Facility Plan Amendment, Wastewater Treatment Facility, Warwick, Rhode Island

Prepared for:

Warwick Sewer Authority
Warwick, Rhode Island

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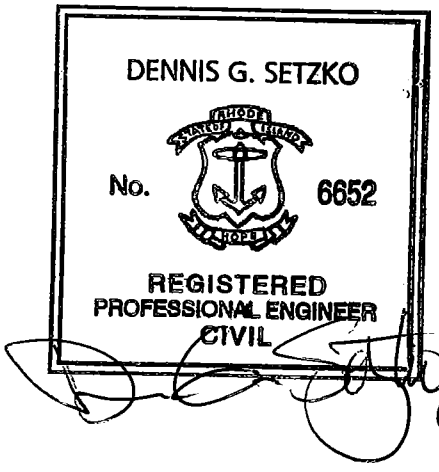

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I. EXECUTIVE SUMMARY

A. Project Need and Planning Area

The Warwick Sewer Authority (WSA) owns and maintains a 7.7 million gallons per day (MGD) Advanced Wastewater Treatment Facility (WWTF) which discharges into the Pawtuxet River, a major tributary to Narragansett Bay. The original facility was constructed in 1965 and it has undergone several upgrades and modifications. The WSA also owns and maintains 48 wastewater pump stations and over 250 miles of sewers.

In 2008, the City of Warwick and WSA negotiated a consent agreement with the Rhode Island Department of Environmental Management (RIDEM) that requires WSA to prepare a Facility Plan Amendment and complete upgrades necessary to meet a revised phosphorus discharge limit of 0.1 mg/L and a nitrogen discharge limit of 8.0 mg/L. This project shall identify ways to optimize the current treatment process and to determine the most suitable strategy for completing these upgrades, taking into account future flows and loads and potential changes in future effluent limits.

Due to the ongoing sewer construction program and new connections to the expanding sewer system, the number of people served by the system continues to grow. This plan also considers the sewer expansion and establishes the flows and loads that are expected at the 20-year planning horizon. It also evaluates the capacity of the current and future collection system. This project shall examine major interceptors, force mains, and pump stations to determine if replacements or upgrades are required.

The collection system and the treatment plant will be discussed separately.

B. Treatment Plan Effluent Limitations

The current effluent limits are set by RIPDES Permit RI0100234 and require that the treatment plant effluent meet new, more stringent nitrogen and phosphorus limits. Between May 1 and October 31, a total nitrogen concentration of 8 mg/L is required. Between April 1 and October 31, a total phosphorus concentration of 0.1 mg/L is required. There is no total nitrogen limit during the rest of the year and the total phosphorus concentration required between November 1 and March 31 is 1.0 mg/L. This evaluation also looks at modifications that would be required if lower nitrogen and phosphorus limits were required or if the seasons were expanded.

C. Current Flows at the Wastewater Plant

Past operating data was used to develop existing flows and loads as shown below in Table I-1.

Table I-1: Existing Wastewater Flows and Loads

	Annual Average	Maximum Month	Hydraulic Peak
Flow, gpd	5,000,000	6,350,000	13,305,150
BOD, lb/d	11,828	19,308	
TSS, lb/d	12,318	16,762	
TKN, lb/d	1,447	2,362	
TP, lb/d	209	340	

1. Unit Processes – Capacity

The major wastewater treatment facility unit processes were evaluated for capacity at the future wastewater flows and loads. The capacity of each of the unit processes and a brief commentary on performance are shown below in Table I-4.

Table I-4: Capacity of Wastewater Treatment Processes

Treatment Process	Current Capacity (MGD)	Status for Future Flows	Notes
Screening	18	Adequate	Use bypass channel with grinder for flows over 18 mgd
Grit Removal	20	Adequate	Minor capacity shortfall at peak flow does not warrant additional investment
Primary Treatment	19.4	Adequate	Minor capacity shortfall at peak flow does not warrant additional investment.
BNR Basins	20.5	Adequate	Able to maintain process capacity throughout winter. Will need existing third BNR tank to meet permit limits
Secondary Clarification	20.5	Adequate	Based on current settling characteristics and guidelines.
Disinfection	26	Adequate	
Solids Handling	0.58	Adequate	Future solids handling flow approximately 0.3 - 0.4 MGD.

2. Unit Processes – Condition Assessment

While capacity of the equipment for future flows is adequate, some unit processes at the plant are approaching the end of their useful life and will be in need of rehabilitation, improvement or replacement during the planning period. The recommended action plan and the unit processes in question include:

- Replacement in kind of the fine screen equipment;
- Replacement of all submersible mixers in the BNR tanks for improved process performance;
- Addition of a scum removal system in two secondary clarifiers to improve clarifier performance;
- Rehabilitation of the existing rotary screen thickener;
- Addition of a second rotary screen thickener as a standby unit and for improved solids processing.

3. Unit Processes – Nitrogen Removal Optimization

Based on modeling, there are several treatment process optimization steps recommended which will improve nitrogen removal and energy efficiency. Most have already been considered and are underway. These optimization areas are:

	Aqua-Aerobics Aqua MiniDisk®	Kruger Actiflo®	Kruger Hydrotech Discfilter®
Ability to removal additional P below current permit	Cannot reliably meet permit limits less than 0.1 mg/L	Likely able to meet permit limits as low as 0.07 mg/L	Cannot reliably meet permit limits less than 0.1 mg/L
Mechanical Intensiveness	Less mechanically intensive	Mechanically intensive	Less mechanically intensive
Proprietary Process	Yes	Perhaps. Another company is offering a similar process but has no known installations	No
Ancillary needs	Will require Intermediate Pump Station	Will require Intermediate Pump Station	Will require Intermediate Pump Station

Table I-6: Life Cycle Cost Comparison

	Aqua-Aerobics	Kruger Actiflo	Hydrotech Discfilter
Escalated Capital Cost (2013)	$11,797,526	$11,599,775	$12,703,535
Annual Operating Cost	$324,100	$147,200	$240,200
Present Worth Operating Cost	$4,606,300	$2,092,100	$3,413,900
Total Life Cycle Cost	$16,403,826	$13,691,875	$16,117,435

Based on the results of the pilot testing, the qualitative evaluation, and the life cycle costs, AECOM recommends designing and installing a Kruger Actiflo® TURBO process or similar ballasted flocculation technology. The pilot results show that this process has the ability to meet the permit limits more reliably with less coagulant and polymer over the range of operating conditions. If the phosphorus limit were ever reduced below 0.1 mg/L, this process also has the ability to consistently meet slightly lower limits, perhaps as low as 0.07 mg/L. Additionally, this process has the lowest overall life cycle cost.

G. Collection System

1. Existing Flows

Using the flows and loadings for existing and future conditions as well as the details of the collection system obtained from WSA staff, the collection system was evaluated at current flows. The evaluation found that all the interceptors and pump stations are adequately sized for the current peak flows.

2. Future Flows

The existing interceptors and pump stations were evaluated at the future flows to ensure that they are properly sized and that the equipment in them will last for the planning period. All of the existing interceptors are properly sized however some pump stations will need upgrades and/or replacement to meet the required flows over the planning period. The pump stations in need of upgrades and/or replacement are:

- Warwick Neck Pump Station and Force Main

Table I-7: Summary of the Total Probable Project Costs for the Recommended Improvements to the Wastewater Collection System and Capital Improvements

Service Area	Total Cost	Program Implementation
Governor Francis III	$ 4,600,000	2014, pending bond authorization
Northwest Gorton Pond	$ 4,000,000	2015, pending bond authorization
O'Donnell Hill Area	$ 1,899,800	2016, pending funding
Bayside I	$ 5,635,000	2018, pending archaeological findings
Bayside II	$ 4,370,000	2018, pending archaeological findings
Bayside III	$ 3,900,000	2018, pending archaeological findings
Warwick Neck South	$11,048,800	2020, pending funding
Strawberry Field II	$ 860,500	2021, pending cleanup of contamination
Greenwood East	$13,362,160	2022, pending airport roadway extension
Pilgrim Park	$ 4,250,540	2023, pending funding
Upgrades associated with Warwick Neck P.S.	$ 2,393,000	2018, Pending funding
Upgrades to 7 Existing Ejector Stations	$ 2,275,000	Pending funding
WSA Capital Improvements:		
Cedar Swamp Pump Station Upgrades	$ 250,000	2012
Main Influent Interceptor Upgrades	$ 300,000	2012
Bellows Street Pump Station Replacement	$ 980,000	2012, EDA grant
Emmons Ave. Pump Station Upgrades	$ 250,000	2013
Warwick Ave. Pump Station Upgrades	$ 345,000	2013
Oakland Beach Pump Station Upgrades	$ 500,000	2014
Knight St. Pump Station Upgrades	$ 1,750,000	2014, pending funding
Lockwood P.S. Force Main Relocation	$ 1,150,000	2014, pending funding
Warwick Vets P.S. Force Main Relocation	$ 600,000	2015
Loveday Pump Station Upgrades	$ 250,000	2015
Apponaug Pump Station Upgrades	$ 250,000	2018

2. Wastewater Treatment Facility

Recommended improvements to the treatment facility are identified in Table I-8 along with planning level estimates for capital costs and the anticipated dates for implementation.

4. Funding and Financing

A review of the current sewer rate schedule and fee structure was completed in May, 2011. This study reviewed the existing rate structure, projected revenues and expenditures, including the phosphorus removal project, for the WSA and developed a rate design model for the period from 2012 to 2016. This period was selected to cover the major capital expenditures related to the phosphorus removal project. This study concluded it will be necessary for the WSA to increase sewer usage rates and/or redesign the rates to cover future operation and maintenance costs. Any changes adopted by the City must meet state regulations for recovery of costs to operate, maintain and repair as necessary the wastewater collection, transmission and treatment facilities. The information in the study shall be reviewed and updated annually during the 5-year period to ensure the revenues and expenditures are in line with the rate model.

Financing for capital improvements and related projects for wastewater facilities can be obtained in the form of low interest loans via the Clean Water State Revolving Fund (SRF) financing program. The SRF is a subsidized loan program for local governmental units to finance wastewater infrastructure projects. In order for a project to be eligible for funding, the project must be on RIDEM's Project Priority List (PPL) and have a Certificate of Approval (CA) from RIDEM.

The SRF program requires compliance with federal and state employment regulations and utilization of minority and women owned business enterprises. By the end of the project, all of the percentages for MBE/WBE requirements associated with SRF funding shall be met.

AECOM recommends that WSA pursue SRF funding for this project.

I. Future Nutrient Removals and Nutrient Trading

Should the effluent nitrogen or phosphorus permit be revised lower than the current level described in this Plan, additional process modifications and additions for nitrogen removal will need to be implemented. Based on our speciation evaluation of phosphorus in Warwick, it is unlikely that phosphorus can be removed to levels much lower than the current 0.1 mg/L limit.

Another option if the permit limits were reduced would be to explore trading nitrogen or phosphorus credits, as is done in other states. RIDEM has previously expressed that they would be willing to discuss this option should it be supported by the treatment plants in the area. The framework for this credit trading should be started at this time.