REPURPOSING EXISTING INFRASTRUCTURE FOR ENHANCED WET WEATHER FLOW TREATMENT FOR VAUXHALL PCP, CITY OF LONDON

Louis Tasfi, Ph.D., P.Eng.
Dillon Consulting Limited, Canada

Geordie Gould
City of London, Canada

The Vauxhall Pollution Control Plant (PCP) is one of the first Ontario municipal wastewater treatment plants to have implemented a wet weather strategy that involves chemically enhanced primary treatment (CEPT) and chemically enhanced secondary clarification processes and repurposes existing infrastructure.

Wet weather events were a major concern for the City of London (City). Prior to plant upgrade, when major wet weather flows occurred plant overflow would discharge directly into the Thames River. The solution designed by Dillon Consulting Limited treats wet weather flows of nearly ten times the rated average day plant capacity. The average and peak flow treatment capacity of the treatment plant is 20,900 m^3/d and 34,640 m^3/d, respectively. The wet weather operating strategy accommodates peak plant flows of about 200, 000 m^3/d and includes:

- New Headworks incorporating grit removal and fine screens sized to handle maximum wet weather flows
- Chemically enhanced primary clarification to increase wet weather treatment capacity of existing primary clarifiers to 150, 000 m^3/d
- Increased biological treatment capacity of the existing system using chemically enhanced secondary clarification. The treatment capacity of the biological treatment process is increased to 50,000 m^3/d

The new inlet works incorporating screens and grit removal are sized to handle maximum wet weather flows up to 200,000 m^3/d. Under dry weather flow conditions effluent from screening and grit removal are sent to the primary clarifies before biological treatment. During wet weather flows, effluent from screening and grit removal are split between the biological treatment step and the chemically enhanced primary clarification stage.

During high wet weather flow conditions flows up to the maximum capacity of the biological treatment step are directed to this process step. The maximum peak wet weather treatment capacity of the biological process is 50,000 m^3/d. The increased peak wet weather treatment capacity is achieved by the flow proportional addition of a cationic polymer and iron salt to the mixed liquor ahead of the secondary clarifiers. Chemical addition enhances the peak wet weather treatment capacity of the process by retaining the mixed liquor solids in the biological treatment step. The wet weather operating strategy involves the gradual increase of flows to the biological treatment to avoid “washing out" and losing the biomass inventory in the aeration tank. This strategy requires a sophisticated flow control system. Effluent from the biological treatment process is discharged to the receiver.

Flows in excess of the maximum wet weather treatment capacity of the biological process are diverted to the existing primary clarifiers. Existing primary clarifiers were upgraded to facilitate chemically enhanced primary clarification. Chemically enhanced primary clarification increases solids and associated contaminant removal and reduces the contaminant load to the receiver. An anionic polymer and iron salt are added flow proportionally to the inflow to enhance the efficiency of the primary clarifiers. After chemically enhanced primary clarification, treated effluent is discharged to the receiver. The chemically enhanced primary clarification process has a maximum treatment capacity of 150, 000 m3/d.

Pilot tests were performed to confirm design parameters and performance of the proposed wet weather treatment strategy.

The new inlet works incorporates an ozonation system for odour control, which operates as part of the heat recovery air make-up unit. Ozonation is considered an innovative form of odour control and provides full oxidation of odourous compounds, without use of chemicals, in a small and easy-to-operate unit. The combination of ozonation and heat recovery reduces chemical consumption for odour control and energy consumption required for ventilation.

The heat recovery air make-up unit includes an air-to-air heat recovery feature. The inbuilt-heat-pipe type heat exchanger re-captures approximately 45% of the energy for make-up air heating that would otherwise be wasted. The heat recovery unit incorporated special start-up purge cycles to make natural gas heating suitable for classified spaces. Dual ventilation rates for air recirculation were implemented to reduce the energy consumption for heating, by using occupancy sensors and gas detectors.

As with any upgrade to an existing facility, this project presented a number of challenges that were successfully addressed by the team such as:

- A limited hydraulic grade line was available within the existing site to accommodate new inlet works equipment, channels and chambers and allow for flow control and diversion between the primary and aeration tanks within each plant section.
- Wet weather operating strategy involves the gradual increase of flows to the biological treatment to avoid "washing out" and losing the biomass inventory in the aeration tank. This requires a sophisticated flow control system.

In summary, by using the chemically enhanced primary clarification for wet weather flows and chemically enhanced secondary clarification for increased treatment capacity of the biological treatment process, the overall maximum wet weather treatment capacity of the plant is increased to approximately 200,000 m^3/d. Of this flow 50,000 m^3/d receives full biological treatment while the rest of the flow is treated to achieve high effluent quality for excess wet weather flows.

This project offered re-investment in existing infrastructure through re-use, rehabilitation and repurposing of existing primary and secondary clarifiers to wet weather treatment. This provided a cost-effective approach for peak wet weather flow treatment.

The proposed wet weather treatment strategy can be easily adopted by other municipalities operating plants with similar configuration to cost-effectively manage excess wet weather flows and has been proposed and adopted in other Ontario municipal wastewater treatment plants, including the City of London's Greenway Pollution Control Centre.