Regional District of
Okanagan-Similkameen

New Sewer Extension to Kaleden From Okanagan Falls

Preliminary Design Report

April 28, 2020

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OQM CERTIFIED

EXECUTIVE SUMMARY

This preliminary design report summarizes findings, conclusions and recommendations for a new sanitary sewer collection and trunk conveyance system for the community of Kaleden, BC.

The preliminary design study was completed in accordance with Terms of Reference for the assignment issued by the Regional District of Okanagan-Similkameen (RDOS) on June 28, 2019.

The Regional District currently has approval for $6.6 million as a grant from the New Building Canada Fund – Small Communities Fund to assist with costs for the design and construction of a sewer system for Kaleden. An additional $3.3 million would be funded from the property owners within the initial sewer service area. We do note that the overall grant amount of $6.6 million would be reduced by about $219,900 to reflect the portion used for the preliminary engineering studies completed in 2018 for a proposed sewer system in the Skaha Estates community located on the east side of Skaha Lake. The table below provide a summary of grant funding and allocations.

SUMMARY OF GRANT FUNDS USED AND AVAILABILITY	2/3 Grant funds provided	Matching 1/3 expense from residents	Total Estimated Eligible Costs associated with the Grant Funding
2017 New Building Canada Grant	$ 6,600,000	$ 3,300,000	$ 9,900,000
2018: Skaha Estates Preliminary Design - Completed	$ 219,900 This expense paid by grant funds	$ 109,900 This expense paid by Rural Projects Area "D" Budget	$ 329,800 Total Cost of Skaha Estates Preliminary Design
2019: Kaleden Preliminary Design	$ 160,500 This expense paid by grant funds	$ 80,300 This expense paid by Rural Projects Area "I" budget	$ 240,800 Total Cost of Kaleden Preliminary Design
Remaining funds associated with the grant for Kaleden detailed design and construction	$ 6,219,600	$ 3,109,800	$ 9,329,400
Note: $9.33M is the amount of the total project that is eligible for grant funding; there will costs incurred that cannot be recovered with the grant called ineligible expenses that will be 100% paid for by the new sewer service area; the estimated total cost for the project is provided in the Preliminary Design Costing Summary of this report			

In advance of the preliminary engineering exercise for the Kaleden area, the RDOS arranged for a planning study to confirm current and future service areas and tributary populations for the sewer system. The results of the planning study are provided as Appendix A of this report.

As noted above, an earlier engineering study completed by Tetra Tech Canada examined the requirements for, and costs associated with a sewer system in the Skaha Estates area on the east side of Skaha Lake. The Tetra Tech report established several unit criteria for the Skaha Estates system (e.g. unit domestic sewage flows, infiltration/inflow allowances) which differ from the current RDOS Subdivision and Development Bylaw No. 2000, 2002. These values were determined in conjunction with the RDOS staff currently preparing an updated Works and Services bylaw. Those unit values have been adopted in our report for the design and operation of the Kaleden system.

The preliminary design engineering work completed for the Kaleden sewer system includes the following:

- Topographic surveys and development of base mapping;
- Geotechnical investigations;
- Environmental assessments;
- Archeological studies;
- Collaboration with Indigenous Peoples;
- Site reconnaissance;
- Structural reviews;
- Downstream capacity analyses;
- Geometric design (linear) and facility design; and
- Consultation with third party utilities.

The Kaleden sanitary system will consist of two main elements, namely;

- A collection system comprised of gravity mains, service connections, a small sewage lift station and force main and, by association, restoration of roads, lanes and other surface features affected by the construction; and
- A main sewage lift station conveying the sewage via a 250 mm diameter force main some five kilometers to a connection point with the Okanagan Falls sewer system. The majority of the force main will be installed within the existing KVR trail.

Figures 1.3 and 1.4 in the report will assist the reader with understanding the location and extent of the proposed works for the Kaleden system.

Following a successful referendum and approval of a borrowing bylaw by the property owners within the new service area (comprised of some 146 properties), the consultant will complete detailed designs for the new works. Public tendering of the project would then follow.

We expect construction would commence around mid-2021 within the collection system service area. Installation of works in Okanagan Falls, including installation of the Cedar Street gravity main, along with construction of the main Kaleden lift station and the installation of the KVR force main, is anticipated to begin in the late summer or early fall of 2021. A detailed construction schedule will be prepared so as to avoid major impacts to the public during the summer months and to keep within the anticipated environmental work windows. The entire project should be completed and fully commissioned by the end of 2022.

Overall costs for the system, including previous preliminary engineering work completed for Skaha Estates, is estimated at **$9,722,000** which includes a 15% contingency. A contingency allowance of fifteen percent is considered standard for a preliminary level study of this nature.

In addition to finalizing borrowing for the project, several key issues will need early resolution. These include:

- Approval from the Province for tenure and to construct works within the KVR trail. Currently applications for approval to the relevant Ministry can take up to a year;
- A number of environmental approvals which may also require a year's time for Ministry approval;
- About 10 (ten) statutory rights-of-way across private property are required in order to accommodate the proposed collection system mains and services. Discussions and negotiations with private property owners can often take considerable time; and
- The RDOS does not currently have approved access points to the KVR trail to accommodate construction equipment and activities. As with the right-of-way acquisitions, working with private property owners to obtain approvals may take considerable time.

The RDOS may wish to consider initiating action on these issues in advance of completing the referendum process, given the potential time delays for approvals. The critical nature and time sensitivity of these issues warrant a proactive and early course of action to prevent significant delays during detailed design or tendering phases of the project.

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1. INTRODUCTION

1.1. Preamble

The Regional District of Okanagan-Similkameen owns and operates the Okanagan Falls sewer collection system and wastewater treatment plant. Since the first Liquid Waste Management Plan was completed in 1989, the community areas of Skaha Estates and Kaleden have been anticipating the addition of a sanitary sewer extension from Okanagan Falls. Several studies were completed over the years to determine the optimal servicing methods for these communities.

In 2016, a New Building Canada Fund – Small Communities Component Grant was submitted for Phase 1 of the Skaha Estates and Kaleden Sewering Project. The funding application was based upon a conceptual report entitled "Kaleden Lakeshore and Skaha Estates Conceptual Sewer Design" prepared by MMM Group. According to RDOS staff, an $8 Million grant application was prepared based on an estimated $12 Million project.

In late March 2017, the RDOS was notified that funding for Phase 1, a community sewer system for the Skaha Estates community, was approved, although the overall value of the grant was reduced to $6.6M for a total funded project of $9.9M. Phase 2 of the overall project, namely a sewer system for the Kaleden community, would hopefully be funded in a future grant program.

The Regional District would need formal approval from the residents of the Skaha Estates community to proceed with the project and, further, to borrow the monies needed to fund the additional $3.3 million required to match the Small Communities Grant of $6.6 Million. Prior to proceeding with a referendum on the borrowing bylaw, the RDOS needed to complete a preliminary engineering design and updated costing for the Skaha Estates sewer project.

Tetra Tech Canada Inc. ("Tetra Tech") was engaged in January 2018 by the RDOS to undertake a preliminary design report, Class B cost estimates and recommendations for the Skaha Estates Sanitary Sewer Extension to Okanagan Falls. The outcome of that preliminary study was the conclusion that bringing sewers along Eastside Road to Skaha Estates would cost closer to $14.2 Million. This amount was financially out of reach for the majority of the Skaha Estates residents as over $8 Million would need to be covered by under 200 properties.

The Regional District was subsequently successful in having the grant monies redirected to the Kaleden Lakeshore service area. The RDOS then undertook a public procurement process to select a consulting firm to complete a preliminary study and cost estimate for the sewering of the Kaleden Lakeshore area (**Figure 1.1**), similar to the preliminary study completed for Skaha Estates. The RDOS ultimately selected Urban Systems Ltd. as the successful candidate firm.

FIGURE 1.1: INITIAL PROPOSED KALEDEN LAKESHORE SERVICE AREA

The terms of reference and scope of work for this assignment are set out in the following documents:

- Urban System's proposal for Engineering Services dated July 24, 2019; and
- Request for Proposals for the New Sewer Extension to Kaleden from Okanagan Falls (RDOS-19-PW-19); dated June 28, 219 including addendum #1.

As with the Skaha Estates initiative, the RDOS first requires completion of a fairly detailed preliminary design, complete with Class 'B' cost estimates. The objective of this preliminary design exercise is to not only verify the viability of the concept laid out by the MMM Group but to confirm that the Kaleden Lakeshore area sewer project can be completed with the grant funds available to the RDOS.

Prior to the start of the preliminary design, the Regional District contracted with CML Project Services Ltd. to determine the magnitude and type of future development within a potentially expanded sewer service area. Urban Systems was retained as a subconsultant by CML Project Services to complete that assessment. This information was critical for sizing and phasing of specific elements of the proposed sewage collection and conveyance systems. The results of this planning work are provided in **Appendix A** of this report.

1.2. Servicing Concept

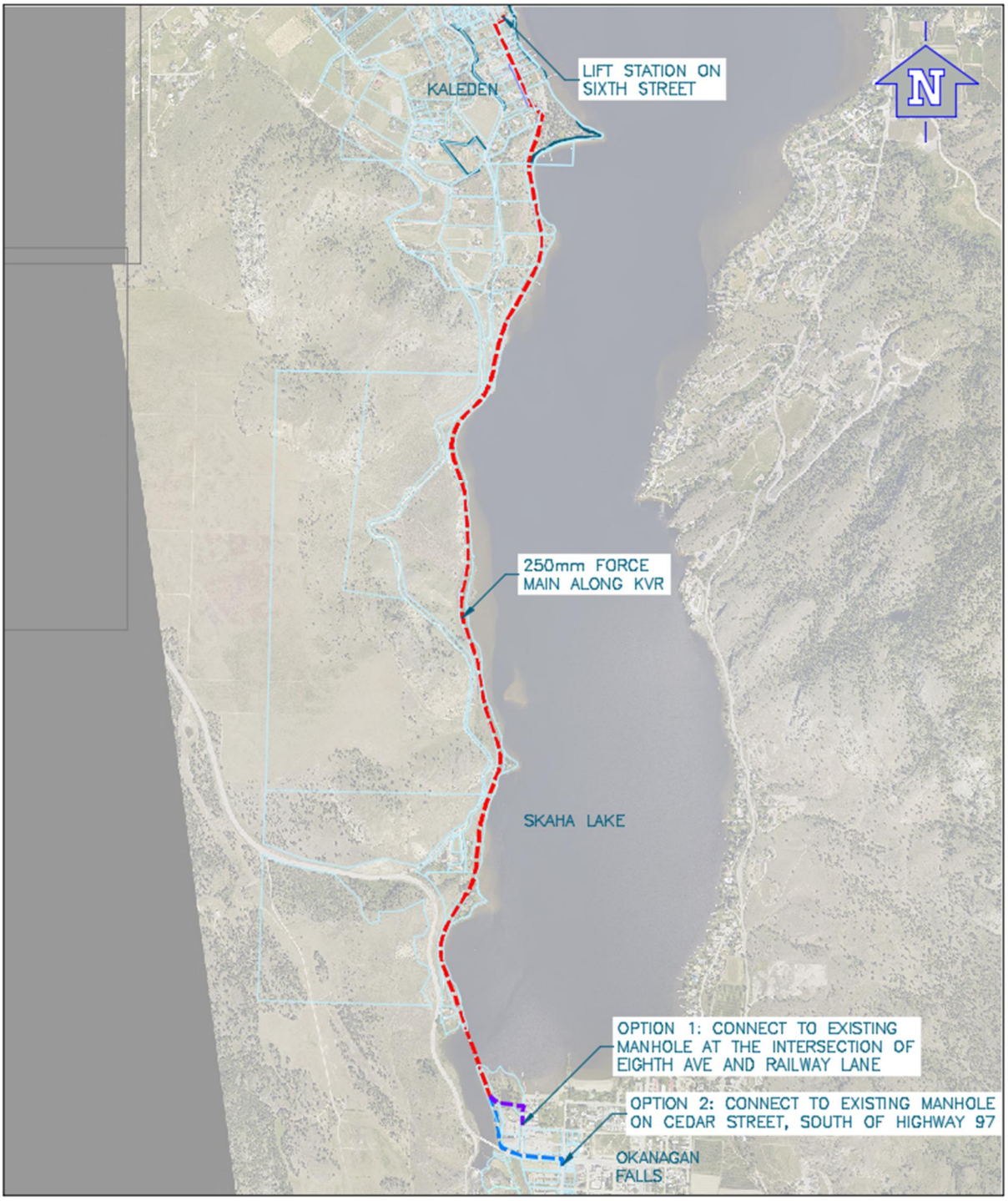
The servicing concept, as generally proposed by the MMM Group, envisions a local collection system for the Old Kaleden Road Service Area (initial service area), coupled with a main lift station and linear force main along the former KVR rail corridor. The force main would terminate at and connect to the existing sanitary sewer system in Okanagan Falls.

At the outset of the preliminary design assignment, Urban Systems proposed two potential connections points to the existing Okanagan Falls system, namely:

1. Into an existing manhole at the intersection of Eighth Ave and Railway Lane, via Lions Gardens Park. This would be the shortest (and likely the least costly) route. However, all sewage from Kaleden would ultimately have to flow through existing Lift Station #3 near the lakeshore, at the north end of Main Street. This may be an acceptable approach if the existing lift station and force main both have sufficient capacity for sewage flows from Kaleden; or
2. Into an existing manhole on Cedar Street, just south of Highway 97. This route is about 320 meters longer than the Eighth Ave option but avoids loading Lift Station #3 and, additionally, avoids disrupting an existing community park and adjacent riparian area. The force main would route along Highway 97, through to Cedar Street.

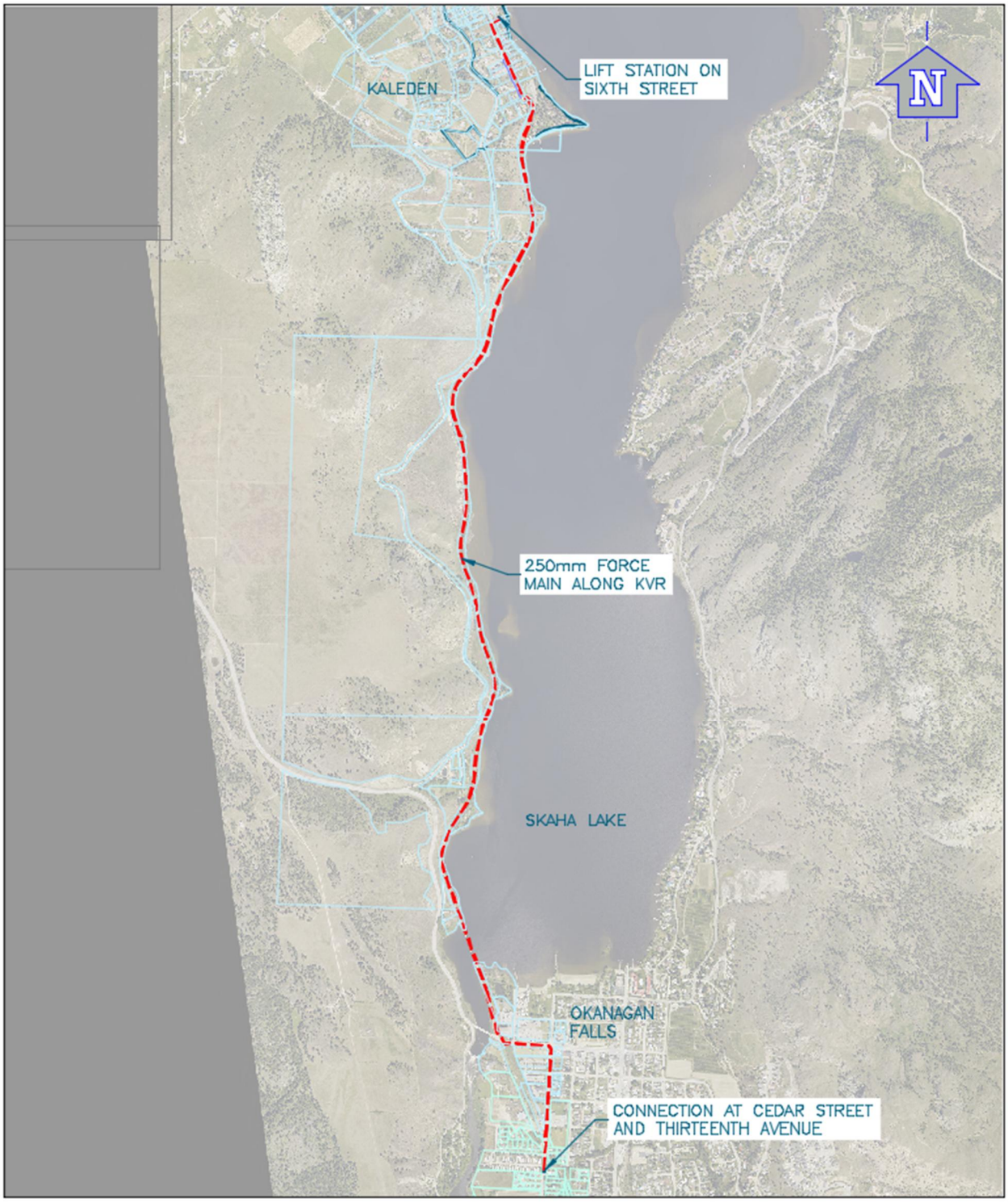
Both of these connection locations and force main routes are identified in **Figure 1.2**.

FIGURE 1.2: FORCE MAIN ROUTING OPTIONS – KALEDEN TO OK FALLS



The RDOS subsequently confirmed that the first option was not viable, given the limited capacity of the existing Lift Station #3 on Main Street. The RDOS also confirmed that their preference for a connection point for the second option was about 500 m south of the location noted by Urban Systems, on Cedar Street (**Figure 1.3**). At that more southerly location, the downstream piping is somewhat larger, offering greater capacity to accommodate flows from Kaleden. Reference **Appendix M** for further discussion on downstream capacity matters.

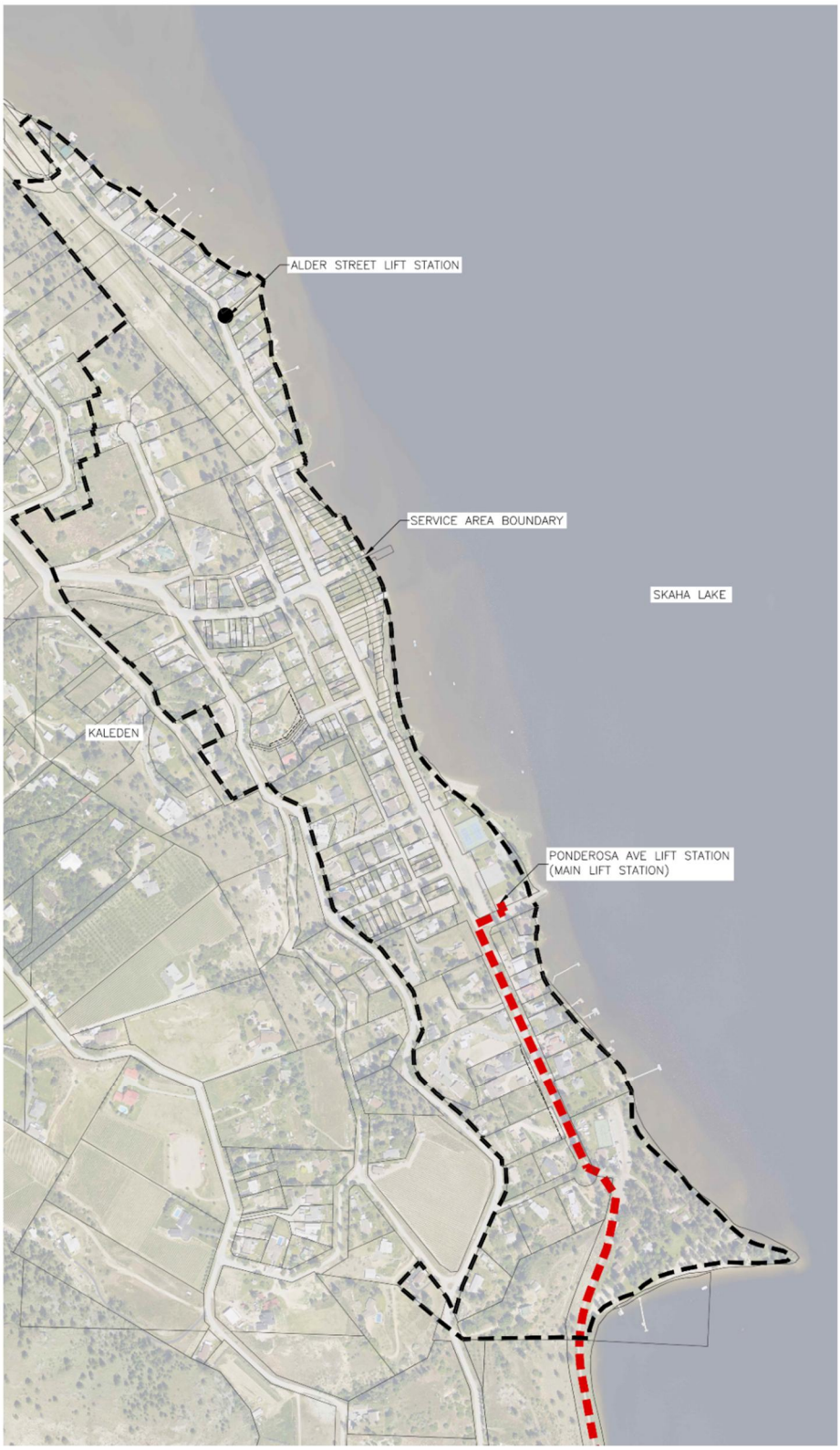
FIGURE 1.3: CEDAR STREET FORCE MAIN TIE-IN LOCATION (OK FALLS)



After additional analysis and vetting by both Urban and the RDOS, two additional sub-service areas were added to the initial service area originally noted in the RFP. These sub-service areas, described respectively as “the north end of Oak Avenue” and “Pine Avenue”, can be provided with sewer relatively easily without negatively impacting the cost-per-parcel for the initial service area. Expansion into these two sub-service areas adds an additional 14

properties to the initial service area. **Figure 1.4** illustrates this revised initial service area on which this report is based.

FIGURE 1.4: REVISED INITIAL SERVICE AREA BOUNDARY



1.3. Report Structure and Content

Sections 2 through 10 of this report address topics generally applicable to the entire project.

From there, our preliminary design investigation essentially divides the project into two distinct discussion topics, given their unique characteristics and challenges. More specifically, the report addresses the collection system separately from the works required to convey sewage from the collection area to the point of connection with the Okanagan Falls sewer system (conveyance system). Section 11 speaks specifically to the collection system. Section 12 summarizes our findings about the conveyance system.

Sections 13-16 summarize cost, risk, schedule and recommended action items related to the project as a whole.

The reader may note similarities in the structure of and, in some cases, text from the Tetra Tech Skaha Estates preliminary report [(1)]. We attempted to maintain consistency between the two reports as much as possible. Further, where specific wording or descriptions applied to both reports, we have taken the liberty of utilizing relevant text from the Tetra Tech report in this document about the Kaleden system.

2. EXISTING AND FUTURE DEVELOPMENT

Both the RDOS and the consultant team recognize that prior to sizing and locating sewer infrastructure for any service area, an agreed upon plan for future growth and development is necessary for the project. For the Kaleden community, development of such a plan was prepared by CML Projects Services Ltd. with Urban Systems' planning staff engaged by CML as a sub-consultant. The future growth and development plan for Kaleden was prepared in advance of Urban Systems' engagement as the RDOS's consultant for the preliminary sewer design assignment.

The planning work considered the following elements:

- The land use recommendations and designations contained in the Official Community Plan;
- The Zoning Bylaw for the community;
- Topography within the future service area; and
- Environmental Development Permit Area designations.

The subsequent analysis determined the maximum allowable development potential for each land parcel by overlaying the above noted individual elements for the service area, based on the constraints associated with each element. The analysis also generated "Future Buildout" and "Ultimate Buildout" scenarios, which represents successive development within the service area.

CML's work identifies both the expected number of single-family homes and the number of anticipated secondary suites within each subarea. The Regional District agreed that the maximum percentage of units developing secondary suites, either in the form of suites within a building or suites in a separate accessory building (carriage homes), would be 50% for preliminary design purposes. **Figure 2.0** in **Appendix A** summarizes the results of Urban's analysis.

The "Initial Service Area-Current Development" scenario reflects current conditions and current populations within the Initial Service Area-some 146 lots with a population of approximately 355 people.

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[1] Tetra Tech Canada Inc., 'Skaha Estates Sanitary Sewer Extension to Okanagan Falls', Predesign Report, File No. 704-PENG.KGEO03112-01, (July 2018).

The "Initial Service Area-Full Buildout" scenario reflects potentially full development within the Initial Service Area with a projected service population of approximately 1055 people.

The "Ultimate Service Area Full Buildout" reflects the potential to fully develop well beyond the limits of the Initial Service Area with a projected service population of some 3150 people.

For the purposes of this study, the following has been discussed and agreed upon with the RDOS:

- Detached Dwelling: 2.5 persons/residential unit
- Secondary Suite: 1.5 persons/residential unit

3. DESIGN CRITERIA

The relevant design criteria applied to this project were selected from the Regional District of Okanagan-Similkameen's Subdivision Servicing Bylaw No. 2000, 2002, Appendix A, Section 4.2. A copy of the design criteria is provided in **Appendix B** of this preliminary design report.

Having said that, the preliminary design also recognizes that:

- the project will be constructed under an MMCD contract and where the specifications of MMCD are thought to be more up to date than the Bylaw, the MMCD requirements would prevail; and
- This is a utility project constructed in a developed area with many challenges facing both the designer and the constructor. As a result, the design may incorporate features which are intended to address both cost savings, practicality and constructability, with the result that not every aspect of the Subdivision Servicing Bylaw will necessarily be incorporated into the work.

We also note the RDOS Bylaw gives a great deal of latitude to the designer and the Regional District in terms of the requirements for and features of sewage lift stations. For the purposes of this preliminary design report and this project, we extracted relevant lift station design standards from the Tetra Tech Canada report for Skaha Estates. We understand the RDOS reviewed and approved these standards earlier. The sanitary sewer lift station design criteria are provided in **Appendix C**.

We also applied the inflow/infiltration allowances adopted for the Skaha Estates preliminary design study as these allowances amended the RDOS Bylaw rates (**Table 3.1**). The Regional District has confirmed acceptance of this recommendation.

TABLE 3.1: UNIT INFILTRATION/INFLOW RATES (L/HA/D)

For new pipe in water table	For new pipe not in water table
8,000	5,000

Lastly, we also applied the unit value of 350 Lpcd (litres per capita per day) for domestic sewage generation. Again, this figure was used for the Skaha Estates preliminary design study and the Regional District has confirmed acceptance of this figure for the Kaleden service area.

4. DESIGN FLOWS

The planning and growth projection information from **Section 2.0** was then fused with the design criteria in **Section 3.0** to generate design flows for a combination of design horizons and hydraulic loading conditions.

Detailed derivation of the design flows is provided in **Figures 1.0, 2.0, and 3.0** of **Appendix D**.

For the Kaleden Service area, we summarized the anticipated flows for three key development scenarios in **Table 4.1** below.

TABLE 4.1: SEWAGE FLOWS VERSUS DEVELOPMENT SCENARIO

Growth and Development Scenario			
Flow Condition (Lps)	**Initial Service Area Current Development**	**Initial Service Area Full Buildout**	**Ultimate Service Area Full Buildout**
Average Dry Weather Flow	1.4	3.9	13.5
Average Wet Weather Flow	3.7	6.1	23.2
Peak Wet Weather Flow	8.0	17.8	57.0

Average Dry Weather Flow (ADWF) means the average daily rate of wastewater flows generated by the service population during periods of dry weather, without inflow from rainwater.

Average Wet Weather Flow (AWWF) means the average rate of wastewater flows generated by the service populations during periods of wet weather.

Peak Wet Weather Flow (PWWF) means the highest measured rate of wastewater flows generated by the service populations during periods of wet weather.

The information in Table 4.1 was used to size trunk mains, force mains and lifts stations under a variety of operating conditions. The information also allowed the design team to determine how best to phase specific aspects of the sewer system so as to fit costs within the current budget while, additionally, allowing for expansion of the service area well into the future.

5. BASE MAPPING

For this assignment, we developed preliminary design level base mapping, allowing us to generate reliable sewer main and service alignments both within road rights-of-way and across private properties, as required. The objective was to achieve sufficiently accurate quantities for both pipeline and road works in order to generate Class B cost estimates for the proposed sewer project.

The base mapping was compiled using the following information:

- 1m LiDAR mapping provided by the Regional District, with an accuracy of +/- 30 cm depending on terrain, forest cover, and the like;

- Cadastral information, based on field surveys completed by our BCLS sub-consultant, to an accuracy of +/- 30 cm;
- Preliminary topographic surveys of existing surface infrastructure to an accuracy of +/- 5 cm; and
- Record information provided by the various utility purveyors operating services within the subject area including: FortisBC Electric, FortisBC Gas, Telus, Shaw, and Kaleden Irrigation District (KID).

As the project evolves to detailed design, additional information and detail will be required to inform the higher level of technical and costing accuracy. Such additional information and detail includes:

- Surveying the limits of all asphalt roadway surfaces to accurately identify horizontal limits and elevations for pavement restoration purposes;
- Topographic surveys of all roadway ditching and adjacent embankments to support sanitary service details for each land parcel;
- Determining finished floor elevations for the lowest living space in each home to ensure adequate sanitary sewer service grades;
- Surveying locations of all major vegetation/trees that may be impacted by the proposed sanitary sewer construction; and
- Completing additional topographic surveys both at lift station sites and along rights-of-ways within private properties.

6. ENVIRONMENTAL CONSIDERATIONS

Urban Systems' scope for the preliminary design assignment includes completing an Environmental Impact Assessment (EIA) for the project, given the proximity of Skaha Lake and other sensitive land use designations potentially affected by the planned works. A copy of the EIA documentation is provided in **Appendix E**. Highlights of the EIA and information pertinent to the collection system and trunk system are discussed in **Section 11.0** (Collection System) and **Section 12.0** (KVR Trail Trunk Conveyance System) respectively.

7. GEOTECHNICAL CONSIDERATIONS

Urban Systems retained the professional services of Interior Testing Services Ltd. (ITSL) to examine the geotechnical aspects of the project. The geotechnical work was completed in two stages. The initial stage addressed geotechnical conditions within the proposed initial Kaleden service area. The second investigation concentrated on geotechnical conditions along the KVR trail between Kaleden and Okanagan Falls, the proposed route for the force main conveying sewage to Okanagan Falls. In addition, ITSL completed sieve analyses for subsurface soils along Alder Avenue to better understand the soil stratigraphy and, more importantly, anticipated well-point dewatering requirements during trenching operations. Copies of Interior Testing's reports are provided in **Appendix F**. Highlights of the geotechnical investigation and information pertinent to the collection system and trunk system are discussed in **Section 11.0** (Collection System) and Section **12.0** (KVR Trail Trunk Conveyance System) respectively.

8. ARCHAEOLOGICAL CONSIDERATIONS

4 Seasons Heritage Consulting (4SHC) was retained, with agreement from the Penticton Indian Band (PIB), to undertake the archaeological Preliminary Field Reconnaissance (PFR) report and associated cost estimate for additional archaeological components for the sewering project. A draft PFR has been completed by 4SHC.

Unfortunately, PIB field crews have not been available yet to complete a field review, so the PFR is considered to be in draft form until this field review, plus a secondary joint field review in conjunction with 4SHC is conducted. These field reviews are imperative to ensure PIB's observations and interests are incorporated into the final PFR. With permission from the PIB-Natural Resources department, a draft PFR and associated cost estimate was provided by 4SHC and can be found in **Appendix G**.

The proposed Kaleden collection area and KVR conveyance route have been previously impacted by the construction and decommissioning of the Kettle Valley Railway, the construction and maintenance of the Kettle Valley Trail and by major residential developments and associated infrastructure. Despite previous impacts to the area, numerous areas along the proposed route were observed and professionally assessed to contain high potential for archaeological materials or features.

In-field observations of the proposed route indicated five (5) areas of potential (AOPs) for further archaeological work along the proposed route that have high probability of recovering archaeological resources and should be subjected to subsurface testing. The north extent, where the proposed forcemain connects to the Kaleden collection system, and the south extent, in the community of Okanagan Falls, are also considered to have high archaeological potential due to the presence of registered archaeological sites. The determination for these AOPs was based on a number of factors including: level, or near level landforms; well-drained landforms; access to fresh water; access to utilitarian, food and medicinal resources; ease of access to upper benches, knolls and bedrock outcrops.

Based on the results of the PFR survey, in accordance with the Heritage Conservation Act, all further archaeological work is recommended to be conducted under a concurrent Section 12.2 Heritage Inspection Permit and Section 12.4 Site Alteration Permit. These components will be completed during the detailed design and construction phases of the project.

9. ROAD ASSESSMENT

Retrofit projects of this nature normally entail a significant amount of road restoration following utility installation. In fact, the costs for removal and replacement of roads can often exceed the cost of the underground utility work.

A unique aspect of this project is that the existing roads are neither owned nor maintained by the Regional District. Rather, the Ministry of Transportation and Infrastructure (MOTI) is the agency responsible for the roads within the Kaleden project limits. This authority will ultimately be responsible for providing reconstruction specifications and approvals prior to the project moving forward to public tender.

At the outset of the preliminary engineering phase, the Regional District was hopeful that a detailed road assessment would potentially identify cost sharing opportunities with MOTI. The thinking was that many of the roads were possibly in need of repair and/or past their design life. If so, would MOTI then participate in part for the reconstruction of those roads impacted by utility construction?

However, after meeting with MOTI, the RDOS now understands that MOTI has very limited funds available for any cost sharing program and the entire cost of road reconstruction will likely be borne by the sewer project. Potentially, the MOTI's maintenance contractor may be able to assist with some resurfacing as part of their annual repaving work. This matter will be discussed further with MOTI and their maintenance contractor during the detailed design phase.

MOTI also indicated that they would not approve of any drilling through the existing asphalt for the purposes of subsurface investigation - all drilling would have to be completed within the shoulders of the roads. And, lastly,

MOTI prefers that for all roads affected by construction, where the paved surface is disturbed, a minimum of one half of the road must be fully replaced. No partial lane replacement will likely be permitted.

Given MOTI's limitations, Interior Testing's scope was altered for the road assessment portion of the project. Interior Testing completed the following:

- Assessed the soil stratigraphy of each test pit and bore hole;
- Assessed depth to groundwater table where applicable;
- Assessed soil conditions on Alder Avenue to support a well-point dewatering strategy;
- Completed a general visual assessment of road surfaces and conditions in the Kaleden service area;
- Worked with Vector Geomatics to georeference tests pits along the KVR; and
- Provided recommendations for appropriate reconstruction of roads and suitability of native materials for re-use.

Copies of the Interior Testing's reports are provided in **Appendix F**.

In general, the Interior Testing report for the Kaleden area (Job 19.318 – November 6, 2019) identifies the following:

- The majority of the roads within the project area are in relatively fair to good condition with respect to signs of cracking or base failure. However, when asphalt nears the end of its design life it often becomes quite brittle and will be susceptible to breaking and cracking during trenching, saw-cutting and heavy vehicle loading activities. Much of the asphalt in the service area appears to be close to the end of its design life;
- Complete road reconstruction/resurfacing is recommended for older, narrower roads;
- Fillet construction (as opposed to complete road reconstruction) adjacent to older, brittle asphalt can lead to reduced quality and life span of the new asphalt surface. Regardless, economics of the project may mean fillet construction is the only viable option irrespective of the reduced design life of the new surface. This would be subject to MOTI approval.

The Interior Testing report also outlines recommended road structures (asphalt, base and sub-base) for road reconstruction after completion of the utility installations.

10. INDIGENOUS PEOPLES COLLABORATION

Per the Terms of Reference for the preliminary design phase of the project, the Regional District managed and facilitated all discussions and collaboration with First Nation governments and organizations as they relate to the extension of sewer from Okanagan Falls to Kaleden.

Indigenous engagement and communication was initiated at the very beginning of the project, prior to the consultant being retained, as involving the local Indian Bands is considered to be essential to project success. The two entities engaged during the steps leading up to the preliminary design for Kaleden being completed were the Penticton Indian Band (PIB) and the Osoyoos Indian Band (OIB).

The first communication with the PIB was upon requesting a letter of support for the grant application to the New Building Canada –Small Communities Fund for the sewering project. A very supportive letter was provided in April 2016 as they recognize and affirm the importance for the preservation of lands, water and natural resources.

In July of 2019, while the RDOS was in the process or retaining a consultant, the PIB and the OIB were contacted initially through a formal letter addressed to their respective Chief and Council. The letter contained information about the purpose of the project and invited participation in an archaeological review assessment. The intent was

to have a team from one or both of the Bands conduct the Archaeological Overview Assessment and the Preliminary Field Reconnaissance as part of the preliminary design of the sewer system.

In September 2019, the Regional District met with a representative from the PIB and discussed retaining an archaeologist and field technicians for the project. In October 2019, the OIB confirmed that they would be deferring further consultation and engagement and had requested that PIB take the lead on this essential work. A quote was received through PIB from 4 Seasons Heritage Consulting to complete the archeological tasks for the Predesign work.

Once the report is complete, the RDOS will be providing the document to PIB for review and comment. Meetings will be held as requested to answer questions that may arise. The RDOS intends to retain the important archeological services through PIB for the remainder of the project and are committed to ongoing communication and collaboration for project success.

11. COLLECTION SYSTEM

11.1. Introduction

The proposed collection system consists primarily of 150 mm, 200 mm and 300 mm diameter gravity mains terminating at two lift stations—the Alder Avenue Lift Station and the Ponderosa Avenue Lift Station. The Ponderosa Avenue Lift Station forms a major part of the KVR Trail Trunk Conveyance System and is more fully discussed in **Section 12.0** of this report. Details about the Alder Avenue Lift Station are provided in **Section 11.4** below.

Preliminary plan/profile drawings and detail sheets for the collection system are provided in **Appendix I**.

11.2. Existing Utilities

11.2.1. Kaleden Irrigation District

Kaleden Irrigation District (KID) maintains an existing water distribution system that services the Kaleden community. The piping system is comprised primarily of Asbestos Concrete (AC) mains, ranging in size from 100mm to 150mm diameter. Some localized areas of the distribution system were replaced with 150mm diameter PVC. The KID provided a composite map of the water system that included information on approximate location, size and alignment of the mains and services for use during design of the sewer. As the design progresses, Urban Systems will be continuing to work with the KID to confirm any questions addressing the status or condition of water mains. Care will be taken to avoid older watermains where possible, to prevent damage to the water system.

KID also provided Urban Systems and the RDOS with a GIS record of all curb stop locations. Our understanding is that this information was gathered by a surveyor while KID was enhancing records to identify and locate all water service locations within their service area.

As noted, our survey partner, Vector Geomatics, located any visible water main valves and hydrants to include with the provided KID record information. In addition, KID provided extra details when the base drawings for the sewer service area were being developed. The results of these data gathering activities are compiled and are reflected within the plan/profile drawings contained in **Appendix I**.

With the complexity of installing sewers into an established community, Urban Systems recommends that the RDOS verify locations for some of the complex areas with KID mains and other utilities before the final design is

completed and the project is issued for tender. This type of activity, frequently used during detailed design projects, can help reduce risk for the contractor during the construction period and ultimately reduce costly surprises.

11.2.2. Power and Communications

With but a few minor exceptions, power and communications infrastructure is suspended aerially on utility poles. Pole locations, for the most part, do not appear to impact the design and construction of sewer mains, although there may be isolated locations where a "pole-hold" could be required to assist with trench excavation activities.

11.2.3. Gas Mains

Many of the road rights-of-way in the service area also contain buried FortisBC Gas mains. The alignment and size of the gas mains, based on FortisBC Gas record drawings and some field locates, are also reflected on the plan/profile drawings located in **Appendix I**. We expect to cross a few of these gas mains within the road corridor, however, we do not anticipate major conflicts as the standard depth for gas mains are much shallower than the proposed sanitary mains.

11.2.4. Alignments

The alignments of the proposed sanitary mains are illustrated on the preliminary plan/profile drawings. The alignments take into consideration such criteria as:

- Location of existing infrastructure, both below and above ground;
- Position of carriageway in the right-of-way;
- Right-of-way width;
- Topography;
- Asphalt and shoulder restoration requirements;
- Road geometry; and
- Potential sanitary sewer service connection locations.

Ideally, new sewer mains and existing water mains should be separated horizontally by a distance of three meters- a standard Interior Health Authority guideline. However, given the limitations imposed by constructing new utilities in developed areas, maintaining such a separation is not always realistic or achievable. Where such limited conditions exist, the following precautions will be implemented:

- The sewer will be installed at a lower elevation than the water mains; and
- All sewer main joints will be wrapped with a petrolatum tape to supplement the air tested bell and spigot pipe connections.

Lakehill Road is particularly challenging, in that the road right-of-way currently contains a dedicated steel water supply main, a new PVC water distribution main, an abandoned water distribution main, a HDPE storm main and, at surface, a pedestrian sidewalk. KID also indicated they might want to install a future dedicated supply main to replace the existing steel supply main. The proposed sewer main alignment on Lakehill Road takes all of this existing and proposed infrastructure into consideration. Reference **Drawing C06** in **Appendix I.**

A two-meter-high mechanically stabilized earth (MSE) wall will be required at the south end of Ponderosa Avenue to create a platform for the sanitary sewer, thereby assisting with a reduction in the required trench depth further to the north. This wall location is noted on **Drawing C05** in **Appendix I**. Without this arrangement, the trench (and sewer main) through the summit on Ponderosa Avenue would be unreasonably deep and would necessitate removal and replacement of the existing water main as part of the sanitary sewer main installation.

Alternatively, if the RDOS is able to obtain a Statutory Right-of-Way across the eastern boundary of the adjacent private property at #290 Ponderosa Avenue, the costly MSE wall can be eliminated. (The approximate cost of the wall is $73,000).

11.3. Environmental, Geotechnical and Archaeological Considerations

As noted previously, extensive assessments and investigatory work were undertaken to better understand any sensitivities or specific site information that could impact the proposed project. These include environmental, geotechnical and archaeological reviews.

11.3.1. Environmental

Within the proposed service area for the collection system, there does not appear to be any environmental issues or concerns. As a general rule, standard Best Management Practices would apply. Some consideration may need to be given to well-point dewatering on Alder Avenue, specifically where and how to discharge groundwater if turbidity levels are high. Typically, such an issue is best remedied by overland pumping to a suitable site for surface-to-ground recharge.

11.3.2. Geotechnical

Our geotechnical consultant drilled a total of 13 test holes within the sewer collection area. Highlights of the Interior Testing Services Ltd. report in relation to the collection system include the following:

- The native sandy soil mixtures can be used for trench backfill;
- Groundwater will be an issue along Alder Avenue given the close proximity of the lake; and
- Complete road reconstruction, rather than installation of patches and fillets, is recommended for older, narrow roads disturbed by the trenching operations.

The absence of bedrock and the ability to reuse the native soils for backfill is good news in terms of cost.

A high groundwater table along Alder Avenue will necessitate well-point dewatering in order to install the sanitary mains and services in dry trench conditions. Alternatively, where well-point dewatering is less effective and proper bedding compaction becomes difficult, drain rock within the pipe bedding zone can be an effective solution.

11.4. Alder Avenue Lift Station

11.4.1. Commentary

This lift station will service a small tributary portion of the overall Kaleden community service area. The majority of the Alder Avenue Lift Station service area consists of lakeshore lots located between Alder Avenue and Skaha Lake. The service area also incorporates future properties to the west and north, as indicated in Drawings **C01 and C02**, **Appendix I**.

The lift station will be constructed within an existing right-of-way situated between Alder Avenue and Skaha Lake, and between #198 Alder Avenue and #206 Alder Ave.

Drawing **C29**, **Appendix I** sets out the general layout of the lift station elements. Specifically, the duplex lift station will include:

- A 2.4 m diameter concrete wet well housing the submersible pumps;

- Two 240V, single-phase, 5 HP submersible pumps rated for 8 L/s at 15 m TDH [(2)];
- An above ground valve box attached to the wet well structure;
- A standby power unit housed in an acoustic enclosure installed on a concrete pad; and
- An electrical and controls kiosk.

We note that while the RDOS lift station standards specify three-phase motors for the pumps, only single-phase power is available on Alder Avenue. We propose the RDOS allow single phase motors for the Alder Lift Station as single-phase pumps are less expensive, and in this case, there would be no difference in performance or life expectancy of the pumps. The cost estimate in this report assumes this is an acceptable approach. As an alternative, Variable Frequency Drives (VFDs) can be installed for phase conversion thereby allowing for three-phase pump motors.

11.4.2. Design Flows

Table 11.1 summarizes the hydraulic loadings on the Alder Avenue Lift Station under various growth/development conditions. Please reference Sections 2 and 4 for an explanation of the development scenarios and the different flow conditions outlined in Table 11.1. Of course, the tributary populations described in Section 2 are considerably smaller for the Alder Avenue Lift Station since the collection area for the lift station forms a portion only of the initial and ultimate service areas.

TABLE 11.1: ALDER AVENUE LIFT STATION HYDRAULIC LOADINGS

Flow Condition (Lps)	Initial Service Area Current Development	Initial Service Area Full Buildout	Ultimate Service Area Full Buildout
Average Dry Weather Flow	0.30	1.00	1.00
Average Wet Weather Flow	0.96	1.66	1.66
Peak Wet Weather Flow	1.87	4.7	4.7

11.4.3. Pump Selection

We selected a design flow of 8 L/s, which exceeds the peak wet weather flow, for selecting the proposed pumps. This flow rate ensures a minimum cleansing velocity of 1 m/s is achieved in the force main. A 5 HP Flygt NP 3085 SH 3 256 pump equipped with a 240V single phase motor was selected as the preferred unit. Refer to **Appendix P** for a copy of the preliminary system curve and pump selection.

11.4.4. Above Ground Valve Box

An above ground valve box will be installed on the Alder Avenue Lift Station. The valve box will house the check valve and isolation valve for each pump. Installing the valves in an above ground box eliminates the need for RDOS operational staff to enter the wet well during routine operation and maintenance functions.

[2] TDH "Total Dynamic Head" - The vertical distance from the elevation of the energy grade line on the suction side of the pump to the elevation of the energy grade line on the discharge side of the pump

11.4.5. Odor Control

A passive carbon filter will be installed on the wet well vent pipe to reduce odors. An odor control system, using injection of odor control chemicals (e.g. Biomaxx), is deemed unnecessary for this small, localized facility.

11.4.6. Standby Power

A standby power unit will be provided in an acoustic enclosure located outside and adjacent to the wet well. The standby power unit is considered prudent as a mitigation measure against the potential risk of a sewage spill or overflow, particularly given the proximity of this lift station to Skaha Lake. We recommend diesel rather than natural gas as the preferred fuel for the standby power unit since the natural gas distribution system can be shut down in the event of a local or regional emergency situation. Diesel is not subject to the same considerations and thus is considered more reliable. The standby power unit comes equipped with a spill containment vessel in case of leakage or a fueling accident.

Lastly, the diesel motor is specifically muffled to reduce noise levels to 65 dB, a standard level for most Okanagan communities.

11.4.7. Emergency Storage

Emergency storage will be provided in the station's wet well, influent pipe and adjacent storage pipe to contain up to one hour of Peak Wet Weather Flow. **Table 11.2** outlines the total storage volumes required for the initial service area and ultimate service area buildouts.

While the Alder Avenue Lift Station wet well will provide up to 10.2 m^3 of storage, based on an initial peak flow of 4.7 L/s, an overflow pipe will be required to accommodate the emergency storage requirement. We recommend installing 10.5 m of 900 mm pipe which will provide an additional 6.7m^3 of storage capacity, satisfying the emergency storage requirement for the ultimate buildout scenario.

Using an oversized pipe to provide emergency storage (as opposed to over sizing the wet well) offers several advantages:

- Reduces the overall costs for wet well storage;
- Reduces the short-term costs for wet well storage; and
- Simplifies the wet well and lift station construction.

TABLE 11.2: EMERGENCY STORAGE REQUIREMENTS

Emergency Storage Condition	Initial Service Area Full Buildout	Initial Service Area Full Buildout Storage	Ultimate Service Area Full Buildout	Ultimate Service Area Full Buildout Storage
	Lps	Cubic Meters	Lps	Cubic Meters
Peak Wet Weather Flow	4.7	16.9	4.7	16.9

11.4.8. Wet Well Installation

Since the majority of the wet well for the Alder Avenue Lift Station will be below groundwater levels, the wet well will be constructed by lowering a 2.4 m diameter concrete barrel into the subsurface soils as the interior soils and groundwater are removed. A concrete plug will then be tremied into place to seal the bottom of the concrete barrel, as well as to act as a counterweight against uplift.

11.4.9. Easements and Rights-of-Way

The majority of the sanitary sewer mains and services will be accommodated in gazetted road rights-of way as they are currently configured. Currently, we only see the need for ten additional and separate statutory rights-of-way (SROW) across private properties in order to provide the necessary corridors for the new sewer mains. The addresses of the specific properties and a short explanation of each SROW are provided as follows:

- #260, #264, #272, and #278 Ponderosa Avenue

  Ponderosa Avenue, adjacent to the #260, #264, #272 and #278 Ponderosa Avenue land parcels, rises up and crests at an elevation several meters higher than the adjoining properties to the west. Placing the proposed pipeline in the roadway would result in a very deep and wide trench, possible impacts to the adjacent water main, undoubtedly impacts to traffic, and likely temporary closure of the road to the south in order to facilitate construction. Instead, we propose shifting the alignment of the sanitary pipeline to the west of the existing road surface, onto private property. By doing so, we can take advantage of the terrain as it drops off away from the road. This alignment results in a much shallower trench, no impacts to the water main or road surface, fewer traffic issues and significant savings in restoration costs.

- #290 Ponderosa Avenue
  This particular SROW may be optional and is only required if the RDOS elects to avoid the retaining wall replacement in the cul-de-sac at the south end of Ponderosa Ave. The sanitary main could then take a more direct north-south alignment. The main would be located behind the existing utility poles, minimizing impacts to private property except for removal of one or two trees and some turf, as well as removal/reinstatement of a section of fencing. Avoiding the need for a retaining wall would offer savings of approximately $73,000.

- #139 Oak Avenue
  #139 Oak Avenue is located at the west end of 3rd Street. To avoid pumped services for #149 Oak Ave, #119 3rd Street and #137 Oak Ave, a SROW is required along both the west and south sides of #139 Oak Avenue to accommodate a gravity sewer main. An existing storm water culvert and overhead power SROW along the west side of said parcel must be avoided here.

- #172 Pine Avenue
  A rear yard SROW will be required on this property in order to eliminate the need for pumped services to several properties on Pine Avenue. #172 Pine Avenue requires a small SROW to accommodate the rear yard main and terminal manhole. Minimal property impacts and restoration are anticipated.

- #166 Pine Avenue
  As noted above, to eliminate the need for pumped services, a rear yard SROW will be required to accommodate the sanitary main that serves #172 Pine Avenue. Restoration to the property appears to be limited to sodding of manicured lawn areas.

- #156 Pine Avenue
  Effectively two SROWs are required on #156 Pine Avenue. A rear yard SROW is required to eliminate the need for pumped services and to accommodate the sanitary main that serves #166 and #172 Pine Avenue. The second SROW runs east-west along the south property line and accommodates the gravity main on Pine Avenue and the gravity main serving #156, #166 and #172 Pine Avenue. Sodding of manicured lawns, along with hydroseeding of embankments, is anticipated in order to restore the property. Isolated tree removal may also be required here.

- #148 Pine Avenue
  The SROW for #148 Pine Avenue runs along the east edge of the property and connects the gravity collection system for the Pine Avenue area to the collection system on Alder Avenue. We anticipate some general hydroseeding of embankments to restore disturbed areas.

Copies of the proposed SROW drawings for each affected parcel are provided in **Appendix J**.

11.5. Construction Zoning

For construction within a developed area, we recommend development of a construction and zoning plan that places some control on where and when the contractor can proceed with the work. This plan addresses such things as traffic management, timing of road and boulevard restoration and backfilling requirements. Such a plan endeavors to balance the contractor's desire to maximize the rate of work (and hence improve profitability and lower costs) with the needs of and impacts upon those living within the work area.

More specifically, the plan places limits on the extent of additional trenching operations until road restoration and cleanup behind the current trenching zone is completed. The plan also ensures the contractor's operations within key zones does not jeopardize access to other portions of the service area. Further, the construction and zoning plan places areal limits on the extent of unpaved roads where utility installation, clean up and placement of road gravels has already been completed. While this latter condition does add some additional mobilization and demobilization costs for the paving subcontractor, we suggest this premium is offset by savings associated with eliminating both maintenance of graveled surfaces and provision of dust control measures. In addition, paving streets soon after the utility work is completed normally leads to decreased complaints from those impacted by the construction project.

Figures 16.1 and 16.2, **Appendix H** outline our recommended construction and zoning plan for the collection area. We note that the plan is normally supplemented by zone specific language in the final contract documents and specifications binding the Contractor.

11.6. Pumped Services

In our experience, we've encountered a number of approaches to address the cost and installation of pumped services for residential properties connecting to a new sewer system. These are:

1. The homeowner is responsible for the entire cost of supply and installation with no compensation by the governing jurisdiction to offset the additional cost for a pump unit;
2. The homeowner is responsible for the entire cost of supply and installation with some compensation provided by the governing jurisdiction to offset the additional cost for a pump unit. Usually this is a lump sum amount which is identical for all situations where a pump is required;
3. The governing jurisdiction pays for the cost of supply and installation of the pump unit after receipt of three quotes provided by the homeowner. The homeowner is then responsible for overseeing the work and is compensated by the municipality once the work is complete; or
4. The governing jurisdiction pays for the cost of supply and installation of the pump unit after receipt of three quotes provided from contractors. The governing jurisdiction is then responsible for overseeing the work and takes care of payment once the work is completed.

We would not recommend Options 3 and 4, as they carry a significant burden, in terms of resources and risk, for the Regional District.

Option 2 is likely the fairest and simplest approach for the following reasons:

- Easy to administer;
- Homeowner retains responsibility for ownership, operation and maintenance along with the warranties for the materials and labour;
- Treats all properties requiring a pump service equally, irrespective of any individual differences in actual circumstances at each property; and
- Recognizes the incremental cost for a pumped service versus a gravity service.

However, providing compensation for a pumped service does raise a few questions:

- Do the Federal and Provincial grant monies for the project cover the cost of compensation to homeowners for a pumped service?
- Does the project budget have adequate funds for compensation?
- Will homeowners with a pumped service accept compensation which may be less than the actual incremental cost for the pump installation?

We suggest the first two points are the most critical of the three and will be explored during detailed design.

11.7. Residential Connection Program

We expect while the new sewer is being constructed and getting ready for use by the property owners, the RDOS would embark upon a communications plan addressing such matters as:

- Final costs per parcel;
- Payment options; and
- Connection procedures and timelines.

For the latter, we've generated a guideline document, which is contained in **Appendix K**. The guideline is intended to assist homeowners with arranging and organizing the connection of their properties to the new sewer system.

Determining a "typical" cost for a property to complete onsite work, such as decommissioning the septic system and installing the necessary piping to bring it out to the RDOS installed main, is very difficult. A unit cost for each meter of service pipe is also difficult, in that each connection will have its own individual challenges and characteristics. These would include:

- Length of the service;
- Location of the septic tank
- Ease of access;
- Proximity of adjacent structures and trees;
- Any asphalt and concrete driveway cutting and restoration requirements;
- Gravity or pumped connection;
- Landscape and yard restoration requirements;
- Retaining walls;
- Availability of contractors and market conditions; and
- Subsurface conditions including the potential for encountering rock, groundwater or unsuitable soils.

11.8. Maintenance Considerations

Regular maintenance of the entire collection system, including lift stations, is imperative to ensure the functionality, performance and lifespan of each component and the system as a whole. General operations and maintenance recommendations, along with associated costs, have been provided in **Section 13.0** below.

11.9. Preliminary Class B Costing-Collection System Construction

Appendix L summarizes the estimated construction costs for only the Collection System within the service area. See **Section 15.0** of this report for a complete Class 'B' estimate summary for the entire project.

12. KVR TRAIL TRUNK CONVEYANCE SYSTEM

12.1. Introduction

The KVR Trail Trunk Conveyance System consists of the following general elements:

- Ponderosa Avenue Lift Station;
- Five-kilometer-long force main to Okanagan Falls;
- Trestle and highway crossings;
- Approximately 500m of 300 mm diameter gravity main on Cedar Street in Okanagan Falls;
- Tie-in to Cedar Street Trunk Main; and
- Pinch Valve and Odor Control facilities at terminus of the force main.

Each of the components of the trunk conveyance system is discussed in detail in the following pages.

12.2. Existing Utilities

Section 11.2 of this report describes the type and general location of the existing utilities within the Kaleden sewer service area collection system. This section, Section **12.2**, speaks to the existing utilities impacting design and construction of the Conveyance System.

The most significant utility within the old railway trail corridor is a 400 mm diameter high pressure gas main bisecting the trail alignment. As part of the crossing permitting process, this main will require exposure and confirmation of its exact location and elevation. This can be accomplished with the assistance of a hydrovac truck. The approximate location of the gas line is indicated on **Drawing C20** in **Appendix I**.

Additionally, two drainage culverts cross the trail about 0.66 km and 0.84 km, respectively, north of the trestle. The obvert elevations and exact diameter of the culverts should be confirmed as part of the final design program.

A private residential water line also bisects the KVR some distance north of the trestle crossing the Okanagan River at Okanagan Falls. The location of this water line will also be confirmed with the assistance of a hydrovac truck during the detailed design phase to ensure the main is not damaged during installation of the forcemain.

We also note the potential presence of a private sewer force main crossing the KVR trail near the Ponderosa Resort. We believe this pipe connects the resort with a small tile field adjacent to the trail.

Within the Highway 97 corridor, between the terminus of the KVR trail and Cedar Street, a number of shallow utilities, including a critical fibre optics communications line, will need to be addressed. As part of the crossing

permit process and to avoid potential conflicts with new mains, further information will be required to confirm exact locations and elevations of this existing underground infrastructure.

The Cedar Street right-of-way, between Highway 97 and 13th Street, contains an OK Falls Irrigation District water main on the east side of the street as well as overhead power and communications infrastructure and a gravity sewer main on the west side of the street. These utilities are identified on the plan/profile drawings in **Appendix I**.

12.3. Environmental, Geotechnical and Archeological Considerations

12.3.1. Environmental

As noted in the environmental report contained in **Appendix E**, the trunk conveyance system passes through critical habitat identified for seven species-at-risk listed under the federal Species-At-Risk-Act (SARA).

The species are:

- Western rattlesnake;
- Great basin gopher snake;
- Desert nightsnake;
- Pallid bat;
- Lewis's woodpecker;
- Yellow breasted chat; and
- Behr's hairstreak (butterfly).

Based on our preliminary discussions with the Ministry of Forest, Lands, Natural Resource Operations and Rural Development (FLNRORD), we understand the project (land tenure) will not be recommended for approval if critical habitat is destroyed as a result of the planned construction.

Urban Systems undertook a review of the physical habitat in the area and the specific attributes that comprise critical habitat for these species. More importantly, we needed to understand what construction activities could potentially destroy or damage critical habitat in order to determine how best to mitigate any risks associated with the work.

Potential adverse effects to six of the seven species are linked to removal of trees (i.e. pallid bat, Lewis's woodpecker), removal of rose shrubs (yellow breasted chat), and alteration to rock cliffs (all snake species and pallid bat). For the Kaleden sewer project, tree and/or shrub removal is not expected to occur, or only anticipated in isolated instances. Alteration of rock cliffs will not be included in the scope of work either.

Snakes start returning to their dens in late summer or early fall, with all snakes at their dens by October. Snakes stay at the surface of the den, emerging on warm days until mid-October or, in isolated cases, until November (Environment and Climate Change Canada. 2017).

Therefore, during the proposed fall construction period (i.e. beginning after Labour Day long weekend), snakes will be making their way back to their dens and may pass through the worksite. The construction contract will include provisions to ensure that individual snakes are not harmed.

Construction will be slow moving (50 to 75 m per day) and the open trench will be backfilled each day as construction progresses. During September and October when temperatures are suitable for snake movement, site personnel will visually inspect the worksite throughout the day. Should a snake be observed within the worksite, works will be temporarily halted to allow the individual animal to pass through the site.

Destruction of Behr's hairstreak butterfly critical habitat could occur by any impacts to, or removal of, antelope-brush. To better understand the potential impacts and how to protect the species, Urban engaged Crispin Guppy,

wildlife habitat biologist and entomologist with Ecofor Consulting BC Ltd, to provide further insights and recommendations for mitigation of potential impacts to the Behr's hairstreak butterfly. These mitigation measures are identified in **Appendix E.**

To better address the challenges presented by the proximity of the antelope-brush habitat, Urban Systems subsequently mapped the extent and location of antelope-brush within five meters of the KVR trail. Urban also noted where shrubs leaning into the active trail area may be contacted by machinery during the construction process. Location of the antelope brush within the project area is outlined in **Figure 3.2, Appendix E**.

At this point, we have devised a potential mitigation plan for dealing with the antelope-brush during the construction phase. Our contractor consultant, who provides guidance on constructability issues, confirmed that the force main could be installed within a 3.3m wide corridor—enough width to accommodate the excavator tracks.

To protect the antelope-brush, any protruding branches would be tied back, out of the path of the machinery. In a few locations, the branches overhang into the trail by a meter. The thickness and stiffness of the branches in these locations likely precludes tying them back. In such locations, we suggest that cutting a few branches to allow the excavator to pass freely may be less intrusive. For the few branches that may warrant cutting, our environmental staff recommend the branches be inspected for butterfly larva prior to cutting. The branch would then be placed on a live antelope brush bush back from the trail. Where the antelope brush is densely populated along the trail corridor, the environmental report recommends installation of a temporary steel construction fence to protect the antelope-brush and to better demarcate the limits of the corridor for the construction forces. Construction activities would take place after Labour Day weekend to avoid butterfly feeding activities occurring prior to August 10.

We note that the aforementioned mitigation measures would ultimately be contained in a general Environmental Management Plan (EMP). The EMP is included with environmental permitting applications submitted to the Province for the overall project. The EMP will provide watercourse crossing mitigations specifics, an environmental monitoring plan, a spill contingency plan and a species mitigation plan. We also point out that:

- Environmental approvals from the Province can take up to one year to process; and
- There is no guarantee the Province will approve the proposed measures for addressing the antelope brush intrusions into the work area as laid out in this report.

12.3.2. Geotechnical

As mentioned earlier in this document, Interior Testing Services Ltd. completed a geotechnical investigation along the old railway corridor, between Kaleden and the trestle across the Okanagan River, near Okanagan Falls. The field work included excavation of 13 test pits along the route. A copy of the Interior Testing report (Job 19.318 – December 2, 2019) is provided in **Appendix F**.

Highlights of the geotechnical investigation include:

- The route is generally characterized by natural sands and silts overlain by various depths of fill;
- Relatively shallow bedrock (under 1.5 m depth) was encountered in three of the 13 test locations; and
- Groundwater was not encountered in any of the test pits.

In addition to the work carried out by Interior Testing, Urban Systems completed a field reconnaissance exercise using GPS technology to map the extent of rock cuts along the KVR route. The objective was to better identify the limits of those areas where trench rock removal will likely be necessary and, ultimately, determine the probable cost of that trench rock removal. The results of that investigation, coupled with the work completed by Interior Testing, is summarized in the plan/profile drawings for the force main, provided in **Appendix I**. Based upon these observations, the extent of the trench rock removal sections constitutes approximately 15 percent (720m) of the overall five-kilometre force main length.

12.4. Ponderosa Avenue Lift Station

12.4.1. Location and Configuration

At the outset of the assignment, the Regional District and Urban Systems identified two potential sites for the Ponderosa Avenue Lift Station. This is a fairly major facility and consideration of a number of factors entered into the site evaluations**.** Ultimately the RDOS selected the recommended site just north of 6th Avenue, adjacent to the boat launch access, in Pioneer Park. A summary of the site evaluations is provided in **Appendix O**.

Drawing C28 In **Appendix I** sets out the general layout of the lift station elements. Specifically, the triplex lift station will include:

- A 3.0 m diameter concrete wet well housing the submersible pumps;
- Three 600V, 3-phase, 50 HP submersible pumps that are each rated for 29 L/s at 57.5 m TDH (two pumps will deliver 58 L/s at 57.5 m TDH);
- A 7m x 10m utility building to house process piping, instrumentation, odor control chemicals and electrical controls;
- A standby power unit housed in an acoustic enclosure and installed on a concrete pad; and,
- A 1.2 m diameter emergency storage pipe, discussed further in Section 12.4.7 below.

12.4.2. Design Flows

Table 12.1 below summarizes the near term and future hydraulic loadings that will be imposed on the Ponderosa Avenue Lift Station. Please reference Sections 2 and 4 for an explanation of the development scenarios and the different flow conditions outlined in Table 11.1.

TABLE 12.1: PONDEROSA AVENUE LIFT STATION HYDRAULIC LOADINGS

Flow Condition (Lps)	Initial Service Area Current Development	Initial Service Area Full Buildout	Ultimate Service Area Full Buildout
Average Dry Weather Flow	1.4	3,9	13.5
Average Wet Weather Flow	3.7	6.1	23.2
Peak Wet Weather Flow	8.0	17.8	57.0

12.4.3. Pump Selection

Refer to **Appendix P** for a copy of the preliminary system curve and pump selection. The pumps will be equipped with variable frequency drives (VFD's) to accommodate the wide flow range as noted in **Table 12.1**. A 50 HP Flygt NP 3202 SH 3 275 pump was selected as the preferred unit. Each pump is capable of delivering between 8 Lps and 29 Lps.

12.4.4. Utility Building

The building will be constructed next to the wet well and will house process piping (including check, isolation and air release valves), instrumentation (including flow meter, pressure transmitter and level transmitter), odor control chemicals, and electrical controls. Locating the process piping and valves in the utility building will eliminate the need to enter the wet well for routine operation and maintenance functions.

At this preliminary state we estimate the building will be approximately 70 m^2 (10m x 7m) in area constructed of either pre-cast concrete panels or masonry block. Pre-cast concrete panels are manufactured with internal rigid insulation panels and decorative finishes can be added to the exterior of the panels for aesthetic purposes. If a masonry block structure is preferred by the RDOS, we recommend finishing the exterior with rigid insulation and cement board (e.g., Hardie board) for aesthetic purposes.

Process piping, instrumentation, odor control chemicals and electrical equipment will all be housed in a single room.

A public or private washroom can be added to the facility upon request from the RDOS. Of course, this addition would increase the cost of the building, but could offer additional function for the park. If budget is a concern, the facility can be designed to allow for a future washroom expansion if and when funding does become available.

12.4.5. Odor Control

The force main is designed to accommodate peak hour flows from the ultimate Kaleden service area. However, expansion of the service area from the initial Service Area will take many years. The impact of that lengthy development timeframe is that the initial detention time in the force main will be significant, necessitating the need to mitigate the formation of H_2S gas and odors in the system. Furthermore, the station will receive seasonally variable flows, given that many of the homes do not see full occupancy throughout the year. We also anticipate longer detention times in the wet well during winter months. And, lastly, irrespective of the very low initial service population, a five-kilometer long force main will result in lengthy detention times between the lift station and the point of discharge.

All of these factors-- low initial service populations, low winter flows and long detention times-- will likely result in generation of hydrogen sulphide (H_2S) gas and other odors. To address this issue, the Ponderosa Avenue Lift Station will be equipped with measures to reduce/eliminate odor as follows:

- A passive carbon filter will be installed on the wet well vent;
- *Evoqua Bioxide® or Biomaxx OXYN8 B*, trademarked liquid phase chemical solutions, will be injected into the sewage as it departs the station via the force main. These chemicals are designed to negate hydrogen sulphide and other odor generation in the force main. The chemical totes and metering equipment will be housed within the proposed utility building. The RDOS can expect to spend $5,000 to $25,000 annually for the supply and delivery of Biomaxx. The cost will vary based on recorded H_2S levels.
- An H_2S sensor will be housed in the terminus manhole located at the discharge point of the force main. The sensor will be energized from the flow control kiosk located immediately upstream of the terminus manhole. Data from the sensor will be fed from the sensor back to the flow control kiosk, with the intention that the chemical injection rates can be adjusted as necessary to minimize H_2S formation. The introduction of Bioxide or OXYN8 into the force main will go a long way to managing potential odor issues at both the discharge point and in downstream infrastructure. The chemical can be relatively costly, so careful calibration for the amount of chemical introduced into the force main is very desirable both from a cost and odor perspective. The data collected at the sensing locations will allow operations staff to optimize the dosing rates.

12.4.6. Standby Power

Similar to the Alder Avenue Lift Station, the Ponderosa Avenue Lift Station will be equipped with a diesel genset housed in an acoustic enclosure. The unit will be installed on a concrete pad beside the building.

12.4.7. Emergency Storage

Emergency storage will contain up to one hour of Peak Wet Weather Flow. Storage will be available in the station's wet well, influent pipe and in an adjacent storage pipe. **Table 12.2** summarizes the total storage volumes required for the initial service area and for the ultimate service area, both at full buildout.

The Ponderosa Avenue Lift Station wet well will provide up to 22.8 m^3 of storage with the additional storage available in a 1.2 m diameter pipe installed underground in the 6th Street and Ponderosa Avenue rights-of-way. Initially, some 36 m of 1.2 m diameter pipe will be installed, increasing the total available storage to 64 m^3. This storage pipe must eventually be extended an additional 124 m (160 m total length) to satisfy the 205 m^3 storage requirements for the ultimate buildout scenario.

The storage pipe will be graded back to the wet well allowing the storage pipe to drain after each use.

TABLE 12.2: EMERGENCY STORAGE REQUIREMENTS

Emergency Storage Condition	Initial Service Area Full Buildout	Initial Service Area Full Buildout Storage	Ultimate Service Area Full Buildout	Ultimate Service Area Full Buildout Storage
	Lps	Cubic Meters	Lps	Cubic Meters
Peak Wet Weather Flow	17.8	64	57.0	205

The 1.2 m diameter storage pipe can be extended further northward on Ponderosa Avenue at some point in the future, as demands on the system dictate. Unfortunately, extending the storage pipe northward will be expensive and disruptive to the newly finished Pioneer Park parking lot. Installation of the storage main will necessitate removal and replacement of the existing drainage swale, catch basins and a portion of the western perimeter of the parking lot. Any future funding for the extension of the storage pipe should be sufficient to cover costs for restoration of the surface works.

12.4.8. Other Features

Other features of the Ponderosa Avenue Lift Station design include:

- Cost effective wet well selection – Similarly to the Alder Avenue Lift Station, the Ponderosa Avenue Lift Station will be installed below the groundwater level in manner that does not require expensive dewatering.
- Allowance for wash water supply - Water supply for the station will be available from the nearby Kaleden Irrigation District system.
- Means for cleaning the force main - A pigging station to allow cleaning of the force main as required.

12.5. Force Main to Okanagan Falls

Drawings C14 - C25, contained in **Appendix I**, outline the preliminary details for the force main construction.

Ultimately, at full buildout of the Kaleden community and well beyond the limits of the initial phase of the sewer program, the force main must be capable of conveying peak wet weather flow of 57 Lps (Reference **Section 4** above). To provide for a minimum flushing velocity of 1 m/sec, the diameter of the main must be in the order of 250 mm for this peak flow rate. DR 25 PVC pipe conforming to AWWA C-900, with an interior diameter of 258 mm, nicely accommodates this requirement. In addition, our construction consultant advises us that the narrow construction corridor associated with the KVR route for the force main lends itself well to a bell and spigot type of pipe, rather than a fused HDPE alternative.

The option of decreasing the pipe diameter (to save costs) and increasing the fluid velocity unfortunately is not viable. The hydraulic friction losses associated with the five-kilometer long pipe escalate quickly once velocities increase much above 1 m/sec. Installing two smaller mains (say 2- 200 diameter pipes) would increase costs and introduce hydraulic complications related to the very lengthy force main.

The force main will be installed with a saw tooth profile in order to create high points where air release valves can release air pockets. A.R.I. Model D-0205B Direct Bury combination air valves (or equivalent) lend themselves well for this project since the direct bury feature will not interfere with traffic on the trail and obviates any confined space issues.

The force main will be attached to the existing pedestrian trestle crossing the Okanagan River, near the outlet of Skaha Lake. This crossing will consist of a steel pipe conduit, insulated and heat traced, with protective aluminum jacket encasing the pipe and insulation. Additional details on the trestle crossing are provided in **Section 12.6** below.

Farther south, the force main will cross under Highway 97. The Ministry of Transportation and Infrastructure (MOTI) has confirmed that the force main crossing under Highway 97 must be installed by boring, auguring or some other trenchless method. In addition, the force main must be contained within a steel casing pipe. To accommodate the carrier pipe and appropriate spacers and fittings, a 450mm steel casing will be required, approximately 16m in length.

The terminus of the force main will be on Cedar Street, just south of Highway 97, in Okanagan Falls. Currently, the downstream mains provide limited capacity for the proposed flows from Kaleden. This challenge will be met with installation of about 470 m of new 300 mm diameter gravity main along Cedar Street, connecting at the intersection of Cedar Street and 13th Avenue. This upgrade is discussed in some detail in **Appendix O**.

The highest point along the force main route will be south of the Ponderosa Avenue Lift Station, where the summit of the hill is higher than the terminus of the force main in Okanagan Falls. After completion of a transient analysis assessing the effects of water hammer on the proposed force main, we determined the need for a pinch valve to keep the force main full and maintain a fixed upstream pressure. A modulating pinch valve will be installed in a kiosk located immediately upstream of the force main discharge point on Cedar Street. The pinch valve will normally be closed to prevent the force main from draining and will modulate so as to maintain a constant upstream pressure when the Ponderosa Avenue Lift Station operates. A copy of the transient analysis is included in **Appendix Q.**

The transient analysis also identified the need for three 50 mm combination air release and air/vacuum valves to alleviate negative pressures should a sudden pump stoppage occur, usually immediately following a system power failure. The required air valves are identified on the preliminary drawings contained in **Appendix I**.

12.6. Okanagan River Pedestrian Trestle

The KVR trail corridor crosses the Okanagan River slightly north of Okanagan Falls. The trail utilizes a former railway trestle, modified to accommodate pedestrian traffic only. Vehicles are prohibited from using the trestle.

Where the force main to crosses the Okanagan River, we propose it be attached to the outside of the trestle, on the west side. The west side of the structure provides more heat from the sun in winter and, additionally, avoids any conflicts with the diving platforms on the trestle. The carrier pipe will be steel, equipped with a premanufactured insulation collar and a polyethylene, protective jacket. The pipe will also be provided with heat tracing to supplement the insulation. Details of the connection are provided in **Drawing D02** in **Appendix I**.

The Regional District recently received a report from the Ministry of Forests, Lands, Natural Resources Operations & Rural Development which summarizes the results of a condition assessment of the trestle. A copy of the Ministry's report is provided in **Appendix M**. Generally speaking, the trestle is in good condition. Some immediate work is needed on several wooden piles to extend their life. Five piles appear to need replacement in the near future. Both abutments will need work in the next couple of years.

Our structural sub-consultant, CWMM Consulting Engineers, also examined the trestle, with a view to connecting the insulated force main to the trestle. A copy of the CWMM report is provided in **Appendix M**.

The main conclusion drawn from the CWMM report is as follows:

"*Recognizing there is no pedestrian loading on the outer edges of the pier cap, the trestle pier cap and outermost pile were found to be able to safely support the marginal new sewer pipe loading*."

The RDOS may wish to consider economies of scale by incorporating identified work at the two abutments into the construction contract for the force main. Presumably the abutment replacement work would be funded separately. The insulated force main will penetrate both the north and south abutments.

Co-ordinating both initiatives will avoid duplication of costs and, potentially, any higher costs for the abutment replacement if the force main is in place prior to the abutment replacement work.

We recommend that the RDOS initiate the abutment replacement design and budget allocation well in advance of tendering the Kaleden sewer project.

12.7. Access to the Force Main Corridor

During our earlier discussions with the RDOS, we highlighted that construction access to the KVR trail, between Kaleden and Okanagan Falls, is absolutely critical to the financial and physical success of this project if the force main from Kaleden is to be aligned within the trail. The trestle at the south end of the trail is physically and structurally inadequate for heavy, wide construction equipment. At the north end, the trail width through the Ponderosa Resort property is entirely too narrow to reasonably accommodate construction activities. Further, we note a designated right-of way through the Ponderosa Resort lands to accommodate the trail is currently not in place.

We've identified several potential solutions for access to the railway grade:

- Arrange for a temporary construction right-of-way through the Ponderosa Resort property. However, the April-October tourist season may dictate construction in less desirable months of the year.
- Negotiate a temporary (or possibly permanent) construction right-of-way nearer the south end of the project, about one kilometer north of the trestle. At the moment, the lakefront property east of the rail right-of-way is accessed via an easement from the Old Kaleden Highway. Is it possible to arrange for access down this easement for construction traffic?
- Investigate a potential access from Highway 3A down to the former railway right-of way. Is it possible to arrange for access down this easement for construction traffic?

We strongly recommend that prior to finalizing the design and proceeding to the tender phase, the temporary access solutions be in place with the respective landowners.

Reference **Appendix N** for additional information on the location and extent of these suggested access points.

12.8. Road Restoration

Design and construction of the trunk conveyance system (and associated costing) must also account for the MOTI's position on road restoration. As with the roads in the collection system, MOTI has also indicated that for all roads, if the paved surface is disturbed, a minimum of one half of the road must be fully replaced. No partial lane replacement will be permitted. This condition primarily affects work on Cedar Street in Okanagan Falls.

12.9. Preliminary Class B Costing—KVR Trail Trunk Conveyance System

Appendix L summarizes the preliminary design level estimated construction costs for the KVR Trail Trunk Conveyance System only. The KVR Trail Trunk Conveyance system consists of the Ponderosa Avenue Lift Station, the force main, trestle crossing, Cedar Street gravity main and the connection point with the Okanagan Falls sanitary sewer system. See **Section 15.0** of this report for a complete Class 'B' estimate summary for the entire project.

13. MAINTENANCE CONSIDERATIONS

The required maintenance tasks for the Kaleden sewer project are summarized in **Table 13.1**. This table is intended to highlight major tasks and does not identify every task that may need to be completed over the service life of the infrastructure.

TABLE 13.1: RECOMMENDED MAINTENANCE SUMMARY

Component	Routine Maintenance Tasks	Estimated Annual Cost
Gravity Sewer Collection System	• General O&M – pipes ($1.50/m)	• $7,945
Lift Stations	• Inspect building or kiosk weekly (4hrs) • Test backup power monthly (2hrs) • Replace chemical metering pump parts as required, arranging for chemical deliveries, changing out drums or totes as needed, reviewing H_2S data periodically and adjusting dosage rates, and periodically cleaning injection quill (30hrs every 6 months) • Test check valves every six months to a year (2hr per LS) • Maintain HVAC equipment as specified (20 hrs) • Test chemical secondary containment system annually (4hrs) • Exercise internal valves annually (2hrs per LS) • Unblock pumps as needed	• $13,520 • $1,560 • $3,900 • $260 • $1,300 • $260 • $260
Force Mains	• General O&M – pipes ($1.50/m)	• $7,040
Flow Control Kiosk	• Lubricate valve and actuator each month (4hrs per month) • Calibrate and maintain H2S sensor as per supplier recommendations (20 hrs per year)	• $3,120 • $1,300
TOTAL:		**$40,465/ year**

Notes:

1. Labour cost of $65/hr used in above estimates.

14. KNOWN UNCERTAINTIES AND RISKS

At the conclusion of the preliminary design stage, some items were identified as requiring additional investigation. The RDOS should be aware of a number of uncertainties and risks associated with the project that may impact both cost and schedule. These include:

- Extent of bedrock on the KVR Trail – level of information needs to be increased;
- Construction access approval – subject to private property owners' co-operation;
- Statutory right-of-way acquisitions – subject to private property owners' co-operation;
- Government agency approvals – lengthy approval process and subject to Ministry staff position;
- FortisBC's commitment to providing a timely power supply to the lift stations;
- Public reaction to KVR trail closure during construction period;
- Downstream capacity – real time flow measurement and capacity analysis confirmed;
- KID and FortisBC record information – add additional detail and construction instructions to locations of complex crossing areas with additional field effort; and
- Restoration requirements of the KVR trail – can we re-use existing materials or is there a stringent RDOS specification for the trail replacement?

15. PREDESIGN COSTING SUMMARY

Construction costs for the Kaleden sewer system, including both collection and conveyance systems, are summarized in **Table 15.1** below. In addition, we summarized costs already incurred by the RDOS for preliminary designs for both the Skaha Estates and Kaleden systems and have accounted for anticipated detailed design costs to advance the current design through to award of the construction contract.

TABLE 15.1: COLLECTION AND TRUNK CONVEYANCE SYSTEM - PRELIMINARY CLASS 'B' ESTIMATE

Project Element	Class "B" Estimate	Grant Funding Portion	Kaleden Portion
Preliminary Design			
- Kaleden Preliminary Design	$ 240,800	$ 160,500	$ 80,300
- Skaha Estates Preliminary Design (*Remaining $109,900 paid by Electoral Area D)	$ 329,800	$ 219,900	
Detailed Design			
- Engineering (Including tendering services and expanded service area)	$ 210,200	$ 140,100	$ 70,100
- Additional Geotechnical Investigation	$ 15,000	$ 10,000	$ 5,000
- Additional Surveys	$ 10,000	$ 6,700	$ 3,300
- Additional Environmental	$ 7,600	$ 5,100	$ 2,500
- Additional Structural Design	$ 15,000	$ 10,000	$ 5,000
- Pre-locate Utilities	$ 10,000	$ 6,700	$ 3,300
- Public Engagement and Communications	$ 60,000	$ 40,000	$ 20,000
- Archaeological Pre-Construction Field Work, Permit, and Reporting (Per PIBNR Memo)	$ 77,400	$ 51,600	$ 25,800
Construction costs			
- *Collection System only (Appendix)*	$ 2,937,700	$ 1,958,500	$ 979,200
- *Trunk Conveyance System only (Appendix)*	$ 4,049,600	$ 2,699,700	$ 1,349,900
- Construction Engineering Services (per USL proposal) Plus Expanded Service Area	$ 378,200	$ 252,100	$ 126,100
- Public Communications	$ 50,000	$ 33,300	$ 16,700
- Environmental Monitoring Allowance (Estimate 12hrs/wk, 4 months)	$ 42,100	$ 28,100	$ 14,000
- Archaeological Monitoring Allowance (Per PIBNR Memo)	$ 74,600	$ 49,700	$ 24,900
- Geotechnical Testing Quality Assurance	$ 20,000	$ 13,300	$ 6,700
Subtotal	$ 8,528,000	$ 5,685,300	$ 2,732,800
Contingency allowance (15%) - Applied to Detailed Design and Construction Costs Only	$ 1,193,600	$ 795,700	$ 397,900
TOTAL (Excl. GST):	**$ 9,722,000**	**$ 6,481,000**	**$ 3,131,000**

Costing Summary Notes:

Engineering fees and archeological/environmental monitoring reflect administration of a single construction contract comprised of both the collection system and the trunk conveyance system works.

A Class B estimate is categorized as follows:

"This estimate is prepared after site investigations and studies have been completed and the major systems defined. It is based on a project brief and preliminary design. It is used for obtaining firm financial commitments, budgetary control and design cost control. A contingency allowance of 15% plus engineering and other allowances is appropriate for this class of estimate."

We also note the cost estimate reflects current and general 2021 construction year values and therefore should be modified for inflation and local construction cost increases for the actual year of construction.

No allowances have been made in the estimate for:

- Private homeowner connection charges;
- Statutory rights-of-way or private property acquisitions;
- Legal fees and legal survey fees;
- Interim or short-term financing;
- Municipal Financing Authority charges;
- RDOS and/ or KID staff administration charges; or
- Goods and Services Tax (GST)

16. SCHEDULE AND CONSTRUCTION

With input from our construction consultant, we developed a preliminary construction schedule:

- Designed to minimize impacts to residents while maintaining construction efficiencies,
- That can be completed in one construction season; and
- That reduces or prevents risks to sensitive species and critical habitat.

In conjunction with the construction zoning plan (**Figures 16.1 and 16.2, Appendix H**), we believe construction could commence as early as Spring, 2021 with commissioning completed by the end of 2022, barring any challenges or delays receiving all necessary permits and approvals. We base this belief on the following strategy:

- Construction start-up –Spring 2021
- Kaleden Collection System – Spring to late fall 2021 (possibly multiple crews – multiple mainline crews and Alder Avenue Lift Station crew)
- Cedar Street gravity system –three to four weeks between Spring and Summer 2021
- Ponderosa Avenue Lift Station – Fall 2021
- Kaleden/KVR Trail force main to Cedar Street tie-in – Fall 2021 within the allowable environmental work window and outside of peak trail user season
- Final miscellaneous items – wrapping up in 2022

17. NEXT STEPS

Assuming funding for this project is confirmed, we suggest the following steps be initiated prior to tendering the project. A number of them are time sensitive.

17.1. Meeting with MOTI and Kaleden Irrigation District

Since MOTI will be approving the application to construct works within their rights-of-way, we suggest an early meeting with that agency to ensure they are “on board” with the project and the impacts on their infrastructure. In addition, road restoration prescriptions will be confirmed.

Similarly, KID will be substantially impacted by the construction and we understand KID may be contemplating a new supply main up Lakehill Road. An early meeting with KID to discuss partnering and co-operation related to the project is deemed highly worthwhile.

17.2. Arrange for Power Supply for Lift Stations

We recommend initiating the process with Fortis BC as early as possible, given the length of time required to arrange for third party utilities work.

17.3. Secure Construction Access Points

This topic is discussed in **Section 12.7** of this report. Addressing this topic is considered a high priority for the project.

17.4. Questionnaires

Individual questionnaires to each property owner should be issued as soon as the design phase is initiated. These questionnaires provide valuable information to the designer and, as well, can generate insightful conversations between the design team and the property owners.

17.5. Additional Surveys

The survey work required to complete the design will entail acquiring main floor and/or basement elevations in order to establish service elevations at both the property line and at the main. Road cross-sections will be needed to re-establish roads to their existing locations and elevations. Additional survey information will be needed to confirm the location and/or grades of existing utilities within the construction area, including Cedar Street. Lastly, elevations of the cross-members of the trestle should be confirmed in order to establish precise settings for the hangers supporting the insulated pipe crossing.

17.6. Rights-of-Way Acquisition

The preliminary design is based upon the assumption that all rights-of-way through private properties can be acquired by the RDOS. The process of contacting the individual property owners and confirming the rights-of-way is time critical and should be initiated as early as possible.

17.7. Additional Geotechnical work

We expect that some additional drill holes will be needed to more accurately define the extent and depth of bedrock on the KVR force main route. In addition, we recommend additional test holes south of the trestle up to the point of connection with the Okanagan Falls collection system and at the augured crossing location under Highway 97. At the moment, we do not have geotechnical information for this segment of the force main construction.

17.8. Expose Key Points of Vertical Conflict

The expense of dealing with grade conflicts during construction can be significant, both in terms of time and cost. We recommend where there may be potential grade conflicts between the existing storm and water mains and the proposed new sewer main, the existing utilities be exposed during the design stage in order to verify the pipe obverts. We noted earlier that exposing the gas main under the KVR trails will be required as part of the crossing application to FortisBC Gas. The private water line and two drainage culverts north of the trestle should also be checked at the same time for invert elevation and grade across the trail.

17.9. Finalize Plan/Profile drawings

The plan/profile drawings provided at the preliminary design stage will need to be modified and adjusted to reflect the new information generated by the questionnaire process and the basement/main floor surveys. We expect that a number of sewer main depths and profiles will need adjustment.

17.10. Finalize Detail Drawings

The details provided in the preliminary design report are generally schematic in nature. The final design package will require far more details in order to supplement the MMCD contract. Of particular note will be the undercrossing details required for sanitary service connections beneath the existing asbestos cement water mains. The detail will need to address the fragility of the AC piping relative to any settlement underneath the conduit.

17.11. Finalize Lift Station Design

As with the detail drawings, the preliminary design report does not provide a design level of detail for the lift stations. Mechanical, electrical, architectural, civil and structural input will be required. In addition, the pump selection and system hydraulics should be reviewed and confirmed during the design process.

17.12. Approvals

Approvals for this project will be required from:

- MOTI – An Application to Construct Works in a Public Right-of-Way will be required from the Ministry.
- FLNRORD and DFO – We anticipate approvals to construct works on the KVR trail, including installing the pipe on the trestle, may take up to a year. Preparation and submission of the following applications should be completed as soon as possible, perhaps even before the referendum process, as the approvals are often time critical.

    - Environmental Management Plan (EMP)
      This plan typically guides the development of environmental work plans for construction activities and provides effective environmental protection during the construction and operations phases of the project. The EMP typically includes the environmental monitoring program, identifies reporting requirements and outlines an emergency response plan.

    - WSA Section 11 Approval Application
      A Water Sustainability Act (WSA) Section 11 Notification Application will be needed for the aerial crossing of the sewer line on the trestle crossing the Okanagan River. This application would also cover crossing of multiple streams along the proposed project site.

    - WSA Section 10 Short-term Use Approval
      During construction of the sewage pump stations and Alder Avenue sewer mains, groundwater from well-point watering will need to be pumped and discharged. A Section 10 Short-term Use approval from FLNRO will be required.

- Crown Land Tenure
  All utilities located on Crown land require permission from the Province to use the land. This permission will be obtained via an application under the Land Act. We expect the entirety length of the force main within the KVR trail will require either a Licence of Occupation or a statutory Right-Of-Way.

- First Nations – Continue with PFR and apply for permit to alter if necessary.
- FortisBC Gas – RDOS will need to apply for a pipeline right-of-way permit at https://www.fortisbc.com/build-renovate/pipeline-right-of-way-permits. The permit application is reviewed by FortisBC's engineering department and they will provide RDOS with their specific requirements and the applicable Oil and Gas Commission (OGC) regulations. Such requirements will likely include minimum separation, crossing angle and the requirements for ground disturbance activities and heavy equipment use around the pipeline. This approval will likely only be required for the transmission main crossing on the KVR.

17.13. Supplementary Specifications and Measurement and Payment Clauses

While MMCD is an admirable contract document, retro fit projects such as Kaleden sewer project necessitate development of additional specific technical and contractual language. Equally as important is provision of measurement and payment clauses for each of the units of work associated with the project, many of which are not covered within the base MMCD document. The standard details contained within the MMCD document itself will also need modification and adaptation to suit this particular project.

17.14. Public Consultation

An ongoing public consultation and information program will be essential to the success of the project. The public will need to be kept informed on an ongoing basis about the progress of both the design and construction phases. Further, we recommend the residents be made very much aware that the construction will be disruptive and noisy, since these inconveniences come with utility and road construction within developed residential neighborhoods. We believe being candid about the construction impacts upfront will keep expectations in check, rather than painting too rosy a picture initially and face criticism later when the reality becomes apparent.

17.15. Evaluate Alternative Procurement Models

Historically, communities and governments have tendered and awarded capital projects to the lowest tenderer, assuming of course that contractor has submitted a compliant tender. The MMCD tender documents are founded on that model. Unfortunately, the lowest tender does not necessarily mean that the contractor has the requisite experience working in developed areas and/or will not be prone to submit a continuous string of extra claims to make up for a tender price that was too low.

Amongst some of our municipal clients we are seeing innovative and successful alternatives to the historical low bid ethos. These include:

- *Prequalification of contractors*: Under this model, the RDOS would issue a request for qualifications, similar to the process used for selecting consultants. A short list of three or four qualified contractors is prepared and these firms are then asked to submit competitive tenders. The benefit of this model is that only those contractors with a history of successfully completing similar retrofit projects in a co-operative partnering fashion are eligible to participate in the tendering process.

- *Modified MMCD tender documents:* A recent court case decision has opened the doors for municipalities to include selection criteria other than price into the MMCD form of contract. This approach eliminates the prequalification step while incorporating the benefits of a prequalification process.
- *Negotiated Request for Proposal:* The City of Kamloops has adopted this model of procurement for larger capital projects and is extremely pleased with the results. This approach requires the contractors to submit a proposal, (including detailed pricing based on a standard Schedule of Quantities and Prices) rather than a tender. The appeal of this model is that the contractors can provide suggestions, ideas and pricing alternatives that otherwise cannot be submitted to the Owner under the traditional tender process. The final result is a negotiated contract and price, although the price originally submitted with the proposal would only change (up or down) where the scope changes significantly from that outlined in the final design documents provided by the Consultant.

17.16. Other Considerations

Other items the RDOS may want to consider initiating prior to (or as part of) the detailed design work which will further support the design, design assumptions or proposed construction schedule include:

- Timing of any tree removals should be carried out to avoid any bird nesting issues.
- Completion of any engineering designs for the north and south abutments of the pedestrian trestle across the Okanagan River.
- Real-time flow measurement and downstream analysis update. We recommend the RDOS acquire reliable data on daytime peak flows and night low flows in order that the assumptions and calculations completed earlier by Urban Systems can be confirmed.

17.17. Summary

Please note items **17.1 - 17.16** are not an exhaustive summary. The items listed above are seen as significant tasks that should be considered when setting a timeline to complete the project as well as to address regulatory, co-ordination and design matters. Many of the items are already included in the detailed design phase scope for the consulting assignment. Others have been identified as the preliminary design phase has unfolded. **Table 17.1** below summarizes key elements of the project and assigns a rating to the element in terms of its urgency from a schedule and impacts perspective.

TABLE 17.1: PRIORITY POST PRELIMINARY DESIGN TASKS

Project Element	Urgency Rating
Preparation and submission of FLNRORD and DFO approvals (tenure, environmental, fisheries)	Critical - could take one year
Access permission to KVR trail	High
SROW acquisitions	High
FortisBC power service to lift stations	High
Trestle abutment design	High
Additional geotechnical investigation	Moderate
Additional Surveys	Moderate
Vertical conflicts investigation	High-especially for FortisBC Gas approval
Issue homeowner questionnaires	High
MOTI approval	High
Downstream flow monitoring and capacity analysis	Critical - hopefully confirms assumptions and calculations made for preliminary design purposes

The RDOS may wish to consider initiating action on some or all of these items in advance of public consultation and information activities, the Bylaw referendum, as well as the final design and tendering phases for the project. Given the critical nature and the time sensitivity of several these items, a proactive and early course of action is recommended to realize their early resolution.