## City Strategy on Sewer Separation and Epcor Letter

THE CITY OF Edmonton FINANCIAL SERVICES AND UTILITIES

OFFICE OF THE CHIEF FINANCIAL OFFICER & TREASURER
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June 1, 2013 File: 51-275-001-001

Mr. Randall Barrett,
Director, Northern Region
Alberta Environment and Sustainable Resource Development
1st Floor, Twin Atria Building
4999 – 98 Avenue
Edmonton, AB T6B 2X3

Dear Mr. Barrett:

**Subject: Combined Sewer Discharge Strategy (CSDS) – Submission of Final Report**

Please find enclosed the final report of the above noted report. This submission fulfills the following requirement in the City of Edmonton's Approval-to-Operate No. 639-02-07 issued on April 30, 2008:

> "3.2.5 The approval holder shall develop a comprehensive *Combined Sewer Discharge Strategy* to address, at a minimum, the following:
>
> (a) further reduce the discharge of untreated combined sewage flows from Edmonton's combined sewer system, including the plant bypass at the Gold Bar Wastewater Treatment Plant, and
> (b) work towards the long term goal of sewer separation or its environmental equivalent to protect the North Saskatchewan River water quality.
>
> 3.2.6 The approval holder shall submit a draft of the *Combined Sewer Discharge Strategy* to the Director by June 1, 2012 and receive a letter of acknowledgement.
>
> 3.2.7 The approval holder shall submit the Combined Sewer Discharge Strategy to the Director by June 1, 2013 and receive a letter of acceptance."

A draft submission of CSDS report was submitted to your office on June 1, 2012 for review and comments. Upon receiving comments on the report, this report has been finalized after collaboration with your staff. This new strategy sets the stage for the second phase of combined sewer overflow (CSO) control strategy starting in 2016.

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I want to thank your staff for their input provided during the development of the Strategy, and we look forward to Alberta Environment and Sustainable Resource Development's collaboration on the Combined Sewer Discharge Strategy implementation plan.

If you required further information on any aspect of the Strategy, please feel free to contact me at 780-495-1948(email: todd.wyman@edmonton.ca).

Yours truly,

for Todd Wyman, P.Eng.
Director, Drainage Planning
Drainage Services

TW/rs

Enclosure

c.:

- Derek Alexander, M.Eng., P.Eng., Municipal Engineer, Municipal Authorizations, Alberta Environment and Sustainable Resource Development
- David Curran, P.Eng., Municipal Engineer, Municipal Authorizations, Alberta Environment and Sustainable Resource Development
- Chris Ward, P.Eng., Branch Manager, Drainage Services, City of Edmonton
- Simon Thomas, P.Eng., Director, EPCOR GoldBar Wastewater Treatment Plant

*Final Report*

# Combined Sewer Discharge Strategy

Prepared for

City of Edmonton

June 1, 2013

CH2MHILL®
211 Bannatyne Avenue, Suite 403
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# Executive Summary

The City of Edmonton (City) Drainage Services assigned the Combined Sewer Discharge Strategy (CSDS) project to CH2M HILL Canada Limited (CH2M HILL) in July 2011. The project involved developing a strategy for implementing the second phase of combined sewer overflow (CSO) mitigation beginning in 2016, as required by the Alberta Ministry of Environment and Sustainable Resource Development (ESRD) (formerly, Alberta Environment) under the City's current Approval to Operate.

Section 3.2 of Approval to Operate 639-02-07 identifies the requirements for the CSDS as follows:

- Further reduce the discharge of untreated combined sewage flows from Edmonton's combined sewer system, including the plant bypass at the Gold Bar Wastewater Treatment Plant (GBWWTP).
- Work towards the long-term goal of sewer separation or its environmental equivalent to protect the North Saskatchewan River (NSR) water quality.

A draft submission of the CSDS was submitted on June 1, 2012 and reviewed by ESRD, and this final report submission is due on June 1, 2013.

## Current Situation

The City began implementing a 16-year *Long-Term Control Plan* (LTCP) (UMA et al., 1999) for CSO mitigation in 2000. At the time, there was an average of 89 CSO events per year to the NSR, with 56 percent of the combined sewage being captured and treated at GBWWTP. The goals of the LTCP were to reduce CSO events from 89 to 46, and increase the volume of capture from 56 to 86 percent. The City is now about two-thirds of the way through implementation of the LTCP, and it is expected that the program will reduce overflows to 34 and increase the amount of capture by 93 percent, well ahead of its goal (actual percent capture could reach 98 percent, as discussed in this report) under the current LTCP implementation, which is scheduled to be finished in 2016.

The CSDS reviewed the progress of the City's program and undertook a benchmark comparison of the program with other peer communities. A limitation with the benchmarking approach was that there are very few other locations that have advanced to the same level of CSO control as Edmonton. In comparing the program to the hundreds of locations with combined sewers across North America, it was concluded that Edmonton has progressed ahead of nearly all other programs.

The review also compared program metrics to metrics from industry-leading United States (U.S.) and Canadian programs, including those in Milwaukee, Wisconsin and Omaha, Nebraska, U.S.; and Toronto, Ontario and Winnipeg, Manitoba, Canada. Considering all metrics, it was concluded that Edmonton's program is positioned within the top tier of all North American programs in terms of level of advancement and level of control.

Development of the LTCP was based on 1991 rainfall, which was considered a baseline year because of its average storm and rainfall accumulation conditions. The CSDS estimated that completion of the LTCP would result in complete capture of the June 11, 1991 rainfall event, which means that 50 percent of future years will have no CSOs. The review also found an appropriate balance between combined sewer capture in the collection system with the level of treatment at GBWWTP. This well-balanced system means there would be very few rainfall events that would cause high pollutant loads, and those that do would be from large, infrequent events that would be impractical if not impossible to control.

## Regulatory Requirements

The development of a CSDS required defining the two requirements identified in the Approval to Operate: to "further reduce" CSOs and to achieve the "environmental equivalent" to separation. ESRD provided clarification on January 10, 2012 at a meeting in which the issues were discussed and further definition was provided for the equivalent to sewer separation requirement. It was clarified that the expectation for sewer separation would be met for the situation in which new storm sewers were constructed within the combined sewer area, with all street inlets being reconnected to the storm sewers. Foundation drains and other private property sources of flow

would not need to be connected to the storm sewers, nor would storm discharge treatment be required. The environmentally equivalent comparison is meant to be pollutant based, with the pollutants of concern being total suspended solids (TSS), carbonaceous biochemical oxygen demand (CBOD), total phosphorus (TP), ammonia, and fecal coliform bacteria.

Loadings were estimated from the City's CSO system with the LTCP fully implemented and compared to those estimated for sewer separation as already defined. The comparison showed that for the baseline year, a separated system would discharge about 2,000,000 kilograms per year (kg/yr) of TSS in comparison to the CSO control option of 218,000 kg/yr. In other words, the CSO controls would outperform sewer separation for this parameter by a factor of about 10 to 1. The reason for the strong performance for CSO controls is that it would capture nearly all of the annual runoff volume and direct it to GBWWTP. By comparison, sewer separation would allow runoff from every rainfall event to discharge directly to the NSR. The stormwater solids would have a lesser concentration than combined sewage, but the concentrations would still be significant and discharge much more frequently. Surface runoff collects solids and other pollutants from the streets and grassed areas before entering the storm sewers, resulting in a significant discharge directly to the NSR.

The other pollutant calculated for the sewer separation comparison was bacterial loading. Unlike solids loading, bacteria are of concern on an event basis because of the direct contact risk, rather than because of cumulative annual loading. The comparison demonstrated that CSO controls completely eliminate bacteria discharges from the collection system for all but a few events per year. By comparison, discharges from separated storm sewers would occur for every rainfall event, with bacteria levels greater than provincial guidelines.

In summary, the comparison of CSO controls to sewer separation showed that, in most respects, CSO controls outperform sewer separation. This is particularly true in Edmonton's case because of the high level of CSO control that will be in place with the completion of the LTCP. The drawbacks to the CSO control option are that when overflows do occur, the bacterial concentrations are much greater than for sewer separation, and the bacteria are of concern because of their human origin. Another intangible issue with CSO control is that the stigma associated with the discharge of untreated sewage will remain, regardless of how infrequent. Notwithstanding that each option has its strengths and weaknesses, it was concluded that the "environmental equivalent of sewer separation" for Edmonton will be achieved upon completion of the LTCP.

The second Approval to Operate requirement – to "further reduce" – was addressed by identifying a series of options and evaluating them in the CSDS study for application to the Edmonton situation. Further reducing could mean carrying on with major infrastructure upgrading, as was done for the LTCP; enhancing and optimizing the LTCP by moving to a green infrastructure approach with more use of best management practices (BMPs); or even a more modest upgrading program, provided that further improvements are made.

## Recommended Strategy

The recommended strategy for the CSDS is what has been termed a "green approach." It is referred to as green because it includes green infrastructure (GI), and does not include large capital works that are known as grey infrastructure. The recommended green approach is based on continuous improvement rather than meeting design targets for future performance. This is, in part, because the GI options are relatively new, and their performance will be site specific.

The green approach is much more than just GI; it also includes:

- Taking a broader watershed view of water quality management rather than individual discharge sources: In other words, loading contributions are to be considered equally regardless if they are from upstream, small stream, industrial, storm sewer, sewage treatment plant, or combined sewer sources; and each should be considered for the merits of control options in developing cost-effective control measures.
- Alignment and development of a common direction and metrics for existing programs: This would reduce the effort required to compare competing programs, streamline project selection and funding, and free up resources currently spent developing and supporting disparate metrics. One element of this consolidation

would include expanding and validating the Global Trunk Model (GTM), which provides computer simulation of the entire drainage network to better assess the interactions of the several programs.

- LTCP optimization: With the completion of LTCP implementation, the number of overflows for the 1991 baseline year will be reduced to 34, with 11 of these predicted to be at the Rossdale location. The Rossdale overflows could be further reduced through separation of part of the service area or addition of local offline storage. Other methods of optimization include implementation of global real-time control (RTC) and further raising weirs, which could be standalone options, not necessarily targeting a defined level of improvement.
- Asset integration: The City has separate projects that reduce basement flooding, and others that repair and replace sewers, in addition to the CSDS that will reduce CSOs. All of these initiatives involve work on the same sewer system, but the work is done independently. Implementing a coordinated effort would potentially achieve the same results at less cost. A single-system concept is fundamental to system optimization and cost efficiencies.
- Enhanced stakeholder education and involvement in all wet-weather programs: Stakeholder involvement will strengthen CSDS, related watershed programs, and related City initiatives by focusing on common objectives and metrics for improvement. A particular focus of the stakeholder involvement should include engaging engineering educators and designers toward a goal of incorporating more stormwater BMPs in street and highway design guidance.

## Strategy Rationale

Selecting the green approach was based on review and evaluation of a number of control options that would provide a broad range of further CSO reduction. The green approach was considered appropriate for Edmonton based on a number of criteria, including:

- Regulatory Compliance: The green approach will satisfy the requirements of the current Approval to Operate. The goal of achieving the environmental equivalent of sewer separation will be met, in most respects, with completion of the LTCP. The green approach also satisfies the requirement to "further reduce" by a series of project optimizations and new initiatives that will reduce the volume of overflows.
- Value Engineering (VE) Results: A formal VE study compared various CSO control options and rated the green approach option the highest (CH2M HILL, 2012c).
- Environmental Stewardship: The benchmarking review rated Edmonton's CSO control program as being in the top tier of Canadian and U.S. programs. This high ranking places Edmonton high in terms of environmental stewardship, which is even further enhanced when considering the pursuit of GI, low-impact development (LID), and the City's River for Life strategy (2011b).
- Affordability: The LTCP is a capital-intensive program that is just over two-thirds complete and already creating a heavy burden on the rate payers. Demands for further investment to enhance a program that has already been established as successful is likely to be considered over-taxing on the community.
- Watershed Based: One of the most advantageous features of the green approach is the concept of watershed-based improvements. Water quality will be considered on a holistic basis, with the watershed approach allowing the most cost-effective solutions to be implemented.
- Risk Management: SMA Consulting Ltd.'s (SMA's) Risk Assessment (RA) (included in the appendixes) identified a number of risks and recommended actions for their mitigation that could readily be incorporated into the green approach.
- Drainage Asset Management Strategy (DRAMS) Compliance: Dealing jointly with programs that involve the combined sewer system would have a high potential for cost efficiencies, which can best be achieved by applying the asset management tenets to an integrated view in conformance with the existing DRAMS program.

- Adaptability: The RA and engineering judgment have identified that an adaptive approach is best suited to the CSDS. Edmonton's CSO program is at the forefront in comparison to those of its peers and, from this perspective, is in a leadership position. The City should remain vigilant in tracking industry trends and developments, and adjust the program accordingly.

The grey approach was seriously considered as an option but was not selected. The preferred grey option was a storage-transport tunnel that was sized for the next largest storm-causing overflows. To meet this requirement, a storage-transport tunnel of 50,000 cubic metres ($m^3$) would be required for the August 23, 1991 baseline year event. An increase in the storage-transportation tunnel to provide balancing storage of about the same size would be required for a commensurate level of wet weather flow treatment at GBWWTP. The combined tunnel was estimated to cost approximately $178 million, and would only reduce TSS by about 250,000 kg/yr for the collection system and GBWWTP combined. This level of improvement is about one-tenth that of the LTCP, but at about the same cost. This demonstrates the diminishing rate of return in making improvements to high-performing CSO control programs.

## Implementation Plan

With the CSDS being a strategic plan by definition, it will provide general program direction and not project-by-project definitions. The projects presented herein and their budgets are, therefore, to be considered conceptual, to be further refined during adaptive implementation.

The plan assumes the core work for the LTCP will be completed by 2016, with only implementation of additional opportunistic sewer separation (OSS) carrying on from the program. The new projects recommended under the CSDS include:

- New Studies: Studies should be carried out at the outset to assist in further defining the program direction, including:
  - Program Alignment Study: The CSDS includes a number of recommendations for integrating existing initiatives for area-wide program optimization. The program alignment study would accomplish this by confirming the current situation; clarifying the goals and plans for each initiative; and identifying integration opportunities specific to meeting common goals, and achieving an overall improvement in delivery of the programs.
  - Communications Plan: It is recommended that review and further definition of the communications plan be undertaken, along with the program alignment study. This will allow time to better define how to integrate CSDS projects into other watershed-related projects, and lead to a clearer, unified, and more focused message.
  - Project-specific Studies: An outcome of the program alignment study will be the definition of further studies for asset integration and system optimization. Project-specific studies may include further work in areas related to DRAMS, inflow and infiltration (I/I), basement flooding integration, and sewer rehabilitation and replacement integration.
- CSDS Monitoring, Refining, and Optimizing: The routine programs that are in place will continue, and be refined and expanded to new programs as recommended by the program alignment study, with the addition of ad-hoc monitoring programs and studies to support system understanding and optimization, including:
  - Environmental Monitoring
  - RTC Monitoring
  - Interconnection Monitoring
  - Combined Sewer System Site Monitoring and Optimization
  - GTM Refinement
  - GBWWTP Monitoring
  - Public Education
  - GI and LID Initiatives

- Continuation of OSS: Continuation of the OSS program will require sustained reassessment of the combined sewer area for new opportunities.
- CSDS New Projects: New projects will be identified, beginning with the program alignment study, and evolving based on the findings of that study and those of project-specific studies. The new projects may include:
  - Enhanced GI: GI options for implementation in the combined sewer areas should, first, proceed with pilot and demonstration projects on public or private properties to assess and evaluate the technology, as recommended in the preceding studies.
  - New Implementation: New projects, such as full-scale GI for further reduction of combined sewer discharge, should be undertaken after the pilot and demonstration project evaluations are complete. The extent of implementation will depend on several years' of planning and development prior to committing to full-scale implementation.

## Schedule

The CSDS will not officially commence until after completion of the LTCP in 2016. It would, however, be in the City's interest to commence some of the initial investigations and planning as far in advance as possible to develop an optimized and cost-effective approach, including:

- The initial review and planning should include an ongoing focus on monitoring, refining, and optimizing the controls already being implemented.
- The program alignment study should be the first new study priority and commence as soon as practicable.
- Project-specific studies focused on program coordination, system optimization, and asset integration should follow immediately thereafter, in accordance with the alignment study recommendations.
- Evaluation of GI should be undertaken early in the program, with pilot and demonstration projects as recommended from the preceding studies.

Subsequent steps of the strategy should selectively implement additional controls whose efficacy was proven in the first decade. Over the long-term, it is anticipated that the impacts of CSOs will have been minimized to the point where further CSO mitigation will no longer be a priority, and the River for Life strategy (City, 2011b) will take precedence.

## Budget

The CSDS implementation plan is relatively modest in terms of capital investment, being focused more on performance evaluation and sustainable improvements than on large construction projects. A number of the recommended actions will require alignment with other ongoing projects and programs that already have budget allocations.

Table ES-1 provides budget estimates for the anticipated 15-year approval period.

TABLE ES-1
**Budget Estimates (15-year Approval Period)**

| Project Year | Annual Budget Estimate |
|---|---|
| 2014 - 2016 | $1,150,000/year |
| 2017 - 2024 | $8,500,000/year |
| 2025 - 2030 | ($8,500,000 + TBD capital program)/year |

Note: TBD – to be determined

The first 3 years should focus on enhanced monitoring, planning studies, and system evaluations to bring greater clarity to the green approach. Beginning in 2017, the funding will increase for existing system optimization, the GI pilot and demonstration testing, and other watershed initiatives that affect CSOs, such as upstream sanitary sewer I/I. It is expected that additional areas for OSS implementation will be identified, and this program will continue under the CSDS project. By about 2025, the path forward on GI and other upgrading options will have been clarified, and this will mark the beginning of full-scale implementation, if the decision at the time is to move in that direction.

The budgets are based on incremental project costs, and do not include costs for continuation of the existing LTCP initiatives or the ongoing OSS program.

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March 26, 2020

Kris Lima, M.Eng., P.Eng.
Director,
Integrated Infrastructure Services
Infrastructure Planning & Design
City of Edmonton

Dear Mr Lima,

**Re: Proposed Underground Stormwater Storage Tank - Fort Road Widening Project**

As requested in our March 24th discussion, this correspondence summarizes EPCOR's view regarding the siting of the City's proposed underground stormwater storage tank for the Fort Road widening project undertaken by the City of Edmonton. Like for any other design project, good engineering practices require that site-specific constraints and opportunities be fully evaluated to converge to the most appropriate circumstantial solution. At this point, EPCOR has not yet seen the completed City design considerations for the site to confirm the final location and size of the proposed storage tank.

Although there are instances where storage tanks are located within the road right-of-way, in this particular circumstance, EPCOR supports the underground storage tank being located outside the road right-of-way allowance for the following reasons:

- To minimize traffic-related safety concerns for EPCOR employees and the public when accessing the storage tank to carry out inspections or maintenance works at the site; and;
- To minimize potentially significant disturbances to users of Fort Road when rehabilitating or upgrading the storage tank, as the proposed location would situate the tank further away from the road and facilitate safe and full access at all-times to the site.

Please feel free to contact me if you have any questions at 780-613-4133 or email gvachon@epcor.com

Best Regard,

Guillaume Vachon
Director, Project Management & Engineering