A Comprehensive Approach to Developing a Regional WRRF

by Sarah Purdy, Andrea Smith, Scott Thornhill, Carrie Tuttle and Charles Prior

he City of Ogdensburg, located in the Northern New York Region, is undertaking a major project to upgrade its wastewater system. The project will be one of the most substantial investments in the city's history. The \$35 million Wastewater System Improvements Project will achieve many goals and put the city in a position to transform the water resource recovery facility (WRRF) into a valuable asset.

This article explains the steps taken by the City of Ogdensburg to achieve several critical goals so that it can realize the long-term vision of a regional water resource recovery system that will support the needs of the city and surrounding communities for decades to come.

History and Background

The City of Ogdensburg is in northern St. Lawrence County, along the southern shore of the St. Lawrence River, and it is the only city in St. Lawrence County. The city includes a nearly 6-mile long shoreline along the river and is home to the confluence of the Oswegatchie and St. Lawrence rivers. According to the 2010 census, the city has a population of 11,128. In the last 10 years the City of Ogdensburg has experienced a 25 percent decline in its population and has lost several large industrial customers. The city has been working hard to rebuild its waterfront and reposition itself as a destination on the St. Lawrence River. As part of these efforts, it is investing capital to rebuild access and critical public infrastructure that is necessary to support existing and future business development.

The city owns a 6.5 million gallons per day (mgd) Grade 4A WRRF and the associated wastewater collection infrastructure. The facility serves residential, commercial and industrial users, and is permitted by the New York State Department of Environmental Conservation (NYSDEC). The WRRF and the wastewater collection infrastructure are maintained by the city's Department of Public Works. The city contracts with the Development Authority of the North Country to provide management support services at the WRRF.

The WRRF is in the eastern portion of the City of Ogdensburg near the St. Lawrence River and Port of Ogdensburg. Before the WRRF was built, the site was utilized as a railroad depot station. The WRRF was initially constructed in 1965 to provide preliminary treatment, primary treatment, solids handling and disinfection. It was expanded in 1978 to include secondary treatment through the addition of aeration tanks, blowers and final clarifiers. The WRRF has a peak hourly primary treatment and disinfection capacity of 20 mgd and a peak hourly secondary treatment capacity of 13 mgd. Since the secondary treatment expansion, there have been limited upgrades at the WRRF; most recently in 2010 an aeration system rehabilitation project was completed. This project added fine-bubble diffusers in each of the two aeration tanks, several turbo blowers and a Programmable Logic Controller driven dissolved oxygen control system.

Along with the WRRF, the city's wastewater infrastructure consists of 87 miles of sewers, six wastewater pump stations, 17 permitted combined sewer overflows (CSOs) and the WRRF outfall. The city completed a Long-Term Control Plan (LTCP) in 2012 and has completed several of the recommended projects, except for the installation of an 800,000-gallon combined sewer overflow/ equalization tank. Upon completion of the last LTCP project and after performing post-construction compliance monitoring, the city will comply with the federal CSO Control Policy, which mandates 85 percent capture of wet weather-induced combined sewer flow during the average precipitation year.

Project Development and Drivers

The WRRF is a major public asset for the city, but in its deteriorated condition it was not able to serve as a regional resource and a tool to promote economic development. While previous projects to upgrade individual systems or components were beneficial, a new, progressive approach was necessary for a long-term, sustainable solution that would develop the WRRF from a city asset into a regional asset. With this goal in mind, a vision for the future began to take shape for the Wastewater System Improvements Project, which incorporated these four elements:

- Protect the St. Lawrence River.
- Create an asset that promotes growth for the city and neighboring communities.



The City of Ogdensburg WRRF is located along the St. Lawrence River in northern New York.

- Perform wastewater system upgrades for a 20-year design life.
- Create a safe working environment for operating staff.

In conjunction with the goals and technical aspects of the project, the city's leadership made a commitment to be actively engaged with the project. Every two weeks, a meeting was held with representatives of the City Council, the City Manager, the Director of Planning and Development, the Director of Public Works, the Development Authority of the North Country (program manager and WRRF operator) and the project engineers. Given the scale of the project, its goals and necessary funding, it was critical for the team to be integrated and operating as a single unit. The meetings served primarily to communicate project status and progress, coordinate the design with operations and to strategize various funding approaches. In addition, regular updates were provided to the City Council to seek public input and to prepare the elected representatives for their action on various critical project matters (i.e., project scope and budget, State Environmental Quality Review, bonding, funding strategies and professional services).

To gather information and identify those upgrades most critical to achieving the vision, as well as to position the city to secure the necessary approvals and project funding, the city commissioned a Preliminary Engineering Report. This document provided a comprehensive evaluation of the wastewater systems and identified repairs and critical upgrades to the wastewater infrastructure. The Preliminary Engineering Report was commissioned in the summer of 2016. The city set forth an aggressive schedule that would align the completion and regulatory approval of the report with the following year's funding opportunities.

Regulatory Revisions and an Order on Consent

In parallel with the Preliminary Engineering Report development, the city was issued notice by NYSDEC that its State Pollutant Discharge Elimination System (SPDES) permit was being evaluated for renewal. At the same time, the city received a notice of violation for significant noncompliance of its existing permit. Based on discussions with NYSDEC, the city anticipated that the agency was considering issuance of an Order on Consent. The Preliminary Engineering Report was finalized and submitted for regulatory review in March 2017, while permit revisions and a consent order were forthcoming.

Draft SPDES Permit

Upon receipt of the draft SPDES permit in spring 2017, the city realized that several changes to the permit were proposed that could have significant impacts on the overall budget for the Wastewater System Improvements Project. After evaluating the permit changes, it became clear to the city that compliance with a revised, lower Total Residual Chlorine (TRC) limit would require additional chemical storage and new metering facilities, which would add to the overall cost of the project. Several discussions were held with the NYSDEC Regional and Central offices to review the proposed SPDES revisions. The city proposed an approach to implement disinfection technology for both primary and secondary effluent. Following a technical review of the mixing zone analysis and assessment of the proposed approach by the city, the TRC effluent parameter in the SPDES permit remained unchanged. Instead, NYSDEC added a new monitor-only requirement for periods of wetweather flows.

The city was issued a new SPDES permit with revised limits. While the revised limits will increase administrative, operation and

maintenance costs, the permit did not require any new or additional treatment technologies. This helped to maintain the capital project budget within the previously approved bonding amount.

Order on Consent

Following submittal of the Preliminary Engineering Report and review of the SPDES permit revisions, the city received a draft Order on Consent. The order was issued due to several effluent exceedances from November 2016 through April 2017. These exceedances occurred due to multiple treatment processes and equipment reaching the end of their useful asset life and failing to perform properly.

The consent order considered the city's proactive approach to addressing the issues of noncompliance based on the recommendations described in the Preliminary Engineering Report. The recommendations also included a modified approach for compliance with the previously approved LTCP. The order's compliance schedule aligned with the report's recommended approach, and provides for interim limits for flow, biochemical oxygen demand, fecal coliform and TRC.

The Wastewater Systems Improvement Project

The Preliminary Engineering Report refined the vision for the Wastewater Systems Improvement Project into these specific goals:

- Comply with new SPDES permit limits.
- Comply with an Order on Consent issued by the NYSDEC with respect to exceedances of the SPDES permit limits.
- Comply with LTCP requirements to mitigate CSO events.
- Implement critical upgrades to the WRRF liquid treatment and solids handling systems and five wastewater pumping stations for a 20-year design life.
- Create an operator-friendly, accessible and safe working environment.

To achieve these goals, the report evaluated several alternatives for many of the wastewater treatment processes. The final project, with an estimated cost of \$35 million, includes modifications and upgrades in these areas (*Figure 1*, *see next page*):

- WRRF liquid process.
- WRRF solids process.
- LTCP compliance.
- Pumping stations.
- Other project components.

A Proactive City Executes a Funding Strategy

With a loss in local industry and a declining population over the last two decades, the City of Ogdensburg faces some challenging times to continue delivering safe and affordable wastewater treatment to its residents. The Wastewater Systems Improvement Project as proposed could have been separated into several phases; however, the city understood the long-term value in completing the work in a single-phase approach.

To mitigate the impact to the sewer users, the city has employed a comprehensive and extensive strategy to maximize grant funding and low interest loans to complete the project. Many different state and federal loan and grant funding programs were explored. A key strategic approach was to align the project with key funding program goals, whether it be for:

- Water quality improvement by reducing the number of CSOs.
- Economic development by providing a new septage receiving continued on page 26

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station for a neighboring community to discharge its sludge waste.

- Provide an option for a local industry to discharge its dairy waste.
- Establishing financial hardship due to a median household income below state average.
- Pursuing other opportunities such as the Water Infrastructure and Improvement Act or Community Development Block Grants.

The city was proactive by contacting their local economic leaders, state and federal representatives and the funding program representatives to get the word out and market the project. Several neighboring communities and local industry leaders provided their support for the project. This effort, compounded with a positive public outreach communicating the benefits and financial need, helped to shore up the support necessary for the project.

Through the collected effort of the project team, the required funding was secured through several sources:

• New York State Environmental Facilities Corporation.

- Clean Water State Revolving Fund, 30-Year Interest-Free (i.e., hardship) Loan – \$20,000,000.
- Infrastructure Improvement Grant \$5,000,000.
- Water Quality Improvement Project Grant \$5,000,000.
- U.S. Department of Agriculture Rural Development.
 - 38-Year Subsidized-Interest Loan \$3,890,000.
 Grant \$1,001,000.

When Does It Get Built?

The project design is complete and ready to be bid. By the time you read this article, we expect that the bid phase of the project should be underway. The construction will begin in mid-2019 and is expected to last 24 months. Sarah Purdy is the City Manager for the City of Ogdensburg and can be reached at spurdy@ogdensburg.com. Andrea Smith is the City Director of Planning and Development and can be reached at asmith@ogdensburg. com. Scott Thornhill is the Director of Public Works and can be reached at sthornhill@ogdensburg.com. Carrie Tuttle, P.E., Ph.D. is the Director of Engineering for the Development Authority of the North Country located in Watertown, New York, and can be reached at ctuttle@danc.org. Charles Prior, P.E. is a Senior Managing Engineer with Environmental Design and Research, DPC located in Syracuse, New York, and can be reached at cprior@edrdpc.com.



The spatial use within the WRRF Control Building will be reconfigured as part of the overall project. Charles Prior

Figure 1.

WRRF Liquid Process Replace:

- Influent mechanical bar screen, washer compactor and associated piping, valves, slide gates and manual bar rack.
- Raw sewage pumps and associated piping, valves and wet well slide gates.
- Primary and final settling tank sludge and scum collection equipment and weirs.
- Existing chlorine gas disinfection system with the following:
- An ultraviolet (UV) system to disinfect secondary effluent flows up to a peak hourly flow of 13 mgd.
- A liquid sodium hypochlorite storage and feed system to disinfect up to a peak hourly flow of 7 mgd of primary effluent flow.
- Utilize one existing contact tank channel for UV and modify the other channel for disinfecting primary effluent flow, when necessary. Construct a new building to house UV system components and bulk storage of sodium hypochlorite and metering pumps.

Provide:

- A single-story building for new grit removal equipment including a grit removal unit, grit pumps. Washing and classifying units would be in same space as that existing in the adjacent building.
- New means of flow control to limit flow to the secondary process to a peak hourly flow of 13 mgd. This will be accomplished by a set of modulating weir gates.

Demolish:

• The existing storage building and construct a single-story building for new septage receiving system.

WRRF Solids Process

Replace:

- Raw sludge pumps with associated piping and valves.
- Return-activated sludge, waste-activated sludge, thickened sludge transfer and thickener makeup pumps with associated piping and valves.
- Gravity thickener mechanical and electrical equipment.
- Existing plate-and-frame press with new centrifuge dewatering equipment.

Provide:

- New primary scum pumping equipment in the existing scum box.
- A polymer blending system, digested sludge pumps and discharge conveyor.

Rehabilitate:

• The three existing anaerobic digesters and replace cover, heat exchangers, pumps and the mixing system.

Repurpose:

• The gas scrubbing system and perform preventative maintenance.



Orthoimagery from the New York State GIS Clearinghouse shows the City of Ogdensburg WRRF and the St. Lawrence River. New York State GIS Clearinghouse

Pumping Stations

Upgrade:

The South Water, Main Street, Psychiatric Center, East River and Heavy Industrial Park Pump Stations. Improvements will include new pumping and controls, electrical systems, heating and plumbing components. A new generator will be installed at the Psychiatric Center and the East River station will include components to mitigate impacts from a 100year flood condition.

LTCP Compliance

A modified approach to LTCP compliance was developed, since the previous approach limited access to the city's public boat launch area and would have required operation and maintenance of an underground storage tank. The modified approach is twofold:

- Construct a new 4-mgd CSO pump station at the intersection of Elizabeth Street and Riverside Drive.
- Install a 16-inch force main to pump CSO to an 800,000-gallon storage tank located on the WRRF site.

Other Project Components

Along with the treatment and pumping system upgrades, other project components that will be addressed include:

- 480-volt power service for the WRRF, including new power distribution.
- Replacement of Variable Frequency Drives.
- Replacement of backup power system with natural gas-fired twin 500kW generators.
- New site, building and interior lighting.
- Provide required National Electric Code workspace clearances.
- Reconfigure the spatial use throughout the Control Building.
- Roof, window and door replacements.
- Brick repointing and concrete repair to buildings and tankage.
- Code compliant means of egress and railing systems.
- Create code compliant separation between classified and unclassified spaces.
- New heating systems including a dual fuel (i.e., methane and natural gas) boiler.
- New supply and exhaust fan ventilation systems.

- Relocating incoming water service to above grade and outside of a classified space.
- New water-efficient plumbing fixtures.
- New hose bibbs, deck and yard hydrants.
- Provide a central Ethernet-based, plant-wide monitoring and control system integrated with the major process equipment at the WRRF.
- Monitor and/or control new treatment process and pumping equipment at the new plant-wide monitoring and control system.
- Provide security surveillance system at the WRRF.
- Provide new communications from remote pump stations to the WRRF.