April 19, 2021

Paul Sampson
Planner II
Urban & Rural Planning
HRM
PO Box 1749
Halifax, NS
B3J 3A5

Dear Paul:

RE: Seton Ridge Development Approval Amendment Application

Southwest Properties Limited proposes the following amendments to the Development Approval Agreement executed in October 2018:

1. Heated Source for Heated Road and Sidewalk

Discussion: Schedule C7 addresses the issue of potential steep grades on Seton Road by requiring a long-term heated concrete paving system. In the short-term, MSVU's excess heat from their adjacent plant makes sense for this development; however, in the long-term, hinging our DA on a third party like the university may be problematic since neither HRM nor the developer can control the actions of the third party to provide excess heat. 2023 will be the centenary of the university, and MSVU may be planning a campus expansion plan which could eventually compromise the 'excess heat' which is readily available today. We understand it is HRM's intent in Schedule C7 to ensure that the pavement system operates in perpetuity at no cost to the municipality.

We believe the public benefit of providing a stand-alone heat source rather than excess heat from MSVU as a more cost-effective option that will also provide HRM with more control over the source, where they would not be relying on excess heat produced by MSVU. For example, if MSVU required unplanned system repair, the heat source would be impacted. Similarly, if MSVU relocated in the future, the heat source would be unavailable, or if they built more buildings the excess heat may be used up. As a result, we believe that decoupling the MSVU heat source from the DA is important for the future of the development and, consequently, we would like to remove the MSVU reference from the DA.

The developer will pay for the operating costs (including heating costs) for seven years after municipal acceptance of the primary services in accordance with clause 1(d). Beyond this seven-year period, the developer will pay solely for the heating costs by establishing a Homeowners' Association (HOA) or other form of agreement determined acceptable by the municipality to distribute these costs to the residents/businesses of Seton Ridge in perpetuity.

Southwest Properties Ltd. 1475 Lower Water Street, Suite 100, Halifax, Nova Scotia, Canada B3J 3Z2
tel. 902.422.6412 **fax.** 902.429.7697 info@southwest.ca **www.southwest.ca**

Requested DA Changes:

1. Development Agreement Document #113520820: The proposed revised wording for clause 1 of Schedule C7 – "The portion of the collector road identified on Schedule C2 as "Potential Steep Grades" shall be heated by a concrete pavement system that uses excess heat from Mount St. Vincent University subject to the following terms and conditions:". Change to:

   The portion of the collector road identified on Schedule C2 as "Potential Steep Grades" shall be heated by a concrete pavement system that uses either (a) excess heat from Mount St. Vincent University or (b) a dedicated heating plant financed through a homeowner's association, subject to the following terms and conditions:

2. Similarly, we would like to revise the wording for clause 1(e) of Schedule C7 (assuming clause 1[d] remains as is) - "the Developer agrees to secure the rights and use of the excess heat from Mount St. Vincent University in perpetuity at no cost to the Municipality". Change to:

   The developer agrees to secure the rights and use of excess heat from MSVU (at no cost to the Municipality) or to provide a stand-alone heat source and pay for the heating costs in perpetuity."

Background:
The *Seton Ridge Snowmelt Study* prepared by GMB dated December 14, 2018 provides details for the heated road system. It demonstrates that this system would provide a more efficient use of land and would be more energy efficient than utilizing MSVU's excess heating capacity. The report estimates the following costs:

Operating Costs
MSVU heating plant: $92,000/year
Dedicated boiler using natural gas: $80,000/year

Capital Costs
Total approximate cost using MSVU's heating plant, including contingency, mobilization, overhead and profit, and detailed engineering: $1,240,000
Total approximate cost using dedicated boiler plant, including contingency, mobilization, overhead and profit, and detailed engineering: $1,150,000

See attached sketch C-SK10 showing the approximate location of the proposed stand-alone heat source building.

2. Max 200m between intersections

Discussion: This change is being requested to be consistent with the current and upcoming revision to the *Municipal Design Guidelines* for intersection spacing and satisfies the spacing contained on the approved concept plan. Maintaining the maximum 200m spacing from the DA will significantly increase the length of roadway and maintenance costs to the municipality beyond what would typically be required elsewhere in the municipality. Both our consultants and our internal team missed this item from the DA review so we're not sure where the 200m max length originated. The approved subdivision could not have been implemented as shown with this restriction. We would request an increase in the maximum intersection spacing to 500m to align with the *Municipal Design Guidelines* requirement.

We would suggest the following modification to 3.4 (h)i.:
"The maximum length of any local street between intersections is no greater than five hundred (500) metres as measured from street centre line to centre line."

3. AT trail grade

This clarification is being requested to confirm the intent of Schedule C7 (2). Southwest and our design consultants understood this clause was added to facilitate the design of an AT trail along the steep portions of the collector road (11.8%). The Red Book requires an 8% max grade for minor collectors, and unlike local roads, which permit a "a 12 percent grade may be allowed under exceptional circumstances", there are no variance pathways for the 11.8% slope of Seton Ridge which was already approved through the DA. The Red Book states that "*Where the designer proposes variations from this document and where the designer can show that alternate approaches will produce the desired results, such approaches may be considered for approval*". So, generally speaking, the Red Book is a guideline, not a specification and there is nothing in that specifically establishes a firm requirement for the slope of an AT trail. Instead, the Red Book sets the maximum grades of the adjoining roads and the width of the corridor, but nothing specifically about maximum grades for AT trails. The Developer's engineer believes that HRM was referencing 5.1.6 of the Design Guidelines which states:

"Walkways shall be located and designed whenever possible so that the grade of the walkway shall not exceed 8%. Steeper grades may be permitted only where the topography makes it impractical for grades to be less than 8%, or to avoid the installation of stairs. On streets where the maximum grade is 10%, the maximum walkway grade is 10%"

Firstly, we would contend that an 'AT Trail' is not a 'walkway' since the standard details distinguish between both and consequently are not interchangeable definitions. Even if they were considered interchangeable, the guideline is essentially saying that the walkway cannot exceed the slope of the road.

It was always our understanding that the 'curvilinear design' reference in the DA was added in an attempt to reduce the overall grade of the trail where possible compared to Seton Road; with the understanding that since the road right-of-way width is constrained, there are real practical limitations to the degree of curvilinear-ness that could be accommodated to reduce the trail slope. To meet an 8% slope limit, the AT trail would have to be 1.4x the length of the Seton Road and we simply do not have the room in the future and existing right-of-way to accommodate this length.

Southwest is concerned that this interpretation is not consistent with the municipal engineer's interpretation that the AT trail must meet the maximum slopes as set out in the Municipal Design Guidelines, and if slopes are to exceed the guideline, a request must be made to the municipal variance committee. This additional step would add a level of uncertainty that was understood to be addressed by Schedule C7 clause 2 of the development agreement when it was written.

Adding clarification to this clause as part of the current development agreement amendment application would provide clarity for both the design consultant and the municipal engineer.

We would suggest the following modification to C7(2):

2. The Developer agrees to construct an Active Transportation (AT) pathway alongside the collector road, within the general area shown on Schedule C2, that includes a curvilinear design with rest and transition areas to reduce the overall grade of the AT pathway as much as possible from the adjacent road slope.

4. Earthwork/blasting clarification

There is a significant amount of earth removal that will be needed to achieve the eventual road grades and building pad elevations for this project. Due to the magnitude of earthmoving for this project (hundreds of thousands of cubic yards), Southwest would like to commence some of the earthworks for this project in advance of full design approval to help to reduce the overall construction timeline. We know that HRM's current and future housing shortage will be well served by reduced construction timelines. The revised wording below is intended to allow the developer to begin earthworks in advance of full design approval.

Southwest requests the following changes to part 4 of the:

*Rename Part 4 from "*ENVIRONMENTAL PROTECTION MEASURES" to "ENVIRONMENTAL PROTECTION MEASURES AND PROJECT PHASING"

Add the following section:
*"**4.2 Clearing, Excavation and Blasting***
Notwithstanding 4.1, the developer may commence clearing, excavation and blasting activities required for grading and installation of municipal services prior to the Developer receiving full design approval, provided that the conditions of section 4.1 have been met."

5. Building construction prior to final road approval

Again, in order to more rapidly bring new much-needed units to market we would like to phase the construction of new multi-unit buildings in tandem with the road construction, instead of waiting till the roads are fully built and approved. These 100+ units often take 2-3 years to construct and we believe we can shave a year or more off the construction schedule if we didn't have to wait till final road commissioning to commence construction. There would also be less disruption to the new public streets and to local single-family residents if these larger buildings could be commenced while the roads were being constructed.

Southwest requests that the following clause be added to the DA:

"**4.3 Construction Phasing**

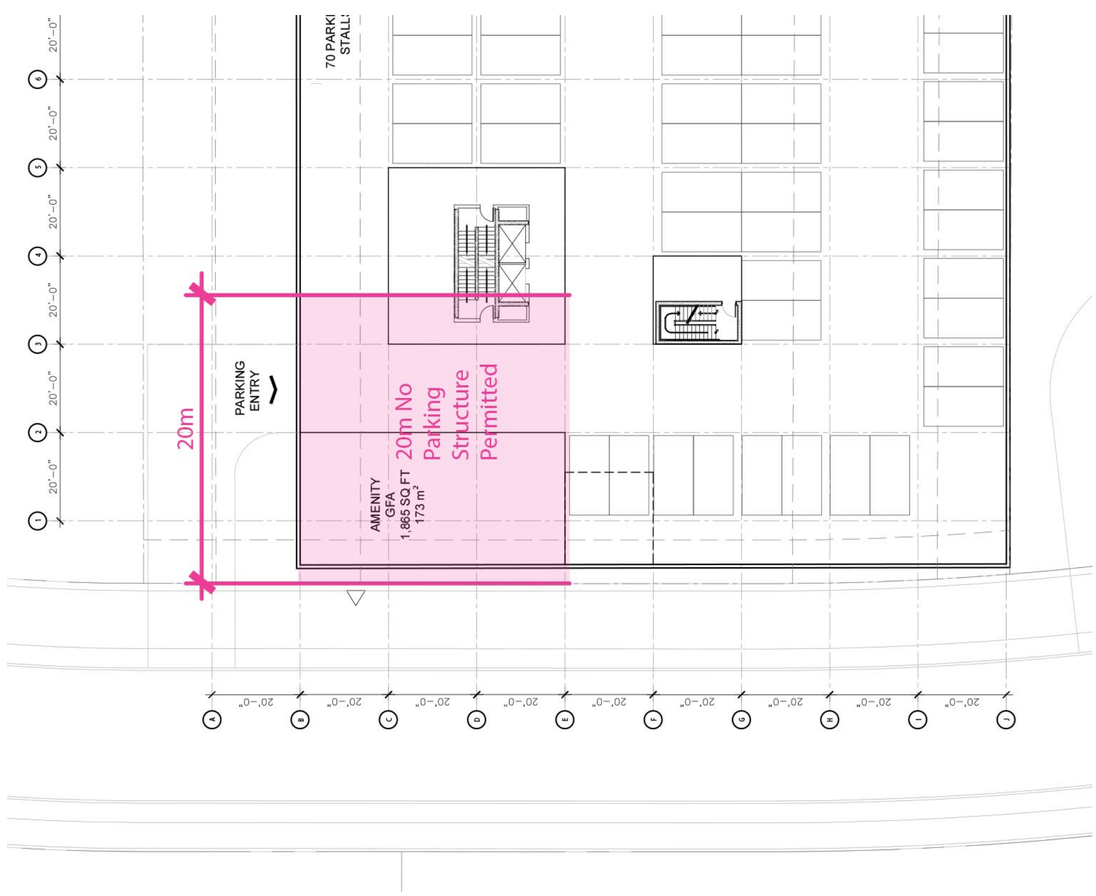
Up to three multi-unit buildings may be constructed within the Neighbourhood Centre prior to final subdivision approval provided that the building permits have been secured using the HRM approved road design, and the Development Engineer and Development Officer are reasonably satisfied that the proposed development is capable of conforming with all applicable terms and conditions of this agreement. These buildings may only be occupied on a temporary basis for display or for office uses pertaining to the sale of properties until subdivision approval has been granted and municipal services have been accepted."

6. Parking Structures

Schedule C4, section 6(d) of the DA, notes that "*parking structures located above grade shall not be located within 20 metres of a collector road."*

Again, we are a bit worried about how a DO may interpret this regulation as there are many above ground parking garages along Seton Road which are faced with residential or commercial units. When we were working through the DA with Ben Sivak, we believe this policy was meant to address a stand-alone parking structure that was originally planned between Buildings G and H. Ben did not want the parking garage front and centre on Seton Road so he added the setback.

Instead, we're now worried that if this definition was applied to all underground parking garages in multi-unit buildings, the setback would necessitate unusably deep residential units (20m deep). This is double the typical depth on most buildings (9-10m is a typical unit depth), and with the building code requirement for windows in bedrooms, there would be no practical use for a 20m deep unit. See the diagram below to illustrate our point.

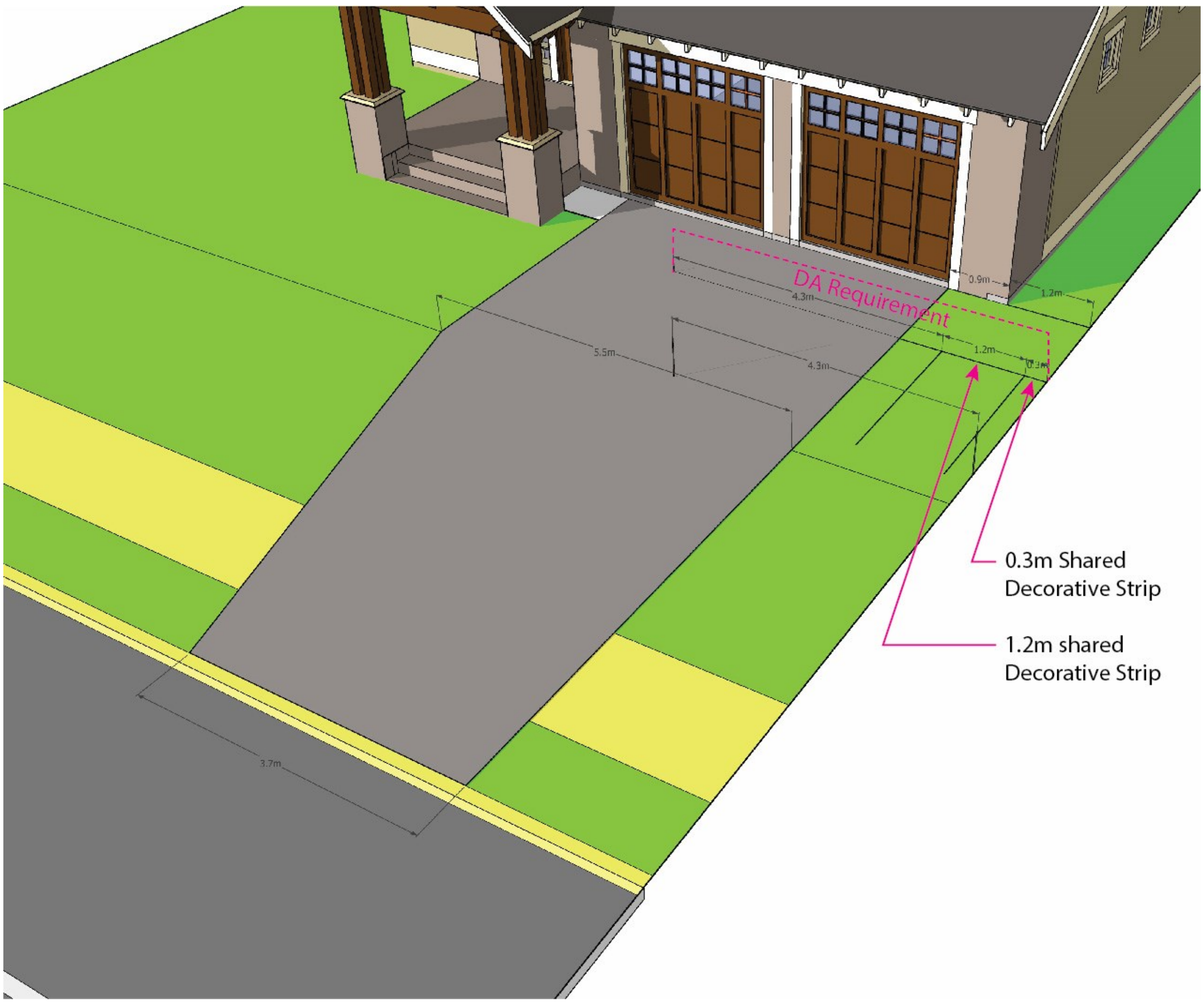


We think the easiest solution to this is to add a definition for "parking structure" in the DA. There is no definition of a parking structure in the mainland bylaw, the peninsula bylaw or even the downtown bylaw. There are references to "commercial parking structures", but again even under-building parking could be considered "commercial parking structures", since people pay to park there. The best solution is to add "parking structure" to the list of definitions as proposed below:

"Parking Structure means a building dedicated solely to commercial parking."

7. DA definitions and additional requested changes

Southwest, through Fathom Studio, requested a series of additional DA changes and in Fathom's letter dated Dec 10, 2020. Those additional requests are appended to this letter of for DA changes. In reference to those requests, staff requested a few drawings to clarify the proposed intent of the request. We have provided those drawings separately to staff, but we have attached them in this document as well to provide additional clarity. The drawing below shows the supporting argument for the driveway width request for Item 5 in Fathom's Dec 10 letter.



We look forward to receiving your response. I can be reached by telephone at 902-830-4241 and by email at ben.young@southwest.ca should you require any further information.

Sincerely,

Original Signed

Senior Vice President – Development

BY/lsm

Attach.

cc: Steve Higgins – Planning Manager, Planning & Development, HRM
Kelly Denty – Director, Planning & Development, HRM

fathomstudio.ca
1 Starr Lane
Dartmouth, NS
B2Y 4V7

ROSEMARY MACNEIL & PAUL SAMPSON
PRINCIPAL PLANNER AND DEVELOPMENT OFFICER
CURRENT PLANNING | LAND DEVELOPMENT & SUBDIVISION

fathom

ARCHITECTURE LANDSCAPE ARCHITECTURE PLANNING INTERPRETIVE WAYFINDING BRANDED ENVIRONMENTS

Seton Ridge DA Questions/Amendments. Case 19514

Issued
Dec 10, 2020

Dear Rosemary and Paul,

Thanks for our chat a few weeks ago on the Seton Ridge DA. As I mentioned, we are a little worried about some missing definitions in the DA and the potential of being tied to the Mainland Bylaw definitions if these definitions change over the course of the Seton development. As I mentioned, and as you rightly pointed out, it may be prudent to include some definitions in the DA since Southwest is going through an amendment now anyway.

Generally, we would like to use the Mainland Bylaw definitions, but we would like to meet to get some clarity on a few issues that we think a future DO may interpret differently than you or I. If we could meet in the near future, we would like to review our collective interpretation of some if the Mainland definitions to ensure we are on the same page and we have a few other definitions we would like to add that are not in the Mainland Bylaw. Here's what we are suggesting:

1. **We place the following Mainland Bylaw definitions in the DA:**

   "Height" when applied to a building, means the vertical distance of the highest point of the roof above the mean grade of the surface of all the streets adjoining the building or the mean grade of the natural ground so adjoining if such grade is not below the grade of the surface

   "Street Line" means the boundary of the street

   "Street Line Grade" means the elevation of a street line at a point that is perpendicular to the horizontal midpoint of the street wall. Separate street line grades shall be determined for each streetwall segment that is greater than 8 metres in width or part thereof

   "Street Wall" means the wall of a building or portion of a wall facing a street line that is below the height of a specified step-back, which does not include minor recesses for elements such as doorways or intrusions such as bay windows

   "Street Wall Height" means the vertical distance between the top of the street wall and the street line grade, extending across the width of the street wall

I am a little concerned about the interpretation of height, in particular, what it means by 'surface of all streets' and the lack of clear definition on what a "Roof" is. A meeting should help us clear this up but we may want to tweak these definitions for future clarity. I will also suggest a roof definition and a penthouse definition below.

2. I think we need a clear "roof" definition since we use it for measuring height.

"Roof" means the top of the slab elevation for the highest part of the building excluding the penthouse, excluding rooftop exemptions.

3. It would be good to have rooftop exemptions like in the Centre Plan and Downtown Bylaws so that we are not including parapets, arbours, elevator enclosures, etc. Could we include table 4 from the CentrePlan?

Table 4: Features exempt from maximum height requirements

Feature	Column 1: Maximum height above roof	Column 2: 30% coverage restriction	Column 3: Minimum setback from roof edge
Antenna	Unlimited	●	3.0 metres
Chimney	Unlimited	●	
Clear, uncoloured glass guard and railing system	2.0 metres	●	
Clock tower or bell tower	Unlimited	●	
Communication tower required to support uses and activities in the building	Unlimited	●	3.0 metres
Cooling tower	Unlimited	●	3.0 metres
Elevator enclosure	5.5 metres	●	3.0 metres
Flag pole	Unlimited	●	
Heating, ventilation and air conditioning equipment and enclosure	5.5 metres	●	3.0 metres
High-plume laboratory exhaust fan	Unlimited	●	3.0 metres
Landscaping	4.5 metres		
Lightning rod	Unlimited	●	
Penthouse	4.5 metres	●	3.0 metres
Parapet	2.0 metres		
Rooftop cupola	4.5 metres	●	
Rooftop greenhouse	6.0 metres		3.0 metres
Skylight	2.5 metres		
Solar collector	4.5 metres		
Spire, steeple, minaret, and similar features	Unlimited	●	
Staircase or staircase enclosure	4.5 metres	●	2.5 metres
Windscreen	4.5 metres	●	

4. DA policy 28 was taken almost word for word from the Halifax downtown By-Law, but there is no definition for a 'penthouse' in the Mainland Bylaw. In our discussions with planning developing this DA, we all assumed the Penthouse would allow habitable space, but without a definition we're worried there could be contention. Surprisingly, the downtown by-law does not include a definition for 'penthouse' but all penthouses in the downtown are habitable. We would suggest the following definition be added for clarity:

"Penthouse" means an enclosed rooftop space used for mechanical, habitable or shared amenity space purposes.

fathom

ARCHITECTURE LANDSCAPE ARCHITECTURE PLANNING INTERPRETIVE WAYFINDING BRANDED ENVIRONMENTS

5. There is no potential for variances in the DA like there is in the downtown bylaw and centreplan for slight height allowances which may be required to achieve the intended height map (Schedule C6) in the DA. On a highly sloping site there is no flexibility. Is there a way we can add a height variance of about 1.5m (half storey) to provide some flexibility in achieving the intended height schedules on a sloping lot; as long as we do not exceed the intended number of storeys in the DA (assuming 3m per floor typical)?

6. Lastly, Regulations 15 and 16 of Schedule C5 - SETON RIDGE LOW DENSITY (SRLD), as I recall, were intended for Townhomes only to create a decorative strip between combined driveways. The design requirement really doesn't work for single family homes or semi's due to the required sideyard setback of 4' and the maximum decorative strip width of 4.92'. A garage on these units would be at least 1.5' from the side of the building, so the combined 4'+1.5' = 5.5' on each property would set the maximum decorative strip for a SF or semi to, at least, 11' wide. This wouldn't make sense. I believe that 15 and 16 were meant for Townhouse units (which have no sideyard between units). We would like to add "For Townhomes,...." to Regulation 15. In regulation 17, the 14' min width for the driveway is too narrow for 2 cars to pass on the driveway for a 2 car garage so we would like to increase this to 16'.

I think it would be beneficial to everyone to meet and review the definitions to make sure we are all on the same page with how height is measured. We have attached some documents to show you how our interpretation of the definitions would impact the massing all the multi-unit building sites. Maybe we can review these documents together when we meet.

If you have any questions, please feel free to reach out to me at your convenience.

Sincerely,

Original Signed

Rob LeBlanc, Planner
902 461 2525 x102 direct, 902 483-2424 mobile
rob.leblanc@fathomstudio.ca

CONSULTANT	CLIENT	PROJECT DESCRIPTION	SHEET DESCRIPTION		
DESIGN POINT ENGINEERING & SURVEYING PHONE: 902.832.5597 www.designpoint.ca	Southwest™ Live. Shop. Work. Play.™	SETON RIDGE HALIFAX, NOVA SCOTIA	PROPOSED HEATED ROADWAY LIMITS AND NATURAL GAS HEAT SOURCE BUILDING LOCATION	Engineer: A. FORSYTHE Scale: 1:1000 Project No.: 18-034 Filename: 18-034_CSK10.dwg	Drawn: J. DWYER Date: Dec. 02, 2019 Drawing No.: C-SK10 1 OF 1

P:\2018\18-034 Seton Ridge Southwest Properties\01 - Drawings\Engineering Design\Sheets\SKetches\18-034_CSK10.dwg, Plot Date: 2019-Dec-2, Plot Size: ANSI FULL BLEED B (11.00 X 17.00 INCHES)

January 7, 2019

Halifax Regional Municipality
7071 Bayers Road
Halifax, NS
Attention: Ashley Blissett, P.Eng.

RE: Seton Road Snowmelt System
DesignPoint Project #18-034

The Snowmelt Specialist, GMB, from Holland Michigan, has completed the pre-design study for a snowmelt system for the portion of Seton Ridge that is steeper than 8%. See attached report dated December 14th, 2018 titled "Seton Ridge Snowmelt Study".

The study has concluded that a snowmelt system can be installed to keep the steep section of Seton Road snow and ice free. The study provides several options, with a preferred option to install a stand alone heating system using natural gas as the heat source to heat a glycol solution that would be circulated in the under-pavement tubing installed within Seton Road.

We also recommend that the system be set up to only heat the pavement during times of snow or ice to reduce the total energy consumption.

The estimated capital cost for the installation of the preferred system option is $1.15M plus HST and the annual operating costs are estimated at $54,000 plus HST.

We ask that the Halifax Regional Municipality review this report and the proposed snowmelt system. Once HRM has reviewed this report and approved an approach, the next step is to start the detailed design.

If you have any questions or require additional information, please feel free contact us.

Thank you,
DesignPoint Engineering & Surveying Ltd.

[redacted]

Glenn Woodford, P.Eng.
Senior Engineer & Principal

cc Ben Young, Southwest Properties Ltd.

SETON RIDGE SNOWMELT STUDY

SOUTHWEST PROPERTIES/DESIGNPOINT ENGINEERING
HALIFAX, NOVA SCOTIA

GMB PROJECT 5-4578
December 14, 2018

GMB ARCHITECTURE + ENGINEERING 85 EAST EIGHTH STREET SUITE 200 HOLLAND MI 49423
P 616.796.0200 F 616.796.0201 E info@gmb.com W www.gmb.com

Executive Summary

A portion of Seton Road has a grade of up to 11.8%. Per the city requirements, the road cannot exceed 8% for bus traffic. To avoid having to regrade the road, it is proposed to install a snowmelt system. This snowmelt system would melt snow and ice to make at safer to drive vehicles up and down Seton Road.

The snowmelt system would include a heat source, glycol pumps, snowmelt piping, and snowmelt tubing. Two options for a heat source are presented for the snowmelt system. One option uses steam from the existing Mount Saint Vincent University (MSVU) heating plant. The other option is to build a dedicated boiler plant for the snowmelt system close to Seton Road.

Advantages of snowmelt systems over traditional snow removal methods include:

- Safer to drive up and down the hilly portion of Seton Road which has the snowmelt system.
- Somewhat reduced maintenance labor, since the heated street would not need plowing.
- Reduces costs of operating and maintaining snow removal equipment.
- Reduces the cost and pollution from deicing chemicals, such as salt or chlorides.
- Eliminates frost heaving of roadways and the associated damage to road surfaces. With snowmelt, the road surfaces usually last longer.

Disadvantages of snowmelt systems:

- Installation cost is relatively high.
- Operating cost is significant.
- Snowmelt tubing installed under street and sidewalk surfaces may be in the way of accessing underground utilities. However the tubing can be removed and reinstalled for underground work.

The opinion of probable installation costs for the proposed snowmelt system for Seton Road approximately $1,240,000 if the heat source is the existing MSVU heating plant. The opinion of installation costs for the proposed snowmelt system is approximately $1,150,000 if the heat source is a dedicated boiler plant.

The operating costs for the proposed snowmelt system would be about $92,000/year if the existing MSVU heating plant is used as the heat source. The operating costs would be about $80,000/year with dedicated boilers fired with natural gas. If manual (operator) controls are used instead of automatic controls and the heat is turned off when the snow is not in the near term forecast, then the operating costs could be reduced by perhaps 30%. This would be about $54,000/year from a dedicated source.

General Description of Snowmelt Systems

A snow and ice melting system, commonly called "snowmelt" is a means to reduce or eliminate snow and ice accumulation using heat. Snowmelt systems are different than traditional snow and ice removal methods. Traditional snow and ice removal methods use deicing chemicals and/or a mechanical method to scrape off the snow/ice. Usually a snow plow scrapes off most of the snow/ice and deicing chemicals, such as rock salt, are spread on the surface to remove the rest of the snow/ice. Snowmelt systems melt the snow as it falls on the surface to water. The water then drains away from the heated surface the same way rain water would drain away from the surface.

Most snowmelt systems use heated water/glycol solution that is circulated below the surfaces through plastic tubing. The tubing warms sand or gravel surrounding the tubing and this heats the surface. With the appropriate design and installation, the surface is adequately heated to a temperature above the freezing point of water. So as the snow falls, it melts to water. How quickly the snow melts, or the "snowmelting performance," depends on the design of the system, the installation, the operating conditions, and most importantly the weather. In general with good snowmelt design, the warmer the circulating water, the better the snowmelting performance. Better performance can mean the ability to melt snow falling at a faster rate, and/or melting at colder temperatures.

General Components of Snowmelt Systems

Snowmelt systems using heated glycol/water antifreeze mixture have the following components. First is a heat source to heat the glycol/water mixture. The heat source is usually a boiler. The heat source for small snowmelt systems is usually a local boiler. Large systems may use heat from a local power plant or district heating system. A system of pumps, piping and manifolds supply the heated glycol/water mixture from the heat source to the snowmelt area containing the tubing. Transmission piping transfer the heated glycol/water mixture from the heat source to the snowmelt areas.

The most important component of snowmelt systems is the plastic tubing under the surfaces. Heated glycol/water mixture is pumped through the tubing which heats the surface to melt the snow. Although usually not considered a component of the snowmelt system, the makeup of the material surrounding the plastic tubing is also important. The material must conduct the heat from the tubing to the surface. Common materials used for snowmelt include concrete, brick pavers with sand bedding, and asphalt with gravel bedding. The last component of a snowmelt system is the controls to adjust the temperature of the heated glycol/water mixture for optimum melting performance.

Typical Street Area with Snowmelt Tubing

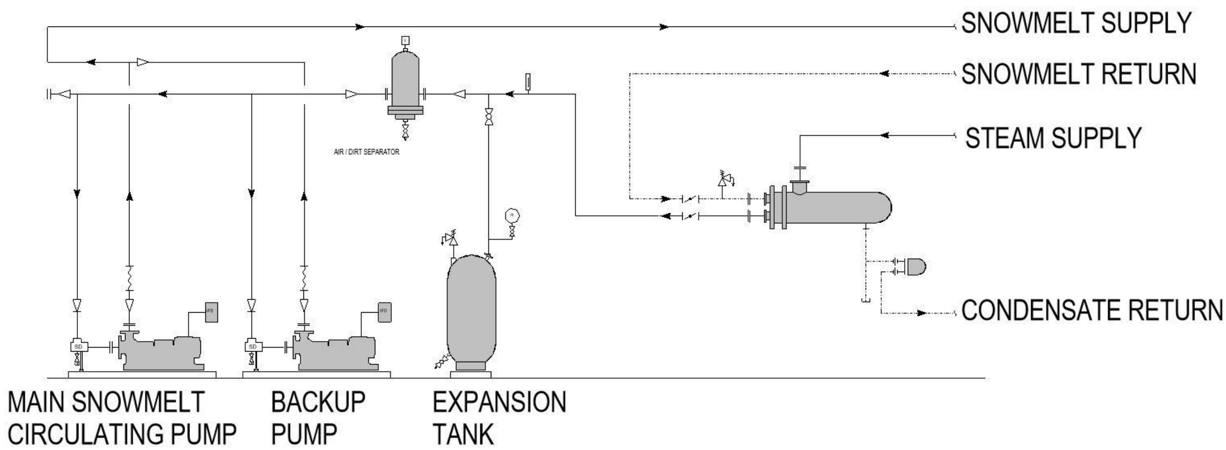
Components of the Proposed Seton Ridge Snowmelt System

The heat energy for the proposed Seton Ridge snowmelt system could come from the two possible sources. One source is the existing Mount Saint Vincent University (MSVU) heating plant. Another possible source of heat could be a dedicated boiler located in a separate building closer to Seton Road.

The MSVU heating plant has three steam boilers (one 200 HP and two 500 HP) that produce steam for heating the university. Steam is produced at 125 psig (862 kPa) and distributed at 85 psig (586 KPa) to the university's buildings. Since only one boiler is operating at a time, excess capacity is available at the MSVU heating plant. The boilers are usually fired with natural gas, but backup fuel oil is used when gas availability is limited and/or gas prices are high.

To use the MSVU heating plant as a source for a snowmelt system, a building addition would have to be built to house the snowmelt hydronic equipment, since there isn't space inside the existing heating plant for the snowmelt equipment. The snowmelt hydronic equipment would include a steam to water/glycol heat exchanger, two pumps, air separator, expansion tank, filter, piping and controls. See the snowmelt system schematic below. Heated water/glycol mixture would be pumped from the heating plant to Seton Road through snowmelt transmission piping. Snowmelt transmission piping is direct buried plastic piping that supplies the heated water/glycol mixture from the heat source to the snowmelt tubing under the street. The distance of this heating plant from the portion of Seton Road having the snowmelt is approximately 280 meters.

The advantage to using the MSVU heating plant is the steam available from the existing boiler system. The disadvantage of using this heating plant is the relatively low efficiency of the steam plant (approximately 75-80%) and the relatively long distance away from Seton Road (~280 meters). See the drawing at the end of this report for the location of the MSVU heating plant with respect to the Seton Road snowmelt areas.



Snowmelt system schematic using steam from MSVU Heating Plant.

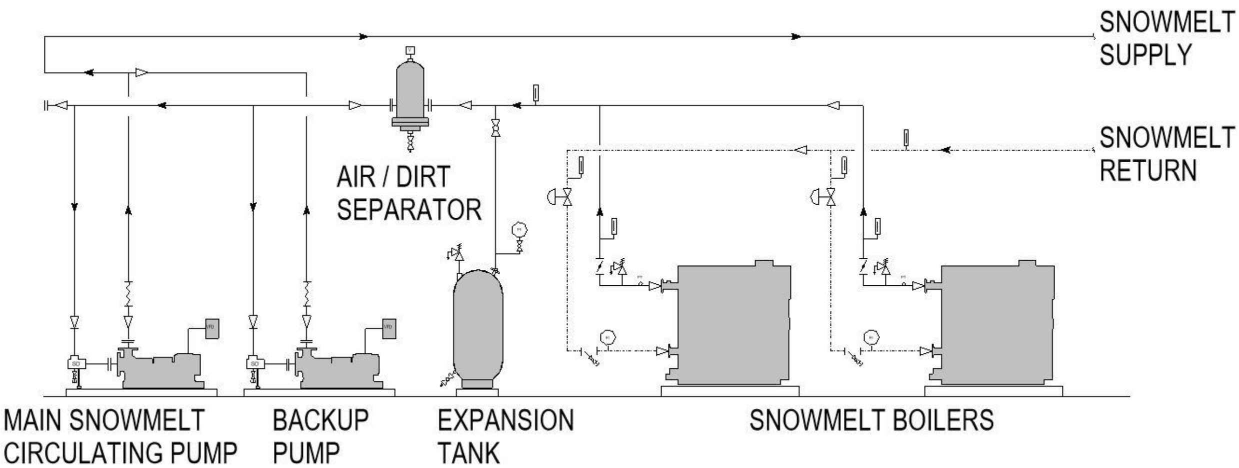
Snowmelt system reliability

To improve reliability of a snowmelt system, back up components are usually included in case a component fails. Back up components include pumps, boilers, control valves, and steam traps. Pump, heat exchanger. or boiler operation can be monitored with instrumentation. If a pump or boiler fails then an alarm is signaled and the back-up pump or boiler automatically starts. When an alarm is triggered an alert can be sent to an operator, whether on site or remotely with a mobile device. Then the operator can check out the equipment to verify the back-up equipment is functioning and initiate repairs on any failed equipment. With the appropriate back-up equipment, controls, and operator response the downtime of a snowmelt system should be minimal. Perhaps only a few hours or minutes per season. With preventative maintenance to components in the off season, it is common for snowmelt systems to run continuously during the winter without an downtime.

Typical snowmelt system mechanical room with heat exchangers and pumps

The alternate source of heat for a snowmelt system is a dedicated boiler system located in a building close to Seton Road. This alternate boiler plant would house the snowmelt equipment; including two boilers, pumps, air separator, expansion tank, filter, piping, and controls. The boilers would use natural gas with propane or fuel oil as a backup. See the basic schematic below with boilers. See the drawing at the end of this report for a possible location of a dedicated boiler plant.

The advantage of installing a dedicated boiler building close to Seton Road, is the reduced length and cost of the snowmelt transmission piping. Also, the efficiency of this dedicated boiler plant would be greater than the MSVU heating plant (80-95% versus 75-80%). The disadvantage of a dedicated boiler building would be additional costs to run the appropriate utilities (natural gas, power, sanitary drain, etc.) to the building. Also the installed cost of new boilers in a dedicated plant would be greater than the installed cost of a heat exchanger in the MSVU heating plant.



Snowmelt system schematic using dedicated boilers

As described above, transmission piping would supply the heated glycol from the heat source to the snowmelt areas under Seton Road. The transmissions mains are typically high density polyethylene (HDPE) piping. This piping is durable enough to withstand the traffic loads if buried 1 meter or deeper below the surface. This piping is welded together so there is little chance of it leaking. See the photo below.


Typical snowmelt transmission mains under street

From a design and operating standpoint, the snowmelt areas under the street would be divided into snowmelt “zones”. Each zone may be about 300 square meters (3250 sqft). At each zone, snowmelt branch piping and manifolds would distribute the heated glycol/water into the snowmelt tubing. In basic terms, manifolds are an assembly of pipe fittings to transfer the hot glycol/water from one set of relatively large supply and return piping to the small snowmelt tubing. In each zone there may be 10-15 loops of snowmelt tubing. The snowmelt tubing size is nominally 19 mm (3/4”) diameter.

For the proposed Seton Ridge snowmelt system, the tubing would be embedded in gravel under the asphalt paving. The asphalt thickness would be about 125 mm (5”) thick.

Typical Snowmelt Tubing Manifold

Example of Snowmelt Tubing Covered with Gravel Prior to Paving

Snowmelt System Operating Conditions

The snowmelt system would operate continuously during the winter season when snow and/or ice are expected. In the Halifax, Nova Scotia area this may be from late November to early April. When snow or ice accumulation is not expected, the system would operate in an "idle mode". During the idle mode the temperature of the heated glycol is set at a lower temperature to conserve energy. Typically the surface temperature may be just near the freezing point of water (0.5°C to 1.7°C) during the idle mode. When accumulation of snow starts falling on the surface, the system would switch to a "melting mode." In the melting mode, the glycol temperature is higher to increase the surface temperature to a point where the snow and/or ice can melt. Typically the surface temperature may be several degrees above the freezing point (4°C to 6°C) during the melting mode. Once the snow event is over and the road dries, the system would switch back to the idle mode. Snowmelt controls can be installed to automatically switch from idle mode to melting mode and back. Automatic predictive control with weather forecasts may improve the performance.

The temperatures of the glycol during the idle mode and melting mode are dependent on the snowmelt design criteria and the climate/weather. There is a wide range of operating temperatures with different snowmelt systems. During melting modes, glycol temperature may be as low as 30°C to as high as 60°C. During the idle mode the glycol temperature may be reduced by 5°C to 20°C below the melting mode temperature. The glycol supply temperatures proposed for the Seton Ridge snowmelt system is 38.9°C (102°F) during the melting mode (for about 400 hours/year); and about 18.3°C (65°F) during the idle mode (for about 2600 hours/year).

One option to reduce the operating costs, is to shut off the heat in the idle mode when the weather is warmer. For example, perhaps the heat can shut off when the outdoor temperature rises above 2°C (35.6°F) and it is not snowing. The number of days or hours that these conditions occur is difficult to predict. If it is assumed out of an approximate 125 day (3000 hour) winter season, there are about 30 days (720 hours) that these conditions occur, then the operating costs can be reduced by about 20%.

Another option would be to not have a heated idle mode at all, but only a melting mode. With this option the pumps would run continuously during the winter as usual, but the heat would only be turned on prior to and during a snow/ice event. Based on an estimate of running the system without idle and 1000 hours per year in melting mode, the operating costs could be reduced by about 32%. This is different than the base case where 400 hours are in melting mode and 2600 hours in idle mode.

Shutting off the snowmelt system heat during warmer weather and/or when it is not snowing will require some manual control by operators. Typical automatic controls (snow/ice sensors and electronic controls) keep the snowmelt system in the idle mode all winter long. And the automatic controls switch to the melting mode when it is snowing. To override these controls an operator would have to turn the system into a manual no-heat mode. Based on a forecast of an upcoming snow or ice storm, the operator would have to switch the system back into the idle or melt mode to get the system heated up. Depending on the weather, the system may have to be turned back into the idle mode a day before the snow event. For faster heat up the system could be manually switched to the melt mode before the snow event. It is suggested the operator have remote access by a mobile device to be able to turn up the heat at any time. Preferably turn the heat on if a weather forecast predicts it will be snowing within 12-24 hours.

Example Street Area with Snowmelt

Advantages of Snowmelt System

They advantages of a snowmelt system compared to traditional snow and ice removal methods are as follows:

- Since the snow and ice is melted, the system should make it safer for vehicles to drive up and down the Seton Road hill. On the hilly street this should reduce the chance of vehicles sliding down the hill; and make it easier for vehicles to drive up and down the hill.
- The existing road at grades up to 11.8% could remain if snowmelt is installed. Otherwise the road would have to be regraded to 8% or less to allow bus traffic per the city requirements.
- Reduces the personnel time to operate snow removal equipment. The snowmelt system can be totally automated, or one operator can spend minimal time operating the system. This is much less than the time it takes to plow the street.
- Somewhat reduces the costs for maintaining snow plows, snow blowers or other mechanical equipment since they will not be used in the areas served by the snowmelt system.
- Eliminates the cost and pollution from deicing chemicals in the areas served by the snowmelt system.

Advantages of Snowmelt System, Continued

- Since they don’t have to deal with the snow and ice, areas with snowmelt general tend to attract people, such as runners, walkers, and visitors, Although hard to quantify, snowmelt has a positive economic impact.
- Eliminates or reduces the amount of frost in the ground under the heated street. This extends the life of asphalt and prevents freezing underground water lines. There is no frost heaving of streets with snowmelt installed under them if the system is kept in the idle mode. If the heat is turned off, then the ground may still freeze, but at a much slower rate. Snowmelt installation includes insulation under the tubing, so this will prevent, or greatly reduce, the chance of the ground freezing.

Disadvantages of Snowmelt System

The disadvantages of snowmelt system are as follows:

- Installation costs of the system, including heating equipment, pumps, transmission piping, and snowmelt tubing.
- The operating costs for energy and pumping the water or water/glycol mixture. Energy costs vary greater on the source of heat.

- Maintenance of snowmelt infrastructure. There are some costs associated with maintaining heating equipment, pumps, and piping. This is usually much less than the maintenance cost for traditional snow removal equipment. Heat exchangers, boilers, and pumps can have a lifetime of 10-40+ years if maintained. Underground transmission piping and snowmelt tubing has a long lifetime of 50-100 years if not disturbed.
- The snowmelt transmission piping and/or tubing may be in the way of access to other underground utilities. But if coordinated during installation, the transmission piping may be installed away from other utilities. Unlike sewer and water lines, the snowmelt transmission piping can be easily routed around other utilities. Snowmelt transmission piping does not need to be sloped like sewer lines; or buried about 1.5-2 meters below the surface to prevent freezing like potable water lines. Also, snowmelt tubing can be cut and repaired relatively easily if access to utilities is necessary below it. If large areas of the asphalt if removed, it is possible to pull up the snowmelt tubing without damaging it so it can reinstalled. For the Seton Ridge project, most of the utilities will not be under the snowmelt portion of the street; but rather along-side the street.
- The heat from snowmelt may cause trees or other plants to bud/bloom earlier in the spring. To prevent this, insulation can be installed around the planters.

Seton Road Snowmelt Areas and Energy Requirements

The snowmelt concept is to install snowmelt tubing under Seton Road from Bedford Highway to approximately station 370. This will include the hill which has up to a 11.8% grade. The street is 9 meters wide from curb to curb. The total proposed snowmelt area is about 340 m x 9 m = 3,060 square meters.

Taking into account the climate and typical snowfall rates, the approximate energy requirements were estimated to melt the snow. These estimates are for melting snow from typical snow events. During typical snow events the snow will melt when it hits the surface and the surface will be wet. During extreme snow events, such as blizzards where the snowfall rates and winds are higher than usual events, the snowmelting performance may suffer. This means that during these extreme events snow may accumulate temporarily on the surface, but it will melt eventually. This temporary snow accumulation could be a water/slushy mixture. Higher (hotter/faster) snowmelting performance could be used, but the energy requirements and costs would be higher.

The estimated thermal energy usage to melt the total 3,375 square meters of snowmelt surface is approximately 33,000 KJ/hr (3,600,000 Btu/hr) during the melting mode based typical snow events, outdoor temperature of -9.4°C (15°F), and 16 km/hour (10 mile/hour) wind. During the idle mode the estimated energy usage is about 75% of the melting energy usage (24,600 KJ/hr, or 2,700,00 Btu/hr). An estimate of electrical energy usage for pumping the heated water or glycol/water mixture continuously during the winter is approximately 32,600 kwhr/year. See the snowmelt loads spreadsheet attached at the end of this report.

Operating Costs

Operating Costs are dependent on the weather and price of fuel. To estimate the operating costs an estimate is needed of the time the system is in the idle mode and the time the system is in the melting mode. The amount and snowfall and the snowfall rate determine the time the system is in the melting mode. The rest of the winter, the system should be in the idle mode. A general estimate for Nova Scotia is approximately 400 hours per year that the system would be in the melting mode. The rest of the winter, or about 2600 hours per year, the system would be in idle mode. Of course the actual hours of snow received varies from year to year.

Using the above basis for hours per year it is snowing, thermal energy costs of various fuels, and electrical energy costs of $0.1559/kwhr, the approximate operating cost options are as follows. See the attached operating costs spreadsheet.

MSVU heating plant: $92,000/year
Dedicated Boiler using natural gas: $80,000/year
Dedicated Boiler using fuel oil: $150,000/year
Dedicated Boiler using propane: $111,000/year

One option to save operating costs, is to turn off the heat for the snowmelt system when the outdoor temperature is above 2°C (35.6°F) and/or it is not snowing. Before a snow event the heat would have to be manually turned on perhaps 8-12 hours day before it starts snowing. With this mode the operating costs are as follows. See the attached cost spreadsheet labeled "Operating Costs w/o Idle for ~30 days". These costs are about 20% less than the above costs with a constant idle mode when it is not snowing.

MSVU heating plant: $74,000/year
Dedicated Boiler using natural gas: $64,000/year
Dedicated Boiler using fuel oil: $121,000/year
Dedicated Boiler using propane: $89,000/year

A second option to save operating costs is to turn off the heat altogether when it is not snowing, despite the outdoor temperature. Before a snow event the heat would have to be manually turned about 12-24 hours before it starts snowing. With this mode the operating costs are as follows. See the attached cost spreadsheet labeled "Operating Costs - No Idle". These costs are about 32% less than the above costs with a constant idle mode when it is not snowing.

MSVU heating plant: $62,000/year
Dedicated Boiler using natural gas: $54,000/year
Dedicated Boiler using fuel oil: $102,000/year
Dedicated Boiler using propane: $76,000/year

Installation Costs

The opinion of probable installation costs include the building, boilers or heat exchangers, pumps & hydronic equipment, transmission piping, and the snowmelt tubing under the street. A breakdown of costs are as follows:

Snowmelt transmission piping, manifolds, and tubing under Seton Road: $235,000
Building addition and equipment using Mount Saint Vincent University (MSVU) heating plant: $664,000
Dedicated boiler plant and equipment for snowmelt system along Seton Road: $593,000

Total approximate cost using MSVU heating plant; including contingency, mobilization, overhead & profit, and detailed engineering: $1,240,000

Total approximate cost using dedicated boiler plant; including contingency, mobilization, overhead & profit, and detailed engineering: $1,150,000

See the attached cost breakdown.

Maintenance Costs

Maintenance costs are relatively low. Maintenance costs would include periodic maintenance of the recirculating pumps, boilers, and filter element replacement. Eventually some components may need cleaning, repair, or replacement, such as heat exchanger, control valves, etc. But these costs are probably several years after the system is started up. Perhaps a maintenance budget of approximately $3,000/year could be allocated.

Design Basis:
-9.4°C (15°F) outside, 16 kph (10 mph) wind
Melting mode: 38.9°C (102°F) water in, 27.8°C (82°F) water out; 5.6°C (42°F) surface
Revised idle mode: 18.3°C (65°F) water in, 7.2°C (45°F) water out; 1.7°C (35°F) surface

Street	Area sq. meters	Area sq. feet	Load KJ/hr	Load Btu/hr	Flow L/sec	Flow GPM
Seton Ridge, Sta. 30 to 370 m	3,060	32,938	3,474,910	3,293,753	21	329

Operating Costs - MSVU heating plant - steam	Idle Mode	Melting Mode	Total
Operating Hours per season, hours/year	2,600	400	3,000
Heating Energy per season, GJ/year	4,633	1,782	6,415
Heating Costs per season, $/year	$ 63,336	$ 24,360	$ 87,696
Pump BHP	12	12	12
kwhr/year	25,637	3,944	29,581
Pumping Costs per season	$ 3,997	$ 615	$ 4,612
Total Annual Operating Costs with MSVU steam	$ 67,333	$ 24,975	**$ 92,308**

Operating Costs - Dedicated boiler w/ gas	Idle Mode	Melting Mode	Total
Operating Hours per season, hours/year	2,600	400	3,000
Heating Energy per season, GJ/year	4,015	1,544	5,560
Heating Costs per season, $/year	$ 54,891	$ 21,112	$ 76,003
Pump BHP	11	11	11
kwhr/year	22,141	3,406	25,548
Pumping Costs per season	$ 3,452	$ 531	$ 3,983
Total Annual Operating Costs with gas	$ 58,343	$ 21,643	**$ 79,986**

Operating Costs - Dedicated boiler w/ Oil	Idle Mode	Melting Mode	Total
Operating Hours per season, hours/year	2,600	400	3,000
Heating Energy per season, GJ/year	4,517	1,737	6,255
Heating Costs per season, $/year	$ 105,001	$ 40,385	$ 145,385
Pump BHP	12	12	12
kwhr/year	25,637	3,944	29,581
Pumping Costs per season	$ 3,997	$ 615	$ 4,612
Total Annual Operating Costs with oil	$ 108,997	$ 41,000	**$ 149,997**

Operating Costs - Dedicated boiler w/ Propane	Idle Mode	Melting Mode	Total
Operating Hours per season, hours/year	2,600	400	3,000
Heating Energy per season, GJ/year	4,015	1,544	5,560
Heating Costs per season, $/year	$ 77,148	$ 29,672	$ 106,820
Pump BHP	11	11	11
kwhr/year	22,141	3,406	25,548
Pumping Costs per season	$ 3,452	$ 531	$ 3,983
Total Annual Operating Costs with propane	$ 80,599	$ 30,203	**$ 110,803**

Natural Gas Cost, $/GJ (Rate Class 2)	$ 13.670	1,000	MJ/GJ	$6,756
Fuel Oil Cost, $/liter	$ 0.89	38.29	MJ/liter	Gas sve charge
Propane Fuel Cost, $/liter	$ 0.49	25.50	MJ/liter	
MSVU Steam plant efficiency	78%			
Dedicated boiler efficiency - gas or propane	90%			
Dedicated boiler efficiency - fuel oil	80%			
Motor/drive efficiency	93%			
Electricity Costs, $/kwhr	0.1559			

Design Basis:
-9.4°C (15°F) outside, 16 kph (10 mph) wind
1136 KJ/sqmeter-hr (100 Btu/sqft-hr) @152mm (6") OC, 38.9°C (102°F) water in, 27.8°C (82°F) water out; 5.6°C (42°F) surface
Revised idle mode: 454 KJ/sqmeter-hr (40 Btu/sqft-hr) @152mm (6") OC, 18.3°C (65°F) water in, 7.2°C (45°F) water out; 1.7°C (35°F) surface

Street	**Area sq. meters**	**Area sq. feet**	**Load KJ/hr**	**Load Btu/hr**	**Flow L/sec**	**Flow GPM**
Seton Ridge, Sta. 30 to 370 m	3,060	32,938	3,474,910	3,293,753	21	329

Operating Costs - MSVU heating plant - steam	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	1,900	400	2,300
Heating Energy per season, GJ/year	3,386	1,782	5,168
Heating Costs per season, $/year	$ 46,284	$ 24,360	$ 70,644
Pump BHP	12	12	12
kwhr/year	18,735	3,944	22,679
Pumping Costs per season	$ 2,921	$ 615	$ 3,536
Total Annual Operating Costs with MSVU steam	$ 49,205	$ 24,975	**$ 74,180**

Operating Costs - Dedicated boiler w/ gas	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	1,900	400	2,300
Heating Energy per season, GJ/year	2,934	1,544	4,479
Heating Costs per season, $/year	$ 40,113	$ 21,112	$ 61,225
Pump BHP	11	11	11
kwhr/year	16,180	3,406	19,586
Pumping Costs per season	$ 2,522	$ 531	$ 3,054
Total Annual Operating Costs with gas	$ 42,635	$ 21,643	**$ 64,278**

Operating Costs - Dedicated boiler w/ Oil	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	1,900	400	2,300
Heating Energy per season, GJ/year	3,301	1,737	5,039
Heating Costs per season, $/year	$ 76,731	$ 40,385	$ 117,116
Pump BHP	12	12	12
kwhr/year	18,735	3,944	22,679
Pumping Costs per season	$ 2,921	$ 615	$ 3,536
Total Annual Operating Costs with oil	$ 79,652	$ 41,000	**$ 120,652**

Operating Costs - Dedicated boiler w/ Propane	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	1,900	400	2,300
Heating Energy per season, GJ/year	2,934	1,544	4,479
Heating Costs per season, $/year	$ 56,377	$ 29,672	$ 86,049
Pump BHP	11	11	11
kwhr/year	16,180	3,406	19,586
Pumping Costs per season	$ 2,522	$ 531	$ 3,054
Total Annual Operating Costs with propane	$ 58,900	$ 30,203	**$ 89,103**

Natural Gas Cost, $/GJ (Rate Class 2)	$ 13.670	1,000	MJ/GJ	$6,756
Fuel Oil Cost, $/liter	$ 0.89	38.29	MJ/liter	Gas sve charge
Propane Fuel Cost, $/liter	$ 0.49	25.50	MJ/liter	
MSVU Steam plant efficiency	78%			
Dedicated boiler efficiency - gas or propane	90%			
Dedicated boiler efficiency - fuel oil	80%			
Motor/drive efficiency	93%			
Electricity Costs, $/kwhr	0.1559			

Design Basis:
-9.4°C (15°F) outside, 16 kph (10 mph) wind
1136 KJ/sqmeter-hr (100 Btu/sqft-hr) @152mm (6") OC, 38.9°C (102°F) water in, 27.8°C (82°F) water out; 5.6°C (42°F) surface
Revised idle mode: 454 KJ/sqmeter-hr (40 Btu/sqft-hr) @152mm (6") OC, 18.3°C (65°F) water in, 7.2°C (45°F) water out; 1.7°C (35°F) surface

Street	Area sq. meters	Area sq. feet	Load KJ/hr	Load Btu/hr	Flow L/sec	Flow GPM
Seton Ridge, Sta. 30 to 370 m	3,060	32,938	3,474,910	3,293,753	21	329

Operating Costs - MSVU heating plant - steam	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	-	1,000	1,000
Heating Energy per season, GJ/year	-	4,455	4,455
Heating Costs per season, $/year	$ -	$ 60,900	$ 60,900
Pump BHP	12	12	12
kwhr/year	-	9,860	9,860
Pumping Costs per season	$ -	$ 1,537	$ 1,537
Total Annual Operating Costs with MSVU steam	$ -	$ 62,437	**$ 62,437**

Operating Costs - Dedicated boiler w/ gas	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	-	1,000	1,000
Heating Energy per season, GJ/year	-	3,861	3,861
Heating Costs per season, $/year	$ -	$ 52,780	$ 52,780
Pump BHP	11	11	11
kwhr/year	-	8,516	8,516
Pumping Costs per season	$ -	$ 1,328	$ 1,328
Total Annual Operating Costs with gas	$ -	$ 54,108	**$ 54,108**

Operating Costs - Dedicated boiler w/ Oil	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	-	1,000	1,000
Heating Energy per season, GJ/year	-	4,344	4,344
Heating Costs per season, $/year	$ -	$ 100,962	$ 100,962
Pump BHP	12	12	12
kwhr/year	-	9,860	9,860
Pumping Costs per season	$ -	$ 1,537	$ 1,537
Total Annual Operating Costs with oil	$ -	$ 102,499	**$ 102,499**

Operating Costs - Dedicated boiler w/ Propane	Idle Mode*	Melting Mode	Total
Operating Hours per season, hours/year	-	1,000	1,000
Heating Energy per season, GJ/year	-	3,861	3,861
Heating Costs per season, $/year	$ -	$ 74,180	$ 74,180
Pump BHP	11	11	11
kwhr/year	-	8,516	8,516
Pumping Costs per season	$ -	$ 1,328	$ 1,328
Total Annual Operating Costs with propane	$ -	$ 75,508	**$ 75,508**

Natural Gas Cost, $/GJ (Rate Class 2)	$ 13.670	1,000 MJ/GJ	$6,756
Fuel Oil Cost, $/liter	$ 0.89	38.29 MJ/liter	Gas sve charge
Propane Fuel Cost, $/liter	$ 0.49	25.50 MJ/liter	
MSVU Steam plant efficiency	78%		
Dedicated boiler efficiency - gas or propane	90%		
Dedicated boiler efficiency - fuel oil	80%		
Motor/drive efficiency	93%		
Electricity Costs, $/kwhr	0.1559		

Item	Quantity	Unit	Unit Cost	Unit Total
			CAN $	CAN $
Seton Road Snowmelt Area				
6" HDPE piping under Seton Road	740	Meters	102	75,682
3" HDPE piping	216	Meters	27	5,891
6" DR 11 HDPE 90 deg. elbow	4	Each	239	955
6"x3" reducing tees DR 11 HDPE	22	Each	300	6,600
3", 45 deg HDPE elbow	22	Each	143	3,150
3" HPDE flange adapter	22	Each	102	2,250
48"x30" valve box with 3" valves & manifold	11	Each	8,864	97,500
PEX snowmelt tubing, 6" O.C.	3060	sq meters	11	34,216
Insulation under tubing, 2" foam	3060	sq meters	2.3	7,094
Mesh to tie down tubing	3060	sq meters	0.8	2,504
Subtotal Seton Road Snowmelt Area				**$235,841**
MSVU Heating Plant as heat source				
Building addition, 5m x 10m	50	sq meters	2,202	110,086
Steam to glycol heat exchanger w/ steam & cond drops	1	Each	75,000	75,000
Snowmelt pumps, centrifugal, 20 HP w/ pipe drops	2	Each	40,909	81,818
Air separator, 6"	1	Each	6,000	6,000
Expansion Tank, ~200 gallon acceptance, bladder type	1	Each	11,455	11,455
Glycol filter, stainless cartridge type, ~15 gpm side stream	1	Each	4,091	4,091
Glycol fill tank & pump, 100 gallon	1	Each	6,818	6,818
Equipment installation	10	%	18,518	18,518
Steam piping, 3" steel	30	Meters	335.5	10,064
Condensate piping, 2.1/2" steel	30	Meters	313.1	9,393
Snowmelt piping, 6" steel	30	Meters	581	17,444
Steam control regulator, control valve, traps	1	Allowance	20,455	20,455
6" HDPE piping from MSVU heating plant	560	Meters	335	187,855
6" DR 11 HDPE 90 deg. elbow	2	Each	239	477
6", 45 deg HDPE elbow	2	Each	239	477
Insulation under transmission piping, 2" foam	560	sq meters	25	13,974
Pump variable frequency drives, 20 HP	2	Each	8,727	17,455
Power feed to pumps	2	Each	2,045	4,091
Electrical power distribution panel, 575 volt, 100 amp	1	Each	2,727.3	2,727
Building heating & ventilation	1	Allowance	13,636.4	13,636
Controls	1	Allowance	13,636	13,636
Propylene glycol, 40%	10,749	Liters	3.60	38,727
Subtotal MSVU Heating Plant as heat source				**$664,196**

Item	Quantity	Unit	Unit Cost	Unit Total
Dedicated Boiler Plant for Snowmelt System			**CAN $**	**CAN $**
Building, 5m x 10m	50	sq meters	2,202	110,086
Boilers, condensing type, 3.6 MMBH output, gas & propane	2	Each	102,273	204,545
Snowmelt pumps, centrifugal, 20 HP w/ pipe drops	2	Each	40,909	81,818
Air separator, 6"	1	Each	6,000	6,000
Expansion Tank, ~200 gallon acceptance, bladder type	1	Each	11,455	11,455
Glycol filter, stainless cartridge type, ~15 gpm side stream	1	Each	4,091	4,091
Glycol fill tank & pump, 100 gallon	1	Each	6,818	6,818
Equipment installation	10	%	31,473	31,473
Boiler piping, 6" steel	15	Meters	581.5	8,722
Snowmelt piping, 6" steel	30	Meters	581.5	17,444
Gas service & piping to boilers	1	Allowance	6,818	6,818
6" HDPE piping from boiler plant	50	Meters	335	16,773
Insulation under transmission piping, 2" foam	50	sq meters	25	1,248
Pump variable frequency drives, 20 HP	2	Each	8,727	17,455
Power feed to pumps	2	Each	2,045	4,091
Electrical feed & power distribution panel, 575 volt,100 amp	1	Each	9,545	9,545
Building heating & ventilation	1	Allowance	13,636	13,636
Controls	1	Allowance	13,636	13,636
Propylene glycol, 40%	7,721	Liters	3.60	27,818
Subtotal Dedicated Boiler Plant for Snowmelt System				**$593,472**
Subtotal using MSVU Heating Plant				**$ 900,037**
Contingency	15	%		128,577
Detailed Engineering for snowmelt				71,429
Contractor Mobilization	10	%		85,718
Contractor Overhead and Profit	6	%		51,431
Total using MSVU Heat Plant				**$1,237,191**
Subtotal using Dedicated Boiler Plant				**$ 829,313**
Contingency	15	%		118,473
Detailed Engineering for snowmelt				71,429
Contractor Mobilization	10	%		78,982
Contractor Overhead and Profit	6	%		47,389
Total using Dedicated Boiler Plant				**$1,145,586**

Costs do not include gravel base, concrete, asphalt, landscaping and other civil items.

Regional cost factor 1.05

US $ to CAN $ exchange rate $ 0.77