

# SNOWMELT ALTERNATIVES REVIEW

FEBRUARY 11, 2020

PICTURE TAKEN WHILE SIMS UNIT 3 WAS OPERATIONAL (1/19/19)





## DESIGN CRITERIA

- 126,000 square feet total of PEX tubing.
  - 79,000 square feet of streets.
  - 47,000 square feet of sidewalks.
- Energy Load for existing snowmelt area = 11 mmBtu/hr.
- Snowmelt supply water temperature is 100-110°F for 'melting mode' with a return temperature of 90°F.
- Heat loss (temperature drop) from the pump house to downtown is minimal due to insulation installed over the transmission mains and the insulating factor of the transmission main piping itself. GMB estimated that losses are less than 1%.
- Circulating 1,100 gallons of water per minute at 60 psi.
- Heating Loads are designed for 15°F outdoor temperature and a 10 mph wind. (GMB email to City Director of Public Works dated 1/21/2013).

Note: Picture taken while unit 3 was operational (3/5/2019).



## WHY ARE SIDEWALKS CLEAR BUT NOT STREETS?

- Design snowmelt heating loads is 100 Btu/sqft-hr for the sidewalks and 80 Btu/sqft-hr for the streets.
- Higher heating load for sidewalks was selected for safety reasons (pedestrian slips on ice). This design reduces the energy needs, instead of overheating all the areas.
- Picture taken on 11/26/2018 when auxiliary boiler was providing 140°F water supply. Note snow accumulation on streets but not sidewalks.





# COMPARISON OF WASHINGTON TO COLUMBUS

PICTURE TAKEN WHILE SIMS UNIT 3 WAS OPERATIONAL (11/12/19)



# COMPARISON OF WASHINGTON STREET TO SECOND STREET

PICTURE TAKEN WHILE UNIT 3 WAS OPERATIONAL (11/7/2019)

## EVALUATIONS CONDUCTED

- 2/13/2012: *Email from GMB.*
  - Data correlating the surface temperature necessary to melt snow falling at certain rates is not available directly.
  - There is limited data on what snowfall rates are expected from climatic and weather databases.
  - There are only guidelines on what snowmelt heating loads in Btu/sqft-hr are recommended based on climatic data.
  - Range of heating loads recommended varies “widely”, just as weather (snowfall) varies widely.
  
- 3/21/2013: *Proposal received from GMB to conduct Supplemental/Redundant Heating Source Analysis*
  - System was not originally designed with a redundant heat source.
  - Unit 3 had tripped causing a loss of all heat to the downtown snowmelt system.
  - Plant staff creatively solved issue by using auxiliary boiler through deaerator and valving in scrubber reheat section to provide enough heat to keep system from freezing in the event of Unit 3 forced outage.
  - Supplemental/Redundant Heating Source Analysis was not conducted until 2018.

## ■ 7/10/2018: *Study from GMB, Snowmelt System Alternate Energy Source Study*

- Evaluate alternative forms of heating streets and sidewalks.
  - Gas-fired Boilers – ‘least expensive and easiest to install for providing heat energy.’
  - Combined Heat and Power –concluded that ‘CHP’s systems cost significantly more than standard gas boilers.’
  - Heat Pumps – Heat pump system would need a source of water at about 40-50°F which is ‘not an inexpensive source of water at this temperature during the winter.’
- Recommendation was three 6,000,000 Btu/hr boilers.
  - Would also need to add additional recirculating pumps, expansion tank, and new controls.
  - Would require a new facility to be built.
- Also, took into account possible future expansion (sidewalks along Harbor Drive) of 7,100 square feet which would require an additional 700,000 Btu/hr and circulate an additional 70 gpm of water.
- Cost if an existing downtown building could be used - **\$1,450,000**
  - Looked at existing Depot building but determined that basement clearance height not adequate.
  - No other sites were identified in the study.
- Cost if new plant would need to be built - **\$2,500,000.**
  - Looked at new building on Harbor Island that would likely require pilings.
- Annual operating costs would be \$166,000/yr. for current system and \$177,000 if system was expanded. Based on \$5.55/mmBtu natural gas costs. Note was added that operating costs were based on average climatic data for western Michigan and can vary greatly from year to year, depending on the weather on how the system is operated.
- Also evaluated filling the system with glycol/water mixture to turn the water and prevent the system from freezing when not in ‘melting mode’ at an estimated cost of \$550,000. However, due to the large volume of glycol needed (61,000 gallons) , the costs would be ‘significant’ and was not recommended.



- **9/20/2018: *GHBLP Staff Presentation, Auxiliary Boiler Presentation to Board of Directors***

- Overview of repairs made to auxiliary boiler since 2015.
- Presented results of condition assessment on the 40 years old boiler conducted by Johnston Boiler.
- Staff informed the Board that they will evaluate if the auxiliary boiler is an acceptable solution during the power supply transition and if not begin evaluating the most cost-effective options to provide for snowmelt during the power supply transition.

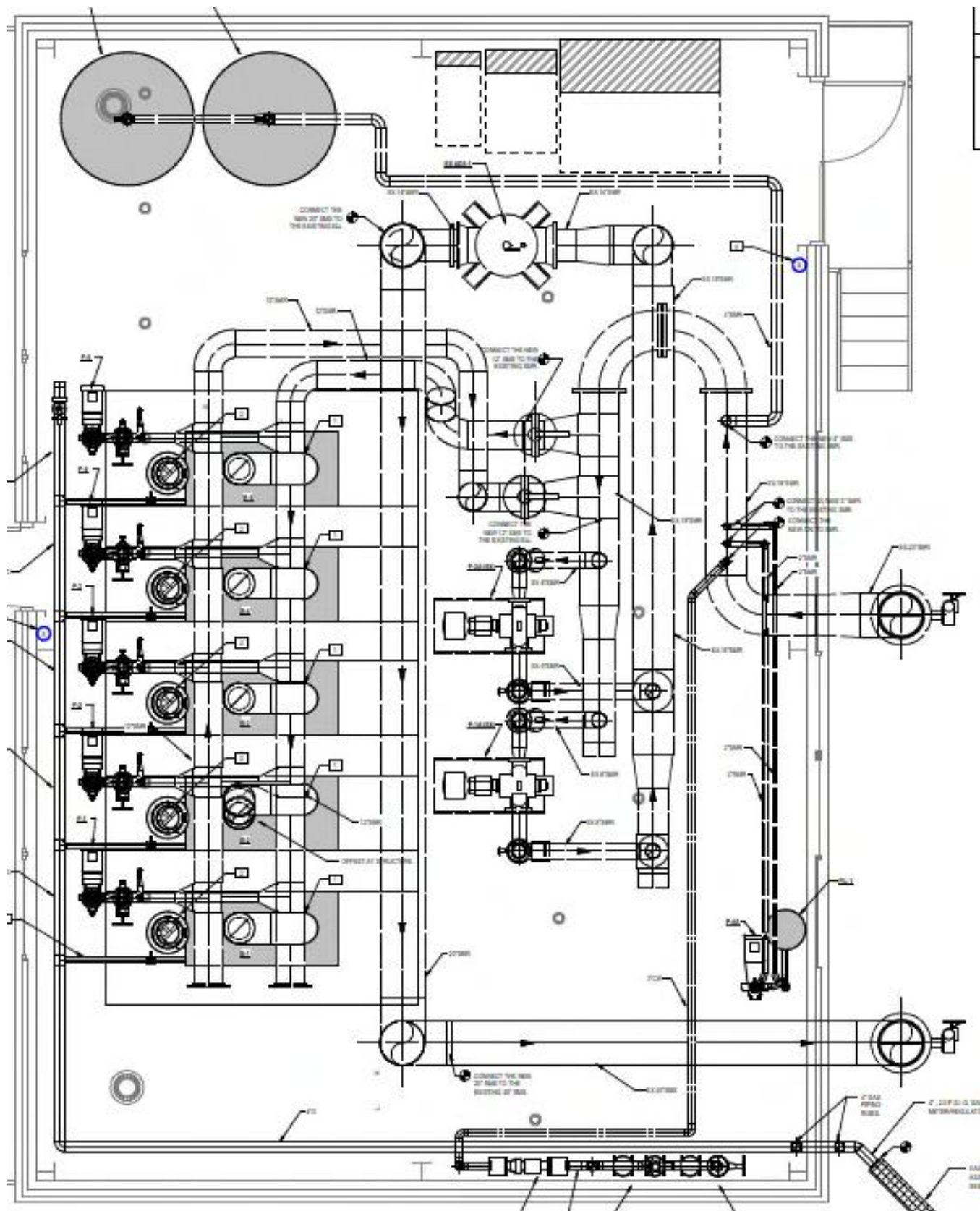
- **6/27/2019: *Burns & McDonnell Presentation, Project Definition Report***

- Re-use existing intake building to save costs (do not include in 2020 demolition plan).
- Install new boilers, boiler pumps, and auxiliary equipment necessary to provide heat during power supply transition.
- Confirm structural integrity of existing building to support added weight.
- If done properly, purchased interim system could be coupled with integrated plant and engine heating once Harbor Island is redeveloped.
- Recommendation was to hire engineering firm to fully develop temporary snowmelt system for installation in 2020.
- Report was provided in October 2019 which outlined the following:
  - Use of auxiliary boiler was ruled out early in the process due to its age, reliability, design, conversion costs, and annual costs to operate.
  - Three medium sized boilers and pumps should be designed with N+1 redundancy.
  - May need to be placed outside of intake structure due to space limitations and weight.
  - Estimated costs = **\$1,242,000**. (relatively close to GMB's estimates).

## PROGRESSIVE AE DESIGN

- Utilize smaller low mass condensing boilers that can fit inside existing snowmelt building to keep installation costs low.
- Smaller boiler size saves 30-50% floor space.
- Break up into smaller units to minimize annual operating costs during idle mode operations.
- N+1 Contingency (for redundancy) can be obtained at a lower cost.
- Small condensing boilers can reach up to 99.3% efficiency with a return water temperature of 60°F.
- Smaller boilers will be cheaper to replace in the future and can be staged to minimize financial impact.
- Will allow for a greater use of existing piping.

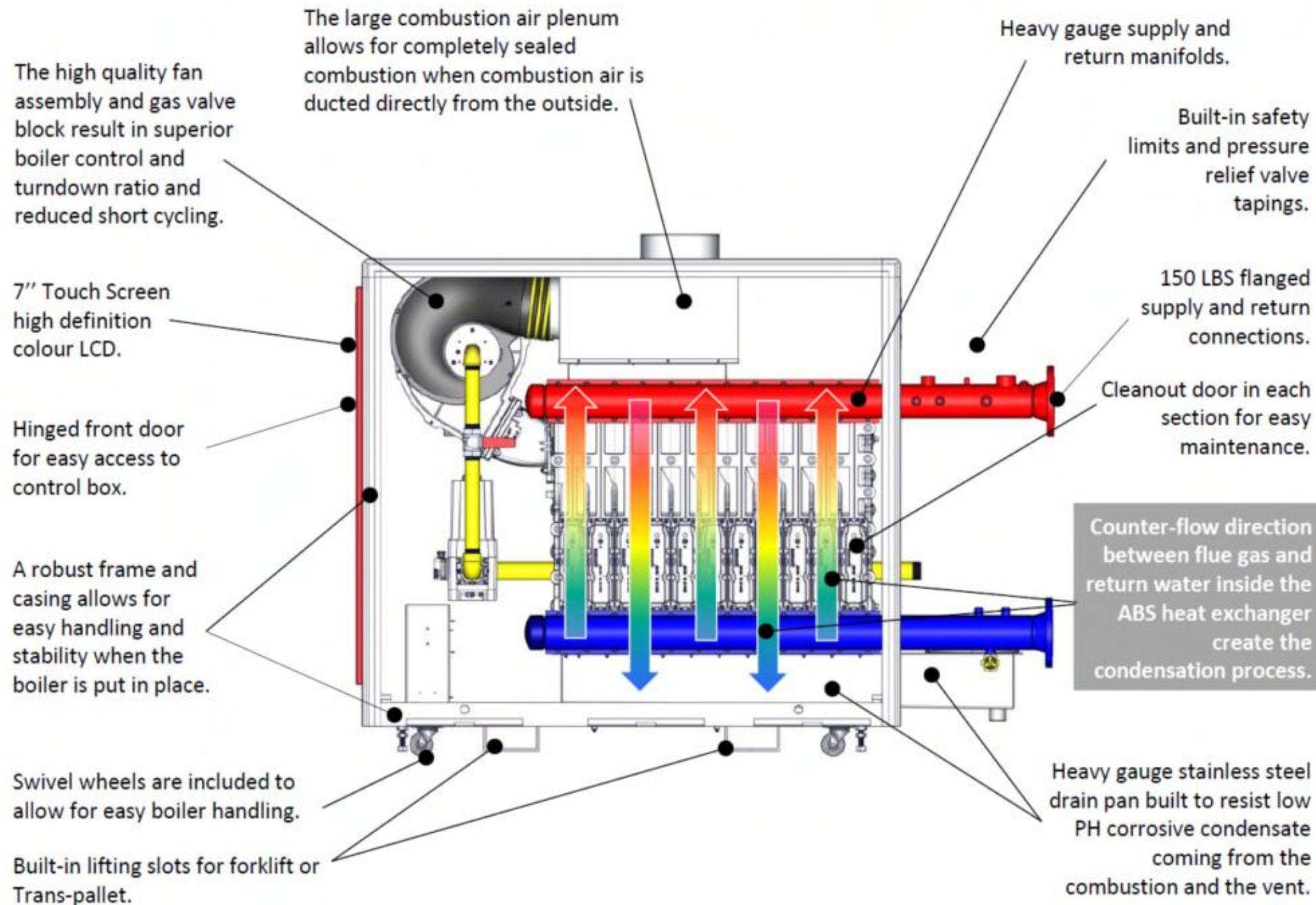




## LAYOUT

- Five – 4 mmBtu/hr Absolute Boilers.
- Pumps equipped with variable frequency drives for each boiler.
- Reuse existing snowmelt supply pumps.
- Reuse existing Air/Dirt Separator.
- Addition of 2 expansion tanks since changing to a closed loop system.
- Install water and gas supply to intake structure.
- City water will supply snowmelt water in future.
- Designed to require minimal new piping installation thus reducing costs.

## Absolute ABS SERIES 1500-2000-2500-3000-4000 Features





## PROJECT WAS COMPETITIVELY BID

- Project was competitively bid out with construction costs ranging from \$953,385 - \$1,308,400.
  - Excluding costs to install water and gas lines.
  - Those costs were very similar to estimated costs provided by both GMB and Burns & McDonnell.
- Labor costs were a significant amount in proposals received.
- Some design changes can be made to reduce costs until a permanent solution is developed on Harbor Island.
- Evaluated modifying the design and performing a greater amount of installation in house considering the following:
  - Design is simplistic in nature and well within capabilities of steam plant maintenance department.
  - GHBLP has a licensed electrician and Instrumentation and Controls Technician on staff that can work with a local electrical contractor to provide power and controls.
  - Only hire out necessary items for welding and boiler license required duties.
  - Will need to work more closely with engineering firm to procure equipment and construct.
- If majority of work is performed in house estimated costs can be reduced substantially.
  - Current engineering estimate is \$750,000.
  - Plus costs to install water and gas lines.



## CONCLUSIONS

- A lot of evaluations have been done over the past two years.
- Multiple engineering firms have evaluated this to ensure we are moving in the right direction.
- The engineered option presents the best solution to continue providing snowmelt to the downtown area both in capital costs and annual operating costs.
- Annual operating costs are estimated to be \$126,000 (based on current gas prices at \$4.50/mmBtu and climatic design data). These prices have been extremely stable over the last couple of years and projections show this number holding steady. However, annual costs will vary greatly based on weather.
- Historical annual operating costs have ranged greatly from as low as \$24,610 (2016-2017 winter) to as high as \$108,445 (2013-2014 winter). The average annual costs to operate and maintain since 2010 has been approximately \$50,500/year.
- Progressive AE design is also supported by the historical evaluations conducted by both GMB and Burns & McDonnell.
- This solution offers the ability to utilize the equipment purchased during this transition in a more permanent fashion once the new facility is constructed and the power supply transition is complete (equipment purchased can be coupled with new facility). This maximizes the value of the investment made during the transition.
- Staff is comfortable performing the work based on the current design to keep installation costs as low as possible.
- The appropriate time was taken to not just pick a solution but work towards the ‘right’ solution for the sustainability of the downtown snowmelt system.

## **RECOMMENDATION**

If Board concurs with this direction, staff will be seeking Board approval for a budgeted amount of \$750,000 during the February 20, 2020 Board meeting.

