

City of Iqaluit

Preliminary Design Report

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Creekside Village Watermain Replacement

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1. Background

The Creekside Village area of the City of Iqaluit (City) is situated south of the Astro Hill Complex, between the complex and Queen Elizabeth Way. There is an existing watermain that transects this development area, which was installed during the construction of the original row housing units found in this area. In the late 1970's this watermain was extended at Queens Elizabeth Way into an underground network serving the Lower Iqaluit neighbourhood of the City. Thus, the watermain through Creekside Village has served for almost 40 years as an integral part of the water distribution networks serving the City, as it provides service to both Creekside Village and to a significant area south of Queen Elizabeth Way.

The original watermain was principally constructed using asbestos cement (AC), enclosed within metal boxes and protected from freeze with poured in insulation. One notable feature of AC piping is vulnerability to freeze damage due to the brittle nature of the pipe barrel. Over the operating life of this watermain various repairs have taken place. Typically these repairs have taken the form of replacements of sections of the piping with high density polyethylene (HDPE) piping. Performance of these repairs has required opening of the metal enclosures. In some instances these enclosure have become distorted and lost the internal insulation. The remaining sections of AC piping represent an ongoing risk of failure, both due to freeze and mechanical damage.

The City of Iqaluit has commissioned an assessment of the Creekside Village watermain and the design of the rehabilitations identified in the assessment. The following report describes the condition of the existing watermain, evaluates alternative approaches to rehabilitation and identifies issues that must be considered during detailed design.

2. Existing Installation

2.1 Existing Watermain

The Creekside Village watermain initiates in a small metal building adjacent to the Astro Hill Complex. The piping enters the building as 250 mm diameter HDPE and immediately reduces to 200 mm. A relatively recently installed valve is situated on the 200 mm HDPE piping. City staff reports that this valve is functional. This metal building also contains the service connection to a portion of the Astro Hill Complex. It was noted that the service connection is not equipped with an isolation valve. The internal arrangement at this building is depicted in the adjacent photograph.



The 200 mm HDPE watermain extends approximately 40 metres from the metal building to a valve and concrete thrust block. A 45° bend is situated within the thrust block. A pair of repair clamps has been installed on the HDPE piping within 4 metres of the thrust block. The plywood enclosure surrounding the valve is in an advanced state of deterioration leaving the valve poorly enclosed and at risk of freeze and vandalism. This valve is currently not essential for operational reasons, as this function can be provided by the valve situated upstream in the metal building. Photographs below depict the arrangement in the vicinity of the thrust block.



The watermain extends beyond the thrust block within a metal enclosure. Access into the metal enclosure between the thrust block and the northern most row house block was very limited due to snow cover over the enclosure. The metal enclosure within 9 meters of the thrust block has been repaired with a wooden cover. City staff opened this wooden cover, which provided the opportunity to determine that the piping near the thrust block is 200 mm iron pipe.

Near the northern most row housing unit there was an opportunity to for City staff to open the metal enclosure. The presence of AC piping was confirmed at this location. A sample of the insulation was taken at this location. It was noted that the much of the pipe diameter was not protected by insulation at this location. It was also noted that the AC piping no longer aligned with the centreline of the enclosure. The adjacent photograph 4 depicts conditions at this location. A sample of the insulation was captured at this location, and an analysis of this insulation is currently being conducted.



It was reported that most of the piping situated between the row housing units is AC. This could not be confirmed as much of the enclosure is covered with gravel and snow. The condition of the metal enclosure, at those locations where the enclosure is visible, supports this report.

A wooden box has been constructed at a location between the pair of row housing units in closest proximity to Queen Elizabeth Way. It was reported by City staff, that this box was installed to protect a transition from AC to HDPE piping. It was further reported that the piping between this point and the metal shelter adjacent to Queen Elizabeth Way had been replaced with HDPE piping due to damage by construction equipment. This recent replacement is approximately 38 metres in length. Specific details regarding the method of connection between the AC and HDPE piping were not examined during the site visit as extensive investigations into the wooden box were not felt to be prudent at the time of the visit due to ongoing cold weather conditions. The location of the wooden enclosure is depicted the adjacent photograph.



During the site visit it was confirmed that the piping within the metal shelter at Queen Elizabeth Way is 150 mm diameter HDPE, and that there is a valve within the shelter. The conditions with this metal shelter are depicted in the adjacent photograph.



That section of watermain between the thrust block and the southernmost row housing unit is currently made up of AC and a limited length of iron piping that is not resistant to freeze damage. The insulation within the metal enclosure, which was originally intended to provide freeze protection, is in questionable condition, and it is likely that much of the enclosure is incompletely filled. There is an ongoing potential for further shifting of this piping out of alignment, in part due to a lack resistance to lateral movement due incomplete fill of the insulation fill within the metal enclosure. Lateral displacement of the piping could lead to separation of the couplings on the AC piping. It has also been noted that the valve at the trust block represents vulnerability due to freeze or vandalism.

Based upon the above it is concluded that replacement of the piping between the repair clamp 4 metres uphill from the thrust block and existing transition to HDPE piping at the southernmost pair of row housing units is prudent.

Two sections of the existing piping, as have been described above, have been constructed using HDPE. Both of these sections have been installed relatively recently using materials that are consistent with current practices in Iqaluit. Both of these sections have good potential for retention.

The attached Figure 1 depicts the existing watermain, and the various points referenced above.

2.2 Sewer

The Creekside Village watermain is paralleled, through most of its length by a sanitary sewer. This sewer is contained within a metal enclosure of similar dimension to those for the watermain, and there is typically 10 cm of separation between the watermain and sewer enclosures. This sewer discharges into Manhole 9 at Queen Elizabeth Way. The location of the sewer between the thrust block and the Astro Hill Complex could not be determined in the field.

The sewer provides service to the Astro Hill Complex and the six existing row house building. The scope of the service area for this sewer raises questions regarding ownership and responsibility that the City may choose to investigate.

There have no reports regarding unusual operating challenges with this sewer. There was no specific evidence noted during the site visit if a need for the replacement of the sewer.

3. Infrastructure Improvement Alternatives

3.1 Introduction

An evaluation has been conducted of the potential alternatives for improvements to the watermain piping in Creekside Village. This evaluation has considered potential locations and the scope of improvements.

The potential location for improved infrastructure is constrained by several issues including:

- Connection points to existing infrastructure at the Astro Hill Complex and at Queen Elizabeth Way.
- Connection points to served buildings and the internal plumbing within the buildings.
- Vehicular access to the row housing units.

Water servicing to the row housing units is provided into the mechanical rooms shared by pairs of buildings. These mechanical rooms also provide heating and hot water to the buildings. No practical alternative location for servicing has been identified.

The current location of the water and sewer mains permits vehicle access to all of the row housing units.

Based upon the above considerations it is concluded that rehabilitation or replacement of existing infrastructure should occur along the current alignment. The remaining question that merits consideration is the matter of the scope of improvements.

3.2 Water Distribution Improvements

The following are the potential alternatives regarding the scope of improvements to the water system.

- Replacement of that portion of the water piping between the thrust block and the transition to HDPE piping approximately 60 metres north of Queen Elizabeth Way; or
- Replacement of all of the existing piping from the Astro Hill Complex to Queen Elizabeth Way.

The following comments are provided regarding the alternative or replacement of a portion of the existing piping.

- No improvement in service will be derived from a replacement of the piping between the Astro Hill Complex and the thrust block as the replacement would be constructed with the same diameter and type of piping as is currently in place.
- That section of iron and AC piping between the thrust block and the southernmost row housing unit should be replaced. The existing piping is vulnerable to freeze damage, and the deteriorated condition of the insulation and enclosure enhances this risk.
- There is a potential to increase the piping size between the southernmost row housing unit and Queen Elizabeth Way. This would represent the replacement of the existing 150 mm diameter HDPE piping with 200 mm HDPE piping. The resulting hydraulic improvements would be modest at best as the downstream network was constructed with 150 mm and 100 mm piping.

Regarding the alternative of replacement of all of the existing piping the following comments are provided.

- Replacement of all of the piping will not lead to an improvement in technical performance beyond that provided by partial replacement as described above.

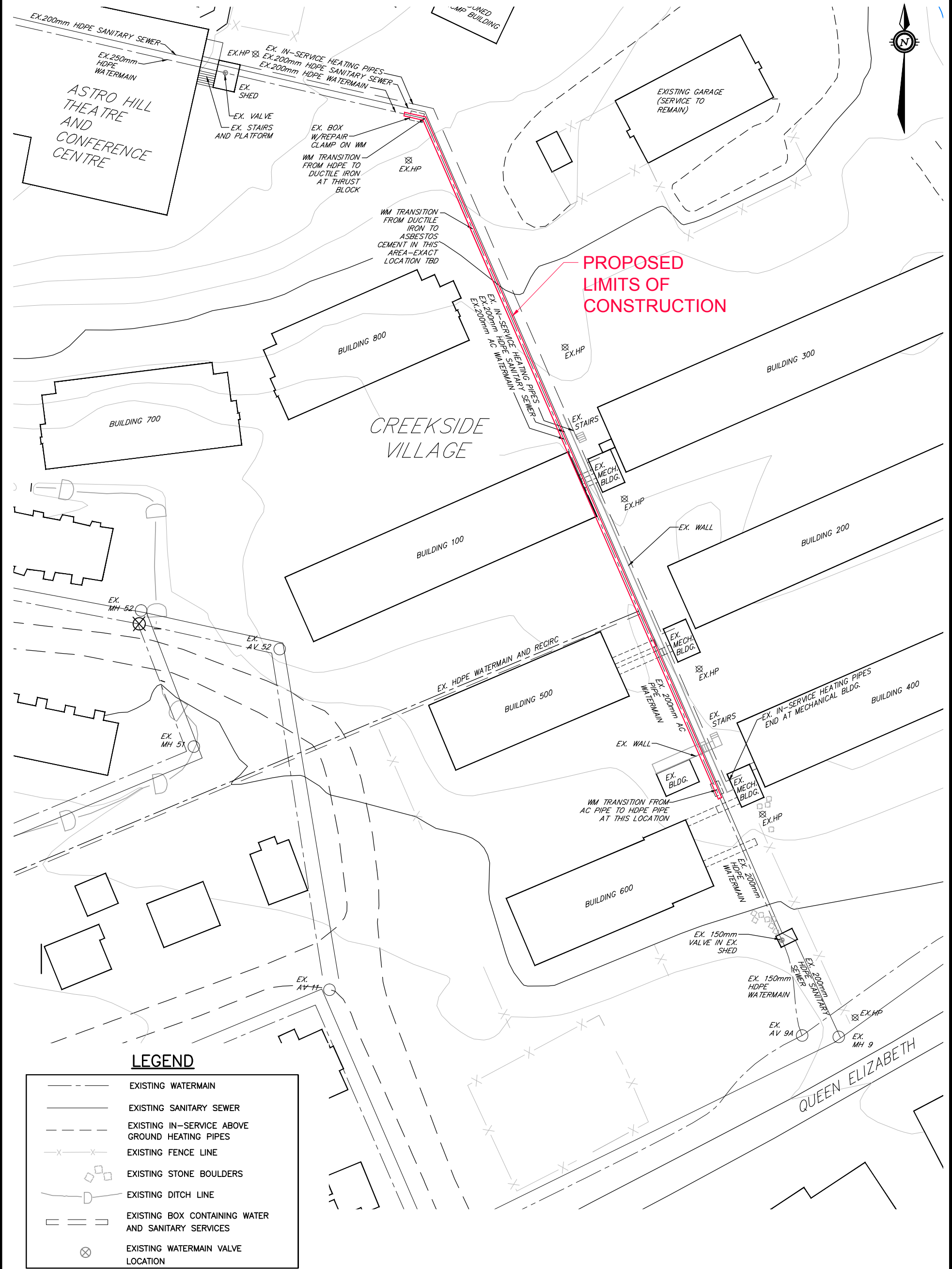
- Replacement of all of the piping will lead to an increase in watermain replacement cost by approximately 20%.


In summary there appear to be no advantages or performance improvements associated with replacement of all of the watermain and higher cost is associated with this alternative. The scope of proposed improvements is depicted on Figure 2.

3.3 Summary

The alternatives of partial or complete replacement of the watermain have been examined. At this juncture replacement of that portion of the watermain between the thrust block and the transition to HDPE piping near the southernmost row housing unit represents a prudent scope.

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4. Design Issues

4.1 Style of Installation

There is the potential of installation of the replacement watermain in either a buried or above-grade configuration. Buried installations carry the advantages of protection from ultraviolet and mechanical damage, while minimizing impacts on future surface uses. In this instance deep burial is not considered viable due to the constrained working space and need to accommodate existing connections. Shallow bury merits consideration. An above ground installation will require protection from ultraviolet and mechanical damage. This can be provided using a metal jacket or metal enclosures that similar to the current installation. The use of metal enclosures is not attractive for several reasons. Provision of new boxes is costly, and rehabilitation of the existing boxes is felt to be very challenging as an accurate scope of the required effort cannot be defined prior to construction. It is also noted that the existing boxes, with their internal piping, have been buried in the vicinity of the row housing units with a shallow layer of gravel as a measure to improve the general appearance of the area.

Following a review of the potential installation alternatives shallow bury is recommended. This may require the importation of some gravel to provide cover over the piping. At the connection points to the row housing units a profile which is similar to the current profile will be required. Attention should be directed towards the maintenance of drainage during the detailed design.

4.2 Hazardous Materials

Most of the piping that is proposed for replacement contains asbestos. Direction regarding the appropriate handling and disposal of this piping material must be incorporated into the construction documents.

A sample of the insulation within the metal enclosures was obtained during the site visit. This sample has been sent for analysis. The findings of this analysis must be incorporated into the construction documents.

4.3 Alignment Adjustments

It is understood that there is a desire on the part of the owners of the Astro Hill Complex to construct an access road in the general location of the existing watermain. This will require a road crossing of both the watermain and the heating piping. Relocation of the watermain in closer proximity to the heating piping would facilitate the construction of the road crossing at the piping. This is relatively easy to accommodate using bends, but the location of the existing sewer should be confirmed prior to finalizing the details of this change in alignment.

4.4 Hydrants

It further understood that property owner is seeking fire hydrants in the general vicinity of the row housing units. Freeze prevention issues require that tee based hydrants be used. Specific design attention will be required for such matters as support of the hydrants, resistance to lateral forces and protection from freeze.

4.5 Service Connections

The existing row housing units are served using 65 mm (2 ½") copper connections. Unfortunately the maximum size of connection that can be accommodated with a standard service saddle on HDPE piping is 50 mm (2"). Provision of services that are larger will require tees, which are normally installed in a permanently accessible location.

4.6 Access Points

Access points should be provided at service connections and hydrants to accommodate valves and fittings in an environment protected from freeze. These access points must be large enough to be usable by operating personnel. Entrance ways into these access points must be resistant against unauthorized access and vandalism. Specific attention on these matters will be required during detailed design, as this requirement has not arisen in the past in Iqaluit.

4.7 Coordination with Building Owner

There are several issues that must be coordinated with the building owner. These include.

- Locations and sized of service connections. These sizes and locations of the existing service connections were captured during the field visit.
- Issues regarding the provision of fire hydrants require some careful consideration. Specific concerns include freeze prevention, housing of valves and resistance to forces that will arise during normal service.
- The location and methods of temporary service must be determined. Information gathered during the field visit indicates that the only opportunities to connect to the buildings are found inside the mechanical rooms.

5. Summary and Recommendations

The findings of the site assessment may be summarized as follows.

1. Approximately 40 metres of the Creekside Village watermain, in proximity to the Astro Hill complex has been replaced with 200 mm diameter pre-insulated HDPE piping. The southernmost 40 metres of this watermain, in the vicinity of Queen Elizabeth Way, has been replaced with 150 mm diameter HDPE piping. The remainder of the watermain is made up from the original piping, the majority of which is AC.
2. Replacement of this watermain, with the exceptions of those sections that have been replaced with HDPE piping is appropriate. This will enhance reliability and reduce the risks associated with sudden and unanticipated pipe failures.

Based upon the above it is recommended that a detailed design for the replacement of the Creekside Village watermain be prepared. Various design details, which are described elsewhere in this report should be considered during the course of this design.