Wastewater Treatment

Regionalization of wastewater treatment in Central Alberta

By Stephan Weninger and Pervez Sunderani

In the autumn of 2005, following several years of robust population growth and increasing demands on area watersheds, Alberta Environment advised the municipalities in the Central Alberta region that continuous wastewater discharges into a sensitive stretch of the Red Deer River between the Dickson Dam and the City of Red Deer Water Treatment Plant’s intake would be phased out.

With 150,000 people in two dozen urban and rural municipalities relying on this segment of the watershed, the department needed to find a new way to keep operations running.

Considering the centralization of wastewater treatment and disposal as an initiative consistent with both its Sustainable Resource and Environmental Management (SREM) policies and the Water for Life Program, which is aimed at protecting water resources and ensuring access to quality sources of water, the department determined that centralizing wastewater treatment and disposal would be its best option.

A reduction in the number of wastewater treatment plants and lagoons discharging to the Red Deer River was also considered preferable to upgrading or replacing the six wastewater treatment plants in the area that were operating at or over capacity and were up for approval over the next few years.

To begin moving forward with a plan, Alberta Environment then invited several of the urban municipalities in the region – the City of Red Deer and the Towns of Lacombe, Blackfalds, Sylvan Lake, Innisfail and Olds – to provide representation on a steering committee to oversee the development of a conceptual design for a regional wastewater transmission system or systems extending north, south and west of the City of Red Deer.

In February 2006, the steering committee retained the engineering firm, Stantec, to develop regional transmission and treatment options, to identify priority areas for system connections, and to identify governance and rate structure options for the resultant regional system or systems.

Making connections

The conceptual design identified a “core area” of priority system connection and a secondary servicing area, in which connection to a regional system was deemed less critical because of low wastewater impact on the Red Deer River sub-basin, the capacity of existing facilities to meet current demands, proximity to the centralized area, or a combination of those factors.

The core area consisted of 14 municipalities, requiring the addition of over 150 km of wastewater transmission lines.

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The centralization plan for the Red Deer WWTP will be rolled out over the course of several phases, the first of which is expected to be completed in 2011.

With a price tag of $252 million, servicing both the core and the secondary areas would require 300 km of transmission mains at a capital investment of $394 million. With these estimates in hand, Alberta Environment hosted an information session for elected officials and media in April 2006 and received immediate buy-in from several municipalities.

Over the course of the next several months, Alberta Environment worked with Alberta Transportation, the province’s capital projects funding arm, to devise a roll-out strategy that would address the needs of sustainable growth and environmental protection in the sub-basin, while meeting budgetary constraints during a period of high growth and rapidly inflating construction costs.

The province decided to move ahead with the plan, first focusing on services for the core area by augmenting at the City of Red Deer Wastewater Treatment Plant with the South Leg, a 90-km system to connect the towns of Innisfail, Bowden and Olds, and Mountain View County to the Red Deer plant. Once the connection plan moved through preliminary design, the system would then incorporate the Waskasoo Regional Sewer System, a 30-km gravity and forcemain system built in 1984 to connect Red Deer County and the Town of Penhold to the Red Deer plant.

Meanwhile, the municipalities of the core area worked with the province to develop the Central Alberta Regional Wastewater Master Plan, which established the guiding principles and timelines for the development of regional wastewater infrastructure in Central Alberta. On its completion, the master plan was endorsed by the 16 municipalities of the core area.

Planning for growth

On the governance front, the core area municipalities branched into three separate groups, each applying to become a regional commission.

Under the province’s Municipal Government Act, regional commissions are similar to municipalities, with power to establish bylaws and accrue assets and debt separately from member municipalities. As a result, the South Red Deer Regional Wastewater Commission (SRDRWC) was created in August 2008, and included the towns of Penhold, Innisfail, Bowden and Olds, and the counties of Red Deer and Mountain View.

The Sylvan Lake Regional Wastewater Commission (SLRWCC) was created in October 2008, and included the Town of Sylvan Lake, Red Deer County, Lacombe County and the summer villages of Jarvis Bay, Norglenwold, Half Moon Bay, Sunbreaker Cove and Birchcliff. The North Red Deer Regional Wastewater Services Commission (NRDRWWSC) was also created in October 2008, and included the towns of Blackfalds and Lacombe and Lacombe County.

The City of Red Deer agreed in principle with the plan to provide wastewater treatment to the SRDRWC, subject to confirmation that the group was able to upgrade its own plant to meet its long-term treatment capacity needs.

To this end, an updated City of Red Deer Wastewater Treatment Plant Master Plan was needed to assess the current plant capacity and to provide a plan for phased plant expansion to meet city and regional growth needs over the next 50 years, over which time plant capacity would be expanded from the current 35 MLD to over 300 MLD.
In December 2008, the city engaged Stantec to complete the year-long master plan update, which included the first complete review of the plant’s biosolids management system as well as its long-term strategy for wastewater treatment. A project steering committee was also established, including representatives of the city, Alberta Environment, Alberta Transportation, the SRDRWC and Stantec.

Planning for an eightfold increase of influent wastewater flows involved a complete revision to previous facility capital planning. While the newest bioreactors at the plant have a 12.5-MLD capacity, future upgrade phases had to be significantly larger just to meet the short-term needs of the new regional legs, let alone city growth. Conversely, sizing of the new components had to be small enough to be built within project timelines and local industry capacity, and to avoid stranding capital investment and the budget.

Also of importance, the team had to consider how the continued development of the area and the diversification of the economy would change the characteristics of the influent wastewater in a city with additional loadings from large meat processing and oilfield service industries.

Ultimately, the major liquids treatment components were sized to 25-MLD capacities in each phase, with one phase roughly representing the respective 25-year needs of each of the three regional transmission legs and the other related to the City of Red Deer’s expected growth. The phases will each be developed based on the collective treatment capacity needs of the city and the three regional systems, with new phases coming on-stream every five years to coincide with demand growth.

In order to shoehorn as much treatment capacity as possible onto the plant site, future primary and secondary clarifiers will be arranged in long, rectangular shapes instead of the current circular configurations. In the area, coupled with changing regulatory trends, suggests that the current storage and land application process will not be viable over the long term.

A total of 15 options were explored, including the identification of mar-
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ketable byproducts of the biosolids. Ultimately, it was determined that the most cost-effective option was to transition to sludge dewatering to improve storage capacity on-site, and then to move towards fluidized bed treatment of biosolids for energy recovery.

Bringing it all together
The South Red Deer Regional Wastewater System will be the first of the three regional legs to connect to the City of Red Deer Wastewater Treatment Plant. When completed, the system will include the 30 km of transmission mains, including the three lift stations of the former Waskasoo Regional Sewer System, 92 km of new mains, and six new lift stations.

With the completion of the South Red Deer line, three existing wastewater treatment facilities will be taken offline: the Town of Bowden’s facultative lagoon system, and the two rotating biological contactor (RBC) plants, both over 30 years old and servicing towns of 7,500 in Olds and Innisfail. Portions of existing storage cells in Bowden and Innisfail will be converted into emergency storage ponds for the new system, and oversized collection mains will be added in each to all three communities upstream of their lift stations, to provide on-line storage of wastewater to attenuate system flows under peak events.

While the vast majority of the system will consist of forcemains, additional flow attenuation of flows will be achieved through the incorporation of gravity sections in the system between Bowden and Innisfail and along the last 8 km of the system upstream of the wastewater treatment plant. The project is being rolled out for tender in three stages, the first of
which is being tendered this spring. The overall SRDRWC system is expected to be completed by the end of 2011.

The SLRWWC is developing the west leg of the Central Alberta Regional Wastewater system. The Sylvan Lake area is a rapidly developing residential and recreation area, and the Town of Sylvan Lake has consistently ranked among the fastest-growing communities of its size in Canada over the past decade. In addition to the town, seven municipalities (summer villages) surrounding Sylvan Lake will need service connections.

The Town of Sylvan Lake operates an aerated lagoon system that also services the summer villages of Jarvis Bay and Norglenwold, while the remaining unserviced developments around the lake are currently using septic tank-truck haul or on-site systems. The SLRWWC is currently proceeding with interim upgrades to the Sylvan Lake WWTP in order to extend septage haul services to the remaining lakeside communities until a regional transmission line extension to the Red Deer WWTP is established.

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The unserviced areas are concurrently developing low-pressure sanitary collection systems, which will ultimately connect to SLRWWC lift stations around the lake, which will in turn pump the wastewater to a centralized lift station for transmission to Red Deer.

The members of the NRDRWWSC are currently preparing for the initiation of design phases of the regional system. Its two urban municipality members, the towns of Lacombe and Blackfalds, have moved ahead with interim upgrades to their respective aerated lagoon wastewater treatment systems in order to maintain regulatory compliance in their wastewater discharges until the development of the 30-km regional transmission system to service their communities and growth areas of Lacombe County.

With the exponential growth Central Alberta has experienced over the last several years, it is no surprise that the region’s infrastructure is beginning to reach its limits. Expansion plans must consider not only the increasing capacity needs of their service areas, but also the important environmental and economic effects those changes will have both immediately and as the region continues to grow.

By centralizing wastewater transmission and treatment into regional hubs, as this Red Deer example shows, municipalities can ensure continued service to their residents with manageable costs and minimize the impacts their operations have on the surrounding environment.

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