Appendix A

City of Peterborough

To:	**Members of the General Committee**
From:	**Patricia Lester** **Commissioner of Corporate and Legislative Services**
Meeting Date:	**August 27, 2018**
Subject:	**Report CLSFM18-021** **Increase to the Pre-commitment of the 2019 Capital Budget for the Peterborough Memorial Centre Ice Pad Replacement**

Purpose

A report to recommend an increase to the pre-commitment of the 2019 Capital Budget for the Peterborough Memorial Centre Ice Pad Replacement.

Recommendation

That Council approve the recommendation outlined in Report CLSFM18-021, dated August 27, 2019 of the Commissioner of Corporate and Legislative Services as follows:

That the pre-committed 2019 Capital Budget for the Peterborough Memorial Centre Ice Pad Replacement be increased by $1,500,000 from $2,000,000 to $3,500,000.

Budget and Financial Implications

The estimated cost of the Peterborough Memorial Centre Ice Pad Replacement is $3,500,000 and includes the budget required to provide consulting services to design, tender and administer the work and the actual construction itself. The cost, net of HST rebate, has been included in the 2019 Draft Capital Budget. Approval of this report will pre-commit that project and allow staff to tender the project in November 2018.

Line	Description	Amount
1	Peterborough Memorial Centre Ice Pad Replacement	$2,310,000
2	Dasher Boards and Glass System	$400,000
3	Design and Contract Administration Fees	$108,000
4	Building Permit Cost	$52,000
5	Abatement Work	$130,000
6	Contingency	$500,000
7	**Total Project Cost**	**$3,500,000**

Background

Summary

The purpose of this report is to provide a comprehensive overview of the deterioration of the self supporting wall and ice slab at the south end of the rink and seek a pre-commitment so the project can be tendered this fall. Staff have taken remedial actions to maintain the structural integrity of the ice rink pad and support structure until the scheduled replacement in June 2019.

History of the Peterborough Memorial Centre floor

The Peterborough Memorial Centre was constructed in 1955 with an ice pad cast on a steel deck. The pad is supported by concrete block foundation walls with a crawl space below. In 1979, a new concrete pad was constructed over the existing pad complete with new refrigeration piping, headers and dasher boards.

In 2009 – 2010 City staff hired a third party consultant to perform Building Condition Audits (BCA's) on most City Facilities. The BCA's detailed all components of a facility and provided a life cycle to each building component and an estimated budget to replace. The Peterborough Memorial Centre's ice slab floor was given a life cycle of 40 years with a scheduled replacement for 2019. The refrigeration plant was given varying life cycles on components, from 25 – 40 years and was originally scheduled for replacement in 2022.

Over the last ten years arena staff have made many concrete repairs to the upper surface of the ice slab at the south end because of deterioration and spalling concrete from the freeze thaw cycle each season. The existing dasher board system was designed to be removable for special events. Due to the concrete deterioration, the dasher board supports at the south end were no longer structurally sound and steel plates were installed and welded to the dasher boards permanently fixing them in place.

In July 2016, arena staff asked for a structural review of the ice rink pad. Staff was considering options to offer different types of events, such as monster trucks. CSE Inc. was hired by the City to investigate and establish the allowable working load limitations of the existing slab. The original construction of the slab is a 5" thick suspended concrete slab cast on a steel deck. The slab is supported along its length by a series of 8" thick concrete block foundation walls, which are spaced at 8'-8" o/c. below the slab is a crawl space. The existing slab was structurally modified in 1979. The structural modifications included the complete removal of all the dasher boards and the complete installation of a new 4 ½" – 5" thick concrete slab (topping) with a hard "trap rock" surface hardener complete with new brine pipes. The new topping was cast on top of the original slab. The existing rink pipes were abandoned, and new PVC pipes were re-routed into the new topping and connected to the brine pipes. The PVC pipes run from south to north and loop back at the north end of the rink to return to the brine headers. Modifications also included building up the perimeter of the slab around the ice pad at various locations. The build-up included non-structural concrete, which has been sloped to achieve the elevation of the new slab.

The inspection in July 2016 found the top surface of the ice slab to be in very good condition. Spalls/cracking was, however, noted at the south end of the slab along its edge at the dasher board locations and around the perimeter edge of the rink slab where staff had made previous repairs. Only the first (south) interior masonry block wall was accessible. In general, the wall was in fair to good condition. There were some minor cracks along the length of the wall, but they did not pose any structural concerns.

On the other hand, the concrete foundation wall below the dasher boards at the south end was found to be in poor condition. Many large cracks were noted along the length of the wall, as well as evidence of severe water leakage and efflorescence. This wall was also severely delaminated, and corrosion/rust and concrete spalls were noted along the complete length of the wall. The condition of this solid concrete foundation wall was of high concern, and the wall would require repairs.

The extent of the visual review of the underside of the slab was limited to the first (south) bay. Overall, the underside of the slab was covered by the steel deck and cork insulation and was not visible. At locations where the deck had corroded and the insulation had peeled off, the condition of the slab was found to be in poor to very poor condition. At some locations the rebar was exposed and visible, and was extremely corroded. The condition of the steel deck varied widely from one area to the next. Some locations of the deck were severely corroded, and there were areas of complete section loss. There were other areas where the deck was in fair condition and was only mildly rusted.

The condition of the ice rink slab and topping was found to be in good condition with the exception of the perimeter foundation wall and adjacent rink slab/topping. Along the south side of the rink, the PVC cooling pipes are fed from the header pipe which penetrates the topping edge. The topping edge coincides with the location of the dasher board anchorage system, and an expansion joint and a thermal break is also present at this location. The slab/topping at this location is exposed to severe freeze-thaw and water penetration exposure which has caused the slab/topping and supporting wall to

become structurally deteriorated. This condition in 2016 was not considered a structural safety concern, but yearly monitoring was to be scheduled and structural rehabilitation repairs to be scheduled in 2018 - 2020.

Based on the information provided in the Report by CSE Inc., City staff were of the opinion that structural repairs were warranted immediately and consulted with TS Engineering (one of the City's consulting firms of record) who also have 20 plus years experience with the Arena design and construction. Initial conversations with TS Engineering indicated the proposed repair work was complicated by the issue that the slab and foundation repairs would also require work on the brine header and piping in the slab. Because the refrigeration lines running through the slab and brine header were approximately 38 years old, it was recommended by the City's Refrigeration Preventive Maintenance Contractor (Cimco) not to perform any repairs, unless staff was prepared to replace the entire concrete slab and in-floor piping inclusive of the brine headers and branch piping. The concern is with the in-floor PVC piping and over time the piping becomes brittle. If the piping were cut and then tried to be reconnected, the coupling fitting inserted into the pipe end would likely split the pipe and the City would have to continue to chase the pipe into the floor to try and make the connections (50 plus) and would be unsuccessful and would need to make major floor repairs.

In consideration of the above, staff presented Report CPPS17-008 to Council and it was approved on March 6, 2017. The report identified issues with the various roofs, HVAC equipment and the need for the replacement of the Ice Rink Pad in 2018 (Attachment 1 – Report CPPS17-008).

Impact on Major Tenants

At one point, it was discussed whether the work could be completed in the summer of 2018. Staff would design the work and coordinate schedules with the Peterborough Petes and Peterborough Lakers for any disruptions in their 2018 schedules. Staff recommended a premium work schedule of 24/7 to shorten the down time of the Peterborough Memorial Centre and minimize the impact on the Petes and Lakers' schedule. The project was estimated to take approximately 16 weeks with a start date of mid May and completion by the end of August 2018.

This would have required the relocation of the Lakers for the 2018 season, however, the MANN cup could be held in September. It would have affected some early season Petes' events such as their Training Camp and Exhibition games but would not have an impact on their regularly scheduled games. Staff would work with the Petes and Lakers to find alternate facilities to accommodate their needs. Council asked that City staff meet with the Lakers, Petes and the Agricultural Society to discuss options and viability of timing to replace the concrete ice slab.

Meetings with Stakeholders

City staff met with the Lakers, Petes and the Agricultural Society on three separate occasions in February and March 2017. Staff presented three options for 2017, 2018 and 2019 with expected construction time lines of 16 weeks, 24/7 if the work was done immediately in 2017. No matter when the work was to be performed, it would require participation from all parties to facilitate this work and would provide disruption to schedules and/or entire seasons for the Lakers, summer exhibition of the Agricultural Society and the Petes.

It was agreed by the Lakers and Petes that 2017 could not be accommodated due to the immediate timing and schedules already in place. It was also decided that 2018 was not a viable option because, if the Petes were to go all the way in the playoffs, construction would not be able to start until mid to late May and the construction schedule would not be complete in time to play the MANN Cup.

It was agreed to by all parties, that the work would be done in 2019 and the start date for the project would be immediately after the end of the Petes 2018–2019 season. Consequently staff came to Council with Report CPPS17-015 as this would require the Lakers' 2019 season to be played at another venue and staff agreed to work directly with the Lakers to find a viable option within the City of Peterborough.

It was also suggested that a monthly structural review of the ice pad slab at the south end of the rink be performed and that a written report complete with photographs be provided to the Lakers and the Petes monthly, to reassure everyone, there are no immediate concerns. If at any time the concrete pad became structurally unstable, City staff agreed to inform all parties and immediately start the construction process to replace the slab and refrigeration lines.

It was also agreed by all parties, that if the ice pad refrigeration system was to fail prior to its replacement in 2019, that a temporary ice surface would be installed to allow the completion of the Petes then current season and immediate replacement would be done. It was understood that this could then affect the 2018 season for everyone if this failure was to occur. In providing this temporary ice pad option the City would pre-purchase long lead time equipment and have them available if needed.

Pre-commitment Report to Council

Report CPPS17-015 was approved by Council on April 25, 2017 (Attachment 2). Council pre-committed $2,000,000 in the 2019 capital budget for the replacement of the ice pad in 2019. The purpose of the pre-commitment was to ensure Council's commitment to the major ice pad work in 2019. Although none of the $2.0 million would be incurred prior to 2019, all tenants required a commitment from Council, well in advance, due to the complex re-scheduling and pre-planning that is required.

2019 Ice Rink Pad Replacement Budget

The 2017 Capital Budget pre-commitment request of $2,000,000 was a high level estimate of the construction cost to serve as a 2019 Capital Budget placeholder. City staff has been working with TS Engineering Inc. since late 2017 to create a design and construction schedule for the Ice Pad Replacement. The design is 80% complete and a formal Class C cost estimate has been performed by the Cost Consultant A.W. Hooker. The estimated construction cost inclusive of design/contract administration and permit fees, abatement remediation and contingency is $3,500,000.

The increase in the construction budget is due partially to various unknowns when staff and the consultant estimated the original $2.0 million. Also increased construction costs of 6%-10% per year ($400,000), added contingency of ($500,000) in case the outer perimeter foundation wall requires repairs and or replacement (foundation wall is not visible until the floor is removed), permit and abatement costs ($182,000) and additional design requirements. City staff worked closely with the design team to control the budget and ensure the requested budget increase is sufficient to complete the project and allow for any possible unknowns.

Monthly Structural Review Reports

City staff hired CSE Inc. to perform monthly structural reviews of the south supporting wall and ice slab at the south end of the rink. The purpose of the reviews was to provide a structural professional opinion on the existing condition of the Wall at the present time and to monitor for any further deterioration of the Wall in the future. Subsequent monthly reviews would be scheduled to document any changes to the existing wall structure. The scope of work for the monthly reviews is defined as follows:

- Visit the site to perform a visual survey of the Wall to identify areas of concern (i.e. cracks, water staining and efflorescence);
- Install tell-tale crack monitors at significant cracks and record initial reading;
- Perform a delamination survey (sounding) on the concrete surface, on both the north and south face of the Wall, and record the limits of delaminated concrete;
- Prepare a report that summarizes the conditions found.

Copies of all monthly reports have been provided to the Petes and Lakers.

Report #1, June 23, 2017

The monthly reviews started in June 2017. During the initial site visit, CSE Inc. cleared and removed all existing debris from the header trench and installed drop sheets to provide a better understanding of the amount of debris that would continue to fall over the coming months and allow for better photographs and documentation of the debris (Attachment 3). The initial monthly findings are as follows:

- A complete visual survey of the South Wall was performed (as visually accessible) to document any significant concerns

- The review revealed that two wide cracks and one medium crack were present along the length of the wall. At each of these locations, tell-tale crack monitors were installed. The initial readings of the tell-tales were recorded and photographs were taken to document the current conditions
- Evidence of severe water leakage and efflorescence was typically noted along the length of the wall
- A large area of hollow sounding concrete was identified along the complete length of the wall. The majority of the delaminations were found along the top portion of the wall, on both the interior and exterior faces. Typically the top 12" of the wall was found to be severely delaminated. In many locations the area of delaminated concrete extended down towards the base of the wall

Report #3, August 31, 2017

- A hammer tap (which is performed by tapping a small hammer on the surface of the concrete and listening to sounds to detect near surface delimitations) was conducted around the perimeter of the previously noted delaminated areas. In general, there was no noticeable increase in the area of delaminated concrete
- There was a significant increase in the amount of debris in the header trench tunnel at the east end. This is the location of the Zamboni path above. The vibrations from the travelling equipment above caused loose pieces of the concrete wall and/or slab to dislodge
- No additional cork or deck loss was observed and there was no further concrete deterioration of the slab underside in the first bay. Please note that the slab and steel deck had started to freeze over due to the flooding of the ice rink, therefore some areas were not visible
- Based on the observed concrete debris on the ground, CSE Inc. was of the opinion that some localized shoring should be designed and installed along the Zamboni path between the storage area and the ice rink

Report #5, October 29, 2017

- There were no noticeable increases in the amount of debris in the header trench tunnel, with the exception of a few large concrete spalls on the floor at the west end of the wall

Report #7, December 20, 2017

- There was a small increase in the amount of concrete debris in the header trench tunnel since the previous review in November. Since the monthly reviews commenced, a significant amount of debris has accumulated in the header trench tunnel
- CSE Inc. recommended again that steel shoring be designed and installed in the header trench at the earliest convenience as a precautionary measure

Report #9, March 23, 2018

- A hammer tap was conducted around the perimeter of the previously noted delaminated areas on both the north and the south faces of the wall. The review revealed that there had been an increase in the area of delaminated concrete since the initial investigation
- The amount of fallen debris in the header trench was continuing to grow. Since the monthly reviews commenced in June 2017, a significant amount of debris had accumulated in the header trench tunnel. The source of the debris is the original slab that has been overlaid by the newer slab on top
- Overall, the reviews had revealed that the deterioration of the wall is progressing

Report #11, May 9, 2018

- A hammer tap was conducted around the perimeter of the previously noted delaminated areas on the south (outside) face of the wall. There has been a significant increase in the area of delaminations since the initial investigation in June 2017
- Since the previous site review on March 23, 2018, there has been a notable increase in the accumulation of debris on the header trench floor
- The top of the concrete wall was reviewed since the previous build-up of ice was gone and it revealed that there was significant deterioration and loose concrete at the top of the wall. CSE Inc. believes this to be the result of frost damage
- CSE Inc. scheduled a more detailed review of the south wall to determine the extent of frost damage and appropriate remedial measures.

Report #12, June 1, 2018

- A hammer tap was conducted around the perimeter of the previously noted delaminated areas on the south (outside) face of the wall. Since the monthly reviews commenced there had been continuous growth of the area of delaminated concrete
- A chipping hammer was used to determine the thickness of frost damaged concrete on both the inside and outside face of the south wall. The investigation revealed that in general there was 2-3 inches of damaged concrete on both faces of the 8 inch thick wall (top of wall). The damaged concrete was observed to be loose and disintegrated easily.
- Based on the results of the investigation and the safety concern of the continued use of the rink slab, CSE Inc. is recommending that the first bay north of the header trench be completely backfilled with a blown aggregate material to stabilize the ice rink slab.

One area that did not change over the year was the tell-tale crack monitors. Tell-tale crack monitors are plastic crack gauges used to monitor horizontal or vertical movement across a crack. The bottom plate is transparent and marked with a hairline cursor in the form of a cross. They are typically attached with screws or adhesive and are installed in line with an existing crack to determine any future movement. These were reviewed

monthly to see if there had been any movement and/or crack growth. During the initial 12 month period, no changes in the readings were noted.

July 1, 2018, Structural Updated Report, Comments and Recommendations

In June 2018, City staff asked CSE Inc. to provide an overall update of their findings from the first year of monthly reviews (Attachment 4). As per the information provided in Reports 1 through 12, there has been continued spalling and delamination of concrete. The conditions have continued and the worst concerns are when the ice pad is taken out in April and the entire area thaws out creating severe delamination and spalling.

The condition of the perimeter foundation wall along the south side of the rink where the PVC cooling pipes are fed from the header pipe and penetrate the topping edge is in an advanced state of deterioration and continues to deteriorate. CSE Inc. has requested that the south wall needs to be shored/replaced prior to the next ice season.

CSE Inc.'s understanding is that the complete ice rink will be replaced in 2019 and they provided the following recommendations for the time between now and then:

- Continue to monitor the south wall and Zamboni path slab on a monthly basis for any signs of significant movement.
- Install shoring along the Zamboni path, as deemed possible. Significant interferences are present along this path due to the trench header pipes.
- Install shoring for the section of ice rink that is supported by the south wall. This shoring will need to be installed in the interior between the south wall and first intermediate masonry wall. The shoring being recommended is to fill the first cavity completely with a self-compacting backfill. Although it will not be possible to attain full bearing with the slab's underside, the backfill will provide the required shoring to prevent any significant collapse of the rink slab and any associated Health and Safety concerns.

In mid August 2018, City staff completed all suggested remedial measures recommended by CSE Inc. to ensure no disruptions to the 2018/2019 Petes' hockey season and to maintain the structural integrity of the ice rink pad and support structure until the scheduled replacement in June 2019. This included the shoring and the first bay north of the header trench being completely backfilled with a blown aggregate material to stabilize the ice rink slab.

Proposed Construction Schedule

The original 2017 schedule was an accelerated schedule to perform the Ice Rink Pad Replacement under emergency conditions working 24/7. As part of the recent design, the consultant was requested to create a construction schedule that would allow the work to be performed at extended hours beyond a normal 8 hour work day, but not include for 24/7 premium work. The final agreed upon schedule was a 19 week construction schedule with a 3 week contingency to allow for any unknowns for a total 22 week construction schedule.

High Level Construction Schedule

Task	# of Weeks
Demolition: including mobilization, bleacher removal, demo headers and dasher boards, demo top rink slab, demo bottom rink slab and pan, excavation, demo pier walls and trench wall, demo misc. apron slabs	6.5
Installation of rink slab: including perimeter foundation wall prep work; pour new trench wall; rink backfill and drainage system; underfloor heating system; insulation; vapour barrier; cooling floor pipe; chairs and reinforcing	6.5
Cure time and Installation of other elements after floor pour: including dasher boards; trench covers; trench pit; miscellaneous apron slabs; and bleacher install	4.0
Start-up: Including six day controlled pull-down and five days to make ice and general clean up and demobilization for total completion	2.0
Three week contingency	3.0
Total Working Weeks	22.0

City staff created the 22 week schedule to begin June 3, 2019 to allow the Junior Lakers to play their season at the Peterborough Memorial Centre and also host the Laker Classic Tournament. As there is not a predictable end date for the Petes' season and there is a requirement when tendering the project to provide a firm start and end date to the contractor, staff took into account what was practical and what venues could be accommodated at both ends of the schedule.

City staff has confirmed with the Petes, that they are able to start their home season after November 1, 2019, and will continue to meet and work directly with the Lakers to find the best possible option for the 2019 season and will work with the Agricultural Society concerning the 2019 summer exhibition.

Summary

If Council accepts the recommendation contained in this report, staff will proceed with tendering the project in November 2018 with a proposed start date of June 3, 2019 and total completion date of November 1, 2019.

Submitted by

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Attachments
Attachment 1 – Report CPPS17-008, Dated February 27, 2017
Attachment 2 – Report CPPS17-015, Dated April 18, 2017
Attachment 3 – CSE Inc. Report No. 1, June 23, 2017
Attachment 4 – Structural Update Report South Supporting Ice Rink Wall, July 1, 2018