Hillcrest Infrastructure Renewal Project
Pre-Design Report

DRAFT #2 FOR PUBLIC REVIEW

(Working document, periodically updated)

City of Whitehorse
Engineering Services Department

August 2016

- THIS DOCUMENT IS FORMATTED FOR DOUBLE-SIDED PRINTING -

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1.0 INTRODUCTION

1.1 PROJECT ASSIGNMENT

Infrastructure renewal for the Hillcrest subdivision of Whitehorse was first identified in the mid-1990s, and has been considered for development since that time. In 2010, the Hillcrest Community Association requested that the City of Whitehorse consider reconstructing the infrastructure to bring the water, sewer and roads to meet new standards. In the 2012 and 2013 Capital Plan, City Council allotted funds for data acquisition and pre-design development of the project and community neighbourhood planning. The project is anticipated to be partially funded through Local Improvement Charges applied to all benefitting properties.

A draft of the Infrastructure Pre-design Report was completed by the City's Engineering Department through consultation with City departments, consultation with Hillcrest property owners and residents, and with the assistance of engineering and planning consultants in 2013. Public input on the initial design was received through public meetings and surveys.

Comments have been considered and incorporated within this updated draft Pre-design report.

1.2 PROJECT DESCRIPTION

The scope of the proposed infrastructure renewal project is focused on reconstruction of existing municipal infrastructure. No changes are planned to zoning. The proposed construction will be contained within the boundaries of the Hillcrest subdivision. Off-site improvements are under consideration for water supply and storm sewer discharge. Drawings are included within this report for the contemplated changes to the storm water, water supply and sanitary sewer systems, road network, and active transportation network. The changes include but are not limited to:

- Reviewing existing and potential new easements required for operation and maintenance of the water supply, sanitary sewerage and power/telephone systems to determine what areas are expected to remain.
- Upgrading water supply and distribution system considering use of shallow-bury water mains to minimize impact on the neighbourhood and relocate from easements into the road right-of-way where possible.
- Upgrading sanitary sewerage collection system for those sewer mains that require upgrading to new standards and relocate from easements into the road right-of-way where possible.
- Providing new storm drainage infrastructure, or replacement and enhancement of existing rural drainage features such as drainage ponds, swales, ditches, and bio-swales.
- Replacing water and sanitary services within road rights-of-way where required, and where possible and cost effective on residential property to meet new bylaws by eliminating bleeding of water services. Existing sewer services on private property will be reviewed and evaluated with property owners as to possible replacement at the time of construction as the cost for sanitary service replacement will be at the cost of property owner.

- Confirming with property owners the plumbing modifications and home restoration that would be necessary to install and connect new water recirculating service for frost protection.
- Improving sanitary sewer services if possible to meet City water and sewer bylaws both inside buildings and outside on private property.
- Reviewing the continued use of combined water and sewer services for the Steelox (duplex) units currently sharing a single service to determine if physical separation is possible and cost effective. Assist in developing easement agreements between duplex owners to enable use and maintenance as necessary.
- Upgrading paved roadway structures to new standards and reviewing the width and alignment of paved roadways as it relates to the existing neighbourhood and new standards for minimum and recommended widths, and centring within the road rights-of-way to minimize impact on adjacent properties and developments.
- Reviewing the current standard for new developments where curb and gutter may or may not be connected monolithically with sidewalks in the neighbourhood. Consider curb/gutter that could replace ditches and swales to address drainage issues, parking needs, restore disturbed areas, improve pavement life, or improve rural drainage ditches and swales that can maintain the current look of the community and achieve the same results.
- Providing sidewalks where recommended for pedestrian and traffic safety and accessibility along bus routes and/or collector roadways (Roundel Rd, Hillcrest Dr, other transit streets.)
- Reviewing impact on streets, existing landscape features, traffic safety and traffic calming improvements, accessibility and historical character of the area with rural ditches/swales.
- Minimizing impact of improvements to existing landscaping on and in front of existing lots that may be located within the road rights-of-way that could be damaged with the installation of new sewer, water and road infrastructure. Repair landscape areas, but while recognizing that all landscaping cannot be replanted to current conditions.
- Working with ATCO Electric Yukon and Northwestel where existing overhead wires attached to wooden poles impact on existing homes and infrastructure. Burying overhead infrastructure is not cost effective and the impact on new street lights, transformers, switching cubicles, and connection to existing homes would be significant.
- Providing for improved active transportation routes and connections where possible.

1.3 NAMING CONVENTIONS

1.3.1 Institutions

The City of Whitehorse, primarily represented by Engineering Services in regards to this Pre-design Report is referred to herein as **the City**; the Yukon Territorial Government is referred to as **YG;** Northwestel is referred to as **NWTEL**, and the ATCO Electric Yukon Company Limited is **ATCO**.

1.3.2 Street and Lot Directions

For ease of use, Sunset Dr N, Roundel Rd, and Hillcrest Dr are referred to as running in an east/west direction. The front of each lot is the side that borders the street fronting it as defined by the street address, regardless of the orientation of the building situated thereupon.

1.3.3 Sunset Dr N and Summit Rd

The triangular configuration of the intersection of Summit Rd and Sunset Dr N could lead to confusion regarding the reconstruction of that intersection and the lots to the west. For the purposes of this report, Summit Rd will be considered to terminate at the north intersection of Summit Rd and Sunset Dr N. The lots between #85 and #89 Sunset Dr N (north-west of the intersection) will be considered to be on Sunset Dr N, as this is how they are listed in the City's tax records.

Further to the above issue regarding the Summit Rd and Sunset Dr N intersection, the property at the northeast end of Sunset Dr N has been known as both #90 Summit Rd and #90 Sunset Dr N. For the purposes of this report, this property will be referred to as #90 Sunset Dr N.

1.3.4 Condominiums and Apartments

The lots east of Summit Rd, south of Roundel Rd, and north of Hillcrest Dr are currently developed as apartments and condominiums. Although they should also be listed by street address, the names of these developments are also referred to in this report. The current names of the developments are:

- 19 Roundel Rd (Terra Apartments)
- 20 Roundel Rd
- 156 Hillcrest Dr

1.4 LOCAL IMPROVEMENT QUESTIONNAIRE

In preparation for the design and execution of this local improvement (LI) project, the City's Planning Services Department administered a voluntary questionnaire in January 2012. Residents and property owners were asked for their input on infrastructure issues and design preferences. The results of the questionnaire are referenced in this report and are included in Appendix A (a summary version is available online).

2.0 EXISTING SITE CONDITIONS

2.1 GENERAL DESCRIPTION AND SITE HISTORY

The Hillcrest subdivision is centrally located in Whitehorse, west of the Alaska Highway and opposite of the Erik Nielsen Whitehorse International Airport. The geographic area is roughly rectangular, and is bordered by greenbelt on the north, south, and west. The eastern border is the highway and an industrial area that parallels the highway heading north. The topographic character is a hillside rising with a relatively consistent grade from east to west.

The subdivision has several types of residential zoning in place, which includes RS–Residential Single Detached, RS2–Residential Single Detached 2, RCT–Comprehensive Residential Townhouse, RM–Residential Multiple Housing, and RCM–Comprehensive Residential Multiple Family. Housing in the area

consists of single-detached homes, duplexes, townhouses, and apartment units. Park Ln, Dalton Tr, and the west end of Hillcrest Dr are developed with the 'Steelox' brand of buildings (mostly duplexes and one single unit) that were assembled by the Canadian Military. Other zones in the subdivision include CNC–Comprehensive Neighbourhood Commercial, PS–Public Services, PR–Parks and Recreation, and CH–Highway Commercial.

At the time of the subdivision's development, the airport was occupied by the military whose personnel were undertaking the development of the airport, the City of Whitehorse, and the continued development and operation of the Alaska Highway. The bulk of the construction of the Hillcrest subdivision occurred between 1955 and 1960. During that time, Hillcrest Dr, Summit Rd, Roundel Rd, Chalet Cr, Kluane Cr, Sunset Dr S, Park Ln, and Dalton Tr were built. Roundel Rd was later extended from the intersection with Summit Rd east to the Alaska Highway. By 1970 the operation and maintenance of Hillcrest was passed from the Department of National Defence to the City of Whitehorse. Since then, some limited redevelopment and modifications have occurred:

- In the 1970s, the roads in the subdivision were upgraded from gravel to bituminous surface treatment (BST) and then to asphalt, but the asphalt is now failing in many areas and the structure and width of road surfaces do not meet current City standards.
- In 1976, YG developed Sunset Dr N from Roundel Rd to Park Ln.
- In 1988, portions of Hillcrest Dr and Roundel Rd were reconstructed at the Alaska Highway.

There are approximately 165 residential lots with single family detached and duplex homes. Four multiple housing buildings are located between Summit Rd and Burns Rd. The Yukon Bureau of Statistics' December 2014 Population Report listed a subdivision population of 643.

Two large and centrally located green spaces, approximately 3 ha in total size, represent 13% of the total area of Hillcrest. Walkways and/or Public Utility Lots (PULs) connect streets to these central parks. Located near the east/north end of Hillcrest, adjacent to Sunset Dr N and Roundel Rd is a treed area owned by YG (Lot 130) with a surveyed laneway adjacent.

2.2 ADJACENT LANDS

Hillcrest is bordered on three sides by greenbelt areas (Lot 421 Rem and Lot 421-138 Rem). These areas are untitled public land under the jurisdiction of YG and are designated as recreation areas in the City's 2010 Official Community Plan. All of the greenbelt areas adjacent to Hillcrest are developed with walking/cycling trails, and are used heavily by commuters, recreationalists, cyclists, and pedestrians. The lands bordering Hillcrest are illustrated in Figure 2.1 (note all figures are separated into various appendices and are not located within the text for easier reading).

Beyond the 250 m wide greenbelt to the north is Hamilton Blvd, a primary transportation artery for the Copper Ridge, Granger, and McIntyre Subdivisions with no vehicle connection to Hillcrest. To the northwest, separated by the greenbelt, is the Elijah Smith Public Elementary School. Beyond the 200 m greenbelt to the west lies Thompson Rd, part of the Granger subdivision.

The greenbelt to the south extends 1.5 km and more towards the Hamilton Blvd Extension. The land to the south is low relative its surroundings so that most of the southern border of Hillcrest is a marshland. This greenbelt area contains a seasonal marsh called Paddy's Pond, and a small lake named Ice Lake.

The area in the Official Community Plan is 'Paddy's Pond/Ice Lake Park', and is a classified as a Regional Park.

The eastern border of the subdivision is the Alaska Highway right-of-way. The highway is owned and maintained by YG. YG has recently completed a Functional Plan identifying changes to the Highway that would see the Highway widened to 4 lanes. The plan proposes a new service road running parallel on the west side of the Highway, which would connect Hillcrest Dr to Roundel Rd and the businesses north of Roundel Rd. This service road would not connect all the way through to the north entry of Burns Rd. New traffic signals are also proposed. The work is being reviewed by YG's Department of Highways and Public Works and changes are planned within the next 5 years.

The northeast edge of the subdivision and west of the Alaska Highway are Burns Rd and Wasson Pl. This mixed commercial/industrial area is known as the "Burns Rd Industrial Area" or "Hillcrest Industrial Area", and was developed in 1976 and 2009. No work is planned for this area as a part of the Hillcrest LI Project. The limit of construction is anticipated to be the intersection of Burns Rd and Roundel Rd.

North of Sunset Dr N and east of Hamilton Blvd is the Tank Farm property, formerly owned by White Pass as a fuel storage facility. The current owner of the property is considering a mixed-use residential/ commercial development at the site, though the timeline for development is unknown as the site requires clean-up of hydrocarbon contaminated soils and groundwater. Clean-up of the Tank Farm area has begun and requires the removal of existing soils.

In 2014, the City installed a new water supply main connecting the water main on Sunset Dr N to Hamilton Blvd water main, replacing the existing supply main that angled across the Tank Farm property from the Alaska Highway water main. That existing main has now been abandoned.

2.3 LAND MANAGEMENT

2.3.1 Easements

The original design for the Hillcrest Subdivision included easements to allow for the operation and maintenance of the water/sewer infrastructure. Affected infrastructure included water mains, sewer mains, and storm drainage ditches (front and rear). When the titled lots were surveyed and sold, the easements were registered with the lots, but with no agreements in place to specify what the City is required to do with regards to required maintenance and the subsequent complete site restoration.

When designing the planned improvements to the subdivision, it will be crucial to understand the current and future implications of those easements. In some areas of Hillcrest it will not be possible to relocate all existing sewer mains without completely revising the plumbing within the property, and that would necessitate the complete replacement of existing mains that would not otherwise require replacement. Water mains will be relocated as much as possible.

For Steelox duplex lots, single water and sewer connections to and within the building are shared, separated inside the middle of one of the units. Many of the duplex units have separate owners, yet an easement agreement may not exist between the owners to address situations where repairs or replacement of broken or failed water and/or sewer systems may be required, or how to handle the resulting repairs and costs.

2.3.2 Laneways, PULs, and Roads

Hillcrest was designed for rear lane accesses and/or PULs behind many lots with street connections. Road rights-of-way (ROWs) were provided, but the access lanes within the PULs were never developed. In some cases the PULs are left as natural spaces but other locations (for example, west of Sunset Dr S and in the middle of Chalet Cr) the lots have been completely taken over by an adjacent property owner. PULs behind Dalton Tr and Park Ln have power/telephone lines. A portion of the PUL north of Sunset Dr N has a sewer main. In many PULs property owners have encroached with fences, sheds or just the storage of materials.

On the north side of Roundel Rd (at the west end), homeowners have purchased the laneway, but only one owner (#39 Roundel Road) has consolidated the two lots as one. In other areas of Hillcrest, some property owners have encroached on public lands or within PULs. They should take steps to get City and Council approval for such encroachment, or to restore the open space. Such steps could be arranged to be done at time of sale of lots to future homeowners and this requirement option could be considered by the City.

In the laneways adjacent to Dalton Tr and Park Ln W, overhead power and telephone lines installed on wooden poles serve the properties there.

Residential road rights-of-way in the old areas of Hillcrest are 12 m in width, which is smaller than what is typical in other areas of the City. In new subdivisions rights-of-way generally range from 18 to 20 m. Houses, garages, power poles retaining walls, and in some areas mature landscaping affects the normal design of roads and utility lines located within the road rights-of-way and some lots on Chalet Cr and Kluane Cr have no driveway or parking areas, so vehicles are parked within the right-of-way.

2.3.3 Private Servicing for Roundel and Summit Apartments

There are four multiple housing complexes located east of Summit Rd, between Roundel Rd and Hillcrest Dr. There are two groupings of eight townhouses developments at 156 Hillcrest Dr which are serviced from mains on Hillcrest Dr. The other three complexes – the condominiums at 19 Summit Rd (apartments), 20 Roundel Rd (townhouses), and the rental apartments at 19 Roundel Rd – are serviced by water and sewer mains that run through the shared central parking lot. The sewer main has a registered easement, and runs through all three lots. The water main is a dead-end system contained fully on the lot for 19 Roundel Rd. There is no easement for the water main.

From an operational perspective in terms of maintenance requirements by City staff on private property and to improve the operation of the overall water and sewer collection system, it is proposed to install new mains within the Roundel Rd right-of-way, and then transfer the ownership and maintenance of the existing mains to the apartment and condominium properties and their respective owners similar to what other multi-family properties are required to do.

2.3.4 New Land Uses

There are few land use changes being considered within the Hillcrest Subdivision. Lot 130, located at the east end of Sunset Dr N, between Summit Rd and Roundel Rd, is identified in the 2010 Official Community Plan (OCP) for potential residential infill. The vegetated area on the south side of Hillcrest Dr was another potential site, which is not currently identified in the OCP and is partially a wetland area. Storm outfalls have been proposed to cross Hillcrest Dr that will drain the residential areas into the

wetland area south of the intersection of Hillcrest Dr and Summit Rd, and into the greenbelt west of Dalton Tr from the intersection of Dalton Tr and Park Ln. The location of these outfalls would affect the number and availability of lots, and so infilling lots in those areas is not being pursued.

Some additional land or easement areas appear to be needed to provide proper operational and maintenance access to the sanitary sewer lines behind and adjacent to houses in Hillcrest, including the area west and north of Sunset Dr N and to the east within Lot 421 Rem. Access to the sewer mains for maintenance purposes will significantly impact the area, but has been avoided to date as operational issues appear not to be a problem.

2.4 INFRASTRUCTURE PLANS AND RECORDS

Record-keeping from the development of the Hillcrest Subdivision has not been consistent with today's standards. The availability of as-built data and service records is limited. Background drawings and reports as kept by the City's Engineering Department are available upon request and are listed below:

- *General Site Plan: Roads, Sanitary Sewer System, Water Distribution, and Location of Power Poles in PMQ Area*, Department of National Defence – Air Materiel Command (1954) *(sic)*
- *Sunset Drive North Water Sewer Plan Profile* – Government of the Yukon (1976)
- *Sunset Drive North Storm Drainage & Surface Works,* Government of the Yukon (1976)
- *Hillcrest Drive & Roundel Road Reconstruction Profile & Cross-Sections*, Stanley (1989)

This information is supplemented by City surveys of the infrastructure, which form the basis for the drawings contained in this report.

2.5 INFRASTRUCTURE CONDITIONS

2.5.1 Access, Existing Road Network, and Laneways

There are two road access points to Hillcrest residential areas. The primary accesses are Hillcrest Dr and Roundel Rd from the Alaska Highway. Future plans that are being proposed by YG are to close off Roundel Rd from accessing the Highway. Access to Roundel Rd and the businesses along the Highway would be from a new service road.

These accesses have been mostly unchanged since the mid-1980s, when portions of Hillcrest Dr and Roundel Rd connecting to the Highway were reconstructed. A third access is via Burns Rd, which connects Roundel Rd to the Alaska Highway at the north end of the Hillcrest commercial area serving the industrial areas there and on Wasson Pl. Future plans for the Highway show no service road to Burns Rd from Roundel Rd. The existing road network in the subdivision is illustrated in Figure 2.2.

The roadways within the subdivision are asphalt-surfaced. The older roads do not meet the City's current standards applied to new developments. The paved width varies from 5 m to 7 m, with gravel shoulders that are 0.5 to 2 m wide.

The newer roads meet current design standards in most respects. Sunset Dr N has a 9 m paved width from Park Ln to Roundel Rd. The eastern portions of Hillcrest Dr and Roundel Rd, between the Burns Rd and Alaska Highway intersections, are 10 m to 11 m wide.

Barrier curb with attached sidewalk exist along Sunset Dr N from Park Ln to Roundel Rd (the portion built in the 1970s). Barrier curb and a detached sidewalk are present in the portion of Hillcrest Dr between the Summit Rd and Burns Rd intersections. On all other streets, pedestrians and cyclists use the streets with vehicles and this "shared street" concept provides traffic calming features for the area, although concerns about pedestrian safety on the streets have been expressed particularly where cars travel at speeds higher than some feel is safe, especially during the winter.

Two laneways extend into the large greenbelt in the centre of the subdivision. They are primarily used by the City's Parks & Trails crew to maintain the ice rink that is located in the greenbelt between Kluane Cr and Chalet Cr. Although the lanes are not intended for public use, the homeowners on Roundel Rd, Kluane Cr, and Sunset Dr N have used the lanes to access their properties from the rear. One lane is an old Sunset Dr S right-of-way that runs north from the intersection of Kluane Cr and Sunset Dr S. It is paved for the first 100 m north of Kluane Cr, where a control gate has been installed. The lane is gravel and dirt beyond the gate. A second lane intersects Sunset Dr N on the southwest corner of the westerly intersection with Roundel Rd. It is essentially a trail with no surface treatment.

At the Hillcrest Dr/Park Ln W intersection, there is a cleared right-of-way that runs west, rising to intersect with Thompson Rd in the Granger subdivision. This right-of-way was the proposed location for a road connection to the Granger and Copper Ridge developments. It was cleared and graded in the 1990s, but public pressure led to the abandonment of the planned road connection. The right-of-way is gated to prevent vehicle access, and there are no plans to build a road, but a paved path has been proposed for active transportation opportunities. This access provides emergency exit for vehicles that may have to leave Granger and/or Copper Ridge in the unlikely event of an emergency.

East of Sunset Dr N, leaving the road across from #89 Sunset Dr N, there is a laneway access to an existing City snow dump. The cleared area in the snow dump is approximately 200 m^2. The laneway is gated to prevent public access. Access to the laneway and the snow dump must be kept for use by City staff in order to service the community.

2.5.2 Storm Drainage

Storm drainage in the Hillcrest subdivision is accommodated predominately by overland flow and exfiltration ditches or swales. The existing drainage system reflects the topography of the subdivision, and is made possible by the relatively high percolation rates of the underlying soils.

The newer construction of Sunset Dr N and connections to the Highway have curb and gutter. Older streets are served with ditches and/or swales. These ditches are typically cut at a 2:1 slope from the shoulder of the road, and vary in depth between 0.5 m in flatter areas or no depths. Ditches have no depth at driveways or where roads are steep. In some areas the driveways have culverts, but a number of these have collapsed or are plugged, and many lots may never have had any installed so that continuous ditches are not common. The ditches located adjacent to narrow road widths restrict available parking, or when cars do park on the side of the road, people may have to step out into ditches, or block through traffic. Driveways front all properties and at a few locations driveways have been expanded in length such that much of the front yard is driveway or parking area, and this affects proper drainage or deflects drainage onto adjacent properties.

In normal rainfall conditions, the ditches are able to exfiltrate storm water without over-topping onto the road or private property. In severe storm conditions, and during spring melt when the soil is frozen,

the storm water exceeds the exfiltration capacity of the ditches, and flooding can encroach onto the front lawns of private properties. In a few locations, the properties are lower than the road and the ditch line, and flooding onto those properties often occurs. These low lying areas will be addressed wherever possible by improving the grade of the roadway and construction of new ditches or deepen ditches to redirect storm drainage flows. Re-grading properties may be possible and if the homeowner wishes, but such cases may not be possible because of the way the homes were built.

The respondents to the City's LI Questionnaire (Appendix A) reported seasonal flooding issues in many areas, but did not consider the flooding sufficiently problematic to merit the construction of concrete curb and gutters and storm collection system, preferring instead to maintain the rural character of the area.

The relative lack of flooding problems can also be attributed to the practice of City staff removing snow from the roads ahead of the spring melt. Snow melt and rainfall then drain along the roads to the green belts. The current practice of removing snow quickly in the spring and the same day is not going to be changed and is necessary because the road rights-of-way and road widths are much smaller than what is built in other newer areas of the City.

Ponding does occur on some roads, but is limited mostly to the upper portion of Hillcrest Dr and Park Ln where the terrain is very flat, and in localized flat spots on other streets. The western portions of the subdivision are relatively flat. On Sunset Dr N, the road is lower than the surrounding properties and the curb and gutter system collects and disperses storm water effectively. Hillcrest's one existing section of storm pipe is on Sunset Dr N. It collects the gutter flow in two catch basins, and discharges via an outfall running north into the green belt between Lots 150 and 151 (#23 and 25 Sunset Dr N).

On Park Ln, Dalton Tr, Roundel Rd, and the western end of Hillcrest Dr, the topography is flat and the storm ditches are not deep (0.3 to 0.5 m). Overland flow is limited and exfiltration is the main mechanism of storm water dispersion. These ditches act as bio-swales and are grassed. To maintain the rural character and improve the aesthetics, it will be beneficial to re-landscape portions of the ditches rather than grass.

On Sunset Dr S, Kluane Cr, and Chalet Cr, the topography is a downhill grade from north to south. Although the storm ditches are shallow (0 to 0.3 m), the grade of the road allows storm water to flow overland, eventually crossing Hillcrest Dr to discharge into the greenbelt to the south. The properties on the south side of Chalet Cr, especially #1 Chalet Cr, which sits adjacent to Hillcrest Dr, experience significant flooding during the spring melt. Some existing storm infrastructure is in place, but improvements to Chalet Cr and Hillcrest Dr will consider a means to improve storm water collection away from those properties and drain into the green belt south of Hillcrest.

On the eastern (older) part of Sunset Dr N, the properties are significantly lower than the shoulder of the road (as much as 3 m lower at the south side of the homes). As a result, flooding is common on these properties. Storm sewers will be required here to reduce the impact.

The eastern portion of the subdivision has a topography sloping west to east, parallel to the centreline of Roundel Rd and Hillcrest Dr. Overland flow discharges off the edge of the road profile and onto adjacent properties. A significant portion of those roads is fronted by greenbelt, so the resulting flooding does not create significant problems. Culverts under Roundel Rd and Hillcrest Dr allow storm

water to flow to the wetland south of Hillcrest Dr and west of the Alaska Highway. Vacant industrial/commercial lands also collect storm drainage, so future developments will have to address storm water flow.

For some lots adjacent to Park Ln W, flooding has occurred which is caused, at least in part, by storm water flow draining from the Granger neighbourhood. The City has done some surface and storm drainage improvements along the commuter path coming from Granger leading to Hillcrest Dr, and flooding appears to have been resolved as no flooding concerns have been expressed by the public.

2.5.3 Water Distribution

The existing water distribution system layout is illustrated in Figure 2.3, and was installed in early 1950s.

Water supply to Hillcrest, Valleyview, and airport areas is via Two Mile Hill Booster Station, supplied from potable ground water wells in Riverdale. Water from the underground aquifers in Riverdale has made up 100% of the City's water supply since 2010 and meets Canada's Water Quality Guidelines.

The Valleyview Reservoir serves the Hillcrest area as well and water pressure is dependent on the elevation of water within the reservoir. Operating pressures within the subdivision are estimated to be 375-540 kPa (54-78 psi). In 2012/2013, the Valleyview Reservoir was expanded to service the then new Whistle Bend subdivision, but this will also improve water security for the area.

The water supplied to Hillcrest is provided by a 300 mm water main connected also to a 500 mm Alaska Highway Transmission Main which was installed in the late 1990s to improve fire flow in the airport area. The mains run parallel to the Alaska Highway to the Erik Nielsen Whitehorse International Airport property across the Alaska Highway at Burns Rd and at Roundel Rd.

There are two water supply connections to the network in Hillcrest:

- A 250 mm/200 mm water supply main installed in 2014 from Hamilton Blvd.
- A second connection is via the distribution network at the Burns Rd Industrial Area, where a 300 mm ductile iron water main crosses the Alaska Highway at the Burns Rd. A second 150 mm cast iron water main also crosses the Alaska Highway near Roundel Rd, but the connection to Burns Rd at the rear of existing lots was abandoned. It is intended to restore this second connection from the Alaska Highway as part of the upgrade of the infrastructure.

Internal distribution within the subdivision is by 150 mm cast iron mains, with 200 mm cast iron and asbestos cement main. None of the existing water mains are insulated. The mains are located within the road rights-of-way, outside of the paved surface of the road in most parts of the subdivision, but the separation from existing sewer mains does not meet City standards of 3.0 m.

The following sections of water mains are not located with road rights-of-way:

- Roundel Rd apartments are served by a 150 mm main that leaves Roundel Rd east of #20 Roundel Rd, and terminates in the parking lot for the apartment complex. This is a dead-end main, but has had no frost protection issues due to use. The water main on Roundel Rd is proposed to connect this section to the rest of Hillcrest to improve flows and fire protection.

- The water (and sewer) mains along Park Ln are located within easements along the outside of some of the lots. New mains are to be installed within right of way and away from easement. But a smaller easement may still be needed for a portion of the sewer mains.
- Lots 120 and 121 (#134 to 137 Dalton Tr) and Lots 113 and 114 (#128 to 131 Hillcrest Dr), and Condo 154 (#132 and 133 Hillcrest Dr) are served by a 150 mm main that runs along the rear property lines between the serviced lots. This main provides a connection to the main on Dalton Tr to maintain flows and protect the mains from freezing. It is proposed to abandon these mains in favour of new mains on Dalton Tr and Hillcrest Dr to avoid future access and maintenance issues with mains at the rear of lots.

New water main connections will be required if mains are changed. New developments on the Hillcrest Dr lots are underway for triplexes. They will be connecting temporarily to the existing mains while making provision for a future connection within Hillcrest Dr when, and if, reconstruction is done in the future.

There is a water main connection between Roundel Rd and Chalet Cr located within public utility lane. The grade change is very steep and the PUL is not sufficiently wide to allow the main to be serviced and there is also a sewer main running through the same PUL, further complicating maintenance. The lane is not accessible. Installing new water mains will eliminate this connection and avoid future maintenance issues related to access.

The City's water system operators report that Hillcrest has a low rate of water main failures in relation to the age of the system. This could be in part attributable to a relatively deep installation depth compared to modern standards of 3 m. (Localized recorded depths of 3.5-4.5 m are common, although as-built profiles are not available.) It could also be attributable to quality of the installation and main quality, but pipe deterioration in the supply main coming through the Tank Farm did cause one failure, and this could indicate the beginning of more repairs in the future. The mains are over 60 years old, and they will not last forever. The deeper mains can also help protect mains from freezing, but services to the units are not normally at the same depth. Frost depths vary with weather and so maintaining frost protection is important.

The City's 2003 Water and Sewer Study recommended that existing fire flows within Hillcrest, although acceptable, could be improved by the construction of a main from Thompson Rd in the Granger subdivision or to the main servicing McIntyre and connecting to Hillcrest Dr via the existing cleared right-of-way. The Thompson connection would require a pressure reducing valve to be added, as the Granger subdivision is at a much higher pressure zone. The City did install a new main from Sunset Dr to Hamilton Blvd through a portion of the Tank Farm and this connection will also service a future development at the Tank Farm as well. In addition to increasing fire flows, water circulation was improved.

As noted above, second connection to the Highway from Burns Rd and along Roundel Rd will also improve security of supply should a failure occur on the Alaska Highway main and improve fire flows.

There is an existing water quality testing station at the north end of Sunset Dr S. Upgrades to the water mains would accommodate a connection to the existing station.

2.5.4 Sanitary Sewerage

The existing sanitary sewer system layout is shown in Figure 2.3 and was installed in the early 1950s.

Existing sanitary sewers in the Hillcrest Subdivision consist of 250 mm concrete pipe, as well as 150 mm and 200 mm asbestos cement pipe. Effluent is discharged from the area via a 400 mm asbestos cement sewer main that crosses the Alaska Highway 50 m north of the Roundel Rd intersection, and then runs parallel to the highway eventually crossing the Airport property to tie in to the Downtown sewer system through Black St.

Sewer mains are sized to handle the ultimate build-out of the subdivision and increased densities. The City's sewer system operators have reported that the existing Hillcrest system has generally required very little maintenance relative to its age. This could be attributable to the relatively large diameter mains used, and the quality of the installation originally completed.

Typically, the sanitary sewers run in the boulevard between the property line and the edge of the existing pavement. In many locations the system passes through private lots, and is often situated in close proximity to garages, fences, and landscaping features. The following locations have been identified as requiring re-alignment to make maintenance and repairs possible:

- The Roundel Rd Apartments are served by a 250 mm concrete main that runs through the parking area between #19 Summit Rd, and #19 - 20 Roundel Rd. This main is likely encumbered and limited for maintenance by the footings of #20 Roundel Rd and #19 Summit Rd, as it runs between the two buildings. An easement and easement agreement is in place for this main.
- Lots 120 and 121 (#134 to 137 Dalton Tr) and Lots 113 and 114 (#128 to 131 Hillcrest Dr) are served by a sanitary main that runs from Dalton Tr to Hillcrest Dr along the lot lines between lots 119 and 120 (#138/139 and #137/138 Dalton Tr), and 112 and 113 (#126/127 and #128/129 Hillcrest Dr), with a spur aligned along the rear lot lines of lots 113 and 120. This section has been covered by sheds and fences. It will be difficult to maintain this main, so a new main along Dalton Tr is proposed to service Lots 120/121, but the homes will require altering the internal plumbing to direct the sewers towards the fronting road and a new sewer main. Operational concerns have not been identified for those existing areas.
- Proposed new developments on the Hillcrest Dr lots will require extension of new services to connect to the mains within the streets. These lots are being redeveloped as triplexes. They will be connecting temporarily to the existing mains while making provision for a future connection within Hillcrest Dr when, and if, reconstruction is done in the future.
- A sewer main connection between Roundel Rd and Chalet Cr passes an undeveloped public utility lane (PUL). The PUL is not sufficiently wide to allow the sewer main to be serviced, and is not accessible and there is also an existing water main in the PUL, further limiting its serviceability. New sewer mains on Roundel Rd will eliminate this connection.
- At the east end of Sunset Dr N (Lots 80-87, #80 to 89 Sunset Dr N) the sanitary sewer main runs behind the houses, near the rear property lines. The lots in this area are significantly lower than the road, inhibiting relocation of the mains to the Sunset Dr N right-of-way. There is no existing infrastructure for access to the manholes and mains behind these properties for servicing and repairs. No changes are being proposed.
- The sewer crosses Summit Rd north of Lot 87 (#89 Sunset Dr N) and is located within the green space east of Summit Rd. No changes are being proposed.

The condition of sanitary sewers was assessed via video analysis in 2010 and 2012. Results have been summarized and included as Appendix B. Localized failures were identified and repairs are proposed, but not shown on plans. Overall the existing sanitary sewer mains are generally in good condition, so total replacement is not recommended and the life of the mains will not be compromised. However, the City proposes as part of the detailed design work for each phase to re-video tape sewer mains not proposed to be replaced in order to confirm if any further deterioration may have occurred.

2.5.5 Service Connections

Relatively little data is available regarding water and sewer service connections, as Hillcrest subdivision predates the City's service card record system. As with the water and sewer mains City operators report that the services have required little maintenance and repair.

Water services in the older area of Hillcrest are protected from freezing by bleeding of water to the sewers which is against the water and sewer bylaw for new areas. Thermostatically controlled bleeders (TCBs) were installed by the City to all properties to reduce water waste.

Most single services are estimated at 15 or 20 mm diameter and are not insulated, and so the services are bled for frost protection. Some units may not be bleeding, and may not experience freezing issues due most likely to water usage and existing conditions like the depth of mains. However, frost depth is variable and can penetrate the soil well below ground level and the existing pipes, so it is not recommended practice to leave the services unprotected.

The Steelox buildings are primarily duplex units, with one single unit exception. The buildings rest on concrete grade beams with no crawl space or basement making access extremely difficult. 40 or 50 mm water line feeds both units with internal plumbing connected between them and located within the middle of the larger unit. This practice was typical at the time of the original construction. Freezing services occurred due to the size of the service and the lack of water use and this resulted in the frozen water services having to be thawed and temporary water connections provided until service could be restored. TCBs were removed and bleeding occurs.

The LI Questionnaire (Appendix A) confirmed that a number of systems where the original frost protection, being either a heat trace wire or City-supplied TCBs, has failed and been replaced by a free-flow bleeder, which does not meet City Bylaws.

New lots on Sunset Dr N were developed in the 1970s. Water services are 20 mm insulated copper pipe with heat trace wire. Some failures of heat trace have occurred and this is not uncommon in other areas of the City. New City standards require the installation of a water recirculation system, which consists of two services where water flows in one pipe and returns through the other for frost protection.

Sanitary services for most residences are typically 100 mm or 150 mm cast iron. In the cases where sanitary services have been added, repaired, or replaced in the past 10 to 15 years, the pipe material may be PVC. For the Steelox duplexes, the service comes into the middle of the largest unit and a side connection is made to service the other, and majority of those units have no crawl space or basements. The City attempted to video tape the existing sewer mains at a couple of units, but this was not possible.

The majority of water and sewer services run from the front of each unit to the main, however in some cases the services are located at the side or back of the unit. An analysis of the known data regarding

water and sewer services was completed in summer of 2012. This included measurement of the sewer main tie-in locations from the sewer camera videos, and analysis of the available record drawings.

The City requires all services to be recorded on a service card showing pipe sizes, depths and location but this area which was built by the armed forces, had no service cards prepared.

Water and sewer service alignments are shown in Figure 2.3 based on plans prepared from the Military in the 1950s. It is typical for the water services to share a common trench with the sewer services, but this will be confirmed during detailed design work.

Engineering is proposing to video tape all sanitary services to determine their condition for the owners during detailed design phase for all areas and timed to coincide with the sewer mains.

2.5.6 Electrical Power, Telephone, and Internet

Primary electrical power enters the subdivision via overhead lines from the north along the Alaska Highway. The lines cross the highway at the intersection with Burns Rd. Telephone and Internet lines generally follow ATCO overhead lines. There are some limited sections of buried power and telephone lines along Hillcrest Dr. Some changes were done by ATCO in 2013 and 2014, but are not detailed here.

Subdivision distribution of all utilities is overhead, mounted on wooden poles at various locations along front, side and rear property lines. Services enter properties from overhead lines to the rear of lots on Park Ln and Dalton Tr and the newer lots of Sunset Dr N. Street lights are mounted on the wooden poles located within the road allowances. Overhead power and telephone lines are not to be converted to underground, based on previous discussions with the utility companies and the significant impact to the lots, as well as the high costs to homeowners that would be required to do the work on the lots.

2.5.7 Transit Infrastructure and Services

The City's Transit Department provides hourly bus service to Hillcrest. The bus route has remained the same over the past 10 years, and it is expected that this is a valuable service to the community and will remain consistent following the proposed reconstruction. The existing transit route and stops are illustrated in Figure 2.4, including the service stop on Hamilton Blvd at the roundabout, now accessible by a paved asphalt path built by the City in 2012.

The existing road network in Hillcrest is narrow compared to new standards for transit service areas. The narrow roads and on-street parking can result in delays because the presence of delivery trucks, public works equipment, school buses, oncoming traffic, etc. can affect the progress of a transit bus. Delays are common, as are close calls involving other vehicles. Concerns about speed of buses have been noted by some. One problem from this perspective is the intersection of Sunset Dr N and Park Ln, where tight corners and poor visibility further exacerbate the problems with narrow roads. However, no changes are proposed.

A secondary issue is the bus stops. All stops could benefit from the addition of a paved waiting area, benches and/or shelters. Sidewalks serve a few of the stops, but for the most part, the sidewalks are on the opposite side of the street, or are not present at all. New sidewalks will benefit all forms of active and public transportation as well as safety considerations.

New accessible concrete aprons will be constructed at bus stops not serviced with sidewalks.

The transit route is not expected to change as routing optimizes movement with no left turns at the Alaska Highway.

Transit recommendations for the reconstruction of Hillcrest are to:

- Increase the radius of the corners on Park Ln adjacent to the intersection of Sunset Dr N and Park Ln, and clear trees as needed to improve visibility at this location.
- Ensure that road widths accommodate on-street parking, if it is intended, while still allowing sufficient width for buses and other large vehicles.
- Upgrade key bus stops with 3 m x 4 m asphalt pads for future shelters or benches.
- Install sidewalks on roads that are bus routes or accessible concrete pads with no sidewalks.

2.5.8 Fire Department and Emergency Vehicle Requirements

City Fire Department and ambulance services have noted the existing subdivision's narrow roads can impede fire truck access, especially when on-street parking is combined with narrow road widths.

The design requirements require fire truck access to have:

- A clear width of 6 m to set support rigging when fighting a fire;
- An overhead clearance not less than 5 m;
- A change in gradient not more than 1 in 12.5 over a minimum distance of 15 m;
- A design to support the loads imposed by firefighting vehicles (60,000 lbs); and
- Turnaround facilities for any dead-end portion of the route 90 m long.

2.5.9 Parks Infrastructure, Open Spaces, and Services

A children's playground with swings, slide, sand box and climbing apparatus is located in the west park area near north end of Park Ln. No water or sewer services exist but a service is proposed.

A rink is located in the east park space between Chalet Cr and Kluane Cr. The rink has new boards, and a concrete surface for year-round use. Ice is provided City's Parks crew, and the access is cleared by Operations' Transportation crew. The ice rink is cleared of snow by local residents. Access to the rink is available via service road. A water service is desirable but the location of the rink means a water service would not be possible due to capital and operating costs.

A 3 m wide new asphalt commuter path was built in 2012 from Hillcrest to Elijah Smith School and bus stops on Hamilton Blvd. The Hillcrest Community Association also received a Community Development Fund grant to complete the design for a new commuter path along the Alaska Highway adjacent to the airport connecting Burns Rd to the existing path at the north end of the Whitehorse airport property.

Plans are proposed to connect the paved commuter path from Sunset Dr N where the path to Elijah Smith School starts through the open space area east of Park Ln, and along south-side of Hillcrest Dr at Dalton Tr to the Highway. Along Hillcrest Dr, the path will be adjacent to the curb and gutter to minimize impact on properties and costs.

2.5.10 Landscaping and Right-of-Way Encroachments

A significant number of properties in Hillcrests are equipped with a garage, storage sheds, garbage stands, clothes lines, parking areas, or other infrastructure fronting the existing road. In many cases, that infrastructure does not meet required property line setbacks. In other more isolated cases, that infrastructure encroaches over the property line and into the road right-of-way.

Similarly, there are mature gardens and other landscaping features such as trees, paths, stairs, and retaining walls, and power poles that encroach upon the road right-of-way, or have no setback to be free and clear of the planned reconstruction. In the case of Kluane Cr and Chalet Cr, the road alignments are proposed to remain as they currently are.

Approval of existing right-of-way encroachments will be handled on a case by case basis, respecting the principles adopted by the City for reconstruction and/or maintenance work. In general:

- Boulevards are not suitable for parking and should not be allowed in the boulevard under zoning regulations except if in front of a driveway or a garage. Some units on Chalet Cr for example, have no choice but to park vehicles on the right of way, so exceptions can be allowed in those types of situations.
- Structures currently encroaching on the property line and road right-of-way will be retained, but no further encroachments will be permitted. Property owners will not be allowed to rebuild structures that encroach on City infrastructure and must avoid building over private services on their lots.
- Trees may have to be removed to allow for water and/or sewer servicing. Depending on size, they could be replaced. The homeowner must take responsibility in the work to water and care for repaired landscaping, including re-planted trees/shrubs. The success of re-plantings cannot be warranted.
- Retaining walls which currently encroach on the right-of-way or are installed on private property will significantly affect the installation of new infrastructure. Attempts will be made to minimize the impact and if possible avoid reconstruction issues. Where possible, they could be replaced by a groomed back slope or new retaining wall installed, depending on the height and the costs. Repairs could be considered on individual basis if required due to geometric and cost constraints. However, renewal work or any replacement work on many of the homes on Chalet Cr cannot economically be done because of the topography and landscaping that exists. Consequently, it will be necessary to end work at the property line, or close to the property line.
- Homeowners should remove and re-install any landscaping features or avoid new installations that will affect the existing and/or new water and sewer infrastructure.
- New water and/or sewer services when being replaced within the lots will be located where possible to avoid or minimize impact on landscaped areas, structures, sidewalks, porches, etc. on a site by site basis. Existing sewers may not be replaced, and new water mains can be shallow-buried and insulated in areas like Kluane Cr and Chalet Cr to minimize impact.

2.6 ADJACENT DEVELOPMENTS

2.6.1 Whitehorse International Airport and Alaska Highway

The Erik Nielsen International Airport is located east of the Alaska Highway, directly across from the Hillcrest Subdivision. The Airport is managed by the YG Aviation Branch and the Highway by the Yg Department of Highways and Public Works. Infrastructure development in Hillcrest will not be affected by Airport or Highway regulations, except if work within the Highway right-of-way is required.

Recent changes at the airport have improved accesses relative to the Alaska Highway and improved safety as they are located opposite Burns Rd and Hillcrest Dr. YG Highways is currently working on a new highway corridor plan which will address encroachment by buildings, future widening to 4 lanes, service roads, and signals. Concerns regarding line painting and snow removal are maintenance issues which have been relayed to YG Highways and City Operations Departments.

2.6.2 Tank Farm Property

The Tank Farm property is a 56 ha site situated north of Hillcrest and the Burns Rd Industrial Area. The owners of the property are considering options for development of the site and environmental remediation is underway for hydrocarbon contamination from its former use as a fuel storage facility. Impacts on Hillcrest from the development of the Tank Farm property could include:

- The existing 200 mm water supply main that angles through the Tank Farm from the Alaska Highway has been abandoned and a new water supply main installed from Hamilton Blvd.
- Trail networks that cross through the Tank Farm to and from Hillcrest are no longer safe to use. New trails and new paths are proposed to become part of the future development plans for the Tank Farm, but timing of this development is not known.

2.7 GEOTECHNICAL INVESTIGATION AND EXISTING CONDITIONS

EBA Engineering Ltd., A Tetra Tech Company (EBA) conducted a geotechnical investigation program during February 2011 along the streets of the Hillcrest Subdivision. This program consisted of:

- Review of existing documentation and borehole logs in the local and adjacent area.
- Advancing of seven test holes at a depth of 4.5 m, with the exception of one hole at 3.0 m.
- Documented borehole logs detailing the findings for each of the new test holes.
- Soil sampling and analysis.

The geotechnical report is included as Appendix C. Highlights are summarized as follows:

- The majority of the tested area is comprised of granular fill overlaying fine grained glaciolacustrine soils, varying in thickness from 1.7 m to 3 m. The remaining area is made up of fair to good quality glaciofluvial gravel (similar to the Tank Farm area now being remediated) that is considered well drained and non-frost susceptible.
- Fine grain silt and sand was found under some areas of the existing road surfaces. This material is thought to have been brought in during the initial construction of the road surfaces and is very frost susceptible based on findings of up to 25% silt content.
- No bedrock, groundwater, or permafrost was encountered in any of the boreholes drilled.

- It is required that all frost susceptible materials be removed when preparing the sub-base for roadway construction. The sub-base should consist of either 50 mm crushed sub-base gravel with 100 mm pit run, depending on the sub-cut required when removing the silt. The silty material excavated from beneath the existing road surface may be used at depth during the installation of the deep utilities.
- When installing the deep utilities, excavations will require trench slopes to meet O H & S guidelines of about 1.5:1 with excavated piles kept well back from the edge of the trenches. Contractors may use trench braces to reduce the excavation and minimize impact on the area and this will be reviewed and considered during detailed design work.
- Sand or rock pipe bedding for water and sewer mains will meet City standards.
- Pavement structures will be 75 mm asphalt, 150 mm of 20 mm crushed base course gravel built over non-frost susceptible soils.

3.0 PROPOSED LAND USE PLAN

There is relatively little change planned for the land use in the Hillcrest subdivision as a result of this reconstruction project. The intent is to update the infrastructure while maintaining the character of the neighbourhood. The planned land use changes are detailed herein.

3.1 CREATION OF NEW RESIDENTIAL LOTS

The City's 2010 OCP has identified a desire to provide lots for people to move into the Hillcrest area. It identified the treed Lot 130 fronting Sunset Dr N and north of Lots 35 to 40 (#35-40 Roundel Rd) as a potential site for residential infill to take advantage of the rebuilding of the existing infrastructure and overhead utility lines which currently service only one side of the road right-of-way. The green space surrounding Sunset Dr N, Summit Rd, and the large open space centrally located is not to be changed. The open area east of Summit Rd would also remain open space.

In order to service potential new development, the following work would be done:

- Connections to a new relocated water main along Sunset Dr N would be required.
- A new sewer would be added on Sunset Dr N connecting to existing main east of Summit Rd.
- Changes to the legal boundary of Lot 130 and Sunset Dr N would be done to provide space for single family, duplex, or a multi-housing development depending on public consultation and Council approval.
- There is a lane right-of-way (shown as Lots 35A to 40A, #35-40 Roundel Rd) that was identified, but like other lane locations is not used as a lane. Those lots are now owned by the lots facing Roundel Rd. Currently some property owners are using Lot 130 to access the rear of their lots and have expanded use into portions of Lot 130 as well, but this would stop if infill development proceeds.
- The Sunset Dr N is a bus route and would include a continuation of the sidewalk on the south side of Sunset Dr N and west side Summit Rd N to Roundel Rd.

- Concerns have been noted about the speed of traffic along this road and around the intersection, and changes to the design would occur.

The intersection of Sunset Dr N/Summit Rd would be relocated slightly at the same time as the road is rebuilt and the water main replaced as part of the infrastructure improvements now being considered. The construction of the new water main would result in elimination of the triangular landscaped area at the intersection.

To address traffic flow concerns two options were considered. The first option examined is to construct a small roundabout (similar in design to ones built in Takhini North). The roundabout would be centred over the existing landscaped area and the roundabout re-landscaped with some trees and shrubs in consultation with local residents. While a roundabout is acceptable, the recommended alternative is to build a T-intersection as shown in Figure 4.6. The existing roads would be completely removed and the area landscaped. Driveways would be extended and paved to match the intersection. The Figure also shows the area that could be developed as residential infill, subject to Council approval.

3.2 SNOW DUMP

The road rights-of-way within Hillcrest are cleared of snow by the City's Operations Department each spring. The existing snow dump at the north end of Sunset Dr N would remain. Further expansion is not anticipated, and additional space for expansion is limited. Continued use of the existing snow dump is key to providing effective road maintenance service to the community.

3.3 RE-ALIGNMENT OF THE DALTON TR – KLUANE CR – HILLCREST DR INTERSECTION

Hillcrest Dr has been identified for traffic safety concerns in the LI Questionnaire (Appendix A), and through discussions with the Hillcrest Community Association and other members of the public. The most significant issues are traffic speed and sight lines at the intersections of Kluane Cr and Dalton Tr.

The City is recommending that the re-alignment of Dalton Tr east be located away from Lot 126 (#122 Dalton Tr) and intersect with Kluane Cr at a more perpendicular angle with Hillcrest Dr, which will improve safety with better sight lines and create a 4-way intersection. To achieve this:

- Some encroachment into the green belt east of Dalton Tr at Hillcrest Dr would be required on the southeast corner of the intersection.
- Fill would be required, as the green space southeast of Dalton Tr is lower than the road. Excess material from the installation of new water and sewer mains could be used in this application.
- Kluane Cr would be re-aligned within the available right-of-way to intersect Hillcrest Dr across from the re-aligned Dalton Tr.
- The intention is to construct a raised intersection to help address traffic speed issues. A roundabout was suggested as an option but the use of raised intersection at this location reduces the impact in this area and costs.

Further detail regarding the proposed changes to this intersection is described in Section 4.

4.0 PROPOSED ROADWAY, DRAINAGE, AND SURFACE IMPROVEMENTS

4.1 TRAFFIC SAFETY

Improving road safety is a top priority for Hillcrest residents, as revealed by responses to the LI Questionnaire (Appendix A) and based on conversations with the Hillcrest Community Association and members of the public. There are general concerns regarding road safety which apply to the entire subdivision, and site-specific concerns which apply to certain streets and intersections. The City has considered the comments from residents and proposed some solutions; however, the major concern with safety is the behaviour of drivers, and this issue is prevalent in urban areas everywhere.

4.1.1 Road Width and Speed Limit

The Hillcrest road network was consistent with other residential areas in the City in that the maximum speed limit was 50 km/h. In 2014, City Council approved a proposal to reduce the speed limit on streets throughout Hillcrest residential areas to 40 km/h, with the exception of the playground area on Park Ln which remains at 30 km/h.

Road widths vary in Hillcrest, but are generally between 6 and 10 m wide, including 1 m wide gravel shoulders on each side. Most streets are without sidewalks. Without rear lanes for vehicle access to lots, front driveways onto the street are common. The combination of road widths, straight and curved roads, driveways, parked vehicles (in driveways and on-street), and the number of vehicles, cyclists, and pedestrians on the roads, all affect safety and traffic calming options.

Long sight lines, few cars, and few pedestrians make speeding traffic a common occurrence on Park Ln, Dalton Tr, and particularly on Roundel Rd E and Hillcrest Dr W. The design of roads need to consider more than just speed limit signage when addressing safety. Consideration has been given for narrowing roads, using curb and gutters, shared street options with medians, traffic bulbs, roundabouts, traffic circles, landscaping, and tighter turning radius at intersections to provide traffic calming. In addition, raised intersections are proposed on:

- Hillcrest Dr at Kluane Cr, Chalet Cr, and Summit Rd
- Park Ln and Sunset Dr N
- Roundel Rd at Summit Rd

4.1.2 Active Transportation

Since 2004 the City has been promoting active transportation (cycling and walking) as a way to improve environmental and personal health. Many Hillcrest residents are also advocates for active transportation. A new commuter path from Hillcrest along the Highway and airport property was constructed in 2014 and 2015 to a paved surface through the efforts of the Hillcrest Community Association. Other network improvements to the south end of Elijah Smith School, a commuter path to Granger from Hillcrest Dr, and connections through future development of the Tank Farm are future goals jointly supported by Hillcrest residents and the City.

Further, providing safe routes for cyclists and pedestrians needs to be considered. With the exception of newer part of Sunset Dr N, all roads in Hillcrest are considered “shared” streets between motorists,

cyclists, and pedestrians. So, it is important that all users are not only aware of other users, but it is particularly necessary that vehicles watch out for pedestrians and cyclists.

There are no designated bike lanes on the main collector roads of Hillcrest Dr and Roundel Rd. Cyclists use the road as a vehicle would on all residential streets, in accordance with the Motor Vehicle Act.

Public consultation to date has revealed that Hillcrest residents are generally not in favour of adding sidewalks to the minor residential streets, preferring instead to maintain the existing character of the subdivision. However, sidewalks are proposed to be added to the traffic collector roadways of Hillcrest Dr and Roundel Rd and are proposed along bus routes.

With the continued use of shared streets for vehicles, pedestrians, and cyclists on the minor residential streets, pedestrian and cyclist safety is the responsibility of all. Shared street use has been happening for several decades. But, as more residents move into the area, higher volume of traffic and higher speeds occur, and this is particularly noticed on Hillcrest Dr.

In an attempt to improve safety, signage advising motorists about “sharing” the streets with pedestrians and cyclists is proposed, similar to what was installed in the Takhini North subdivision.

Paved commuter paths are proposed to connect the Alaska Highway, along south side of Hillcrest Dr through the open space east of Park Ln and connect to the paved path leading to Elijah Smith School.

4.2 SIDEWALKS AND BIKE LANES

New 1.2 m wide sidewalks are proposed to be constructed along the bus routes on the south side of Hillcrest Dr from Park Ln W to Dalton Tr, and on the south side of Roundel Rd from the Alaska Highway to Summit Rd. A sidewalk along the west side of Park Ln E is also being recommended adjacent to transit service. The roadway on Park Ln E will need to be shifted east, away from private property, to accommodate the new infrastructure.

A sidewalk is proposed on the south side of Sunset Dr N between Summit Rd and Roundel Rd, which will provide continuity from the existing sidewalk on the western (newer) portion of Sunset Dr N. This will connect to a new sidewalk proposed for the northern portion of Summit Rd.

Burns Rd will also be fitted with a sidewalk on the western side of the street.

Accessible ramps will be installed at the terminus of each sidewalk at intersections with other sidewalks or walkways where street access is warranted.

Painted bike logos and chevrons are proposed on Hillcrest Dr from the Alaska Highway to Dalton Tr, and on Roundel Rd from the Alaska Highway to Summit Rd. The logos will indicate that the lane is to be shared.

4.3 STORM DRAINAGE

The grades within Hillcrest are flat in some areas, and steep in others. The existing storm drainage ditch system is effective in exfiltrating storm water into the soil where it is absorbed by plants. In places without storm ditches, either overland flow or exfiltration/absorption on private property is able to

handle the storm water. Use of existing ditches and/or swales and/or exfiltrating catch basins will be considered in some areas adjacent to Park Ln and Dalton Tr, creating landscaped bio-swales. Thus a combination of continuing on-street rural ditches, creation of bio-swales, and piped storm drainage is proposed. The plan showing existing drainage patterns is shown on Figure 4.1.

4.3.1 Storm Water Collection System

Surface drainage is proposed to retain the rural character that is seen to work and is preferred by the residents for most portions of the subdivision. But, along Hillcrest Dr new storms sewers with catch basins will be installed at the intersections of streets connecting to Hillcrest Dr, to collect runoff from road surfaces and adjacent properties. Discharge of storm drainage systems will be into existing open green spaces.

A piped drainage system is proposed to accommodate run-off from Hillcrest Dr and Roundel Rd. Minor collection and outfall systems are proposed for the intersections of Sunset Dr N and Park Ln; Sunset Dr N and Summit Rd; and Dalton Tr/Park Ln W/Hillcrest Dr. There will also be the addition of culverts across roads to accommodate drainage to green space areas and to improve drainage away from low lying lots, and designs will be required to prevent erosion at the outlets of piping.

4.3.2 Surface Drainage Collection Infrastructure

In addition to surface drainage along roads, drainage into undeveloped open spaces will be required, as well as creating landscaped bio-swales and drainage ponds within the open space east of Park Ln.

Excavations on properties adjacent to property lines will be required to restore and keep the rural drainage system and the areas affected by the work will be re-landscaped.

On minor residential roads, storm water collection is to be maintained through the use of road side swales and/or ditches by exfiltration of storm water into the soil and away from the road surface, as opposed to using curb and gutter for surface drainage collection. This roadside drainage is in keeping of the historic character of the neighbourhood. Hillcrest Dr and Roundel Rd would still be designed as curb and gutter with storm sewers providing catch basins at the intersections of those residential roads to reduce overland flow from the side streets, and to reduce the impact on low-lying properties.

Exfiltration into subsoil and/or bio-swales irrigates the area naturally, and in a more sustainable manner by reducing the large amounts of storm water that is collected and discharged through storm sewers.

The alternative cross-section is illustrated in Figure 4.2.

The changes resulting from the adoption of the alternative cross-section would include that:

- Storm ditches and swales would need to be deepened and widened, resulting in some impact on adjacent properties as back slopes would extend onto private property, but the area would be re-landscaped in discussion with property owners
- Driveways will be paved to match the new road surface with 300 mm drainage swales to provide drainage, remain accessible and minimize the use of culverts. Existing paved driveways will be restored with asphalt and existing gravel driveways will be paved where necessary for 200 mm drainage swale. Width of driveways is to be a maximum of 9 m per property or per unit.

- Road profile adjustments will be made to create consistent grade profiles along storm ditches and ensure that the width provides safe and effective parking to ensure traffic flow and avoid issues associated with exiting a vehicle into a ditch.
- Repair of existing culverts or new culverts where necessary.
- Construction of storm exfiltration pits at key low points could include new catch basins.

The storm system and volumes will be designed to the City's Servicing Standards Manual.

4.3.3 Off-Site Disposal

Discharge of collected run-off will require the installation of storm outfalls in the following locations:

- South of Hillcrest Dr at the intersection of Burns Rd and Hillcrest Dr.
- South of Dalton Tr adjacent to Lot 125 (#164/165 Dalton Tr).
- Southwest of the Dalton Tr/Hillcrest Dr/Park Ln intersection.
- East of Summit Rd at the Summit Rd/Sunset Dr N intersection.

4.4 ROADWAYS

The proposed roadway and surface works site plan is presented in Figure 4.3.

The proposed roadway structure and drainage improvements will follow City standards and include:

- Centring of roadways is normally followed in new developments but in Hillcrest, this is not possible because of development so many years ago. So the road location will vary generally matching its current location on Kluane Cr, Sunset Dr S, Chalet Cr, Hillcrest Dr and Roundel Rd to minimize impact on existing properties and landscaping.
- Replacement of unsuitable sub-grade materials.
- Supply and place crushed granular base materials (150 mm).
- Asphalt surfacing (minimum 75 mm).
- Roads will generally be crowned to split road drainage. Park Ln E, Summit Rd N, Roundel Rd E, and a portion of Hillcrest Dr will have a partial, if not full, cross fall that drains into green spaces or existing ditches.
- Rolled face concrete curb and gutter will be used where necessary for driveway access.
- Installation of catch basins as required for storm water collection from road surfaces along Hillcrest Dr, and including dispersion and exfiltration into open spaces.
- Boulevard re-landscaping impacted by roads and new infrastructure.

The roads have been grouped based on the existing roadway and drainage infrastructure and the available right-of-way widths. Specific details regarding site improvements and road re-alignment for traffic safety, and detailed information regarding road cross-sections and storm drainage infrastructure is explained in the sections below.

4.4.1 Dalton Tr, Park Ln E and W, Burns Rd S

Dalton Tr, Park Ln E and W, and Burns Rd S (between Roundel Rd and Hillcrest Dr) all share common roadway and drainage infrastructure cross-sections.

The existing infrastructure is as follows:

- R.O.W. width: 12 m
- Paved width: 5.5 – 6.5 m, plus 1 - 1.5 m gravel shoulders
- Storm ditches: 0.3 - 0.5 m deep, 1.5 - 2 m wide

The proposed cross-section for Park Ln W and the western portion of Dalton Tr is illustrated in Figure 4.5a. The south east side of Dalton Tr and the east side of Park Ln E are bordered by green space; taking advantage of the opportunity to drain storm water into these areas, an alternative cross-section is proposed, as illustrated in Figure 4.5b (note that Dalton Tr would not have the side walk indicated in this figure). The proposed cross section for Burns Rd is illustrated in Figure 4.5j.

The location of water and sewer mains will vary, dependent on the location of existing infrastructure and will conform to the alignments presented in Sections 5.0 and 6.0.

4.4.2 Chalet Cr, Kluane Cr, Roundel Rd W, Summit Rd, Sunset Dr N, Sunset Dr S

Chalet Cr, Kluane Cr, the western section of Roundel Rd, Summit Rd, Sunset Dr S, and the eastern sections of Sunset Dr N are all similar in existing roadway and drainage infrastructure.

The existing infrastructure is as follows:

- R.O.W. width: 18 m
- Paved width: 3.5 - 7 m, plus 1 - 1.5 m gravel shoulders
- Storm ditches: 0.1 - 0.5 m deep, 1 - 2 m wide

The profile for the portion of Sunset Dr N between Lots 81 to 84 (#81 to 85 Sunset Dr N) is shown in Figure 4.5f, and will be similar to the proposed profile of Hillcrest Dr between the Park Lns. The profile for the more eastern portion of the street (#86 and east) will be similar to that shown in Figure 4.5a, or could be designed to have a full cross fall that slopes towards the open green space on the east side. The profile proposed for Chalet Cr, Kluane Cr, Roundel Rd W, Sunset Dr S, and the south portion of Summit Rd is indicated in Figure 4.5c.

The northern portion of Summit Rd is also bordered by green space on the east side. A cross fall that takes advantage of the opportunity to drain storm water into the green space is illustrated in Figure 4.5d.

4.4.3 Roundel Rd – East of Summit Rd

The eastern portion of Roundel Rd will consist of a combination of existing infrastructure features along with upgrades.

The existing infrastructure is as-follows:

- R.O.W. Width: 18 m
- Paved Width: 6 - 10 m, plus gravel shoulders
- Barrier curb and gutter near Burns Rd, with surface runoff into green space near Summit Rd

The proposed cross-section is presented in Figure 4.5e.

4.4.4 Hillcrest Dr

The eastern portion of Hillcrest Dr, from the Alaska Highway to Dalton Tr, is the main access into Hillcrest. Traffic speed and safety are concerns along this stretch due in part to there being few properties and access points connecting onto this street.

The existing infrastructure is as follows:

- R.O.W. width: 12 m between Park Ln E and W, 20 m from Park Ln E to Alaska Highway
- Paved width: 5.5 m - 11 m, plus gravel shoulders west of Summit Rd, curb and gutter on the north side, east of Summit Rd
- Storm ditches: 0.1 - 2 m deep, 1 - 5 m wide

On the south side of Hillcrest Dr, drainage is proposed to flow through catch basins and culverts into the marsh land in the green space bordering the road. The ditch on the north side is to be maintained. Culverts will be extended south as necessary and new culverts installed as well to drain the north ditch and the low lying lots adjacent to Hillcrest Dr.

The section of Hillcrest Dr between Park Ln E and W has a significantly smaller right-of-way at 12 m wide. To facilitate the construction of a safe intersection at the eastern intersection of Hillcrest Dr with Park Ln, the centreline of Hillcrest Dr will be aligned to match the road being constructed within the 20 m right-of-way. A sidewalk will be located on the south side of the road, extending from Dalton Tr/Park Ln W to Dalton Tr/Kluane Cr intersection.

A constraint affecting the design of Hillcrest Dr is the elevation of the adjacent properties relative to the road profile and the use of the land by adjacent owners. Although the available right-of-way width is 20 m, the existing right-of-way has only been developed to a width of 12 m. Adding the proposed sidewalk and on-street parking will necessitate re-sloping the adjacent properties, and/or building small retaining walls.

On the north side of Hillcrest Dr, from Park Ln E to the Kluane Cr/Dalton Tr intersection, a 2.5 m paved multi-use path will be constructed that branches off to the north into the adjacent green space.

A storm drainage collection system is proposed for the eastern portion of Hillcrest Dr from Sunset Dr S to Burns Rd. This system will capture storm flows from Hillcrest Dr, and flows from Chalet Cr, Summit Rd, and Kluane Cr. The steep intersecting grades are a known issue in terms of storm drainage, as the existing intersections direct storm drainage across Hillcrest Dr leading to surface water flowing over the road, ice build-up and impact to low lying residential lots. Ditch and culverts on the north side is maintained.

The existing configuration of Hillcrest Dr is the primary source of resident concerns regarding traffic safety. As discussed in greater detail in Section 4.5.2, re-alignment of the intersection of Dalton Tr/Kluane Cr/Hillcrest Dr is recommended along with the intersection constructed as a raised intersection. Proposed curb, gutter, and sidewalks on Hillcrest Dr will mitigate the issue of perceived road width, as the road cross-section will be consistent with an urban residential road rather than a secondary highway design. Re-profiling of Hillcrest Dr between the Dalton Tr/Kluane Cr intersection and Sunset Dr S is recommended in the interest of improving sight lines.

Hillcrest Dr from Dalton Tr to Summit Rd will have curb and gutter on the south side, splitter medians to split the traffic flow, and raised intersections to slow traffic down. A 3 m wide paved multi-use path will be provided on the south side extending to the Highway. No sidewalk is proposed for the north side because the existing drainage ditch is to be maintained, and to keep pedestrians from walking in front of the steeper side roads of Kluane Cr, Chalet Cr and Summit Rd, which is a safety concern.

The proposed cross-sections for Hillcrest Dr are presented in Figures 4.5f, 4.5g, and 4.5h.

4.5 INTERSECTION RE-ALIGNMENTS

In the interest of improving the effectiveness of the road network with a focus on traffic safety, re-alignment and re-development of certain intersections is recommended.

4.5.1 Summit Rd N / Sunset Dr N Intersection

Summit Rd intersects Sunset Dr N in the northwest corner of the subdivision. The existing intersection configuration has been in place since the original development of the subdivision.

Existing issues with the intersection include:

- The curve of Sunset Dr N as it approaches Summit Rd is super-elevated in the wrong direction, towards the outside of the curve, creating a traffic safety hazard that worsens in winter conditions.
- The intersections have not been problematic from a traffic safety perspective but created more maintenance work during winter.
- The site (Lot 130) immediately south of Sunset Dr N adjacent to the intersection has been identified for potential residential infill. The available land and configuration of the lot benefits from the re-alignment of the intersection and the adjacent portion of Sunset Dr N.

The proposed re-alignment would address the existing issues by turning the intersection into a single T-intersection by tightening up the curve will slow vehicles down.

Driveways for Lots 84 and 85 (#85 and 86 Sunset Dr N) will be re-aligned and re-paved as necessary to safely connect to the intersection. The proposed new configuration is illustrated in Figure 4.6.

4.5.2 Hillcrest Dr/Dalton Tr/Kluane Cr Intersection

The primary source of resident concern regarding traffic safety is Hillcrest Dr Residents report that speeding and poor sight lines are the primary source of concern as reported in the LI Questionnaire (Appendix A). The primary issues identified are:

- The profile west of the Dalton Tr/Kluane Cr intersection interrupts sight lines in both directions. Re-profiling Hillcrest Dr will increase visibility.
- The width and straight alignment of Hillcrest Dr invites speeding because drivers have good sight lines with few trees, structures set back of property and relatively few cars and pedestrians.
- The angle of intersection of Dalton Tr onto Hillcrest Dr, when combined with the adjacent developments and profile of Hillcrest Dr and existing treed areas, creates unsafe situations as sight lines are compromised from the west.
- Drivers entering Hillcrest Dr from Dalton Tr in the eastbound direction are often guilty of failing to stop at the stop sign, often 'rolling through' and sometimes failing to yield to eastbound traffic on Hillcrest Dr.

The following work is proposed:

- Addition of curb, gutter, sidewalk, paved multi-use paths and medians to mitigate drivers' visual perception of a secondary highway cross-section by giving defined limits to the road surface. Hillcrest Rd will offer cyclists the option of staying on Hillcrest Dr or use paved paths.
- Re-profiling of Hillcrest Dr west of Dalton Tr/Kluane Cr intersection will improve sight-lines at Dalton Tr. Work would include some clearing trees and shrubs affecting sight lines.
- Re-alignment of Dalton Tr to allow for intersection at an angle with Kluane Cr that meets transportation and City design standards of a minimum intersection angle of 70°, or as close to perpendicular as possible. This would include:
    - Acquisition of land from YG, or a land use permit.
    - Fill would be required, as the green space southeast of Dalton Tr is significantly lower than the road. Excess material from the installation of new water and sewer mains could be used in this application, and for re-landscaping the side slope.
    - Removal and replacement of guide rail.
    - Kluane Cr would be re-aligned within the available right-of way to intersect Hillcrest Dr across from the re-aligned Dalton Tr.
    - The profile of Kluane Cr would be redesigned as-possible to create better storage on Kluane Cr adjacent the intersection.
    - Intersection will be a raised.
    - Use of zebra markings to direct pedestrians to the multi-use paths.

A conceptual design for the re-alignment of the intersection is presented in Figure 4.7.

4.5.3 Sunset Dr N and Park Ln Intersection

The intersection of Sunset Dr N with park Ln is a source of concern for motorists, pedestrians, cyclists and transit bus drivers. Buses travelling along Sunset Dr N have difficulty effecting a left turn onto Park Ln E, which can affect drivers reaching the intersection simultaneously from other directions.

Property lines at this intersection complicate any improvements, so the suggestion is to realign Sunset Dr N to more effectively intersect with Park Ln and create a raised intersection. This will involve pulling the intersection north, so as to open the angle of both sides of the intersection. It was suggested to

change the bus route to Park Ln W, but after consultation, the route will remain as it currently runs along Park Ln E. A multi-use path will extend from Sunset Dr N east to the park space and playground.

Advantages of the revised intersection:

- Transit/vehicle conflict reduced at intersection
- Improved safety access to playground and park space
- Transit safety and turning movement improved
- No change in bus stop locations necessary

A conceptual design for the re-alignment of the intersection is presented in Figure 4.8.

4.5.4 Traffic Safety Options

Potential traffic safety and calming improvements could include:

- Painted logos on surface showing shared bike/ vehicle lanes
- Chicanes (bulbs or planters set within the road), either permanent, or temporary which can be removed during the winter.
- Shared street signage showing pedestrians

5.0 PROPOSED WATER DISTRIBUTION SYSTEM

5.1 DESIGN PARAMETERS

Design of the water distribution system for Hillcrest will be in conformance with the City's Servicing Standards Manual. The parameters to be used in the design of the water distribution system are summarized in the following tables:

Table 5.1 WATER DISTRIBUTION SYSTEM DESIGN PARAMETERS

Subdivision Population	650
Residential Average Day Demand (ADD)	500 Lpcd
Maximum Day Demand (MDD)	2 x ADD
Peak Hour Demand (PHD)	3 x ADD
Fire Flows	Per Insurance Advisory Organization Guidelines
Residential Fire Flow	75 L/s
Commercial Fire Flow	100 L/s
Minimum Pressure at Peak Flow	280 kPa (40 psi)
Minimum Pressure at MDD Plus Fire Flow	140 kPa (20 psi)
Maximum Design Operating Pressure	550 kPa (80 psi)
Maximum Velocity	3.0 m/s
Minimum Velocity	0.15 m/s (or as determined by thermal analysis)

TABLE 5.2 WATER MAIN CHARACTERISTICS

Water Main Materials	HDPE – Series 160 Ductile Iron – ASTM A536, 350 psi rating PVC – ASTM D1784, Type 1, Grade 1 Welded Steel – ASTM A53 Grade B, ASTM A139 Grade B
Roughness Coefficient (Hazen Williams)	120
Minimum Diameter	150 mm
Minimum Depth of Bury – Uninsulated	3.0 m to pipe obvert
Minimum Depth of Bury – Insulated	2.5 m to pipe obvert
Minimum Separation from Sewer Main	3.0 m
Hydrant Type	In-line
Maximum Hydrant Spacing	90 m
Valve Configuration	20 residences per valve shutdown (max) 1 hydrant per valve shutdown (max) No more than 3 valves required to effect a shutdown

5.2 WATER DISTRIBUTION SYSTEM

5.2.1 Off-Site Network

As discussed in Section 2.5.3, water supply to Hillcrest is provided via the Alaska Highway 300 and 500 mm transmission mains, with two connections via Burn Rd and across Tank Farm property.

The Hillcrest subdivision is part of the Valleyview service area, which is controlled by the Valleyview Reservoir. Pressure is controlled by the static elevation in the reservoir. Based on the City's water model, operating pressures within the subdivision are estimated to be 375 - 540kPa (54 - 78psi).

Changes are currently planned to the off-site network to accommodate the development of the Tank Farm property. The water main running through the Tank Farm has been decommissioned and replaced by a main connecting the Hamilton Blvd transmission main to the north end of Summit Rd (the same location where the Tank Farm main connects to the Hillcrest network).

The new supply main as installed has greatly increase flows throughout the Hillcrest network, which will in turn result in water quality and thermal protection benefits, and fire flows.

It is proposed that a new water main connection will be provided across the Alaska Highway connecting the recently installed 500 mm water main along the Airport lands to the Burns Rd/Roundel Rd intersection, replacing an abandoned connection that previously existed in the area. This main, along with a new connection along Roundel Rd from Summit Rd, will also improve water supply quality, fire protection and security of supply by having another connection to the west end of Hillcrest as originally provided.

5.2.2 Distribution Network

The proposed internal water distribution network for Hillcrest will generally mirror the existing configuration, with some minor changes intended to improve flows and operation and maintenance conditions. Tie-in points for the new network will be:

- West end of Sunset Dr N at the intersection with Park Ln
- East end of new portion of Sunset Dr N at the intersection with Roundel Rd
- North end of Summit Rd/Sunset Dr N (in the City snow dump).
- East end of Roundel Rd at intersection with Burns Rd

The proposed internal water distribution network is illustrated in Figure 5.1.

5.2.3 Hydrants

All existing hydrants will be removed during construction and salvaged for re-use by the City. New hydrants will be in-line hydrants complete with an isolation valve, and having a maximum hydrant spacing of 90 m, per the standard for multiple-family residential, school, hospital, industrial-commercial and public areas. Hydrants will be placed at low points on the system to facilitate draining of the system. A hydrant will also be placed at the highest elevation in the system to release air trapped in the system during filling. Entrained air released into the system during operation will be allowed to escape through the residential services.

Figure 5.2 presents the available fire flows and associated pipe velocities for a fire flow event, as modelled using the City's water model (EPANet). It should be noted that the fire flow to the southeast corner of Dalton Tr does not meet the required residential fire flow. To address this issue, up-sizing of the water mains on Dalton Tr and Kluane Cr should be examined, while considering the added costs and decreases in normal operating velocities.

5.3 HYDRAULIC ANALYSIS

The proposed water distribution system was analysed using the City of Whitehorse Water Model. This model uses EPANet, a software package by the United States Environmental Protection Agency that models water distribution piping systems and has been made available free of charge to communities such as ours. The digital model is available from the City's Engineering Department and is provided to consultants working within Whitehorse.

Highlighted modelling results are as follows:

- Maximum system pressure at ADD (Average Daily Demand) is equal to 530 kPa
- Minimum system pressure at PHD (Peak Hourly Demand) is equal to 340 kPa
- ADD in the subdivision is modelled at 4.62 L/s
- ADD flow through the subdivision towards Hamilton Blvd and Hamilton Booster is 13.1 L/s
- Pipe velocities below 0.15 m/s are common under normal demand conditions. The final design will balance the need for velocity and thermal protection against the need for fire flows.
- But, preliminary designs to date, coupled with a new connection to Hamilton Blvd, fire flows and pipe velocities are improved.

The modelled flows and nodal pressures at ADD are presented in Figure 5.3. The proposed network including pipe sizes and nodal demands is presented in Figure 5.4.

5.4 THERMAL ANALYSIS

A thermal model of the proposed water distribution network has not been completed. Preliminary modelling results indicate that thermal conditions in the network will be improved by the anticipated construction of the Hamilton Blvd. connector transmission main. A detailed thermal analysis must be completed ahead of, or as a part of detailed design.

City Engineering is proposing shallow-buried insulated water mains as a means to minimize the disturbed width required for reconstruction of the subdivision.

All mains having less than 2.8 m of cover will be factory insulated with protected polyurethane in accordance with City standards.

5.5 GEOTECHNICAL CONSIDERATIONS

The geotechnical evaluation report has been included with this report as Appendix C. Installation of sanitary sewers will follow the recommendations of that report, and the standards of the City's Servicing Standards Manual.

The geotechnical recommendations are summarized as follows:

- Excavation of utility trenches must conform to the Yukon Occupational Health & Safety Regulations.
- Excavations are prone to sloughing so trench side slopes have to meet O H & S guidelines and be a minimum of 1.5:1 (horizontal to vertical). Excavation piles will be located well back from the edge of the trench excavation. As an option, all excavations could be braced to avoid sloping trenches in favour of vertical walls, thus reducing the excavation and backfill work and the impact on adjacent properties.
- All material excavated from the waterline trench will be acceptable for trench backfill. Even the silty sand material sub-cut from the paved roadways can be reused at depth in the utility trenches and then the remainder of the trench backfill will be good quality granular backfill.
- It is recommended that a Class "B" pipe bedding configuration with sand, gravel of crushed clean rock (as required by City Servicing Standards Manual) is to be specified for this site. This insures proper protection of the buried utility lines during backfill.
- Bedding may be imported bedding sand, but the use of bedding stone may be preferred if sloughing during compaction in the pipe zone causes unsafe working conditions.

6.0 PROPOSED SANITARY SEWERAGE SYSTEM

6.1 DESIGN PARAMETERS

The parameters to be used in the design of the sanitary sewer system are presented in the following tables. The sanitary sewer system will be designed in conformance with the City's Servicing Standards Manual. Detailed information regarding the sanitary sewer design parameters is contained therein.

Table 6.1 Sanitary Sewerage System Design Parameters

Subdivision Population	650
Residential Average Daily Demand (ADD)	500 Lpcd
Sanitary Recovery Rate	90%
Subdivision ADD Water Consumption	3.76 L/s
Peaking Factor	Harmon Peaking Factor = 4
Peak Sewage Production	4 x 0.9 x ADD
Infiltration Allowance	6,000 L/ha/day
Maximum Velocity	3.0 m/s
Minimum Velocity	0.60 m/s
Source Temperature	10 C
Ground Temperature at 2.5 m cover	-5.0 C
Ground Temperature at 3.0 m cover	-4.0 C
Ground Temperature at 3.5 m cover	-3.0 C

Table 6.2 Sanitary Sewer Main Characteristics

Sewer Mains	Concrete, HDPE, Ductile Iron (Asphaltic Coated), PVC Pipe
Design Capacity	Capacity at 75% full pipe
Minimum Size	200 mm
Minimum Grade	200 mm @ 0.4% Initial run @ 0.6% Services @ 2.0%
Manhole Size	1200 mm diameter, conical top
Maximum Manhole Spacing	110 m
Minimum Service Depth at P/L	2.4 m
Minimum Depth of w/o Insulation	2.8 m to pipe obvert
Insulation (if required)	50 mm

6.2 SANITARY SEWAGE MAINS LOCATION AND DISCHARGE POINTS

In-keeping with the results of the Sanitary Sewer Video Assessment (Appendix B), the majority of the existing sanitary sewer system will be retained for the new sanitary sewer network. The mains in need of replacement have been identified, and the new proposed network is illustrated in Figure 6.1. Implementation details are described in Section 6.4.

The sanitary sewer mains are to follow the natural ground contours and roadway layout of the area and operate as gravity lines. The Hillcrest sanitary sewer flows will discharge into the existing 400 mm sewer main on Burns Rd at the Burns Rd/Roundel Rd intersection.

To the extent that is practical, where replacement of sanitary sewers is recommended, the mains will the re-aligned to run within the road right-of-way or in the case of Park Ln, as close as possible to the road right-of-way. For Park Ln, total relocation will not be possible because of existing services to the lots have been built to match the existing elevation and the sewer depths cannot be changed significantly. Sufficient offset from property lines will be provided to allow for repairs to the sewer as-needed without disturbing private property.

No provisions for upsizing the mains for future expansion and densification are necessary nor recommended. There is sufficient excess capacity to accommodate the anticipated growth.

The only offsite connection that could require upsizing of the mains is a sewer main discharging flows from the Tank Farm property. This is not the recommended route for the flows from the Tank Farm, and as-such, the lines should not be upsized in-anticipation of that future connection.

6.3 GEOTECHNICAL CONSIDERATIONS

The geotechnical evaluation report has been appended to this report as Appendix C. Installation of sanitary sewers will follow the recommendations of that report, and the standards of the City's Servicing Standards Manual. The geotechnical recommendations will follow the same recommendations noted in Section 5.5 Water System.

6.4 IMPLEMENTATION OF SANITARY SEWER RECONSTRUCTION

The City's intent is to retain a significant portion of the existing sanitary sewer system as the system has been found to be in good condition. Leaving the sewer system in place will minimize the impact on adjacent properties, and simplify construction. However, some isolated spot repairs will be necessary.

But, Engineering is proposing to video tape all the sanitary sewer mains and sanitary services as part of the detailed design work that will be done for the specific phases of the work and where existing sewers are being proposed to remain. The condition will be re-evaluated as to whether the condition as worsened and its replacement recommended. During the detailed design work, other options for sewer main renewal work such as installing new pipe through the existing mains would be considered.

Sanitary service will be maintained to all units during construction with only minor short-term requests to stop discharge of effluent. Existing services will be removed if they are located in the same trench as a new service. If not, they will be filled and capped off at the building foundation.

But sanitary sewer replacement and work will impact from time to time physical access to the property thus requiring special arrangements made for parking and access during construction. Such inconvenience will be as minimal as possible, and subject of course to contractor progress, and weather.

Existing sewer mains that are scheduled for replacement will be removed from service and physically separated from the upgraded system. Those existing mains scheduled for replacement which are encountered during trenching operations will be removed. Exposed ends of sewer mains not being removed would be filled with fill-crete or other suitable materials.

Existing manholes that are scheduled for replacement will be filled with gravel or removed, the immediate surrounding area landscaped, and the frames and covers salvaged.

Existing sewer mains that are not scheduled for replacement will be excavated and repaired on a site-specific basis as directed by the results of the sewer camera video assessment (see Appendix B). New manholes will be added as needed to re-direct flows to new sections of sewer main.

Existing manholes that are not scheduled for replacement will be repaired as needed, based on the assessment. The anticipated repairs may include:

- Addition of new ladder rungs
- Replacement of ladder rungs
- Full replacement of access ladder
- Repair of benching
- Repair of trough
- Repair and addition of pipe grout
- Adjustment of frame and cover
- Replacement of frame and cover
- Supply and install frost covers and insulation around manhole

6.5 INSULATION

Insulation is not anticipated to be required on the majority of sanitary mains. All mains having less than 2.8 m of cover shall be factory insulated with protected polyurethane in accordance with City standards.

7.0 SERVICES

It is the aim of infrastructure renewal to ensure all existing infrastructure is upgraded as necessary to ensure no future impact on new roads that will be provided. For services, the aim of infrastructure renewal is bring the services up to City standards and stop wasting water through bleeding services. The City is replacing and upgrading all water mains with new insulated mains. Some of those mains will be shallowly buried. Consequently new water services will be installed from the mains to connect up to existing water services at the buildings, within or at the property line depending on the condition of the homes being serviced or the state of the property that will be impacted by the new work.

Servicing of residential units is very important for property owners, as the majority of physical changes on private property have been done over top of existing services severely limiting the repairs that can be done or will result in significant impact costs both on the property, or within the home.

The City has determined that the condition of the sanitary sewer mains in some areas may not need to be replaced. But, as noted earlier, the City will be video-taping all existing sewer mains proposed to remain, and will video tape all existing sewer mains, providing access is possible. It is important to note that access for video-taping services may not be possible as was confirmed with some Steelox buildings.

See Figure 6.1 for conceptual layout of the existing and proposed new mains. In areas where the existing mains are to remain, sewer services are not proposed for replacement. Areas where the mains will be replaced and/or new mains installed in new locations within the right-of-way will require the services to be replaced from the main to at least the property line to ensure proper grade is maintained. Replacement of sewer on private property will be the owner responsibility and details will be discussed and confirmed during detail design and then also during construction.

7.1 WATER SERVICES

The residential water services will be constructed in conformance with the City's current Servicing Standards to eliminate bleeding. Use of recirculating water services (25 mm supply pipe and a 20 mm return) is the normal standard. Unlike sanitary sewer services, water services will be replaced from the main to and inside the building at the City's cost where physically possible. The City is willing to invest in replacement of the private portions of the service pipes because of the water consumption savings that can be realized by using recirculation for frost protection rather than bleeders. Bleeding not only wastes treated water, but is against the Water and Sewer bylaws and the City's sustainability plan. This standard has been followed in all infrastructural renewal areas since Takhini North (2008).

The standard water service configuration is illustrated in Figure 7.1.

Residential services will be the recirculating type will be made of high density polyethylene plastic pipe with a minimum of 50 mm of factory-applied polyurethane insulation. The service will be connected to the existing plumbing serving the residential unit. A new penetration into the crawl space or basement of the serviced home will be required to accommodate the new return line, and a second new penetration may be required if the penetration from the existing service cannot be re-used.

The property owners will be responsible for execution of any plumbing retrofits within the building as required for the new recirculating water service. At minimum, this will involve the purchase and installation of a recirculation pump, which is installed inside the home at the point where the water

service pipes enter the building. The pump operates very quietly and has a warranty period of 10 years but the life of the pump will exceed that length of time.

Existing water services that are encountered during installation of the new mains or service will be removed. All existing bleeders (including thermostatically controlled bleeders) must be removed during the installation of the plumbing modifications and the TCB devices returned to the City.

All work inside the building is to be done by a qualified individual hired by the homeowner. All work is to be coordinated with the work being done on the mains by the City contractor and sufficient notice will be provide to the homeowner to ensure that such work can be completed before temporary connections is eliminated.

Temporary water connections will be provided to ensure potable water supply is maintained during construction at all times. 24-hour contact with the contractor will be provided to the homeowners. Where applicable, existing water service pipes will be abandoned in place.

However, the City is proposing not to offer a recirculating water service to all property owners given the major impact that will occur on some private properties with retaining walls or significant out-buildings, or where the building itself is not structurally sound or built in such a way that it is not capable or possible for the work to be done within the building. In these cases, other service alternatives are being explored such as the use of different types of heat trace including heat trace system inside of the service pipe, or installing insulated pipe with external heat trace to the building face and where the electrical heat trace is extended into the building and the use of Aqua-flos which have been used successfully in the past.

In the case with the Steelox buildings for example, not only has it been found that sufficient space is not available within the unit for a new water service, there is no space below the flooring, nor any basement or a crawl space that could provide sufficient space to install a new unit or to even do the installation work without significant costs to the homeowner.

Where upgrading is not possible at this time, the City would install new water services up to the property line or closer to the face of the building where it could be extended at some time in the future should failure occur, or the home is demolished and a new home built such as what is being done on 113 and 114 Hillcrest Dr.

Further, options such as pipe bursting methods and directional drilling of services may also prove possible, but to date such upgrading systems have never been done locally, but has been successful in other communities and still require excavations and access to the front of the buildings and the mains.

7.2 SANITARY SEWER SERVICES

If sanitary sewer services require to be reconstructed for non-conformance with the City's current servicing standards, or they are not operating effectively, sanitary sewer services will be replaced from the sewer main to the property line, where they will be connected to the existing sanitary service pipe.

At that time, the homeowner may, at their option, hire the City's contractor to extend the new sewer service to the home at the same time as they install the new water service, rather than just connecting to the existing sanitary service at the property line. The City strongly recommends that homeowners

take advantage of this opportunity to upgrade their service should it be necessary, as the cost will be incrementally less than the cost of a future sanitary service failure and replacement or repair.

Sanitary services will be 100 mm dia. piping to City standards, with factory-applied polyurethane insulation where sewer depth is less than recommended. Each service will connect to the main using in-line tees or stainless steel saddles and long-radius elbows.

Existing sanitary service pipes will be removed as needed to facilitate installation of the new service pipes, or left in place. Existing service pipes which have been cut off will be capped to isolate the sewer main. Installation will be performed in a manner that minimizes downtime for the homeowners.

7.3 IMPACT OF SERVICING ON PRIVATE PROPERTY

A City policy review was prepared to inform the development of this pre-design and the ongoing public consultation process with residents of Hillcrest. The policy review has been included herein as Appendix D. The installation of services is very important to property owners, because digging the service trench(es) constitutes the most significant impact of infrastructure renewal on private property. It is important to note that the policies applied to infrastructure renewal in Hillcrest are consistent with past projects, including recent infrastructure renewal projects: Takhini North, Hanson St, Black St, and Ogilvie St.

The City's policies for servicing in infrastructure renewal projects are summarized as follows:

- The City's current standard for servicing in infrastructure renewal is that all water services will be upgraded to eliminate bleeding of mains for frost protection. A recirculating system from the water main to the building has become the standard. The owner is responsible for the cost of the recirculation pump and plumbing retrofits and will be given a reasonable time to make the changes themselves, hire their own plumber, or retain the services of the City contractor performing the work.
- Sewer service will be replaced from the main to the property line, or close to it, at the City's cost where the sewer main is being replaced. Sewers replaced to the building will be at the owner's cost using the services of the City contractor if the work can be done concurrently with the water service replacement.
- The City and its agents will endeavour to minimize impact on private property when installing new water and sewer services. Water services, separated from sanitary services not being replaced can be relocated in such a way to avoid keep trees and/or features, but not always.
- All improvements inside property line requiring removal will be replaced at the City's cost. Special consideration is made for removal and re-planting of existing trees and plants but replacement of like for like will not always be possible.
- Driveways, walkways, and lawns in the road right-of-way requiring removal will be reinstated at the City's cost.
- Garages, sheds and decks which encroach on the right-of-way will be assessed on a case by case basis, but if they are found to impact on any City infrastructure renewal work, the City cannot be responsible for damages although reasonable care and attention will be given. Further, replacement may not be possible.

- All other improvements in the right-of-way will be removed if required to complete the infrastructure renewal work, and will not be replaced by the City.

To ensure that the impact of servicing is minimized and repairs are done where necessary, the City will perform a site-specific assessment of each property. Ideally, an alignment will be available to construct the service trench without impacting on any existing improvements other than the lawn between the property line and the building.

Where such an alignment is not available, the City must assess the location of the existing services, the tie-in points at the water/sewer main and the home, and existing development. The alignment having the lowest impact on existing improvements will be selected for the new service trench and the installation of the new services, if possible. If alignment cannot be effectively determined then the use of Aqua-flo or in-line heat trace may have to be used. The homeowner will be consulted to determine the lowest-impact trench alignment and the selected option that is most cost effective.

For information on all properties for selection of a service trench alignment, all available data regarding existing services will be confirmed and/or collected during detailed design work for each phase.

The City has had few complaints about sewer service, but prior to hiring a consultant to do the detail designs for the work the City will conduct videotaping of existing services to confirm condition.

7.4 SERVICING STEELOX DUPLEXES

Construction of new water and sewer services for the Steelox duplexes will be unlike the servicing of the rest of the Hillcrest subdivision. The affected units are:

- #91-119 Park Ln
- #120-133 Hillcrest Dr
- #134-165 Dalton Tr

The Steelox duplexes were constructed with conjoined plumbing systems. The two sides of the duplex share a single common water service and a single common sanitary sewer service. The internal plumbing of the units is connected together to allow both sides to be served by a single service pipe. The typical service configuration for the Steelox duplexes has the water and sewer services centred on the left hand side unit when facing the structure from the fronting road. The services typically enter the unit beneath the front door. Internal plumbing connections service the unit on the right.

The City has visited a number of Steelox buildings, and unfortunately in order for a new water and/or sewer service to be provided to service one or both sides of the Steelox duplex units, the homeowner(s) will have to undertake a number of significant changes to make it possible. This work would be necessary at any time the system may fail and some units have seen failures occur.

The challenges related to infrastructure renewal within the Steelox duplexes are:

- There is no crawl space and no space below the flooring with sufficient depth to install the service or to maintain them. Ground level is inches away from the underside of the floor joists.
- Although the water service piping has been extended to a trap door within a utility room in order to provide access to service the other unit, the pipe and connections are not easily accessible and some of the units have little space to work around the trap door. Thus the water

service pipe connecting and serving both units is difficult to access and will require the removal of soil within the crawl space to make it accessible, particularly where the pipe enters underneath the building foundation and the 10 inch concrete grade beam that supports the outside walls. Access to the sewer if necessary is also difficult for the reasons noted above, and where the sewer enters the building from under the foundation.

- The City knows of one unit which had a trap door installed just inside the front door in order to help access the water and sewer service located below ground. The sanitary cleanout was welded shut and access is restricted without its removal and replacement. The condition of the sewer pipe within the unit could not be videotaped as a result.
- Some of the utility rooms are not even accessible to the underlying water and sewer pipes.
- The electrical system may not have power supply or a breaker to support a recirculating pump or heat trace without changes.

Another complicating factor in servicing the Steelox buildings is that the legal status of the lots and buildings varies. Some lots have been subdivided, while others have not. In some cases, both units on a given lot are occupied by the same owner, similar to a single family home. In other cases, one unit is used as a rental suite, while the other is occupied by the owner.

A third situation is that the property has been subdivided, sold to separate owners and classified as a condo because of the shared services. An easement agreement between the owners of the two units has often not been created, so the owner of the unit that does not have the main supply pipe has to rely on help from the other property owner to ensure a water supply. A failure of the water supply will cut off the water to the side unit, but the failure will more drastically affect the other unit, so both owners share the risk and the cost of repair. These owners may wish a new supply service to the “un-serviced” side of the property to enable a formal subdivision. This improvement would be done at the property owners’ cost. If a new second service is to be added, the service would be installed in a separate trench as a common trench to reduce costs may not be completely possible because of internal plumbing.

To properly address the lack of available data regarding the existing services, a site visit will be needed for each individual Steelox unit. Alignment of sewer services can be inferred, but inspection of the interior plumbing will be needed to reveal any instances where the water/sewer system has been altered or split between the two units. The City will need to work with property owners interested in a cost-sharing plan to provide a dual-servicing option noted above for both units but in separate trenches, as a common trench would not be possible. As an alternative, both property owners who do not wish to upgrade the plumbing within their unit can elect to execute an easement agreement that will outline responsibilities for what happens when repairs or maintenance on the plumbing within the units or within the lot are necessary.

In order to provide the normal recirculating water service to the units, the City is pursuing an option that could see the current system of supply maintained but provide frost protection other than bleeding by inserting a heat trace system within the service pipe. This may be possible depending on the size and configuration of the pipe layout and has been used in other areas. The City is investigating a pilot project to install some of these systems in test homes as it may have application in other situations within the City besides Hillcrest. Aqua-flos are also a viable option but the unit does require space for its placement within the building and space may not always be available.

The proposed servicing option for Steelox units will conform to the existing as illustrated in Figure 7.2 with as a minimum the recirculating water service terminated at the property line for future extension.

As another option, the City could install new insulated services with the normal heat trace system up to the face of the building where a connection would be made to the existing service pipe, and then heat trace would be installed separately from the service pipe within the floor joists of the main unit. The electrical service would be installed in a metal conduit and then drilled through the external wall extending to the trap door of the main unit where it would be connected to the power supply. This may be possible, and we could consider this as a pilot project as the method suggested above.

Based on the City's estimated timing for the work (Figure 10.1), the area that has Steelox buildings would be the last and second to last phase of construction given its location and dependency on the other downstream infrastructure. So, this delay does give property owners an opportunity to prepare their units for new water and sewer services should the Steelox building be demolished in favour of a newer home, or repairs to the existing water and sanitary sewer services within the buildings are necessary or could be done to avoid possible future repairs.

8.0 SHALLOW BURIED AND OVERHEAD UTILITIES

The existing shallow buried and overhead utilities in the Hillcrest subdivision are expected to stay in service throughout the infrastructure renewal project. The existing power distribution and street lighting infrastructure is owned and operated by ATCO. The telephone/internet infrastructure is owned and operated by NWTel. Although ongoing improvements to the system will continue to be undertaken by the owners, there is no plan at this time to coordinate any significant upgrades with the City's planned infrastructure renewal project.

8.1 EXISTING POWER AND TELEPHONE INFRASTRUCTURE

The existing electrical distribution and telephone/internet infrastructure is a combination of overhead wires and underground installations.

Typically, both networks utilize the same overhead poles. The poles are located on lot lines or within the road right-of-way. The poles are chemically treated wood, and vary in age and condition. The owners have an inspection and replacement program to ensure none of the infrastructure becomes critically degraded by age and exposure. Service poles are located on certain private properties, and must be considered and secured when selecting the service trench alignment and main replacements or repairs.

The existing street lights are mounted on the same wood poles serving the distribution infrastructure. On Sunset Dr N there are steel street light standards, and City standard that is where existing street lights only are serviced with overhead lines within road rights-of-way (e.g. Dalton Tr), these lights will be removed and replaced with buried infrastructure and steel poles. New street lamps will be fully capped, although the City is working with ATCO to install new LED street lights for new or replacement installations.

8.2 CONFLICTS BETWEEN OVERHEAD AND DEEP BURIED UTILITY INFRASTRUCTURE

Dating back to the original construction of the subdivision, there are a number of locations where the overhead poles and deep buried utilities are in conflict. The overhead poles are directly over top of the deep utility lines in some locations and are also sufficiently close that the deep utility lines cannot be excavated for repair, tie-ins, etc. without undermining the adjacent poles.

The City intends to keep a significant portion of the existing sanitary sewer network in service, which will result in many conflicts during construction of the infrastructure renewal project, and many existing conflicts persisting beyond the completion of the planned work.

In order to inform the detailed design process, where conflicts will need to be identified in detail, a schematic representation of the existing areas of conflict has been prepared, as shown in Figure 8.1. It is recommended that the City undertake negotiations with NWTel and ATCO with the goal of eliminating utility conflicts to the benefit of both parties.

9.0 CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

9.1 CONSTRUCTION

9.1.1 Water and Sewer Service

Full water and sewer service will be maintained to the residential units during construction. If required, temporary connection to the houses will be made, particularly for water main replacement work. Plumbing modifications will require the services to be discontinued for short periods of time, but every effort will be made to keep such interruptions to a minimum. Decommissioning of abandoned lines will occur only after new systems are put into service and will involve removal where conflicts occur or left in place.

9.1.2 Access and Safety

Full access to the subdivision will be maintained for emergency vehicles and for waste collection. Individual street closures will occur with traffic diverted to parallel streets or laneways, or by maintaining at least one lane of traffic.

There will be inconvenience due to construction, particularly because of the very narrow rights-of-way, the existence of power poles, existing landscaping, infrastructure, etc. But when complete or partial street closures occur, parking areas will be defined and located as close as possible to the homes impacted by construction which the residents may use. Pedestrian access will be maintained at all times.

Job site safety will be stressed in the contract specifications. Particular attention will be paid to pedestrian safety adjacent to work areas. All excavations will be suitably barricaded and defined at the end of each construction day, as it will not be possible to completely backfill open trenches as the work proceeds.

Notices of temporary road detours, restricted access or service shut-downs will be placed in the mailboxes of affected residences, with as much lead time as is reasonably possible, but all work depends on progress, difficulties that occur during construction and weather. Daily or periodic updates on the status of construction will be sent by the construction inspector to homeowners, the City's Engineering and Operations Departments, the Fire Department, RCMP and Ambulance Services.

On temporarily closed streets, the contractor will be responsible to collect garbage and compost bins on the weekly pickup day, deliver them to designated pickup points, and return them at the end of the day.

9.1.3 Public Liaison

An important reason for the success of previous infrastructure renewal projects is the contractor's public liaison. The contractor will supply a representative who will be on site and available on a full time basis to respond to residents' inquiries and requests and will have 24 hour call answering service in case of emergencies. This representative will coordinate with the contractor's superintendent and the construction inspector to ensure that the residents are provided with timely answers to questions and prompt action in response to their requests.

9.1.4 Construction Waste

Bituminous materials removed from the site will be salvaged for re-use in recycled asphalt pavement. Excavated materials identified as not suitable for use in backfill and waste concrete and construction debris will be hauled to the City landfill for disposal or to approved landfilling sites. It is not anticipated that much of the existing infrastructure material will be suitable for salvage, however, all hydrants, manhole frame and covers and valves could be salvaged.

9.1.5 Landscaping

All existing landscaped areas, including on private property, which may be disturbed or impacted by construction will be restored as close as reasonably possible to original or better condition. All grassed areas will be top-soiled (using City approved Grade A compost as a supplement) and seeded. Trees and/or shrubs that are of a size and shape that can be relocated will be, but property owners should take the initiative to relocate the vegetation they wish to preserve following discussions with design engineers on the impact to their property due to construction.

Property owners will be expected to take reasonable care to water regularly all re-landscaped areas particular new or relocated trees and shrubs.

No new landscaping projects are proposed to be included as part of this local improvement project, except where bio-swales for surface drainage has been identified as part of the work, or landscaping of any roundabouts which may be constructed as part of this project, or the medians proposed within Hillcrest Dr.

No hard landscaping, such as community gardens, benches, bike racks, sculptures, etc. are included within this LI Project. However, homeowners and the community should be aware that the City does offer Environmental Grants for the community to landscape public spaces, the details of which can be obtained through its Environmental Sustainability Department or on the City Website.

9.2 MAINTENANCE

Inspection, cleaning, and flushing of the buried infrastructure should be conducted on a regular basis as part of the City's maintenance program.

The water and sewer mains will be designed to meet the City's criteria for prevention of freeze-ups. In the event of loss of circulation or simultaneous full stoppage of the Two Mile Hill Booster Station and McIntyre Creek Pumphouse for a period of longer than 15 hours, bleeding or other means of freeze protection should be implemented.

The storm water system and catch basins should be checked prior to the spring thaw to ensure debris and ice are not obstructing the flow.

As-built drawings, service cards, hydrant, and valve cards and sign inventory sheets will be completed and provide to the City upon completion of construction.

10.0 PROJECT SCHEDULING AND CO-ORDINATION

10.1 OVERALL PROJECT SCHEDULE

The development of the Hillcrest LI Project is occurring in concert with an ongoing public information and consultation process with Hillcrest residents and property owners. The development of a Hillcrest Neighbourhood Plan led by the City's Planning Department has been completed and implementation is underway. The consultation elements of the planning process have helped to inform this pre-design work and will in turn inform the development of the future detailed design.

Follow up meetings with the community has been suggested and to be scheduled sometime in January 2016, before Council is presented with a possible LIC Bylaw for their consideration. Three meetings are being suggested to discuss the project and the specific work planned for the area. The three meetings would include:

- Roundel Rd, Sunset Dr N, and Summit Rd
- Chalet Cr and Kluane Cr
- Steelox buildings (Dalton Tr, Hillcrest Dr, and Park Ln)

All areas can provide comments on Roundel Rd and Hillcrest Dr reconstruction work.

The infrastructure renewal project will be partially funded by a Local Improvement Charge (LIC). In accordance with the City's LIC bylaw, a vote will occur among affected residents to confirm their approval of the project prior to the start of detailed design. The LIC Bylaw would include all benefitting properties, so that a set price would be allocated to each, in accordance with the LIC policy, regardless of when construction would occur in their area.

The LIC is based on the current Council approved LIC policy that was approved and used as a basis for funding all urban areas and is based on building average roadways irrespective of where people may live. For comparison purposes, in 2013, the LIC Bylaw allocated a frontage charge, but no side yard charge, of $600 per metre.

Pending the approval of the Hillcrest LIC vote, the detailed design process followed by construction timing and phasing is subject to City Council approval.

The City 2016 Budget has allocated detailed design funds in 2017 but construction funds have not been confirmed. Both detailed design and construction timing is subject to LIC and funding approval.

The City has received tentative approval of funding from YG through the Building Canada Fund Program, the details and scope of work is subject to Federal Government approval, and approval is not expected until later in 2016.

10.2 CONSTRUCTION SCHEDULE

In the interest of completing the project in manageable sections with minimal impact on the community since noise and access will become restricted during the project and the duration of which is dependent on contractor performance and weather. A phased schedule has been proposed. The construction would be over a 4-year period, depending on funding and Council approval. It is tentatively shown on Figure 10.1.

10.3 CO-ORDINATION WITH OTHER CONSTRUCTION

In anticipation of this infrastructure renewal project, the following projects must be considered from a scheduling and co-ordination standpoint:

- Re-alignment of Overhead and Shallow Buried Utilities (ATCO, NWTEL)
- Alaska Highway Corridor Improvements (YG Transportation Engineering, dates being confirmed).
- Hillcrest Neighbourhood Plan 2014

11.0 PREDESIGN COST ESTIMATE

The estimated budget for this project, including construction, engineering, and utility installations is $17,050,000, not including GST. This estimate is based on updated construction prices for similar projects in Whitehorse for 2016.

The tentative design and construction budget is summarized as below:

• Underground	$ 7,600,000
• Surface Works	$ 5,650,000
• Contingency for Design & Construction	$ 1,850,000
• City Engineering – Consultant	$ 1,950,000
TOTAL ESTIMATED PROJECT COST	**$17,050,000**

Funding for construction and engineering for this project has not been confirmed due to the size of the project, and the ever-growing demand for renewal work in other areas of the City from Downtown core which has upgrading plans prepared since 1993, to completing Marwell, Range Rd North, and other

subdivisions such as the north end of Porter Creek. Council has proposed in the 2016 Capital Budget commencing engineering detail design work for the first phase in 2017.

Funding applications for Building Canada and Gas Tax program have been proposed. City has received confirmation that Building Canada Funding is possible, but requires Federal Government approvals.

Funding for the surface works will also come from approval and acceptance of a Local Improvement Bylaw, in accordance with the City's Local Improvement Policy approved in 2011, and used for Ogilvie St Reconstruction project in 2013 and proposed for future urban renewal projects, adjusted annually.

12.0 PRE-DESIGN CONCLUSIONS AND RECOMMENDATIONS

The recommendations developed during the pre-design process have been summarized below. To facilitate work plan development, the recommendations have been arranged in chronological order relative to the proposed project schedule presented in Section 10.0.

12.1 PRE-DESIGN ENRICHMENT RECOMMENDATIONS

The following recommendations should be completed by the City at the earliest available opportunity. The results and decisions developed through this work will inform the public consultation process, LIC vote and the detailed design.

12.1.1 Water Network Thermal Assessment

As presented in Section 5.0, the thermal assessment of the pre-design water network has not been completed. An assessment should be performed to consider the costs and benefits of a shallow-buried, insulated water network as opposed to a deep-buried, un-insulated water network. The sizing of mains to increase available fire flows on Dalton Tr should also be considered.

12.1.3 Conflicting Shallow-Buried and Overhead Infrastructure and Proposed Improvements

As presented in Section 8.0, there are significant conflicts between the existing shallow-buried and overhead infrastructure owned by YECL and NWTEL and the proposed improvements presented herein. It is recommended that the City undertake a consultation process with the utility companies to establish an agreement for the execution of upgrades with the goal of eliminating conflicts and improving operability for all parties.

12.1.4 Confirm Status of Existing Easements

As presented in Section 2.3, confirmation of the status of existing easements is required to ensure the operability of the proposed water/sewer network, especially the sewer network, wherein many of the existing pipes intended to be kept in-service are located on private property. The pre-design has been prepared with the assumption that these easements will be available going forward. The City's Planning and Engineering Services Departments should confirm the availability of the easements prior to the start of detailed design.

12.1.5 Land Acquisitions

As presented in Section 2.3, proposed changes to the snow dump and the potential infill site on Sunset Dr N and the proposed addition of storm outfalls to the greenbelts south of Hillcrest Dr, west and east of

Dalton Tr and east of Summit Rd will require new land use permits from YG and changes to the legal boundaries. The City will begin the process of acquiring the new land to confirm the availability of those proposed improvements required for the detailed design process for the various phases.

The City's Planning Services Department should proceed in 2016/2017 with possible residential infill development of Lot 130 so that servicing can be confirmed if necessary in 2017, and construction completed if approved by Council. Such work would enable those infill lots to allow sale of the lots when construction within this area has been completed. The local improvement costs for this lot will be charged according to the 2011 LIC Policy and the value included with the sale price of the land.

12.2 EXTERNAL/INTERNAL CONSULTATION REQUIREMENTS

12.2.1 Manhole and Sewer Main Inspections

The existing manholes on the sanitary sewer network are known to be in need of repair, as described in Section 6.0, and presented in detail in Appendix B. The City will undertake a detailed assessment of all the existing manholes in the Hillcrest network to confirm existing conditions as part of the design work as each phase proceeds, and will incorporated the detailed design of the new sanitary sewer network. These inspections will be performed with the City's consultant and with the City`s Water and Waste Department to ensure that the results are consistent with the needs of that department as the work proceeds.

Engineering Services is proposing to conduct new video-taping of all sanitary sewer mains and analyse their current condition with the City's consultant and Operations department during the detail design work for each phase along with future life estimates and options for replacement that could include in line renewal work with minimal excavations.

12.2.2 Water and Sanitary Sewer Servicing

As described in Section 7.4, the available service data for Hillcrest is incomplete. To better-inform the planning and design process for servicing of the Steelox properties on Dalton Tr, Park Ln, and Hillcrest Dr, the City undertook site visits at six properties to confirm:

- The location of the existing water and sewer services to the units.
- The access availability to the internal plumbing of the Steelox (specifically, have the two units been separated via internal plumbing retrofits?).
- The condition of the sewer service.
- Estimate the scope of work required for repair and maintenance.

Engineering Services will discuss further with property owners the issues and options for future servicing, particularly for those units which will have a major impact on the property (i.e. Chalet Cr) or within the building (i.e. Steelox buildings) and what steps should be taken to complete upgrading of water and sewer services for those buildings as and when necessary.

Consideration of a pilot project for heat trace existing supply service pipe will be considered and the use of Aqua-flos could be a recommendation.

Video-taping of sewer services along with the sewer main work during the year the detail design work is to be done to determine the current condition of the service pipe and operational concerns. Access to the sewer service from within the home or unit must be provided by the homeowner in order to complete the video-taping.

12.2.3 Curb and Gutter vs. Storm Ditches/Swales

The responses to the LI Questionnaire indicate that many residents feel strongly that the existing storm drainage ditches should be maintained or re-established and are opposed to the construction of a curb and gutter system. To address drainage issues and facilitate sidewalk construction, the pre-design is recommending that the City install curb and gutter along the: south side of Hillcrest Dr, portions of its north side, and along the proposed medians; south side of Roundel Rd and portions of its north side; west side of Park Ln E; both sides of Sunset Dr N (between Roundel Rd and Summit Rd); west side of Summit Rd (north of Roundel Rd); and both sides of Burns Rd. The rural ditches and swales that currently exist in other areas will be maintained and improved, where needed.

12.2.4 Land Status of Internal Laneways

As described in Section 2.3.2, there are existing surveyed laneways at the centre of Chalet Cr, between the rear of properties along Sunset Dr S and both sides of Kluane Cr, that may be suitable for sale to adjacent property owners, as a means to formalize their use, in-that most property owners are already encroaching onto these laneways. The situation is similar for properties located between Roundel Rd and Sunset Dr N; however, owners here have purchased their respective lane portions, though only one has proceeded with consolidated. It is recommended that Engineering Services consult with Planning Services and property owners to explore the topic further.

12.3 DESIGN RECOMMENDATIONS

12.3.1 Realign Summit Rd/Sunset Dr N Intersection

Section 4.5.1 establishes the recommendation that the intersection of Summit Rd and Sunset Dr N be re-aligned, and that the boundary of Lot 130 on the southwest corner of the intersection be changed to a T-intersection. It is recommended that this re-alignment be completed, and that the detailed design process include an intersection design for this location and that driveways be relocated as necessary.

12.3.2 Public Liaison

As described in Section 9.1.3, it is recommended that the construction contracts for implementation of this project include provision of a public liaison.

13.0 REFERENCES

City of Whitehorse **Servicing Standards Manual** – Updated 2007.
Available at www.whitehorse.ca/engineering

City of Whitehorse **Official Community Plan (OCP)** – Updated 2010.
Available at www.whitehorse.ca/planning