	59.46	285	239	0.84	67	139	36.32	116.56	0.07	1.57	15.36	4.2
29-May-2014	61.15	206	196	0.95	133	216	43.46	205.51	0.09	1.53	16.95	3.6
30-May-2014	58.82	192	177	0.92	108	156	40.19	143.81	0.19	1.6	19.19	3.9
31-May-2014	57.89	172	148	0.86	140	144	43.95	123.91	0.08	1.58	22.45	5.6
1-Jun-2014	57.81	133	112	0.84	113	118	39.63	99.37	0.08	1.74	23.51	4.4

2-Jun-2014	58.34	163	158	0.97	106	104	41.01	100.81	0.25	1.88	21.27	4.2
3-Jun-2014	57.59	231	208	0.90	120	138	46.82	124.26	0.24	1.87	21.89	3.8
4-Jun-2014	57.27	188	168	0.89	104	152	43.4	135.83	0.43	2.04	24.9	3.4
5-Jun-2014	57.31	205	196	0.96	109	156	44.93	149.15	0.07	1.67	22	3
6-Jun-2014	55.99	327	282	0.86	138	212	45.28	182.83	0.07	1.38	19.26	5.6
7-Jun-2014	54.47	194	161	0.83	120	156	43.54	129.46	0.24	1.88	21.6	4.8
8-Jun-2014	53.98	162	151	0.93	176	129	43.86	120.24	0.07	1.56	22.05	4.6
9-Jun-2014	55.72	191	174	0.91	88	136	39.63	123.90	0.13	1.53	23.79	4.6
10-Jun-2014	55.17	244	242	0.99	83	176	42.38	174.56	0.21	1.96	17.1	3.4
11-Jun-2014	57.42	288	273	0.95	78	196	45.68	185.79	0.68	2.21	15.06	2.8
12-Jun-2014	57.25	246	230	0.93	167	211	42.98	197.28	0.31	1.71	15.63	3.4
13-Jun-2014	58.98	188	159	0.85	174	138	49.4	116.71	0.09	1.35	17.85	3.4
14-Jun-2014	58.21	143	134	0.94	150	100	43.4	93.71	0.21	1.56	19.12	1.8
15-Jun-2014	57.72	128	121	0.95	73	102	38.65	96.42	0.06	1.53	23.9	2
16-Jun-2014	60.25	169	166	0.98	154	195	41.52	191.54	0.07	1.36	24.75	1.6
17-Jun-2014	60.34	243	230	0.95	83	209	37.82	197.82	0.07	1.56	22.31	2
18-Jun-2014	60.14	191	170	0.89	120	214	40.55	190.47	0.11	1.54	19.62	2
19-Jun-2014	59.09	295	266	0.90	87	210	42.59	189.36	0.04	1.4	19.09	1.8
20-Jun-2014	58.37	258	256	0.99	140	193	42.84	191.50	0.1	1.34	17.29	1.6
21-Jun-2014	56.83	152	126	0.83	69	86	39.71	71.29	0.04	1.4	18.01	2
22-Jun-2014	54.50	148	125	0.84	85	88	37.9	74.32	0.04	1.36	22.17	1.6
23-Jun-2014	55.78	230	218	0.95	60	99	36.29	93.83	0.04	1.3	21.56	1.4
24-Jun-2014	55.07	248	216	0.87	70	125	39.52	108.87	0.07	1.41	20.76	1.8
25-Jun-2014	54.86	255	224	0.88	73	130	38.62	114.20	0.05	1.47	24.6	1.6
26-Jun-2014	56.22	210	208	0.99	95	156	42.19	154.51	0.05	1.3	18.73	1.6
27-Jun-2014	55.71	210	182	0.87	101	106	40.65	91.87	0.04	1.21	17.17	1.8
28-Jun-2014	54.85	192	151	0.79	49	162	38.61	127.41	0.04	1.26	18.33	1.6
29-Jun-2014	53.21	138	127	0.92	123	85	23.15	78.22	0.04	1.58	20.62	1.8
30-Jun-2014	55.03	228	195	0.86	60	106	33.4	90.66	0.06	1.22	19.14	1.8
1-Jul-2014	55.05	236	202	0.86	87	160	41.39	136.95	0.03	1.26	16.17	2
2-Jul-2014	55.06	221	203	0.92	78	132	39.17	121.25	0.04	1.31	21.27	1.4
3-Jul-2014	55.26	233	217	0.93	82	176	39.03	163.91	0.04	1.21	15.84	1.6
4-Jul-2014	52.39	127	114	0.90	107	159	37.12	142.72	0.04	1.35	14.29	1.6
5-Jul-2014	53.93	126	113	0.90	101	138	34.37	123.76	0.04	1.19	17.28	1
6-Jul-2014	58.02	119	104	0.87	92	112	32.82	97.88	0.07	1.26	15.64	2
7-Jul-2014	59.54	182	159	0.87	58	100	33.01	87.36	0.07	1.42	16.95	2.4
8-Jul-2014	61.54	145	121	0.83	98	182	36.04	151.88	0.05	1.43	16.26	2.8
9-Jul-2014	65.08	202	162	0.80	73	154	35.44	123.50	0.05	1.53	17.31	1.8
10-Jul-2014	61.96	296	246	0.83	127	202	40.13	167.88	0.04	1.35	15.19	1.6
11-Jul-2014	60.38	206	172	0.83	53	133	34.09	111.05	0.05	1.37	16.64	1.8
12-Jul-2014	59.21	182	156	0.86	129	154	38.97	132.00	0.04	1.4	18.02	1.8
13-Jul-2014	59.33	202	182	0.90	93	175	34.51	157.67	0.05	1.33	18.79	2.4
14-Jul-2014	59.51	220	214	0.97	49	106	33.71	103.11	0.06	1.13	16.34	2.6
15-Jul-2014	58.10	248	228	0.92	127	163	40.98	149.85	0.05	1.23	15.88	3.2
16-Jul-2014	72.32	211	194	0.92	52	136	33.17	125.04	0.1	1.6	14.73	3.2
18-Jul-2014	68.24	186	172	0.92	55	131	34.81	121.14	0.09	1.58	15.79	2.9
19-Jul-2014	63.27	166	145	0.87	27	76	30.9	66.39	0.04	1.46	18.02	3.2
20-Jul-2014	61.57	195	152	0.78	60	79	31.67	61.58	0.04	1.51	17.69	1.8
21-Jul-2014	62.78	171	148	0.87	28	112	32.74	96.94	0.16	1.57	18.61	3
22-Jul-2014	62.69	212	206	0.97	57	130	35.57	126.32	0.17	1.67	17.38	3.2
23-Jul-2014	61.38	198	166	0.84	165	214	42.42	179.41	0.06	1.53	17.61	2.4
24-Jul-2014	61.97	151	143	0.95	70	171	36.79	161.94	0.06	1.46	17.21	2
25-Jul-2014	61.56	168	172	1.02	80	184	37.91	188.38	0.06	1.25	17.08	2.2
26-Jul-2014	62.29	200	176	0.88	93	148	35.4	130.24	0.05	1.4	16.37	2.4
27-Jul-2014	60.19	164	159	0.97	141	135	33.59	130.88	0.03	1.5	15.55	1.8
28-Jul-2014	60.62	220	208	0.95	77	126	34.82	119.13	0.04	1.4	16.55	1.8
29-Jul-2014	61.36	221	207	0.94	73	144	34.66	134.88	0.05	1.5	12.95	2.2
30-Jul-2014	59.94	214	198	0.93	60	132	36.99	122.13	0.03	1.44	14.67	1.8
31-Jul-2014	58.50	198	202	1.02	86	134	37.09	136.71	0.04	1.57	12.86	2.8
1-Aug-2014	57.70	300	215	0.72	58	92	38.09	65.93	0.04	1.28	12.92	1.4
2-Aug-2014	57.13	196	174	0.89	42	133	34.28	118.07	0.06	1.4	15.64	2
3-Aug-2014	59.00	155	137	0.88	58	128	34.12	113.14	0.06	1.43	16.34	2
4-Aug-2014	58.61	202	195	0.97	78	154	34.1	148.66	0.03	1.3	19.41	3.2
5-Aug-2014	58.69	200	202	1.01	39	158	38.29	159.58	0.07	1.53	15.74	1.4
6-Aug-2014	59.66	224	202	0.90	104	136	38.03	122.64	0.06	1.29	12.52	2.2
7-Aug-2014	61.53	224	226	1.01	75	145	35.67	146.29	0.04	1.45	15.92	2.2
8-Aug-2014	60.58	240	237	0.99	115	137	37.74	135.29	0.06	1.39	18.73	2.4
9-Aug-2014	58.20	188	159	0.85	114	108	40.47	91.34	0.06	1.41	20.11	2.8
10-Aug-2014	57.62	169	150	0.89	54	85	37.2	75.44	0.06	1.66	24.12	2.6
11-Aug-2014	60.28	218	205	0.94	96	157	38.15	147.64	0.08	1.49	20.59	1.8
12-Aug-2014	60.02	226	220	0.97	81	159	37.47	154.78	0.44	1.91	14.89	1.6
13-Aug-2014	60.69	254	224	0.88	114	166	40.52	146.39	0.05	1.44	15.82	1.8
14-Aug-2014	61.37	246	224	0.91	58	140	35.08	127.48	0.06	1.46	12.9	1.8
15-Aug-2014	69.53	204	173	0.85	49	78	33.23	66.15	0.04	1.47	17.82	1.8
16-Aug-2014	67.57	63	56	0.89	92	111	34.5	98.67	0.03	1.44	17.7	2
17-Aug-2014	65.93	115	103	0.90	56	89	31.71	79.71	0.03	1.72	18.48	1.6
18-Aug-2014	65.94	68	57	0.84	87	72	33.4	60.35	0.04	1.23	17.54	2.4
19-Aug-2014	64.61	97	90	0.93	65	106	33.63	98.35	0.01	1.35	16.96	1.8
20-Aug-2014	63.31	100	91	0.91	50	142	35.67	129.22	0.05	1.74	15.21	2.2
21-Aug-2014	61.61	192	198	1.03	53	121	35.86	124.78	0.06	1.22	17.93	2
22-Aug-2014	61.64	78	66	0.85	56	123	35.84	104.08	0.06	1.26	17.77	2
23-Aug-2014	61.92	145	115	0.79	43	156	39.65	123.72	0.05	1.26	19.01	2
24-Aug-2014	62.27	86	77	0.90	101	152	37.87	136.09	0.06	1.33	19.62	2.4

25-Aug-2014	63.19	100	99	0.99	79	132	37.68	130.68	0.03	1.41	20.66	3.6
26-Aug-2014	61.74	107	97	0.91	59	136	37.26	123.29	0.05	1.36	19.18	2.2
27-Aug-2014	61.09	239	202	0.85	46	143	35.16	120.86	0.06	1.47	16.71	2.4
28-Aug-2014	60.17	159	158	0.99	124	190	40.19	188.81	0.07	1.45	14.75	1.8
29-Aug-2014	58.69	195	190	0.97	42	120	36.98	116.92	0.05	1.33	14.87	1.2
30-Aug-2014	56.96	94	83	0.88	58	90	33.49	79.47	0.06	1.26	13.81	2.6
31-Aug-2014	56.08	90	92	1.02	56	140	32.65	143.11	0.05	1.3	13.51	3
1-Sep-2014	58.66	83	81	0.98	42	128	34.47	124.92	0.06	1.28	16.88	2.6
2-Sep-2014	61.25	192	161	0.84	62	88	33.91	73.79	0.05	1.28	14.96	2.4
3-Sep-2014	60.90	184	164	0.89	74	128	36.61	114.09	0.12	1.55	14.01	2
4-Sep-2014	62.76	77	69	0.90	68	147	35.86	131.73	0.07	1.67	12.91	3.8
5-Sep-2014	60.36	128	123	0.96	100	127	38.85	122.04	0.06	1.49	15.71	7.5
6-Sep-2014	58.08	74	65	0.88	74	135	34.33	118.58	0.06	1.47	15.59	2
7-Sep-2014	58.86	75	64	0.85	61	90	33.49	76.80	0.06	1.43	16.82	1.8
8-Sep-2014	58.73	98	89	0.91	45	114	35.13	103.53	0.05	1.35	16.42	1.8
9-Sep-2014	57.94	157	153	0.97	62	156	38.65	152.03	0.03	1.35	14.07	2.2
10-Sep-2014	57.70	152	138	0.91	72	146	39.56	132.55	0.04	1.28	12.52	3
11-Sep-2014	57.20	118	115	0.97	42	191	39.43	186.14	0.05	1.33	12.22	2.4
12-Sep-2014	56.42	157	148	0.94	121	170	42.03	160.25	0.14	1.42	14.96	2.8
13-Sep-2014	55.12	114	109	0.96	111	148	43.7	141.51	0.43	1.86	20.68	3.4
14-Sep-2014	56.56	120	87	0.73	77	169	37.9	122.53	0.06	1.21	19.81	3.4
15-Sep-2014	57.32	180	173	0.96	55	120	36.94	115.33	0.06	1.13	18.86	3.2
16-Sep-2014	57.69	167	155	0.93	104	195	42.42	180.99	0.05	1.33	14.72	3.4
17-Sep-2014	65.03	172	143	0.83	62	112	37.45	93.12	0.04	1.53	16.42	3.2
18-Sep-2014	63.30	185	152	0.82	61	124	37.81	101.88	0.03	1.43	15.35	3
19-Sep-2014	66.36	146	135	0.92	97	212	38.23	196.03	0.05	1.33	17.33	3.4
21-Sep-2014	68.82	98	94	0.96	55	94	31.4	90.16	0.15	1.6	19.97	2.2
22-Sep-2014	71.55	111	123	1.11	73	120	29.65	132.97	0.03	1.42	17.72	3.6
23-Sep-2014	72.11	105	97	0.92	52	130	29.16	120.10	0.14	1.77	13.81	2.8
24-Sep-2014	68.42	131	120	0.92	53	147	31.34	134.66	0.03	1.33	11.75	2.8
25-Sep-2014	67.60	138	162	1.17	110	135	37.99	158.48	0.05	1.32	12.86	3.4
5-Oct-2014	72.37	78	70	0.90	41	51	27.3	45.77	0.05	1.58	20.09	4.6
6-Oct-2014	70.53	94	99	1.05	37	64	28.88	67.40	0.04	1.49	21.8	5.2
7-Oct-2014	68.90	135	116	0.86	60	76	28.93	65.30	0.07	1.6	16.8	4.8
8-Oct-2014	68.09	139	116	0.83	36	83	32.03	69.27	0.05	1.54	17.7	2.8
9-Oct-2014	66.62	142	145	1.02	87	116	35.22	118.45	0.08	1.53	18.1	3.8
10-Oct-2014	64.97	116	104	0.90	60	80	33.31	71.72	0.06	1.32	15.6	3.6
11-Oct-2014	63.15	122	109	0.89	64	106	32.65	94.70	0.05	1.31	16.6	3
12-Oct-2014	62.82	170	152	0.89	63	98	32.51	87.62	0.06	1.25	17.4	3
13-Oct-2014	63.14	127	111	0.87	81	90	32.93	78.66	0.06	1.67	17.02	4
14-Oct-2014	64.38	162	169	1.04	58	122	34.55	127.27	0.15	1.36	17.39	3.6
15-Oct-2014	69.94	126	107	0.85	88	121	35.02	102.75	0.05	1.49	17.76	3.2
16-Oct-2014	66.07	125	120	0.96	59	114	34.19	109.44	0.05	1.29	16.24	2.8
17-Oct-2014	62.79	150	137	0.91	109	185	36.7	168.97	0.06	1.43	16.8	2.6
18-Oct-2014	60.27	119	115	0.97	88	116	35.82	112.10	0.05	1.47	18.14	3
19-Oct-2014	59.81	137	120	0.88	100	136	35.37	119.12	0.05	1.35	18.83	3
20-Oct-2014	60.93	138	105	0.76	151	114	34.05	86.74	0.07	1.33	16.87	3.4
21-Oct-2014	60.71	147	128	0.87	74	138	38.09	120.16	0.02	1.26	15.85	3.4
22-Oct-2014	60.37	192	170	0.89	98	150	37.95	132.81	0.03	1.64	17.31	2.8
23-Oct-2014	60.44	122	114	0.93	106	159	37.89	148.57	0.03	1.32	16.08	3.4
24-Oct-2014	59.03	168	152	0.90	104	130	40	117.62	0.05	1.43	18.16	3.4
25-Oct-2014	56.93	137	121	0.88	121	130	40.69	114.82	0.06	1.54	19.54	5.4
26-Oct-2014	57.55				73	108	35.18		0.06	1.5	19.1	5.6
27-Oct-2014	57.99	181	165	0.91	131	172	39.37	156.80	0.04	1.6	18.46	4.6
28-Oct-2014	57.83	206	199	0.97	106	163	44.37	157.46	0.05	1.72	16.11	4.4
29-Oct-2014	57.79	196	170	0.87	113	146	40.79	126.63	0.05	1.6	17.94	4.2
30-Oct-2014	57.71	165	159	0.96	126	155	41.53	149.36	0.06	1.74	14.38	3.8
31-Oct-2014	55.29	186	180	0.97	104	176	42.14	170.32	0.05	1.6	19.66	4.2
1-Nov-2014	53.98	166	146	0.88	113	144	39.17	126.65	0.06	1.47	21.23	5
2-Nov-2014	53.87	145	125	0.86	109	148	34.33	127.59	0.06	1.6	18.89	4.8
3-Nov-2014	55.02	163	160	0.98	99	191	38.14	187.48	0.07	1.35	17.77	4.6
4-Nov-2014	55.20	196	198	1.01	102	161	41.65	162.64	0.06	1.71	18.26	8.2
5-Nov-2014	55.99	176	155	0.88	98	184	40.44	162.05	0.11	1.7	14.59	6
6-Nov-2014	55.93	151	148	0.98	109	144	44.59	141.14	0.04	1.49	14.63	5.8
7-Nov-2014	55.44	217	210	0.97	154	171	40.71	165.48	0.03	1.4	18.92	7.4
8-Nov-2014	54.00	158	147	0.93	110	138	42.55	128.39		1.78	19.09	9.6
9-Nov-2014	56.54	152	134	0.88	92	105	38.74	92.57	0.01	1.57	20.59	8.4
10-Nov-2014	56.10	164	154	0.94	155	141	43.21	132.40	0.03	2.33	19.14	17
11-Nov-2014	55.89	164	149	0.91	110	228	43.53	207.15	0.06	1.58	17.01	4.8
12-Nov-2014	55.38	213	190	0.89	118	240	38.51	214.08	0.06	1.63	15.98	4.8
13-Nov-2014	55.27	176	173	0.98	166	200	45.35	196.59	0.08	1.85	16.33	6
14-Nov-2014	53.90	214	198	0.93	137	143	43.38	132.31	0.06	1.65	17.69	2.4
15-Nov-2014	52.94	198	170	0.86	126	168	42.4	144.24	0.06	1.37	19.86	4.3
16-Nov-2014	54.61	154	144	0.94	98	176	41.15	164.57	0.05	1.51	19.35	4
17-Nov-2014	58.70	138	128	0.93	147	217	39.15	201.28	0.06	2.02	20.28	6.4
18-Nov-2014	57.38	167	145	0.87	163	182	43.34	158.02	0.05	1.44	14.76	3.4
19-Nov-2014	56.67	191	155	0.81	130	238	42.93	193.14	0.04	1.6	17.98	4.4
20-Nov-2014	57.52	156	146	0.94	148	216	52.57	202.15	0.05	1.5	18.8	4.6
21-Nov-2014	55.97	179	164	0.92	124	178	41.72	163.08	0.06	1.19	19.6	4.6
22-Nov-2014	54.97	194	169	0.87	100	196	40.33	170.74	0.05	1.33	20.31	3.6
23-Nov-2014	55.46	158	139	0.88	100	172	41.16	151.32	0.05	1.71	21.55	3.2
24-Nov-2014	56.69	146	136	0.93	157	207	43.57	192.82	0.03	1.32	19.05	3.2
25-Nov-2014	67.66	144	135	0.94	135	209	39.73	195.94	0.1	1.51	13.57	1.2

27-Nov-2014	66.98	88	87	0.99	125	154	36.05	152.25	0.05	1.36	18.85	3.6
28-Nov-2014	62.50	75	69	0.92	90	140	35.53	128.80	0.04	1.58	20.75	3.6
29-Nov-2014	62.42	115	103	0.90	86	145	38.79	129.87	0.06	1.21	23.9	3.6
30-Nov-2014	63.11	114	109	0.96	112	180	39.35	172.11	0.04	1.42	23.2	2.6
1-Dec-2014	63.52	132	129	0.98	135	191	37.87	186.66	0.06	1.44	23.02	3.2
2-Dec-2014	59.66	241	254	1.05	133	182	40.51	191.82	0.06	1.63	19.69	1.8
3-Dec-2014	56.93	165	139	0.84	114	148	38.09	124.68	0.04	1.65	18.04	2.4
4-Dec-2014	56.34	145	148	1.02	109	130	37.99	132.69	0.04	1.53	18.54	2.2
5-Dec-2014	55.38	199	161	0.81	134	165	41.27	133.49	0.05	1.26	17.13	2.4
6-Dec-2014	54.29	125	111	0.89	93	181	43.37	160.73	0.05	1.28	20.21	2
7-Dec-2014	53.57	159	151	0.95	144	180	42.88	170.94	0.05	1.33	23.25	4
8-Dec-2014	54.87	153	141	0.92	90	162	36.19	149.29	0.57	2.09	19.1	2.2
9-Dec-2014	55.91	129	115	0.89	89	139	40.7	123.91	0.06	1.42	18.15	2.4
10-Dec-2014	54.51	176	161	0.91	94	166	40.67	151.85	0.04	1.53	19.81	2
11-Dec-2014	53.61	149	137	0.92	106	254	42.73	233.54	0.05	1.59	16.8	2.2
12-Dec-2014	52.10	145	125	0.86	101	188	42.08	162.07	0.06	1.33	17.64	1.8
13-Dec-2014	51.63	130	118	0.91	178	212	48.05	192.43	0.06	1.33	18.61	1.6
14-Dec-2014	51.44	136	122	0.90	98	148	39.29	132.76	0.06	1.47	18.66	2.4
15-Dec-2014	51.57	179	167	0.93	78	137	37.54	127.82	0.03	1.34	18.4	2.8
16-Dec-2014	51.82	166	162	0.98	91	174	44.43	169.81	0.11	1.56	15.93	2.2
17-Dec-2014	52.15	228	196	0.86	135	179	44.65	153.88	0.18	1.78	20.81	2.6
18-Dec-2014	50.98	150	144	0.96	111	190	44.32	182.40	0.06	1.45	18.65	3
19-Dec-2014	51.25	155	142	0.92	83	162	41.62	148.41	0.06	1.74	18.89	1.8
20-Dec-2014	50.84	154	133	0.86	95	150	40.23	129.55	0.06	1.4	19.24	2.4
21-Dec-2014	51.21	167	150	0.90	97	198	39.59	177.84	0.06	1.53	19.44	3.4
22-Dec-2014	52.39	243	236	0.97	72	153	38.23	148.59	0.18	1.67	15.07	2.8
23-Dec-2014	52.71	234	210	0.90	126	211	42.42	189.36	0.19	1.58	12.1	3
24-Dec-2014	52.21	180	161	0.89	156	155	45.28	138.64	0.12	1.56	13.01	2.8
25-Dec-2014	47.52	69	59	0.86	181	207	44.23	177.00	0.05	1.44	13.67	2.4
26-Dec-2014	49.26	172	155	0.90	81	152	38.23	136.98	0.04	1.21	18.71	2.6
27-Dec-2014	49.62	147	131	0.89	125	166	42.24	147.93	0.04	1.28	18.24	1.8
28-Dec-2014	50.57	121	113	0.93	166	182	40.47	169.97	0.04	1.34	18.45	2.8
29-Dec-2014	51.64	164	148	0.90	92	176	38.46	158.83	0.05	1.37	16.17	3
30-Dec-2014	52.36	206	180	0.87	138	220	41.6	192.23	0.06	1.4	14.89	3.2
31-Dec-2014	54.75	209	182	0.87	118	199	41.23	173.29	0.22	1.67	13.09	2.4
1-Jan-2015	49.91	178	190	1.07	156	195	46.25	208.15	0.31	1.72	13.81	2.2
2-Jan-2015	51.23	145	131	0.90	99	186	39.79	168.04	0.06	1.29	17.71	2.8
3-Jan-2015	51.08	114	109	0.96	114	155	42.07	148.20	0.06	1.33	15.47	2.7
4-Jan-2015	51.71	395	407	1.03	77	144	38.58	148.37	0.06	1.47	16.94	2.6
5-Jan-2015	52.15	126	123	0.98	79	117	36.14	114.21	0.06	1.35	18.65	2.8
6-Jan-2015	51.16	116	135	1.16	160	205	45.15	238.58	0.07	1.7	15.66	3.2
7-Jan-2015	51.47	219	186	0.85	95	156	42.38	132.49	0.03	1.44	21.2	3
8-Jan-2015	50.26	146	140	0.96	59	153	42.84	146.71	0.05	1.42	18.94	3.8
9-Jan-2015	49.39	272	251	0.92	69	140	40.33	129.19	0.06	1.26	19.23	1.8
10-Jan-2015	48.94	172	177	1.03	84	175	44.02	180.09	0.04	1.21	18.08	2.8
11-Jan-2015	50.05	159	158	0.99	92	145	40.47	144.09	0.04	1.37	18.99	2.4
12-Jan-2015	51.61	187	192	1.03	95	163	40.24	167.36	0.04	1.51	17.89	2.6
13-Jan-2015	52.62	130	127	0.98	63	129	38.84	126.02	0.04	1.33	15.97	2
14-Jan-2015	52.16	276	270	0.98	111	218	43.4	213.26	0.06	1.39	23.01	3.2
15-Jan-2015	51.25	509	457	0.90	73	174	43.12	156.22	0.05	1.53	23.44	3
16-Jan-2015	50.51	196	168	0.86	85	134	43.54	114.86	0.03	1.44	20.85	2.2
17-Jan-2015	49.73	160	153	0.96	79	168	42.93	160.65	0.03	1.37	20.36	3
18-Jan-2015	49.04	163	143	0.88	115	140	43.12	122.82	0.04	1.31	20.15	3.2
19-Jan-2015	50.47	178	164	0.92	98	170	40.12	156.63	0.03	1.58	20.19	1.6
20-Jan-2015	51.16	182	164	0.90	101	176	44.14	158.59	0.04	1.74	20.52	3.2
21-Jan-2015	50.71	220	218	0.99	116	194	47.02	192.24	0.04	1.64	20.68	2.4
22-Jan-2015	51.22	186	190	1.02	81	162	43.3	165.48	0.05	1.47	22.08	2
23-Jan-2015	50.28	183	171	0.93	114	200	47.22	186.89	0.04	1.67	19.82	2.4
24-Jan-2015	54.97	195	182	0.93	50	116	39.12	108.27	0.04	1.53	23.41	2.8
25-Jan-2015	51.88	132	121	0.92	102	189	41.36	173.25	0.03	1.53	21.07	2.6
26-Jan-2015	53.48	212	198	0.93	48	104	39.34	97.13	0.06	1.31	20.9	2.2
27-Jan-2015	52.46	186	195	1.05	132	194	45.88	203.39	0.04	1.4	17.2	3
28-Jan-2015	51.62	217	220	1.01	186	257	48.66	260.55	0.06	1.58	15.65	2
29-Jan-2015	52.07	260	240	0.92	175	271	51.36	250.15	0.16	1.69	16.07	2.8
30-Jan-2015	51.22	461	437	0.95	229	282	52.51	267.32	0.06	1.5	20.44	2.2
31-Jan-2015	50.56	214	204	0.95	125	216	44.92	205.91	0.06	1.22	17.19	2
1-Feb-2015	50.82	190	187	0.98	140	176	46.69	173.22	0.06	1.43	19.36	2.8
2-Feb-2015	51.96	245	246	1.00	155	214	45.43	214.87	0.04	1.43	21.37	3.2
3-Feb-2015	50.14	202	196	0.97	151	229	48	222.20	0.04	1.58	19.06	1.8
4-Feb-2015	50.93	338	321	0.95	55	182	43.54	172.85	0.06	1.53	17.28	2.6
5-Feb-2015	62.99	215	224	1.04	108	202	45.52	210.46	0.1	1.67	16.57	3.4
6-Feb-2015	57.06	275	281	1.02	90	214	43.49	218.67	0.15	1.74	17.71	2.8
7-Feb-2015	54.95	194	185	0.95	168	254	51.49	242.22	0.15	1.78	21.48	2.8
8-Feb-2015	55.01	162	147	0.91	130	189	40.19	171.50	0.05	1.55	19.68	4
9-Feb-2015	59.11	208	192	0.92	109	187	44.87	172.62	0.54	2.09	18.93	5
10-Feb-2015	60.65	163	163	1.00	108	178	33.63	178.00	0.07	1.75	18.16	4.2
11-Feb-2015	58.48	190	171	0.90	168	249	45.09	224.10	0.07	1.58	17.82	3.8
12-Feb-2015	57.52	252	245	0.97	105	134	44.17	130.28	0.06	1.77	18.69	3.8
13-Feb-2015	55.53	266	240	0.90	201	223	50.09	201.20	0.05	1.71	16.85	3.4
14-Feb-2015	54.22	178	172	0.97	112	196	42.22	189.39	0.05	1.57	17.47	3.1
15-Feb-2015	54.63	157	160	1.02	101	174	42.14	177.32	0.05	1.53	19.68	3
16-Feb-2015	54.93	155	147	0.95	69	120	40.47	113.81	0.05	1.59	21.93	3.4
17-Feb-2015	58.24	224	207	0.92	132	188	43.99	173.73	0.1	1.36	18.06	3.2

18-Feb-2015	67.11	200	196	0.98	188	210	43.05	205.80	0.04	1.92	17.48	3.6
19-Feb-2015	61.10	309	208	0.67	33	107	36.98	72.03	0.04	1.66	19.68	2.6
20-Feb-2015	58.56	194	182	0.94	143	231	48.23	216.71	0.05	1.63	19.41	1.8
21-Feb-2015	57.19	274	240	0.88	88	148	41.91	129.64	0.04	1.4	20.93	2.4
22-Feb-2015	57.35	208	188	0.90	123	212	41.75	191.62	0.04	1.47	18.57	2.4
23-Feb-2015	57.82	203	186	0.92	73	108	38.13	98.96	0.28	2.12	19.74	4.2
24-Feb-2015	57.99	286	227	0.79	120	173	42.42	137.31	0.07	1.7	20.79	4
25-Feb-2015	57.32	236	215	0.91	101	172	38.23	156.69	0.18	1.67	20.8	4.6
26-Feb-2015	57.36	228	218	0.96	91	182	43.4	174.02	0.03	1.61	21.81	3
27-Feb-2015	54.60	237	239	1.01	60	106	37.74	106.89	0.14	1.93	27.4	6
28-Feb-2015	65.09	166	142	0.86	195	221	41.56	189.05	0.49	1.97	22.08	6.4
1-Mar-2015	69.07	103	101	0.98	73	112	30.55	109.83	0.01	1.53	19.06	4.2
2-Mar-2015	65.42	262	227	0.87	154	57	36.74	49.39	0.06	1.72	18.11	3.6
3-Mar-2015	62.63	245	206	0.84	67	92	34.05	77.36	0.11	1.91	20.28	3.6
4-Mar-2015	61.62	263	214	0.81	107	140	37.44	113.92	0.04	1.58	22.56	4.4
5-Mar-2015	60.36	168	149	0.89	91	114	37.95	101.11	0.04	1.92	21.94	4.4
6-Mar-2015	59.02	292	243	0.83	90	168	35.72	139.81	0.05	1.69	21.84	5.2
7-Mar-2015	56.57	110	100	0.91	102	162	41.44	147.27	0.05	1.8	24.19	5.6
8-Mar-2015	56.13	92	88	0.96	109	148	40.25	141.57	0.05	1.67	28.38	7
9-Mar-2015	55.99	396	414	1.05	90	121	39.31	126.50	0.15	2.23	24.57	7.8
10-Mar-2015	58.03	250	212	0.85	95	143	39.38	121.26	0.07	2.18	22.19	6.4
11-Mar-2015	56.89	451	269	0.60	165	174	47.38	103.78		1.93	22.64	6.2
12-Mar-2015	53.40	233	208	0.89	150	126	45.29	112.48	0.06	1.95	24.61	6.2
13-Mar-2015	54.13	530	486	0.92	144	154	46.67	141.22	0.06	1.74	19.87	4.6
14-Mar-2015	53.17	117	106	0.91	76	108	41.37	97.85	0.11	1.67	18.39	3.8
15-Mar-2015	53.12	188	172	0.91	33	74	36.43	67.70	0.05	1.76	22.98	3.2
16-Mar-2015	54.07	196	164	0.84	69	124	39.55	103.76	0.06	1.75	23.36	3.4
17-Mar-2015	53.30	194	175	0.90	68	109	40.17	98.32	0.07	1.88	21.22	2.8
18-Mar-2015	53.71	296	262	0.89	62	154	44.51	136.31	0.17	1.6	20.77	2.8
19-Mar-2015	54.07	178	190	1.07	101	195	45.44	208.15	0.03	1.7	17.74	2.6
20-Mar-2015	53.34	254	238	0.94	121	168	47.26	157.42	0.06	1.63	19.77	3.6
21-Mar-2015	51.51	312	296	0.95	93	134	43.36	127.13	0.06	1.42	21.82	2.4
22-Mar-2015	52.20	123	111	0.90	153	92	45.12	83.02	0.06	1.54	19.96	1.6
23-Mar-2015	54.34	189	176	0.93	97	118	43.68	109.88	0.07	1.3	20.02	3
24-Mar-2015	52.74	230	209	0.91	89	136	42.51	123.58	0.06	1.62	19.47	2.2
25-Mar-2015	52.56	322	306	0.95	116	124	44.7	117.84	0.06	1.39	19.2	3.8
26-Mar-2015	52.66	181	181	1.00	104	132	47.58	132.00	0.06	1.57	17.1	1.6
27-Mar-2015	54.16	196	199	1.02	102	158	45.17	160.42	0.1	1.53	18.88	2.4
28-Mar-2015	51.78	126	106	0.84	145	190	45.35	159.84	0.06	1.44	21.97	2.2
29-Mar-2015	51.25	171	172	1.01	113	135	43.06	135.79	0.06	1.64	22.95	3
30-Mar-2015	51.75	194	173	0.89	75	121	42.28	107.90	0.07	1.5	18.91	2.4
31-Mar-2015	51.82	194	180	0.93	44	116	42.14	107.63	0.04	1.61	21.73	1.8
1-Apr-2015	52.05	296	268	0.91	45	126	41.16	114.08	0.04	1.55	17.04	2
2-Apr-2015	51.67	167	148	0.89	62	104	42.21	92.17	0.06	1.63	18.96	2.8
3-Apr-2015	51.29	152	151	0.99	52	173	41.15	171.86	0.04	1.43	16.49	3.8
4-Apr-2015	50.39	178	159	0.89	38	113	38.27	100.94	0.04	1.37	18.55	3
5-Apr-2015	51.54	145	119	0.82	36	78	37.6	64.01	0.04	1.47	21.35	3.2
6-Apr-2015	53.48	156	141	0.90	50	98	37.91	88.58	0.1	1.77	22.1	2.8
7-Apr-2015	53.56	180	167	0.93	61	86	39.5	79.79	0.06	1.47	19.38	2.4
8-Apr-2015	53.31	226	203	0.90	47	105	40.19	94.31	0.06	1.62	18.86	2
9-Apr-2015	52.79	258	270	1.05	56	114	39.92	119.30	0.05	1.64	16.6	3.8
10-Apr-2015	52.09	240	219	0.91	56	156	42.18	142.35	0.05	1.4	15.23	2.2
11-Apr-2015	50.74	133	107	0.80	61	137	40.89	110.22	0.06	1.05	19.57	1.8
12-Apr-2015	50.93	109	109	1.00	57	80	36.13	80.00	0.06	1.22	18.74	2.6
13-Apr-2015	51.43	224	206	0.92	55	102	38.48	93.80	0.05	1.18	20.04	2.2
14-Apr-2015	51.83	163	153	0.94	66	100	40.47	93.87	0.06	1.47	17.77	2.2
15-Apr-2015	51.89	160	134	0.84	54	66	38.23	55.28	0.05	1.32	17.21	3
16-Apr-2015	52.36	241	214	0.89	68	94	42.11	83.47	0.01	1.43	16.9	2.4
17-Apr-2015	51.43	224	184	0.82	79	99	39.68	81.32	0.04	1.19	21.28	2.6
18-Apr-2015	50.14	163	133	0.82	81	103	39.07	84.04	0.05	1.46	18.89	2.8
19-Apr-2015	50.29	133	111	0.83	128	206	42.7	171.92	0.04	1.51	20.1	2.8
20-Apr-2015	52.76	204	170	0.83	119	146	41.42	121.67	0.05	1.53	17.18	2.2
21-Apr-2015	52.03	152	152	1.00	88	131	42.56	131.00	0.06	1.42	16.88	3.2
22-Apr-2015	51.64	250	221	0.88	49	112	40.36	99.01	0.05	1.47	22.01	2.6
23-Apr-2015	53.45	196	192	0.98	76	127	42.28	124.41	0.08	1.39	23.09	3.8
24-Apr-2015	51.15	182	177	0.97	46	110	43.68	106.98	0.33	1.81	20.36	3
25-Apr-2015	50.91	167	167	1.00	128	157	43.86	157.00	0.28	1.45	25.32	3.4
26-Apr-2015	51.36	151	133	0.88	55	112	38.23	98.65	0.1	1.5	20.31	2.4
27-Apr-2015	51.47	294	274	0.93	93	120	40.41	111.84	0.15	1.4	20.44	3
28-Apr-2015	53.79	188	182	0.97	99	119	43.68	115.20	0.17	1.55	18.35	2.8
29-Apr-2015	52.88	232	220	0.95	110	146	43.68	138.45	0.14	1.68	23.49	3.6
30-Apr-2015	51.69	198	184	0.93	93	146	46.68	135.68	0.12	1.79	23.05	2.8
1-May-2015	50.54	220	188	0.85	114	174	47.2	148.69	0.27	1.81	23.45	3.6
2-May-2015	49.19	189	152	0.80	59	124	37.99	99.72	0.21	1.57	24.03	3.2
3-May-2015	48.79	148	129	0.87	67	82	38.61	71.47	0.08	1.63	22.37	3.2
4-May-2015	49.43	235	187	0.80	94	142	39.35	113.00	0.05	1.33	20.3	3
5-May-2015	49.86	212	194	0.92	107	140	42.91	128.11	0.06	1.33	17.53	2.6
6-May-2015	49.79	304	250	0.82	93	147	41.65	120.89	0.06	1.6	15.71	2.2
7-May-2015	50.04	200	189	0.95	66	128	40.75	120.96	0.06	1.79	14.37	2.4
8-May-2015	49.38	260	232	0.89	106	172	43.16	153.48	0.06	1.3	16.38	2.6
9-May-2015	48.37	184	149	0.81	56	111	39.86	89.89	0.06	1.34	18.26	3
10-May-2015	47.36	140	142	1.01	40	86	36.2	87.23	0.06	1.52	18.37	2.6
11-May-2015	51.43	191	163	0.85	110	137	40.67	116.92	0.06	1.33	20.54	2.6

12-May-2015	50.78	247	250	1.01	101	189	41.13	191.30	0.23	1.71	17.29	3.2
13-May-2015	51.12	256	208	0.81	92	156	41.95	126.75	0.06	1.74	17.18	3
14-May-2015	52.84	188	190	1.01	63	126	47.38	127.34	0.38	1.99	21.31	3.4
15-May-2015	53.19	153	133	0.87	87	138	40.91	119.96	0.11	1.02	25.19	3.4
16-May-2015	51.60	131	111	0.85	66	108	35.51	91.51	0.06	1.33	19.98	3.2
17-May-2015	53.54	186	151	0.81	54	112	35.97	90.92	0.06	1.51	19.16	3.6
18-May-2015	53.30	260	203	0.78	90	136	36.63	106.18	0.1	1.52	21.71	3.6
19-May-2015	52.51	244	223	0.91	83	143	39.01	130.69	0.04	1.75	19.07	3.4
20-May-2015	52.20	208	194	0.93	99	190	42.84	177.21	0.07	1.43	19.92	4.6
21-May-2015	51.67	182	183	1.01	79	148	43.03	148.81	0.07	1.49	19.69	3.4
22-May-2015	50.51	218	186	0.85	101	179	43.15	152.72	0.07	1.19	24.55	3.4
23-May-2015	49.14	154	133	0.86	127	166	42.14	143.36	0.06	1.34	20.87	3.2
24-May-2015	48.04	95	80	0.84	72	116	37.76	97.68	0.06	1.22	20.86	3.2
25-May-2015	49.01	129	113	0.88	80	104	37.54	91.10	0.05	1.29	22.58	2.2
26-May-2015	53.32	256	250	0.98	122	192	43.85	187.50	0.07	1.55	19.85	2.6
27-May-2015	63.38	251	156	0.62	69	126	31.54	78.31	0.33	1.93	15.68	3.6
28-May-2015	55.26	163	141	0.87	61	124	41.08	107.26	0.07	1.35	16.29	3.4
29-May-2015	53.85	151	137	0.91	64	118	37.69	107.06	0.1	1.42	27.5	2.8
30-May-2015	53.00	149	125	0.84	77	132	36.27	110.74	0.04	1.26	20.33	2.2
31-May-2015	56.45	106	106	1.00	68	106	34.87	106.00	0.06	1.36	21.34	1.8
1-Jun-2015	60.58	227	214	0.94	49	87	30.23	82.02	0.14	1.47	17.42	2.6
2-Jun-2015	61.59	149	140	0.94	72	118	34.19	110.87	0.26	1.85	13.91	2.6
3-Jun-2015	60.51	174	158	0.91	62	124	33.44	112.60	0.05	1.4	17.33	3.2
4-Jun-2015	58.42	133	136	1.02	46	109	35.26	111.46	0.04	1.51	19.41	2.8
5-Jun-2015	57.96	147	135	0.92	180	158	38.18	145.10	0.04	1.37	18.47	4.8
6-Jun-2015	55.90	196	110	0.56	79	125	34.53	70.15	0.04	1.36	17.35	2.4
7-Jun-2015	56.69	116	101	0.87	76	102	33.58	88.81	0.04	1.48	16.99	2.2
8-Jun-2015	60.58	149	131	0.88	79	126	33.35	110.78	0.04	1.51	16.74	3
9-Jun-2015	58.14	234	198	0.85	67	138	36.88	116.77	0.04	1.35	17.26	3.2
12-Jun-2015	72.00	88	73	0.83	82	78	31.77	64.70	0.04	1.44	16.7	4.2
13-Jun-2015	67.16	97	86	0.89	63	113	30.69	100.19	0.04	1.44	16.49	3.2
14-Jun-2015	63.92	65	64	0.98	73	97	32.13	95.51	0.04	1.53	18.41	2.4
15-Jun-2015	66.60	103	106	1.03	118	131	36.74	134.82	0.14	1.44	19.87	3.6
16-Jun-2015	69.09	110	93	0.85	67	89	28.72	75.25	0.07	1.33	16.32	2.8
17-Jun-2015	71.55	136	129	0.95	60	79	30.18	74.93	0.04	1.28	15.8	1.4
18-Jun-2015	73.30	95	98	1.03	61	78	33.26	80.46	0.06	1.33	18.61	3
21-Jun-2015	71.37	60	46	0.77	35	53	25.44	40.63	0.04	1.45	14.07	2.4
22-Jun-2015	74.22	107	99	0.93	66	63	29.52	58.29	0.04	1.41	13.68	2.6
23-Jun-2015	74.16	117	113	0.97	72	80	30.7	77.26	0.06	1.6	17.91	3
26-Jun-2015	74.47	156	131	0.84	87	100	30.58	83.97	0.04	1.48	18.89	4.2
27-Jun-2015	70.04	85	74	0.87	66	86	29.91	74.87	0.04	1.39	17.66	3.6
28-Jun-2015	68.92	92	77	0.84	82	128	30.52	107.13	0.04	1.44	18.19	3.4
29-Jun-2015	70.74	149	137	0.92	69	117	29.16	107.58	0.04	1.48	16.7	4
30-Jun-2015	69.94	183	174	0.95	71	126	30.14	119.80	0.04	1.5	17.26	3.6
1-Jul-2015	67.45	146	131	0.90	80	151	33.21	135.49	0.06	1.47	15.02	2.6
2-Jul-2015	66.54	134	137	1.02	72	122	33.57	124.73	0.04	1.4	16.52	3
3-Jul-2015	63.49	288	298	1.03	65	124	33.15	128.31	0.04	1.33	15.88	3.6
4-Jul-2015	61.97	104	94	0.90	55	130	29.86	117.50	0.03	1.53	15.83	3.2
5-Jul-2015	66.29	46	39	0.85	48	86	28.05	72.91	0.04	1.43	16.71	4
6-Jul-2015	66.22	214	214	1.00	57	103	31.01	103.00	0.03	1.48	14.07	3.2
7-Jul-2015	66.02	168	159	0.95	70	104	32.85	98.43	0.03	1.57	15.67	4.2
8-Jul-2015	64.25	173	157	0.91	75	130	34.43	117.98	0.05	1.53	16.6	3.4
9-Jul-2015	63.83	169	155	0.92	53	122	32.83	111.89	0.04	1.63	18.21	3.6
10-Jul-2015	63.14	347	299	0.86	69	138	33.21	118.91	0.05	1.35	18.76	4.4
11-Jul-2015	63.46	84	72	0.86	88	150	35.81	128.57	0.04	1.39	18.96	6.8
12-Jul-2015	65.65	59	53	0.90	62	114	29.54	102.41	0.05	1.38	18.67	4.8
13-Jul-2015	65.90	157	144	0.92	92	161	35.9	147.67	0.03	1.47	19.07	4.2
14-Jul-2015	65.84	139	137	0.99	74	128	33.35	126.16	0.06	1.3	17.83	4
15-Jul-2015	68.31	275	244	0.89	77	140	34.66	124.22	0.05	1.43	16.68	4.6
16-Jul-2015	71.36	159	158	0.99	78	130	32.21	129.18	0.04	1.53	18.47	4
17-Jul-2015	70.05	163	155	0.95	82	120	32.48	114.11	0.03	1.42	17.05	4.4
18-Jul-2015	67.69	81	80	0.99	78	104	32.5	102.72	0.04	1.33	18.75	4
19-Jul-2015	66.31	100	103	1.03	55	113	29.15	116.39	0.03	1.31	16.37	3.4
20-Jul-2015	68.59	161	139	0.86	73	116	32.13	100.15	0.04	1.4	16.84	4
21-Jul-2015	70.30	186	174	0.94	88	162	34.19	151.55	0.07	1.59	12.93	4.4
22-Jul-2015	70.55	342	292	0.85	74	144	32.97	122.95	0.04	1.6	15.95	4
23-Jul-2015	70.74	162	177	1.09	55	132	30.56	144.22	0.03	1.48	16.84	6.4
27-Aug-2015	65.67	132	121	0.92	61	72	26.19	66.00	0.06	1.95	18.96	7.4
28-Aug-2015	70.16	151	145	0.96	44	64	26.51	61.46	0.01	1.92	22.16	7.2
29-Aug-2015	74.35	84	75	0.89	92	87	27.35	77.68	0.02	1.69	21.99	7.6
12-Sep-2015	73.97	85	69	0.81	104	112	31.35	90.92	0.02	1.28	20.81	3.4
18-Sep-2015	73.73	126	112	0.89	92	124	40.11	110.22	0.04	1.31	22.22	3.6
19-Sep-2015	72.40	72	74	1.03	88	79	31.39	81.19	0.04	1.18	22.28	4.4
20-Sep-2015	72.24	88	68	0.77	71	75	26.71	57.95	0.04	1.35	19.79	5.6
21-Sep-2015	71.43	140	114	0.81	65	79	30.42	64.33	0.03	1.76	22.72	4.4
22-Sep-2015	70.78	142	115	0.81	52	100	30.12	80.99	0.08	1.58	21.31	5.8
23-Sep-2015	69.63	245	206	0.84	46	98	30.25	82.40	0.05	1.69	21.93	5
24-Sep-2015	69.35	106	101	0.95	32	80	30.39	76.23	0.04	1.47	21.54	6
25-Sep-2015	69.04	132	123	0.93	77	96	30.62	89.45	0.02	1.63	22.86	5.3
26-Sep-2015	69.98	128	119	0.93	36	77	28	71.59	0.02	1.42	21.47	5.8
27-Sep-2015	74.54	84	66	0.79	59	85	28.25	66.79	0.04	1.63	22.33	5.8
Average	56.72	170.84	155.36	0.91	89.36	131.61	38.26	120.45	0.06	1.35	23.03	5.84

Median	54.94	164.00	152.00	0.91	83.00	130.00	38.92	117.95	0.04	1.33	23.46	5.80
Min	43.42	44.00	35.00	0.47	20.00	46.00	20.56	23.30	0.01	0.75	10.04	1.00
Max	74.98	751.00	735.00	1.52	540.00	297.00	79.00	296.49	3.87	4.99	40.60	25.80

Influent Flow 75 to 80 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality					DAR FST Effluent		
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
29-Mar-2010	76.54	101	80	0.79	69	134	29.03	106.14	0.04	1.52	20.59	4.2
5-Jul-2010	75.90	75	54	0.72	240	125	36.82	90.00	0.04	1.13	19.68	7
6-Jul-2010	79.50	116	73	0.63	118	79	28.61	49.72	0.03	1.72	15.4	7.4
7-Jul-2010	77.27	58	38	0.66	89	80	25.8	52.41	0.06	1.86	18.53	7.2
27-Aug-2010	79.43	69	63	0.91	125	104	29.12	94.96	0.02	1.41	20.41	2.4
28-Aug-2010	76.50	52	39	0.75	132	96	24.99	72.00	0.02	1.19	18.25	7.2
9-Jul-2011	77.80	95	45	0.47	27	37	18.15	17.53	0.04	1.3	13.74	7.6
9-Aug-2011	79.71	145	112	0.77	51	82	28	63.34	0.09	1.85	23.06	10.6
11-Aug-2011	79.03	68	43	0.63	76	114	25.33	72.09		1.26	15.12	7.8
9-Sep-2011	75.23	92	86	0.93	69	82	25.63	76.65	0.01	1.34	21.32	6.6
22-Sep-2011	79.85	116	109	0.94	49	91	28.7	85.51	0.05	1.61	20.83	9.6
24-Sep-2011	76.94	73	48	0.66	54	57	24	37.48		1.3	17.18	7.6
29-Sep-2011	75.82	83	81	0.98	42	53	23.14	51.72	0.08	1.52	15.69	9.6
9-Oct-2011	79.49	106	94	0.89	45	54	23.84	47.89		1.45	19.45	9
28-Jun-2012	78.08	123	100	0.81	161	158	30.44	128.46	0.08	1.48	18.31	10
17-Jul-2012	78.06	151	124	0.82	99	120	27.34	98.54	0.02	1.68	19.48	8.8
18-Jul-2012	79.42	132	114	0.86	76	110	22.06	95.00	0.01	1.38	17.77	9
22-Jul-2012	79.21	95	63	0.66	59	72	19.74	47.75	0.06	1.49	20.4	9.2
23-Jul-2012	76.01	113	80	0.71	66	88	22.4	62.30	0.28	1.64	17.14	8
7-Aug-2012	76.24	171	134	0.78	36	57	20.4	44.67	0.01	1.18	17.41	9.8
18-Aug-2012	77.29	117	107	0.91	30	58	21.62	53.04	0.03	1.26	21.7	7.6
19-Aug-2012	75.27	70	63	0.90	42	53	18	47.70	0.03	1.15	13.78	8.4
25-Aug-2012	79.34	60	62	1.03	50	73	21.08	75.43	0.02	1.19	16.65	7.6
26-Aug-2012	75.01	98	82	0.84	58	72	18.1	60.24	0.03	1.21	16.28	9.4
1-Sep-2012	76.33	64	56	0.88	76	110	23.84	96.25	0.04	1.22	18.47	6.6
6-Sep-2012	79.52	190	167	0.88	109	123	30.8	108.11	0.07	1.4	22.93	8.8
14-Sep-2012	79.02	134	112	0.84	33	58	18.84	48.48	0.03	1.42	17.84	7.6
15-Sep-2012	75.83	103	87	0.84	56	63	20.66	53.21	0.03	1.51	19.01	6.8
16-Sep-2012	75.17	85	73	0.86	35	48	22.49	41.22	0.03	1.44	18.82	7.4
17-Sep-2012	75.04	154	152	0.99	72	94	23.42	92.78	0.03	1.54	19.22	8.6
24-Sep-2012	78.21	101	73	0.72	47	68	23.58	49.15	0.02	1.66	17.76	8
25-Sep-2012	75.87	134	113	0.84	50	80	26.5	67.46	0.01	2	18.13	8
4-Oct-2012	78.29	136	125	0.92	67	91	26.7	83.64	0.04	1.49	19.13	12
6-Oct-2012	76.84	218	179	0.82	56	50	23	41.06	0.02	1.57	19.72	8.8
7-Oct-2012	75.09	105	88	0.84	37	48	22.49	40.23	0.04	1.09	19.24	8.2
6-Jun-2013	78.61	132	118	0.89	78	80	28.95	71.52	0.04	1.59	21.66	9
30-Jun-2013	75.36	187	168	0.90	38	62	21.63	55.70	0.06	1.4	19.16	6.2
7-Jul-2013	77.56	57	44	0.77	70	47	22.71	36.28	0.05	1.6	17.93	6
8-Jul-2013	75.27	95	74	0.78	85	77	23.16	59.98	0.04	1.47	19.16	6.2
14-Jul-2013	76.85	78	67	0.86	57	61	21.55	52.40	0.04	1.35	14.44	5.4
18-Jul-2013	76.08	105	90	0.86	105	90	24.7	77.14	0.03	1.27	14.24	5.4
19-Jul-2013	76.65	82	68	0.83	85	88	24.23	72.98	0.07	1.47	14.07	6.2
24-Jul-2013	77.90	127	113	0.89	99	92	26.37	81.86	0.05	1.59	15.71	6.4
25-Jul-2013	76.09	121	117	0.97	108	84	26.39	81.22	0.05	1.59	15.07	5.8
27-Jul-2013	77.07	91	79	0.87	90	92	25.14	79.87	0.01	1.31	15.27	5
31-Jul-2013	75.56	97	77	0.79	90	80	23.02	63.51	0.07	1.42	13.87	6.6
1-Aug-2013	75.75	108	102	0.94	90	90	24.32	85.00	0.03	1.26	15.07	6.2
2-Aug-2013	77.65	140	138	0.99	85	130	24.7	128.14	0.04	1.15	13.21	6.4
11-Aug-2013	78.56	48	34	0.71	75	62	20.43	43.92	0.04	1.52	11.18	5.6
12-Aug-2013	75.98	115	106	0.92	89	82	22.65	75.58	0.05	1.41	12.04	6.2
24-Aug-2013	76.98	75	60	0.80	113	137	27.11	109.60	0.06	1.38	13.36	7.4
25-Aug-2013	75.21	70	64	0.91	97	108	26.35	98.74	0.04	1.63	14.14	6.2
26-Aug-2013	78.46	105	91	0.87	89	115	26.92	99.67		1.46	13.68	6.2
27-Aug-2013	79.22	99	103	1.04	77	120	25.5	124.85		1.53	14.07	6.2
28-Sep-2013	77.00	92	77	0.84	81	119	23.3	99.60	0.02	1.47	10.54	5
3-May-2014	75.12	155	147	0.95	45	49	27.42	46.47	0.02	1.59	14.28	5.1
17-Jul-2014	76.73	196	180	0.92	45	101	32.37	92.76	0.31	1.7	13.54	3.4
20-Sep-2014	75.16	86	76	0.88	51	90	30.16	79.53	0.06	1.67	18.41	3.8
26-Sep-2014	77.83	141	127	0.90	115	82	31.88	73.86	0.14	1.44	15.58	5
3-Oct-2014	79.62	114	91	0.80	51	68	26.51	54.28	0.05	1.33	18.38	4.6
4-Oct-2014	77.16	99	77	0.78	57	43	24.89	33.44	0.05	1.5	19.47	5.4
19-Jun-2015	79.89	103	96	0.93	49	71	28.27	66.17	0.05	1.43	19.8	3.6
20-Jun-2015	76.34	64	78	1.22	63	74	26.04	90.19	0.03	1.36	12.25	2.8
24-Jun-2015	78.67	100	87	0.87	59	68	24.49	59.16	0.05	1.49	16.08	4.4
25-Jun-2015	79.00	73	67	0.92	51	92	29.39	84.44	0.05	1.46	18.04	3.8
10-Sep-2015	78.69	137	140	1.02	87	82	29.96	83.80		1.28	19.38	3.2
11-Sep-2015	75.58	156	159	1.02	130	132	33	134.54	0.02	1.48	21.61	3.8
15-Sep-2015	77.55	231	234	1.01	138	110	41.06	111.43	1.14	2.38	23.76	3.2
16-Sep-2015	76.43	208	163	0.78	196	108	34.79	84.63	0.49	1.77	26.44	4.6
17-Sep-2015	75.38	140	120	0.86	180	142	38.09	121.71	0.04	1.45	23.54	4.6
28-Sep-2015	78.43	114	121	1.06	57	66	25.05	70.05	0.04	1.41	19.71	6.2
29-Sep-2015	79.30	155	143	0.92	38	76	26.16	70.12	0.04	1.51	18.84	3.8
30-Sep-2015	76.07	209	178	0.85	40	68	28.51	57.91	0.06	1.6	20.27	5.6
Average	77.24	113.81	98.53	0.86	77.45	85.21	25.78	73.48	0.07	1.47	17.61	6.62
Median	77.00	105.00	90.00	0.86	69.00	82.00	25.14	72.09	0.04	1.46	18.13	6.40
Min	75.01	48.00	34.00	0.47	27.00	37.00	18.00	17.53	0.01	1.09	10.54	2.40
Max	79.89	231.00	234.00	1.22	240.00	158.00	41.06	134.54	1.14	2.38	26.44	12.00

75th PCTL	78.64083333	136.5	120.5	0.92042839	90	106	28.39	91.47	0.06	1.59	19.58	8

Expected Values-Based on Dilution				
Average	65.62	96.63	28.09	88.44
Median	59.23	92.77	27.77	84.17
Min	11.58	26.63	11.90	13.48
Max	506.80	278.74	74.14	278.26

Influent Flow 80 to 100 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality					DAR FST Effluent		
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
23-Aug-2010	83.92	122	98	0.80	129	134	30.14	107.64	0.03	1.42	17.17	8.4
24-Aug-2010	94.11	73	58	0.79	108	80	23.71	63.56	0.03	1.48	13.84	8.2
25-Aug-2010	90.12	102	95	0.93	115	78	21.96	72.65	0.02	1.45	16.74	7.8
26-Aug-2010	81.54	60	46	0.77	124	96	25.16	73.60		1.59	17.29	5
31-Mar-2011	88.92	206	195	0.95	92	154	32.81	145.78	0.06	1.78	27.05	8.4
1-Apr-2011	81.82	130	116	0.89	25	146	21.69	130.28	0.07	1.19	13.18	9
8-Jul-2011	91.77	114	100	0.88	51	56	25.51	49.12	0.39	1.89	22.88	10.4
10-Aug-2011	90.15	74	68	0.92	67	73	19.68	67.08	0.01	1.74	11.74	9.8
7-Sep-2011	91.89	83	68	0.82	61	63	22.77	51.61		1.47	16.57	9
8-Sep-2011	82.10	102	94	0.92	66	67	21.36	61.75	0.01	1.52	15.78	6
23-Sep-2011	88.38	91	62	0.68	29	43	17.17	29.30		1.63	12.95	13
25-Sep-2011	86.37	69	62	0.90	72	63	20.89	56.61		1.44	16.42	9
26-Sep-2011	90.98	60	52	0.87	28	104	15.96	90.13		1.49	13.73	8.8
27-Sep-2011	89.48	240	168	0.70	40	56	18.06	39.20	0.01	1.61	13.22	10.4
28-Sep-2011	81.45	139	101	0.73	71	85	18.67	61.76	0.01	1.59	15.01	10.2
10-Oct-2011	80.82	74	60	0.81	40	57	20.3	46.22		1.61	16.3	7
24-Jun-2012	96.37	87	74	0.85	75	257	25.55	218.60	0.06	1.54	23.18	15.2
27-Jun-2012	85.39	152	133	0.88	266	207	39.86	181.13	0.04	1.29	16.52	9.8
6-Aug-2012	80.07	206	153	0.74	52	91	25.56	67.59	0.01	1.07	22.92	8.2
21-Aug-2012	92.86	122	111	0.91	83	89	20.86	80.98	0.01	1.3	16.32	10
23-Aug-2012	94.85	95	83	0.87	62	78	15.91	68.15	0.01	1.35	14.38	9.8
24-Aug-2012	84.46	140	128	0.91	92	86	20.24	78.63	0.01	1.17	16.03	8
29-Aug-2012	92.69	128	136	1.06	51	60	18.31	63.75	0.06	1.12	15.16	6.8
30-Aug-2012	86.77	128	112	0.88	24	45	16.66	39.38	0.05	1.36	17.55	5.8
31-Aug-2012	83.49	148	139	0.94	57	64	18.2	60.11	0.09	1.54	15.42	7.2
8-Sep-2012	85.67	104	55	0.53	25	24	17.59	12.69	0.06	1.44	17.43	7
11-Sep-2012	92.82	143	135	0.94	84	104	21.94	98.18	0.04	1.35	16.3	7.4
12-Sep-2012	87.51	116	111	0.96	68	76	21.64	72.72	0.06	1.58	18.04	8.6
13-Sep-2012	82.26	147	97	0.66	74	91	24.31	60.05	0.07	1.67	19.66	8
18-Sep-2012	89.99	113	85	0.75	56	83	21.98	62.43	0.14	1.48	19.42	12.8
19-Sep-2012	89.95	87	63	0.72	76	93	20.97	67.34	0.12	1.44	16.22	8.6
20-Sep-2012	85.56	152	145	0.95	36	55	22.45	52.47	0.04	1.23	18.06	7
21-Sep-2012	88.56	121	107	0.88	44	58	18.76	51.29	0.03	1.38	15.11	7.6
22-Sep-2012	91.14	69	44	0.64	51	45	19.18	28.70	0.03	1.68	17.16	8.6
23-Sep-2012	81.72	91	72	0.79	45	45	20.51	35.60	0.03	1.75	16.52	7.4
5-Oct-2012	80.81	96	92	0.96	84	90	26.26	86.25	0.06	1.46	17.04	8.4
1-Jul-2013	97.97	65	67	1.03	94	61	21.63	62.88	0.04	1.68	14.51	7.6
2-Jul-2013	97.16	55	42	0.76	314	118	29.27	90.11	0.03	1.45	12.79	6.8
3-Jul-2013	86.76	54	37	0.69	55	51	20.94	34.94	0.03	1.42	15.56	5.2
4-Jul-2013	87.76	57	48	0.84	46	43	20.02	36.21	0.06	1.35	16.93	6
5-Jul-2013	91.08	67	59	0.88	101	70	20.33	61.64	0.05	1.33	14.95	8.8
6-Jul-2013	81.98	86	48	0.56	74	67	21.29	37.40	0.05	1.47	15.55	6
11-Jul-2013	88.07	75	67	0.89	67	71	19.95	63.43	0.41	1.47	12.4	6.4
12-Jul-2013	88.34	86	71	0.83	70	66	20.12	54.49	0.04	1.21	12.87	6.2
13-Jul-2013	83.16	69	51	0.74	87	78	21.37	57.65	0.03	1.21	13.3	5
26-Jul-2013	86.13	106	91	0.86	80	75	23.56	64.39	0.01	1.43	14.61	5.8
7-Aug-2013	81.22	130	99	0.76	127	82	25.4	62.45	0.04	1.59	12.67	6.8
8-Aug-2013	90.14	78	69	0.88	96	63	19.04	55.73	0.11	1.77	12.85	9
9-Aug-2013	89.03	95	77	0.81	96	84	22.74	68.08	0.04	1.53	12.38	6.8
10-Aug-2013	89.70	50	38	0.76	74	70	18.14	53.20	0.03	1.6	11.04	6.8
19-Aug-2013	87.07	85	71	0.84	95	102	22.99	85.20	0.05	1.6	13.33	6.4
20-Aug-2013	92.69	67	59	0.88	135	129	24.44	113.60	0.03	1.61	10.54	7.2
21-Aug-2013	87.33	77	70	0.91	109	105	24.38	95.45	0.04	1.55	10.25	5.2
22-Aug-2013	84.07	83	88	1.06	131	134	26.57	142.07	0.04	1.23	10.85	5.6
23-Aug-2013	82.99	105	114	1.09	95	104	24.24	112.91	0.06	1.24	13.16	7
24-Sep-2013	85.67	89	82	0.92	45	68	23.51	62.65	0.01	1.33	12.49	5.2
26-Sep-2013	93.74	64	54	0.84	106	126	23.17	106.31	0.04	1.6	10.54	5.8
27-Sep-2013	82.63	123	86	0.70	78	118	23.16	82.50	0.03	1.3	11.09	5.4
27-Sep-2014	80.54	101	77	0.76	66	107	26.58	81.57	0.04	1.43	14.33	4.4
28-Sep-2014	95.03	90	66	0.73	67	82	22.63	60.13	0.06	1.6	14.82	5.2
29-Sep-2014	97.90	74	62	0.84	53	64	20.65	53.62	0.05	1.65	14.38	5.2
30-Sep-2014	95.34	75	73	0.97	86	104	23.8	101.23	0.05	1.75	15.98	6.6
1-Oct-2014	98.87	80	71	0.89	39	57	18.16	50.59	0.04	1.54	13.81	5.6
2-Oct-2014	85.12	69	60	0.87	64	62	25.26	53.91	0.03	1.51	14.99	3.8
26-Nov-2014	81.20	103	84	0.82	137	147	29.02	119.88	0.23	2.23	15.37	6.2
10-Jun-2015	80.37	143	133	0.93	96	158	33.4	146.95	0.1	1.64	14.68	5.2
11-Jun-2015	83.21	67	73	1.09	62	76	26.75	82.81	0.03	1.74	13.2	6.8
24-Jul-2015	94.56	200	188	0.94	97	120	26.83	112.80	0.04	3.14	16.31	26.4
20-Aug-2015	97.49	58	46	0.79	54	60	20.61	47.59	0.2	1.81	13.41	8
21-Aug-2015	96.34	76	64	0.84	62	58	22.05	48.84	0.11	1.73	15.61	7.6
22-Aug-2015	96.64	72	50	0.69	42	60	19.4	41.67	0.05	1.4	16.48	9.8
23-Aug-2015	91.51	41	35	0.85	75	59	21.63	50.37	0.03	1.69	15.38	8.4
24-Aug-2015	86.57	131	106	0.81	94	91	26.3	73.63		1.55	17.32	8.2
25-Aug-2015	83.33	90	64	0.71	66	69	26.09	49.07		1.5	18.09	8.4
26-Aug-2015	83.69	198	143	0.72	100	111	28.24	80.17	0.04	1.6	17.24	8.4
30-Aug-2015	88.55	71	50	0.70	67	82	22.33	57.75	0.02	1.85	16.49	8.6
1-Sep-2015	97.77	99	80	0.81	78	46	20.9	37.17	0.03	1.77	12.63	8.4
2-Sep-2015	89.27	117	86	0.74	46	44	21.02	32.34	0.04	1.64	16.48	7.4
3-Sep-2015	85.36	140	139	0.99	51	62	25.49	61.56		1.25	18.22	6.4

4-Sep-2015	83.31	125	105	0.84	92	89	28.37	74.76	0.21	1.91	21.42	6.6
5-Sep-2015	81.75	66	57	0.86	81	64	27.58	55.27	0.03	1.43	21.48	4.8
6-Sep-2015	82.10	115	145	1.26	68	78	24.62	98.35	0.02	1.41	20.28	4.6
7-Sep-2015	88.65	80	73	0.91	76	90	23.2	82.13	0.03	1.65	20.82	4.4
8-Sep-2015	85.86	146	122	0.84	94	66	23.25	55.15	0.02	1.52	14.59	3.8
9-Sep-2015	81.09	174	150	0.86	81	92	29.72	79.31	0.04	1.55	17.74	3.4
13-Sep-2015	82.39	93	81	0.87	48	70	25.63	60.97	0.11	1.5	20.18	4.4
14-Sep-2015	80.57	133	115	0.86	48	64	25.97	55.34	0.03	1.25	19.7	3.2
Average	87.77	103.18	87.40	0.85	78.02	84.06	23.04	71.73	0.06	1.53	15.80	7.51
Median	87.33	93.00	77.00	0.85	72.00	76.00	22.45	62.65	0.04	1.52	15.56	7.20
Min	80.07	41.00	35.00	0.53	24.00	24.00	15.91	12.69	0.01	1.07	10.25	3.20
Max	98.87	240.00	195.00	1.26	314.00	257.00	39.86	218.60	0.41	3.14	27.05	26.40
Expected Values-Based on Dilution												
Average					57.75	85.05	24.72	77.84				
Median					52.22	81.79	24.48	74.21				
Min					10.84	24.94	11.15	12.63				
Max					409.53	225.24	59.91	224.85				

Influent Flow 100 to 120 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality				DAR FST Effluent			
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
26-Jun-2012	101.42	84	62	0.74	56	51	16.24	37.64	0.04	1.29	11.53	9.8
22-Aug-2012	106.21	94	80	0.85	68	59	17.41	50.21		1.44	14.79	10
27-Aug-2012	114.91	79	82	1.04	62	72	16.95	74.73	0.16	1.31	15.95	14
28-Aug-2012	106.60	110	90	0.82	115	108	20.18	88.36	0.06	1.54	13.13	9
7-Sep-2012	105.12	106	80	0.75	57	71	18.01	53.58	0.08	1.57	16.17	10.6
9-Sep-2012	108.45	62	38	0.61	77	68	17.37	41.68	0.06	1.54	17.01	9.6
10-Sep-2012	108.55	69	65	0.94	37	45	13.37	42.39	0.02	1.28	11.53	9
25-Sep-2013	105.12	64	54	0.84	139	136	25.42	114.75	0.04	1.47	11.82	7.4
25-Jul-2015	118.96	78	72	0.92	59	82	17.96	75.69	0.03	2.7	12.03	24
26-Jul-2015	105.58	42	40	0.95	106	124	22.29	118.10	0.03	2.3	11.05	15.8
27-Jul-2015	110.92	90	89	0.99	38	58	20.91	57.36	0.03	1.53	15.03	5.8
29-Jul-2015	109.43	101	77	0.76	53	85	19.2	64.80	0.04	1.65	12.39	5.8
30-Jul-2015	105.64	61	53	0.87	56	91	20.47	79.07	0.03	1.42	9.97	3.6
31-Jul-2015	110.06	76	69	0.91	33	47	19.33	42.67	0.03	1.32	14.89	4.2
5-Aug-2015	119.98	114	91	0.80	44	37	16.53	29.54	0.03	1.46	10.45	6.4
6-Aug-2015	107.59	97	98	1.01	123	82	24.79	82.85	0.03	1.55	11.47	4.6
7-Aug-2015	106.16	102	120	1.18	51	43	19.15	50.59	0.04	1.57	12.69	3.3
8-Aug-2015	118.22	78	64	0.82	46	40	16.7	32.82	0.04	1.47	12.2	5.4
11-Aug-2015	105.95	87	77	0.89	37	49	17.37	43.37	0.05	1.74	11.07	4.4
12-Aug-2015	100.17	104	68	0.65	32	50	18.09	32.69	0.05	1.64	9.81	4.8
13-Aug-2015	107.66	61	67	1.10	35	53	20.23	58.21		1.45	12.97	5.4
14-Aug-2015	115.91	41	30	0.73	55	76	19.43	55.61	0.04	1.74	10.5	5.6
15-Aug-2015	113.26	67	52	0.78	31	21	15.44	16.30	0.04	1.72	12.12	6.4
16-Aug-2015	111.84	44	43	0.98	42	49	15.54	47.89	0.04	1.52	12	7
19-Aug-2015	100.59	145	103	0.71	40	56	16.56	39.78	0.03	1.72	11.02	8.2
31-Aug-2015	100.10	102	86	0.84	75	50	18	42.16	0.03	1.84	13.25	9
Average	108.63	83.00	71.15	0.86	60.27	65.50	18.57	56.65	0.04	1.61	12.57	8.04
Median	107.63	81.50	70.50	0.85	54.00	57.00	18.01	50.40	0.04	1.54	12.08	6.70
Min	100.10	41.00	30.00	0.61	31.00	21.00	13.37	16.30	0.02	1.28	9.81	3.30
Max	119.98	145.00	120.00	1.18	139.00	136.00	25.42	118.10	0.16	2.70	17.01	24.00

Expected Values-Based on Dilution

Average	46.66	68.71	19.98	62.89
Median	42.37	66.36	19.87	60.22
Min	8.67	19.95	8.92	10.10
Max	337.47	185.61	49.37	185.29

Influent Flow 120 to 130 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality				DAR FST Effluent			
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
28-Jul-2015	120.06	61	50	0.82	57	65	18.01	53.28	0.04	1.79	11.35	8.2
9-Aug-2015	121.56	65	54	0.83	38	31	14.05	25.75	0.04	1.61	10.07	4.8
10-Aug-2015	120.84	83	63	0.76	30	42	14.76	31.88	0.04	1.6	8.97	5.4
17-Aug-2015	126.37	73	55	0.75	37	49	15.95	36.92	0.04	1.43	10.92	8.4
18-Aug-2015	121.26	55	53	0.96	44	38	16.74	36.62	0.03	1.57	11.17	9.4
Average	122.02	67.40	55.00	0.83	41.20	45.00	15.90	36.89	0.04	1.60	10.50	7.24
Min	120.06	55.00	50.00	0.75	30.00	31.00	14.05	25.75	0.03	1.43	8.97	4.80
Max	126.37	83.00	63.00	0.96	57.00	65.00	18.01	53.28	0.04	1.79	11.35	9.40
Expected Values-Based on Dilution												
Average					41.54	61.17	17.78	55.99				
Min					7.23	16.63	7.43	8.42				
Max					320.40	176.22	46.87	175.92				

Influent Flow 130 to 140 MGD

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality				DAR FST Effluent			
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
25-Jun-2012	131.98	72	64	0.89	52	40	13.2	35.56	0.01	1.79	12.67	15.2
1-Aug-2015	130.79	48	50	1.04	41	38	15.57	39.58	0.03	1.63	12.3	12.6
Average	131.38	60.00	57.00	0.97	46.50	39.00	14.39	37.57	0.02	1.71	12.49	13.90
Expected Values-Based on Dilution												
Average					38.58	56.81	16.52	52.00				

Influent Flow 140 MGD to PHF

	Total Plant Influent (w/o recycles)				Main Pump Station Water Quality				DAR FST Effluent			
	Plant Influent Flow	BOD	cBOD	cBOD/BOD	TSS	BOD	TKN	Expected cBOD	NH3	TKN	NO3+NO2	TSS
Date	(MGD)	(mg/L)	(mg/L)	(-)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
2-Aug-2015	148.71	66	59	0.89	58	56	13.65	50.06	0.02	1.91	8.8	9.6
3-Aug-2015	159.47	63	52	0.83	55	31	15.13	25.59	0.07	2.58	10.48	15
4-Aug-2015	140.38	86	66	0.77	103	49	17.72	37.60	0.03	1.47	9.96	7
Average	149.52	71.67	59.00	0.83	72.00	45.33	15.50	37.75	0.04	1.99	9.75	10.53
Expected Values-Based on Dilution												
Average					33.90	49.92	14.51	45.69				

APPENDIX G

Florida Department of Environmental Protection

Southwest District Office
13051 North Telecom Parkway
Temple Terrace, FL 33637-0926

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Secretary

November 23, 2015

In the Matter of an
Application for Permit by:

City of Tampa Wastewater Department
Mr. Eric Weiss, P.E., Director Wastewater Department
2545 Guy N. Verger Boulevard
Tampa, Florida 33605
eric.weiss@tampagov.net

File Number FL0020940-019-DW1P/NR
Hillsborough County
City of Tampa - Howard F. Curren AWTP

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number FL0020940 to operate the Howard F. Curren AWTP, issued under Chapter 403, Florida Statutes.

Monitoring requirements under this permit are effective on the first day of the second month following the effective date of the permit. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, within fourteen days of receipt of notice. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Under Rule 62-110.106(4), Florida Administrative Code, a person may request an extension of the time for filing a petition for an administrative hearing. The request must be filed (received by the Clerk) in the Office of General Counsel before the end of the time period for filing a petition for an administrative hearing.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Section 120.60(3), Florida Statutes, however, also allows that any person who has asked the Department in writing for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition or request for an extension of time within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information, as indicated in Rule 28-106.201, Florida Administrative Code:

(a) The name and address of each agency affected and each agency's file or identification number, if known;
(b) The name, address, any e-mail address, any facsimile number, and telephone number of the petitioner, if the petitioner is not represented by an attorney or a qualified representative; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the determination;
(c) A statement of when and how the petitioner received notice of the Department's decision;
(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the Department's proposed action;
(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the Department's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the Department to take with respect to the Department's proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This permit action is final and effective on the date filed with the Clerk of the Department unless a petition (or request for an extension of time) is filed in accordance with the above. Upon the timely filing of a petition (or request for an extension of time), this permit will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the permit action under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this permit action is filed with the Clerk of the Department.

Executed in Hillsborough County, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Kelley M. Boatwright
Program Administrator
Permitting & Waste Cleanup Program
Southwest District

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this NOTICE OF PERMIT ISSUANCE and all copies were mailed before the close of business on the date indicated below.

FILING AND ACKNOWLEDGMENT

FILED, on this date, under Section 120.52, Florida Statutes, with the designated Deputy Clerk, receipt of which is hereby acknowledged.

Rhonda Hughes November 23, 2015
[Clerk] **[Date]**

cc:

EPA Region IV – Water Management, r4npdespermits@epa.gov
Jeff Hilton, P.E., City of Tampa, Jeffrey.Hilton@tampagov.net
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STATE OF FLORIDA
DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:
City of Tampa Wastewater Department

RESPONSIBLE OFFICIAL:
Mr. Eric Weiss, P.E., Director Wastewater Department
2545 Guy N. Verger Boulevard
Tampa, Florida 33605
(813) 274-8039
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PERMIT NUMBER: FL0020940 (Major)
FILE NUMBER: FL0020940-019-DW1P/NR
EFFECTIVE DATE: **November 23, 2015**
EXPIRATION DATE: **November 22, 2020**

FACILITY:

City of Tampa - Howard F. Curren AWTP
2700 Maritime Blvd
Tampa, FL 33605-6744
Hillsborough County
Latitude: 27°55' 25.10" N Longitude: 82°26' 14.26" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.) and constitutes authorization to discharge to waters of the state under the National Pollutant Discharge Elimination System. This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above named permittee is hereby authorized to operate the facilities in accordance with the documents attached hereto and specifically described as follows:

WASTEWATER TREATMENT:

An existing 96.0 MGD Annual Average Daily Flow (AADF) permitted capacity Type I two-stage, high rate (pure oxygen and fine bubble aeration) activated sludge biological nitrification/denitrification domestic wastewater treatment plant. The facility has the capability to operate in a number of modes as described in the submitted basis of design. The facility includes the following units: Pre-aeration with odor control consisting of three tanks of 0.670 MG total volume, mechanical screening and grit removal consisting of eight tanks of 0.727 MG total volume, eight primary sedimentation tanks of 50,464 square feet total surface area and 4.94 MG total volume, six pure oxygen reactors of 7.62 MG total volume, twelve carbonaceous sedimentation tanks of 201,552 square feet total surface area and 18.08 MG total volume, four nitrification reactors of 8.48 MG total volume, eight final sedimentation tanks of 134,368 square feet total surface area and 12.00 MG total volume, thirty-two coarse sand, denitrification filters of 33,600 square feet total surface area, three chlorine contact chambers of 2.38 MG total volume with post aeration, and dechlorination facilities, two gravity sludge thickeners of 0.350 MG total volume, seven anaerobic digesters of 9.87 MG total volume, sludge storage tanks, eight belt filter presses, sludge heat drying facility and fifty-seven sludge drying beds and other associated facilities.

This plant is operated to achieve Advanced Wastewater Treatment (AWT), with high-level disinfected and dechlorinated effluent discharged to Hillsborough Bay. Biosolids generated by this facility are heat dried to meet Class AA standards for distribution and marketing or are dewatered for land application as Class A or Class B biosolids.

REUSE OR DISPOSAL:

Surface Water Discharge D-001: An existing 96.0 MGD AADF discharge to Hillsborough Bay (Upper), Class III Marine waters, (WBID# 1558E) which is approximately 141 feet in length and discharges at a depth of approximately 29.1 feet. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Surface Water Discharge D-002: An existing intermittent discharge to Ybor City Drain, Class III Marine waters, (WBID# 1584A) which discharges at a depth of approximately 4.5 feet. Ybor City Drain flows into WBID 1558E of Hillsborough Bay (Upper). Outfall D-002 shall only discharge as result of flows to the treatment plant in excess of approximately 100 MGD coupled with extreme high tide conditions. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Surface Water Discharge D-003: An existing intermittent discharge to Ybor City Drain, Class III Marine waters, (WBID# 1584A) which discharges at a depth of approximately 6.8 feet. Ybor City Drain flows into WBID 1558E of Hillsborough Bay (Upper). Outfall D-003 shall only discharge as result of flows to the treatment plant in excess of approximately 100 MGD coupled with extreme high tide conditions. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Pursuant to Rule 62-4.244, F.A.C., the permittee is hereby granted a mixing zone for Dichlorobromomethane and Dibromochloromethane for the effluent discharge at Outfalls D-001, D-002 and D-003. The permittee's discharge shall not cause a violation of the Chapter 62-302, F.A.C., Class III Water Quality Standards outside the boundaries of the mixing zones described below.

The mixing zone for Dichlorobromomethane has a circular area of 1.0 meter radius, with a total surface area of 3.14 square meters, centered over the outfall(s). The mixing zone for Dibromochloromethane has a circular area of 1.17 meters radius, with a total surface area of 4.3 square meters, centered over the outfall(s). These mixing zones include the entire water column from the surface to the bottom and otherwise complies with the physical requirements of Rule 62-4.244, F.A.C. Parameter limits at the outfall(s) are as shown in Condition I.A.1., below.

REUSE:

Land Application R-001: An existing 6.0 MGD AADF permitted capacity slow-rate public access system (City of Tampa Public Access Reuse System) consisting of the City of Tampa service area as outlined on attachment VI on the permit application.

Industrial Reuse R-002: An existing 2.3 MGD AADF permitted capacity Part VII industrial reuse system providing Part III quality reclaimed water for use as cooling water and minor irrigation at the City of Tampa Refuse to Energy Facility (McKay Bay Facility). R-002 is located approximately at latitude 27°56' 56" N, longitude 82°25' 19" W.

Industrial Reuse R-003: An existing 4.32 MGD AADF permitted industrial reuse system providing secondary treatment reclaimed water to a closed-loop system for heating purposes at Mosaic Fertilizer, LLC (Formerly CF Industries). R-003 is located approximately at latitude 27° 55' 02" N, longitude 82° 26' 14" W.

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 3 through 36 of this permit.

I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Surface Water Discharges

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to discharge effluent from Outfall D-001 to Hillsborough Bay (Upper). In addition, the permittee is authorized to discharge effluent from Outfalls D-002 and D-003 to Ybor City Drain and then to Hillsborough Bay (Upper). Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8. :

			Effluent Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max Max	Report 96.0	Monthly Average Annual Average	Continuous	Recording Flow Meter with Totalizer	FLW-05	
Flow	MGD	Max Max	Report Report	Monthly Average Annual Average	Continuous	Recording Flow Meter with Totalizer	FLW-06	See I. A.4
Flow	MGD	Max Max	Report Report	Monthly Average Annual Average	Continuous	Recording Flow Meter with Totalizer	FLW-07	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max	5.0	Annual Average	Monthly	Calculated	EFA-01	
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max	6.25 7.5 10.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	5.0	Annual Average	Monthly	Calculated	EFA-01	
Solids, Total Suspended	mg/L	Max Max Max	6.25 7.5 10.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab	EFB-01	
Nitrogen, Total	mg/L	Max	3.0	Annual Average	Monthly	Calculated	EFA-01	
Nitrogen, Total	mg/L	Max Max Max	3.75 4.5 6.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
Phosphorus, Total (as P)	mg/L	Max	Report	Annual Average	Monthly	Calculated	EFA-01	
Phosphorus, Total (as P)	mg/L	Max Max	Report Report	Monthly Average Single Sample	Weekly	24-hr FPC	EFA-01	
pH	s.u.	Min Max	6.5 8.5	Single Sample Single Sample	Continuous	Meter	EFD-01	See I.A.3

			Effluent Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	Monthly	Calculated	EFA-01	See I.A.5
Coliform, Fecal	#/100mL	Max	25	Single Sample	Daily; 24 hours	Grab	EFA-01	
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter	EFA-01	See I.A.3 and I.A.6
Chlorine, Total Residual (For Dechlorination)	mg/L	Max	0.01	Single Sample	Daily; 24 hours	Grab	EFD-01	
Oxygen, Dissolved (DO)	mg/L	Min	5.0	Single Sample	Daily; 24 hours	Grab	EFD-01	
Enterococci	#/100mL	Max Max	35 276	Monthly Geometric Mean Single Sample	5/Month	Grab	EFA-01	See I.A.7
Copper, Total Recoverable	ug/L	Max	3.7	Single Sample	Quarterly	24-hr FPC	EFD-01	
Dichlorobromomethane	ug/L	Max	33.0	Annual Average	Monthly	Calculated	EFD-01	
Dichlorobromomethane	ug/L	Max	Report	Monthly Average	Monthly	Grab	EFD-01	
Dibromochloromethane	ug/L	Max	39.0	Annual Average	Monthly	Calculated	EFD-01	
Dibromochloromethane	ug/L	Max	Report	Monthly Average	Monthly	Grab	EFD-01	
Nitrogen, Total	ton/mth	Max	Report	Monthly Total	Monthly	Calculated	EFA-01	
Nitrogen, Total	ton/yr	Max	319.8	Annual Total	Monthly	Calculated	EFA-01	
Nitrogen, Total	ton/yr	Max	213.2	5 Year Average	Monthly	Calculated	EFA-01	
Chronic Whole Effluent Toxicity, 7-Day IC25 (Ceriodaphnia dubia)	percent	Min	100	Single Sample	Quarterly	24-hr FPC	EFD-01	See I.A.8
Chronic Whole Effluent Toxicity, 7-Day IC25 (Pimephales promelas)	percent	Min	100	Single Sample	Quarterly	24-hr FPC	EFD-01	See I.A.8

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-05	Flow from D-001 to Hillsborough Bay (FLW-05 = FLW-04 – FLW-07 - FLW-06 – FLW-02 – FLW-01)
FLW-01	Flow to City of Tampa Public Access Reuse System - R-001
FLW-02	Flow to City of Tampa Refuse to Energy Facility (McKay Bay Facility) R-002
FLW-04	Total plant flow measured at the headworks
FLW-06	Flow from D-002 to Hillsborough Bay (metered)
FLW-07	Flow from D-003 to Hillsborough Bay (metered)
EFA-01	After disinfection and prior to discharge to R-001, R-002, and R-003
EFB-01	Turbidity and TSS monitoring point after filtration and prior to disinfection
EFD-01	After dechlorination and prior to discharge to Hillsborough Bay

3. Hourly measurement of pH and total residual chlorine for disinfection during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. Over a 30-day period, at least 75 percent of the fecal coliform values shall be below the detection limits. No sample shall exceed 25 fecal coliforms per 100 mL. No sample shall exceed 5.0 mg/L of total suspended solids (TSS) at a point before the application of the disinfectant. To report the "% less than detection," count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer). *[62-600.440(5)(f)]*

6. Total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. *[62-600.440(4)(b), (5)(b), and (6)(b)]*

7. The enterococci monthly geometric mean value shall be based on all samples of effluent collected during a period of 30 consecutive days (monthly); a minimum of 5 samples of effluent, each collected on nonconsecutive days, is required. *[62-302.500(1)(a)6. and 40 CFR Part 131.41]*

8. In accordance with the load allocations for the Tampa Bay Reasonable Assurance, the Total Maximum Daily Load for Total Nitrogen (TN) shall be calculated from the monthly average Total Nitrogen concentration. The Total Nitrogen loading shall be calculated as a twelve-month rolling total and shall not exceed 319.8 tons/year and the five year average of the yearly totals shall not exceed 213.20 tons/year.

Monthly Total (Mt)
$Mt = \frac{(\text{Monthly Average Total Nitrogen Concentration, mg/l})(\text{Total Monthly Flow, MG})(8.3454)}{2000 \text{ lbs}}$
Mt = Tons/Month

The annual total shall be calculated as a 12-month rolling total based on the cumulative total of TN tons discharged during the reporting month plus the total of TN tons discharged during the preceding 11 consecutive months.

Annual Total (At)
Annual Total at the end of the nth Month: $At_n = Mt_{n-11} + Mt_{n-10} \ldots Mt_n$

The 5-year rolling average shall be calculated as the cumulative total of TN tons discharged during the reporting month plus the total of TN tons discharged during the preceding 59 consecutive months, divided by 5.

5 Year Average of the Yearly Totals (5yr)
$5yr_n = (Mt_{n-59} + Mt_{n-58} \ldots Mt_n) / 5$

9. The permittee shall comply with the following requirements to evaluate chronic whole effluent toxicity of the discharge from outfall D-001.

   a. Effluent Limitation
      (1) In any routine or additional follow-up test for chronic whole effluent toxicity, the 25 percent inhibition concentration (IC25) for reproduction or growth shall not be less than 100% effluent. [Rules 62-302.530(61) and 62-4.241(1)(b), F.A.C.]
      (2) For acute whole effluent toxicity, the 96-hour LC50 shall not be less than 100% effluent in any test. [Rule 62-302.500(1)(a)4. and 62-4.241(1)(a), F.A.C.]

   b. Monitoring Frequency
      (1) Routine toxicity tests shall be conducted once every three months, the first starting within 60 days of the effective date of this permit and lasting for the duration of this permit.
      (2) Upon completion of four consecutive valid routine tests that demonstrate compliance with the effluent limitation in I.A.9.a.(1) above, the permittee may submit a written request to the Department for a reduction in monitoring frequency to once every six months. The request shall include a summary of the data and the complete bioassay laboratory reports for each test used to demonstrate compliance. The Department shall act on the request within 45 days of receipt. Reductions in monitoring shall only become effective upon the Department's written confirmation that the facility has completed four consecutive valid routine tests that demonstrate compliance with the effluent limitation in I.A.9.a.(1) above.
      (3) If a test within the sequence of the four is deemed invalid based on the acceptance criteria in EPA-821-R-02-013, but is replaced by a repeat valid test initiated within 21 days after the last day of the invalid test, the invalid test will not be counted against the requirement for four consecutive valid tests for the purpose of evaluating the reduction of monitoring frequency.

   c. Sampling Requirements
      (1) For each routine test or additional follow-up test conducted, a total of three flow proportional 24-hr composite samples of final effluent shall be collected and used in accordance with the sampling protocol discussed in EPA-821-R-02-013, Section 8.
      (2) The first sample shall be used to initiate the test. The remaining two samples shall be collected according to the protocol and used as renewal solutions on Day 3 (48 hours) and Day 5 (96 hours) of the test.
      (3) Samples for routine and additional follow-up tests shall not be collected on the same day.

   d. Test Requirements
      (1) Routine Tests: All routine tests shall be conducted using a control (0% effluent) and a minimum of five test dilutions: **100%**, **50%**, **25%**, **12.5%**, and **6.25%** final effluent.
      (2) The permittee shall conduct a daphnid, **Ceriodaphnia dubia**, Survival and Reproduction Test and a fathead minnow, **Pimephales promelas**, Larval Survival and Growth Test, concurrently.
      (3) All test species, procedures and quality assurance criteria used shall be in accordance with **Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, 4th Edition, EPA-821-R-02-013. Any deviation of the bioassay procedures outlined herein shall be submitted in writing to the Department for review and approval prior to use. In the event the above method is revised, the permittee shall conduct chronic toxicity testing in accordance with the revised method.
      (4) The control water and dilution water shall be moderately hard water as described in EPA-821-R-02-013, Section 7.2.3.

   e. Quality Assurance Requirements
      (1) A standard reference toxicant (SRT) quality assurance (QA) chronic toxicity test shall be conducted with each species used in the required toxicity tests either concurrently or initiated no more than 30 days before the date of each routine or additional follow-up test conducted. Additionally, the SRT test must be conducted concurrently if the test organisms are obtained from outside the test laboratory unless the test organism supplier provides control chart data from at least the last five monthly chronic toxicity tests using the same reference toxicant and test conditions. If the organism supplier provides the required

SRT data, the organism supplier's SRT data and the test laboratory's monthly SRT-QA data shall be included in the reports for each companion routine or additional follow-up test required.

(2) If the mortality in the control (0% effluent) exceeds 20% for either species in any test or the "test acceptability criteria" are not met, the test for that species (including the control) shall be invalidated and the test repeated. Test acceptability criteria for each species are defined in EPA-821-R-02-013, Section 13.12 (**Ceriodaphnia dubia**) and Section 11.11 (**Pimephales promelas**). The repeat test shall begin within 21 days after the last day of the invalid test.

(3) If 100% mortality occurs in all effluent concentrations for either test species prior to the end of any test and the control mortality is less than 20% at that time, the test (including the control) for that species shall be terminated with the conclusion that the test fails and constitutes non-compliance.

(4) Routine and additional follow-up tests shall be evaluated for acceptability based on the observed dose-response relationship as required by EPA-821-R-02-013, Section 10.2.6., and the evaluation shall be included with the bioassay laboratory reports.

f. Reporting Requirements

(1) Results from all required tests shall be reported on the Discharge Monitoring Report (DMR) as follows:

(a) Routine and Additional Follow-up Test Results: The calculated IC25 for reproduction or growth for each test species shall be entered on the DMR.

(2) A bioassay laboratory report for each routine test shall be prepared according to EPA-821-R-02-013, Section 10, Report Preparation and Test Review, and mailed to the Department at the address below within 30 days after the last day of the test.

(3) For additional follow-up tests, a single bioassay laboratory report shall be prepared according to EPA-821-R-02-013, Section 10, and mailed within 30 days after the last day of the second valid additional follow-up test.

(4) Data for invalid tests shall be included in the bioassay laboratory report for the repeat test.

(5) The same bioassay data shall not be reported as the results of more than one test.

(6) All bioassay laboratory reports shall be sent to:
Florida Department of Environmental Protection
Southwest District Office
13051 N Telecom Pkwy,
Temple Terrace, Florida 33637-0926
swd_dw@dep.state.fl.us

g. Test Failures

(1) A test fails when the test results do not meet the limits in I.A.9.a.(1).

(2) Additional Follow-up Tests:

(a) If a routine test does not meet the chronic toxicity limitation in I.A.9.a.(1) above, the permittee shall notify the Department at the address above within 21 days after the last day of the failed routine test and conduct two additional follow-up tests on each species that failed the test in accordance with I.A.9.d.

(b) The first test shall be initiated within 28 days after the last day of the failed routine test. The remaining additional follow-up tests shall be conducted weekly thereafter until a total of two valid additional follow-up tests are completed.

(c) The first additional follow-up test shall be conducted using a control (0% effluent) and a minimum of five dilutions: 100%, 50%, 25%, 12.5%, and 6.25% effluent. The permittee may modify the dilution series in the second additional follow-up test to more accurately bracket the toxicity such that at least two dilutions above and two dilutions below the target concentration and a control (0% effluent) are run. All test results shall be analyzed according to the procedures in EPA-821-R-02-013.

(3) In the event of three valid test failures (whether routine or additional follow-up tests) within a 12-month period, the permittee shall notify the Department within 21 days after the last day of the third test failure.

(a) The permittee shall submit a plan for correction of the effluent toxicity within 60 days after the last day of the third test failure.

(b) The Department shall review and approve the plan before initiation.

(c) The plan shall be initiated within 30 days following the Department's written approval of the plan.

(d) Progress reports shall be submitted quarterly to the Department at the address above.

(e) During the implementation of the plan, the permittee shall conduct quarterly routine whole effluent toxicity tests in accordance with I.A.9.d. Additional follow-up tests are not required while the plan is in progress. Following completion or termination of the plan, the frequency of monitoring for routine and additional follow-up tests shall return to the schedule established in I.A.9.b.(1). If a routine test is invalid according to the acceptance criteria in EPA-821-R-02-013, a repeat test shall be initiated within 21 days after the last day of the invalid routine test.

(f) Upon completion of four consecutive quarterly valid routine tests that demonstrate compliance with the effluent limitation in I.A.9.a.(1) above, the permittee may submit a written request to the Department to terminate the plan. The plan shall be terminated upon written verification by the Department that the facility has passed at least four consecutive quarterly valid routine whole effluent toxicity tests. If a test within the sequence of the four is deemed invalid, but is replaced by a repeat valid test initiated within 21 days after the last day of the invalid test, the invalid test will not be counted against the requirement for four consecutive quarterly valid routine tests for the purpose of terminating the plan.

(4) If chronic toxicity test results indicate greater than 50% mortality within 96 hours in an effluent concentration equal to or less than the effluent concentration specified as the acute toxicity limit in I.A.9.a.(2), the Department may revise this permit to require acute definitive whole effluent toxicity testing.

(5) The additional follow-up testing and the plan do not preclude the Department taking enforcement action for acute or chronic whole effluent toxicity failures.

[62-4.241, 62-620.620(3)]

B. Reuse and Land Application Systems

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse Systems R-001 and R-002. Such reclaimed water shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD MGD	Max Max	6.0 2.3	Annual Average Annual Average	Monthly Monthly	Calculated Calculated	FLW-01 FLW-02	
Flow	MGD MGD	Max Max	Report Report	Monthly Average Monthly Average	Continuous Continuous	Recording Flow Meter with Totalizer	FLW-01 FLW-02	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	Monthly	Calculated	EFA-01	
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max	30.0 45.0 60.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab	EFB-01	See I.B.4
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFD-01	See I.B.3
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	Monthly	Calculated	EFA-01	See I.B.4
Coliform, Fecal	#/100mL	Max	25	Single Sample	Daily; 24 hours	Grab	EFA-01	
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter	EFA-01	See I.B.5 and I.B.8
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter	EFB-01	See I.B.6 and I.B.8
Giardia	cysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Grab	EFA-01	See I.B.9 See I.C.5
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Grab	EFA-01	See I.B.9 See I.C.5

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-01	Flow to City of Tampa Public Access Reuse System - R-001
FLW-02	Flow to City of Tampa Refuse to Energy Facility (McKay Bay Facility) R-002
EFA-01	After disinfection and prior to discharge to R-001, R-002, and R-003
EFB-01	Turbidity and TSS monitoring point after filtration and prior to disinfection
EFD-01	After dechlorination and prior to discharge to Hillsborough Bay

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. *[Chapter 62-601, Figure 2]*

4. Over a 30-day period, at least 75 percent of the fecal coliform values shall be below the detection limits. No sample shall exceed 25 fecal coliforms per 100 mL. No sample shall exceed 5.0 mg/L of total suspended solids (TSS) at a point before the application of the disinfectant. To report the "% less than detection," count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer). *[62-600.440(5)(f)]*

5. The minimum total chlorine residual shall be limited as described in the approved operating protocol, such that the permit limitation for fecal coliform bacteria will be achieved. In no case shall the total chlorine residual be less than 1.0 mg/L. *[62-600.440(5)(b); 62-610.460(2); and 62-610.463(2)]*

6. The maximum turbidity shall be limited as described in the approved operating protocol, such that the permit limitations for total suspended solids and fecal coliforms will be achieved. *[62-610.463(2)]*

7. The treatment facilities shall be operated in accordance with all approved operating protocols. Only reclaimed water that meets the criteria established in the approved operating protocol(s) may be released to system storage or to the reuse system. Reclaimed water that fails to meet the criteria in the approved operating protocol(s) shall be directed to the following permitted alternate discharge system: D-001and R-003. *[62-610.320(6) and 62-610.463(2)]*

8. Instruments for continuous on-line monitoring of total residual chlorine and turbidity shall be equipped with an automated data logging or recording device. *[62-610.463(2)]*

9. Intervals between sampling for Giardia and Cryptosporidium shall not exceed two years. *[62-610.463(4)]*

10. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse System R-003. Such reclaimed water shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max./Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	4.32	Annual Average	Monthly	Calculated	FLW-03	
Flow	MGD	Max	Report	Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-03	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	Monthly	Calculated	EFA-01	
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max	30.0 45.0 60.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	Monthly	Calculated	EFA-01	
Solids, Total Suspended	mg/L	Max Max Max	30.0 45.0 60.0	Monthly Average Weekly Average Single Sample	Daily; 24 hours	24-hr FPC	EFA-01	
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFD-01	See I.B.3
Coliform, Fecal	#/100mL	Max	200	Annual Average	Monthly	Calculated	EFA-01	
Coliform, Fecal	#/100mL	Max Max	200 800	Monthly Geometric Mean Single Sample	Daily; 24 hours	Grab	EFA-01	See I.B.12
Chlorine, Total Residual	mg/L	Max	0.5	Single Sample	Continuous	Meter	EFA-01	See I.B.13

11. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.10. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-03	Flow to industrial reuse system R-003
EFA-01	After disinfection and prior to discharge to R-001, R-002, and R-003
EFD-01	After dechlorination and prior to discharge to Hillsborough Bay

12. The arithmetic mean of the monthly fecal coliform values collected during an annual period shall not exceed 200 per 100 mL of reclaimed water sample. The geometric mean of the fecal coliform values for a minimum of 10 samples of reclaimed water, each collected on a separate day during a period of 30 consecutive days (monthly), shall not exceed 200 per 100 mL of sample. Any one sample shall not exceed 800 fecal coliform values per 100 mL of sample.. *[62-600.440(4)(c)]*

13. A minimum of 0.5 mg/L total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. *[62-610.410 and 62-600.440(4)(b) and (5)(b)]*

C. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C.8.:

			Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow	MGD	Max	96.0	Annual Average	Monthly	Calculated	FLW-04	See I.C.4
Flow	MGD	Max Max	Report Report	3-Month Rolling Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-04	
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	Monthly	Calculated	FLW-04	
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max Max	Report Report	Monthly Average Single Sample	Weekly	24-hr FPC	INF-01	See I.C.3
Solids, Total Suspended (Influent)	mg/L	Max Max	Report Report	Monthly Average Single Sample	Weekly	24-hr FPC	INF-01	See I.C.3

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.C.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-04	Total plant flow measured at the headworks
INF-01	At headworks, prior to primary treatment

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. *[62-601.500(4)]*

4. A recording flow meter and totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-601.200(17) and .500(6)]*

5. Sampling results for giardia and cryptosporidium shall be reported on DEP Form 62-610.300(4)(a)4, Pathogen Monitoring, which is attached to this permit. (If additional sampling is required in accordance with the attached form, only one additional sampling event will be required within the two year monitoring frequency). This form shall be submitted to the Department's Southwest District Office and to DEP's Reuse Coordinator in Tallahassee. *[62-610.300(4)(a)]*

6. The sample collection, analytical test methods and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "FAC 62-4 MDL/PQL Table (April 26, 2006)" is available at http://www.dep.state.fl.us/labs/library/index.htm. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:

   a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;

   b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and

   c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

   When the analytical results are below method detection or practical quantitation limits, the permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

   Where necessary, the permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. *[62-4.246, 62-160]*

7. The permittee shall provide safe access points for obtaining representative influent, reclaimed water, and effluent samples which are required by this permit. *[62-601.500(5)]*

8. Monitoring requirements under this permit are effective on the first day of the second month following the effective date of the permit. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Unless specified otherwise in this permit, monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below. DMRs shall be submitted for each required monitoring period including periods of no discharge.

REPORT Type on DMR	Monitoring Period	Mail or Electronically Submit by
Monthly	first day of month - last day of month	28th day of following month
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 31	July 28 January 28
Annual	January 1 - December 31	January 28

The permittee may submit either paper or electronic DMR forms. If submitting paper DMR forms, the permittee shall make copies of the attached DMR forms, without altering the original format or content unless approved by the Department, and shall mail the completed DMR forms to the Department by the twenty-eighth (28th) of the month following the month of operation at the address specified below:

Florida Department of Environmental Protection
Wastewater Compliance Evaluation Section, Mail Station 3551
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

If submitting electronic DMR forms, the permittee shall use the electronic DMR system(s) approved in writing by the Department and shall electronically submit the completed DMR forms to the Department by the twenty-eighth (28th) of the month following the month of operation. Data submitted in electronic format is equivalent to data submitted on signed and certified paper DMR forms.

[62-620.610(18)][62-601.300(1),(2), and (3)]

9. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, color, odor, and corrosivity). These monitoring results shall be reported to the Department annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted in lieu of the report. The annual reclaimed water or effluent analysis report or the certification shall be completed and submitted in a timely manner so as to be received by the Department at the address identified on the DMR by June 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. *[62-601.300(4)][62-601.500(3)][62-610.300(4)]*

10. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. *[62-610.870(3)]*

11. Operating protocol(s) shall be reviewed and updated periodically to ensure continuous compliance with the minimum treatment and disinfection requirements. Updated operating protocols shall be submitted to the Department's Southwest District Office for review and approval upon revision of the operating protocol(s) and with each permit application. *[62-610.320(6)][62-610.463(2)]*

12. The permittee shall maintain an inventory of storage systems. The inventory shall be submitted to the Department's Southwest District Office at least 30 days before reclaimed water will be introduced into any new storage system. The inventory of storage systems shall be attached to the annual submittal of the Annual Reuse Report. *[62-610.464(5)]*

13. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted to or reported to, as appropriate, the Department's Southwest District Office at the address specified below:

    Florida Department of Environmental Protection
    Southwest District Office
    13051 N. Telecom Pkwy
    Temple Terrace, Florida 33637-0926
    Email Address: swd_dw@dep.state.fl.us

    Phone Number - (813) 470-5700
    FAX Number - (813) 470-5996

    [62-620.305]

14. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. *[62-620.305]*

II. BIOSOLIDS MANAGEMENT REQUIREMENTS

A. Basic Requirements

1. Biosolids generated by this facility may be land applied, distributed and marketed, transferred to biosolids treatment facility, or disposed of in a Class I solid waste landfill. Transferring biosolids to an alternative biosolids treatment facility does not require a permit modification. However, use of an alternative biosolids treatment facility requires submittal of a copy of the agreement pursuant to Rule 62-640.880(1)(c), F.A.C., along with a written notification to the Department at least 30 days before transport of the biosolids. *[62-620.320(6), 62-640.880(1)]*

2. The permittee shall monitor and keep records of the quantities of biosolids generated, received from source facilities, treated, distributed and marketed, land applied, used as a biofuel or for bioenergy, transferred to another facility, or landfilled. These records shall be kept for a minimum of five years. *[62-640.650(4)(a)]*

3. Biosolids quantities shall be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report for Monitoring Group RMP-Q in accordance with Condition I.C.8.

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Biosolids Quantity (Land-Applied)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-1
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-2
Biosolids Quantity (Distributed & Marketed in FL)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-3
Biosolids Quantity (Distributed & Marketed outside FL)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-4

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-5

[62-640.650(5)(a)1]

4. Biosolids quantities shall be calculated as listed in Permit Condition II.3 and as described below:

Monitoring Site Number	Description of Monitoring Site Calculations
RMP-1	Calculated from total solids
RMP-2	Calculated from total solids
RMP-3	Calculated from total solids
RMP-4	Calculated from total solids
RMP-5	Calculated from total solids

5. The treatment, management, transportation, use, land application, or disposal of biosolids shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. *[62-640.400(6)]*

6. Storage of biosolids or other solids at this facility shall be in accordance with the Facility Biosolids Storage Plan. *[62-640.300(4)]*

7. Biosolids shall not be spilled from or tracked off the treatment facility site by the hauling vehicle. *[62-640.400(9)]*

B. Treatment and Monitoring Requirements

8. The permittee is authorized to produce Class A, AA, and B biosolids.

9. The permittee shall achieve Class A pathogen reduction by meeting the pathogen reduction requirements in section 503.32(a)(7) (Use of PFRP (Processes to Further Reduce Pathogens)-Heat Drying, See II.B.10., below) of Title 40 CFR Part 503. *[62-640.600(1)(a)]*

10. Class A PFRP -Heat Drying requires either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of Salmonella, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in section 503.10(b), (c), (e), or (f) of Title 40 CFR Part 503. *[62-640.600(1)(a)]*

11. The permittee shall achieve Class B pathogen reduction by meeting the pathogen reduction requirements in section 503.32(b)(3) (Use of PSRP (Processes to Significantly Reduce Pathogens)-Anaerobic Digestion, See II.B.13., below) or 503.32(b)(2) (Monitoring of Indicator Organisms, See II.B.12., below) of Title 40 CFR Part 503. *[62-640.600(1)(b)]*

12. Class B-Monitoring of Indicator Organisms requires that seven samples of treated sewage sludge (biosolids) be collected over a 2-week period and that the geometric mean fecal coliform density of these samples be less than 2 million CFU or MPN per gram of biosolids (dry weight basis). This approach uses fecal coliform density as an indicator of the average density of bacterial and viral pathogens. Over the long term, fecal coliform density is expected to correlate with bacterial and viral pathogen density in biosolids treated by biological treatment processes. *[62-640.600(1)(b)]*

13. Class B PSRP - Anaerobic Digestion requires sewage sludge is treated in the absence of air for a specific mean cell residence time (i.e. solids retention time) at a specific temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35ºC to 55ºC (131ºF) and 60 days at 20ºC (68ºF). *[62-640.600(1)(b)]*

14. The permittee shall achieve vector attraction reduction for Class A or B biosolids by meeting the vector attraction reduction requirements in section 503.33(b)(1) (Reduce the mass of volatile solids by a minimum of 38%) or 503.33(b)(8) (Reduce moisture content of biosolids that contain unstabilized solids from primary treatment to at least 90 % solids) (See II.B.15., below) or 503.33(b)(10) (Incorporation of Sewage Sludge into Soil – Option 10) of Title 40 CFR Part 503. *[62-640.600(2)(a)]*

15. Reduce moisture content of biosolids that contain unstabilized solids from primary treatment to at least 90 % solids requires that the sewage sludge is dried by direct or indirect contact with hot gases to reduce the moisture content of the sewage sludge to 10% or lower. Either the temperature of the sewage sludge particles exceeds 80 ºC (176 ºF) or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 ºC (176 ºF). *[62-640.600(2)(a)]*

16. Temperature shall be routinely monitored to demonstrate compliance with vector attraction reduction requirements specified in Rule 62-640.600, F.A.C. *[62-640.650(3)(a)2]*

17. Treatment of liquid biosolids or septage for the purpose of meeting the pathogen reduction or vector attraction reduction requirements set forth in Rule 62-640.600, F.A.C., shall not be conducted in the tank of a hauling vehicle. Treatment of biosolids or septage for the purpose of meeting pathogen reduction or vector attraction reduction requirements shall take place at the permitted facility. *[62-640.400(7)]*

18. Class A biosolids shall comply with the limits and be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report in accordance with Permit Condition I.C.8. Biosolids shall not be land applied if a single sample result for any parameter exceeds the following:

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	Monthly	Composite	RMP-A
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	Monthly	Composite	RMP-A
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	Monthly	Composite	RMP-A
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Monthly	Composite	RMP-A
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	Monthly	Composite	RMP-A
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	Monthly	Composite	RMP-A
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	Monthly	Composite	RMP-A
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	Monthly	Composite	RMP-A
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Monthly	Composite	RMP-A
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	Monthly	Composite	RMP-A
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	Monthly	Composite	RMP-A
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	Monthly	Composite	RMP-A

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
pH	s.u.	Max	Report	Single Sample	Monthly	Grab	RMP-A
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	Monthly	Composite	RMP-A
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	Monthly	Grab	RMP-A
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	Monthly	Grab	RMP-A

*Either the fecal coliform limit or Salmonella sp. limit must be met.

[62-640.650(3)(a)(3) and 62-640.700(5)(a)]

19. Class B biosolids shall comply with the limits and be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report in accordance with Permit Condition I.C.8. Biosolids shall not be land applied if a single sample result for any parameter exceeds the following:

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
pH	s.u.	Max	Report	Single Sample	Bi-monthly; every 2 months	Grab	RMP-B
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Coliform, Fecal	CFU/g	Max	2000000	Geometric Mean	Bi-monthly; every 2 months	Grab	RMP-B
Temperature	Degrees	Range	Report	Single Sample	Continuous	Meter	RMP-B
Time	Days	Min	Report	Single Sample	Daily; 24 hours	Calculation	RMP-B
Volatile Solids	% reduction	Min	≥38%	Single Sample	Bi-monthly; every 2 months	Grab	RMP-B

[62-640.650(3)(a)(3) and 62-640.700(5)(a)]

20. Class AA biosolids shall comply with the limits and be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report in accordance with Permit Condition I.C.8. Biosolids shall not be distributed and marketed or land applied if a single sample result or the monthly average of sample results for any parameter exceeds the following Class AA parameter concentrations:

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Monthly Average	Monthly	Composite	RMP-AA
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Monthly Average	Monthly	Composite	RMP-AA
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Monthly Average	Monthly	Composite	RMP-AA
Arsenic Total, Dry Weight, Sludge	mg/kg	Max Max	41.0 75.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max Max	39.0 85.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max Max	1500.0 4300.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Lead, Dry Weight, Sludge	mg/kg	Max Max	300.0 840.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Mercury, Dry Weight, Sludge	mg/kg	Max Max	17.0 57.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Monthly	Composite	RMP-AA
Nickel, Dry Weight, Sludge	mg/kg	Max Max	420.0 420.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Selenium Sludge Solid	mg/kg	Max Max	100.0 100.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Zinc, Dry Weight, Sludge	mg/kg	Max Max	2800.0 7500.0	Monthly Average Single Sample	Monthly	Composite	RMP-AA
pH	s.u.	Max	Report	Single Sample	Monthly	Grab	RMP-AA

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Solids, Total, Sludge, Percent	percent	Max Max	Report Report	Monthly Average Single Sample	Monthly	Composite	RMP-AA
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	Monthly	Grab	RMP-AA
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	Monthly	Grab	RMP-AA

*Either the fecal coliform limit or Salmonella sp. limit must be met.
**Note, monthly averages of parameter concentrations shall be determined by taking the arithmetic mean of all sample results for the month.

[62-640.650(3)(a)(3), 62-640.700(5)(a), 62-640.700(5)(b) and 62-640.850(4)]

21. Class AA biosolids that are stored for more than 45 days shall be re-sampled for fecal coliform or Salmonella sp. monthly. *[62-640.650(3)(a)5]*

22. Sampling and analysis shall be conducted in accordance with 40 CFR Part 503.8 and the U.S. Environmental Protection Agency publication - POTW Sludge Sampling and Analysis Guidance Document, August 1989. In cases where conflicts exist between 40 CFR 503.8 and the POTW Sludge Sampling and Analysis Guidance Document, the requirements in 40 CFR Part 503.8 will apply. *[62-640.650(3)(a)1]*

23. All samples shall be representative and shall be taken after final treatment of the biosolids but before land application or distribution and marketing. *[62-640.650(3)(a)5]*

24. Biosolids samples shall be taken at the monitoring site locations listed in Permit Condition(s) II.18, 19 and 20, as described below:

Monitoring Site Number	Description of Monitoring Site
RMP-A	Class A final product, after heat drying and prior land application
RMP-AA	Class AA final product, after heat drying and prior to distribution
RMP-B	Class B final product, after treatment and prior to land application

C. Distribution and Marketing

25. Biosolids or biosolids products may be distributed and marketed only if the biosolids or biosolids products meet Class AA standards and are either sold or given-away as a fertilizer under a Florida fertilizer law (or "subject to Chapter 576, F.S. and Chapter 5E-1, F.A.C.") or distributed and marketed to a person or entity that will sell or give-away the biosolids or biosolids products as a fertilizer under Florida fertilizer law (or "subject to Chapter 576, F.S. and Chapter 5E-1, F.A.C."). Biosolids composts that are enrolled and certified under the U.S. Composting Council's Seal of Testing Assurance (USCC STA) program do not have to be distributed and marketed as a fertilizer except if distributed and marketed within the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds.. *[62-640.850]*

26. Within 24 hours of discovering that distributed and marketed biosolids did not meet the Class AA standards, the permittee shall notify the Department and all persons to whom they delivered or distributed and marketed the Class AA biosolids. *[62-640.650(6)(g)]*

27. The permittee shall make the following information available to users by product labels or other means:

    a. The fertilizer label required by Florida fertilizer law or the equivalent information required by the USCC STA program;

    b. The name and address of the facility or person that produced the Class AA biosolids;

c. A statement that the biosolids or biosolids product meets the criteria of subsection 62-640.700(5), F.A.C.;

d. Recommendation that biosolids be applied at a rate that does not exceed crop or plant nutrient needs and;

e. Recommendations on proper storage of the biosolids or biosolids product prior to use. For distributed quantities of biosolids or biosolids products greater than one dry ton, the recommendations shall include that biosolids may not be stored on property for more than seven days unless stored to prevent runoff of biosolids or stormwater that has been in contact with biosolids, violation of the odor prohibition in subsection 62-296.320(2), F.A.C., and vector attraction.

[62-640.400(13), 62-640.850(5)]

D. Land Application at Permitted Sites

28. Land application of biosolids at the site shall be in accordance with the site permit, the Nutrient Management Plan, and the requirements of Chapter 62-640, F.A.C. *[62-640]*

29. The biosolids from this facility shall only be land applied at sites identified on the Treatment Facility Biosolids Plan, Form 62-640.210(2)(a), submitted with the permit application or revised in accordance with condition II.30 below, which is incorporated as part of this permit. *[62-640.300(2)]*

30. The permittee shall notify the Department at least 24 hours before beginning biosolids application at a site not listed in the Treatment Facility Biosolids Plan Form 62-640.210(2)(a). The facility's Treatment Facility Biosolids Plan shall be revised to include the new site and submitted to the Department within 30 days of using the site. The revised Treatment Facility Biosolids Plan shall become part of the treatment facility permit. *[62-640.300(2)(c) & 62-640.650(6)(a)]*

31. Land application of "other solids" as defined in Chapter 62-640, F.A.C., is only allowed if specifically addressed in the Nutrient Management Plan(s) approved for the site where the other solids will be applied. *[62-640.860]*

32. The permittee shall maintain hauling records to track the transport of biosolids between the treatment facility and the application site. The hauling records for each party shall contain the following information:

Treatment Facility Permittee
1. Date and time shipped and shipment ID
2. Amount of biosolids shipped
3. Concentration of parameters & date of analysis
4. Name and ID number of permitted application site
5. Class of biosolids shipped
6. Signature of certified operator or designee
7. Signature of hauler and name of hauling firm

Site Permittee
1. Date and time received and shipment ID
2. Name and ID number of treatment facility from which biosolids are received
3. Signature of hauler
4. Signature of site manager

A copy of the treatment facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids site manager. The permittee shall report to the Department within 24 hours of discovery of any discrepancy in the delivery of biosolids leaving the treatment facility and arriving at the permitted application site. Treatment facility permittees shall notify the Department, site manager, and site permittee within 24 hours of discovery of sending biosolids that did not meet the requirements of Rule 62-640.600, F.A.C., or subsection 62-640.700(5), F.A.C., to a land application site.

[62-640.650(4) & (5)]

33. The permittee shall maintain copies of the Biosolids Application Site Annual Summaries, received from site permittees in accordance with 62-640.650(5)(e), F.A.C., indefinitely. *[62-640.650(5)(d)]*

34. The permittee shall submit a Treatment Facility Biosolids Annual Summary to the Department's Southwest District Office on Department Form 62-640.210(2)(b). The summary shall include all biosolids shipped during the period January 1 through December 31 and shall be submitted to the Department by February 19 of the year following the year of application. *[62-640.650(5)(c)]*

E. Disposal

35. Disposal of biosolids, septage, and "other solids" in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with Chapter 62-701, F.A.C. *[62-640.100(6)(b) & (c)]*

F. Transfer

36. The permittee shall not be held responsible for treatment, management, use, land application or disposal violations that occur after its biosolids have been accepted by a permitted biosolids treatment facility with which the source facility has an agreement in accordance with subsection 62-640.880(1)(c), F.A.C., for further treatment, management, or disposal. *[62-640.880(1)(b)]*

37. The permittee shall keep hauling records to track the transport of biosolids between the facilities. The hauling records shall contain the following information:

Source Facility
1. Date and time shipped
2. Amount of biosolids shipped
3. Degree of treatment (if applicable)
4. Name and ID Number of treatment facility
5. Signature of responsible party at source facility
6. Signature of hauler and name of hauling firm

Biosolids Treatment Facility or Treatment Facility
1. Date and time received
2. Amount of biosolids received
3. Name and ID number of source facility
4. Signature of hauler
5. Signature of responsible party at treatment facility

A copy of the source facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids treatment facility or treatment facility. The treatment facility permittee shall report to the Department within 24 hours of discovery any discrepancy in the quantity of biosolids leaving the source facility and arriving at the biosolids treatment facility or treatment facility.

[62-640.880(4)]

G. Receipt

38. If the permittee intends to accept biosolids from other facilities, a permit revision is required pursuant to paragraph 62-640.880(2)(d), F.A.C. *[62-640.880(2)(d)]*

III. GROUND WATER REQUIREMENTS

1. The permittee shall give at least 72-hours' notice to the Department's Southwest District Office, prior to the installation of any monitoring wells. *[62-520.600(6)(h)]*

2. Before construction of new ground water monitoring wells, a soil boring shall be made at each new monitoring well location to properly determine monitoring well specifications such as well depth, screen interval, screen slot, and filter pack. *[62-520.600(6)(g)]*

3. Within 30 days after installation of a monitoring well, the permittee shall submit to the Department's Southwest District Office well completion reports and soil boring/lithologic logs on the attached DEP Form(s) 62-520.900(3), Monitoring Well Completion Report. *[62-520.600(6)(j) and .900(3)]*

4. All piezometers and monitoring wells not part of the approved ground water monitoring plan shall be plugged and abandoned in accordance with Rule 62-532.500(5), F.A.C., unless future use is intended. *[62-532.500(5)]*

5. For the Part III Public Access system, all ground water quality criteria specified in Chapter 62-520, F.A.C., shall be met at the edge of the zone of discharge. The zone of discharge for Land Application Site R-001 shall extend horizontally 100 feet from the application site(s) and vertically to the base of the surficial aquifer. *[62-520.200(27)] [62-520.465]*

6. The ground water minimum criteria specified in Rule 62-520.400 F.A.C., shall be met within the zone of discharge. *[62-520.400 and 62-520.420(4)]*

7. If the concentration for any constituent listed in Permit Condition III.10. in the natural background quality of the ground water is greater than the stated maximum, or in the case of pH is also less than the minimum, the representative background quality shall be the prevailing standard. *[62-520.420(2)]*

8. During the period of operation authorized by this permit, the permittee shall continue to sample ground water at the monitoring wells identified in Permit Condition III.9., below in accordance with this permit and the approved ground water monitoring plan prepared in accordance with Rule 62-520.600, F.A.C. *[62-520.600] [62-610.463]*

9. The following monitoring wells shall be sampled for Reuse System R-001.

Monitoring Well ID	Alternate Well Name and/or Description of Monitoring Location	Latitude			Longitude			Depth (Feet)	Aquifer Monitored	New or Existing
		o	'	"	o	'	"			
MWC-01	SP-1 (Swann Park)	27	56	16	82	31	9	15	Surficial	Existing
MWC-02	SP-2 (Swann Park)	27	56	15	82	31	16	15	Surficial	Existing
MWC-03	GE-1 (Gorrie Elem.)	27	56	23	82	28	7	15	Surficial	Existing
MWC-04	GE-2 (Gorrie Elem.)	27	56	20	82	28	2	15	Surficial	Existing

MWC = Compliance; MWB = Background; MWI = Intermediate; MWP =Piezometer

[62-520.600] [62-610.463]

10. The following parameters shall be analyzed for each monitoring well identified in Permit Condition III.9:

Parameter	Compliance Well Limit	Units	Sample Type	Monitoring Frequency
Water Level Relative to NGVD	Report	ft	In Situ	Quarterly
Nitrogen, Nitrate, Total (as N)	10	mg/L	Grab	Quarterly
Solids, Total Dissolved (TDS)	500	mg/L	Grab	Quarterly
Arsenic, Total Recoverable	10	ug/L	Grab	Quarterly
Chloride (as Cl)	250	mg/L	Grab	Quarterly
Coliform, Fecal	4	#/100mL	Grab	Quarterly
pH	6.5-8.5	s.u.	In Situ	Quarterly
Sulfate, Total	250	mg/L	Grab	Quarterly
Turbidity	Report	NTU	Grab	Quarterly
Sodium, Total Recoverable	160	mg/L	Grab	Quarterly

[62-520.600(11)(b)] [62-601.300(3), 62-601.700, and Figure 3 of 62-601] [62-601.300(6)] [62-520.310(5)]

11. Water levels shall be recorded before evacuating each well for sample collection. Elevation references shall include the top of the well casing and land surface at each well site (NAVD allowable) at a precision of plus or minus 0.01 foot. *[62-520.600(11)(c)] [62-610.463(3)(a)]*

12. Ground water monitoring wells shall be purged prior to sampling to obtain representative samples. *[62-160.210] [62-601.700(5)]*

13. Analyses shall be conducted on unfiltered samples, unless filtered samples have been approved by the Department's Southwest District Office as being more representative of ground water conditions. *[62-520.310(5)]*

14. Ground water monitoring test results shall be submitted on Part D of Form 62-620.910(10) in accordance with Permit Condition I.C.8. *[62-520.600(11)(b)] [62-601.300(3), 62.601.700, and Figure 3 of 62-601] [62-620.610(18)]*

15. If any monitoring well becomes inoperable or damaged to the extent that sampling or well integrity may be affected, the permittee shall notify the Department's Southwest District Office within two business days from discovery, and a detailed written report shall follow within ten days after notification to the Department. The written report shall detail what problem has occurred and remedial measures that have been taken to prevent recurrence or request approval for replacement of the monitoring well. All monitoring well design and replacement shall be approved by the Department's Southwest District Office before installation. *[62-520.600(6)(l)]*

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

A. Part III Public Access System(s)

1. Use of reclaimed water is authorized within the general service area consisting of the City of Tampa service area as outlined on the map titled Section C-VIII Proposed City of Tampa Reclaimed Water Service Area. The following uses of reclaimed water are authorized within this general service area:

   Aesthetic Purposes (Decorative Ponds, Pools, and Fountains)
   Athletic Complexes and Parks
   Construction Dust Control
   Golf Courses
   Other Landscape Irrigation
   Residential Developments
   Toilet Flushing

   [62-620.630(10)(a)]

2. This reuse system includes the following major users (i.e., using 0.1 MGD or more of reclaimed water):

User Name	User Type	Capacity (MGD)	Acreage
STAR	Landscape / Residential	4.25	1,611
Phase A		1.3	
Tampa International Airport	Landscape/ Commercial	0.23	
Tampa Port Authority	Landscape/ Commercial	0.22	
Totals		6.0	

   [62-610.800(5)][62-620.630(10)(b)]

3. New major users of reclaimed water (i.e., using 0.1 MGD or more) may be added to the reuse system using the general permit described in Rule 62-610.890, F.A.C., if the requirements in this rule are complied with. Application for use of this general permit shall be made using Form 62-610.300(4)(a)1. *[62-610.890]*

4. Cross-connections to the potable water system are prohibited. *[62-610.469(7)]*

5. A cross-connection control program shall be implemented and/or remain in effect within the areas where reclaimed water will be provided for use and shall be in compliance with the Rule 62-555.360, F.A.C. *[62-610.469(7)]*

6. The permittee shall conduct inspections within the reclaimed water service area to verify proper connections, to minimize illegal cross-connections, and to verify both the proper use of reclaimed water and that the proper backflow prevention assemblies or devices have been installed and tested. Inspections are required when a customer first connects to the reuse distribution system. Subsequent inspections are required as specified in the cross-connection control and inspection program. *[62-610.469(7)(h)]*

7. If an actual or potential (e.g. no dual check device on residential connections served by a reuse system) cross-connection between the potable and reclaimed water systems is discovered, the permittee shall:

   a. Immediately discontinue potable water and/or reclaimed water service to the affected area if an actual cross-connection is discovered.

   b. If the potable water system is contaminated, clear the potable water lines.

   c. Eliminate the cross-connection and install a backflow prevention device as required by the Rule 62-555.360.F.A.C.

   d. Test the affected area for other possible cross-connections.

   e. Within 24 hours, notify the Department's Southwest District Office's domestic wastewater and drinking water programs.

   f. Within 5 days of discovery of an actual or potential cross-connection, submit a written report to the Department's Southwest District Office detailing: a description of the cross-connection, how the cross-connection was discovered, the exact date and time of discovery, approximate time that the cross-connection existed, the location, the cause, steps taken to eliminate the cross-connection, whether reclaimed water was consumed, and reports of possible illness, whether the drinking water system was contaminated and the steps taken to clear the drinking water system, when the cross-connection was eliminated, plan of action for testing for other possible cross-connections in the area, and an evaluation of the cross-connection control and inspection program to ensure that future cross-connections do not occur.

   [62-555.350(3) and 62-555.360][62-620.610(20)]

8. Maximum obtainable separation of reclaimed water lines and potable water lines shall be provided and the minimum separation distances specified in Rule 62-610.469(7), F.A.C., shall be provided. Reuse facilities shall be color coded or marked. Underground piping which is not manufactured of metal or concrete shall be color coded using Pantone Purple 522C using light stable colorants. Underground metal and concrete pipe shall be color coded or marked using purple as the predominant color. *[62-610.469(7)]*

9. In constructing reclaimed water distribution piping, the permittee shall maintain a 75-foot setback distance from a reclaimed water transmission facility to public water supply wells. No setback distances are required to other potable water supply wells or to any nonpotable water supply wells. *[62-610.471(3)]*

10. A setback distance of 75 feet shall be maintained between the edge of the wetted area and potable water supply wells, unless the utility adopts and enforces an ordinance prohibiting potable water supply wells within the reuse service area. No setback distances are required to any nonpotable water supply well, to any surface water, to any developed areas, or to any private swimming pools, hot tubs, spas, saunas, picnic tables, barbecue pits, or barbecue grills. *[62-610.471(1), (2), (5), and (7)]*

11. Reclaimed water shall not be used to fill swimming pools, hot tubs, or wading pools. *[62-610.469(4)]*

12. Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet from outdoor public eating, drinking, or bathing facilities. *[62-610.471(6)]*

13. A setback distance of 100 feet shall be maintained from indoor aesthetic features using reclaimed water to adjacent indoor public eating and drinking facilities. *[62-610.471(8)]*

14. The public shall be notified of the use of reclaimed water. This shall be accomplished by posting of advisory signs in areas where reuse is practiced, notes on scorecards, or other methods. *[62-610.468(2)]*

15. All new advisory signs and labels on vaults, service boxes, or compartments that house hose bibbs along with all labels on hose bibbs, valves, and outlets shall bear the words "do not drink" and "no beber" along with the equivalent standard international symbol. In addition to the words "do not drink" and "no beber," advisory signs posted at storage ponds and decorative water features shall also bear the words "do not swim" and "no nadar" along with the equivalent standard international symbols. Existing advisory signs and labels shall be retrofitted, modified, or replaced in order to comply with the revised wording requirements. For existing advisory signs and labels this retrofit, modification, or replacement shall occur within 365 days after the date of this permit. For labels on existing vaults, service boxes, or compartments housing hose bibbs this retrofit, modification, or replacement shall occur within 730 days after the date of this permit. *[62-610.468, 62-610.469]*

16. The permittee shall ensure that users of reclaimed water are informed about the origin, nature, and characteristics of reclaimed water; the manner in which reclaimed water can be safely used; and limitations on the use of reclaimed water. Notification is required at the time of initial connection to the reclaimed water distribution system and annually after the reuse system is placed into operation. A description of on-going public notification activities shall be included in the Annual Reuse Report. *[62-610.468(6)]*

17. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. *[62-610.414(8)]*

18. Overflows from emergency discharge facilities on storage ponds shall be reported as abnormal events in accordance with Permit Condition IX.20. *[62-610.800(9)]*

B. Part VII Industrial Uses of Reclaimed Water

1. Reclaimed water shall not be used in the manufacture or processing of food or beverage for human consumption where the reclaimed water will be incorporated into or come into contact with the food or beverage product. *[62-610.650(4)]*

2. Advisory signs shall be posted around the portions of the industrial site in which reclaimed water is used and at the main entrances to the industrial site to notify employees at the industrial site and the public of the nature of the reclaimed water use. *[62-610.658]*

3. Cross-connections to the potable water system are prohibited. *[62-610.660(1)]*

4. There shall be readily identifiable "non-potable" or "do not drink" notices, marking, or coding on application/distribution facilities and appurtenances. *[62-610.660(2)]*

5. The return of reclaimed water to the reclaimed water distribution system after it has been delivered to the industrial facility is prohibited. *[62-610.660(3)]*

6. A 300-foot setback distance shall be provided from the cooling tower that receives reclaimed water to the site property line. *[62-610.668(2)(c)]*

7. The cooling tower shall be designed and operated to minimize aerosol drift to areas beyond the site property line that are accessible to the public. *[62-610.668(2)(c)]*

8. The cooling tower shall be designed, operated, and maintained utilizing best engineering practices to control biological growth. *[62-610.668(2)(c)]*

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of a(n) operator(s) certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category I, Class A facility and, at a minimum, operators with appropriate certification must be on the site as follows:

   A Class C or higher operator 24 hours/day for 7 days/week. The lead/chief operator must be a Class A operator.

2. The lead/chief operator shall be employed at the plant full time. "Full time" shall mean at least 4 days per week, working a minimum of 35 hours per week, including leave time. A licensed operator shall be on-site and in charge of each required shift for periods of required staffing time when the lead/chief operator is not on-site. An operator meeting the lead/chief operator class for the treatment plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(10), (6) and (1)]*

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

1. The application to renew this permit shall include an updated capacity analysis report prepared in accordance with Rule 62-600.405, F.A.C. *[62-600.405(5)]*

2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. *[62-600.735(1)]*

C. Recordkeeping Requirements

1. The permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.

   a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;

   b. Copies of all reports required by the permit for at least three years from the date the report was prepared;

   c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;

   d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the biosolids use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least five years from the date of sampling or measurement;

   e. A copy of the current permit;

   f. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;

   g. A copy of any required record drawings;

   h. Copies of the licenses of the current certified operators;

   i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed; and

   j. Records of biosolids quantities, treatment, monitoring, and hauling for at least five years.

[62-620.350, 62-602.650, 62-640.650(4)]

VI. SCHEDULES

1. The following improvement actions shall be completed according to the following schedule:

Improvement Action	Completion Date
Submit a permit revision for the Dibromochloromethane mixing zone	90 days after the final study plan final report is approved by the Department

[62-620.320(6)]

2. With the application for permit renewal, the permittee shall submit, to the Southwest District Office, the results of sampling monitoring wells specified in the Department-approved monitoring plan for the primary and secondary drinking water parameters included in Chapter 62-550, F.A.C., (excluding asbestos, acrylamide, Dioxin, butachlor, epichlorohydrin, pesticides, and PCBs, unless reasonably expected to be a constituent of the discharge or an artifact of the site). Sampling shall occur no sooner than 180 days before submittal of the renewal application. The Southwest District Office shall be notified prior to initiating the sampling as per permit condition VI.3, below. *[62-520.600(5)(b)]*

3. The facility shall provide a proposal to the Southwest District Office at least 180 days before submittal of the renewal application listing the applicable groundwater monitoring wells for the above renewal sampling. Upon approval by the Department sampling shall occur no sooner than 180 days before submittal of the renewal application. *[62-520.600(5)(b)]*

4. The permittee is not authorized to discharge to waters of the state after the expiration date of this permit, unless:

   a. The permittee has applied for renewal of this permit at least 180 days before the expiration date of this permit using the appropriate forms listed in Rule 62-620.910, F.A.C., and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.; or

   b. The permittee has made complete the application for renewal of this permit before the permit expiration date.

   Please note, effluent testing shall be conducted for each outfall in accordance with the instructions provided in Sections 3.A.12., 13., and 14. of the application form. A minimum of three samples shall be taken within four and one-half years prior to the date of the permit application and must be representative of the seasonal variation in the discharge from each outfall. *[62-620.335(1) - (4)]*

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

A. Implementation Requirements

1. The permittee shall function as the Control Authority and shall be responsible for the performance of all pretreatment program requirements contained in Chapter 62-625, F.A.C. The permittee shall be subject to enforcement actions, penalties, and other remedies by the Department or other appropriate parties. The permittee shall implement and enforce its Approved Pretreatment Program. The permittee's Approved Pretreatment Program is hereby made an enforceable condition of this permit. The Department may initiate enforcement action against an industrial user for noncompliance with applicable standards and requirements. *[62-625.500]*

2. The permittee shall enforce the requirements promulgated under Sections 307(b), 307(c), 307(d), and 402(b) of the Act. The permittee shall cause industrial users subject to Federal Categorical Standards to achieve compliance no later than the date specified in those requirements or, in the case of new industrial users, upon commencement of the discharge. *[62-625.410]*

3. The permittee shall perform the pretreatment functions as required in Chapter 62-625, F.A.C., including, but not limited to, the following:

   a. Implementing the necessary legal authorities as provided in Rule 62-625.500(2)(a), F.A.C. This includes, among other things, the authority to require compliance with applicable pretreatment standards, which includes general prohibitions listed in Rule 62-625.400(1), F.A.C., specific prohibitions in Rule 62-625.400(2), F.A.C., locally developed limits as required by Rules 62-625.400(3) and (4), F.A.C., and national categorical limits in accordance with Rule 62-625.410, F.A.C.;

   b. Implementing the programmatic functions as required under Rule 62-625.500(2)(b), F.A.C.;

   c. Providing the required funding, equipment, and personnel to implement the pretreatment program as provided in Rules 62-625.500(2), (3), and (4)., F.A.C.; and

   d. Providing a written technical evaluation that local limits have been developed in accordance with Rule 62-625.400(3)(a), F.A.C. The evaluation shall verify whether existing local limits protect the wastewater facilities, and if not, the permittee shall develop new local limits as part of the evaluation in accordance with Rule 62-625.600(16), F.A.C. For new local limits, a plan of study shall be submitted to the Department prior to initiating sampling required to develop the new local limits. This evaluation shall be submitted to the Department at the address in the condition below within 180 days after permit renewal.

   [62-625.400 and .500]

4. As required by Rules 62-625.600(8) and (12), F.A.C., the permittee shall submit a signed copy of the annual report for pretreatment activities, including DMRs for Monitoring Site Numbers PRT-I, PRT-E, and PRT-R for this facility, to the Department at the following address:

   Florida Department of Environmental Protection
   Domestic Wastewater Section, Mail Station 3540
   Bob Martinez Center
   2600 Blair Stone Road
   Tallahassee, Florida 32399-2400

   The annual report shall contain the information required in accordance with Rule 62-625.600(8), F.A.C., except section (8)(f) as noted below, and shall describe the permittee's pretreatment activities for the reporting year. In the event that the permittee is not in compliance with any conditions or requirements of the pretreatment program, then the permittee shall also include the reasons for noncompliance and state how and when the permittee shall comply with such conditions and requirements.

   In order to comply with Rule 62-625.600(8)(f), F.A.C., the permittee shall submit annual DMRs with the analytical results of influent, effluent, and residuals for those pollutants listed on the DMRs. For any other nonpriority pollutants which the permittee believes may be causing or contributing to interference, pass through, or adversely impacting residuals quality, the annual report shall provide a summary of all analytical results of influent, effluent, and residuals. The annual report and DMRs are due on November 1 of each year, to cover a period between July 1 and June 30. *[62-625.600(8) and (12)]*

5. No additional facilities are covered by the Howard F. Curren AWTP (FL0020940) pretreatment program.

6. Samples for Monitoring Site Numbers PRT-I, PRT-E, and PRT-R shall be taken at the monitoring site locations described below:

Monitoring Location Site Number	Description of Monitoring Location
PRT-I	Junction chamber No. 1
PRT-E	Final effluent after dechlorination
PRT-R	De-watered sludge cake, prior to pelletization or land application

VIII. OTHER SPECIFIC CONDITIONS

1. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. *[62-600.410(8) and 62-640.400(6)]*

2. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. *[62-604.130(3)]*

3. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. *[62-604.550] [62-620.610(20)]*

4. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):

   a. Which may cause fire or explosion hazards; or

   b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or

   c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or

   d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding 40°C or otherwise inhibiting treatment; or

   e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

   [62-604.130(5)]

5. The treatment facility, storage ponds for Part II systems, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. *[62-600.400(2)(b)]*

6. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. *[62-701.300(1)(a)]*

7. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. *[62-620.310(4)]*

8. The permittee shall provide verbal notice to the Department's Southwest District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Southwest District Office in a written report within 7 days of the sinkhole discovery. *[62-620.320(6)]*

9. Reopener Clause:
   a. The permit shall be revised, or alternatively, revoked and reissued in accordance with the provisions contained in Rules 62-620.325 and 62-620.345, F.A.C., if applicable, or to comply with any applicable effluent standard

or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act (the Act), as amended, if the effluent standards, limitations, or water quality standards so issued or approved:

(1) Contains different conditions or is otherwise more stringent than any condition in the permit/or;
(2) Controls any pollutant not addressed in the permit.
(3) The permit as revised or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

b. The permit may be reopened to adjust effluent limitations or monitoring requirements should future Water Quality Based Effluent Limitation determinations, water quality studies, DEP approved changes in water quality standards, or other information show a need for a different limitation or monitoring requirement.

c. The Department may develop a Total Maximum Daily Load (TMDL) during the life of the permit. Once a TMDL has been established and adopted by rule, the Department shall revise this permit to incorporate the final findings of the TMDL.

[62-620.325 & 62-620.345]

IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1)]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2)]*

3. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3)]*

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. *[62-620.610(4)]*

5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5)]*

6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. *[62-620.610(6)]*

7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7)]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8)]*

9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:

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

   b. Have access to and copy any records that shall be kept under the conditions of this permit;

   c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and

   d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

   [62-620.610(9)]

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. *[62-620.610(10)]*

11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11)]*

12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12)]*

13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13)]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14)]*

15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15)]*

16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted

facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16)]*

17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:

    a. A description of the anticipated noncompliance;

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

    c. Steps being taken to prevent future occurrence of the noncompliance.

    [62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-601, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.

    b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

    c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.

    d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.

    e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.

    f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

    [62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19)]*

20. The permittee shall report to the Department's Southwest District Office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    a. The following shall be included as information which must be reported within 24 hours under this condition:
        (1) Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
        (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,

(3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
(4) Any unauthorized discharge to surface or ground waters.

b. Oral reports as required by this subsection shall be provided as follows:
(1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph IX.20.(a)4. that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the STATE WATCH OFFICE TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Watch Office:
(a) Name, address, and telephone number of person reporting;
(b) Name, address, and telephone number of permittee or responsible person for the discharge;
(c) Date and time of the discharge and status of discharge (ongoing or ceased);
(d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater);
(e) Estimated amount of the discharge;
(f) Location or address of the discharge;
(g) Source and cause of the discharge;
(h) Whether the discharge was contained on-site, and cleanup actions taken to date;
(i) Description of area affected by the discharge, including name of water body affected, if any; and
(j) Other persons or agencies contacted.
(2) Oral reports, not otherwise required to be provided pursuant to subparagraph IX.20.b.1 above, shall be provided to the Department's Southwest District Office within 24 hours from the time the permittee becomes aware of the circumstances.

c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department's Southwest District Office shall waive the written report.

[62-620.610(20)]

21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. *[62-620.610(21)]*

22. Bypass Provisions.

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.

b. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:
(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(3) The permittee submitted notices as required under Permit Condition IX.22.c. of this permit.

c. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.b.(1) through (3) of this permit.

e. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.b. through d. of this permit.

[62-620.610(22)]

23. Upset Provisions.

a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee.
   (1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.
   (2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

b. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the cause(s) of the upset;
   (2) The permitted facility was at the time being properly operated;
   (3) The permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and
   (4) The permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.

c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.

d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in Temple Terrace, Florida.

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Kelley M. Boatwright

Kelley Boatwright
Program Administrator
Permitting & Waste Cleanup Program
Southwest District

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Interim
CLASS SIZE: MA
MONITORING GROUP NUMBER: D-001
MONITORING GROUP DESCRIPTION: D-001, including Influent
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-05	Permit Requirement		96.0 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-05	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 P Mon. Site No. FLW-06	Permit Requirement		Report (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-06	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 R Mon. Site No. FLW-07	Permit Requirement		Report (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 S Mon. Site No. FLW-07	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement					5.0 (An.Avg.)		mg/L		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				10.0 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-01	Permit Requirement					5.0 (An.Avg.)		mg/L		Monthly	Calculated
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-01	Permit Requirement				10.0 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-01	Permit Requirement						5.0 (Max.)	mg/L		Daily	Grab
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Y Mon. Site No. EFA-01	Permit Requirement					3.0 (An.Avg.)		mg/L		Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 A Mon. Site No. EFA-01	Permit Requirement				6.0 (Max.)	4.5 (Max.Wk.Avg.)	3.75 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 Y Mon. Site No. EFA-01	Permit Requirement					Report (An.Avg.)		mg/L		Monthly	Calculated
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 A Mon. Site No. EFA-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFD-01	Permit Requirement				6.5 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-01	Permit Requirement				75 (Min.Mo.Total)			percent		Monthly	Calculated
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement						25 (Max.)	#/100mL		Daily; 24 hours	Grab
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				1.0 (Min.)			mg/L		Continuous	Meter
Chlorine, Total Residual (For Dechlorination)	Sample Measurement										
PARM Code 50060 1 Mon. Site No. EFD-01	Permit Requirement						0.01 (Max.)	mg/L		Daily; 24 hours	Grab
Oxygen, Dissolved (DO)	Sample Measurement										
PARM Code 00300 1 Mon. Site No. EFD-01	Permit Requirement				5.0 (Min.)			mg/L		Daily; 24 hours	Grab
Enterococci	Sample Measurement										
PARM Code 31639 A Mon. Site No. EFA-01	Permit Requirement					35 (Mo.Geo.Mn.)	276 (Max.)	#/100mL		5/Month	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 Y Mon. Site No. EFD-01	Permit Requirement					33.0 (An.Avg.)		ug/L		Monthly	Calculated
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 1 Mon. Site No. EFD-01	Permit Requirement						Report (Mo.Avg.)	ug/L		Monthly	Grab
Dibromochloromethane	Sample Measurement										
PARM Code 32105 Y Mon. Site No. EFD-01	Permit Requirement					60.0 (An.Avg.)		ug/L		Monthly	Calculated
Dibromochloromethane	Sample Measurement										
PARM Code 32105 1 Mon. Site No. EFD-01	Permit Requirement						Report (Mo.Avg.)	ug/L		Monthly	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Total	Sample Measurement										
PARM Code 00600 P Mon. Site No. EFA-01	Permit Requirement		Report (Mo.Total)	ton/mth						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Q Mon. Site No. EFA-01	Permit Requirement		319.8 (An.Total)	ton/yr						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 R Mon. Site No. EFA-01	Permit Requirement		213.2 (5Yr.Avg.)	ton/yr						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 T Mon. Site No. FLW-04	Permit Requirement		96.0 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 U Mon. Site No. FLW-04	Permit Requirement	Report (Mo.Avg.)	Report (3Mo.Avg.)	MGD						Continuous	Flow Totalizer
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 1 Mon. Site No. FLW-04	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C (Influent)	Sample Measurement										
PARM Code 80082 G Mon. Site No. INF-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC
Solids, Total Suspended (Influent)	Sample Measurement										
PARM Code 00530 G Mon. Site No. INF-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: D-001
MONITORING GROUP DESCRIPTION: D-001, including Influent
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-05	Permit Requirement		96.0 (An.Avg.)	MGD						Continuous	Flow Totalizer
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PARM Code 50050 P Mon. Site No. FLW-06	Permit Requirement		Report (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-06	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 R Mon. Site No. FLW-07	Permit Requirement		Report (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 S Mon. Site No. FLW-07	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement					5.0 (An.Avg.)		mg/L		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				10.0 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-01	Permit Requirement					5.0 (An.Avg.)		mg/L		Monthly	Calculated
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-01	Permit Requirement				10.0 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-01	Permit Requirement						5.0 (Max.)	mg/L		Daily	Grab
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Y Mon. Site No. EFA-01	Permit Requirement					3.0 (An.Avg.)		mg/L		Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 A Mon. Site No. EFA-01	Permit Requirement				6.0 (Max.)	4.5 (Max.Wk.Avg.)	3.75 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 Y Mon. Site No. EFA-01	Permit Requirement					Report (An.Avg.)		mg/L		Monthly	Calculated
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 A Mon. Site No. EFA-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFD-01	Permit Requirement				6.5 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-01	Permit Requirement				75 (Min.Mo.Total)			percent		Monthly	Calculated
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement						25 (Max.)	#/100mL		Daily; 24 hours	Grab
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				1.0 (Min.)			mg/L		Continuous	Meter
Chlorine, Total Residual (For Dechlorination)	Sample Measurement										
PARM Code 50060 1 Mon. Site No. EFD-01	Permit Requirement						0.01 (Max.)	mg/L		Daily; 24 hours	Grab
Oxygen, Dissolved (DO)	Sample Measurement										
PARM Code 00300 1 Mon. Site No. EFD-01	Permit Requirement				5.0 (Min.)			mg/L		Daily; 24 hours	Grab
Enterococci	Sample Measurement										
PARM Code 31639 A Mon. Site No. EFA-01	Permit Requirement					35 (Mo.Geo.Mn.)	276 (Max.)	#/100mL		5/Month	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 Y Mon. Site No. EFD-01	Permit Requirement					33.0 (An.Avg.)		ug/L		Monthly	Calculated
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 1 Mon. Site No. EFD-01	Permit Requirement						Report (Mo.Avg.)	ug/L		Monthly	Grab
Dibromochloromethane	Sample Measurement										
PARM Code 32105 Y Mon. Site No. EFD-01	Permit Requirement					39.0 (An.Avg.)		ug/L		Monthly	Calculated
Dibromochloromethane	Sample Measurement										
PARM Code 32105 1 Mon. Site No. EFD-01	Permit Requirement						Report (Mo.Avg.)	ug/L		Monthly	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: D-001

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Total	Sample Measurement										
PARM Code 00600 P Mon. Site No. EFA-01	Permit Requirement		Report (Mo.Total)	ton/mth						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Q Mon. Site No. EFA-01	Permit Requirement		319.8 (An.Total)	ton/yr						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 R Mon. Site No. EFA-01	Permit Requirement		213.2 (5Yr.Avg.)	ton/yr						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 T Mon. Site No. FLW-04	Permit Requirement		96.0 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 U Mon. Site No. FLW-04	Permit Requirement	Report (Mo.Avg.)	Report (3Mo.Avg.)	MGD						Continuous	Flow Totalizer
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 1 Mon. Site No. FLW-04	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C (Influent)	Sample Measurement										
PARM Code 80082 G Mon. Site No. INF-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC
Solids, Total Suspended (Influent)	Sample Measurement										
PARM Code 00530 G Mon. Site No. INF-01	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	mg/L		Weekly	24-hr FPC

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: D-001
MONITORING GROUP DESCRIPTION: D-001, including Influent
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Quarterly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Copper, Total Recoverable	Sample Measurement										
PARM Code 01119 1 Mon. Site No. EFD-01	Permit Requirement						3.7 (Max.)	ug/L		Quarterly	24-hr FPC
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Routine)	Sample Measurement										
PARM Code TRP3B P Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		Quarterly	24-hr FPC
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Additional)	Sample Measurement										
PARM Code TRP3B Q Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Additional)	Sample Measurement										
PARM Code TRP3B R Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Pimephales promelas (Routine)	Sample Measurement										
PARM Code TRP6C P Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		Quarterly	24-hr FPC
7-DAY CHRONIC STATRE Pimephales promelas (Additional)	Sample Measurement										
PARM Code TRP6C Q Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Pimephales promelas (Additional)	Sample Measurement										
PARM Code TRP6C R Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: R-001 and R-002
MONITORING GROUP DESCRIPTION: Public Access Reuse System
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-01	Permit Requirement		6.0 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-01	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 P Mon. Site No. FLW-02	Permit Requirement		2.3 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-02	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: R-001 and R-002

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-01	Permit Requirement						5.0 (Max.)	mg/L		Daily; 24 hours	Grab
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFD-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-01	Permit Requirement						75 (Mo.Total)	percent		Monthly	Calculated
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement						25 (Max.)	#/100mL		Daily; 24 hours	Grab
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				1.0 (Min.)			mg/L		Continuous	Meter
Turbidity	Sample Measurement										
PARM Code 00070 B Mon. Site No. EFB-01	Permit Requirement						Report (Max.)	NTU		Continuous	Meter

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: R-003
MONITORING GROUP DESCRIPTION: Mosaic Fertilizer
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-03	Permit Requirement		4.32 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-03	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Monthly	Calculated
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Daily; 24 hours	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-01	Permit Requirement					20.0 (An.Avg.)		mg/L		Monthly	Calculated

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: R-003

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. EFD-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter
Coliform, Fecal	Sample Measurement										
PARM Code 74055 Y Mon. Site No. EFA-01	Permit Requirement					200 (An.Avg.)		#/100mL		Monthly	Calculated
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement					200 (Mo.Geo.Mn.)	800 (Max.)	#/100mL		Daily; 24 hours	Grab
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				0.5 (Min.)			mg/L		Continuous	Meter

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
REPORT FREQUENCY: Monthly
CLASS SIZE: MA
PROGRAM: Domestic
MONITORING GROUP NUMBER: RMP-A
MONITORING GROUP DESCRIPTION: Class A final product, after heat drying and prior to distribution
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Sludge, Tot, Dry Wt (as N)	Sample Measurement										
PARM Code 78470 + Mon. Site No. RMP-A	Permit Requirement		Report (Max.)	percent						Monthly	Composite
Phosphorus, Sludge, Tot, Dry Wt (as P)	Sample Measurement										
PARM Code 78478 + Mon. Site No. RMP-A	Permit Requirement		Report (Max.)	percent						Monthly	Composite
Potassium, Sludge, Tot, Dry Wt (as K)	Sample Measurement										
PARM Code 78472 + Mon. Site No. RMP-A	Permit Requirement		Report (Max.)	percent						Monthly	Composite
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. RMP-A	Permit Requirement						75.0 (Max.)	mg/kg		Monthly	Composite
Cadmium, Sludge, Tot, Dry Weight (as Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. RMP-A	Permit Requirement						85.0 (Max.)	mg/kg		Monthly	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. RMP-A	Permit Requirement						4300.0 (Max.)	mg/kg		Monthly	Composite

*EITHER THE FECAL COLIFORM LIMIT OR SALMONELLA SP. LIMIT MUST BE MET.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RMP-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-A	Permit Requirement						840.0 (Max.)	mg/kg		Monthly	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-A	Permit Requirement						57.0 (Max.)	mg/kg		Monthly	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-A	Permit Requirement						75.0 (Max.)	mg/kg		Monthly	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-A	Permit Requirement						420.0 (Max.)	mg/kg		Monthly	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-A	Permit Requirement						100.0 (Max.)	mg/kg		Monthly	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-A	Permit Requirement						7500.0 (Max.)	mg/kg		Monthly	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-A	Permit Requirement						Report (Max.)	s.u.		Monthly	Grab
Solids, Total, Sludge, Percent	Sample Measurement										
PARM Code 61553 + Mon. Site No. RMP-A	Permit Requirement						Report (Max.)	percent		Monthly	Composite
Coliform, Fecal	Sample Measurement										
PARM Code 74055 + Mon. Site No. RMP-A	Permit Requirement		1000.0 (Max.)	MPN/g						Monthly	Grab
Salmonella Sludge	Sample Measurement										
PARM Code 71204 + Mon. Site No. RMP-A	Permit Requirement		3.0 (Max.)	MPN/4g						Monthly	Grab

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
REPORT FREQUENCY: Monthly
PROGRAM: Domestic
MONITORING GROUP NUMBER: RMP-AA
MONITORING GROUP DESCRIPTION: Class AA final product, after heat drying and prior to distribution
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Sludge, Tot, Dry Wt (as N)	Sample Measurement										
PARM Code 78470 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Phosphorus, Sludge, Tot, Dry Wt (as P)	Sample Measurement										
PARM Code 78478 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Potassium, Sludge, Tot, Dry Wt (as K)	Sample Measurement										
PARM Code 78472 + Mon. Site No. RMP-AA	Permit Requirement		Report (Mo.Avg.)	percent						Monthly	Composite
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. RMP-AA	Permit Requirement					41.0 (Mo.Avg.)	75.0 (Max.)	mg/kg		Monthly	Composite
Cadmium, Sludge, Tot, Dry Weight (as Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. RMP-AA	Permit Requirement					39.0 (Mo.Avg.)	85.0 (Max.)	mg/kg		Monthly	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. RMP-AA	Permit Requirement					1500.0 (Mo.Avg.)	4300.0 (Max.)	mg/kg		Monthly	Composite

*EITHER THE FECAL COLIFORM LIMIT OR SALMONELLA SP. LIMIT MUST BE MET.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RMP-AA

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-AA	Permit Requirement					300.0 (Mo.Avg.)	840.0 (Max.)	mg/kg		Monthly	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-AA	Permit Requirement					17.0 (Mo.Avg.)	57.0 (Max.)	mg/kg		Monthly	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-AA	Permit Requirement						75.0 (Max.)	mg/kg		Monthly	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-AA	Permit Requirement					420.0 (Mo.Avg.)	420.0 (Max.)	mg/kg		Monthly	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-AA	Permit Requirement					100.0 (Mo.Avg.)	100.0 (Max.)	mg/kg		Monthly	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-AA	Permit Requirement					2800.0 (Mo.Avg.)	7500.0 (Max.)	mg/kg		Monthly	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-AA	Permit Requirement						Report (Max.)	s.u.		Monthly	Grab
Solids, Total, Sludge, Percent	Sample Measurement										
PARM Code 61553 + Mon. Site No. RMP-AA	Permit Requirement					Report (Mo.Avg.)	Report (Max.)	percent		Monthly	Composite
Coliform, Fecal	Sample Measurement										
PARM Code 74055 + Mon. Site No. RMP-AA	Permit Requirement		1000.0 (Max.)	MPN/g						Monthly	Grab
Salmonella Sludge	Sample Measurement										
PARM Code 71204 + Mon. Site No. RMP-AA	Permit Requirement		3.0 (Max.)	MPN/4g						Monthly	Grab

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: RMP-B
MONITORING GROUP DESCRIPTION: Class B final product, after treatment and prior to land application
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal	Sample Measurement										
PARM Code 74055 + Mon. Site No. RMP-B	Permit Requirement		≤2,000,000 (Geo.Mn.)	MPN/g						Bi-monthly; every 2 months	Grab
Nitrogen, Sludge, Tot, Dry Wt (as N)	Sample Measurement										
PARM Code 78470 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
Phosphorus, Sludge, Tot, Dry Wt (as P)	Sample Measurement										
PARM Code 78478 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
Potassium, Sludge, Tot, Dry Wt (as K)	Sample Measurement										
PARM Code 78472 + Mon. Site No. RMP-B	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-B	Permit Requirement						Report (Max.)	s.u.		Bi-monthly; every 2 months	Grab
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. RMP-B	Permit Requirement						75.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RMP-B

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Cadmium, Sludge, Tot, Dry Weight (as Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. RMP-B	Permit Requirement						85.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. RMP-B	Permit Requirement						4300.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-B	Permit Requirement						840.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-B	Permit Requirement						57.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-B	Permit Requirement						75.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-B	Permit Requirement						420.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-B	Permit Requirement						100.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-B	Permit Requirement						7500.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: RMP-Q
MONITORING GROUP DESCRIPTION: Biosolids Quantity
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Biosolids Quantity (Distributed & Marketed in FL)	Sample Measurement										
PARM Code B0004 + Mon. Site No. RMP-3	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Distributed & Marketed outside FL)	Sample Measurement										
PARM Code B0005 + Mon. Site No. RMP-4	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Land-Applied)	Sample Measurement										
PARM Code B0006 + Mon. Site No. RMP-1	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Transferred)	Sample Measurement										
PARM Code B0007 + Mon. Site No. RMP-5	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Landfilled)	Sample Measurement										
PARM Code B0008 + Mon. Site No. RMP-2	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Domestic Wastewater Section, MS 3540, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: PRT-I
MONITORING GROUP DESCRIPTION: Influent Pretreatment
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 G Mon. Site No. PRT-I	Permit Requirement				Report (Min.)		Report (Max.)	s.u.		Annually	Grab
Oil and Grease, hexane extr method	Sample Measurement										
PARM Code 00552 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/L		Annually	Grab
Benzene	Sample Measurement										
PARM Code 34030 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Bromoform	Sample Measurement										
PARM Code 32104 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride	Sample Measurement										
PARM Code 32102 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chlorobenzene	Sample Measurement										
PARM Code 34301 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Chlorodibromomethane	Sample Measurement										
PARM Code 34306 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroethane	Sample Measurement										
PARM Code 85811 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chloroethyl vinyl ether (mixed)	Sample Measurement										
PARM Code 34576 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroform	Sample Measurement										
PARM Code 32106 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene	Sample Measurement										
PARM Code 34536 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichlorobenzene	Sample Measurement										
PARM Code 34566 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene	Sample Measurement										
PARM Code 34571 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1-dichloroethane	Sample Measurement										
PARM Code 34496 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane	Sample Measurement										
PARM Code 32103 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,1-dichloroethylene	Sample Measurement										
PARM Code 34501 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane	Sample Measurement										
PARM Code 34541 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichloropropene	Sample Measurement										
PARM Code 77163 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Ethylbenzene	Sample Measurement										
PARM Code 34371 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl bromide	Sample Measurement										
PARM Code 34413 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl chloride	Sample Measurement										
PARM Code 34418 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methylene chloride	Sample Measurement										
PARM Code 34423 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2,2-tetrachloroethane	Sample Measurement										
PARM Code 34516 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene	Sample Measurement										
PARM Code 34475 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Toluene	Sample Measurement										
PARM Code 34010 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,2-trans-dichloroethylene	Sample Measurement										
PARM Code 34546 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane	Sample Measurement										
PARM Code 34506 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane	Sample Measurement										
PARM Code 34511 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Trichloroethylene	Sample Measurement										
PARM Code 39180 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Vinyl chloride	Sample Measurement										
PARM Code 39175 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chlorophenol	Sample Measurement										
PARM Code 34586 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenol	Sample Measurement										
PARM Code 34601 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dimethylphenol	Sample Measurement										
PARM Code 34606 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,6-dinitro-o-cresol	Sample Measurement										
PARM Code 34657 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrophenol	Sample Measurement										
PARM Code 34616 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2-nitrophenol	Sample Measurement										
PARM Code 34591 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-nitrophenol	Sample Measurement										
PARM Code 34646 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
p-chloro-m-cresol	Sample Measurement										
PARM Code 82627 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol	Sample Measurement										
PARM Code 39032 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenol, Single Compound	Sample Measurement										
PARM Code 34694 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4,6-trichlorophenol	Sample Measurement										
PARM Code 34621 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthene	Sample Measurement										
PARM Code 34205 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthylene	Sample Measurement										
PARM Code 34200 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Anthracene	Sample Measurement										
PARM Code 34220 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzidine	Sample Measurement										
PARM Code 39120 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Benzo(a)anthracene	Sample Measurement										
PARM Code 34526 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene	Sample Measurement										
PARM Code 34247 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(b)fluoranthene (3,4-benzo)	Sample Measurement										
PARM Code 79531 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(ghi)perylene	Sample Measurement										
PARM Code 34521 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(k)fluoranthene	Sample Measurement										
PARM Code 34242 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethoxy) methane	Sample Measurement										
PARM Code 34278 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethyl) ether	Sample Measurement										
PARM Code 34273 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroisopropyl) ether	Sample Measurement										
PARM Code 34283 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate	Sample Measurement										
PARM Code 39100 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-bromophenyl phenyl ether	Sample Measurement										
PARM Code 34636 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Butyl benzyl phthalate	Sample Measurement										
PARM Code 34292 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2-chloronaphthalene	Sample Measurement										
PARM Code 34581 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-chlorophenyl phenyl ether	Sample Measurement										
PARM Code 34641 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chrysene	Sample Measurement										
PARM Code 34320 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dibenzo (a,h) anthracene	Sample Measurement										
PARM Code 34556 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
3,3'-dichlorobenzidine	Sample Measurement										
PARM Code 34631 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Diethyl phthalate	Sample Measurement										
PARM Code 34336 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dimethyl phthalate	Sample Measurement										
PARM Code 34341 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-butyl phthalate	Sample Measurement										
PARM Code 39110 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrotoluene	Sample Measurement										
PARM Code 34611 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2,6-dinitrotoluene	Sample Measurement										
PARM Code 34626 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-octyl phthalate	Sample Measurement										
PARM Code 34596 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2-diphenylhydrazine	Sample Measurement										
PARM Code 34346 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluoranthene	Sample Measurement										
PARM Code 34376 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluorene	Sample Measurement										
PARM Code 34381 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobenzene	Sample Measurement										
PARM Code 39700 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobutadiene	Sample Measurement										
PARM Code 39702 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorocyclopentadiene	Sample Measurement										
PARM Code 34386 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachloroethane	Sample Measurement										
PARM Code 34396 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Indeno (1,2,3-Cd) pyrene	Sample Measurement										
PARM Code 34403 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Isophorone	Sample Measurement										
PARM Code 34408 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Naphthalene	Sample Measurement										
PARM Code 34696 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Nitrobenzene	Sample Measurement										
PARM Code 34447 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodimethylamine	Sample Measurement										
PARM Code 34438 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodi-n-propylamine	Sample Measurement										
PARM Code 34428 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodiphenylamine	Sample Measurement										
PARM Code 34433 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenanthrene	Sample Measurement										
PARM Code 34461 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pyrene	Sample Measurement										
PARM Code 34469 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2,4-trichlorobenzene	Sample Measurement										
PARM Code 34551 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Aldrin	Sample Measurement										
PARM Code 39330 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Alpha-bhc	Sample Measurement										
PARM Code 39336 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
B-bhc-beta	Sample Measurement										
PARM Code 39338 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane)	Sample Measurement										
PARM Code 39782 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Delta benzene hexachloride	Sample Measurement										
PARM Code 34259 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)	Sample Measurement										
PARM Code 39350 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDT (p,p'-DDT)	Sample Measurement										
PARM Code 39300 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDE (p,p'-DDE)	Sample Measurement										
PARM Code 39320 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDD (p,p'-DDD)	Sample Measurement										
PARM Code 39310 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dieldrin	Sample Measurement										
PARM Code 39380 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
A-endosulfan-alpha	Sample Measurement										
PARM Code 34361 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
B-endosulfan-beta	Sample Measurement										
PARM Code 34356 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endosulfan sulfate	Sample Measurement										
PARM Code 34351 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin	Sample Measurement										
PARM Code 39390 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin aldehyde	Sample Measurement										
PARM Code 34366 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor	Sample Measurement										
PARM Code 39410 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide	Sample Measurement										
PARM Code 39420 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1242	Sample Measurement										
PARM Code 39496 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1254	Sample Measurement										
PARM Code 39504 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1221	Sample Measurement										
PARM Code 39488 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1232	Sample Measurement										
PARM Code 39492 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
PCB-1248	Sample Measurement										
PARM Code 39500 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1260	Sample Measurement										
PARM Code 39508 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1016	Sample Measurement										
PARM Code 34671 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene	Sample Measurement										
PARM Code 39400 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Antimony, Total Recoverable	Sample Measurement										
PARM Code 01268 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable	Sample Measurement										
PARM Code 00978 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable	Sample Measurement										
PARM Code 00998 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable	Sample Measurement										
PARM Code 01113 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable	Sample Measurement										
PARM Code 01118 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Copper, Total Recoverable	Sample Measurement										
PARM Code 01119 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-I

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Total Recoverable	Sample Measurement										
PARM Code 01114 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Mercury, Total Recoverable	Sample Measurement										
PARM Code 71901 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Nickel, Total Recoverable	Sample Measurement										
PARM Code 01074 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Selenium, Total Recoverable	Sample Measurement										
PARM Code 00981 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Silver, Total Recoverable	Sample Measurement										
PARM Code 01079 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Thallium, Total Recoverable	Sample Measurement										
PARM Code 00982 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Zinc, Total Recoverable	Sample Measurement										
PARM Code 01094 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cyanide, Total Recoverable	Sample Measurement										
PARM Code 78248 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Phenolic Compounds, Total Recoverable	Sample Measurement										
PARM Code 70029 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Domestic Wastewater Section, MS 3540, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: PRT-E
MONITORING GROUP DESCRIPTION: Effluent Pretreatment
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. PRT-E	Permit Requirement				Report (Min.)		Report (Max.)	s.u.		Annually	Grab
Oil and Grease, hexane extr method	Sample Measurement										
PARM Code 00552 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/L		Annually	Grab
Benzene	Sample Measurement										
PARM Code 34030 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Bromoform	Sample Measurement										
PARM Code 32104 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride	Sample Measurement										
PARM Code 32102 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chlorobenzene	Sample Measurement										
PARM Code 34301 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Chlorodibromomethane	Sample Measurement										
PARM Code 34306 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroethane	Sample Measurement										
PARM Code 85811 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chloroethyl vinyl ether (mixed)	Sample Measurement										
PARM Code 34576 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroform	Sample Measurement										
PARM Code 32106 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene	Sample Measurement										
PARM Code 34536 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichlorobenzene	Sample Measurement										
PARM Code 34566 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene	Sample Measurement										
PARM Code 34571 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1-dichloroethane	Sample Measurement										
PARM Code 34496 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane	Sample Measurement										
PARM Code 32103 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,1-dichloroethylene	Sample Measurement										
PARM Code 34501 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane	Sample Measurement										
PARM Code 34541 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichloropropene	Sample Measurement										
PARM Code 77163 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Ethylbenzene	Sample Measurement										
PARM Code 34371 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl bromide	Sample Measurement										
PARM Code 34413 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl chloride	Sample Measurement										
PARM Code 34418 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methylene chloride	Sample Measurement										
PARM Code 34423 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2,2-tetrachloroethane	Sample Measurement										
PARM Code 34516 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene	Sample Measurement										
PARM Code 34475 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Toluene	Sample Measurement										
PARM Code 34010 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,2-trans-dichloroethylene	Sample Measurement										
PARM Code 34546 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane	Sample Measurement										
PARM Code 34506 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane	Sample Measurement										
PARM Code 34511 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Trichloroethylene	Sample Measurement										
PARM Code 39180 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Vinyl chloride	Sample Measurement										
PARM Code 39175 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chlorophenol	Sample Measurement										
PARM Code 34586 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenol	Sample Measurement										
PARM Code 34601 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dimethylphenol	Sample Measurement										
PARM Code 34606 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,6-dinitro-o-cresol	Sample Measurement										
PARM Code 34657 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrophenol	Sample Measurement										
PARM Code 34616 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2-nitrophenol	Sample Measurement										
PARM Code 34591 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-nitrophenol	Sample Measurement										
PARM Code 34646 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
p-chloro-m-cresol	Sample Measurement										
PARM Code 82627 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol	Sample Measurement										
PARM Code 39032 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenol, Single Compound	Sample Measurement										
PARM Code 34694 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4,6-trichlorophenol	Sample Measurement										
PARM Code 34621 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthene	Sample Measurement										
PARM Code 34205 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthylene	Sample Measurement										
PARM Code 34200 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Anthracene	Sample Measurement										
PARM Code 34220 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzidine	Sample Measurement										
PARM Code 39120 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Benzo(a)anthracene	Sample Measurement										
PARM Code 34526 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene	Sample Measurement										
PARM Code 34247 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(b)fluoranthene (3,4-benzo)	Sample Measurement										
PARM Code 79531 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(ghi)perylene	Sample Measurement										
PARM Code 34521 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(k)fluoranthene	Sample Measurement										
PARM Code 34242 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethoxy) methane	Sample Measurement										
PARM Code 34278 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethyl) ether	Sample Measurement										
PARM Code 34273 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroisopropyl) ether	Sample Measurement										
PARM Code 34283 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate	Sample Measurement										
PARM Code 39100 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-bromophenyl phenyl ether	Sample Measurement										
PARM Code 34636 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Butyl benzyl phthalate	Sample Measurement										
PARM Code 34292 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2-chloronaphthalene	Sample Measurement										
PARM Code 34581 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-chlorophenyl phenyl ether	Sample Measurement										
PARM Code 34641 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chrysene	Sample Measurement										
PARM Code 34320 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dibenzo (a,h) anthracene	Sample Measurement										
PARM Code 34556 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
3,3'-dichlorobenzidine	Sample Measurement										
PARM Code 34631 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Diethyl phthalate	Sample Measurement										
PARM Code 34336 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dimethyl phthalate	Sample Measurement										
PARM Code 34341 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-butyl phthalate	Sample Measurement										
PARM Code 39110 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrotoluene	Sample Measurement										
PARM Code 34611 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2,6-dinitrotoluene	Sample Measurement										
PARM Code 34626 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-octyl phthalate	Sample Measurement										
PARM Code 34596 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2-diphenylhydrazine	Sample Measurement										
PARM Code 34346 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluoranthene	Sample Measurement										
PARM Code 34376 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluorene	Sample Measurement										
PARM Code 34381 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobenzene	Sample Measurement										
PARM Code 39700 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobutadiene	Sample Measurement										
PARM Code 39702 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorocyclopentadiene	Sample Measurement										
PARM Code 34386 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachloroethane	Sample Measurement										
PARM Code 34396 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Indeno (1,2,3-Cd) pyrene	Sample Measurement										
PARM Code 34403 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Isophorone	Sample Measurement										
PARM Code 34408 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Naphthalene	Sample Measurement										
PARM Code 34696 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Nitrobenzene	Sample Measurement										
PARM Code 34447 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodimethylamine	Sample Measurement										
PARM Code 34438 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodi-n-propylamine	Sample Measurement										
PARM Code 34428 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodiphenylamine	Sample Measurement										
PARM Code 34433 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenanthrene	Sample Measurement										
PARM Code 34461 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pyrene	Sample Measurement										
PARM Code 34469 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2,4-trichlorobenzene	Sample Measurement										
PARM Code 34551 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Aldrin	Sample Measurement										
PARM Code 39330 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Alpha-bhc	Sample Measurement										
PARM Code 39336 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
B-bhc-beta	Sample Measurement										
PARM Code 39338 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane)	Sample Measurement										
PARM Code 39782 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Delta benzene hexachloride	Sample Measurement										
PARM Code 34259 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)	Sample Measurement										
PARM Code 39350 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDT (p,p'-DDT)	Sample Measurement										
PARM Code 39300 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDE (p,p'-DDE)	Sample Measurement										
PARM Code 39320 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDD (p,p'-DDD)	Sample Measurement										
PARM Code 39310 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dieldrin	Sample Measurement										
PARM Code 39380 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
A-endosulfan-alpha	Sample Measurement										
PARM Code 34361 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
B-endosulfan-beta	Sample Measurement										
PARM Code 34356 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endosulfan sulfate	Sample Measurement										
PARM Code 34351 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin	Sample Measurement										
PARM Code 39390 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin aldehyde	Sample Measurement										
PARM Code 34366 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor	Sample Measurement										
PARM Code 39410 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide	Sample Measurement										
PARM Code 39420 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1242	Sample Measurement										
PARM Code 39496 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1254	Sample Measurement										
PARM Code 39504 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1221	Sample Measurement										
PARM Code 39488 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1232	Sample Measurement										
PARM Code 39492 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
PCB-1248	Sample Measurement										
PARM Code 39500 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1260	Sample Measurement										
PARM Code 39508 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1016	Sample Measurement										
PARM Code 34671 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene	Sample Measurement										
PARM Code 39400 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Antimony, Total Recoverable	Sample Measurement										
PARM Code 01268 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable	Sample Measurement										
PARM Code 00978 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable	Sample Measurement										
PARM Code 00998 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable	Sample Measurement										
PARM Code 01113 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable	Sample Measurement										
PARM Code 01118 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Copper, Total Recoverable	Sample Measurement										
PARM Code 01119 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-E

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Total Recoverable	Sample Measurement										
PARM Code 01114 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Mercury, Total Recoverable	Sample Measurement										
PARM Code 71901 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Nickel, Total Recoverable	Sample Measurement										
PARM Code 01074 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Selenium, Total Recoverable	Sample Measurement										
PARM Code 00981 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Silver, Total Recoverable	Sample Measurement										
PARM Code 01079 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Thallium, Total Recoverable	Sample Measurement										
PARM Code 00982 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Zinc, Total Recoverable	Sample Measurement										
PARM Code 01094 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cyanide, Total Recoverable	Sample Measurement										
PARM Code 78248 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Phenolic Compounds, Total Recoverable	Sample Measurement										
PARM Code 70029 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Domestic Wastewater Section, MS 3540, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: PRT-R
MONITORING GROUP DESCRIPTION: Residuals Pretreatment
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Cadmium, Sludge, Tot. Dry Wt. (Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Lead, Dry Weight	Sample Measurement										
PARM Code 78468 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Mercury, Dry Weight	Sample Measurement										
PARM Code 78471 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Molybdenum, Dry Weight	Sample Measurement										
PARM Code 78465 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite

*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: PRT-R

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nickel, Dry Weight	Sample Measurement										
PARM Code 78469 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Zinc, Dry Weight	Sample Measurement										
PARM Code 78467 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Wastewater Compliance Evaluation Section, MS 3551, 2600 Blair Stone Road, Tallahassee, FL 32399-2400

PERMITTEE NAME: City of Tampa - Wastewater Department
MAILING ADDRESS: 2545 Guy N. Verger Boulevard
Tampa, Florida 33605

FACILITY: City of Tampa-Howard F. Curren AWTP
LOCATION: 2700 Maritime Blvd
Tampa, FL 33605-6744

COUNTY: Hillsborough
OFFICE: Southwest District

PERMIT NUMBER: FL0020940-019-DW1P

LIMIT: Final
CLASS SIZE: MA
MONITORING GROUP NUMBER: RWS-A
MONITORING GROUP DESCRIPTION: Annual Reclaimed Water or Effluent Analysis
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING NOT REQUIRED: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Antimony, Total Recoverable (GWS = 6)*	Sample Measurement										
PARM Code 01268 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable (GWS = 10)	Sample Measurement										
PARM Code 00978 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Barium, Total Recoverable (GWS = 2,000)	Sample Measurement										
PARM Code 01009 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable (GWS = 4)	Sample Measurement										
PARM Code 00998 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable (GWS = 5)	Sample Measurement										
PARM Code 01113 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable (GWS =100)	Sample Measurement										
PARM Code 01118 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

*GROUND WATER STANDARD (GWS) FOR REFERENCE AND REVIEW ONLY.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Cyanide, Free (amen. to chlorination)(GWS = 200)	Sample Measurement										
PARM Code 00722 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Fluoride, Total (as F) (GWS = 4.0/2.0)	Sample Measurement										
PARM Code 00951 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Lead, Total Recoverable (GWS = 15)	Sample Measurement										
PARM Code 01114 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Mercury, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 71901 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Nickel, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01074 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Nitrogen, Nitrate, Total (as N) (GWS = 10)	Sample Measurement										
PARM Code 00620 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Nitrogen, Nitrite, Total (as N) (GWS = 1)	Sample Measurement										
PARM Code 00615 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Nitrite plus Nitrate, Total 1 det. (as N)(GWS = 10)	Sample Measurement										
PARM Code 00630 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Selenium, Total Recoverable (GWS =50)	Sample Measurement										
PARM Code 00981 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Sodium, Total Recoverable (GWS = 160)	Sample Measurement										
PARM Code 00923 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Thallium, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 00982 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
1,1-dichloroethylene (GWS = 7)	Sample Measurement										
PARM Code 34501 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane (GWS = 200)	Sample Measurement										
PARM Code 34506 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane (GWS = 5)	Sample Measurement										
PARM Code 34511 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane (GWS = 3)	Sample Measurement										
PARM Code 32103 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane (GWS = 5)	Sample Measurement										
PARM Code 34541 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2,4-trichlorobenzene (GWS = 70)	Sample Measurement										
PARM Code 34551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Benzene (GWS = 1)	Sample Measurement										
PARM Code 34030 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride (GWS = 3)	Sample Measurement										
PARM Code 32102 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Cis-1,2-dichloroethene (GWS = 70)	Sample Measurement										
PARM Code 81686 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dichloromethane (methylene chloride)(GWS = 5)	Sample Measurement										
PARM Code 03821 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Ethylbenzene (GWS = 700)	Sample Measurement										
PARM Code 34371 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Monochlorobenzene (GWS = 100)	Sample Measurement										
PARM Code 34031 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene (GWS = 600)	Sample Measurement										
PARM Code 34536 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene (GWS = 75)	Sample Measurement										
PARM Code 34571 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Styrene, Total (GWS = 100)	Sample Measurement										
PARM Code 77128 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene (GWS = 3)	Sample Measurement										
PARM Code 34475 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Toluene (GWS = 1,000)	Sample Measurement										
PARM Code 34010 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-trans-dichloroethylene (GWS = 100)	Sample Measurement										
PARM Code 34546 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Trichloroethylene (GWS = 3)	Sample Measurement										
PARM Code 39180 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Vinyl chloride (GWS = 1)	Sample Measurement										
PARM Code 39175 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Xylenes (GWS = 10,000)	Sample Measurement										
PARM Code 81551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
2,3,7,8-tetrachlorodibenzo-p-dioxin(GWS = 3x10^-5)	Sample Measurement										
PARM Code 34675 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenoxyacetic acid (GWS = 70)	Sample Measurement										
PARM Code 39730 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Silvex (GWS = 50)	Sample Measurement										
PARM Code 39760 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Alachlor (GWS = 2)	Sample Measurement										
PARM Code 39161 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Atrazine (GWS = 3)	Sample Measurement										
PARM Code 39033 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene (GWS = 0.2)	Sample Measurement										
PARM Code 34247 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Carbofuran (GWS = 40)	Sample Measurement										
PARM Code 81405 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)(GWS = 2)	Sample Measurement										
PARM Code 39350 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dalapon (GWS = 200)	Sample Measurement										
PARM Code 38432 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Bis(2-ethylhexyl)adipate (GWS = 400)	Sample Measurement										
PARM Code 77903 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate (GWS = 6)	Sample Measurement										
PARM Code 39100 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Dibromochloropropane (DBCP) (GWS = 0.2)	Sample Measurement										
PARM Code 82625 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Dinoseb (GWS = 7)	Sample Measurement										
PARM Code 30191 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Diquat (GWS = 20)	Sample Measurement										
PARM Code 04443 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Endothall (GWS = 100)	Sample Measurement										
PARM Code 38926 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Endrin (GWS = 2)	Sample Measurement										
PARM Code 39390 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Ethylene dibromide (1,2-dibromoethane)(GWS = 0.02)	Sample Measurement										
PARM Code 77651 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Glyphosate (GWS = 0.7)	Sample Measurement										
PARM Code 79743 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Heptachlor (GWS = 0.4)	Sample Measurement										
PARM Code 39410 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide (GWS = 0.2)	Sample Measurement										
PARM Code 39420 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobenzene (GWS = 1)	Sample Measurement										
PARM Code 39700 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorocyclopentadiene (GWS = 50)	Sample Measurement										
PARM Code 34386 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane) (GWS = 0.2)	Sample Measurement										
PARM Code 39782 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Methoxychlor (GWS = 40)	Sample Measurement										
PARM Code 39480 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Oxamyl (vydate) (GWS = 200)	Sample Measurement										
PARM Code 38865 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol (GWS = 1)	Sample Measurement										
PARM Code 39032 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Picloram (GWS = 500)	Sample Measurement										
PARM Code 39720 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Polychlorinated Biphenyls (PCBs)(GWS = 0.5)	Sample Measurement										
PARM Code 39516 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Simazine (GWS = 4)	Sample Measurement										
PARM Code 39055 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene (GWS = 3)	Sample Measurement										
PARM Code 39400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Trihalomethane, Total by summation(GWS = 0.080)	Sample Measurement										
PARM Code 82080 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	Grab
Radium 226 + Radium 228, Total (GWS = 5)	Sample Measurement										
PARM Code 11503 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L		Annually	24-hr FPC
Alpha, Gross Particle Activity (GWS = 15)	Sample Measurement										
PARM Code 80045 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L		Annually	24-hr FPC
Aluminum, Total Recoverable (GWS = 0.2)	Sample Measurement										
PARM Code 01104 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Chloride (as Cl) (GWS = 250)	Sample Measurement										
PARM Code 00940 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Iron, Total Recoverable (GWS = 0.3)	Sample Measurement										
PARM Code 00980 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Copper, Total Recoverable (GWS = 1,000)	Sample Measurement										
PARM Code 01119 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Manganese, Total Recoverable (GWS = 50)	Sample Measurement										
PARM Code 11123 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: City of Tampa-Howard F. Curren AWTP

MONITORING GROUP NUMBER: RWS-A

PERMIT NUMBER: FL0020940-019-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Silver, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01079 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Sulfate, Total (GWS = 250)	Sample Measurement										
PARM Code 00945 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Zinc, Total Recoverable (GWS = 5,000)	Sample Measurement										
PARM Code 01094 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
pH (GWS = 6.5-8.5)	Sample Measurement										
PARM Code 00400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	s.u.		Annually	Grab
Solids, Total Dissolved (TDS) (GWS = 500)	Sample Measurement										
PARM Code 70295 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Foaming Agents (GWS = 0.5)	Sample Measurement										
PARM Code 01288 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DAILY SAMPLE RESULTS - PART B

Permit Number: FL0020940-019-DW1P Facility: City of Tampa-Howard F. Curren AWTP
Monitoring Period From: _____ To: _____

	BOD, Carbonaceous 5 day, 20C mg/L	Chlorine, Total Residual (For Disinfection) mg/L	Coliform, Fecal #/100mL	Enterococci #/100mL	Nitrogen, Total mg/L	Phosphorus, Total (as P) mg/L	Solids, Total Suspended mg/L	Solids, Total Suspended mg/L	Turbidity NTU	Chlorine, Total Residual (For Dechlorination) mg/L	Dibromochloromethane ug/L
Code	80082	50060	74055	31639	00600	00665	00530	00530	00070	50060	32105
Mon. Site	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFB-01	EFB-01	EFD-01	EFD-01
1											
2											
3											
4											
5											
6											
7											
8											
9											
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21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

DAILY SAMPLE RESULTS - PART B

Permit Number: FL0020940-019-DW1P Facility: City of Tampa-Howard F. Curren AWTP

Monitoring Period From: _____ To: _____

	Dichlorobromomethane ug/L	Oxygen, Dissolved (DO) mg/L	pH s.u. (minimum)	pH s.u. (maximum)	Flow MGD	Flow MGD	Flow MGD	Flow MGD	Flow MGD	Flow MGD	Flow MGD
Code	32101	00300	00400	00400	50050	50050	50050	50050	50050	50050	50050
Mon. Site	EFD-01	EFD-01	EFD-01	EFD-01	FLW-01	FLW-02	FLW-03	FLW-04	FLW-05	FLW-06	FLW-07
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

DAILY SAMPLE RESULTS - PART B

Permit Number: FL0020940-019-DW1P Facility: City of Tampa-Howard F. Curren AWTP

Monitoring Period From: _____ To: _____

	BOD, Carbonaceous 5 day, 20C (Influent) mg/L	Solids, Total Suspended (Influent) mg/L									
Code	80082	00530									
Mon. Site	INF-01	INF-01									
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

GROUNDWATER MONITORING REPORT - PART D

Facility Name: City of Tampa-Howard F. Curren AWTP
Permit Number: FL0020940-019-DW1P
County: Hillsborough
Office: Southwest District

Monitoring Well ID: MWC-01
Well Type: Compliance
Description: SP-1 (Swann Park)
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				
Sodium, Total Recoverable	00923		160	mg/L	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: City of Tampa-Howard F. Curren AWTP
Permit Number: FL0020940-019-DW1P
County: Hillsborough
Office: Southwest District

Monitoring Well ID: MWC-02
Well Type: Compliance
Description: SP-2 (Swann Park)
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				
Sodium, Total Recoverable	00923		160	mg/L	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: City of Tampa-Howard F. Curren AWTP
Permit Number: FL0020940-019-DW1P
County: Hillsborough
Office: Southwest District

Monitoring Well ID: MWC-03
Well Type: Compliance
Description: GE-1 (Gorrie Elem.)
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				
Sodium, Total Recoverable	00923		160	mg/L	Grab	Quarterly				

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NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: City of Tampa-Howard F. Curren AWTP
Permit Number: FL0020940-019-DW1P
County: Hillsborough
Office: Southwest District

Monitoring Well ID: MWC-04
Well Type: Compliance
Description: GE-2 (Gorrie Elem.)
Re-submitted DMR: ☐

Report Frequency: Quarterly
Program: Domestic

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				
Sodium, Total Recoverable	00923		160	mg/L	Grab	Quarterly				

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NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28th of the month following the monitoring period. Facilities who submit their DMR(s) electronically through eDMR do not need to submit a hardcopy DMR. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used, unless indicated otherwise in the permit or on the DMR:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the permittee or authorized representative:

Resubmitted DMR: Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)
No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units. Data qualifier codes are not to be reported on Part A.
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Time Sample Obtained: Enter the time the sample was taken.
Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that. Data qualifier codes are not to be reported on Part D.
Detection Limits: Record the detection limits of the analytical methods used.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.
No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.
No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.
Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

FACT SHEET
FOR
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMIT NUMBER: FL0020940 (Major)

FACILITY NAME: Tampa City of - Howard F. Curren AWWTP

FACILITY LOCATION: 2700 Maritime Blvd, Tampa, FL 33605-6744
Hillsborough County

NAME OF PERMITTEE: City of Tampa - Wastewater Department

PERMIT WRITER: Astrid Flores Thiebaud

1. SUMMARY OF APPLICATION

a. Chronology of Application

Application Number: FL0020940-019-DW1P

Application Submittal Date: May 22, 2015

Additional Information: July 30, 2015

b. Type of Facility

Domestic Wastewater Treatment Plant

Ownership Type: Municipal

SIC Code: 4952

c. Facility Capacity

Existing Permitted Capacity:	96 mgd Annual Average Daily Flow
Proposed Increase in Permitted Capacity:	0 mgd Annual Average Daily Flow
Proposed Total Permitted Capacity:	96 mgd Annual Average Daily Flow

d. Description of Wastewater Treatment

An existing 96.0 MGD Annual Average Daily Flow (AADF) permitted capacity Type I two-stage, high rate (pure oxygen and fine bubble aeration) activated sludge biological nitrification/denitrification domestic wastewater treatment plant. The facility has the capability to operate in a number of modes as described in the submitted basis of design. The facility includes the following units: Pre-aeration with odor control consisting of three tanks of 0.670 MG total volume, mechanical screening and grit removal consisting of eight tanks of 0.727 MG total volume, eight primary sedimentation tanks of 50,464 square feet total surface area and 4.94 MG total volume, six pure oxygen reactors of 7.62 MG total volume, twelve carbonaceous sedimentation tanks of 201,552 square feet total surface area and 18.08 MG total volume, four nitrification reactors of 8.48 MG total volume, eight final sedimentation tanks of 134,368 square feet total surface area and 12.00 MG total volume, thirty-two coarse sand, denitrification filters of 33,600 square feet total surface area, three chlorine contact chambers of 2.38 MG total volume with post aeration, and dechlorination facilities, two gravity sludge thickeners of 0.350 MG total volume, seven anaerobic digesters of 9.87 MG total volume, sludge storage tanks, eight belt filter presses, sludge heat drying facility and fifty-seven sludge drying beds and other associated facilities.

This plant is operated to achieve Advanced Wastewater Treatment (AWT), with high-level disinfected and dechlorinated effluent discharged to Hillsborough Bay. Residuals generated by this facility are heat dried to meet

Class AA or Class A standards for distribution and marketing or are dewatered for land application as a Class B residual.

e. Description of Effluent Disposal and Land Application Sites (as reported by applicant)

Surface Water Discharge D-001: An existing 96.0 MGD AADF flow discharge to Hillsborough Bay (Upper), Class III Marine waters, (WBID# 1558E) which is approximately 141 feet in length and discharges at a depth of approximately 29.1 feet. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Surface Water Discharge D-002: An existing intermittent discharge to Ybor City Drain, Class III Marine waters, (WBID# 1584A) which discharges at a depth of approximately 4.5 feet. Ybor City Drain flows into WBID 1558E of Hillsborough Bay (Upper). Outfall D-002 shall only discharge as result of flows to the treatment plant in excess of approximately 100 MGD coupled with extreme high tide conditions. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Surface Water Discharge D-003: An existing intermittent discharge to Ybor City Drain, Class III Marine waters, (WBID# 1584A) which discharges at a depth of approximately 6.8 feet. Ybor City Drain flows into WBID 1558E of Hillsborough Bay (Upper). Outfall D-003 shall only discharge as result of flows to the treatment plant in excess of approximately 100 MGD coupled with extreme high tide conditions. The point of discharge is located approximately at latitude 27°54' 41" N, longitude 82°26' 27" W.

Mixing zone: The permittee is granted a mixing zone for Dichlorobromomethane and Dibromochloromethane for the effluent discharge at Outfalls D-001, D-002 and D-003. The mixing zone for Dichlorobromomethane has a circular area of 1.0 meter radius, with a total surface area of 3.14 square meters, centered over the outfall(s). The mixing zone for Dibromochloromethane has a circular area of 1.17 meters radius, with a total surface area of 4.3 square meters, centered over the outfall(s).

REUSE:

Land Application R-001: An existing 6.0 MGD AADF permitted capacity slow-rate public access system (City of Tampa Public Access Reuse System) consisting of the City of Tampa service area as outlined on attachment VI on the permit application.

Industrial Reuse R-002: An existing 2.3 MGD AADF permitted capacity Part VII industrial reuse system providing Part III quality reclaimed water for use as cooling water and minor irrigation at the City of Tampa Reuse to Energy Facility (McKay Bay Facility). R-002 is located approximately at latitude 27°56' 56" N, longitude 82°25' 19" W.

Industrial Reuse R-003: An existing 4.32 MGD annual average daily flow permitted industrial reuse system (R-003) providing secondary treatment reclaimed water to a closed-loop system for heating purposes at Mosaic Fertilizer, LLC (Formerly CF Industries). R-003 is located approximately at latitude 27°55' 02" N, longitude 82°26' 14" W.

2. SUMMARY OF SURFACE WATER DISCHARGE

a. This facility does not have a new or expanded discharge to surface waters.

b. The Department does not anticipate adverse impacts on threatened or endangered species as a result of permit issuance.

c. The following exceedances were noted during the previous permit cycle at Outfall D-001:

Date	Parameters	Value	Limit	Units
5/31/12	IC25 Statre 7day Chronic Ceriodaphnia	6.6	100	percent
10/31/12	IC25 Statre 7day Chronic Ceriodaphnia	19	100	percent

1/31/13	IC25 Statre 7day Chronic Ceriodaphnia	7.8	100	percent
10/31/13	IC25 Statre 7day Chronic Ceriodaphnia	8.3	100	percent
7/31/14	IC25 Statre 7day Chronic Ceriodaphnia	86	100	percent
10/31/14	IC25 Statre 7day Chronic Ceriodaphnia	8.3	100	percent
8/31/12	pH	6.4	6.5 (min)	s.u.
9/30/12	pH	6.3	6.5 (min)	s.u.
10/31/14	pH	6.3	6.5 (min)	s.u.
10/31/12	Total Recoverable Cooper	3.9	3.7	ug/L
1/31/13	Total Recoverable Cooper	4.4	3.7	ug/L
4/30/13	Total Recoverable Cooper	4.3	3.7	ug/L
11/30/13	Coliform, Fecal, % less than detection	63	75	percent
12/31/13	Coliform, Fecal	77	25	#/100mL
10/31/14	Coliform, Fecal	34	25	#/100mL
9/30/13	Chlorine, Total Residual	.1	0.01(max)	mg/L
8/31/14	Chlorine, Total Residual	.1	0.01(max)	mg/L
12/31/14	Chlorine, Total Residual	1	0.01(max)	mg/L
1/31/13	Chlorine, Total Residual	.12	1.0 (min)	mg/L
8/31/13	Chlorine, Total Residual	.01	1.0 (min)	mg/L
10/31/14	Chlorine, Total Residual	.19	1.0 (min)	mg/L
12/31/14	Chlorine, Total Residual	.87	1.0 (min)	mg/L
1/31/13	Chlorodibromomethane	42.3	39	ug/L
2/28/13	Chlorodibromomethane	42.8	39	ug/L
3/31/13	Chlorodibromomethane	44.7	39	ug/L
4/30/13	Chlorodibromomethane	45	39	ug/L
5/31/13	Chlorodibromomethane	43.5	39	ug/L
6/30/13	Chlorodibromomethane	43.1	39	ug/L
7/1/13	Chlorodibromomethane	43.1	39	ug/L
7/31/13	Chlorodibromomethane	44.5	39	ug/L
8/31/13	Chlorodibromomethane	46	39	ug/L
9/30/13	Chlorodibromomethane	44.3	39	ug/L
10/31/13	Chlorodibromomethane	47.3	39	ug/L
11/30/13	Chlorodibromomethane	49.3	39	ug/L
12/31/13	Chlorodibromomethane	49.7	39	ug/L
1/31/14	Chlorodibromomethane	49.3	39	ug/L
2/28/14	Chlorodibromomethane	49.1	39	ug/L
3/31/14	Chlorodibromomethane	47.8	39	ug/L
4/30/14	Chlorodibromomethane	46.8	39	ug/L
5/31/14	Chlorodibromomethane	45.6	39	ug/L

3. BASIS FOR PERMIT LIMITATIONS AND MONITORING REQUIREMENTS

a. This facility is authorized to discharge effluent from Outfall D-001 to Hillsborough Bay (Upper) and Outfalls D-002 and D-003 to Ybor City Drain based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow (D-001)	MGD	Max	Report	Monthly Average	62-600.400(3)(b) FAC
Flow (D-001)	MGD	Max	96.0	Annual Average	62-600.400(3)(b) FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow (D-002)	MGD	Max	Report	Monthly Average	62-600.400(3)(b) FAC
Flow (D-002)	MGD	Max	Report	Annual Average	62-600.400(3)(b) FAC
Flow (D-003)	MGD	Max	Report	Monthly Average	62-600.400(3)(b) FAC
Flow (D-003)	MGD	Max	Report	Annual Average	62-600.400(3)(b) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	5.0	Annual Average	403.086(4)(a)1. FS & 62-600.740(1)(b)2.a. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	6.25	Monthly Average	62-600.740(1)(b)2.b. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	7.5	Weekly Average	62-600.740(1)(b)2.c. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	10.0	Single Sample	62-600.740(1)(b)2.d. FAC
Solids, Total Suspended	mg/L	Max	5.0	Annual Average	403.086(4)(a)2. FS & 62-600.740(1)(b)2.a. FAC
Solids, Total Suspended	mg/L	Max	6.25	Monthly Average	62-600.740(1)(b)2.b. FAC
Solids, Total Suspended	mg/L	Max	7.5	Weekly Average	62-600.740(1)(b)2.c. FAC
Solids, Total Suspended	mg/L	Max	10.0	Single Sample	62-600.740(1)(b)2.d. FAC
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	62-600.440(5)(f)3. FAC
Nitrogen, Total	mg/L	Max	3.0	Annual Average	403.086(4)(a)3. FS & 62-600.740(1)(b)2.a. FAC
Nitrogen, Total	mg/L	Max	3.75	Monthly Average	62-600.740(1)(b)2.b. FAC
Nitrogen, Total	mg/L	Max	4.5	Weekly Average	62-600.740(1)(b)2.c. FAC
Nitrogen, Total	mg/L	Max	6.0	Single Sample	62-600.740(1)(b)2.d. FAC
Phosphorus, Total (as P)	mg/L	Max	Report	Annual Average	403.086(4) FS (Phosphorus waiver)
Phosphorus, Total (as P)	mg/L	Max	Report	Monthly Average	403.086(4) FS
Phosphorus, Total (as P)	mg/L	Max	Report	Single Sample	403.086(4). FS
pH	s.u.	Min	6.5	Single Sample	62-600.445 & 62-302.530 FAC
pH	s.u.	Max	8.5	Single Sample	62-600.445 & 62-302.530 FAC
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Average	62-600.440(5)(f)1. FAC
Coliform, Fecal	#/100mL	Max	25	Single Sample	62-600.440(5)(f)2. FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	62-600.440(5)(b) FAC
Chlorine, Total Residual (For Dechlorination)	mg/L	Max	0.01	Single Sample	62-600.440(2) & 62-302.530 FAC
Oxygen, Dissolved (DO)	mg/L	Min	5.0	Single Sample	62-302.533 FAC
Enterococci	#/100mL	Max	35	Monthly Geometric Mean	403.0885(2), FS
Enterococci	#/100mL	Max	276	Single Sample	403.0885(2), FS
Copper, Total Recoverable	ug/L	Max	3.7	Single Sample	62-302.530 FAC
Dichlorobromomethane	ug/L	Max	33.0	Annual Average	62-302.530 FAC
Dichlorobromomethane	ug/L	Max	Report	Monthly Average	62-302.530 FAC
Dibromochloromethane	ug/L	Max	39.0	Annual Average	62-302.530 FAC
Dibromochloromethane	ug/L	Max	Report	Monthly Average	62-302.530 FAC
Nitrogen, Total	ton/mth	Max	Report	Monthly Total	62-650 FAC Final Order Water Quality Based Effluent Limitations for Tampa Bay
Nitrogen, Total	ton/yr	Max	319.8	Annual Total	62-650 FAC Final Order Water Quality Based Effluent Limitations for Tampa Bay

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Nitrogen, Total	ton/yr	Max	213.2	5 Year Average	62-650 FAC Final Order Water Quality Based Effluent Limitations for Tampa Bay
Chronic Whole Effluent Toxicity, 7-Day IC25 (Ceriodaphnia dubia)	percent	Min	100	Single Sample	62-302.530(20) & (61) FAC and 62-4.241(1)(b) FAC
Chronic Whole Effluent Toxicity, 7-Day IC25 (Pimephales promelas)	percent	Min	100	Single Sample	62-302.530(20) & (61) FAC and 62-4.241(1)(b) FAC

(1) Effluent limitations are based on a Level I WQBEL developed by District staff and available in the District permit files. Additionally, effluent limitations are based on Rule 62-302, F.A.C.-Class III Marine Standards, Rule 62-600, F.A.C. and 403.086, F.S

(2) Advanced Wastewater Treatment with high-level disinfection is required by Section 403.086(1)(c), F.S., for discharged effluent from this facility.

(3) This facility has provided reasonable assurance that the discharge will not adversely affect the designated use of the receiving water. Fifth year inspection data, as well as all other available data, have been evaluated in accordance with the Department's reasonable assurance procedures to ensure that no limits other than those included in this permit are needed to maintain Florida water quality standards.

(4) The receiving waters (Hillsborough Bay (Upper), WBID 1558E, and Ybor City Drain, WBID 1584A) were considered during the numeric nutrient criteria (NNC) evaluation for this facility.

(5) Ybor City Drain -WBID 1584A is on the EPA 303D list for Dissolved Oxygen (Nutrients), Fecal Coliform, Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD). Additionally, WBIDs 1584A is on the FDEP verified impaired list for dissolved oxygen (nutrients) and Fecal Coliform.

(6) The receiving stream (Hillsborough Bay (Upper), WBID 1558E) is on the EPA 303D list for dissolved oxygen (Nutrients). Additionally, WBID 1558E is on the FDEP verified impaired list for dissolved oxygen and nutrients.

(7) The permit requires sampling for total nitrogen and total phosphorus, with permit limits that are established by Florida Statute (403.086, F.S.) and Rule 62-600.740, F.A.C. Total nitrogen and total phosphorus concentration limits remain the same as in the previous permit. There is no increase in permitted surface water discharge capacity for this facility, therefore no increase in nutrient loading is anticipated. Phosphorus in not a limiting nutrient for the receiving waters, therefore this facility qualifies for the phosphorus waiver under 403.086, F.S., and the phosphorus concentration limit is listed as report only.

(8) Total Nitrogen loading limitations are based on the facility allocation in the Final Order Adopting Water Quality Based Effluent Limits (WQBEL) for Point Source Discharges to the Tampa Bay Watershed. The loading limits established by the WQBEL ensure compliance with the numeric nutrient criteria established for Tampa Bay in Rule 62-302.532, F.A.C. In accordance with the WQBEL, the five year average total nitrogen load shall not exceed 213.20 tons/year.

(9) Tampa Bay is nitrogen-limited, therefore loading allocations in the WQBEL for Tampa Bay were established for Total Nitrogen only. Continued monitoring by the Department and the Tampa Bay Estuary program indicate the attainment of NNC in Tampa Bay.

(10) This facility is required to conduct chronic toxicity testing for this discharge based on conditions carrying over from the previous permit

(11) There is a statewide TMDL for mercury. The existing Industrial Pretreatment Plan incorporates the mercury minimization plan requirements of the statewide TMDL for mercury.

(12) The exceedances of Dichlorobromomethane and Dibromochloromethane are currently being addressed through the consent order discussed further below. The facility has requested to revise the existing mixing zones, which has been included as a scheduled item.

b. This facility is authorized to direct reclaimed water to Reuse System R-001 and R-002, a slow-rate public access system, based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	6.0	Annual Average	62-600.400(3)(b) & 62-610.810(5) FAC
Flow	MGD	Max	Report	Monthly Average	62-600.400(3)(b) & 62-610.810(5) FAC
Flow	MGD	Max	2.3	Annual Average	62-600.400(3)(b) & 62-610.810(5) FAC
Flow	MGD	Max	Report	Monthly Average	62-600.400(3)(b) & 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.460 & 62-600.740(1)(b)1.a. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	62-610.460(1) & 62-600.440(5)(f)3. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
pH	s.u.	Max	8.5	Single Sample	62-600.445 FAC
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Average	62-600.440(5)(f)1. FAC
Coliform, Fecal	#/100mL	Max	25	Single Sample	62-610.460 & 62-600.440(5)(f)2. FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	62-600.440(5)(b), 62-610.460(2), & 62-610.463(2) FAC
Turbidity	NTU	Max	Report	Single Sample	62-610.463(2) FAC
Giardia	cysts/100L	Max	Report	Single Sample	62-610.463(4) FAC
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	62-610.463(4) FAC

This facility is authorized to direct reclaimed water to Reuse System R-003, an industrial reuse system, based on the following:

Parameter	Units	Max /Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	4.32	Annual Average	62-600.400(3)(b); 62-610.810(5) FAC
Flow	MGD	Max	Report	Monthly Average	62-600.400(3)(b); 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.460 & 62-600.740(1)(b)1.a. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC

Parameter	Units	Max /Min	Limit	Statistical Basis	Rationale
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-610.652 & 62-600.740(1)(b)1.a. FAC
Solids, Total Suspended	mg/L	Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
Solids, Total Suspended	mg/L	Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
Solids, Total Suspended	mg/L	Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
pH	s.u.	Max	8.5	Single Sample	62-600.445 FAC
Coliform, Fecal	#/100mL	Max	200	Annual Average	62-610.510 & 62-600.440(4)(c)1. FAC
Coliform, Fecal	#/100mL	Max	200	Monthly Geometric Mean	62-600.440(4)(c)2. FAC
Coliform, Fecal	#/100mL	Max	800	Single Sample	62-600.440(4)(c)4. FAC
Chlorine, Total Residual	mg/L	Max	0.5	Single Sample	62-600.440(5(b), 62-610.460(2), & 62-610.463(2) FAC

Other Limitations and Monitoring Requirements:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	96	Annual Average	62-600.400(3)(b) FAC
Flow	MGD	Max	Report	3-Month Rolling Average	62-600.400(3)(b) FAC
Flow	MGD	Max	Report	Monthly Average	62-600.400(3)(b) FAC
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	62-600.405(4) FAC
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Monthly Average	62-601.300(1) FAC
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC
Solids, Total Suspended (Influent)	mg/L	Max	Report	Monthly Average	62-601.300(1) FAC
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC
Monitoring Frequencies and Sample Types	-	-	-	All Parameters	62-601 FAC & 62-699 FAC and/or BPJ of permit writer
Sampling Locations	-	-	-	All Parameters	62-601, 62-610.412, 62-610.463(1), 62-610.568, 62-610.613 FAC and/or BPJ of permit writer

4. DISCUSSION OF CHANGES TO PERMIT LIMITATIONS

The current wastewater permit for this facility FL0020940-015-DW1P and associated revisions FL0020940-016-DW1P, FL0020940-017-DW1P, and FL0020940-018-DW1P expires on November 23, 2015. The following items changed from the current permit:

a) The facility requested to adjust the 12 month rolling total and the 5-year average of the yearly totals to 319.8 and 213.2 tons/year, respectively. This is consistent with the nitrogen load allocation for this facility in the Tampa Bay WQBEL.

b) The facility requested to remove the Total Recoverable Nickel from the surface water monitoring requirements. The available data was entered into the reasonable assurance verification worksheet and the theoretical maximum sampling result was 56% of the parameter limit, therefore this parameter has been removed from the surface water sampling requirements.

c) Reporting of ground water monitoring results for Specific Conductance, Dissolved Oxygen and Temperature were removed from the groundwater monitoring plan as these parameters are used to demonstrate sample stability. Therefore, these parameters are not required to be reported on the DMRs, however the field parameters are recorded on sampling field sheets for quality assurance and quality control purposes (QA/QC).

d) The facility requested to remove three groundwater parameters from the permit monitoring requirements; Total Recoverable Cadmium, Total Recoverable Chromium, and Total Recoverable Lead. Removal of these three parameters was based on the Department evaluation of the data collected for 23 consecutive quarters from 06/01/09 to 12/31/14. The monitoring results for these metals were consistently below the regulatory limits for groundwater, therefore, the data was analyzed through the reasonable assurance verification worksheet (RAV). Based on the results of the RAV and best professional judgement, these parameters were removed from the groundwater monitoring plan.

5. BIOSOLIDS MANAGEMENT REQUIREMENTS

Biosolids generated by this facility may be land applied, distributed and marketed, transferred to Biosolids Treatment Facility (BTF) or disposed of in a Class I solid waste landfill.

See the table below for the rationale for the Class A and Class B biosolids limits and monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Coliform, Fecal	CFU /g	Max	1,000.0	Single Sample	62-640.600(1)(b) FAC
Coliform, Fecal	CFU/g	Max	2,000,000	Geometric Mean	62-640.600(1)(b) FAC
Temperature	°F	Min	Report	Weekly	40 CFR Part 503
Time	Days	Min	Report	Weekly	40 CFR Part 503
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	62-640.650(1)(b) FAC
pH	s.u.	Max	Report	Single Sample	62-640.650(1)(b) FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	62-640.650(1)(b) & 700(1), FAC
Monitoring Frequency		All Parameters			62-640.650(3)(a)4. FAC
Pathogen and vector attraction reduction monitoring		All Parameters			62-640.600 & 650(3)(a)1. FAC

See the table below for the rationale for the Class AA biosolids limits and monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	41.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	39.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	1500.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Lead, Dry Weight, Sludge	mg/kg	Max	300.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Mercury, Dry Weight, Sludge	mg/kg	Max	17.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Selenium Sludge Solid	mg/kg	Max	100.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	62-640.700(5)(a) & 650(3)(a)3. FAC
Zinc, Dry Weight, Sludge	mg/kg	Max	2800.0	Monthly Average	62-640.700(5)(b) & 650(3)(a)3. FAC
pH	s.u.	Max	Report	Single Sample	62-640.650(3)(a)3. FAC
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	62-640.650(3)(a)3. FAC
Solids, Total, Sludge, Percent	percent	Max	Report	Monthly Average	62-640.650(3)(a)3. FAC
Coliform, Fecal	MPN/g	Max	1000.0	Single Sample	62-640.600(1)(a) FAC
Salmonella Sludge	MPN/4g	Max	3.0	Single Sample	62-640.600(1)(a) FAC
Monitoring Frequency		All Parameters			62-640.650(3)(a)4. & .850(4)(c) FAC
Pathogen and vector attraction reduction monitoring		All Parameters			62-640.600 & 650(3)(a)1. FAC

See the table below for the rationale for the biosolids quantities monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Biosolids Quantity (Distributed & Marketed in FL)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. & 850(4)(a) FAC
Biosolids Quantity (Distributed & Marketed outside FL)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. & 850(4)(a) FAC
Biosolids Quantity (Land-Applied)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Monitoring Frequency		All Parameters			62-640.650(5)(a) FAC

6. GROUND WATER MONITORING REQUIREMENTS

Ground water monitoring requirements have been established in accordance with Chapters 62-520, 532, 601, 610, and 620, F.A.C.

7. PERMIT SCHEDULES

Permit renewal information is contained in the permit schedule. A permit revision requirement is in the permit schedule for the dibromochloromethane mixing zone once the mixing zone plan of study is complete and approved by the Department.

8. INDUSTRIAL PRETREATMENT REQUIREMENTS

The permittee has an active, approved industrial pretreatment program. The permit includes standard conditions requiring implementation and enforcement of the existing program.

9. ADMINISTRATIVE ORDERS (AO) AND CONSENT ORDERS (CO)

This facility has entered into CO-14-0156, executed 06/12/2014, with the Department, which includes a schedule of compliance. The Consent Order addresses the exceedances of Dibromochloromethane (Chlorodibromomethane). The current permit limitation based on the existing mixing zone is an annual average of 39 ug/L. The Consent Order Interim Limit is 60 ug/L, annual average, for a period of twenty-four months. The Consent Order requires a mixing zone plan of study to assess the availability of mixing in the receiving waters to allow for adjustment of the permitted mixing zone size and effluent limitations.

10. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

No variances were requested for this facility.

11. THE ADMINISTRATIVE RECORD

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received and additional information is available for public inspection during normal business hours at the location specified in item 14. Copies will be provided at a minimal charge per page.

12. CHANGES FROM THE NOTICE OF DRAFT (NOD) TO FINAL PERMIT

On November 17, 2015, the Department received Minor typographical edits from the permittee. Edits were made accordingly.

The Department received comments from EPA on the Notice of Draft permit on October 30, November 16 and 17, 2015. All the comments were addressing on November 12, 13, 16 and 17, 2015. EPA concurred with the Department on November 17, 2015. All the correspondences are available for review or inspection on OCULUS.

13. PROPOSED SCHEDULE FOR PERMIT ISSUANCE

Draft Permit and Public Notice to Applicant and EPA	October 8, 2015
Public Comment Period	Beginning: October 8, 2015 Ending: November 17, 2015
Notice of Permit Issuance	November 2015

14. DEP CONTACT

Additional information concerning the permit and proposed schedule for permit issuance may be obtained during normal business hours from:

Astrid Flores Thiebaud
Engineer IV
Southwest District Office
13051 N Telecom Pkwy
Temple Terrace, FL 33637-0926
Telephone No.: (813) 470-5760

PATHOGEN MONITORING

Part I - Instructions

1. Completion of this report is required by Rules 62-610.463(4), 62-610.472(3)(d), 62-610.525(13), 62-610.568(11), 62-610.568(12), and 62-610.652(6)(c), F.A.C., for all domestic wastewater facilities that provide reclaimed water to certain types of reuse activities. The schedule for sampling and reporting shall be in accordance with the permit for the facility. If a schedule for sampling or re-sampling is not included in the permit, the following schedule shall apply:

   a. Routine Sampling:

      If sampling is required once every two years, this report shall be submitted on or before November 28 of each even numbered year (2006, 2008, 2010, etc.).

      If sampling is required once every five years, this report shall be submitted with the application for permit renewal.

      If sampling is required quarterly, this report shall be submitted on or before February 28, May 28, August 28, and November 28 of each year.

   b. Subsequent Re-Sampling:

      If subsequent re-sampling is required by Item 9 in Part I of this form, this form shall be submitted for the subsequent re-sampling(s) in accordance with the schedule established in Item 9 in Part I of this form.

2. Submit one copy of this form and a copy of the laboratory's final report for the analysis of *Giardia* and *Cryptosporidium* to each of the following two addresses:

   a. The appropriate DEP district office (attention Domestic Wastewater Program). Addresses for the DEP district offices are available at www.dep.state.fl.us/secretary/dist/default.htm.

   b. DEP Water Reuse Coordinator
      Mail Station 3540
      2600 Blair Stone Road
      Tallahassee, Florida 32399-2400

3. Please type or print legibly.

4. In Part II, Items 7 through 12 need to be completed only if this is the first submittal of this report, if the information in Items 7 through 12 has changed since the last submittal, or if the information in any of these questions has not been previously provided.

5. Part III is to be used when sampling for *Giardia* and *Cryptosporidium* at the treatment plant. Part III is also to be used when sampling for *Giardia* and *Cryptosporidium* in a supplemental water supply (see Rule 62-610.472, F.A.C.).

6. For each sample, record the sample volume obtained in liters.

7. For *Giardia*, record the concentrations in cysts per 100 liters. For *Cryptosporidium*, record the concentrations in oocysts per 100 liters. Sufficient sample volumes shall be collected and processed such that the detection limit is no greater than 5 cysts or oocysts per 100 liters. Detection levels on the order of 1 cyst or oocyst per 100 liters are recommended. If an observation is less than the detection limit, make an entry in the form "<2" (where 2 per 100 liters is the detection limit in this example). The actual detection limit will be dictated by the volumes of sample obtained, filtered, and processed. Do NOT record nondetectable values as zero.

8. EPA Method 1623 or other approved methods for reclaimed water or nonpotable waters, adjusted appropriately to accommodate the detection limit requirements, shall be used. Methods previously allowed for EPA's Information Collection Rule (ICR) shall not be used. The full requirements of the approved method, including quality assurance and quality control, are to be met. Quality assurance and sampling requirements in Chapter 62-160, F.A.C., shall apply.

   Two concentrations of *Giardia* and *Cryptosporidium* shall be recorded on Part III of this form:

   a. Total cysts and oocysts shall be enumerated using EPA Method 1623 or other approved methods.

   b. Potentially viable cysts and oocysts shall be enumerated using the DAPI staining technique contained in EPA Method 1623 or similar enumeration techniques included in other approved methods. Cysts and oocysts that are stained DAPI positive or show internal structure by D.I.C. shall be considered as being potentially viable. If the laboratory reports separate values for DAPI positive and for cysts or oocysts having internal structure, the larger of the two concentrations will be reported as being potentially viable.

9. If the number of potentially viable cysts of *Giardia* reported exceeds 5 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. If the number of potentially viable oocysts of *Cryptosporidium* reported exceeds 22 per 100 liters, a subsequent sample shall be taken and analyzed using EPA Method 1623 or other approved methods and reported using this form. This subsequent sample shall be collected within 90 days of the date the initial sample was taken, analyzed for both *Giardia* and *Cryptosporidium*, and the results of the subsequent analysis shall be submitted to DEP using this form within 60 days of sample collection.

10. Rule 62-160.300, F.A.C., requires that all laboratories generating environmental data for submission to the DEP shall hold certification from the Department of Health's (DOH) Environmental Laboratory Certification Program (ELCP). Certification by the ELCP for analysis of *Giardia* and *Cryptosporidium* using EPA Method 1623 for non-potable waters is required. If other approved methods are used, certification by the ELCP is required for the specific method and for the test matrix. Lists of certified laboratories can be found at www.dep.state.fl.us/labs/cgi-bin/aams/index.asp

11. Samples shall be collected during peak flow periods (normally between the hours of 8:00 a.m. and 6:00 p.m.).

12. Recognizing that concentrations of these pathogens generally increase during the late summer through fall period, it is recommended that utilities sample during the August through October time period.

13. If the wastewater treatment facility uses chlorination for disinfection, samples obtained for analysis of *Giardia* and *Cryptosporidium* shall be dechlorinated.

14. When sampling at the treatment facility, obtain a grab sample for total suspended solids (TSS) that is representative of the water leaving the filters at the treatment facility during the period when pathogen

samples are being obtained. In addition, record the highest turbidity and the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

15. When sampling a supplemental water supply, obtain a grab sample for total suspended solids (TSS) that is representative of the surface water or treated stormwater as it is added to the reclaimed water system. This TSS sample shall be taken during the period when pathogen samples are being obtained. In addition, record the lowest total chlorine residual observed during the period when pathogen samples are being obtained.

Part II - General Information

1. DEP wastewater facility identification number: **FL0020940**

   Wastewater facility name: Howard F Curren AWTP

   Permittee name: City of Tampa - Department of Sanitary Sewers

2. Person completing this form:

   Name: _____

   Telephone: (_____)_____

   Email address: _____

3. Sampling and analysis:

   Date samples were taken: _____

   Organization collecting the samples: _____

   Was the sample dechlorinated in the field? ☐ Yes ☐ No

   Was the sample refrigerated or kept on ice during shipment to the laboratory? ☐ Yes ☐ No

   Date samples delivered to laboratory: _____

   Date analytical work was done: _____

   Laboratory doing the analysis: _____

   Laboratory's DOH Identification Number: _____

   Approved method used:

   ☐ EPA Method 1623

   ☐ Other approved method: _____

   Contact person at the laboratory: _____

   Email address of the lab contact person: _____

4. Is this the first time that this form has been submitted for the facility?

   ☐ Yes [Please complete Questions 7 through 16.]

   ☐ No [Proceed to Question 5.]

5. Is this a report of "subsequent re-sampling" required by Item 9 in Part I of this form based on concentrations of potentially viable cysts or oocysts in a previous sampling?

☐ No [Proceed to Question 6.]

☐ Yes [Attach a description of any facility or operational changes made to the treatment facilities since the time of the previous sampling and proceed to Question 6.]

6. Has the information requested in Questions 7 through 12 (below) changed since the last submittal of this form?

☐ Yes [Please complete Questions 7 through 16.]

☐ No [Proceed to Questions 13 through 16 of Part II of this form. You do not need to complete Questions 7 through 12.]

7. Type of secondary treatment system:

☐ Conventional activated sludge ☐ Extended aeration

☐ Contact stabilization ☐ Biological nutrient removal (such as Bardenpho)

☐ Other: _____

8. Does this treatment facility nitrify (convert ammonia nitrogen to nitrate)? ☐ Yes ☐ No

9. Filter type:

☐ Deep bed, single media ☐ Deep bed, multiple media

☐ Shallow bed, automatic backwash ☐ Upflow (including Dynasand)

☐ Slow rate sand filter ☐ Diatomaceous earth filter

☐ Fabric filter ☐ Cartridge filter

☐ Membranes (microfiltration, ultrafiltration, membrane bioreactor, reverse osmosis)

☐ Other: _____

10. Filter Media (complete for each type of media provided):

Top layer of media: Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Middle layer of media: Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

Bottom layer of media: Media type: _____

Effective size: _____ mm

Uniformity coefficient: _____

Bed depth: _____ inches

11. Filter backwash water:

☐ Backwash water is returned to the headworks of the treatment plant.

☐ Backwash water is returned to the aeration basin.

☐ Other. Please describe: _____

12. Disinfection system:

☐ Chlorination, gas ☐ Hypochlorite

☐ Chlorine dioxide ☐ Chlorination, other _____

☐ Ultraviolet ☐ Ozone

☐ Other: _____

13. Is chlorine added before the filters? ☐ No ☐ Yes Dose: _____ mg/L

14. During the period that samples were taken, did you add a coagulant, coagulant aid, polyelectrolyte, or other chemical to enhance filtration?

☐ No

☐ Yes. Please list the chemicals being added and their dose.

Chemical 1 - Name: _____ Dose: _____ mg/L

Chemical 2 - Name: _____ Dose: _____ mg/L

Chemical 3 - Name: _____ Dose: _____ mg/L

15. Wastewater treatment plant permitted capacity: _____ MGD

16. Wastewater flow being treated at the time samples were collected: _____ MGD

PART III - PATHOGEN MONITORING REPORT

FACILITY ID: FL0020940
FACILITY NAME: Howard F Curren AWTP
FACILITY ADDRESS: 2700 Maritime Blvd, Tampa, FL 33605-6744
PERMITTEE NAME: City of Tampa - Department of Sanitary Sewers
MAILING ADDRESS: 2545 Guy N. Verger Boulevard, Tampa, Florida 33605
DATE OF SAMPLING: _____

Parameter	Quantity or Loading		Quality or Concentration	
	Sample Measurement	Units	Sample Measurement	Units
Treatment Plant: After Filter Monitoring Site No.				
Turbidity PARM Code 00070				NTU
TSS PARM Code 00530				mg/L
Treatment Plant: After Disinfection Monitoring Site No.				
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia, total count * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L
Supplemental Water Supply (surface water or stormwater): After Treatment & Disinfection Monitoring Site No.				
TSS PARM Code 00530				mg/L
Total Chlorine Residual PARM Code 50060				mg/L
Volume Collected PARM Code 71994		Liters		
Giardia (total count) * PARM Code GIARD				total cysts/100 L
Giardia, potentially viable cysts * PARM Code VGIAR				potentially viable cysts/100 L
Cryptosporidium, total count * PARM Code CRYPT				total oocysts/100 L
Cryptosporidium, potentially viable oocysts * PARM Code VCRYP				potentially viable oocysts/100 L

* Data entries must be made for both total and potentially viable cysts and oocysts.

PART IV - CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein; and based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Name/Title of Principle Executive Officer or Authorized Agent (Type or Print)	Signature of Principle Executive Officer or Authorized Agent	Telephone No.	Date (YY/MM/DD)
	Email Address		

Hughes, Rhonda

From: Hughes, Rhonda on behalf of SWD_WF_Permitting (Shared Mailbox)
Sent: Monday, November 23, 2015 10:58 AM
To: Eric Weiss (Eric.Weiss@tampagov.net)
Cc: EPA Region IV-Water Management (r4npdespermits@epa.gov); Jeff Hilton (jeffrey.hilton@tampagov.net); 'dan.vanderschuur@tampagov.net'; Tony Alhomsi (alhomsi@epchc.org); 'ifetayo.venner@arcadis-us.com'; Sudano, Monica; Kaur, Ramandeep; Jordan, Jaclyn; FloresThiebaud, Astrid; Champion, Jacquelyn
Subject: Tampa City of-Howard F, Curran AWWTP / FL0020940-019-DW1P-NR / Notice of Permit Issuance / 11-23-2015 / Hillsborough County
Attachments: 019-DW1P-NR NOP.pdf; 019-DW1P-NR Permit .pdf; 019-DW1P-NR- DMRS.pdf; 019-DW1P-NR FactSheet.pdf; 019-DW1P-NR Pathogen Monitoring Report.pdf

Tracking:

Recipient	Delivery
Eric Weiss (Eric.Weiss@tampagov.net)	
EPA Region IV-Water Management (r4npdespermits@epa.gov)	
Jeff Hilton (jeffrey.hilton@tampagov.net)	
'dan.vanderschuur@tampagov.net'	
Tony Alhomsi (alhomsi@epchc.org)	
'ifetayo.venner@arcadis-us.com'	
Sudano, Monica	Delivered: 11/23/2015 10:59 AM
Kaur, Ramandeep	Delivered: 11/23/2015 11:14 AM
Jordan, Jaclyn	Delivered: 11/23/2015 10:59 AM
FloresThiebaud, Astrid	Delivered: 11/23/2015 10:59 AM
Champion, Jacquelyn	Delivered: 11/23/2015 10:59 AM
SWD_Clerical (Shared Mailbox)	
SWD_Clerical@dep.state.fl.us	Delivered: 11/23/2015 10:59 AM

Good morning,

Attached, please find the above-subject Notice of Permit Issuance documents. In an effort to reduce costs and waste, our agency is moving to electronic rather than paper correspondence. This is the only copy that you will receive, unless you request otherwise.

Acrobat Reader 6.0 or greater is required to read the documents. It is available for downloading at http://www.adobe.com/products/acrobat/readstep.html

If you have any questions concerning the contents of the attached documents, please contact the FDEP Permit Engineer Ms. Astrid FloresThiebaud at (813) 470-5760 or via email Astrid.Floresthiebaud@dep.state.fl.us.

Sincerely,

Rhonda Hughes
Secretary Specialist
Florida Department of Environmental Protection
Southwest District
13051 N. Telecom Parkway
Temple Terrace, Florida 33637
Phone: (813) 813-470-5718

Fax: (813) 470-5993
Rhonda.Hughes@dep.state.fl.us

Hughes, Rhonda

From: SWD_Clerical (Shared Mailbox)
Sent: Friday, November 20, 2015 10:46 AM
To: Hughes, Rhonda
Subject: FW: WF - Tampa City of - Howard F Curren AWWTP [FL0020940-019-DW1P-NR][NOP] SIC 4952

Please process

From: Boatwright, Kelley M.
Sent: Friday, November 20, 2015 10:39 AM
To: SWD_Clerical (Shared Mailbox) <SWD_Clerical@dep.state.fl.us>
Cc: FloresThiebaud, Astrid <Astrid.FloresThiebaud@dep.state.fl.us>
Subject: FW: WF - Tampa City of - Howard F Curren AWWTP [FL0020940-019-DW1P-NR][NOP] SIC 4952

Good morning! The referenced permit is signed and ready to be issued. Thanks!

From: Champion, Jacquelyn
Sent: Friday, November 20, 2015 9:06 AM
To: Boatwright, Kelley M.
Cc: FloresThiebaud, Astrid
Subject: FW: WF - Tampa City of - Howard F Curren AWWTP [FL0020940-019-DW1P-NR][NOP] SIC 4952

Good Morning Kelley,
The final permit package for the subject facility is ready for signature (NOP and Permit) and issuance.
Thank you,
Jacki

From: FloresThiebaud, Astrid
Sent: Thursday, November 19, 2015 2:00 PM
To: Champion, Jacquelyn <Jacquelyn.Champion@dep.state.fl.us>
Subject: WF - Tampa City of - Howard F Curren AWWTP [FL0020940-019-DW1P-NR][NOP] SIC 4952

Documents

Notes to Administrative Staff: DW 5-Year Permit

Send to SWD_Clerical for permit issuance.

For IW and DW individual permit, please indicate whether the permit is NPDES-Major

County: **Hillsborough**

DW Permits
Catalog: Wastewater
Profile: Permitting Authorization
Document: **Permit Final**
Permit Type: **DW Facility**

Facility Type: **Domestic Wastewater**
Application Number: [FL0020940]
Document Subject: [019 DW1PNR Final permit]

Astrid Flores Thiebaud
Engineer IV
Permitting and Waste Cleanup Programs
Florida Department of Environmental Protection
Southwest District
13051 North Telecom Parkway
Temple Terrace, FL 33637-0926
Telephone: (813) 470-5760
Fax: (813) 470-5996
Email: astrid.floresthiebaud@dep.state.fl.us

Helpful Links: Waste | Forms | Rules
Drinking Water | Forms | Rules
Wastewater | Domestic Wastewater | Forms | Rules
http://www.dep.state.fl.us/secretary/info/permitting.htm

APPENDIX H

Conceptual Level Capital Cost Estimates

Alt1 Biogas Fueled Boilers

Item	Units	Quantity	Materials	Labor (50%)	Construction Total	Comments
Biogas H2S Removal	EA	1	$500,000	$250,000	$750,000	H2S Removal Only
4" Gas Piping	LF	100	$50	$25	$7,500	
Concrete Pad & Site Prep	LS	1	$50,000	$25,000	$75,000	
			Total Estimate Cost		$832,500	
			Contingencies (20%)		$166,500	
			Engineering (15%)		$124,875	
			Total Estimate Cost		**$1,123,875**	

Alt2a CHP-Refurbished Engines

Item	Units	Quantity	Materials	Labor (50%)	Construction Total	Comments
Refurbish existing engines	EA	5	$250,000	$0	$1,250,000	Quote form WPI
4" Water Piping	LF	50	$100	$50	$7,500	
Gas Cleaning Skid (Siloxand and H2S)	EA	1	$750,000	$375,000	$1,125,000	
Hot Water Recirculation Pump	EA	3	$10,000	$5,000	$45,000	
Electrical Swgr	LS	1	$356,000	$178,000	$534,000	Swichgear Upgrade (5 Generator Breakers)
Mechanical/Elec Misc (10%)	LS	1	$111,610	$55,805	$167,415	
			Total Estimate Cost		$3,128,915	
			Contingencies (20%)		$625,783	
			Engineering (15%)		$469,337	
			Total Estimate Cost		**$4,224,035**	

Alt2b CHP-New Engines

Item	Units	Quantity	Materials	Labor (50%)	Construction Total	Comments
Packaged Engine/Generator (~1500KW)	EA	2	$950,000	$475,000	$2,850,000	1500kW Similar to GEJ416
4" Water Piping	LF	100	$150	$75	$22,500	
4" Biogas Piping	LF	200	$150	$75	$45,000	
Shell in Tube Heat Exchanger	EA	2	$15,000	$7,500	$45,000	
Heat Recovery Piping Modifications	LS	1	$15,000	$7,500	$22,500	
Gas Cleaning Skid (Siloxand and H2S)	EA	1	$750,000	$375,000	$1,125,000	H2S and Siloxane Treatment
Exhaust Piping	LS	1	$25,000	$12,500	$37,500	
Hot Water Recirculation Pump	EA	3	$10,000	$5,000	$45,000	
Electrical Swgr	LS	1	$150,000	$75,000	$225,000	Swichgear Upgrade (2 breakers Ony)
Concrete Pad & Site Prep	LS	1	$50,000	$25,000	$75,000	
Mechanical/Elec Misc (10%)	LS	1	$191,530	$95,765	$287,295	
			Total Estimate Cost		$4,779,795	
			Contingencies (20%)		$955,959	
			Engineering (15%)		$716,969	
			Total Estimate Cost		**$6,452,723**	

Alt 3 - rCNG/RNG

Item	Units	Quantity	Materials	Labor (50%)	Construction Total	Comments
CNG Compression and Treatment System	EA	3	$1,000,000	$500,000	$4,500,000	Similar to BioCNG 200. Storage and gas compression/conditioning equipment.
4" Gas Piping	LF	1200	$150	$75	$270,000	
Condensate Drain Piping	LF	200	$50	$25	$15,000	
Concrete Pad & Site Prep	LS	1	$75,000	$37,500	$112,500	
Remote Storage and Fueling Station	EA	2	$1,500,000	$750,000	$4,500,000	2 Large (1500-2000 gge/d) Fast-Fill Fuel Stations (Only needed for direct vehicle fueling. Omit for pipeline injection only)
DOT Gas Transport Trailer	EA	4	$350,000	$0	$1,400,000	Only needed for direct vehicle fueling. Omit for pipeline injection only
Electrical Misc	LS	1	$50,000	$25,000	$75,000	
			Total Estimate Cost		$10,872,500	
			Contingencies (20%)		$2,174,500	
			Engineering (15%)		$1,630,875	
			Total Estimate Cost		**$14,677,875**	

Alt 4 - Sludge Drying

Item	Units	Quantity	Materials	Labor (50%)	Construction Total	Comments
CNG Compression and Treatment System	LS				$8,941,000	Dryer rehab cost from HFCAWTP Biosolids Processing Assessment Report (8/2012)
			Total Estimate Cost		$8,941,000	
			Contingencies (20%)		Included	
			Engineering (15%)		Included	
			Total Estimate Cost		**$8,941,000**	

APPENDIX I

MASTER
CONSULTING
ENGINEERS, INC.

5523 WEST CYPRESS ST., STE. 200
TAMPA, FLORIDA 33607
PH. 813.287-3600 FAX 813-287-3622

5950 LAKEHURST DR., STE. 183
ORLANDO, FLORIDA 32819
PH. 407-351-2384 FAX 813-287-3622
www.mcengineers.com

October 12, 2015

Mr. Jack Ferras, P.E.
Waste Water Division Head
City of Tampa Wastewater Department
2545 Guy N Verger Blvd.
Tampa, Florida 33605

RE: Site Condition Assessment
COT Wastewater Facility

Dear Jack,

We have completed the building condition assessment inspections in reference to the overall site restoration project in accordance with our stated proposal.

Included in our report are our visual site observations, recommendations for follow up evaluation, and recommended repair details are provided in the format of repair documents.

We very much appreciate this opportunity to provide these services to you. Please do not hesitate to contact us if we can further assist you with the conditions described in this report.

Sincerely,

Master Consulting Engineers, Inc.

Robert L. Bell, P.E.
Associate Principal

OBSERVATIONS

Our observations consisted of a walkthrough visual review of the building to identify structural items in need of repair. Our observations were made without the removal of finishes. No testing or exploratory openings were performed as part of the assessment. Our condition assessment of the individual buildings are detailed in the subsequent pages of this report.

DISCUSSION

STRUCTURAL

For the most part, the structural components of the buildings exhibit normal signs of wear and tear of a structure exposed to this type of environmental conditions. Typical deterioration included concrete spalling and/or exposed reinforcing on different concrete members. There are some areas where the exposed reinforcing steel is due to low concrete cover during construction. Concrete cracks were observed throughout the buildings; however these cracks are not critical to the structural elements at this time. Structural repair documents are enclosed to address the items observed in the condition report.

WATERPROOFING

Due to the presence of very narrow cracks on the concrete decks, the application of a concrete penetrating sealer on the floor levels is recommended to protect the deck form moisture and chloride ion penetration. Concrete penetrating sealers provide protection to concrete structures from damage that can be caused by moisture and chloride ion penetration. Penetrating sealers do not bridge cracks and are not completely effective in situations where there is standing water on the surface of the concrete.

REPAIR PHASE

In the implementation of repair/maintenance programs, it is highly recommended that a qualified and registered restoration consultant to be engaged to provide proven material manufactures and repair industry standards on the application of these programs. Contractor compliance with the contract documents must be verified by the Engineer of Record (EOR) in order to fully recognize the value of the repair products and applications to these buildings.

BUILDING INDEX

I.D. Code	Structure / Facility	Page #
1	Plant Pumping Station(Raw Sludge Pumping Station)	8
2	Junction Chamber #1, Odor Control, Addition of Preaeration on Chamber #3	8
5	Screen & Grit Bldg # 2	9
6	Junction Chamber # 2	10
7	Meter Vault #2	11
8	Junction Chamber #3	11
9	Pri. Sed. Tanks # 1-4	11
10	Main Pumping Station	12
11	Reactors	13
12	Final Sed. Tanks #1 thru #12	14
13	Intermediate Pumping Station	16
14	Denit. Filters #1 thru #20	17
15	Filter Building #1	18
16	Post Aeration, Cl2 tanks 1 thru 3	19
17	Junction Chamber #4	20
20	Primary Sludge Pumping Station #1	20
21	Return Sludge Pumping Station 1	20
22	Anaerobic Digestion Tanks 1-5	20
23	Return Sludge Pumping Station 2	21
24	Return Sludge Pumping Station 3	21
25	Diffused Air Reactor	22
26	Sludge Thickening Tanks	24
28	Digester Control Building A	25
29	Digester Control Building B	25
30	Sludge Treatment Building	25
31	Filtrate Pumping Station	26
32	Sludge Dewatering Facility	27
33	Waste Gas Burner Pad for 1 thru 5 Digesters	28
35	Sludge Heat Drying Facility	28
36	J.C. #1 Odor Control #1 Facility	29
37	J.C. #2 Odor Control #2 Facility	29
41	Oxygen Generation and Storage Equipment	30
42	Chemical Handling Equipment Platform	30
44	Plant Switchgear Building	30
46	Dechlorination Facility	30
47	Filter Building #2	30
48	Denit Filters #21 thru #32	31
49	Junction Chamber #6	31
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BUILDING INDEX - CONTINUED

I.D. Code	Structure / Facility	Page #
51	Carpenter Shop	32
52	Effluent Building and Welding Shop	32
54	Dried Sludge Control Building	32
57	IPS #2 (Nitrification Pumping Station)	32
58	Blower Building (DARs)	33
59	Screen & Grit Bldg # 1	34
61	Final Sed. Tanks #13 thru #20	35
62	Return Sludge Pumping Station 4	36
63	Return Sludge Pumping Station 5	36
71	Mixed Sludge Pumping Station	36
72	Anaerobic Digestion tanks 6 & 7	36
74	Digester Control Building[C] Gas meters, Gas Compressors, Sediment Trap	37
77	Teco Partnership Station	37
78	Stand-By Generator Facility	38
79	Waste Gas Burner Pad for 6 thru 7 Digesters	38
80	Generator Building	38
81	Diesel Building Generator Facility	38
82	Pri. Sed. Tanks # 5 thru 8	39
83	Primary Sludge and Dewatering Pumping Station and Control Building.	40
86	Reclaimed Water Pumps (Incinerator)	40
87	Water Reuse Water Plant	40
89	Fuel Station Facility	40
N/A	Sludge Storage Tanks 1-5	41

STRUCTURE CONDITION ISSUE SUMMARY

PRIORITY – 1 STRUCTURAL - SAFETY RELATED

I.D. Code	Condition Issue	Repair No.	Quantity	Est. Cost per Repair	Est. Total Cost
6	Handrail Spalling	See Sheet S4.1 for Repair	15	$900/Handrail	$13,500.00
11	Handrail Spalling	See Sheet S4.1 for Repair	15	$900/Handrail	$13,500.00
12	Handrail Spalling	See Sheet S4.1 for Repair	1000	$900/Handrail	$900,000.00
12	Full Depth Exposed Reinforcing	9-016/S3.3	100	$45-$90/ft^2	$18,000.00[1]
13	Handrail Spalling	See Sheet S4.1 for Repair	5	$900/Handrail	$4,500.00
14	Handrail Spalling	See Sheet S4.1 for Repair	50	$900/Handrail	$45,000.00
16	Handrail Spalling	See Sheet S4.1 for Repair	100	$900/Handrail	$90,000.00
25	Handrail Spalling	See Sheet S4.1 for Repair	50	$900/Handrail	$45,000.00
26	Handrail Spalling	See Sheet S4.1 for Repair	30	$900/Handrail	$27,000.00
30	Handrail Spalling	See Sheet S4.1 for Repair	10	$900/Handrail	$9,000.00
32	Handrail Spalling	See Sheet S4.1 for Repair	10	$900/Handrail	$9,000.00
48	Handrail Spalling	See Sheet S4.1 for Repair	50	$900/Handrail	$45,000.00
82	Full Depth Exposed Reinforcing	9-016/S3.3	10	$45-$90/ft^2	$1,800.00[1]
N/A	Handrail Spalling	See Sheet S4.1 for Repair	80	$900/Handrail	$72,000.00
N/A	Full Depth Exposed Reinforcing	9-016/S3.3	25	$45-$90/ft^2	$4,500.00[1]

[1] Assumed 2ft^2 of repair per location recorded for budgeting.

PRIORITY – 2 STRUCTURAL - REPAIR

I.D. Code	Condition Issue	Repair No.	Quantity	Est. Cost per Repair	Est. Total Cost
78	Corbel Spalling	See Sheet S4.2 for Repair	8	$1500/Corbel	$12,000

STRUCTURE CONDITION ISSUE SUMMARY - CONTINUED

PRIORITY – 3 MAINTENANCE

I.D. Code	Condition Issue	Repair No.	Quantity	Est. Cost per Repair	Est. Total Cost
2	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
5	Wall Spalling with Exposed Reinforcing	9-006/S3.2	100	$20-40/ft^2	$4,000.00[2]
5	Deteriorating Expansion Joint	N/A See Report for Repair	25	$7-9/ft	$2,250[4]
5	Slab Spalling With Exposed Reinforcing	9-001/S3.1	10	$20-40/ft^2	$400.00[2]
5	Exterior Cracking	9-006/S3.2	25	$40/ft	$2,000.00[3]
7	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
10	Wall Spalling with Exposed Reinforcing	9-006/S3.2	50	$20-40/ft^2	$2,000.00[2]
11	Wall Spalling with Exposed Reinforcing	9-006/S3.2	50	$20-40/ft^2	$2,000.00[2]
11	Slab Spalling With Exposed Reinforcing	9-001/S3.1	50	$20-40/ft^2	$2,000.00[2]
12	Slab Spalling With Exposed Reinforcing	9-001/S3.1	50	$20-40/ft^2	$2,000.00[2]
12	Deteriorating Expansion Joint	N/A See Report for Repair	50	$7-9/ft	$4,500[4]
13	Wall Spalling with Exposed Reinforcing	9-006/S3.2	10	$20-40/ft^2	$400.00[2]
15	Wall Spalling with Exposed Reinforcing	9-006/S3.2	100	$20-40/ft^2	$4,000.00[2]
15	Deteriorating Expansion Joint	N/A See Report for Repair	50	$7-9/ft	$4,500[4]
16	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
22	Wall Spalling with Exposed Reinforcing	9-006/S3.2	15	$20-40/ft^2	$600.00[2]
23	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
24	Wall Spalling with Exposed Reinforcing	9-006/S3.2	15	$20-40/ft^2	$600.00[2]
25	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
25	Deteriorating Expansion Joint	N/A See Report for Repair	50	$7-9/ft	$4,500[4]
25	Exterior Cracking	9-006/S3.2	50	$40/ft	$4,000.00[3]
26	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
30	Wall Spalling with Exposed Reinforcing	9-006/S3.2	10	$20-40/ft^2	$400.00[2]

STRUCTURE CONDITION ISSUE SUMMARY - CONTINUED

PRIORITY – 3 MAINTENANCE

I.D. Code	Condition Issue	Repair No.	Quantity	Est. Cost per Repair	Est. Total Cost
32	Wall Spalling with Exposed Reinforcing	9-006/S3.2	10	$20-40/ft^2	$400.00[2]
32	Column Base Spalling	9-003/S3.2	10	$20-40/ft^2	$400[2]
35	Column Base Damaged Grout	N/A See Report for Repair	25	$250/Column	$6,250
36	Wall Spalling with Exposed Reinforcing	9-006/S3.2	5	$20-40/ft^2	$200.00[2]
37	Wall Spalling with Exposed Reinforcing	9-006/S3.2	5	$20-40/ft^2	$200.00[2]
47	Wall Spalling with Exposed Reinforcing	9-006/S3.2	10	$20-40/ft^2	$400.00[2]
50	Slab Cracking	9-004/S3.2	10	$8-9/ft	$180.00[3]
54	Wall Spalling with Exposed Reinforcing	9-006/S3.2	25	$20-40/ft^2	$1,000.00[2]
58	Wall Spalling with Exposed Reinforcing	9-006/S3.2	5	$20-40/ft^2	$200.00[2]
59	Wall Spalling with Exposed Reinforcing	9-006/S3.2	50	$20-40/ft^2	$2,000.00[2]
59	Deteriorating Expansion Joint	N/A See Report for Repair	25	$7-9/ft	$2,250[4]
59	Slab Spalling With Exposed Reinforcing	9-001/S3.1	10	$20-40/ft^2	$400.00[2]
59	Exterior Cracking	9-006/S3.2	25	$40/ft	$2,000.00[3]
61	Deteriorating Expansion Joint	N/A See Report for Repair	50	$7-9/ft	$4,500[4]
62	Deteriorating Expansion Joint	N/A See Report for Repair	25	$7-9/ft	$2,250[4]
74	Wall Spalling with Exposed Reinforcing	9-006/S3.2	10	$20-40/ft^2	$400.00[2]
77	Exposed/Spalling CMU Horizontal Reinforcing	9-006/S3.2	5	$13-18/ft^2	$90.00[2]
82	Slab Cracking	9-004/S3.2	25	$8-9/ft	$450.00[3]
82	Deteriorating Expansion Joint	N/A See Report for Repair	25	$7-9/ft	$2,250[4]
83	Wall Spalling with Exposed Reinforcing	9-006/S3.2	5	$20-40/ft^2	$200.00[2]
N/A	Wall Spalling with Exposed Reinforcing	9-006/S3.2	100	$20-40/ft^2	$4,000.00[2]

[2] Assumed 1ft^2 of repair per location recorded for budgeting.
[3] Assumed 2ft of repair per location recorded for budgeting.
[4] Assumed 10ft of repair per location recorded for budgeting.

BUILDING NO: 1 PLANT PUMPING STATION (RAW SLUDGE PUMPING STATION)

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 2 JUNCTION CHAMBER #1, ODOR CONTROL, ADDITION OF PREAERATION ON CHAMBER #3

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 5 SCREEN & GRIT BLDG # 2

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	100	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	25	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

Typical Photograph	Condition Issue	
	Slab Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<10	9-001/S3.1
	Priority	
	Maintenance	

BUILDING NO: 5 SCREEN & GRIT BLDG # 2 - CONTINUED

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Exterior Cracking	
	Est. Locations	**Repair Detail No.**
	<25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 6 JUNCTION CHAMBER # 2

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Est. Locations**
	15	See Sheet S4.1
	Priority	
	Structural – Safety Related	

BUILDING NO: 7 METER VAULT #2

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 8 JUNCTION CHAMBER #3

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 9 PRI. SED TANKS # 1-4

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 10 MAIN PUMPING STATION

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	50	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 11 REACTORS

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	50	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Slab Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	50	9-001/S3.1
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	15	See Sheet S4.1
	Priority	
	Structural – Safety Related	

BUILDING NO: 12 FINAL SED TANKS #1 THRU #12

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Slab Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<50	9-001/S3.1
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	1000	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	50	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

BUILDING NO: 12 FINAL SED TANKS #1 THRU #12 - CONTINUED

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Full Depth Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<100	9-016/S3.3
	Priority	
	Structural – Safety Related	

BUILDING NO: 13 INTERMEDIATE PUMPING STATION

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	10	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	5	See Sheet S4.1
	Priority	
	Structural - Safety Related	

BUILDING NO: 14 DENIT. FILTERS #1 THRU #20

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<50	Sheet S4.1
	Priority	
	Structural Safety Related	

BUILDING NO: 15 FILTER BUILDING #1

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	>100	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint Material	
	Est. Locations	**Repair Detail No.**
	50	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

BUILDING NO: 16 POST AERATION, CL2 TANKS 1 THRU 3

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<100	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 17 JUNCTION CHAMBER #4

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 20 PRIMARY SLUDGE PUMPING STATION #1

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 21 RETURN SLUDGE PUMPING STATION 1

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 22 ANAEROBIC DIGESTION TANKS 1-5

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<15	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 23 RETURN SLUDGE PUMPING STATION 2

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 24 RETURN SLUDGE PUMPING STATION 3

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<15	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 25 DIFFUSED AIR REACTOR

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<50	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<25	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	<50	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

BUILDING NO: 25 DIFFUSED AIR REACTOR - CONTINUED

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Exterior Cracking	
	Est. Locations	**Repair Detail No.**
	<50	9-004/S3.2
	Priority	
	Maintenance	

BUILDING NO: 26 SLUDGE THICKENING TANKS

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	30	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 28 DIGESTER CONTROL BUILDING A

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 29 DIGESTER CONTROL BUILDING B

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 30 SLUDGE TREATMENT BUILDING

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<10	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 31 FILTRATE PUMPING STATION

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 32 SLUDGE DEWATERING FACILITY

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<10	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<10	Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Column Base Spalling	
	Est. Locations	**Repair Detail No.**
	<10	9-003/S3.2
	Priority	
	Maintenance	

BUILDING NO: 33 WASTE GAS BURNER PAD FOR 1 THRU 5 DIGESTERS

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 35 SLUDGE HEAT DRYING FACILITY

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Column Base Damaged Grout	
	Est. Locations	**Repair Detail No.**
	25	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace all grout with new non-shrink grout.	

Typical Photograph	Condition Issue	
	Heavy Corrosion on Exterior Siding	
	Est. Locations	**Repair Detail No.**
	Typical	N/A
	Priority	
	Maintenance	

BUILDING NO: 36 J.C. #1 ODOR CONTROL #1 FACILITY

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	5	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 37 J.C. #2 ODOR CONTROL #2 FACILITY

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	5	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 41 OXYGEN GENERATION AND STORAGE EQUIPMENT

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 42 CHEMICAL HANDLING EQUIPMENT PLATFORM

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 44 PLANT SWITCHGEAR BUILDING

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 46 DECHLORINATION FACILITY

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 47 FILTER BUILDING #2

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	10	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 48 DENIT FILTERS #21 THRU #32

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	<50	9-006/S3.2
	Priority	
	Structural – Safety Related	

BUILDING NO: 49 JUNCTION CHAMBER #6

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 50 JUNCTION CHAMBER #5

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Slab Cracking	
	Est. Locations	**Repair Detail No.**
	<10	9-004/ S3.2
	Priority	
	Maintenance	

BUILDING NO: 51 CARPENTER SHOP

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 52 EFFLUENT BUILDING AND WELDING SHOP

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 54 DRIED SLUDGE CONTROL BUILDING

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	25	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 57 IPS #2 (NITRIFICATION PUMPING STATION)

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 58 BLOWER BUILDING (DARS)

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<5	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 59 SCREEN & GRIT BLDG # 1

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	50	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	<25	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

Typical Photograph	Condition Issue	
	Slab Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<10	9-001/S3.1
	Priority	
	Maintenance	

BUILDING NO: 59 SCREEN & GRIT BLDG # 1 - CONTINUED

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Exterior Cracking	
	Est. Locations	**Est. Locations**
	<25	<25
	Priority	
	Maintenance	

BUILDING NO: 61 FINAL SED TANKS #13 THRU #20

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	<50	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

BUILDING NO: 62 RETURN SLUDGE PUMPING STATION 4

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	25	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

BUILDING NO: 63 RETURN SLUDGE PUMPING STATION 5

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 71 MIXED SLUDGE PUMPING STATION

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 72 ANAEROBIC DIGESTION TANKS 6 & 7

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 74 DIGESTER CONTROL BUILDING[C] GAS METERS, GAS COMPRESSORS,SEDIMENT TRAP

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<10	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 77 TECO PARTNERSHIP STATION

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Exposed/Spalling CMU Horizontal Reinforcing	
	Est. Locations	**Repair Detail No.**
	<5	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 78 STAND-BY GENERATOR FACILITY

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Corbel Spalling	
	Est. Locations	**Repair Detail No.**
	4	See Sheet 4.2
	Priority	
	Structural - Repair	

BUILDING NO: 79 WASTE GAS BURNER PAD FOR 6 THRU 7 DIGESTERS

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 80 GENERATOR BUILDING

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 81 DEISEL BUILDING GENERATOR FACILITY

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 82 PRI. SED TANKS # 5 THRU 8

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Slab Cracking	
	Est. Locations	**Repair Detail No.**
	<25	9-004/S3.2

Typical Photograph	Condition Issue	
	Deteriorating Expansion Joint	
	Est. Locations	**Repair Detail No.**
	25	N/A See Note Below
	Priority	
	Maintenance	
	Note: Remove and replace expansion joint material with an approved equivalent.	

Typical Photograph	Condition Issue	
	Full Depth Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	<10	9-016/S3.3
	Priority	
	Structural – Safety Related	

BUILDING NO: 83 PRIMARY SLUDGE AND DEWATERING PUMPING STATION ANS CONTROL BUILDING. (NEW PRIMARY)

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	5	9-006/S3.2
	Priority	
	Maintenance	

BUILDING NO: 86 RECLAIMED WATER PUMPS (INCINERATOR)

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 87 WATER REUSE WATER PLANT

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: 89 FUEL STATION FACILITY

STRUCTURE CONDITION ISSUES

No concrete structural condition issues found.

BUILDING NO: N/A SLUDGE STORAGE TANKS 1-5

STRUCTURE CONDITION ISSUES

Typical Photograph	Condition Issue	
	Wall Spalling With Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	100	9-006/S3.2
	Priority	
	Maintenance	

Typical Photograph	Condition Issue	
	Handrail Spalling	
	Est. Locations	**Repair Detail No.**
	80	See Sheet S4.1
	Priority	
	Structural – Safety Related	

Typical Photograph	Condition Issue	
	Full Depth Exposed Reinforcing	
	Est. Locations	**Repair Detail No.**
	25	9-016/S3.3
	Priority	
	Structural – Safety Related	

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