Attachment

EPCOR Report Attachment for CO01523 – Flood Mitigation Areas as Snow Dumps

1. Executive Summary

This attachment has been prepared to support City of Edmonton Operations review of Snow management practices and in particular in response to the motion.

Motion at Community and Public Services Committee on April 25, 2022 : That Administration consult with EPCOR to examine whether flood mitigation storage areas can also be used as snow dumps and provide a report back to Committee

This attachment provides an overview of EPCOR's stormwater storage infrastructure, and addresses the question of whether or not current stormwater management facilities (SWMFs) would be suitable for snow storage. It also presents information about EPCORs Stormwater Integrated Resources Plan (SIRP) strategy and presents a concept to build additional stormwater storage infrastructure which could be configured to provide a dual benefit to the City of snow management during and following severe snow storms during the winter months.

2. Background

Following severe winter storms and periods of heavy snow, when excess snow gathers on residential streets, it has been necessary to implement increased snow removal practices in residential areas. The current options when this event occurs include:

- hauling to one of five snow management sites in the City, or,
- piling snow locally in neighbourhoods, such as in cul-de-sac and/or windrows parallel with the curbline.

As part of the SIRP strategy, this attachment explores innovative solutions to manage snow through the combination use of snow melting aligned with SWMFs within neighbourhoods to reduce hauling requirements to centralized storage, and reducing the need to have large local windrow and snow piles in the community, which can result in safety issues and reduced road access to adjacent properties.

3. EPCORs SIRP Strategy

EPCOR and the City of Edmonton's approach to stormwater management, SIRP, is an approximately $1.7B strategy over the next 20 years to reduce flood risk throughout the City of Edmonton through an integrated approach involving infrastructure investment, enhanced monitoring, emergency preparedness and extensive public education and stewardship.

Through SIRP, a comprehensive evaluation of flood risk through the City of Edmonton was completed which looked at flood impacts from health and safety, environmental, social and financial perspectives. The capital and operational investments in SIRP have been classified

into the five themes of SLOW, MOVE, SECURE, PREDICT and RESPOND described below along with expected capital expenditures forecast for each theme.

SLOW We slow the entry of stormwater into the drainage network by absorbing it in green infrastructure and holding it in ponds, creating space in the collection system during storm events.

- Ponds ($470M),
- Low Impact Development ($420 - 570M)

MOVE We move excess water safely away from areas at risk, quickly and efficiently.

- Tunnels, Trunks and Sewer Separation ($300M)

SECURE We help secure individual properties in higher risk areas against sewer backups, overland flooding and river flooding.

- Enhanced Flood Proofing ($60M)
- Outfalls and Control Gates ($30M)
- Inflow and Infiltration Reduction ($100M)

PREDICT We predict and manage the movement of stormwater through smart sensors and technologies that integrate into the collection system.

- Monitoring and Controls ($70M)

RESPOND We respond through the fast rollout of flood barriers, traffic diversions and public communications to protect life, safety and property.

- Emergency Response Equipment ($45M)

For this report the focus is on the potential to achieve a co-benefit for snow management with future investments for Stormwater management facilities (SWMF) planned under the SIRP-SLOW theme. Historical design practices for these facilities have been based on SWMFs hydraulic and hydrologic function during summer storm events (statistical major storms and major historical events).

In the past, they have not been designed for managing the quantity and/or quality of snowmelt runoff. These facilities do not adhere to the design guidance provided in the current Provincial "*Snow Disposal Guidelines for the Province of Alberta"* (AEP, 1994).

Additionally, EPCOR, as the owner and operator of Edmonton's sewerage system, has obligations to maintain water quality that is discharged to the environment through the current total loadings plan, a condition of our approval to operate the drainage system with Alberta Environment and Protected Areas.

4. Existing Snow Management Facilities

The City of Edmonton currently operates five large snow storage sites including four public facilities – located in each of the quadrants of the City, and one facility for City of Edmonton use only. Each of these facilities is designed to store snow during the winter. In the spring, snow melt is directed to onsite meltwater collection facilities. Grit and other solids as wells as litter are collected at these snow melt sedimentation facilities, where they are separated from the stormwater prior to release into the storm sewer system. Salts applied to the roads during winter operations, hydrocarbons, and road surface material can create a concern for the water quality of the meltwater and the facilities are designed accordingly including pretreatment and monitoring infrastructure. Additionally the snow melt sedimentation facilities at snow storage facilities must be designed for both snow melt and summer storm hydrologic conditions.

Meltwater from the four of the facilities currently discharge into the storm sewer system. The meltwater is regularly monitored for a wide array of water quality parameters by the City and exceedances are reported to EPCOR on a weekly basis as required by the *EPCOR Drainage Services and Wastewater Treatment Bylaw No. 19627.* . The water quality of meltwater is sometimes elevated in chemical oxygen demand, E.coli, metals and oil content.

5. Analysis of EPCOR's Current Stormwater Management Facilities and Potential for Snow Management Dual Use

SWMFs are designed to store runoff during and following rainfall events and then slowly release it into the sewer system. Generally, SWMFs can be classified into two major types:

1. Regional SWMFs: Includes large storage infrastructure which serve the community at a regional scale during major storm events. Runoff is conveyed to these regional facilities via the storm sewer system and the roadway gutters and catch basins. These facilities may discharge into either the storm system or the combined system. Subtypes of these facilities include:
    a. Wet ponds,
    b. Dry ponds and
    c. Constructed wetlands.

2. Local SWMFs: Include smaller, distributed storage infrastructures which serve the community locally and are activated in minor and major storm events. Generally, runoff is conveyed to these local facilities overland with the intention of capturing runoff as close to the point of generation as possible. These facilities may discharge into either the storm system or the combined system. Subtypes of these facilities include:
    a. LIDs (bioretention areas, soil cells, box planters),
    b. Underground storage tanks and
    c. Oversized pipes (superpipes).

As highlighted previously, the existing EPCOR SWMFs within Edmonton generally are not suitable for snow management, primarily due to the fact that they are not designed to control the sediment/grit load and litter that is aggregated into the snow, and due to water quality impacts to the watershed that would occur from increased contaminants loading into these facilities

connected directly to the watershed.

Additional context based on the type and subtype of SWMF is provided below.

Regional SWMFs

Wet Ponds are large storage facilities which maintain a permanent pool of water at the bottom. These facilities capture runoff during extreme rainfall events and slowly release it into the storm sewer system. The shorelines of the facilities typically have some aquatic vegetation and upland of this is grassed, sometimes with trees and shrubs. Issues with managing snow at wet ponds include:

- Contaminants in the hauled snow (grit, sediments, hydrocarbons, salts) can not be screened or treated and impair the functionality of the pond for water quality management.
- Wet ponds support a variety of shoreline and upslope vegetation which may be damaged by snow hauling equipment.
- The Environmental Protection and Enhancement Act requires provincial approval to release meltwater to a SWMF. Regulators have previously indicated that wet ponds are not to be used for snow management in Edmonton.

Dry Ponds are large storage facilities which are normally dry and only fill during extreme rainfall events. Then they slowly release runoff into the storm sewer system. As these ponds are regularly dry, they are typically used as dual-use park spaces, commonly sited at schools and supporting recreational amenities such as soccer fields and baseball diamonds. Issues with managing snow at dry ponds include:

- Contaminants in the hauled snow (sediments, hydrocarbons, salts) can not be screened and will accumulate on the dry pond surface or infiltrate into the soil.
- Many are designed as dual use public spaces – accumulation of snow will impact public use of park and amenity space and/or create a safety hazard to the public

Constructed Wetlands are large shallow storage facilities which maintain a permanent pool of water at the bottom, which is widely planted with wetland vegetation. These facilities capture runoff during extreme rainfall events and slowly release it into the storm sewer system. The bottom and upland areas of constructed wetlands support a wide variety of flora and fauna and provide an ecosystem function. Potential issues with managing snow at constructed wetlands include:

- Contaminants in the hauled snow (sediments, hydrocarbons, salts) can not be screened and impair the functionality of the wetland for water quality management.
- Support both a stormwater management and an ecosystem function – are more sensitive to changes in seasonal hydrology.
- Support a variety of shoreline and upslope vegetation which may be damaged directly by snow clearing equipment or indirectly by meltwater quality.

- Alberta Environment regulations have previously indicated that constructed wetlands are not to be used for snow management in Edmonton

Local SWMFs

Low Impact Developments (LIDs) are a type of green infrastructure which capture runoff at its point of generation. These facilities capture runoff in both minor and major rainfall events and slow it from entering the sewer system. The storage at these facilities is provided through the inclusion of an engineered soil mix and surface storage. Commonly these are planted with natural vegetation and trees. Potential issues with managing snow at low impact developments include:

- Contaminants from the hauled snow (sediments, hydrocarbons, salts) can not be screened and clog the LID soil structure reducing capacity to capture stormwater in the summer seasons.
- In order to function properly the soils cannot be compacted and therefore are unable to support the loading of piled snow on top of the LID structures.
- LID facilities support both stormwater management and ecosystem functions and are sensitive to changes in seasonal hydrology.
- LID facilities support a variety of vegetation which may be damaged directly by snow clearing equipment or indirectly by meltwater quality.

Underground Storage is a type of infrastructure that also stores runoff close to its point of generation, during both minor and major storm events. These storage facilities may be coupled with low impact developments or be a standalone system. Underground storage can be installed under soft (i.e. turf) or hard (i.e. parking lots) surfaces. Issues with managing snow in underground storage using current design practices include:

- Underground – unable to capture and accept frozen snow.
- Contaminants from hauled snow (sediments, hydrocarbons, salts) can not be screened and treatment and are then either released directly to the environment or pose a risk of clogging the underground system

There is however a potential to modify existing underground storage located within parking lots to support collection of snow meltwater (discussed further in section 6).

Pipe Storage is when storage is provided in the sewer system by oversizing pipes and controlling the outflow rate at the downstream end. This type of storage is activated in both minor and major storm events. Pipe storage can be installed under soft (i.e. turf) or hard (i.e. parking lots) surfaces, however is typically in-line with the sewer network. Potential issues with managing snow in pipe storages include:

- Underground – unable to capture and accept frozen snow
- Contaminants from hauled snow (sediments, hydrocarbons, salts) can not be screened and pose a risk of accumulating within the storage pipe and being released and clogging the adjacent pipe networks.

Since these pipes are typically located within the road right of way, there would be limited opportunities to modify these to accept melted snow, unless there was an adjacent parking lot to these locations.

6. Potential for Future Dual Use Infrastructure – Underground Storage

There is an opportunity for underground storage to be designed as dual function facilities to help achieve snow management objectives in addition to their stormwater function. The two aspects to be considered for this reconfiguration are the management of the grit/sediment and litter within the hauled snow and the management of the water quality impacts to the environment from the salts applied to the roads to manage snow and ice.

In order to function as dual use facilities, it is anticipated the SWMFs designed for snow meltwater management will require the following operational and capital infrastructure components:

- A method to melt snow. This can be achieved via “snow melters”, however energy fueling and usage and noise generation would need to be considered for each location selected for this approach. The size of snow melter required will depend on the number of trucks expected
- Grit removal. The snow melter will need to be equipped with a grit management device such as an oil and grit separator or other screening structure. Collection and disposal of the grit once accumulated must also be considered.
- Connection to sanitary. The storages will collect meltwater and discharge to the sanitary/combined system in the winter and to the storm/combined system in the warmer seasons. Where there is a separate sewer system (sanitary and storm) a diversion structure will be required to modulate the discharge point seasonally.
- Ability to capture road runoff. In order to achieve flood mitigation through the spring and summer, the underground storage will require inlet catchbasins to capture runoff during the warmer seasons.
- The location for the underground storage would need to be in a parking lot that can manage the traffic flow of snow haulers for disposal of their loads into the snow melter.
- Infrastructure to allow water quality sampling the confirm adherence to regulatory requirements.

There are commercially available snow melting equipment types that incorporate the ability to screen out the grits and sediments within the equipment and only discharge the melted snow. This type of equipment is currently used in communities that regularly experience multiple events of extreme snow falls that overwhelm traditional snow hauling techniques. The Transportation Association of Canada suggests that *“multiple use sites such as the parking lots of facilities that are not normally used in the winter can make excellent temporary snow disposal areas – particularly if combined with a snow melter.”* (TAC, 2013).

Stewart, (2017) published an article in Landscape Management exploring the multiple dimensions of snow melting versus traditional snow collection and storage. Depending on municipal operations, the snow melting option may provide a significant environmental benefit.

An example of a commercial snow melter is shown in Figure 1 below. Snow is loaded into the top of the melter by a loader or skid steer. Snow is melted and drains into a storm drain below the snow melter. The snow melter is equipped with a debris and sediment trap, providing pretreatment of the meltwater prior to it being released to the drainage system. This system can be coupled with underground storage (example shown in Figure 2) to collect meltwater and slowly release it into the sewer system.

Figure 1. Commercial Snow Melter. Modified from: Snow Dragon Melters, 2015

Figure 2. Underground Storage System Schematic. Modified from: Stormtrap, 2022.

By actively melting snow at time of collection throughout the winter and discharging the meltwater directly into the Underground storage there may be an opportunity to reduce snow hauling distances and increase efficiencies in snow clearing. This efficiency is offset with additional energy used to melt the snow. The different suppliers of the snow melting equipment have guidelines to help complete this analysis.

Based on the City's current snow removal operations, this approach will result in less snow accumulation at the designated regional snow storage facilities as well as within the public right of way.

In order to design and implement this type of dual use facility, there are both capital and operational costs that would need to be borne by both the City of Edmonton and EPCOR. While a detailed assessment of the magnitude of these costs has not been developed at this stage, an overview of the costs to consider is provided below. Alberta Environment approvals would also be required prior to proceeding.

Cost Type	City of Edmonton	EPCOR
Planning and Feasibility Assessment	Identification of suitable sites requires both parties to identify a site located in location where stormwater management is required and is suitable to manage the snow hauling trucks and snow melting equipment. This may result in a requirement for land purchase. Confirmation that existing sewer infrastructure has adequate capacity to accept meltwater. Evaluation of the economic, social and environmental impacts and benefits of the proposed system.	
Capital	Snow melters and ancillary equipment. Depending on the arrangement of the snow melters, melt pads and grit capture infrastructure may be required.	Installation of Underground storage designed to capture snow meltwater coupled with diversion chamber and pipe connections to both storm and sanitary piped systems
Operational	Snow melting required following severe winter storms. May be achieved by permanent (melt pad) or rented (melt truck) infrastructure. Increased energy costs to operate melters. Additional process to remove accumulated grit from snow melting equipment. Staffing for site control, security and maintenance.	Requires seasonal modulation of outlet from sanitary to storm. Underground storages will have regular cleaning costs. Additional water quality monitoring to confirm adherence to regulatory requirements. Recovery of operational costs during snow season would need to be determined as either through a service level agreement with the City of Edmonton incorporated into EPCOR's Stormwater rates.
Potential Benefits	Reduction in haul distances, cost savings associated with reduced fuel.	Opportunity to provide additional climate change co-benefits through the SIRP investments mitigating impacts of both extreme summer storms and extreme snow fall events.

7. References

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