Barrie Water Pollution Control Centre, Ontario, Canada

GHD was retained by the City of Barrie to investigate alternatives and develop recommendations for meeting proposed phosphorus reduction limits for the City’s 76 ML D (20 mgd) wastewater treatment plant, which is the largest discharge to nutrient-impaired Lake Simcoe. The objective of the study was to consistently achieve 0.04 mg/L TP or less. The project included identification and screening of treatment technologies, a detailed evaluation of selected alternatives, recommendation of the preferred approach, and a pilot study of the recommended system to develop design criteria for full-scale implementation. GHD evaluated 7 advanced technologies as part of a phosphorus removal evaluation: DI DenseDiag™, Kruger ActiFlo™, Parker D2™ filters (1 and 2 stages), BluePro™, CoMag™, tertiary membranes (GE Zenon™, Siemens, and Pall) and Zenon™ MBR. Layouts, costs, and advantages/disadvantages for each alternative were developed. Based on the study, tertiary membranes were selected as the preferred approach and were carried forward to full-scale pilot testing, which was completed in 2012. The project is currently proceeding to final design.

Aldimos WWTP, Perth, Australia

GHD was engaged by the Water Corporation in Western Australia to design the Aldimos WWTP. GHD was chosen on the basis of their concept design and familiarity with Water Corporation standards. The design included screenings, grit removal, oxidation ditch, clarifier, sludge thickening, and odour control. The odour control was achieved using a photo-ionisation process – the first of its kind in Australia. The plant will ultimately service 750,000 people, a large proportion of Perth’s northern suburbs, and is located in a large excavation to facilitate gravity flow without occupying valuable coastal land. The first stage of the project provides an initial treatment capacity of 20 ML/d (5.3 mgd), with provision for growth over the next 80 years to increase to an ultimate capacity of 160 ML/d (42 mgd). The $80 million project was commissioned in September 2010.

North Castle WWTP, New York, USA

The North Castle WWTP discharges to the Long Island Sound and was required to upgrade to reduce effluent TN discharges under a consent order with the state regulatory agency. GHD was retained to evaluate cost-effective options of achieving a 4.0 mg/L TN goal at the 1.7 ML D (450,000 gpd) facility. The selected approach was to upgrade the existing rotating biological contactor process followed by new deep-bed denitrification filters. GHD designed the selected process and construction was completed in 2009. The facility achieves less than 3.0 mg/L TN on an annual basis despite cold temperature operation.

Kawakawa Bay Wastewater Scheme, New Zealand

GHD was engaged to design a public reticulation and wastewater treatment system for this small coastal community in New Zealand, which had been experiencing a high rate of failure for local on-site wastewater systems. Our team designed a vacuum operated collection system followed by a Membrane Bio Reactor (MBR) treatment process. The treatment plant consists of inlet works, process tanks, and the membrane separation system. A 9000 m3 seasonal storage lagoon has been constructed to store effluent for irrigation of the nearby forest using rotating sprinklers. The new system, commissioned in 2011, is delivering significant benefits to the community by ameliorating environmental health problems due to septic tank failures and enhancing the health of the local forest through irrigation.

Westport WWTP, Connecticut, USA

The Town of Westport retained GHD for facilities planning and design of a project to double the capacity of their existing wastewater treatment plant to 12.9 ML D (3.4 mgd) and implement low level nitrogen removal. GHD designed the new facility using the Carrousel Bardenpho oxidation ditch process followed by secondary clarifiers. Sequencing was complicated by a constrained site and the need to keep the existing facility on-line during construction. The new process went on-line in 2007 and has consistently averaged less than 3.0 mg/L effluent TN despite operating with winter wastewater temperatures as low as 7 degrees Celsius.

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Experience

GHD is a global leader in advanced wastewater treatment and reuse, delivering innovative cost-effective solutions with low ecological footprint to suit a wide range of situations. For each project, GHD applies its client relationship focus and in-depth technical expertise to work closely with client representatives to address key concerns, constraints, and issues. Once identified and analyzed, sound engineering alternatives are developed to provide tailored solutions to suit the project at hand. Using the experience gained from the design of more than 300 wastewater treatment facilities, our diverse staff can deliver project-specific wastewater treatment solutions from facilities planning through start-up.

The following are examples of specific GHD project experience in advanced wastewater treatment, enhanced nutrient removal, and water recycling and reuse projects.

Cox Creek Water Reclamation Facility, Maryland, USA
To implement enhanced nutrient removal to achieve less than 3.0 mg/L TN and 0.3 mg/L TP at the 56.8 ML/d (15.0 mgd) Cox Creek Water Reclamation Facility. GHD conducted an exhaustive comparison of alternative approaches before recommending membrane bioreactors (MBRs). GHD led the subsequent design which included new primary clarifiers, upgrade of existing primary, new fine screening facility, reactor upgrade and expansion as a 4-stage Bardenpho configuration, new Membrane Facility using GE Zenon™ membranes, and disinfection, solids handling, or odor control improvements. Peak flows greater than 114 ML/d (30 mgd) will be treated by a unique High Flow Management Biological Treatment System using the BioActiflo™ process. GHD also assisted the client with the implementation of a water reuse system to sell up to 24.6 ML/d (6.5 mgd) of treated effluent to nearby power plant. Phase 1 of the project is complete and Phase 2 is in construction with an expected completion of 2014.

Coffs Harbor Water Reclamation Plant, New South Wales, Australia
The new 97.4 ML/d (25.7 mgd) Coffs Harbor Water Recovery Plant is an advanced wastewater treatment plant capable of producing water suitable for reuse in irrigation. GHD was responsible for detailed design of the new facility, which was completed in 2009. After primary screening and grit removal, the plant uses a biological nutrient removal process comprising anaerobic zones, an oxidation ditch, secondary anoxic and aerobic zones, followed by clarification, for the removal of carbon, nitrogen and phosphorus from the wastewater. The secondary effluent is then passed through cloth disk filters and UV disinfection before ocean discharge or further disinfection for irrigation reuse. Storage of the secondary effluent allows optimization of the tertiary treatment process, while maximizing the volume of reclaimed water that may be supplied and minimizing the treated effluent release to the sensitive environment of the nearby Solitary Islands Marine Park.

Syracuse WWTP, New York, USA
GHD worked with Onondaga County to design improvements to the 318 ML/d (84.0 mgd) Syracuse Metropolitan WWTP to implement year-round nitrification and enhanced phosphorus removal to reduce the impairment of these nutrients to Onondaga Lake. The scope of work included pilot testing and then later design and construction of tertiary biological aerated filters (BAF) for year-round removal, along with a 477 ML/d (126 mgd) high-rate flocculated settling system (HFRS) for achieving Stage II phosphorus removal. Based on the results obtained on both the BAF and HFRS systems, the BIOSTYR® BAF and FACTIL® HFRS were selected and final design completed. Construction of the $130 Million project was completed in 2005 and has reduced effluent ammonia concentrations to less than 2.0 mg/L during cold weather operating conditions (wastewater temperatures below 8°C) and effluent phosphorus concentrations to less than 0.12 mg/L.

Rouse Hill Sewage Treatment and Recycled Water Plant, Australia
GHD, as part of a design-build team with John Holland, implemented a contract to design and construct the upgrade and expansion of Rouse Hill Sewage Treatment Plant and Recycled Water Plant (RWP) from a capacity of 13.5ML/d (3.6 mgd) to 27 ML/d (7.1 mgd). The Rouse Hill RWP produces high-quality recycled water that is sold to customers in northwestern Sydney for outdoor use and for toilet flushing. GHD provided process, civil, mechanical and structural design services to John Holland. The advanced wastewater treatment facility achieves enhanced nutrient removal through four parallel cyclically aerated sequencing batch reactors followed by tertiary clarifiers and deep bed filters. The project was completed in 2008.

Cleveland Bay Wastewater Treatment Facility, Queensland, Australia
GHD was responsible for the design for the upgrade and expansion of the 29 ML/d (7.7 mgd) Cleveland Bay WWTP to achieve biological nutrient removal. To achieve a very high effluent quality, state-of-the-art biological processes were utilized by combining an oxidation ditch (to achieve a high level of nutrient removal) with membrane solids separation. This retains the simplicity and flexibility of the oxidation ditch while adding the exceptional solids separation capability of the membranes. The project includes one of the world’s first retrofit of existing clarifiers to house the BNR and membrane treatment process trains. This significantly reduced the project capital expenditure and construction program. Further, reuse of existing infrastructure offered a staged approach to construction resulting in high-quality treated effluent being introduced to the environment earlier. The MBR process uses hollow fiber membranes manufactured by GE Zenon. The facility serves an estimated population of 126,000 and has been on-line since 2008.

Elkton WWTP, Maryland, USA
GHD designed an Orbal oxidation ditch process followed by secondary clarifiers and continuously backwashing sand filters for the expansion of the Elkton WWTP to 12.1 ML/d (3.2 mgd). Enhanced nitrogen removal is accomplished in a triple concentric loop reactor followed by post-anoxic and reaeration zones. Each loop of the reactor can be separately taken out of service and detoxicated for maintenance. Construction was completed in 2008 and the facility currently produces an average effluent quality of <2 mg/L TN and =< 0.10 mg/L TP. The Elkton WWTP is one of three GHD-design wastewater treatment plants currently achieving low levels of nitrogen and phosphorus using the Orbal oxidation ditch process.

South Caboolture WWTF, Queensland, Australia
The South Caboolture WWTF involved the upgrade and augmentation of the existing sequenced batch reactor treatment plant to accommodate future sewage loads from projected population growth in the region (estimated equivalent population of 80,000) and to achieve higher environmental standards. Challenges with maintaining the operation of the existing plant during construction were overcome through detailed interaction with the plant operators. A unique combination of moving bed biofilm reactors (MBBRs) and disk filters were incorporated into the design for tertiary treatment facilities for enhanced nitrogen removal. Given the plant’s proximity to nearby residents, sensitive odor control designs were undertaken to minimize odor at the inlet works, balance tank, selector zones of the BPRs and sludge handling facilities. GHD was responsible for detailed design and construction phase engineering. Construction was completed in 2011.

Yorktown Heights WWTP, New York, USA
GHD was retained to design the upgrade of the 7.6 ML/d (2.0 mgd) Yorktown Heights WWTP to meet the stringent requirements of the New York City watershed into which the plant discharges. Most of the existing equipment was upgraded and modernized and a new advanced treatment facility that included BOD and ammonia removal, anaerobic zones, thickeners and RBCs, chemical precipitation of phosphorus, sedimentation, membrane microfiltration and ultraviolet disinfection was constructed. To prevent overflows during wet weather events, a large equalization tank was constructed which normalized flow through the plant. The new plant was designed with emphasis on energy conservation, as well as reliability, cost containment and simplicity of operation. Construction was completed in 2008. The plant routinely achieves less than 2 mg/L BOD, less than 2 mg/L SS and less than 0.1 mg/L TP.

Danbury WWTP, Connecticut, USA
GHD was retained by the City of Danbury to determine the most cost effective way of upgrading the City’s existing 58.7 ML/d (15.5 mgd) WWTP to reduce effluent TN from around 25 mg/L to less than 5 mg/L. The Denitification filters had previously been the recommended approach, but the $29 Million price tag was unaffordable for the City. GHD developed a creative cost-effective solution involving modifying the City’s existing nitrification tanks to add post-anoxic zones and feed methanol to achieve denitrification. In this manner, performance was greatly improved without the need for additional process tankage. The $3.9 Million project was completed in 2009 and is now on-line. This low cost modification provides savings of over $600,000 each year and a project payback of just 5 to 7 years. The project won a regional American Council of Consulting Engineers (ACEC) award in 2012.