Camp Oochigaes Wastewater Treatment and Disposal Design

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SUMMARY

Camp Oochigeas exclusively serves children with cancer; their septic systems had failed, and the Camp was considering expansion. The Camp required a new wastewater system which would also address the concern of chemotherapy medications in wastewater. WSP was retained to engineer the new wastewater system, and determine the performance and environmental effects of the medications. WSP engineered an innovative, cost effective, solution using MBBR technology and half-life concepts allowing population expansion, while improving the environment.

PROJECT HIGHLIGHTS

INNOVATION

Camp Oochigeas's historic wastewater systems had failed, while at the same time the Camp was embarking on an ambitious expansion that would take their peak daily design sewage flows from 40,000 L/day to 80,000 L/day. Outside of the regular challenges associated with a design of this nature was the unique concern that many of the children attending the Camp would be on active rounds of chemotherapy medications. Chemotherapy medications have toxic effects on cells or cell growth, thus the potential for negative effects on the wastewater treatment system, which would rely on a healthy microbiological population, was evident.

During the project planning process it became clear that there were little to no case studies, or best practices, to use a starting point for the design process. In order to design a system capable of handling this unique wastewater stream, WSP needed to first understand what medications the Camp administered on a routine basis. Camp Oochigaes works closely with The Hospital for Sick Children in Toronto, and through consultation with both the Camp and the hospital, the predominate medications were noted to be: Mercaptopurine, Methotrexate, Vincristine, and Vinblastine.

WSP's goal was to create the simplest treatment design possible for the reduction/elimination of the medications and decided to explore the innovative idea of using the half-life for the medications to achieve this goal. Of the medications administered at the Camp, the oral medications (Mercaptopurine and Methotrexate) had relatively short half-lives of approximately 2 hours and 15 hours. In order to get to about 95 to 99% removal of the medications we needed about 6 half-life cycles to occur. The intravenous medications (Vinblastine and Vincristine) had longer half-lives of 1 day and 3.5 days, respectively. As these drugs were administered on an infrequent basis versus the number of children who attend the camp (up to 400 people present at any given time), a risk based approach to the design related to the intravenous medications was taken.

WSP designed the system so that it would have a minimum sewage retention time of 6 half life cycles of the Mercaptopurine and Methotrexate medications. With over 95% reduction in the more common oral medications, and the risk of the intravenous medications deemed acceptable, WSP was then able to engineer solutions to the more traditional wastewater effluent parameter of concerns such as BOD5, Total Suspended Solids, and phosphorus.

COMPLEXITY

Outside of the regular challenges associated with a large design of this nature was the uniquely complex issue that many of the children who would attend the Camp would be on active rounds of chemotherapy medications. With only second-hand stories of the negative effects of chemotherapy medications on on-site (septic) systems, WSP understood that this site needed to be carefully engineered. Chemotherapy medications have toxic effects on cells or cell growth, which can include inhibiting DNA synthesis or disrupting the mitotic spindle assembly to prevent mitosis (cell-division); thus the potential for negative effects on the wastewater treatment system, which would rely on a healthy microbiological population, was evident.

During the project planning process it became evident that there were little to no case studies, or best practices, to use a starting point for the design process. Additionally, the problem at Camp Oochigaes was not well understood, with a specific lack of information during the planning stage regarding what types of drugs may be present and in what concentrations at any given time. WSP would therefore need to engineer a solution to this complex problem from first principles and iterative design improvement until a satisfactory design solution was found.

SOCIAL AND/OR ECONOMIC BENEFITS

Camp Oochigaes isn't a regular children's camp, far from it. It is one of the most important Camp facilities that we have in Ontario; Camp Oochigaes is a privately funded, volunteer-based, facility that exclusively serves children with cancer.

The Camp had a history of on-site wastewater systems failures and as such there was significant concern that any proposed solution, if it was not engineered effectively, would be economically detrimental to this privately funded organization. Without a reliable wastewater solution the Camp's expansion plans could not have been realized.

By engineering a cost effective, low maintenance, solution WSP was able to support the Camp's goal of doubling its capacity through their current expansion project. Based on the Camp's mission statement this has allowed for a significant increase in the number of children (over 100 additional children at any given time), no matter how debilitating their illness, to be provided an opportunity to explore enriching, challenging, fun experiences at the only overnight camp in Ontario to offer on-site chemotherapy IV treatment and blood transfusions.

ENVIRONMENTAL BENEFITS

The wastewater treatment system, as designed, provides for a significant decrease in sewage related impacts to the environment when compared to the historic system(s) it was replacing. With the site being situated near a tributary of the Rosseau River, and sewage impacts eventually migrating towards this tributary, the most important environmental benefit was a 90% reduction in the sewage effluent phosphorus concentration. As such, the wastewater treatment system reduces phosphorus mass loadings to the down gradient receiver by 80% from previous levels despite doubling the average daily sewage flow at the Site from the expansion.

A less well defined and understood environmental benefit of this project is the reduction in chemotherapy medication being discharged to the environment. The historic wastewater system did not actively remove these compounds prior to discharging them into the environment. The current design has a more defined approach to removing many of these compounds from the wastewater prior to the effluent discharging to the environment; this in turn will help protect shallow groundwater and local surface water features from the potential effects of these medications.

WSP's design solution for this project will help to preserve the form and function of the water resources in the area for future generations; while recognizing the importance of the development and expansion of this particular facility.

MEETING CLIENT'S NEEDS

The main goals of the Client were to implement a robust, cost effective, wastewater solution at Camp Oochigaes that would allow for the expansion of the facility by up to 200 people per day while effectively treating a wastewater stream that contained unknown quantities of various chemotherapy medications. Secondary goals included a schedule constraint related to a desired construction start date as well as budgetary restrictions due to the fact that site is privately funded.

WSP helped the Client achieve these main project goals by spending a significant amount of effort during the project planning phase in thoroughly understanding the contributing inputs to the wastewater stream. This included consultation with the Hospital for Sick Children to better understand the likely medications and their dosage rates that may be used at the Camp. WSP also completed research into the chemical structure and degradation of the medications to allow for effective treatment.

Through this in depth understanding of the most complex portion of the project, WSP was then able to better design a cost effective, robust, solution for the camp. The solution itself met the clients scope, schedule, and budgetary requirements. The design solution was also approved by the Ministry of the Environment and Climate Change (MOECC) prior to the desired beginning of construction. Thus, WSP was able to meet all of the Clients primary and secondary goals for this project.

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