






COPPER RIDGE DEVELOPMENT AREA

LAND USE MASTER PLAN

JANUARY 2024

CITY OF WHITEHORSE

Whitehorse

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Summary

The City of Whitehorse is focused on ensuring all residents have access to a safe place to call home. To meet this demand, the City is looking at a number of ways it can increase the amount of housing in the community. An area between Copper Ridge Place and Falcon Drive was identified for potential development. To ensure the area is developed in a logical, integrated manner, the City initiated work on a land use master plan (the Plan), which aims to result in a high-quality new development.

The purpose of the Plan is to articulate clear direction and actionable policies to provide residential land for development. The Plan sets out a vision, guiding principles and associated policies to guide decisions on land use and development in the Plan area, to create a quality residential development that meets the needs of current and future residents while also preserving and enhancing natural areas to protect neighbourhood amenities.

The drafting of the Plan was influenced by a review of relevant City plans, policies and bylaws, supporting studies and technical reviews, community, stakeholder and government consultation, and a thorough understanding of the Plan area. To arrive at a preferred land use concept and report for the Plan area, the City went through multiple iterations of information gathering, conceptualization and engagement.

During the Plan engagement process, the community, government partners and technical stakeholders provided perspectives on their vision, values, and priorities for the area. This input was used to create the vision that serves as a guiding framework for the Plan and provides direction for the Plan's concept and policies.

The Plan's vision is supported by four overarching principles that form the foundation of the Plan and inform policy direction, future decision-making and investments in the Plan area:

- Housing Choice and Compatibility
- Natural Area Preservation and Enhancement
- Transportation Choice and Connections
- Safe, Inclusive and Accessible Development

The principles reflect city-wide values and goals, Council priorities and best practices to promote a mixture of development types and support the long-term interests of the Whitehorse community.

The Plan reflects a comprehensive planning process and is intended to be a living document whose implementation includes amendments, as needed, over time to respond to emerging needs and changing conditions.

Land Acknowledgement

The City of Whitehorse (the City) acknowledges that it is situated on the traditional territories of the Ta’an Kwäch'än Council and the Kwanlin Dün First Nation, as defined in the 2002 Ta’an Kwäch'än Council Final and Self-Governing Agreements and the 2005 Kwanlin Dün First Nation Final and Self-Governing Agreements

The City acknowledges that the Ta’an Kwäch'än Council and the Kwanlin Dün First Nation understand their history in what is now Whitehorse since time immemorial and that the two Nations have had, and continue to have, a spiritual, cultural, and economic connection to the land and resources of this area. The City acknowledges that these governments and their citizens contribute significantly to the city’s social, cultural, spiritual and economic prosperity. The City of Whitehorse has committed to strengthening its relationships with Kwanlin Dün First Nation and the Ta’an Kwäch'än Council through the 2018 *Declaration of Commitment*.

Other Acknowledgments

The project team and City Council extend their sincere thanks to the many residents, associations, organizations, consultants, City staff members and governments that have contributed to the development of the Copper Ridge Development Area Land Use Master Plan.

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1 Introduction

The City of Whitehorse is focused on making sure all residents have access to a safe place to call home. To meet this demand[1], the City is looking at a number of ways it can increase the amount of housing within the community. An area between Copper Ridge Place and Falcon Drive was identified for potential development and consists of properties owned by the Yukon Government (YG) and the City (Figure 1). To ensure the area is developed in a logical, integrated manner, the City initiated work on a land use master plan (the Plan), which aims to result in high-quality new developments.

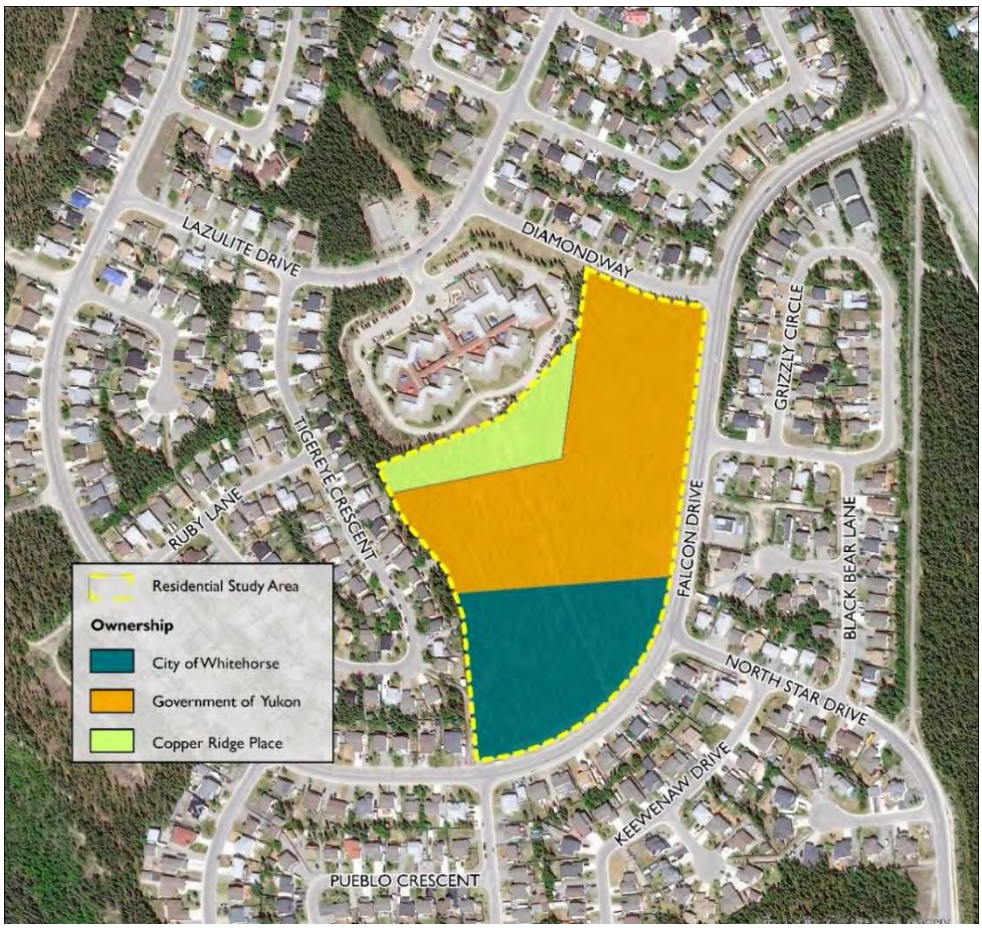

Figure 1: Plan Area

The drafting of the Plan was influenced by a review of relevant City plans, policies and bylaws, supporting studies and technical reviews, community, stakeholder and government consultation, and

[1] Refer to section 2.3.1 of this document.

a thorough understanding of the Plan area. The Plan was prepared to align with the City's overall development goals, objectives, and policies with consideration to the input provided through government, public and stakeholder engagement. The plan is intended to establish the core design principles that need to be considered in the development of the site.

1.1 Land Use Master Plan

A land use master plan is a high-level planning document that directs how an area should be developed. This high-level guiding document has two main components: a preferred land use concept and a report. The land use concept illustrates the approximate location of land uses, including the major road and active transportation networks. The report provides a written description of the land use concept, guidance on land use, density, on- and off-site infrastructure, and how development should occur.

Land Use Master Plans are approved through a resolution of Council. They are an overarching framework intended to inform subsequent preparation of zoning amendment, subdivision, detailed engineering design, development permit and other regulatory applications within a planned area, providing the City with a basis for evaluating the level of compliance of these submissions with the City's vision for this area. Community input is sought throughout the process to receive feedback while preparing the master plan document.

Land Use Master Plans are critical to achieving the City's long-range growth management strategy outlined in the *Whitehorse 2040: Official Community Plan* (OCP). The Land Use Master Plan process integrates the broader objectives of the community at a local scale to advance both community and neighbourhood aspirations.

1.2 Purpose

The purpose of the Plan is to articulate clear direction and actionable policies to provide residential land for development. The Plan sets out a vision, guiding principles and associated policies to guide decisions on land use and development in the Plan area, to create a quality residential development that meets the needs of current and future residents while also preserving and enhancing natural areas to protect neighbourhood amenities.

To arrive at a Plan, the City went through multiple iterations of information gathering, conceptualization and engagement. These steps are described in further detail in section 2 of this report. Sections 3 to 5 establish the framework for the Plan area by articulating the location and types of housing, and other forms of development and land uses that are envisioned for the area and gives guidance on what buildings and private and public spaces should look like.

In addition to land use and urban design considerations, the Plan provides direction on the future transportation network, parks, public places, and community facilities in the area. The policies in the plan also address other issues and opportunities that are important to the community.

The Plan reflects a comprehensive planning process and is intended to be a guiding document whose implementation includes amendments, as needed, over time to respond to emerging needs and changing conditions.

1.3 Process

The process of planning the area was launched in January 2023 (Figure 2). A project webpage was created on the City's engagement platform, engagewhitehorse.ca, to provide publicly available project information and periodic updates. The webpage also allowed the public to ask questions and provide input on the project during three engagement periods.

Figure 2: Master Plan Preparation Process

During the Plan engagement process, the community, government partners and technical stakeholders provided perspectives on their vision, values, and priorities for the area. This input was used to create the vision that serves as a guiding framework for the plan and provides direction for the plan's concept and policies.

1.3.1 Project Launch Engagement

Initial engagement was carried out in January and February 2023 to understand what the community would like to see in the area and identify the vision, issues, and opportunities for the area prior to developing two land use concept scenarios. As part of this engagement, the City hosted a virtual webinar where the project was presented. City staff gave a brief overview of the Plan area, relevant plans, background studies, master plan process, key steps and dates, and future public engagement opportunities. The webinar also included a period for questions and answers. City staff also hosted an in-person presentation with Copper Ridge Place residents.

The City advertised the launch of the project on social media, newspapers, radio stations, and through a public service announcement. The City also directly notified Ta'an Kwäch'än Council, Kwanlin Dün First Nation, Copper Ridge residents, the Copper Ridge Neighbourhood Association, and Copper Ridge Place staff.

Public feedback was generally sought by way of an online survey, with physical copies available upon request. The questions aimed to receive input on:

- how the respondents currently use the Plan area;

- what type of land uses and densities they would support; and
- open-ended questions about their concerns and desires for the development.

The City received a total of 166 survey responses.

1.3.2 Design Workshops

Following the project launch engagement, the City facilitated two design workshops in May 2023. The design workshops were held with the Plan area landowners, Copper Ridge Place residents, technical experts, and designers. The intent of the workshops was to allow the project team to engage quickly and effectively with these parties, to ideate challenges and opportunities, and explore a broad diversity of design ideas.

Two land use concept scenarios were then developed by the project team, taking into consideration engagement and workshop input and guidance from policy documents and background studies.

1.3.3 Planning Charrette Engagement

A second round of engagement was held in May and June 2023. The two land use concept scenarios were posted on the City's engagement platform and the City hosted two open houses to present the scenarios and answer questions.

Public feedback was again generally sought by way of an online survey, with physical copies available upon request. The questions aimed to receive input on which of the two land use concepts respondents preferred overall as well as specific feedback regarding greenspace, active transportation, residential uses, density, and road layout.

The City received a total of 206 survey responses.

1.3.4 Land Use Concept & Report

Following the planning charrette engagement, the City facilitated a third design workshop in August 2023, with similar participants to the first two workshops. The intent of the workshop was again to engage quickly and effectively with these parties to explore a broad diversity of design solutions aimed at addressing engagement input and to arrive at a preferred land use concept.

A preferred land use concept was then developed by the project team, taking into consideration engagement and workshop input. Once the preferred land use concept was finalized, the project team developed this land use master plan report. The final draft plan was presented to the public for feedback prior to being presented to Council for consideration. An in-person presentation by City staff also occurred with Copper Ridge Place residents.

2 Context

2.1 Plan Area

The Plan area includes the entirety of two surveyed land parcels and a section of an adjoining property, consisting of the Copper Ridge Place site. The YG parcel (lot 519) is 3.9 ha, the City parcel (lot 520) is 2 ha and the portion of the Copper Ridge Place site (lot 518) is approximately 0.7 ha (Table 1 and Figure 3).

Table 1. Summary of Plan Area Description

Ownership	Parcel	Legal Description	Size (ha)
City of Whitehorse	Lot 520	Lot 520 83103 CLSR YT LTO Plan 99-0224 YT	2.02
Government of Yukon	Lot 519	Lot 519 83103 CLSR YT LTO Plan 99-0224 YT	3.93
Government of Yukon	Portion of Lot 518	Lot 518 83103 CLSR YT LTO Plan 99-0224 YT	0.70
		TOTAL AREA	**6.65 ha**

The Plan area is topographically flat, has a relatively central location within the Copper Ridge neighbourhood, and is well served by major roads and public transit. The Plan area is located in the Copper Ridge neighbourhood at the intersection of Falcon Drive and Diamond Way and consists of a predominantly vegetated area intersected by multiple informal trails (Figure 4). The portion of Lot 518 that is included in the Plan area is also of a similar vegetated nature.

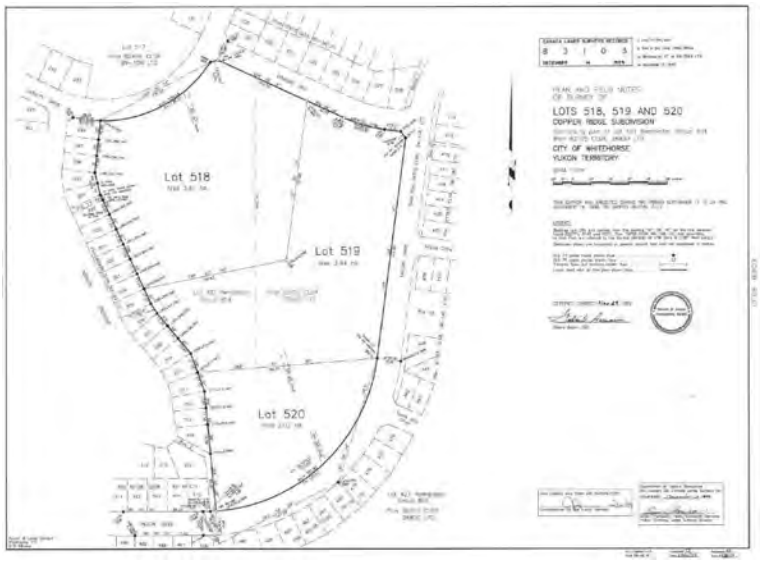

Figure 3: Survey of Plan Area

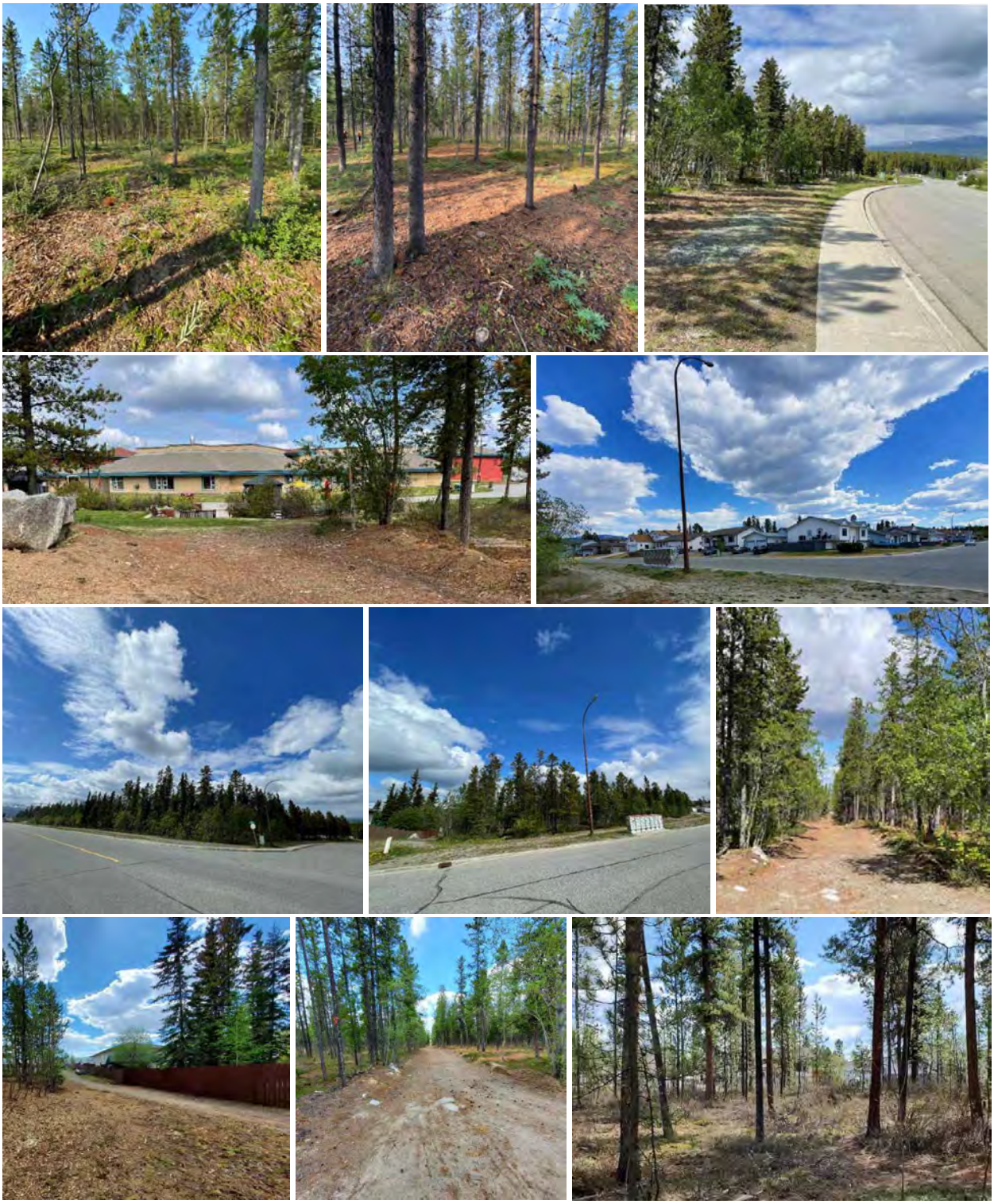

Figure 4: Photos of Plan Area

2.2 Neighbourhood

As of June 2023, the Copper Ridge neighbourhood has an estimated population of 3,338, or 10.5% of Whitehorse's total population of 31,784.[2] Single detached dwellings are located across Falcon Drive and Diamond Way, while others along Tigereye Crescent directly border the Plan area's western boundary. On Lot 518, Copper Ridge Place, a long-term care home, also directly borders the Plan area's western and northern boundaries.

Falcon Drive borders the Plan area along its eastern and southern boundaries, while Diamond Way borders the northern boundary. Falcon Drive connects to Hamilton Drive, which borders the Copper Ridge neighbourhood along its western boundary, connecting the neighbourhood to the rest of the City to the north and south.

Transit routes 2 (Copper Ridge and Granger), 402 (Whistle Bend West) and 5 (Takhini, Lobird, and Copper Ridge) travel along the Plan Area on Falcon Drive, while transit routes 2 and 402 also travel in front of Copper Ridge Place, along Lazulite Drive (Figure 5). Each of the three transit routes operates hourly, the earliest bus typically begins service at 7 a.m., while the latest operates until 9:30 p.m.

Granger Mall is the closest neighbourhood commercial zoned land, located approximately 370 m from the Plan area. The Canada Games Centre and Downtown are both approximately 3.5 km as the crow flies from the Plan Area.

Multiple parks and greenspaces are also located in close proximity to the Plan area (Figure 6). Seven parks, ranging in size from 0.2 ha to 2.25 ha, are located within approximately 165 to 680 m of the Plan area. Park amenities include playgrounds, skating rinks, a soccer field, and a pump track (Winze Park). In addition, the conceptual boundaries of the future Chasàn Chuà/McIntyre Creek and Paddy's Pond/Ice Lake Parks, identified in the OCP, are both within 400 m of the Plan area.

[2] https://yukon.ca/sites/yukon.ca/files/ybs/fin-population-report-q2-2023.pdf

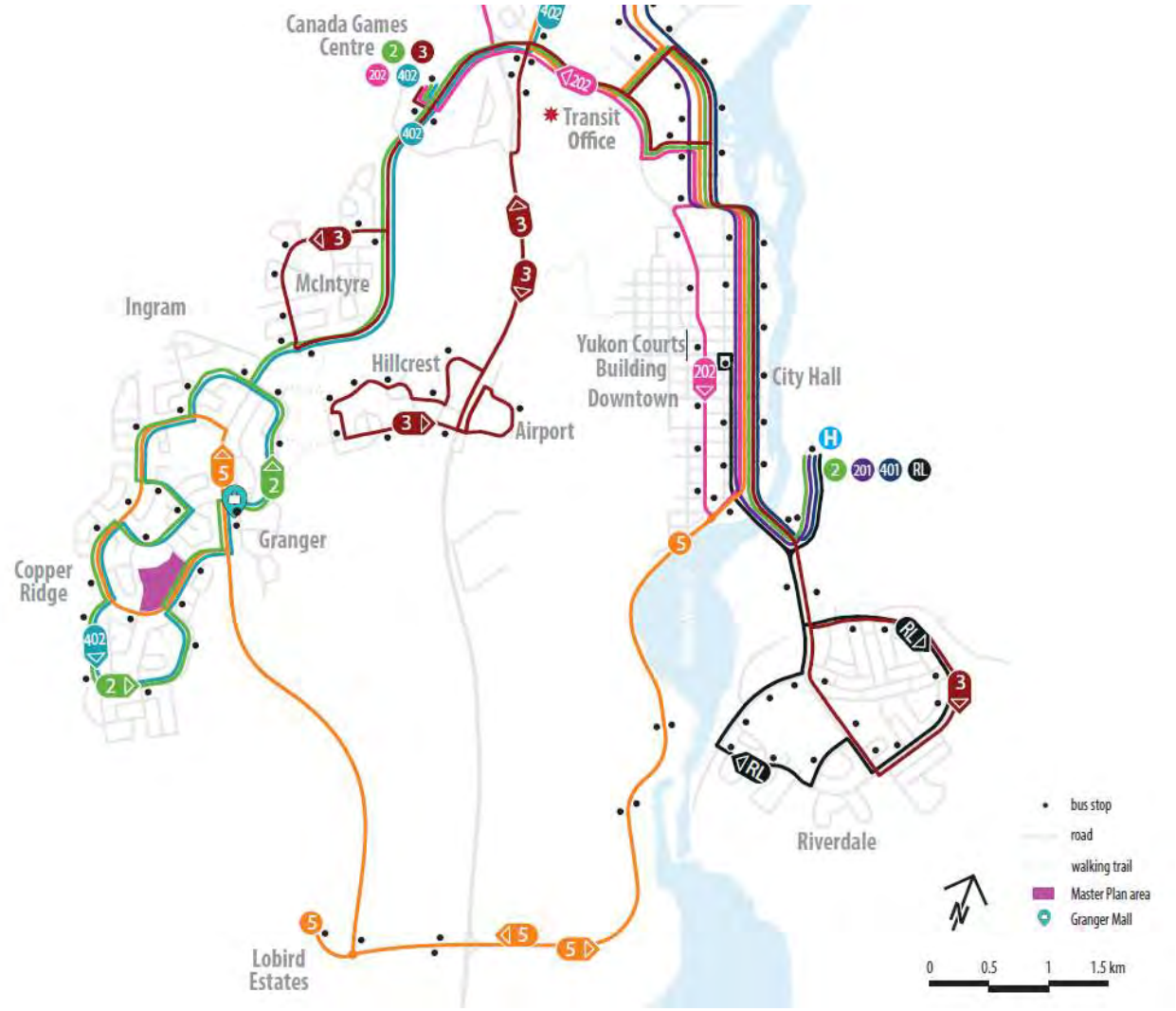

Figure 5: Whitehorse Transit

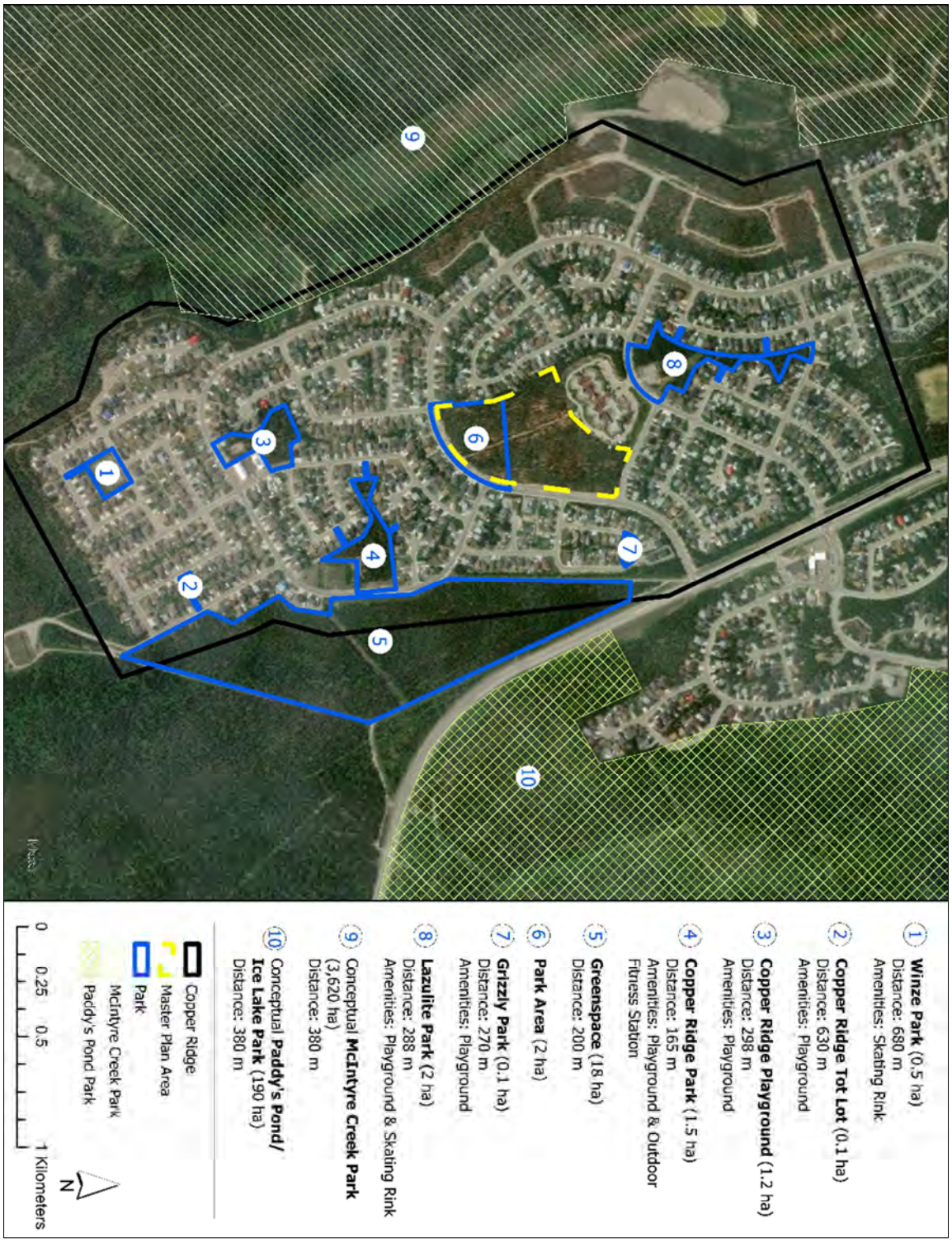

Figure 6: Copper Ridge Parks & Green Spaces

2.3 Direction Documents

Several City documents provide direction on the overall vision and potential land uses for the Plan area. These documents helped inform the development of the Plan.

2.3.1 Official Community Plan

The Official Community Plan is the highest-level policy document for the City that provides the overall long-term vision for the City and guides growth and development. The OCP was adopted by City Council in March 2023 and designates the Plan area as Residential – Urban (Figure 7).

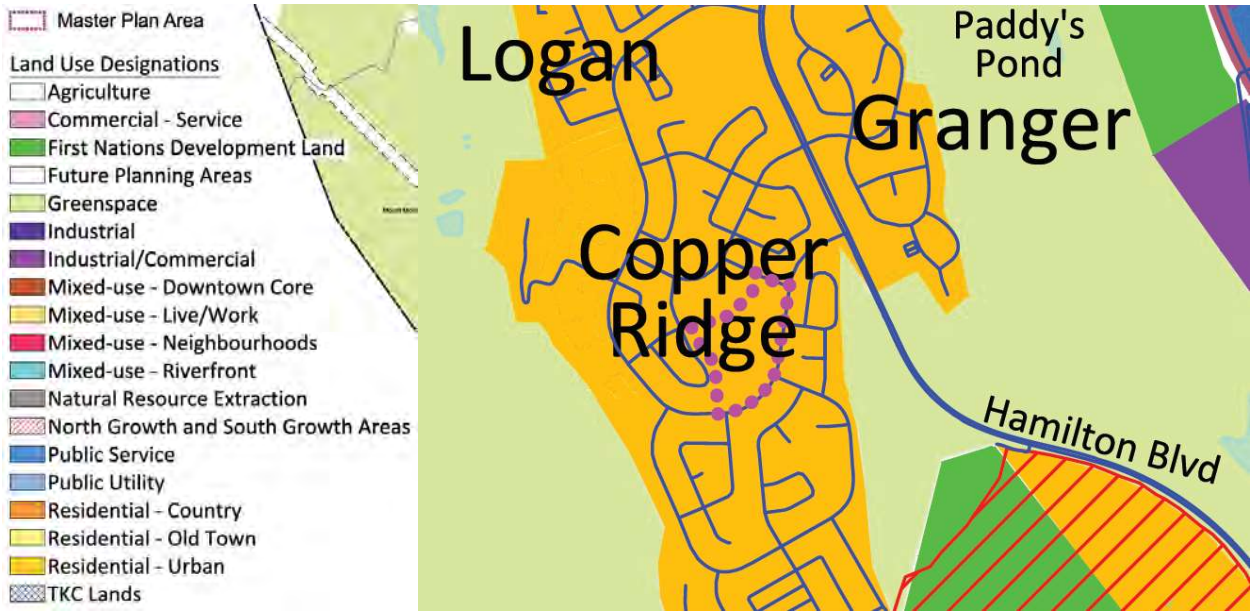

Figure 7: Official Community Plan Land Use Designations

Section 8 of the OCP (Development and Growth) projects growth in Whitehorse's Urban Containment Boundary (UCB) and provides a framework for growth management. The OCP aims to direct development efforts to the most suitable locations within the UCB, with all neighbourhoods, including Copper Ridge, accommodating new residents through intensification development.

Goal 8 (a) of section 8 seeks to reduce urban sprawl to preserve the natural environment, minimize new infrastructure, reduce greenhouse gas emissions, and use existing infrastructure efficiently. Policy 8.1 directs development to be compact to ensure existing public services are used efficiently, transportation impacts are minimized, wilderness spaces are preserved for as long as possible, and neighbourhoods are more walkable. Policy 8.2 also directs that the City will accommodate the demand for residential growth through a mixture of development types including intensification development and greenfield development.

Section 9 of the OCP encourages the construction of a variety of housing types including affordable housing, rental housing, and housing that allows for aging in place. OCP policies also support compact residential development to ensure existing public services are used efficiently. Section 9 also includes the City's Residential Growth Strategy which seeks to accommodate 1,100 new dwelling units within neighbourhoods outside of the Urban Core and Urban Growth Areas, such as Copper Ridge. This development will help the City achieve these goals.

Section 15 of the OCP also establishes the purpose of the Residential – Urban designation, which is intended to accommodate a wide range of residential housing forms and compatible uses. Uses suitable for Residential – Urban areas include, but are not limited to, residential uses of varying density and forms, parks and natural areas, playgrounds, schools, places of worship, community halls, recreation facilities, retail shops, and personal service uses.

Given the OCP's broad scope, its policies do not provide the same level of detail as a land use master plan or plans for specific topics (e.g. Sustainability Plan). The OCP and land use master plans provide direction in terms of future land use that may lead to Zoning Bylaw amendments, subject to Council approval, and guidance to development permit applicants for specific areas and types of development (Figure 8).

Figure 8: Planning Process

2.3.2 Sustainability Plan

The City's 2015-2050 Sustainability Plan identifies twelve long-term goals, with associated action items and targets that the City strives to achieve to create environmental and social benefits (Figure 9). Specifically to housing, the Sustainability Plan aims to address affordable housing and poverty reduction, with a strategy to use planning, zoning, and development tools to encourage or require the inclusion of affordable housing and to support less expensive and denser housing.

To meet this goal, the Sustainability Plan seeks to reduce the percentage of households spending more than 30% of total before tax income on shelter costs by 20% by 2050, with other targets also seeking to increase active transportation and the liveability of neighbourhood by improving transit connections and establishing and incorporating liveability criteria into planning, development, and monitoring. The construction of a variety of housing types in existing neighbourhoods will help the City achieve this goal.

Figure 9: Sustainability Plan Goals and Strategies

2.3.3 Zoning Bylaw

The purpose of the Zoning Bylaw is to implement the OCP and provide orderly, economic, and environmentally sensitive development in the City. The Zoning Bylaw divides the city into zones that enables specific land uses and development requirements. Urban residential, neighbourhood commercial and public/institutional zones are typically considered in alignment with the OCP Residential – Urban designation.

The Plan area is currently zoned PS – Public Service, PSx- Public Service (modified), and PR – Parks and Recreation (Figure 10). Uses in the PSx (modified) zoned area are limited to schools, parks, outdoor participant recreation services, community recreation services, and religious assemblies. The PR zone restricts uses to indoor and outdoor active recreational activities, while the PS zoned area is part of Lot 518 and provides for public and privately owned facilities of an institutional or community service nature.

The surrounding residential neighbourhood is generally zoned RS – Residential Single Detached or RR – Restricted Residential Detached, which primarily provide low-density single detached dwellings. Other PR, PG – Greenbelt, and RM – Residential Multiple Housing zoned land are also located in close proximity to the Plan area.

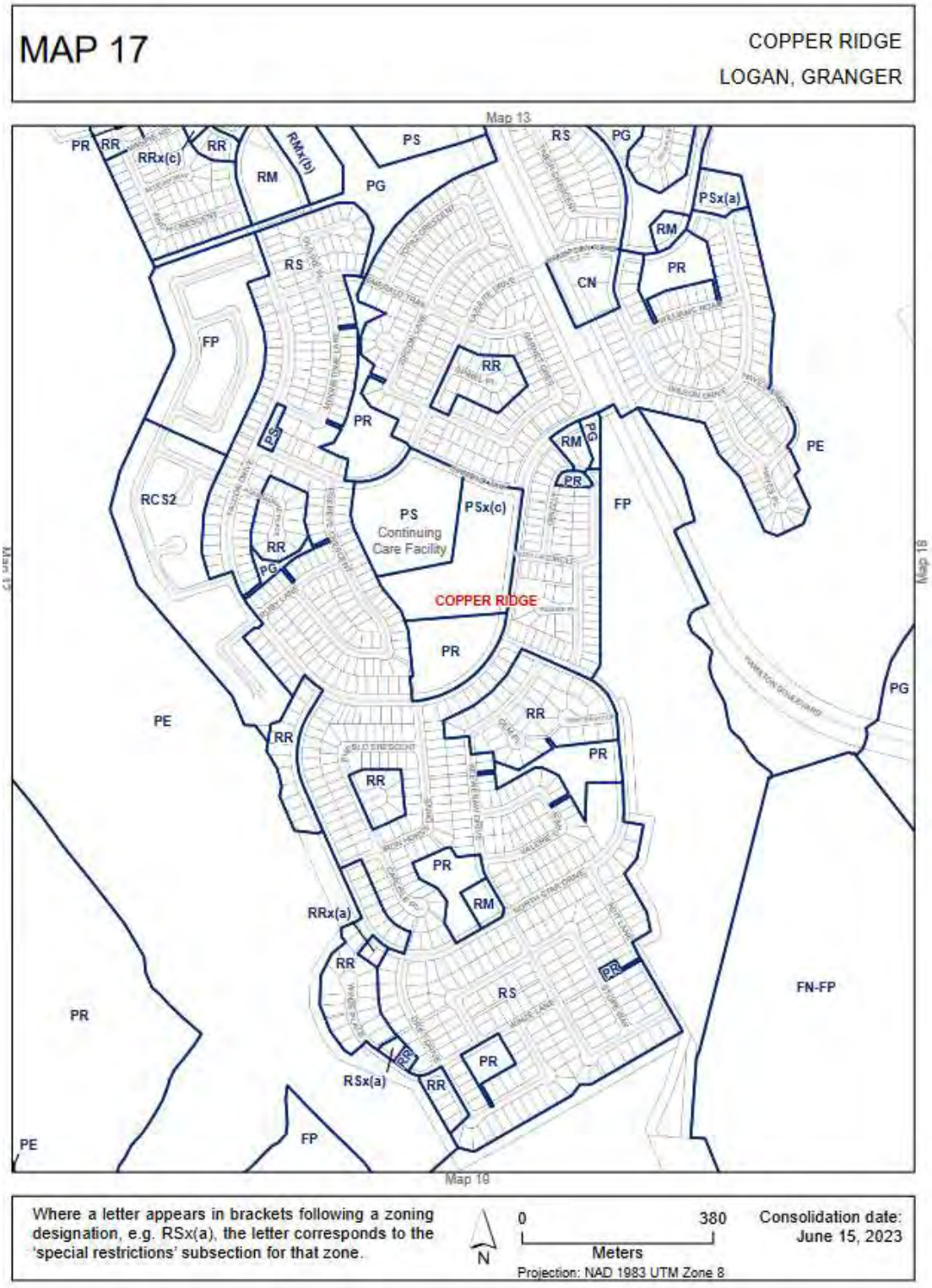

Figure 10: Map 17 of Zoning Bylaw

2.4 Guidance Documents

Other City documents also provide guidance on the overall vision and potential land uses for the Plan area. These documents also helped inform the development of the Plan.

2.4.1 Neighbourhood Conceptual Development Plan

The 1990 Hillcrest Expansion Areas “C” and “D” Conceptual Development Plan is the original development plan for the Copper Ridge neighbourhood. It was developed in 1990 when the City decided to expand the existing Granger and Hillcrest neighbourhoods.

In the Hillcrest Area “D” Land Use Plan (Figure 11 and Appendix D), part of the Land Use Master Plan area was originally planned to have a school, a park and a multi-family site. None of these uses were developed within the Plan area. A small commercial lot and another multi-family site were also planned opposite Falcon Drive and developed as single-family dwellings instead.

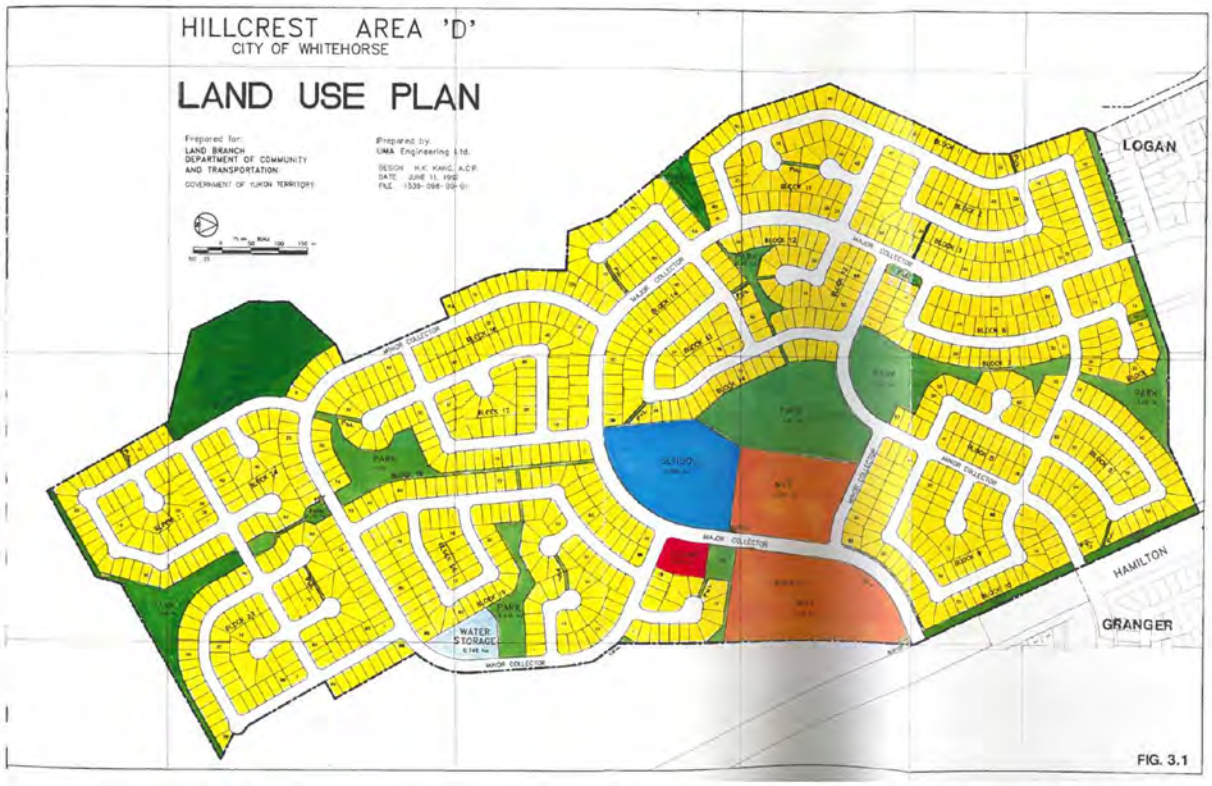

Figure 11: Hillcrest Area "D" Land Use Plan

The Hillcrest Area “D” Land Use Plan also planned for 14.3 ha of park uses across the entire Hillcrest “D” area, representing approximately 10 per cent of the area. There is approximately 16 ha

of public zoned land within the entire Copper Ridge neighbourhood[3], representing 1.7 ha of additional public land from the initial planned amount.

2.4.2 Bicycle Network Plan

In 2018, the Whitehorse Bicycle Network Plan was developed. The purpose of the Bicycle Network Plan is to establish a long-term plan to improve infrastructure for cycling in the city and to increase the percentage of residents that use a bicycle for transportation year-round. In order to gain a modal shift to cycling, the bicycle network needs to serve users of all ages and abilities (AAA). It also needs to be comfortable, safe, convenient, and include Winter City design principles. The Bicycle Network Plan proposes an AAA route through the Plan area as a priority project that should be implemented within one to five years (Figure 12).

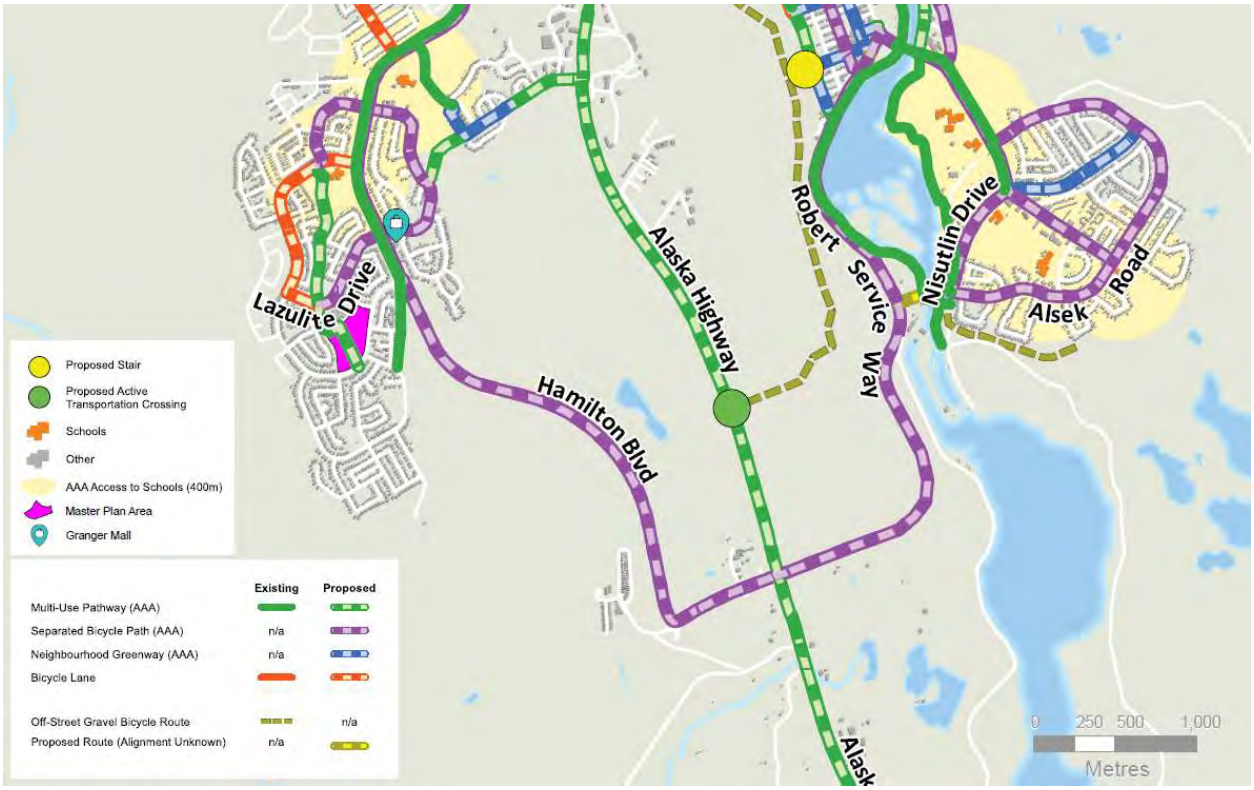

Figure 12: Existing and Proposed Bicycle Network by Facility Type

[3] This does not include land set aside for public use by Kwanlin Dün First Nation in the Copper Ridge West subdivision.

2.4.3 Parks and Recreation Master Plan

The Parks and Recreation Master Plan was approved by Council in 2018. The Parks and Recreation Master Plan creates a blueprint for the City over the next decade by establishing commitments and priorities in parks and recreation delivery. The overall aim is to ensure citizens of Whitehorse enjoy accessible and quality year-round indoor and outdoor active living opportunities (programs, events and activities) that foster wellness, inclusiveness, and sustainability. Key Strategic Directions help the City prioritize its efforts to achieve this vision.

Strategic actions are also identified to help further these directions, such as to continue to integrate parks and recreation considerations into City planning and development initiatives. Key areas of focus include:

- Protecting and/or mitigating impacts to valued parks and recreation amenities and experiences;
- Incorporating an end user and programming/activation “lens” into the design of urban spaces and amenities;
- Maintaining accessibility to parks and recreation opportunities through the provision of open space, transit connections, etc.; and
- Ensuring that walkability and active transportation are supported in urban and residential planning.

2.4.4 Trail Plan

The Trail Plan was adopted by Council in 2020 and identifies priorities to direct the City in future trails-related initiatives, policies and actions over the next 10 years. At the time of the Trail Plan adoption, there was an estimated 150 km of trails of city-wide significance and at least 700 km of local and neighbourhood trails used by Whitehorse residents.

The trail network is designed to link neighbourhoods, provide access to the surrounding hinterland and facilitate public movement about the community. This is implemented through the creation of trail plans on a neighbourhood-by-neighbourhood basis. The Copper Ridge neighbourhood is included in the Above the Airport Trail Plan (Figure 13), which was completed and approved by Council in 2014.

The Above the Airport Trail Plan includes a motorized multi-use trail along the eastern boundary of the Copper Ridge neighbourhood and a non-motorized trail along its western and northern boundaries. Finally, a minor trail/route is identified along the southern boundary of the neighbourhood. No trails are identified within the neighbourhood.

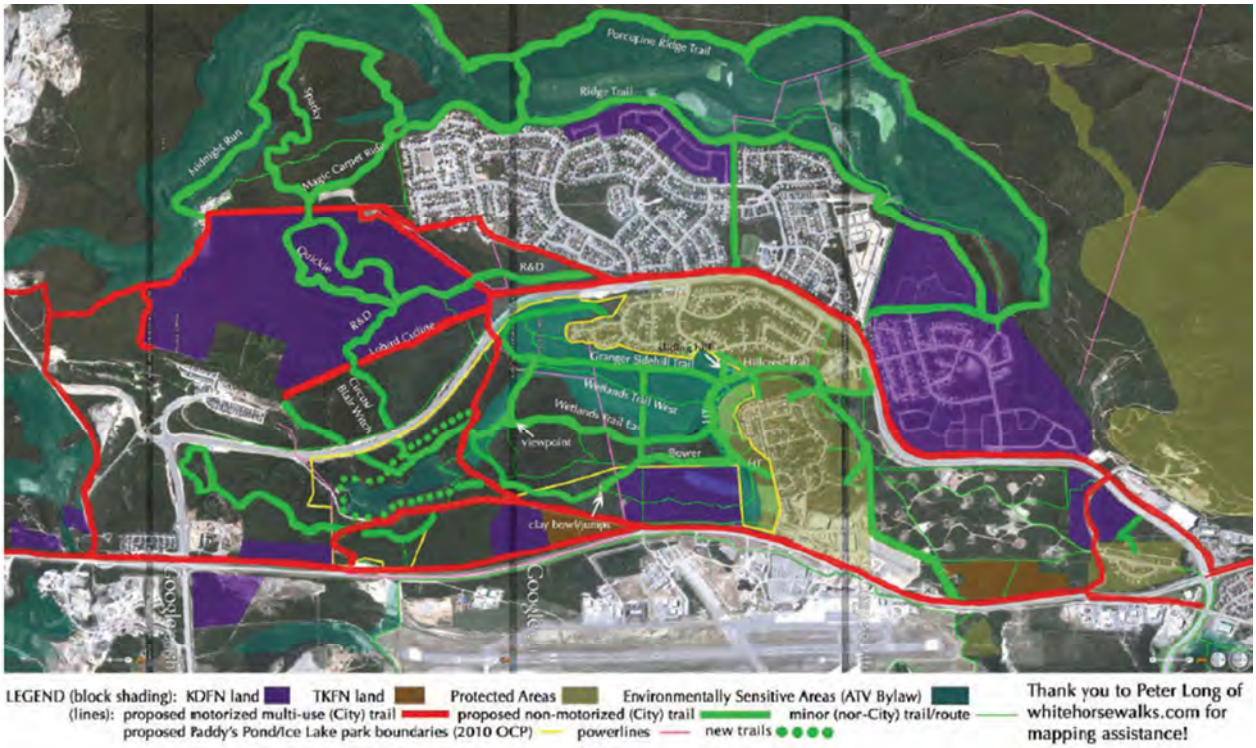

Figure 13: Above the Airport Trail Plan Map

2.5 Supporting Studies

The following studies (Appendix C) were prepared in support of and to inform the Plan. They have contributed to the conceptual land use plan and policies.

2.5.1 Municipal Servicing Assessment

The purpose of the municipal servicing assessment was to determine the maximum additional residential density that can be accommodated with existing infrastructure and identify the threshold when infrastructure upgrades would be required. The assessment examined the topography, sanitary sewer system, storm water sewer system, water network, road network, power, and telecommunications within the area.

The assessment proposed two access layout options for the Plan area. Both options propose a three-way intersection along Diamond Way, while either two four-way or two three-way intersections are proposed along Falcon Drive (Figure 14).

Overall, the limiting factor for the site was determined to be the water network and the rate of water flow required to control a major fire in the area. With current services, the site is limited to low density residential development that could accommodate a population of approximately 248 people

or 103 units. On- and off-site infrastructure upgrades would be required to accommodate higher residential density.

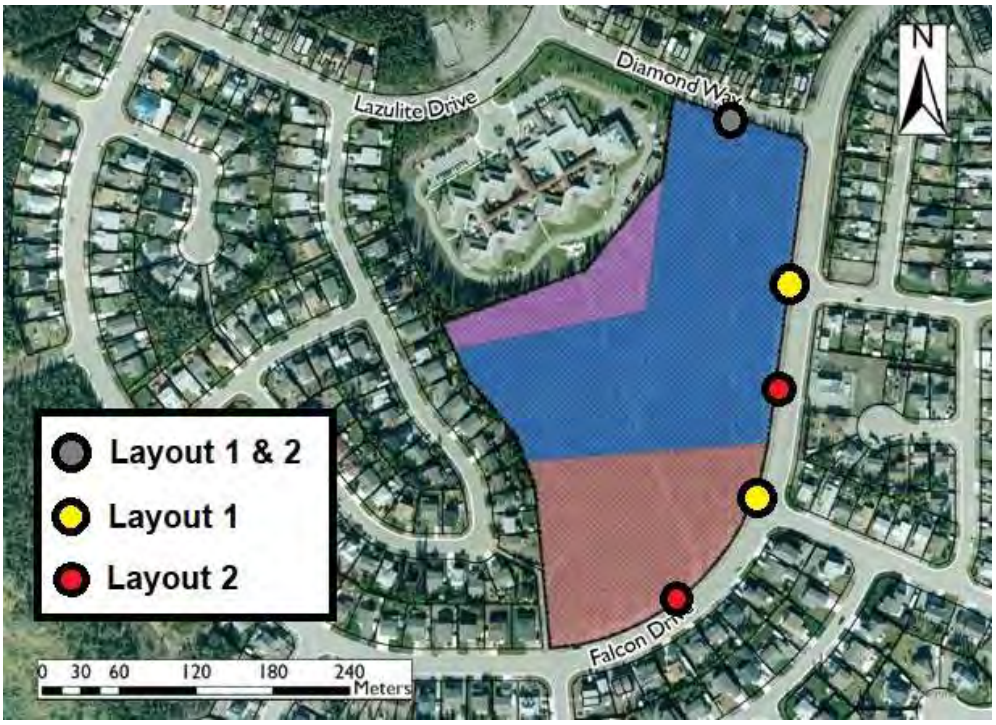

Figure 14: Access Options

2.5.2 Geotechnical Assessment

The geotechnical assessment was conducted to determine the subsurface rock and soil conditions of the site to understand requirements or setbacks for the development of building foundations, underground utilities, and other infrastructure.

The assessment found that there are no severe natural hazard risks on the site. No features were identified that would warrant geotechnical setbacks or negatively affect building foundations. Overall, there were no visible constraints to road or building construction identified within the site. It was however recommended that a detailed geotechnical investigation is conducted prior to development.

2.5.3 Environmental Assessment

The Environmental assessment examined the possibility of areas of potential environmental concerns (APECs) and potential contaminants of concern. The assessment did not identify any on-site or off-site APECs. As such, there is low potential that current or past land use activities at the site or neighbouring properties have resulted in contamination of soil and/or groundwater within the site. Given these results, no further investigation was considered warranted.

2.5.4 Heritage Resource Impact Assessment

The purpose of the heritage resource impact assessment was to identify above and below ground heritage resources in the Plan area (such as pre- or post-contact heritage sites) and to make recommendations concerning the future management of those resources, if needed.

The assessment did not identify any heritage resources within the Plan area. The area was assessed as having low heritage potential and no further heritage work was recommended.

2.5.5 Trail Assessment

Multiple formal and informal trails are located adjacent to and throughout the Plan area (Figure 15). Paths border the Plan area along Falcon Drive and Diamond Way and wide, well used trails connect Diamond Way and Copper Ridge Place to Falcon Drive through the Plan area. A small informal trail also circles around Copper Ridge Place and multiple other small informal trails are located within the Plan area creating connections between the wider, well used, trails and the adjacent road network.

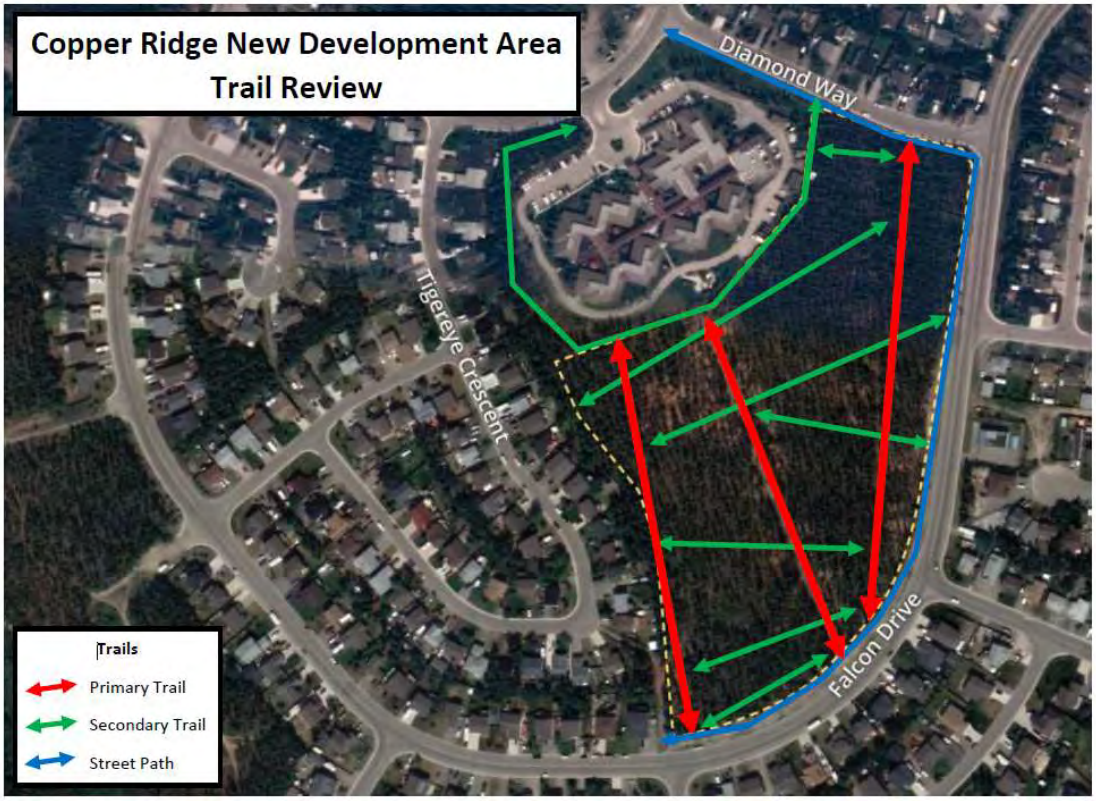

Figure 15: Plan Area Trails

2.6 Guiding Perspectives and Values

Engagement with governments, stakeholders, interested and affected parties (e.g. neighbourhood residents) and the wider community was carried out during three separate occasions to inform the planning process. Input from these parties played a central role in the creation of this Plan.

Feedback provided direction on how to manage growth and support existing residents within the community. Highlights from these engagements are outlined in Table 2. Details on these engagements can be found in Appendix B.

Table 2: Summary of Engagement

Date	Engagement Phase	Target Audiences	Key themes from input
January 2023	Project Launch Webinar	Governments, stakeholders, residents & public	• Concerns with potential loss of greenspace; and • Concerns with potential impacts on the surrounding transportation network.
January – February 2023	Project Launch Survey	Governments, stakeholders, residents & public	• The majority of respondents indicated that they would support greenspace/park uses within the Plan area; • If the Plan area were to include residential uses, low density is preferred despite this resulting in less greenspace or public amenities; • Many respondents indicated that the inclusion of greenspace and parks/open spaces as well as no development would result in a successful project; and • The largest concerns included increased traffic, loss of greenspace, and increased density.
May 2023	Workshops 1 & 2	Landowners, technical experts, designers	• Maintain buffer between houses on Tigereye Crescent and proposed development; • Include trails and connections with Copper Ridge Place; • Include traffic calming in surrounding area; and • Include higher density than surrounding neighbourhood.
May– June 2023	Planning Charrette Concept Options Review & Survey	Governments, stakeholders, residents & public	• Similar levels of overall support between option 1 and option 2; • Option 1 was slightly preferred for its greenspace, trails and active transportation, and the road layout; • Option 2 was slightly preferred for its residential uses and density; • Concerns with potential impacts on the surrounding transportation network; and • Many respondents indicated that they preferred the area is not developed and left as it is.

May 2023	Open Houses	Governments, stakeholders, residents & public	• Concerns with noise and potential impacts on the surrounding transportation network; • Lower density/greenspace is preferred opposite houses that front Falcon Drive; • Include larger buffers between Tigereye Crescent houses and proposed development; • Many attendees expressed that they preferred the area is not developed and left as it is.
August 2023	Workshop 3	Landowners, technical experts, designers	• Increase size of greenspace and compensate the loss of residential areas by replacing lower density elsewhere with medium density. • Maintain buffer between Copper Ridge Place and existing lots all the way along the western side of Plan area; • Retain road configuration of Option 1 but in a more condensed form to allow for more greenspace. • Retain the proposed non-motorized multi-use path.

3 Vision, Principles & Concept

The vision, principles, and concept outline the aspirations of the City of Whitehorse, its partners and stakeholders, and the community for the Plan area.

3.1 Vision

The Plan area will welcome growth in an integrated and well-managed manner, ensuring the existing character of the established neighbourhood is respected and enhanced. The Plan area will provide new housing options that support the various needs of people who live in and want to move to the area. The increased population will provide additional users and support for the existing underutilized services and infrastructure.

Existing community amenities in the area will also be redesigned to better serve the residents of the neighbourhood as density and population increases. The new development will accommodate diverse needs, interests and places that foster interaction amongst residents. Residents will be able to choose how they travel within and beyond the Plan area through multiple, safe and accessibly designed means of transportation.

3.2 Principles

The Plan's vision is supported by four overarching principles that form the foundation of the Plan and inform policy direction, future decision-making and investments in the Plan area. The principles reflect city-wide values and goals, Council priorities and best practices to promote a mixture of development types and support the long-term interests of the Whitehorse community.

In addition to informing the content of this plan, the principles should be taken into consideration when examining development proposals to determine potential benefits to the community and if new development is appropriate as proposed.

Housing Choice and Compatibility

- Provide a variety of housing types and tenures to meet the needs of various segments of the housing spectrum.
- Plan compatible and complementary land uses to mitigate conflicts with the existing residential neighbourhood.
- Encourage building forms that are visually appealing, facilitate active & safe streets, and enhance neighbourhood character and amenities.

Natural Area Preservation and Enhancement

- Accommodate residential growth within the existing neighbourhood to ensure wilderness spaces surrounding the neighbourhood are preserved for as long as possible.
- Preserve natural environments where possible within the Plan area to ensure a visually appealing development and to mitigate conflicts with the existing residential neighbourhood.

- Plan public spaces to provide locations for joint uses, such as public recreation and community gatherings.

Transportation Choice and Connections

- Promote connectivity within the Plan area through a well-connected network of trails and multi-use paths connecting the area in an accessibly, safely, and conveniently designed manner.
- Encourage development that is designed to be walkable and interconnected, to promote active lifestyles for residents of all ages.
- Advance low-impact and sustainable mobility by supporting a transportation network that considers the needs of all users – pedestrians, cyclists, public transportation and private motor vehicles.

Safe, Inclusive, and Accessible Development

- Promote a safe and healthy development through the delivery of good design, safe public realm, and outdoor amenity spaces that complement the quality of the built environment.
- Consider universal accessibility principles and guidelines in the design of buildings, publicly accessible outdoor spaces, and transportation infrastructure.

3.3 Concept

The Land Use Concept envisions a mix of land uses, including residential and recreation uses, such as a connected network of trails, and open spaces. Land uses are carefully distributed, and future built form considered, to minimize impacts on adjacent residential areas.

As illustrated in the Land Use Concept Plan (Figure 16 and Appendix A), the northern portion of the site is projected as low density residential with a mix of single-detached, duplex, and triplex housing. The built form transitions gradually in scale to a more intensive use in the southern portion of the site. A mix of duplex and triplex housing types are provided midblock and a more intensive medium density (e.g. cottage cluster) is proposed to wrap around the southern edge of the site. The internal block also supports additional medium density in the form of four-plex, five-plex, townhomes, and multi-plex housing types.

With regards to greenspace, a linear open space along Copper Ridge Place provides outdoor amenity spaces and facilitates safe connections to the future development area. With a mix of hard and soft scape elements, the open space can accommodate a range of formal and informal activities. A natural greenspace buffer also spans the entire western edge of the site creating a 20 to 90 m vegetated buffer from existing properties on Tigereye Crescent. The linear greenspace wraps around the southern edge to provide an additional vegetated buffer from properties on Falcon Drive.

The Plan concept is projected to result in approximately 102 new housing units, equating to approximately 245 new residents and an average density of 15 units per hectare (Table 3).

Average residential densities of 23 units per hectare (u/ha) for the low density residential areas and 40 u/ha for the medium density residential areas are considered in the calculation of the estimated numbers of units for the neighbourhood.

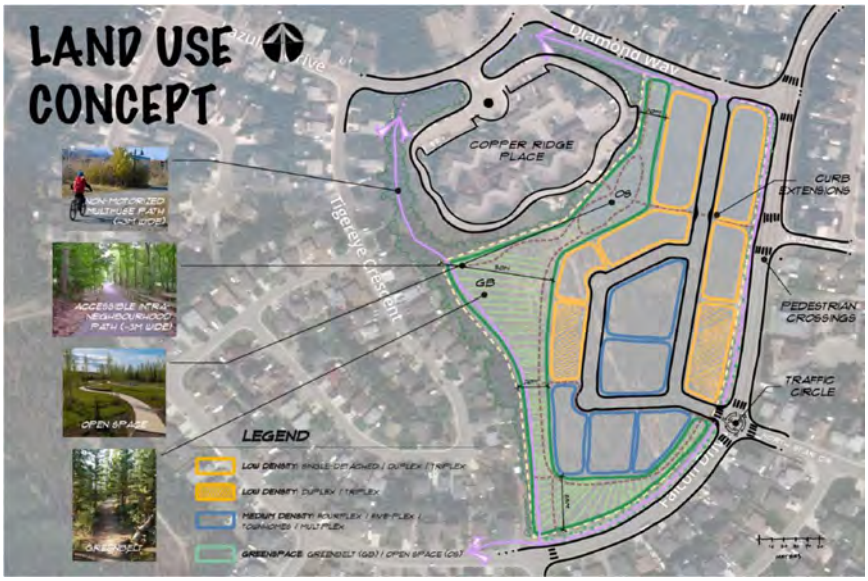

Figure 16: Land Use Concept Plan

The population estimates are based on 2.4 persons per household (p/h) for all residential development types.

The predominant land use consists of low and medium density residential uses (51.41%). Greenbelt and open spaces account for 30.07% of the site (2 hectares) and road rights-of way for 18.51%.

Table 3: Summary of Land Use Concept

Land Use	Ha	% of Total	Average Dwelling Units[4]	Population (2.4 p/h)
Low-Density Residential	2.05	30.87%	47 (23 u/ha)	113
Medium-Density Residential	1.37	20.54%	55 (40 u/ha)	132
Greenbelt	1.42	21.35%	0	0
Open Space	0.58	8.72%	0	0
Road	1.23	18.51%	0	0
Total Residential	3.42	51.41%	102	245
Total Greenspace	2.00	30.07%	0	0
Total	**6.65**	**100%**	**102 (15 u/ha)**	**245**

[4] Rounded to the nearest whole number.

4 Policies

The following policies aim to guide development to achieve the vision, principles and concept of the Plan area, through the development of a diversity of uses and building forms, vital green and open spaces, and high-quality trails and other transportation amenities.

The policies pertaining to the Residential and Greenspace areas apply to the relevant land use areas shown in the Land Use Concept Plan, while the policies pertaining to transportation and servicing apply to the entire Plan area.

4.1 Residential Areas

A majority of land (3.42 ha) is planned for residential development. The Residential areas consist of yellow low-density and blue medium-density blocks in the Land Use Concept Plan. Zoning planned for this area may include:

- Low-density
    - RS – Residential Single Detached;
    - RS2 – Residential Single Detached 2;
    - RCS – Comprehensive Residential Single Family;
    - RCS2 – Comprehensive Residential Single Family 2; and
    - RCS3 – Comprehensive Residential Single Family 3.
- Medium-density
    - RCM – Comprehensive Residential Multiple Family;
    - RCM3 – Cottage Cluster Homes;
    - RCT – Comprehensive Residential Townhomes; and
    - RCT2 – Courtyard Townhomes.

Note that the above zones are based on the City's current 2012-20 Zoning Bylaw (Consolidated to Bylaw 2023-10) and are indicative only. Special modifications to these zones may be required to align with the Plan. The City is also currently undertaking a rewrite of the Zoning Bylaw. Zones may therefore no longer be applicable and new or other zones may become appropriate following amendments to the Zoning Bylaw.

Overall housing forms and design will be determined through the Zoning Amendment and Development Permit application processes based on the following policies:

- **Policy 4.1.** Reasonable efforts shall be made to provide a mix of housing types and sizes to accommodate a broad range of households, including living/garden, affordable, supportive, accessible, and rental housing within the Residential areas.

- **Policy 4.1.2** Where possible, buildings and structures, paths, and the adjacent green areas, will be designed with the aim of reducing opportunities for crime and to increase public safety through the application of *Crime Prevention Through Environmental Design* principles.[5]
- **Policy 4.1.3** Where possible, buildings, structures, paths, and the adjacent green areas, will be designed with the aim of minimizing the risk and spread of heat transfer through the application of *FireSmart* principles.[6]
- **Policy 4.1.4** The adoption of green building practices will be encouraged for all new buildings.[7]

The concept also intends to provide a mix of low- and medium-density housing types based on the following specific areas.

4.1.1 Low-Density Residential

The objective of the Low-Density Residential area is to provide for a low-density residential style of development, including single-detached homes, duplexes and triplexes. The Low-Density Residential area consists of yellow blocks in the Land Use Concept Plan. The two yellow hatched blocks designate areas that only provide for duplex and triplex housing types, to allow a transition between the two residential densities.

The specific residential zoning and subdivision design will be determined through the Zoning Amendment and Development Permit application processes based on the following policies:

- **Policy 1.5** Low-density residential uses shall be the predominant land use, allowing for single-detached housing, duplexes, and triplexes throughout the area.
- **Policy 1.6** A mix of single-detached, duplex and triplex shall be provided, with a majority of development being duplexes and triplexes.
- **Policy 1.7** Only duplexes and triplexes shall be provided within the yellow hatched blocks, to provide a transition between building massing and height.
- **Policy 1.8** Where laneways are not feasible, individual front yard parking and access should be considered appropriate for duplex and triplex housing.

4.1.2 Medium-Density Residential

The objective of the Medium-Density Residential area is to provide for a Medium-Density Residential style of development, including apartment, cottage cluster, courtyard, four-plex, and townhouse housing types. The Medium-Density Residential area consists of blue blocks in the Land Use Concept Plan.

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[5] https://cptedcanada.com/cpted-principles/
[6] https://www.whitehorse.ca/living-in-whitehorse/my-property/fire-smarts/
[7] https://www.cagbc.org/

The specific residential zoning and subdivision design will be determined through the Zoning Amendment and Development Permit application processes based on the following policies:

- **Policy 1.9** Medium-density residential uses shall be the predominant land use, allowing for cottage cluster, four-plex, five-plex, townhomes, apartment and multi-plex housing forms throughout the area.
- **Policy 1.10** Medium-density cluster housing will be encouraged within the Medium-Density Residential area between Falcon Drive and the internal road system.
- **Policy 1.11** Where possible, properties within the Medium-Density Residential area between Falcon Drive and the internal road system should be designed to preserve mature trees and existing vegetation.
- **Policy 1.12** Medium-density four-plex, five-plex, townhomes and multi-plex housing will be encouraged within the central block.
- **Policy 1.13** Where possible, buildings shall be oriented along the perimeter of the central block to create opportunities for courtyards in the interior of the block, which can function as private or semi-private open spaces.
- **Policy 1.14** For smaller medium-density cottage cluster housing properties, with no laneway access, individual front yard parking and access should be considered appropriate to avoid excessive pavement in rear yard areas. In these cases, attention to design is required to emphasize front entryways, pedestrian access, patios, porches, front yard landscaping, and tree planting space, and ensure a pedestrian friendly building façade.
- **Policy 1.15** Development of properties adjacent to a laneway should include a modest setback from the laneway's edge to accommodate landscape or pedestrian areas between the lane (or parking) and the building. Development of these properties should be sited to preserve mature trees and provide tree planting spaces which enhances the appearance of the laneway.
- **Policy 1.16** The design of buildings shall be thoughtfully considered to avoid monolithic forms and reduce massing and height impacts on adjacent outdoor spaces and buildings.

4.2 Greenspace Area

The Greenspace area, consisting of vegetated and open spaces, is a major component of the Plan concept, comprising approximately 30% of the land area (2 ha). The Greenspace area consists of a single green block in the Land Use Concept Plan. It is anticipated that additional public amenities in this area will be constructed by the developer. The City will ensure these community amenities are built as part of the development through the development agreement process. The City will maintain the public amenities once constructed as per the requirements of applicable bylaws and policies.

A combination of walking and biking trails that are comfortable and safe for all ages and abilities are envisioned within this area and connecting to adjacent areas to create opportunities for recreational activity. In addition to the non-motorized multi-use and universally accessible designed paths, green space amenities planned for this area may include:

- outdoor gathering space;
- multi-generational space;
- dog park; or

- community garden.

Zoning planned for this area may include:

- PG – Greenbelt; and
- PR – Parks and Recreation.

Notwithstanding the applicable zoning requirements, overall greenspace amenities and design will be determined based on the following policies:

- **Policy 2.1** Trees and native landscaping are provided along all streets, and in all greenspace areas, covering at least 30% of the overall site. Acceptable landscape planting species are described in the City's *Recommended Tree Species* document[8].
- **Policy 2.2** Street trees and native landscaping will be planted at generally regular intervals along Falcon Drive, and within bump-outs on the internal road system, to double as traffic-calming.
- **Policy 2.3** A continuous 3 m All Ages and Abilities (AAA) Non-Motorized Multi-use Paved Path will be provided along Falcon Drive, Diamond Way and the western edge of the Plan area, as shown on the Land Use Concept Plan.
- **Policy 2.4** A continuous 3 m universally accessible designed intra-neighbourhood path will be provided within the Greenspace area, as shown on the Land Use Concept Plan.
- **Policy 2.5** The non-motorized multi-use and universally accessible designed paths shall be paved, have a smooth surface and vertical disruptions will be avoided for ease of use by people with wheeled mobility devices, strollers, and bicycles.
- **Policy 2.6** Where possible, structures, paths, and the adjacent green areas, will be designed with the aim of reducing opportunities for crime and to increase public safety through the application of *Crime Prevention Through Environmental Design* principles.
- **Policy 2.7** Where possible, structures, paths, and the adjacent green areas, will be designed with the aim of minimizing the risk and spread of heat transfer through the application of *FireSmart* principles.

The concept also intends to provide both passive and active open space opportunities for users, connected by a planned internal path network, based on the below specific areas.

4.2.1 Open Space

The objective of the Open Space (OS) area is to provide for a welcoming area to foster community cohesion. The non-hatched green block area in the Land Use Concept designates the open space area. The specific open space amenities and design will be determined based on the following policies:

[8] https://www.whitehorse.ca/wp-content/uploads/2022/05/CoW-Recommended-Woody-Plants-revised-2023.pdf

- **Policy 2.8** A minimum 20 m wide continuous open space area will be provided adjacent to Copper Ridge Place, as shown on the Land Use Concept Plan, and include a range of hard and soft scape spaces that will support events aimed at bringing residents together and increasing everyday community cohesion such as community gatherings, picnics, outdoor yoga and fitness classes, etc.

4.2.2 Greenbelt

The objective of the Greenbelt (GB) area is to provide for a natural green space for active and passive recreation and to provide a buffer between existing and new developments. The hatched green block area in the Land Use Concept designates the greenbelt area. The specific greenbelt amenities and design will be determined based on the following policies:

- **Policy 2.9** A minimum 20 m continuous vegetated area for active and passive recreation will be provided along the western and southern edges of the development, as shown on the Land Use Concept Plan, to buffer existing properties on Tigereye Crescent and Falcon Drive from the future development area.

4.3 Transportation

Walking, cycling and vehicular movements, among others, will be supported within the Plan area by way of an internal road and trail system, as shown on the Land Use Concept Plan. This internal transportation network will connect to adjacent areas to create opportunities for neighbourhood connectivity.

The below policies focus on ensuring the compatibility and safety of these systems, while making a concerted effort to create an environment that facilitates and encourages active transportation and recreational activity. Overall transportation infrastructure design will be determined based on the following policies:

- **Policy 3.1** A detailed Transportation Impact Study, including all modes of transportation, will be undertaken prior to any zoning amendment relating to the Plan area being adopted.
- **Policy 3.2** Both the multi-use and the universally accessible designed paths will extend outside of the Plan area and provide universally accessible designed connections with adjoining properties, such as Lot 518, and the adjoining transportation network, such as Falcon Drive and Lazulite Drive, as shown on the Land Use Concept Plan.
- **Policy 3.3** Pedestrian safety within and adjoining the Plan area shall be prioritized through the provision of traffic calming devices such as speed bumps and curb extensions as required.
- **Policy 3.4** Two points of vehicular ingress and egress will be provided, one off Diamond Way and another off Falcon Drive, connecting to an internal road system articulated as shown on the Land Use Concept Plan.
- **Policy 3.5** The internal road system shall include a 1.5 m wide sidewalk along at least one side of the entire internal road system to accommodate pedestrian traffic.
- **Policy 3.6** No laneway or driveway access shall be allowed along Falcon Drive and Diamond Way.

- **Policy 3.7** Thoughtfully re-designing off-site intersections shall be considered to improve traffic flow, safety, and reduce conflicts between people walking, cycling, and driving. This shall be based on the findings of the Transportation Impact Study and approved by the City's Engineering Services department. Possible measures could be a traffic circle at North Start Drive and Falcon Drive, median refuges, or a signalized intersection.
- **Policy 3.8** Mid-block connections shall be provided to maximize access to green / open spaces.
- **Policy 3.9** Where possible, both the multi-use and the universally accessible designed paths will extend outside of the Plan area and connect with the adjoining transportation network, such as Falcon Drive and Lazulite Drive, as shown on the Land Use Concept Plan.
- **Policy 3.10** Traffic calming devices and off-site intersections, such as any curb extensions and traffic circles, shall be designed to ensure adequate width for snow removal equipment to safely operate.

4.4 Servicing

The concept envisions a typical urban level of service, including municipal waste collection, snow removal, and potable water distribution and stormwater and wastewater collection supplied by the existing municipal water, stormwater and sanitary sewer systems. Power and telecommunications can also be provided by ATCO Electric and local telecommunications companies.

The Land Use Concept Plan design accommodates a multitude of ways in which phasing can be approached to the servicing and development based upon the logical extension of municipal utilities to the site. As indicated in the Municipal Servicing Assessment, water, stormwater and sanitary sewer services are located within the surrounding streets providing the Plan area an opportunity to tie-into the services. These services will be investigated in greater detail during the preliminary and detailed design phases for the development of the site. Ultimately, phasing of the site is contingent on the developers' proposed subdivision plan and overall preference for extending services based on the following policies:

- **Policy 4.1** The municipal water distribution and sanitary sewer systems shall be extended to service the Plan area. This includes the implementation of an on-site gravity sanitary sewer system to tie into the nearby municipal sanitary sewer system.
- **Policy 4.2** A Preliminary Engineering assessment will be undertaken prior to any zoning amendment relating to the Plan area being adopted.
- **Policy 4.3** Existing water system upgrades shall be considered to improve system pressures and minimum pipe velocities. This shall be based on the findings of the Preliminary Engineering assessment and approved by the City's Engineering Services department.
- **Policy 4.4** Site grading revisions and onsite stormwater infrastructure where required shall direct stormwater runoff from the Plan area to Diamond Way where it will enter the existing storm sewer system.
- **Policy 4.5** A detailed Stormwater Management Plan to address post development runoff, including the provision of storage systems and extensions to municipal infrastructure where required, will be undertaken prior to any zoning amendment relating to the Plan area being adopted.

- **Policy 4.6** Prior to development, a geotechnical investigation will be conducted to determine the subsurface soil stratigraphy, depth to bedrock and properties as they impact the proposed development.

All new road and walkway lighting within the Plan area will be designed appropriately for the intended use, in accordance with the City's Servicing Standards Manual, specifically section 2.10 on street lighting, and based on the following policy:

- **Policy 4.7** Consider lighting where it can increase the use of greenspaces and increase perceptions of safety.
- **Policy 4.8** Lighting designs shall be carefully considered to keep light pollution to a minimum by minimizing light trespass and controlling glare.

5 Implementation

The implementation of this Land Use Master Plan is anticipated to occur over the next few years. The following policies outline the details of the implementation of this Plan, including land disposition and plan modifications, reviews and amendments.

Once the Plan is approved by Council, the City will transfer Lot 520 to YG. The portion of Lot 518 included within the Plan area will then be subdivided off and amalgamated with Lots 519 and 520 to create a single lot that can be sold to a private developer. The developer will be responsible for moving forward with YESAA (if applicable), the transportation impact and geotechnical studies, rezoning, subdivision, detailed engineering design, and ultimately the development of the land and release of lots. Alternatively, YG can develop the land if no private interest is received.

To allow the private sector to implement the Plan, disposition of the properties located within the Plan area will proceed based on the following policies:

- **Policy 5.1** The section of Lot 518 located within the Plan area shall be subdivided into an individual lot.
- **Policy 5.2** The City will transfer Lot 520 to the Government of Yukon.

Development of the land shall proceed in a way to minimize the impact of construction activities anticipated to occur as per the City's Maintenance Bylaw and based on the following policies:

- **Policy 5.3** Reasonable efforts shall be made to ensure initial site clearing, stripping and grading is limited to road and utility construction that will be part of the first phase for development of the site.
- **Policy 5.4** Following internal road construction, perimeter landscaping, servicing and road landscaping will proceed.
- **Policy 5.5** Greenspaces and residential lots will remain as much as possible in their natural state until developed. The intent is to keep undeveloped areas natural with existing vegetation.

The Plan is intended to be flexible and adaptable to emerging or changing conditions. Review and amendments shall proceed based on the following policies:

- **Policy 5.6** Subdivision of the entire Plan area must be approved within ten (10) years of the Plan being approved by Council.
- **Policy 5.7** If subdivision approval is not received within ten (10) years of the Plan approval, an update to the Plan must be submitted to the City for review and approval by Council. Where appropriate, the update process should include public consultation.
- **Policy 5.8** Applications to amend the Plan may be submitted to the City for review and approval by Council. Where appropriate, the amendment process should include public consultation.
- **Policy 5.9** Increases to density within certain Plan areas may be considered as part of a Plan Amendment process, provided that:
    - the overall density of the Plan area remains the same or servicing upgrades are completed to allow for an increase; and

- it is demonstrated that a community benefit(s) results from the increase, such as:
  - an increase in greenspace area or improvements to greenspace areas beyond what is noted in this Plan;
  - off-site improvements to the neighbourhood beyond what is noted in this plan; or
  - provision of affordable, supportive, accessible, or rental housing (as defined in the OCP);[9]

The zoning and actual subdivision pattern will be delineated more precisely, on a stage by stage basis, as individual stages of zoning and subdivision are proposed to the City for approval and will proceed based on the following policy:

- **Policy 5.10** The basic layout depicted in the Land Use Concept is intended to be flexible and may be modified to provide for:
  - Variations in parcel size;
  - Variations in roadway access;
  - Adjustments to topography and provision of stormwater management;
  - Adaptation of servicing requirements to meet the needs of particular land uses;
  - Accommodation of potential large parcel uses; and
  - Increases in greenspace areas.

[9] Policy 5.9. is subject to any future density bonus policy developed by the City.

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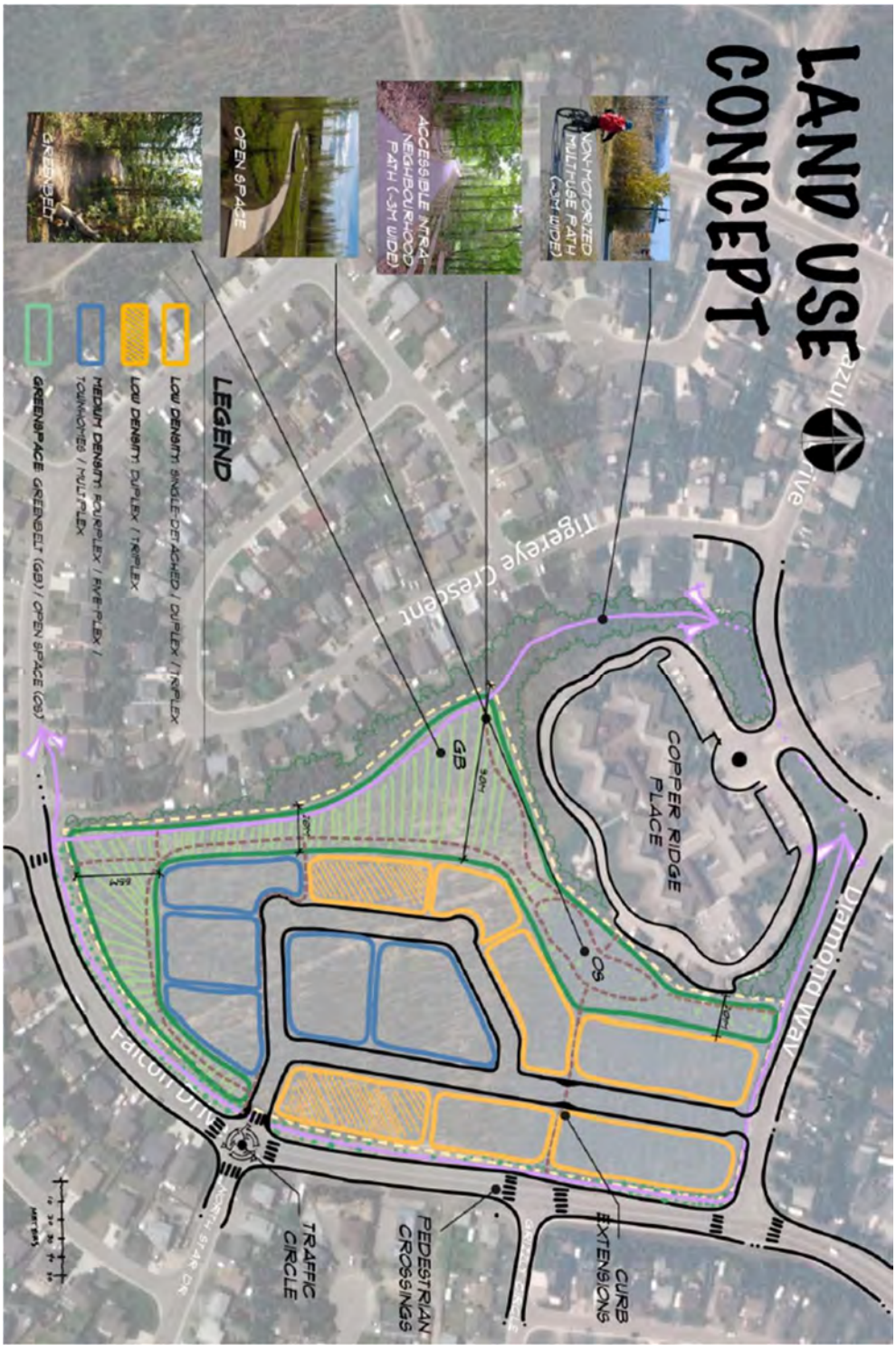
Appendix A. Land Use Concept Plan



Appendix B. What We Heard Report

Copper Ridge New Development Area

What We Heard
November 2023

Planning and Sustainability Services
City of Whitehorse

Whitehorse

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Section 1 - Background

1.1 Project Overview

The City of Whitehorse (City) is focused on ensuring all residents have a place to call home. The City is therefore looking at a number of ways to increase the amount of housing in the city in order to meet the rising demand. An area between Copper Ridge Place and Falcon Drive was identified as a potential location for new development (Figure 1 Study Area). The area consists of properties owned by the Government of Yukon (YG) and the City, with both governments looking to jointly develop the site.

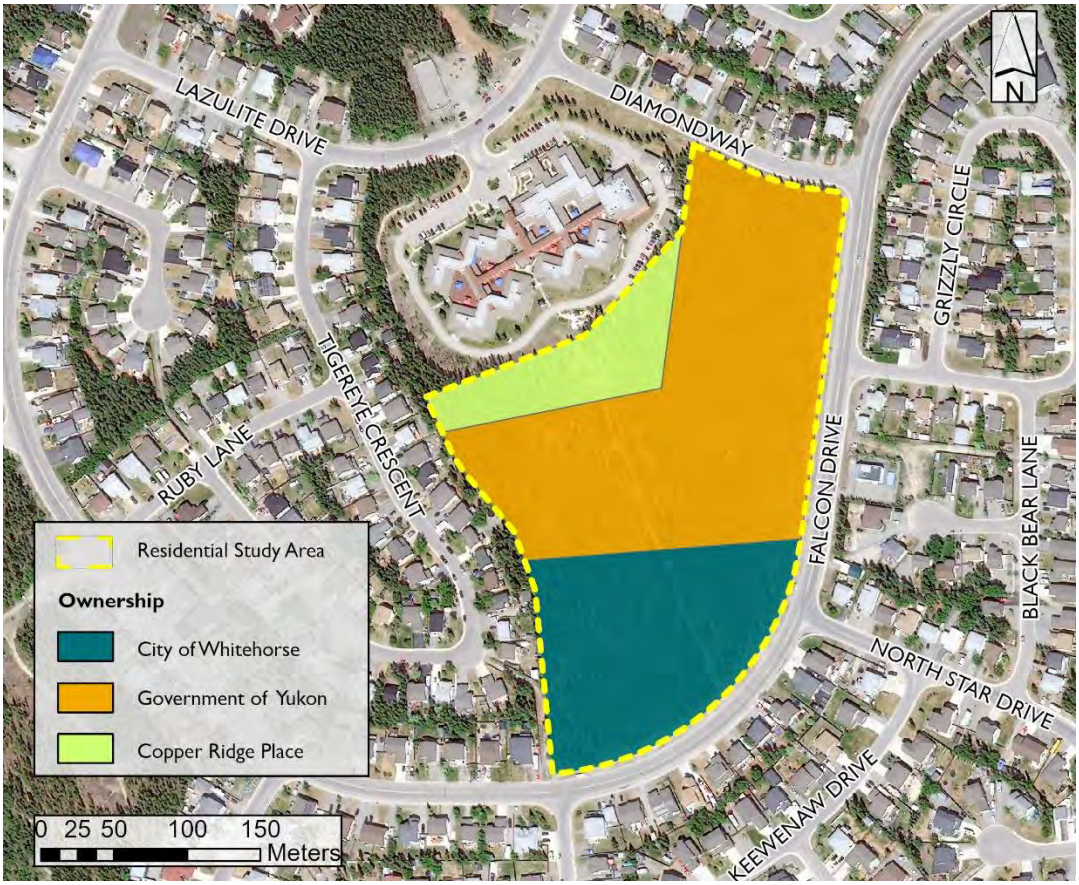

Figure 1. Study Area

1.1.1 SITE CONTEXT

The overall Study Area is approximately 6.65 ha. The YG lot is 3.9 ha in size and was originally planned as a school site. YG has however since determined the lot is no longer required for this purpose. The remainder of the area consists of a City parcel 2 ha in size and a portion of the Copper Ridge Place lot approximately 0.7 ha in size.

The Study Area currently consists of a predominantly vegetated area intersected by multiple informal trails. A portion of the Copper Ridge Place lot was included in the Study Area as it currently consists of an underutilized space that could also be developed.

The Study Area is predominantly surrounded by single family homes. The exception is Copper Ridge Place, an extended care facility, which is located directly north of the Study Area.

Three bus routes service the area along Falcon Drive and the City's trail network can be accessed less than a kilometer to the east, west, or south.

1.1.2 MASTER PLAN

This project will create a master plan for the Study Area to ensure future development fits within the existing community. The City is leading the development of this project, which will establish a vision and framework for the area.

A Master Plan is a high-level planning document that directs how an area should be developed. This high-level guiding document has two main components: a preferred land use concept and a report. The land use concept illustrates the approximate location of land uses, including the major road and active transportation networks. The report provides a written description of the land use concept, guidance on land use, density, on- and off-site infrastructure, and how development should occur.

Community input is sought throughout the process to receive feedback while preparing the master plan document. Engagement was carried out in January and February (Project Launch) and May and June (Planning Charrette) 2023 to understand what the community would like to see in the area prior to developing the master plan document. This report summarizes the community input the City received during these periods.

1.2 Guiding Documents

Several City documents provide guidance on the overall vision and potential land uses for the Study Area. These documents will help inform and provide justification for the land use concepts in addition to input received from the public.

1.2.2 OFFICIAL COMMUNITY PLAN

The 2040 Official Community Plan (OCP) is the highest-level policy document for the City that provides the overall long-term vision for the City and guides growth and development.

The Study Area is designated as Residential – Urban in the OCP which is intended to accommodate a wide range of residential housing forms and compatible uses. Uses suitable for Residential – Urban areas include, but are not limited to, residential uses of varying density and forms, parks and natural areas, playgrounds, schools, places of worship, community halls, recreation facilities, retail shops, and personal service uses.

The OCP encourages the construction of a variety of housing types including affordable housing, rental housing, and housing that allows for aging in place. OCP policies also support compact residential development to ensure existing public services are used efficiently.

The OCP also requires that all sites over 1.5 hectares in size develop a Master Plan prior to undertaking a zoning amendment and/or subdivision. As the Study Area is approximately 6.65 ha in size, a Master Plan is required.

1.2.3 SUSTAINABAILITY PLAN

The Sustainability Plan identifies twelve goals that the community would like to achieve in the long term with associated action items and targets. Affordable housing and poverty reduction is a goal with the rationale that safe, secure, decent housing is a basic need. The use of planning, zoning, and development tools to encourage the inclusion of affordable and denser housing is identified as a strategy to achieve this goal.

1.2.3 ZONING BYLAW

The purpose of the Zoning Bylaw is to implement the OCP and provide orderly, economic, and environmentally sensitive development in the City. The Zoning Bylaw divides the city into land use zones that describe the permitted uses and development requirements for each zone.

The Study Area is currently zoned as PS – Public Service, PSx- Public Service (Modified), and PR – Parks and Recreation (Figure 2). The uses for the PSx (Modified) area are limited to schools, parks, outdoor participant recreation services, community recreation services, and religious assemblies. The PR area is restricted to uses related to indoor and outdoor active recreational activities. The PS area is currently part of the Copper Ridge Place site. The surrounding residential neighbourhood is zoned RS – Residential Single Detached or RR – Restricted Residential Detached which primarily provide low density single detached dwellings. Other PR areas, PG – Greenbelt, and RM – Residential Multiple Housing zoned land is also located in close proximity to the Study Area.

The OCP Residential – Urban designation enables the Study Area to be rezoned to another use that conforms with the designation, such as residential and neighbourhood commercial zones. The current engagement process for the Master Plan will inform whether the zoning of the Study Area should change and, if so, to what type and to what extent. A Zoning Bylaw Amendment, including a public hearing, will be required if the Master Plan recommends a different zoning for the Study Area.

1.2.4 NEIGHBOURHOOD CONCEPTUAL DEVELOPMENT PLAN

The Hillcrest Expansion Areas “C” & “D” Conceptual Development Plan is the original development plan for the Copper Ridge neighbourhood. It was developed in 1990 when the City decided to expand the existing Granger and Hillcrest neighbourhoods.

In the Hillcrest Area ‘D’ Land Use Plan, part of the Study Area was originally planned to have a school (3.47 ha), a park (2.24 ha) and a multi-family site (2.86 ha). Apart from Copper Ridge Place, no other development has occurred within the Study Area. A small commercial lot (2.68 ha) and another multi-family site (4.28 ha) was also planned opposite Falcon Drive. Both of these areas were, however, developed as single family dwellings.

In terms of land dedicated for public use, 14.3 ha were planned for park uses across the entire Hillcrest ‘D’ area, representing approximately 10 per cent of the area. Ultimately 16.01 ha were

zoned for this use, representing more than 1.7 ha of land dedicated for parks over the amount originally planned for the neighbourhood. The Study Area currently contains 2 ha of land zoned for park uses.

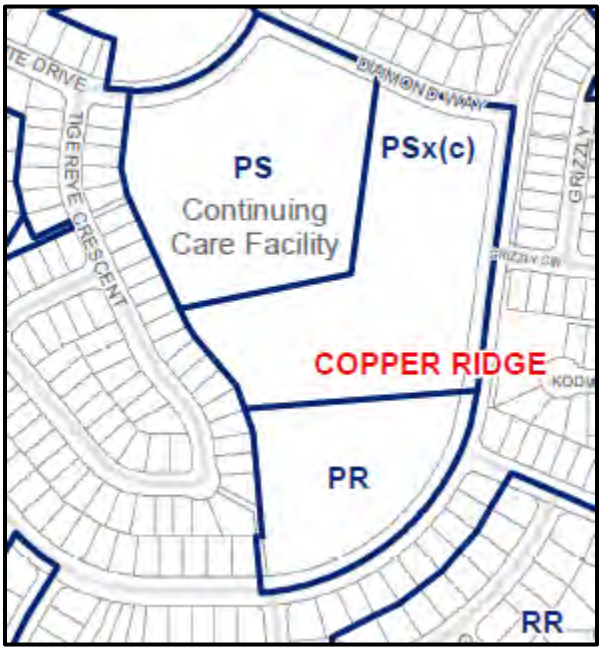

Figure 2. Current Zoning of the Study Area.

1.3 Feasibility Studies

Several preliminary feasibility studies were prepared to better understand the current uses and servicing of the Study Area and potential limitations or constraints. Similar to the previously noted guiding documents, these studies will also help inform and provide justification for the land use concepts in addition to input received from the public.

1.3.1 MUNICIPAL SERVICING ASSESSMENT

The purpose of the municipal servicing assessment was to determine the maximum additional residential density that can be accommodated with existing infrastructure and identify the threshold when infrastructure upgrades would be required. The assessment examined the topography, sanitary sewer system, stormwater sewer system, water network, road network, power, and telecommunications within the area.

The assessment proposed two access layout options for the Study Area (Figure 3). Both options propose a three-way intersection along Diamond Way, while either two four-way (Layout 1) or two three-way (Layout 2) intersections are proposed along Falcon Drive.

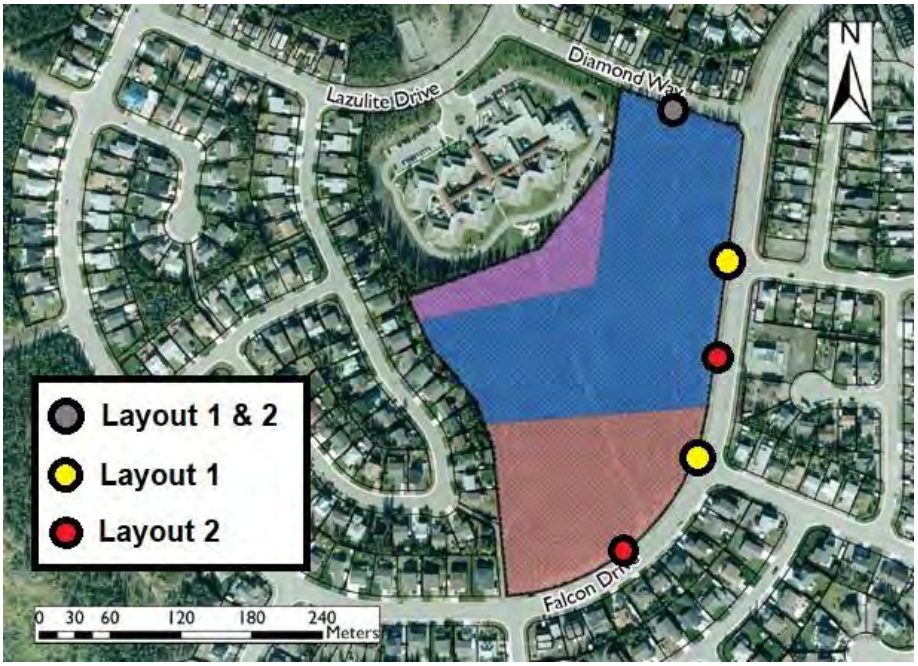

Figure 3. Proposed Access Layout Options

Overall, the limiting factor for the site was determined to be the water network and the availability of fire flows. The site, with current services, would be limited to low density residential development that could accommodate a population of approximately 248 people or 103 units. On- and off-site infrastructure upgrades would therefore be required to accommodate higher residential density.

1.3.2 GEOTECHNICAL ASSESSMENT

A desktop geotechnical assessment was conducted to determine the subsurface rock and soil conditions of the site to understand requirements or setbacks for the development of building foundations, underground utilities, and other infrastructure.

The assessment found that there are no severe natural hazard risks on the site. No features were identified that would warrant geotechnical setbacks or negatively affect building foundations.

Overall, there were no visible constraints to road or building construction identified within the site. It was however recommended that a detailed geotechnical investigation is conducted prior to development.

1.3.3 ENVIRONMENTAL ASSESSMENT

The purpose of the environmental assessment was to determine if areas of potential environmental concerns (APECs) and potential contaminants of concern (PCOC) exist at the site.

The assessment did not identify any on-site or off-site APECs. As such, there is low potential that current or past land use activities at the site or neighbouring properties have resulted in

contamination of soil and/or groundwater within the site. Given these results, no further investigation was considered warranted.

1.3.4 TRAIL ASSESSMENT

The purpose of the trail assessment was to review the existing trail network within the Study Area. A site visit was undertaken in January 2023 to identify the type, location, and direction of trails within and surrounding the Study Area. It was found that multiple trails were located adjacent to and throughout the Study Area.

The assessment identified street paths bordering the Study Area along Falcon Drive and Diamond Way and wide, well used, trails connecting Diamond Way and Copper Ridge Place to Falcon Drive through the Study Area. A small informal trail also circles around Copper Ridge Place and multiple other small informal trails are located within the Study Area creating connections between the wider, well used, trails and the adjacent road network.

1.3.5 HERITAGE RESOURCE IMPACT ASSESSMENT

The purpose of the heritage resource impact assessment was to identify above and below ground heritage resources (such as pre-contact or post-contact heritage sites) and to make recommendations concerning the future management of those resources, if needed.

Within the Study Area, there are numerous signs of contemporary use including walking and motorized vehicle trails, vegetation clearing for fire management, and tree planting. The remainder of the Study Area is characterized by a level of undifferentiated, hummocky terrain.

The assessment did not identify any heritage resources within the Study Area. The area is assessed as having low heritage potential and no further heritage work is recommended.

Section 2 – Engagement Overview

2.1 Engagement Overview

As part of the project launch in January and February 2023, the City sought public feedback in a variety of ways to help inform the next steps in the project, including through a webpage, a webinar, and a survey. The City advertised the launch of the engagement activities related to the Study Area on social media, newspapers, radio stations, and a public service announcement. The City also directly notified Ta'an Kwäch'än Council, Kwanlin Dün First Nation, Copper Ridge residents, the Copper Ridge Neighbourhood Association, and Copper Ridge Place staff.

A second round of engagement was held from May to August 2023, including three design workshops, two open houses, and a survey. The City advertised the open houses and survey and notified key stakeholders and government partners using similar methods to the project launch engagement.

2.2 Notifications

2.2.1 NEIGHBOURHOOD RESIDENTS

Letters were mailed to all residents of the Copper Ridge neighbourhood to advise them of the project launch. The letter contained a brief description and map of the Study Area, the date and time of the Project Launch Webinar, the project webpage address, and contact information for the City's Planning and Sustainability Services department. The letter also advised that a survey would be made available following the webinar.

2.2.2 FIRST NATION GOVERNMENTS

Emails were sent to Ta'an Kwäch'än Council and Kwanlin Dün First Nation staff advising them of the project launch and upcoming webinar, survey, and planning charrette. The City offered to meet individually with each first nation government if desired. Neither first nation government requested to meet at this stage in the project.

2.2.3 NEIGHBOURHOOD ASSOCIATION

Emails were sent to the Copper Ridge Neighbourhood Association advising them of the project launch and upcoming webinar, survey and design workshops. The City offered to meet individually with the neighbourhood association if desired. No request was made to meet at this stage in the project.

The City received a letter from the president of the neighbourhood association following the webinar requesting to repeat the webinar with more adequate notice to residents. A response letter was provided to the president of the neighbourhood association advising that the webinar recording was available on the project webpage and that there would be further opportunities to provide feedback on the project, including through the survey which was launched after the webinar.

The City offered again by email and voicemail to meet individually with the neighbourhood association if desired. However, no request was received.

2.2.4 COPPER RIDGE PLACE

Emails were sent to Copper Ridge Place staff advising them of the project launch and upcoming webinar, survey and planning charrette. The City offered to meet individually with Copper Ridge Place representatives if desired.

City staff also provided an in-person presentation of the project and engagement process at a Family/Residents' council meeting. Attendees had the opportunity to ask questions and hardcopies of the survey were distributed and collected.

2.3 Engagement Activities

The main project launch and public engagement activities included the EngageWhitehorse.ca webpage, a virtual webinar, and a virtual survey.

2.3.1 ENGAGEWHITEHORSE.CA

The project webpage was launched in January 2023 on the City's engagement platform: EngageWhitehorse.ca. It is updated periodically as the project progresses and contains all the information related to the project, including a description of the project, master plan process, key dates and steps, current and future engagement opportunities, and City staff contact information. The project webpage also includes links to relevant documents and recordings, a newsfeed, a project subscription button and tabs to ask and view questions and to fill out surveys.

2.3.2 PROJECT LAUNCH WEBINAR

The project launch webinar was an online meeting that took place on January 31, 2023. A publicly accessible link to the webinar was posted on the project webpage prior to the event. As part of the webinar, City staff presented the project and Study Area and outlined relevant policy documents, the master plan process, completed feasibility and background studies, key steps and dates, and future public engagement opportunities. Following the presentation, attendees were given the opportunity to ask questions and provide comments. The webinar had approximately 18 attendees and a recording was posted on EngageWhitehorse.ca.

Questions and comments received related to:

- the amount of existing greenspace in the neighbourhood and consideration of cumulative loss over time;
- the impact potential development could have on the surrounding transport network and road safety;
- clarifications on if and when a transport impact assessment would be undertaken
- the consideration of Copper Ridge Place as a key stakeholder and a community centre as a potential future use;
- the location, type, and timing of potential development within the Study Area;
- the concern that some attendees did not receive the project launch letter; and

- the further clarification of comments made during the presentation.

2.3.3 PROJECT LAUNCH SURVEY

A survey was released on the project webpage on January 31, 2023 (Appendix A). It remained open for four weeks, until February 28, 2023. The survey consisted of ten questions and took approximately five to ten minutes to complete. The questions aimed to receive input on how the respondents currently used the Study Area, what type of land uses and densities they would support, as well as open-ended questions about their concerns and desires for the development. A total of 166 survey responses were received.

2.3.4 PLANNING CHARRETTE WORKSHOPS

Following the project launch engagement, the City facilitated two design workshops in May 2023. The design workshops were held with the Study Area area landowners, Copper Ridge Place residents and staff, technical experts, and designers. The intent of the workshops was to allow the project team to engage quickly and effectively with these parties, to ideate challenges and opportunities, and explore a broad diversity of design ideas. Two land use concept scenarios were then developed by the project team, taking into consideration engagement and workshop input and guidance from policy documents and background studies.

2.3.5 PLANNING CHARRETTE OPEN HOUSES & SURVEY

A second round of engagement was held in May and June 2023. The two land use concept scenarios were posted on the City's engagement platform and the City hosted two open houses to present the scenarios and answer questions.

Questions and comments received related to:

- concerns with the proposed buffer with Tigereye Crescent residential properties;
- concerns with noise and potential impacts on the surrounding transportation network;
- lower density/greenspace preferred opposite houses that front Falcon Drive; and
- preference for no development and area being left as is.

Public feedback was again generally sought by way of an online survey (Appendix B), with physical copies available upon request. The questions aimed to receive input on which of the two land use concepts respondents preferred overall and regarding greenspace, active transportation, residential uses and density, and the road layout. A total of 206 survey responses were received.

2.3.5 PREFERRED CONCEPT & PLAN REPORT

Following the planning charrette engagement, the City facilitated a third design workshop in August 2023, with similar participants to the first two workshops. The intent of the workshop was again to engage quickly and effectively with these parties to explore a broad diversity of design solutions aimed at addressing engagement input and to arrive at a preferred land use concept.

A preferred land use concept was then developed by the project team, taking into consideration engagement and workshop input. Once the preferred land use concept was finalized, the project team developed the ancillary land use master plan report.

Section 3 – Project Launch What We Heard

3.1 Overview

The following is an overview of the input received from the project launch survey. Most questions allowed respondents to choose from multiple choice answers. Some questions allowed respondents to choose an 'other' response and to specify their answer to the question.

3.2 Demographics

3.2.1 LOCATION

Respondents were asked to identify in which Whitehorse neighbourhood they reside.

The majority (72 per cent) of respondents live in the Copper Ridge neighbourhood. Some residents from the Granger, McIntyre, Ingram, Arkell and Logan neighbourhoods (8 per cent) also responded to the survey. While 17 per cent of respondents indicated residing in Whitehorse Central, North, or South neighbourhoods.

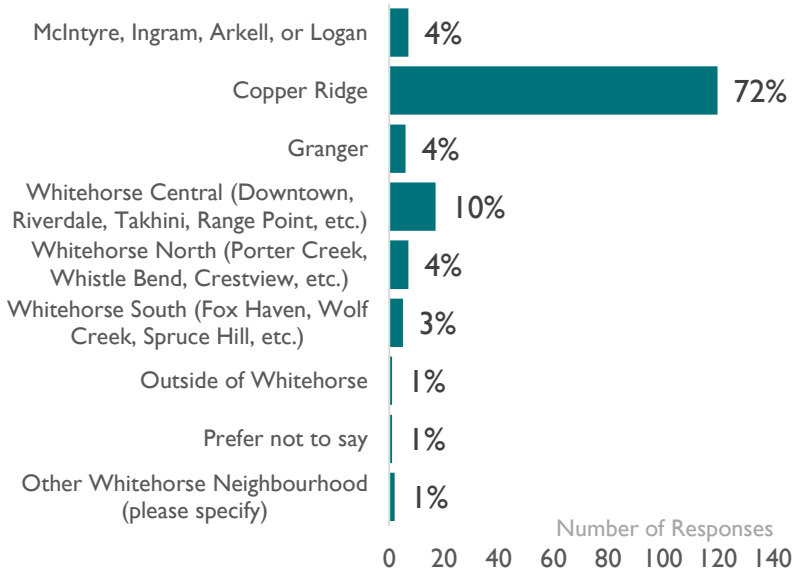

Figure 4. Question 1. What neighbourhood do you live in? (n=166)

3.2.2 FIRST NATIONS CITIZENSHIP OR BENEFICIARY

Respondents were asked if they identify as First Nation citizens or beneficiaries.

Six per cent of respondents identified as either a Kwanlin Dün First Nation citizen or another First Nation citizen or beneficiary. Eleven per cent preferred not to say and 83 per cent did not identify as First Nation citizens or beneficiaries.

No responses were received from Ta'an Kwäch'än Council Citizens.

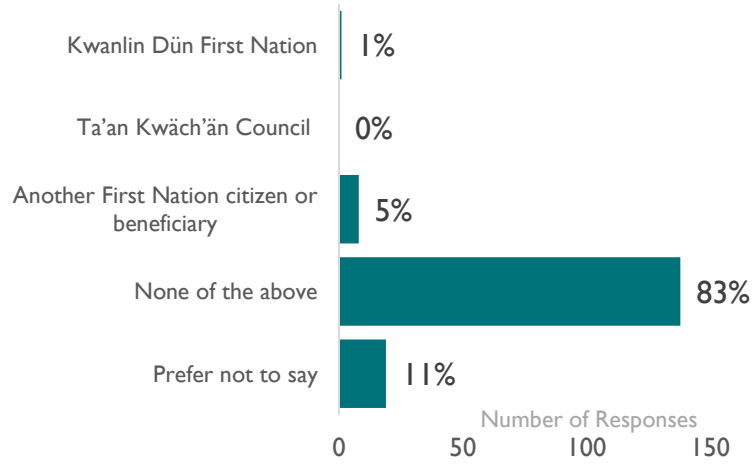

Figure 5. Question 2. Do you identify mainly as? (n=166)

3.3 Current Use

Respondents were asked to identify how they currently use the Study Area. The responses indicated that 71 per cent of respondents use the area for recreation purposes, such as walking, jogging, or dog walking. On the other hand, 45 per cent use the area for aesthetic purposes, such as taking in the nature views, while 26 per cent use the area for transportation or commuting purposes. Finally, 24 per cent use the area for ecological purposes, such as bird watching. Other uses for the area noted by respondents include: berry picking, harvesting traditional medicines, gaining a sense of solitude, and star gazing.

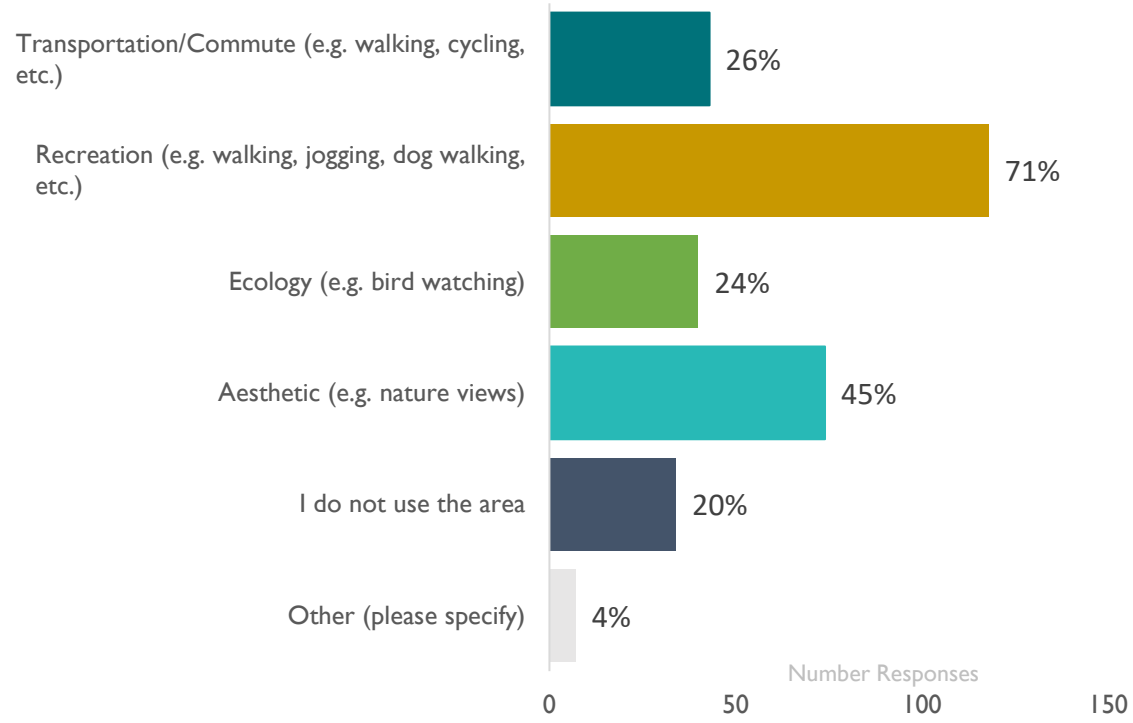

Figure 6. Question 3. How do you currently use the Study Area? (n=166)

3.4 Development Preferences

3.4.1 SUPPORTED USES

The majority of respondents (74 per cent) indicated that they would support greenspace/park uses in any potential future development. Of those who chose the greenspace/park option, over half (54 per cent) only chose this option. In addition, 37 per cent of respondents indicated they would support residential uses, while seven (7) per cent indicated support for commercial uses and 22 per cent for a mix of both. Finally, 17 per cent indicated support for public service/institutional uses.

Other uses supported by respondents include dedicated seniors housing and a racquet sports facility. Other responses also indicated they would not support any development within the Study Area.

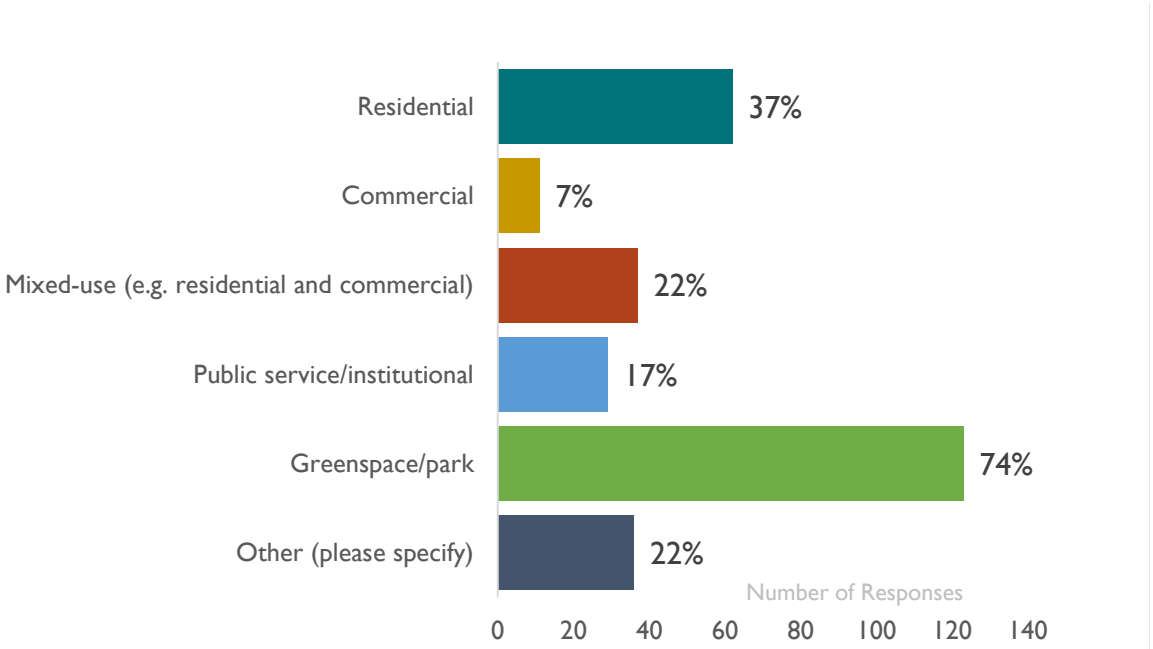

Figure 7. Question 4. If the City and YG were to develop the Study Area, what type of use would you support? Select all that apply: (n=166)

3.4.2 RESIDENTIAL USE DENSITY

Respondents were asked to identify what type of density they would support if the City and YG were to develop the Study Area for residential uses and the associated available land for greenspace and/or amenity space. The majority (58 per cent) of respondents indicated a preference for low-density residential development. One quarter (25 per cent) of respondents indicated support for high-density residential development, while 17 per cent indicated support for medium-density development.

Of those respondents supporting only greenspace/park as a use (40 per cent) in Question 4, 80 per cent would prefer low-density residential development, despite low residential density resulting in less greenspace and/or public amenities. Some of the responses in the open-ended questions 8 and 9 also indicated that some respondents would have liked to have had an 'other' option under this question to allow them to provide another answer (e.g. a no density option to protect the entire existing greenspace).

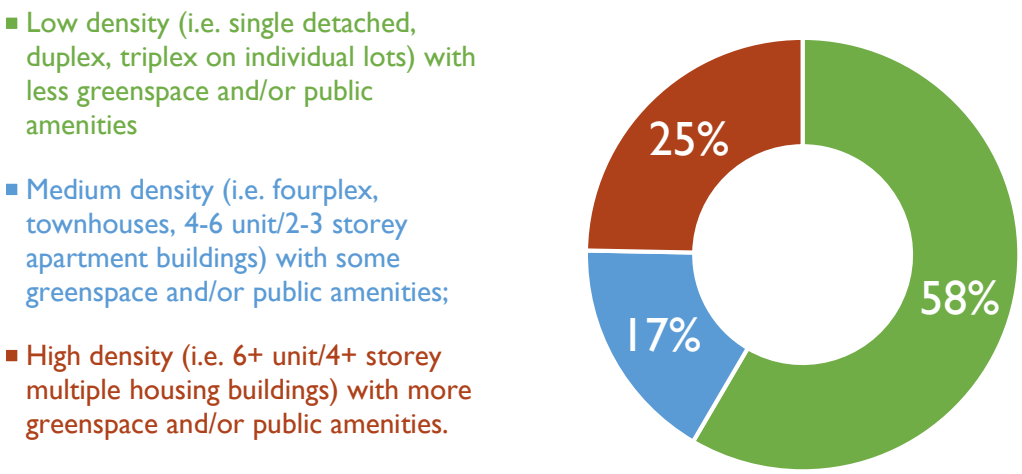

Figure 8. Question 5. If the City and YG were to develop the Study Area for residential uses, what type of density would you support? (n=166)

3.4.3 MIXED-USE BALANCE

Respondents were asked to identify what general mix of residential and commercial land uses they would support if the City and YG were to develop the Study Area into a mixed-use development.

Responses indicated that 40 per cent of respondents would prefer less commercial and more residential if developed as a mixed-use development. On the other hand, 19 per cent would prefer a balance of commercial and residential, and eight (8) per cent would prefer more commercial and less residential.

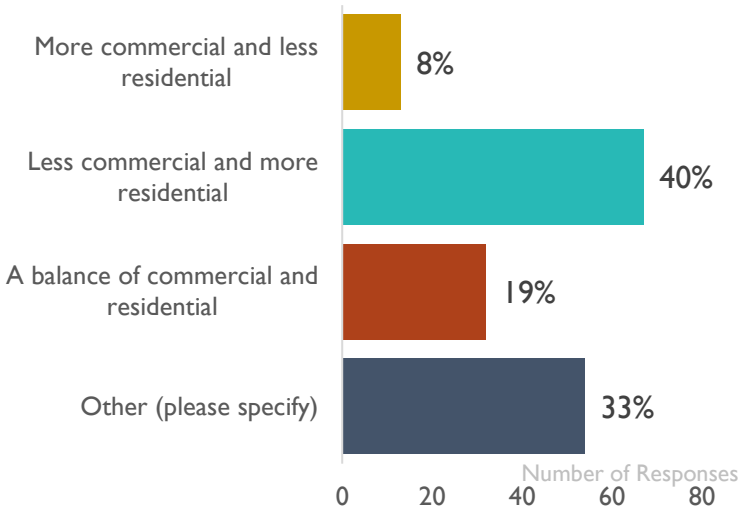

Figure 9. Question 6. If the City and YG were to develop the Study Area into a mixed-use development, what general mix would you support? (n=166)

One-third (33 per cent) of respondents specified that they would prefer something other than the options listed. Responses included preferences for only residential and no commercial, a mix of residential and public service, and a mix of residential and greenspace.

3.4.4 PARKS AND OPEN SPACE AMENITIES/FEATURES

Respondents were asked to identify which uses they would like to see in the parks and open spaces proposed within the Study Area.

The majority (78 per cent) of respondents indicated wanting to have natural greenspaces as part of any parks and open spaces. Nearly half (49 per cent) would also like to have trail connections, while 35 per cent indicated wanting dedicated cycling paths. Community agriculture, a playground, and a dog park were other options that were often chosen.

Other options specified by respondents include keeping the area as it is (nothing), benches, a covered gazebo, indoor racquet facilities, a fountain/garden centre piece, and a wildlife corridor.

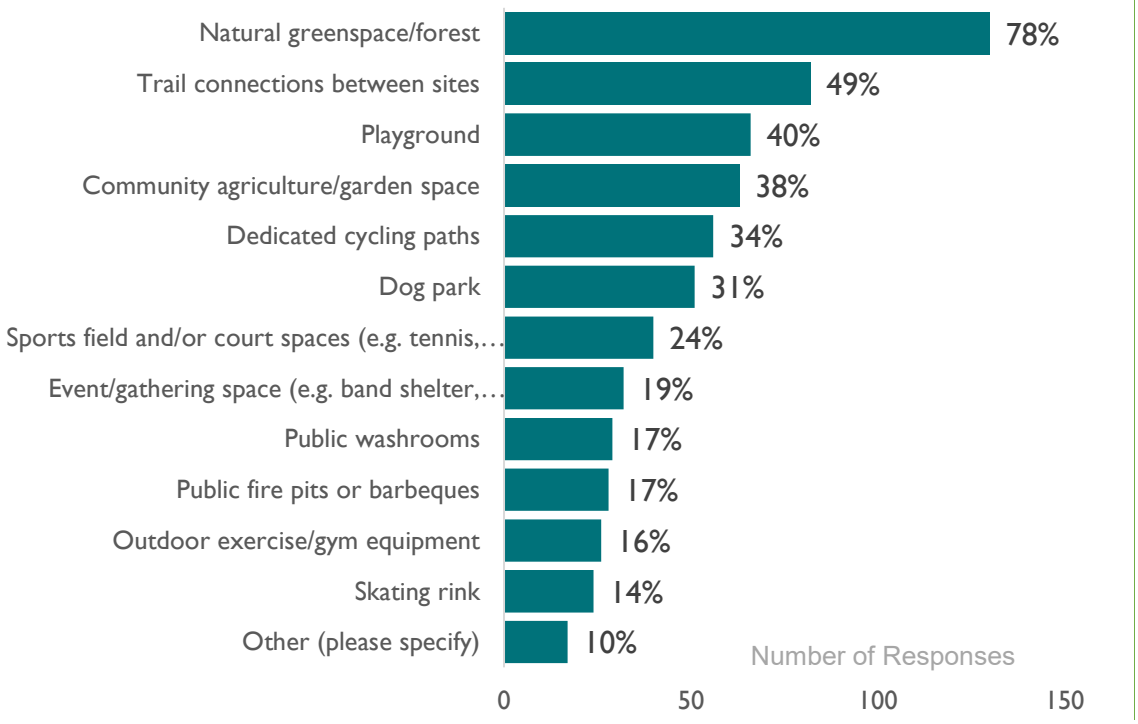

Figure 10. Question 7. What would you like to see included in the parks and open spaces? Select all that apply: (n=166)

3.5 Successful Development

Respondents were asked to describe how this project could result in a successful development, with things to consider being density, the transport network, park and open spaces, land uses and urban design. Figure 11 is a summary of the key themes and opportunities identified in the responses.

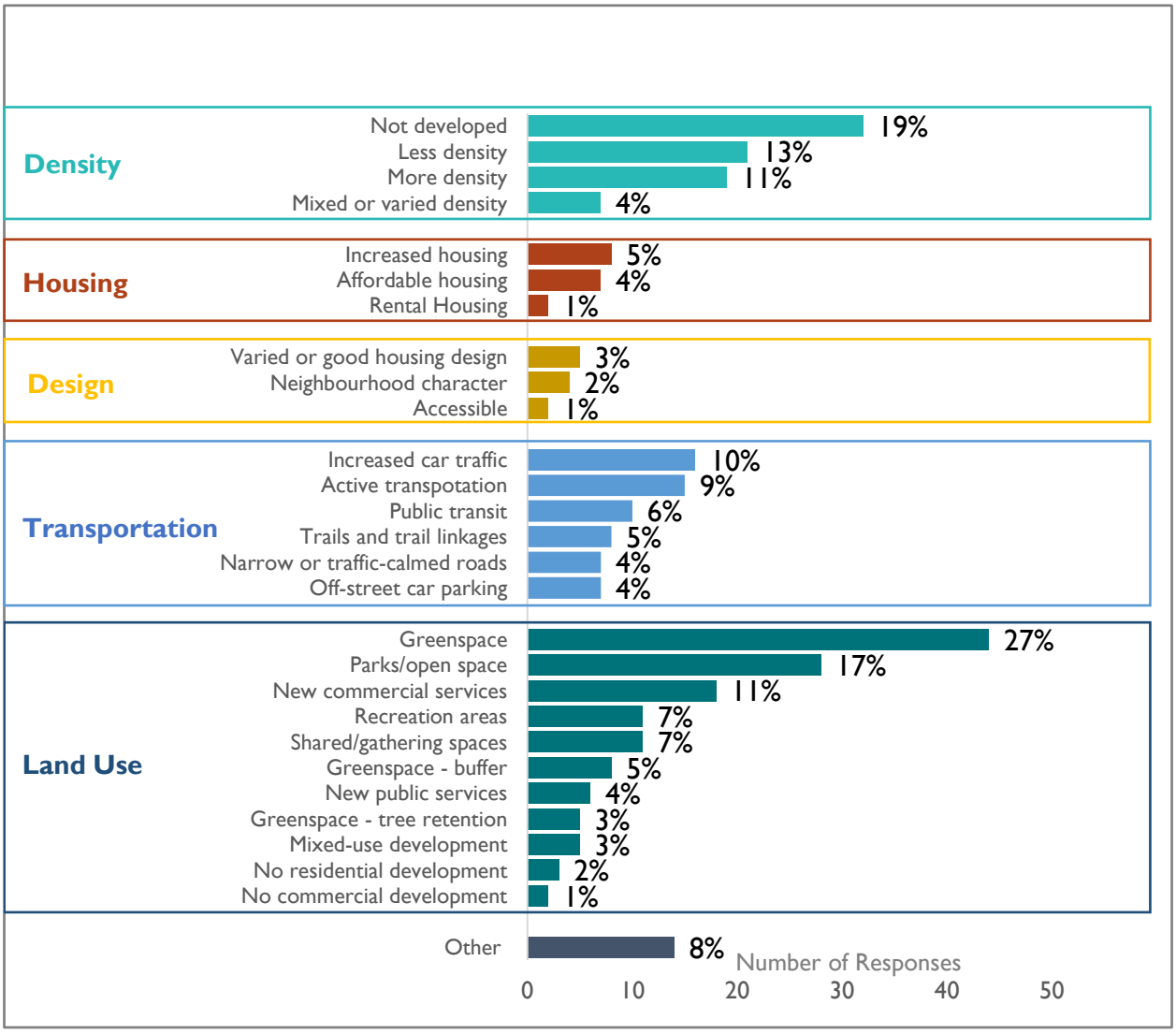

Figure 11. Question 8. What would make this a successful development? Things to consider may include density, transport network, park/open space, land uses, urban design, etc. (n=166)

3.5.1 DENSITY

It was identified that 19 per cent of respondents would not like to see the area developed at all, while 13 per cent of respondents mentioned that less density would make this a successful development. On the other hand, 11 per cent would like to see more density. Finally, four per cent would like to see a mixed or varied density.

3.5.2 LAND USE

Adequate greenspace (27 per cent), park and open spaces (17 per cent) were among the most common land uses identified for a successful development. Retention of trees (5 per cent) and greenspace buffers between residential and non-residential land uses (3 per cent) were also mentioned as part of this.

New commercial services (11 per cent) and recreation areas (7 per cent) were also identified. The lack of commercial services within Copper Ridge was noted several times and the need for more dedicated indoor recreation spaces was also mentioned. Several respondents expressed a desire for racquet courts as an example.

A need for shared/gathering spaces was also noted by respondents (7 per cent). Some noted that this could be fulfilled through commercial uses (e.g. a coffee shop), while others would like more open spaces (e.g. fire pits or a community garden). New public services (4 per cent) were also mentioned as a desired land use (e.g. a school).

Finally, 3 per cent of respondents identified a desire for mixed-use developments. A small percentage of respondents wanted either no commercial development at all (2 per cent) or no residential development at all (1 per cent).

3.5.3 TRANSPORTATION

A development that did not significantly increase car traffic in the surrounding area was highlighted as an aspect of a successful development by 10 per cent of respondents. Many noted that the area was already under traffic pressure. Narrow or traffic-calmed roads were identified as a possible solution to this pressure by four (4) per cent of respondents.

Six per cent of respondents would also like to see transit linkages both within and to and from the new development, while nine (9) per cent would like to see active transportation included within and to and from the Study Area. Ensuring adequate trails and trail linkages were also identified (5 per cent).

3.5.4 DESIGN

Some responses relating to the design of the development include sufficient off-street car parking (4 per cent), development in line with the existing character of the neighbourhood (2 per cent), varied or good housing design (3 per cent), and accessible development (1 per cent).

3.5.5 HOUSING

An increase in the housing stock (5 per cent) and affordable housing (4 per cent) were also mentioned by respondents as an aspect of a successful development. A small percentage (1 per cent) of respondents would like rental housing to be included.

3.6 Concerns

Respondents were also asked to describe any concerns they had about a potential development within the Study Area. Figure 12 is a summary of the key themes and concerns identified by respondents.

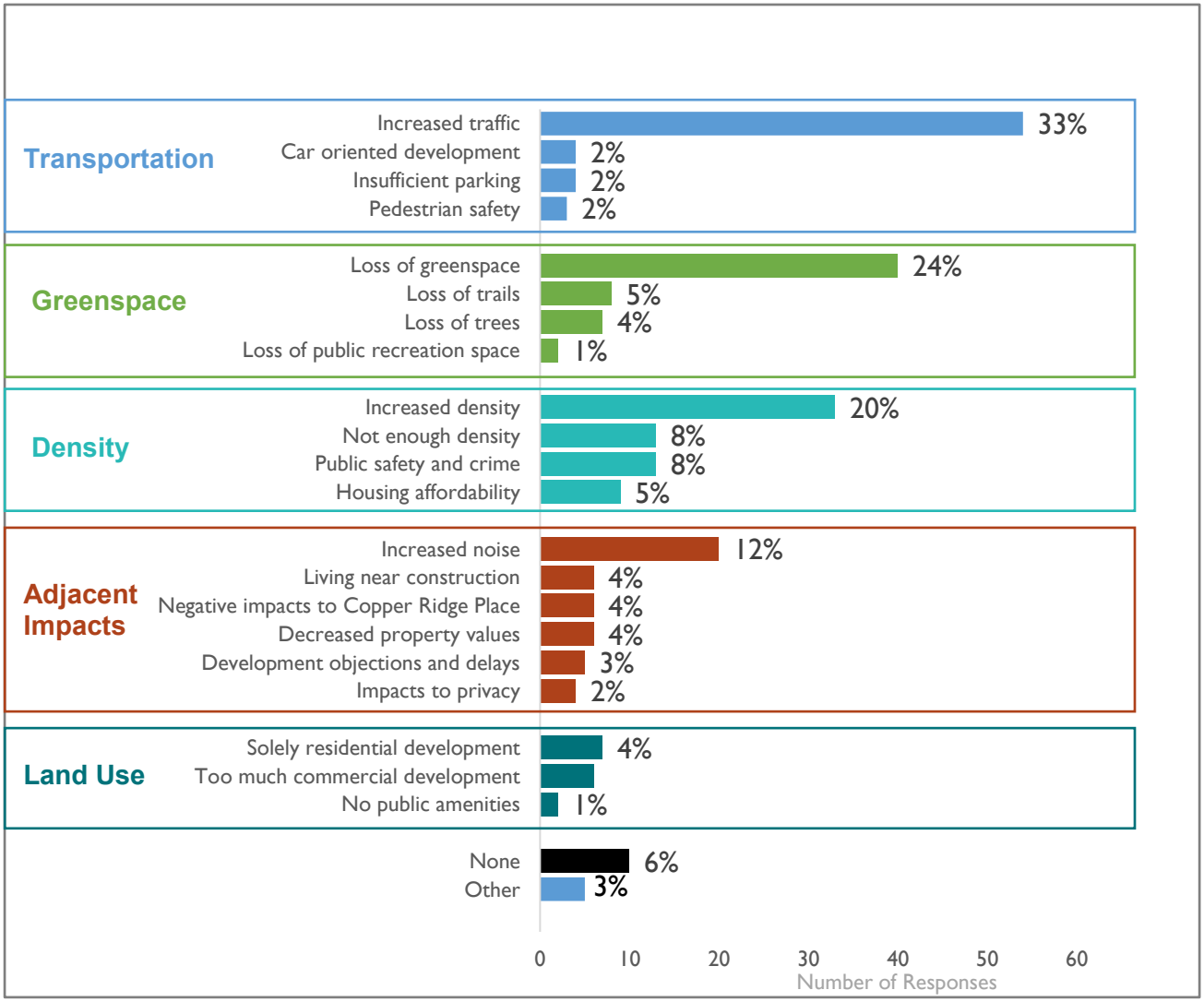

Figure 12 - Question 9 what concerns might you have about this potential development? (n=166)

3.6.1 TRANSPORTATION

The most common (33 per cent) concern identified by respondents was an increase in car traffic as a result of further development in the area. Many feel that Falcon Drive is already unsafe for pedestrians due to the speed and frequency of vehicle traffic. Others expressed concern about an increase in congestion during morning and evening commutes. Pedestrian safety (2 per cent) due to the speed and frequency of vehicle traffic was also associated with this concern.

Some respondents (2 per cent) also expressed concern with the project resulting in a car-oriented development. While others (2 per cent) were concerned there would be insufficient off-street parking.

3.6.2 GREENSPACE

Many respondents (24 per cent) also expressed concern about the loss of the existing greenspace. As previously noted, the majority of the users of this space are using it for recreation or aesthetic purposes. The loss of trees (4 per cent), trails (5 per cent), and recreation spaces (1 per cent) were also associated with this concern.

3.6.3 DENSITY

Twenty (20) per cent of respondents also have concerns with an increase in density above that of the surrounding area. Public safety and increased crime were also often mentioned (8 per cent) in association with this concern.

On the other hand, eight (8) per cent of respondents noted that they were concerned the development would not be dense enough to provide an adequate increase in housing supply or be financially viable for the City in the long term. Five (5) per cent of respondents expressed concern that no affordable housing would be included in the development.

3.6.4 ADJACENT IMPACTS

Multiple concerns were also raised in relation to the negative impacts the potential development may have on adjacent residents and property owners. Some respondents (12 per cent) expressed concern about an increase in noise, either from increased traffic, density, or construction. Living near construction was specifically mentioned as a concern by four (4) per cent of respondents.

Some respondents also voiced concerns that the potential development and associated loss of greenspace would negatively impact their property values (4 per cent) and privacy (2 per cent), while others noted the negative impacts to Copper Ridge Place residents (4 per cent).

Finally, some respondents (3 per cent) raised concerns with adjacent residents and landowners objecting to or delaying development within the Study Area.

3.6.5 LAND USE

Some respondents expressed concern that only residential development would be included (4 per cent) or that there would be too much commercial development (4 per cent). The potential development not having any public amenities was also expressed as a concern by 1 per cent of respondents.

3.7 Key Takeaways

The key takeaways from the survey results are:

- The majority of respondents indicated that they would support greenspace/park uses within the Study Area;
- If the Study Area were to include residential uses, low density is preferred despite this resulting in less greenspace or public amenities;
- Many respondents indicated that the inclusion of greenspace and parks/open spaces as well as no development would result in a successful project; and
- The largest concerns include increased traffic, loss of greenspace, and increased density.

Section 4 – Planning Charrette What We Heard

4.1 Overview

The following is an overview of the input received from the planning charrette survey. Most questions allowed respondents to choose from multiple choice answers. Most questions also allowed respondents to choose an 'other' response and to specify their answer to the question.

4.2 Demographics

4.2.1 LOCATION

Respondents were asked to identify in which Whitehorse neighbourhood they reside (Figure 13). The majority (83.5 percent) of respondents live in the Copper Ridge neighbourhood. Some residents from the Granger (2.9 percent), and McIntyre, Ingram, Arkell, and Logan neighbourhoods (4.9 percent) also responded to the survey. While 7.8 percent of respondents indicated residing in Whitehorse Central, North, or South neighbourhoods.

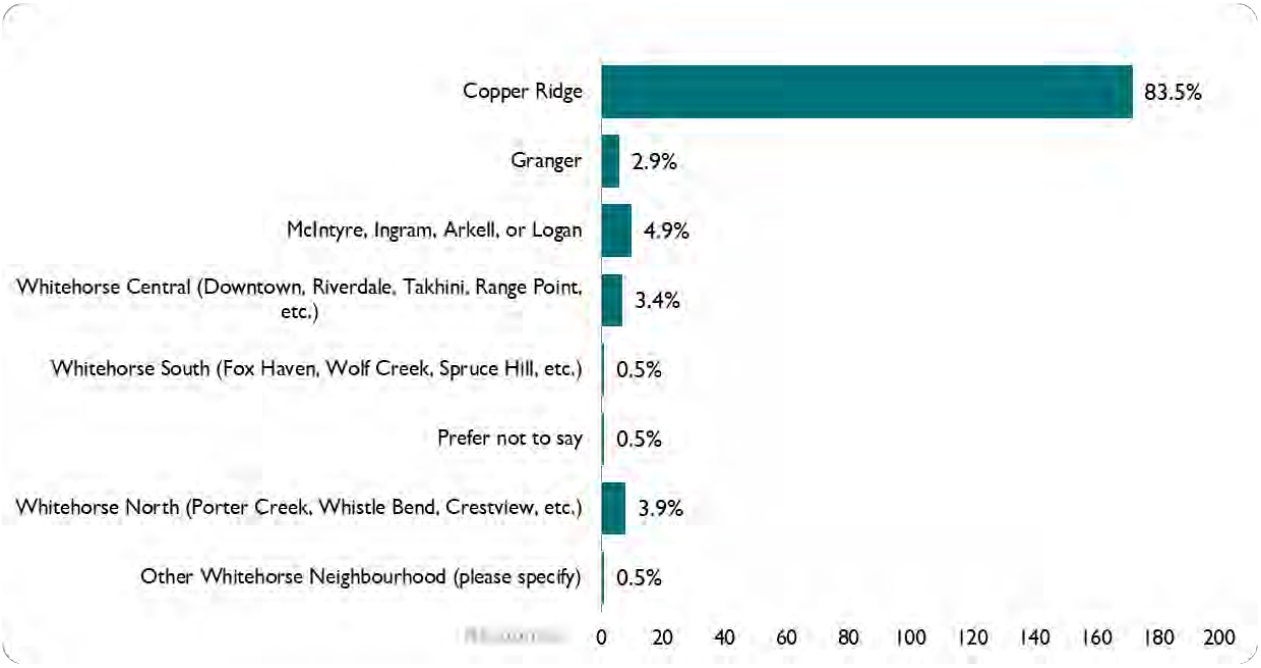

Figure 13. Question 1. What neighbourhood do you live in? (n=206)

4.2.2 FIRST NATIONS CITIZENSHIP OR BENEFICIARY

Respondents were asked if they identify as First Nation citizens or beneficiaries (Figure 14). One per cent of respondents identified as Kwanlin Dün First Nation citizen or beneficiary, while 5.8 per cent identified as another First Nation citizen or beneficiary. A little less than 21 per cent preferred not to say and 72.3 per cent did not identify as First Nation citizens or beneficiaries. No responses were received from Ta'an Kwäch'än Council Citizens.

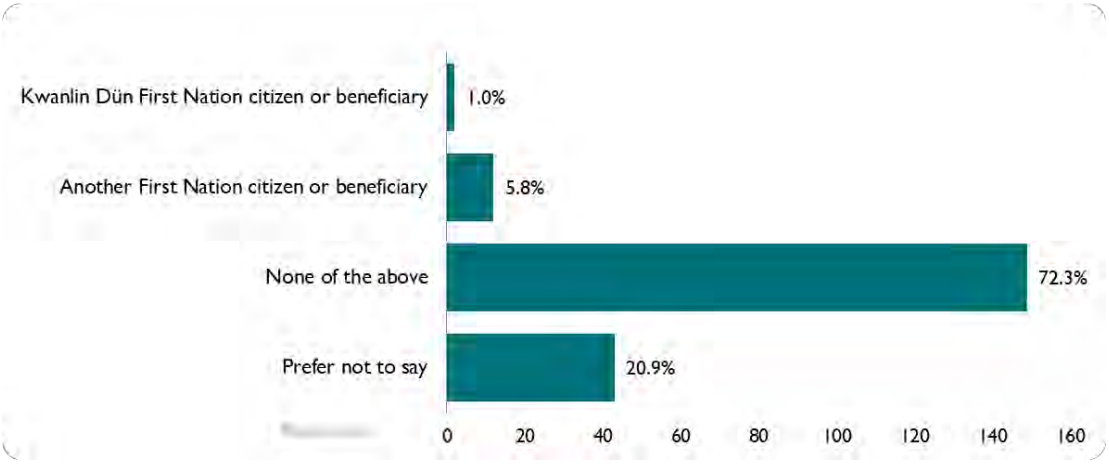

Figure 14. Question 2. Do you identify mainly as? (n=206)

4.3 Development Preferences

4.3.1 OVERALL SUPPORT & PREFERENCE

Respondents were asked to indicate their level of support for each land use concept scenario (Figure 15). Generally, the level of support for each opinion was similar. An equal amount (74.3 per cent) of respondents were either very opposed or somewhat opposed to both scenarios, while a minority of respondents were somewhat supportive or very supportive for Option 2 (19.4 percent) and Option 1 (18.4 per cent).

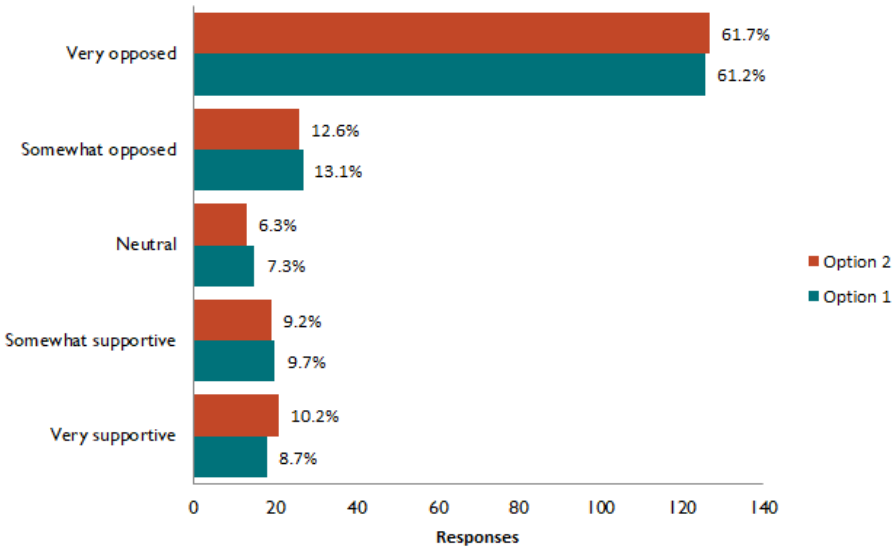

Figure 15. Question 3 & 4. Overall, how supportive are you of the land use concept options 1 and 2? (n=206)

4.3.2 GREENSPACE

Respondents were asked to indicate which option they preferred regarding the greenspaces (Figure 16). Of those preferring one option over the other, Option 1 (20.9 per cent) was slightly more preferred than Option 2 (17.0 per cent).

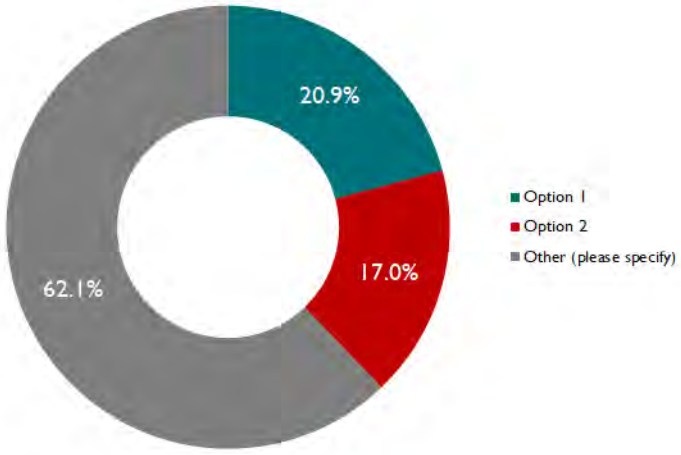

Figure 16. Question 5. Considering the greenspaces, which land use concept option do you prefer? (n=206)

Most respondents (62.1 per cent) however selected 'Other' (Figure 17). Nearly half (46.1 per cent) suggested that the entire Study Area should be left as greenspace. A quarter (25.0 per cent) suggested that there is not enough greenspace in either option. A common comment (29.7 per cent) was that neither option was satisfactory and that the options lacked significant differences to have a preference (10.9 percent). Some respondents (7.8 per cent) also perceived that the options presented were a result of ignoring previous public input.

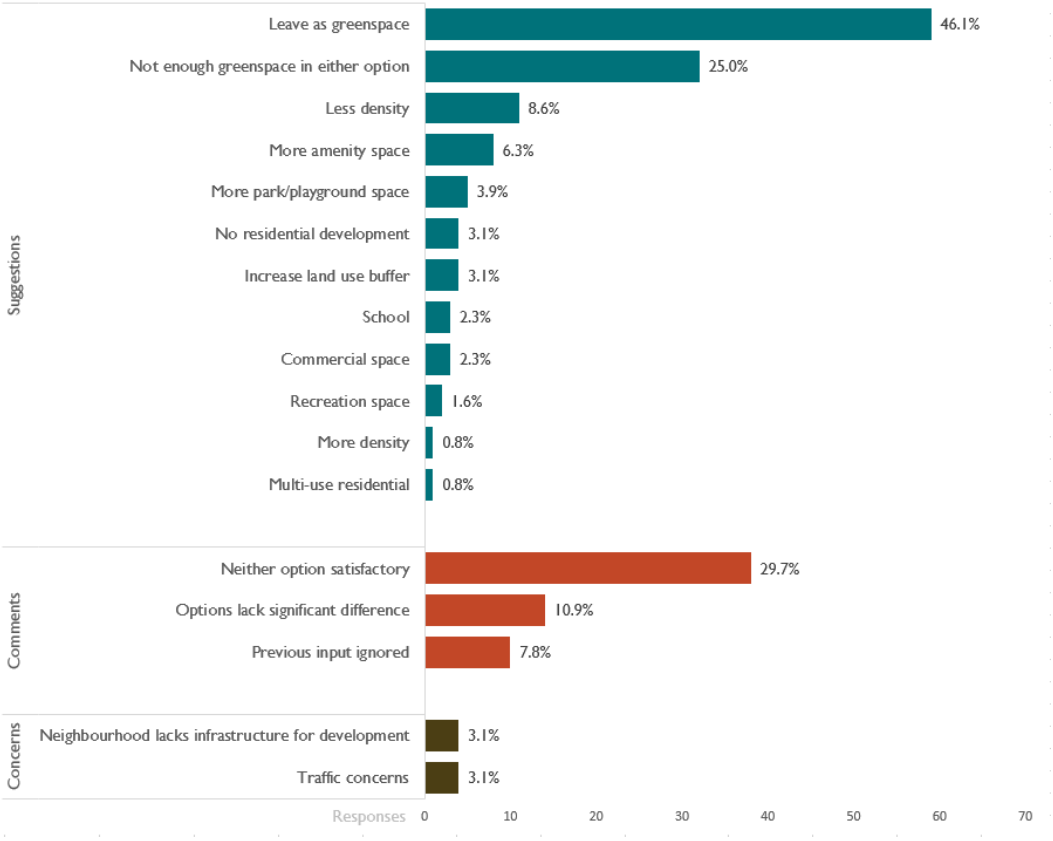

Figure 17. Question 5. Other responses

4.3.3 RESIDENTIAL USE AND DENSITY

Respondents were asked to indicate which option they preferred regarding the residential uses and density (Figure 18). Of those preferring one option over the other, Option 2 (18.4 per cent) was slightly more preferred than Option 1 (18.0 per cent).

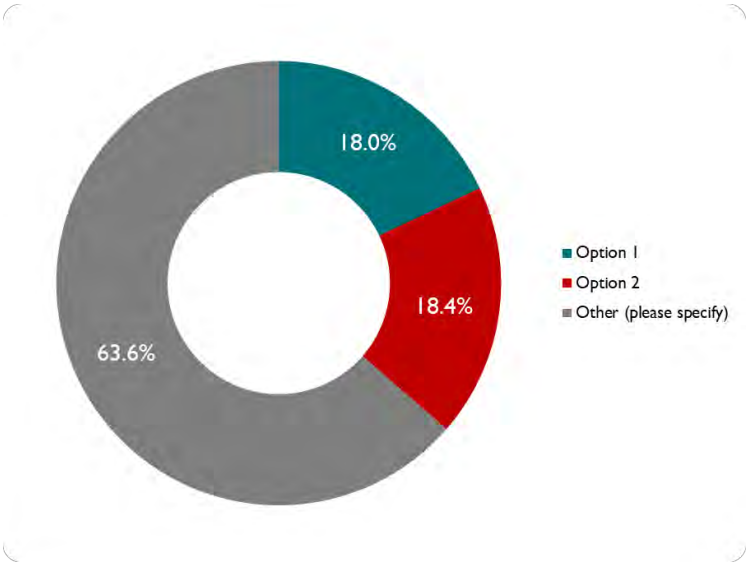

Figure 18. Question 6. Considering the residential uses and density, which land use concept option do you prefer? (n=206)

Most respondents (63.6 per cent) however selected 'Other' (Figure19). A little below thirty per cent suggested that the Study Area should be left as is. A little above twenty per cent suggested that there should be less density in the Study Area, while a little over nine (9) per cent of respondents suggested that there be more greenspace. Other suggestions were including more density (6.1 per cent), adding commercial services (4.6 per cent), and no residential development altogether (3.8 per cent).

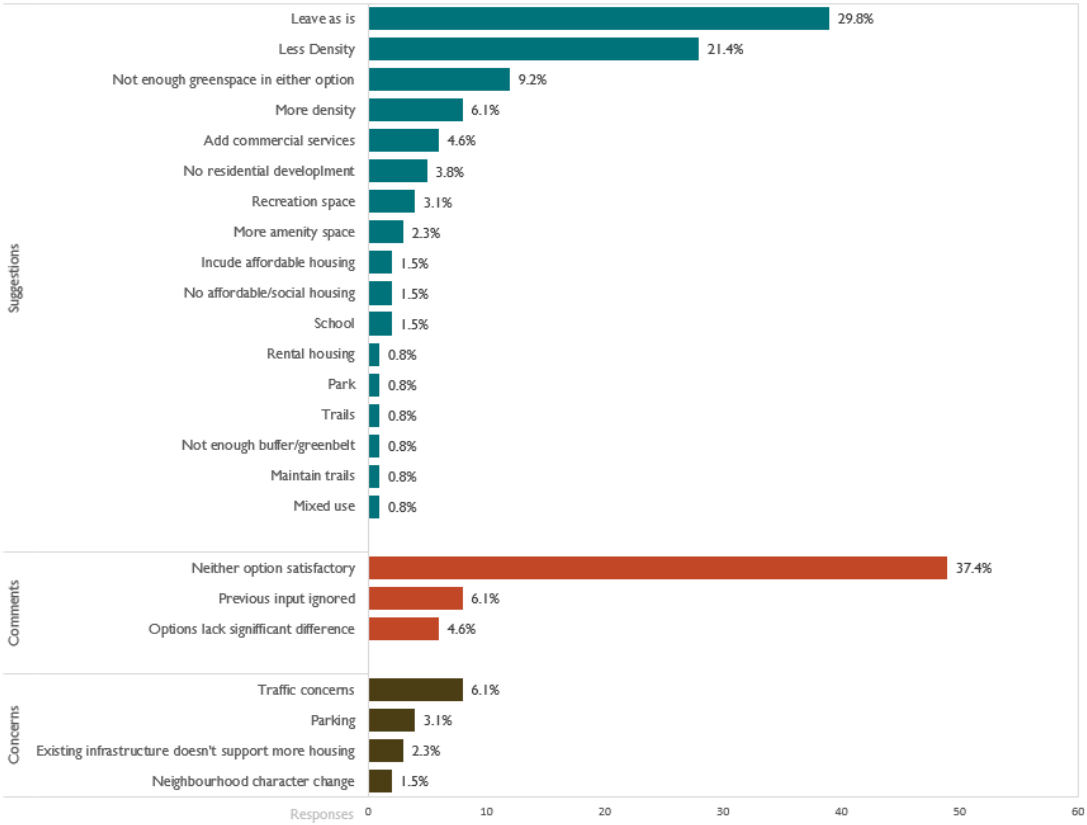

Figure 19. Question 6. Other responses

A common comment (37.4 per cent) was that neither option was satisfactory. Some (6.1 per cent) also noted that previous public input was ignored since development is proposed,. A little over 4 per cent of respondents complained that the options lacked significant difference to have a preference. Finally, traffic (6.1 per cent), parking (3.1 per cent), and existing infrastructure capacity (2.3 per cent) were some other concerns expressed by respondents.

4.3.4 TRAILS AND ACTIVE TRANSPORTATION

Respondents were asked to indicate which option they preferred regarding the trails and active transportation (Figure 20). Of those preferring one option over the other, Option 1 (21.4 per cent) was slightly more preferred than Option 2 (19.4 per cent).

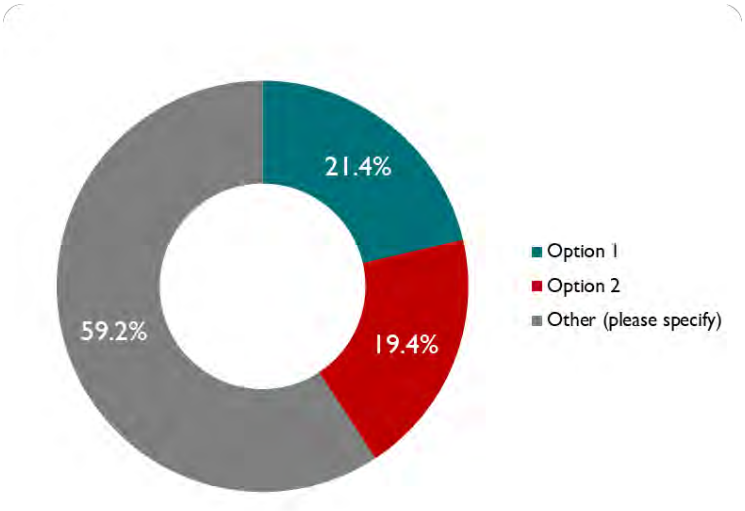

Figure 20. Question 7. Considering the trails and active transport network, which land use concept option do you prefer? (n=206)

Most respondents (59.2 per cent) however selected 'Other' (Figure 21). Just over one third (36.9 percent) suggested that the Study Area should be left as is. Some respondents also suggested that there should be more greenspace (7.4 per cent) and more trails (5.7 per cent). Ensuring active transportation infrastructure is safe for all users (4.1 per cent) and that there is year-round maintenance (3.3%) were also suggested by respondents.

Over one third of respondents (36.9 per cent) noted that both options are unsatisfactory, and some commented that previous input was ignored (3.3 per cent).

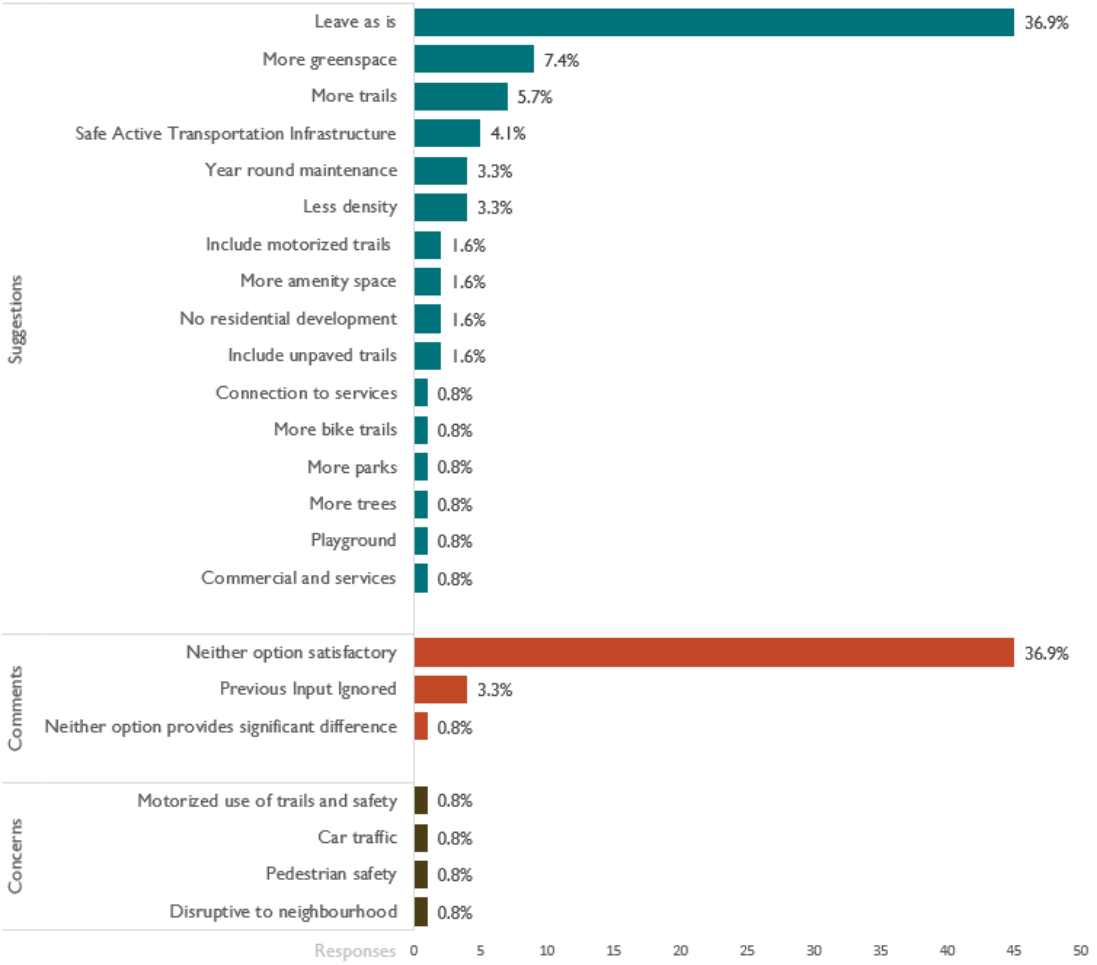

Figure 21. Question 7. Other responses

4.3.5 ROAD LAYOUT

Respondents were asked to indicate which option they preferred regarding the road layout (Figure 22). Of those preferring one option over the other, Option 1 (21.8 per cent) was slightly more preferred than Option 2 (19.4 per cent).

Most respondents (58.7 per cent) however selected 'Other' (Figure 23). Nearly one quarter (24.0 per cent) suggested that the Study Area should be left as is. Keeping the proposed traffic circle (5.8 per cent), less density (5.8 per cent), and narrower/traffic calmed streets (4.1 per cent) were also suggested.

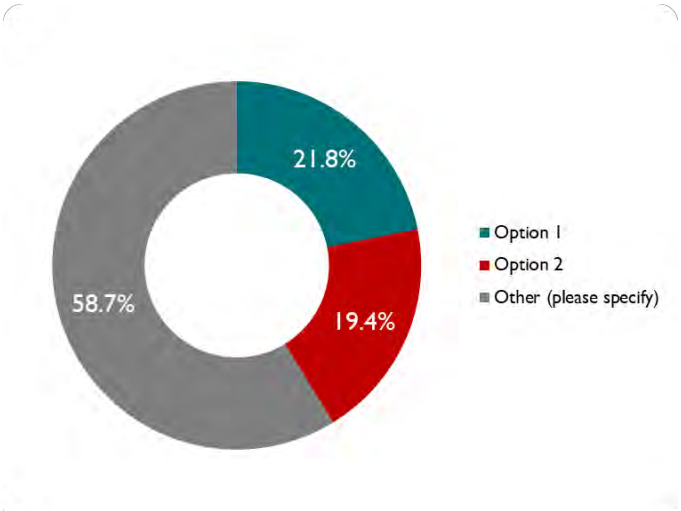

Figure 22. Question 8. Considering the road layout, which land use concept option do you prefer? (n=206)

Almost half of respondents (44.6 per cent) also noted that neither option was preferred, with some commenting that the options did not have significant differences (5.0 per cent) and that previous input was ignored (4.1 per cent).

Traffic was the most common (14.0 per cent) concern expressed by respondents. This was largely in relation to increased congestion coming from and to Copper Ridge, which is already perceived to be too high.

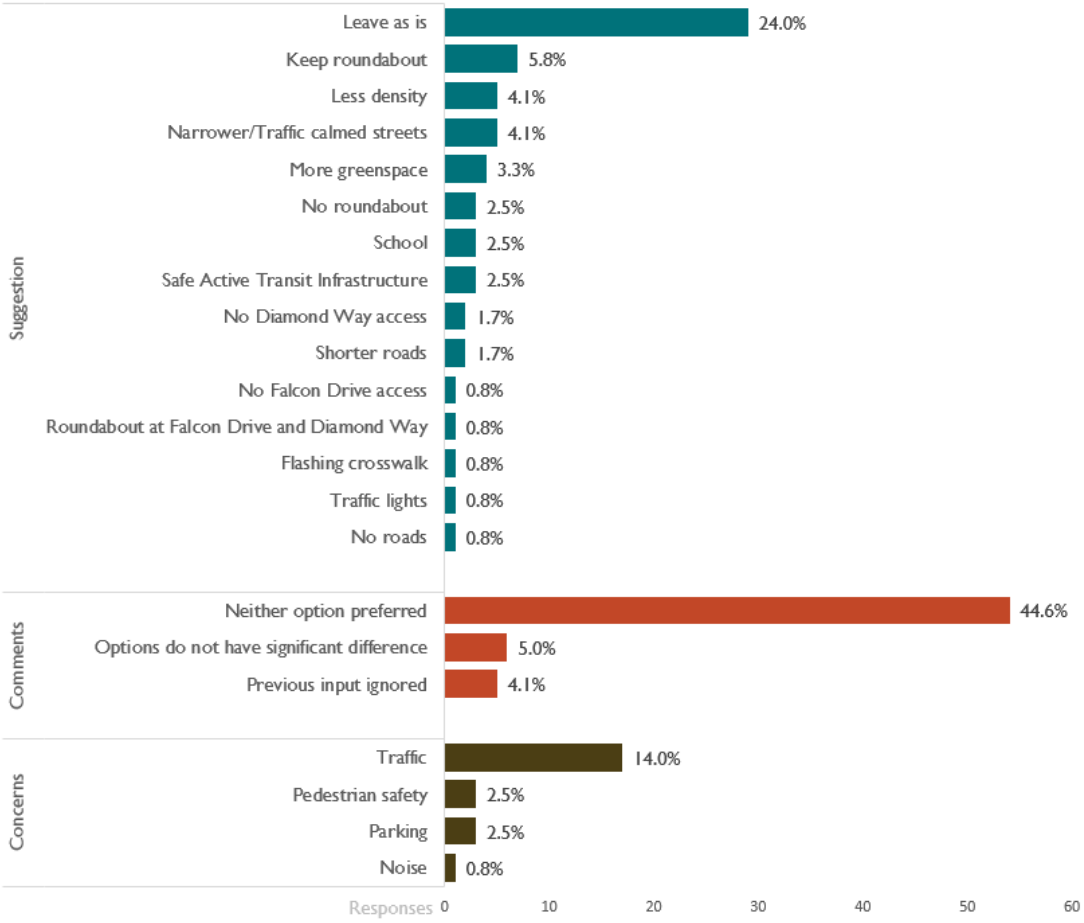

Figure 23. Question 8. Other responses

4.3.6 OVERALL

Respondents were also asked to indicate which option they preferred overall (Figure 24). Of those preferring one option over the other, Option 1 (19.4 per cent) was slightly more preferred than Option 2 (18.0 per cent).

Most respondents (62.6 per cent) however selected 'Other'. About one third suggested leaving the site as it is, with some suggesting no residential development (9 per cent), less density (8 per cent), and more greenspace (8 per cent).

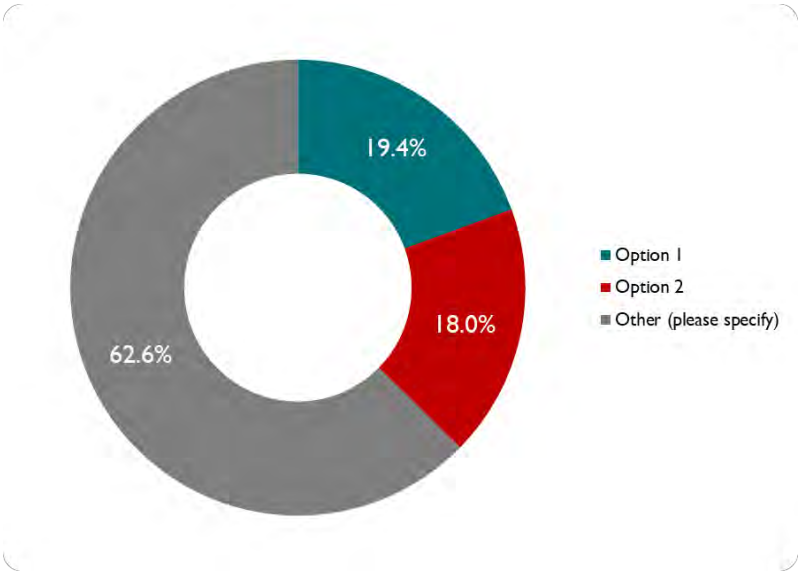

Figure 24. Question 9. Overall, which land use concept option do you prefer?

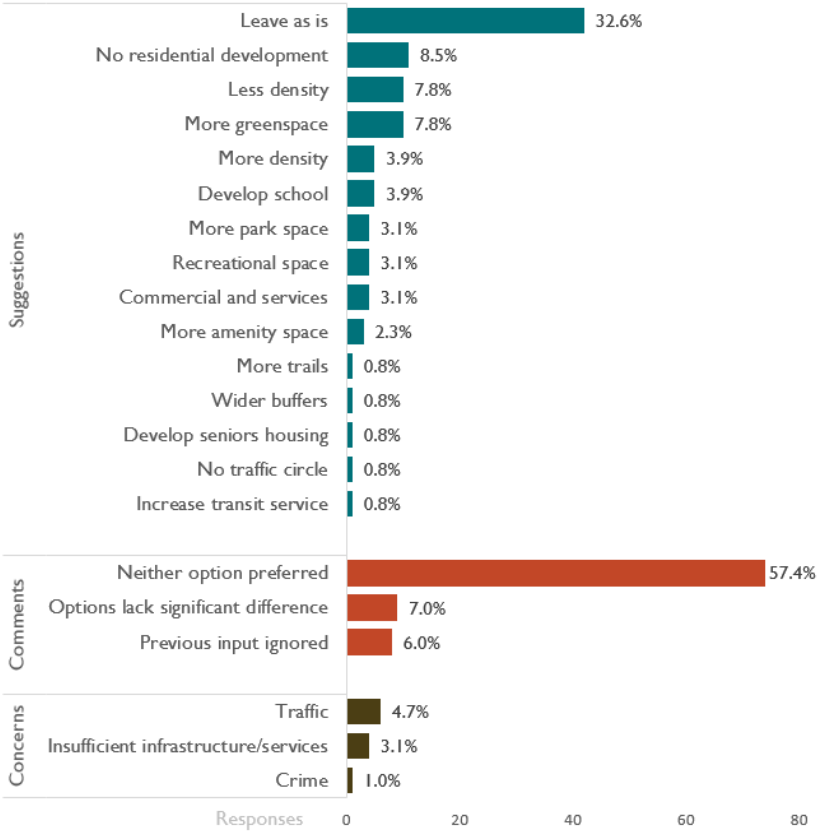

Figure 25. Question 9. Other responses

Over half commented that neither option was preferred, with some commenting that the options lack any significant difference to have a preference (7 per cent) and that previous public input was ignored (6 per cent).

Traffic (4.7 per cent) and insufficient infrastructure and services to support additional housing (3.1 per cent) were some of the other concerns expressed by respondents.

4.3.7 WHAT'S MISSING

Finally, respondents were asked to identify if they felt anything was missing from the proposed land use concepts. A little less than thirty per cent said that the Study Area should be left as it is, while fifteen per cent wanted more greenspace. Some respondents (8.3 per cent) felt that the options lacked commercial services to support both the infill residential housing and the wider Copper Ridge neighbourhood. Recreation space, both indoor and outdoor, was also noted as lacking in both options (5.8 per cent). Traffic calming, less density, and more parks/open spaces (4.9 per cent) were also noted as missing.

A common comment from respondents was the perception that previous public input was ignored (10.7 per cent) and that neither option was preferred (9.25 per cent), as both options proposed residential development and did not have any significant differences.

Finally, traffic congestion and pedestrian safety resulting from both concepts was raised as a concern by 13.1 per cent of respondents.

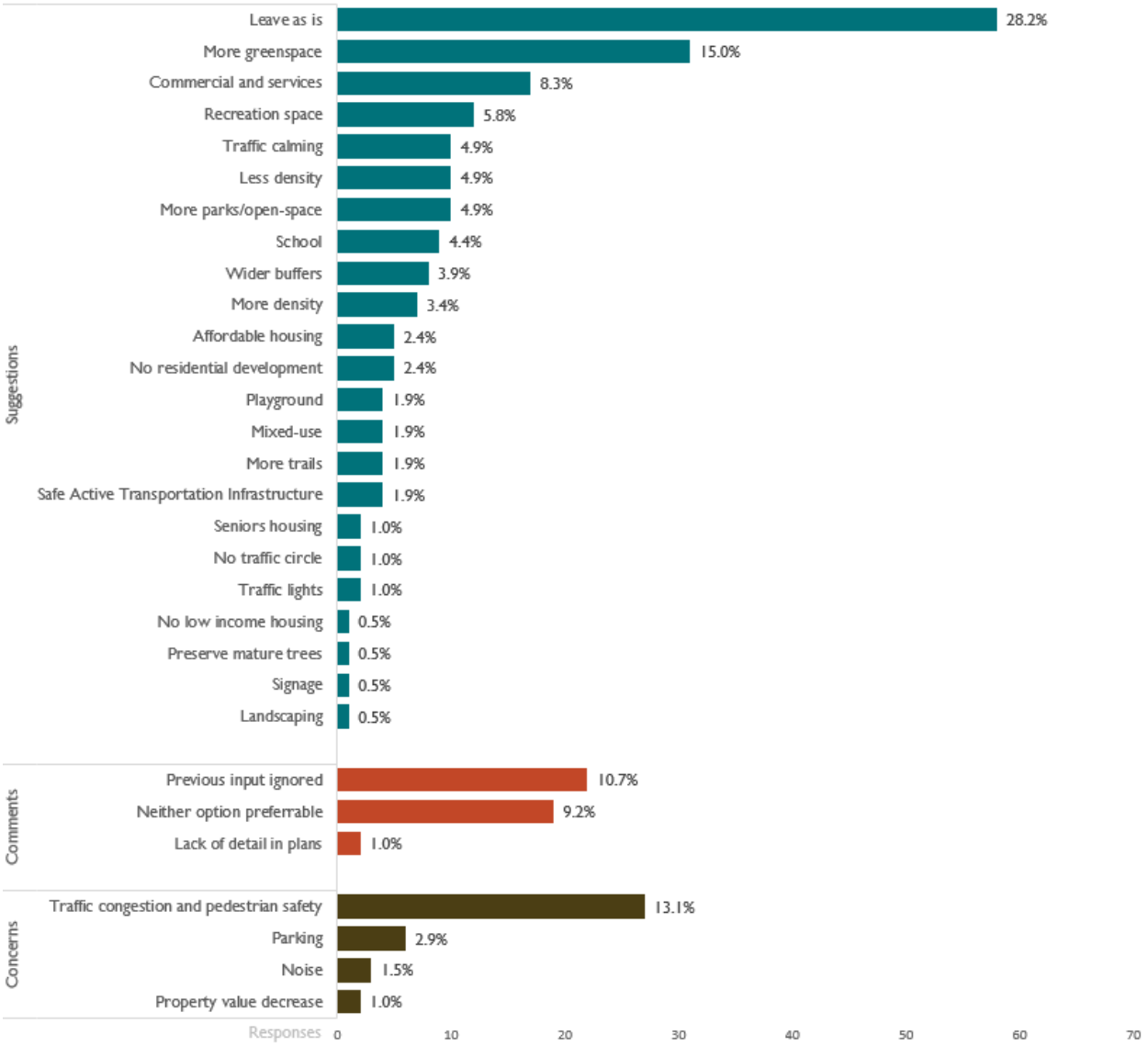

Figure 26. Question 10. Is anything missing from the land use concept options? (n=206)

4.3 Key Takeaways

The key takeaways from the survey results are:

- Similar levels of overall support between options 1 and 2;
- Option 1 was slightly preferred for its greenspace, trails and active transportation, and the road layout;
- Option 2 was slightly preferred for its residential uses and density; and
- Concerns with potential impacts on pedestrian safety and the surrounding transportation network were often noted.

Most respondents also indicated that neither option is preferred. Some of the reasons given are:

- Preference is that the area is not developed and left as it is;
- Both options are too similar to have a preference;
- More greenspace should be included in both options; and
- Previous public input was ignored and not included in either option.

Section 5 – Next Steps

5.1 Land Use Concept & Report

Once the land use concept is finalized, an ancillary land use master plan report will be developed for the Study Area. A draft master plan will be presented to the community to receive input prior to finalizing. Once the master plan is finalized, City staff will bring it forward for Council consideration.

5.2 Implementation

Following the completion of the project, landowners will be expected to follow the recommendations of the master plan prior to and when developing the land. This may require undertaking further studies, such as transport impact assessments, amending the Zoning Bylaw, and undertaking on- and off-site infrastructure upgrades. The master plan will also guide future developer-led work, such as detailed engineering studies, zoning and subdivision layout plans

Appendix

Appendix A – Project Launch Survey

Copper Ridge Development Area

Engage Whitehorse

Project Launch Survey

The City of Whitehorse is leading the development of a master plan for the area between Falcon Drive and Copper Ridge Place. The study area contains land owned by the City and YG, and is designated for residential use in the current and proposed Official Community Plan. The master plan will provide direction for the management of this piece of land.

Take our survey to give input on what you want to see in such a development. Your input will help inform the collaborative planning efforts between the two governments and ensure that the City can facilitate a final plan that meets the key interests of Whitehorse residents.

For more information about the project, please visit the project page. Also, consider registering to the project page to stay informed throughout the process!

This survey takes about 5 to 10 minutes, and closes on Tuesday, February 28 at 11:59 pm.

Thank you for your time and input into this process.

What neighbourhood do you live in?

(Choose any 1 option) (Required)

- ☐ McIntyre, Ingram, Arkell, or Logan
- ☐ Copper Ridge
- ☐ Granger
- ☐ Whitehorse Central (Downtown, Riverdale, Takhini, Range Point, etc.)
- ☐ Whitehorse North (Porter Creek, Whistle Bend, Crestview, etc.)
- ☐ Whitehorse South (Fox Haven, Wolf Creek, Spruce Hill, etc.)
- ☐ Outside of Whitehorse
- ☐ Prefer not to say
- ☐ Other Whitehorse Neighbourhood (please specify)

Do you identify mainly as?

(Choose any 1 option) (Required)

- ☐ Kwanlin Dün First Nation
- ☐ Ta'an Kwäch'än Council
- ☐ Another First Nation citizen or beneficiary
- ☐ None of the above
- ☐ Prefer not to say

How do you currently use the study area? Select all that apply:

(Choose all that apply) (Required)

- ☐ Transportation/Commute (e.g. walking, cycling, etc.)
- ☐ Recreation (e.g. walking, jogging, dog walking, etc.)
- ☐ Ecology (e.g. bird watching)
- ☐ Aesthetic (e.g. nature views)
- ☐ I do not use the area
- ☐ Other (please specify)

If the City and YG were to develop the study area, what type of use would you support? Select all that apply:

(Choose all that apply) (Required)

- ☐ Residential
- ☐ Commercial
- ☐ Mixed-use (e.g. residential and commercial)
- ☐ Public service/institutional
- ☐ Greenspace/park

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Copper Ridge Development Area

Engage Whitehorse

- [ ] Other (please specify)

If the City and YG were to develop the study area for residential uses, what type of density would you support?

(Choose any 1 option) (Required)

- [ ] Low density (i.e. single detached, duplex, triplex on individual lots) with less greenspace and/or public amenities
- [ ] Medium density (i.e. fourplex, townhouses, 4-6 unit/2-3 storey apartment buildings) with some greenspace and/or public amenities;
- [ ] High density (i.e. 6+ unit/4+ storey multiple housing buildings) with more greenspace and/or public amenities.

If the City and YG were to develop the study area into a mixed-use development, what general mix would you support?

(Choose any 1 option) (Required)

- [ ] More commercial and less residential
- [ ] Less commercial and more residential
- [ ] A balance of commercial and residential
- [ ] Other (please specify)

What would you like to see included in the parks and open spaces? Select all that apply:

(Choose all that apply) (Required)

- [ ] Playground
- [ ] Dog park
- [ ] Outdoor exercise/gym equipment
- [ ] Community agriculture/garden space
- [ ] Natural greenspace/forest
- [ ] Dedicated cycling paths
- [ ] Skating rink
- [ ] Sports field and/or court spaces (e.g. tennis, basketball, baseball, etc.)
- [ ] Public fire pits or barbeques
- [ ] Event/gathering space (e.g. band shelter, amphitheater, large sheltered area, etc.)
- [ ] Trail connections between sites
- [ ] Public washrooms
- [ ] Other (please specify)

What would make this a successful development? Things to consider may include density, transport network, park/open space, land uses, urban design, etc.

(Required)

What concerns might you have about this potential development?

(Required)

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Appendix

Copper Ridge Development Area

Engage Whitehorse

Finally, how did you hear about this survey? Select all that apply:

(Choose all that apply) (Required)

- ☐ Engagewhitehorse.ca project update
- ☐ Radio or newspaper advertisement
- ☐ City social media
- ☐ City Newsletter
- ☐ Other (please specify)

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Appendix B – Planning Charrette Survey

Copper Ridge Development Area

Engage Whitehorse

Planning Charrette Survey

The City of Whitehorse is leading the development of a master plan for the area between Falcon Drive and Copper Ridge Place.

The study area contains land owned by the City and YG, and is designated for residential use in the Official Community Plan. The master plan will provide direction for the development of this piece of land. The project team has been busy turning your initial input into two land use scenarios for the Copper Ridge Development Area.

Take our survey to provide input on the two land use concept options. Your input will help inform the creation of a preferred land use concept for the master plan. This survey takes about 5 to 10 minutes, and **closes on Monday, June 12 at 11:59 pm.** Please note, the City is hosting two open houses to provide information on the two land use scenarios and to provide an opportunity to ask questions directly to the project team.

- **Tuesday, May 30** – Canada Games Centre Green Room, 4 to 8 pm
- **Wednesday, May 31** – Canada Games Centre Green Room, 4 to 8 pm

Subscribe to this project page to stay informed throughout the process!

What neighbourhood do you live in?

(Choose any 1 options) (Required)

- ☐ Copper Ridge
- ☐ Granger
- ☐ McIntyre, Ingram, Arkell, or Logan
- ☐ Whitehorse Central (Downtown, Riverdale, Takhini, Range Point, etc.)
- ☐ Whitehorse South (Fox Haven, Wolf Creek, Spruce Hill, etc.)
- ☐ Outside of Whitehorse
- ☐ Prefer not to say
- ☐ Whitehorse North (Porter Creek, Whistle Bend, Crestview, etc.)
- ☐ Other Whitehorse Neighbourhood (please specify)

Do you identify mainly as?

(Choose any 1 options) (Required)

- ☐ Kwanlin Dün First Nation citizen or beneficiary
- ☐ Ta'an Kwäch'än Council citizen
- ☐ Another First Nation citizen or beneficiary
- ☐ None of the above
- ☐ Prefer not to say

Overall, how supportive are you of the land use concept option 1?

(Choose any 1 options) (Required)

- ☐ Very supportive
- ☐ Somewhat supportive
- ☐ Neutral
- ☐ Somewhat opposed
- ☐ Very opposed

Overall, how supportive are you of the land use concept option 2?

(Choose any 1 options) (Required)

- ☐ Very supportive
- ☐ Somewhat supportive
- ☐ Neutral
- ☐ Somewhat opposed
- ☐ Very opposed

Considering the greenspaces, which land use concept option do you prefer?

(Choose any 1 options) (Required)

—

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Copper Ridge Development Area

Engage Whitehorse

- [ ] Option 1
- [ ] Option 2
- [ ] Other (please specify)

Considering the residential uses and density, which land use concept option do you prefer?

(Choose any 1 options) (Required)

- [ ] Option 1
- [ ] Option 2
- [ ] Other (please specify)

Considering the trails and active transport network, which land use concept option do you prefer?

(Choose any 1 options) (Required)

- [ ] Option 1
- [ ] Option 2
- [ ] Other (please specify)

Considering the road layout, which land use concept option do you prefer?

(Choose any 1 options) (Required)

- [ ] Option 1
- [ ] Option 2
- [ ] Other (please specify)

Overall, which land use concept option do you prefer?

(Choose any 1 options) (Required)

- [ ] Option 1
- [ ] Option 2
- [ ] Other (please specify)

Is anything missing from the land use concept options?

(Required)

Finally, how did you hear about this survey? Select all that apply:

(Choose all that apply) (Required)

- [ ] Engagewhitehorse.ca project update
- [ ] Radio or newspaper advertisement
- [ ] City social media
- [ ] City Newsletter
- [ ] Other (please specify)

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Appendix C. Supporting Studies

Associated Environmental

FINAL REPORT

Government of Yukon
Community Services, Land Development

Phase I Environmental Site Assessment
Lot 519 and 520 Copper Ridge
Whitehorse, Yukon

JUNE 2022

AE Project Number: 2022-8202.001

A Carbon Neutral Company

CANADA BEST MANAGED COMPANIES Platinum member

EXECUTIVE SUMMARY

Associated Environmental Consultants Inc. (Associated) was retained by the Government of Yukon, Community Services Land Development Branch, in May 2022 to conduct a Phase I Environmental Site Assessment (ESA) of two land parcels located at Lot 520 and Lot 519 in the Copper Ridge Subdivision of the City of Whitehorse, Yukon (the Subject Site), to support the potential development of the Subject Site.

The Subject Site is in a predominantly residential area. Based on available aerial photographs dating back from 1995 to the present day, the Subject Site appears densely vegetated with no signs of development. A current and historical land title search confirmed Lot 519 to be untitled. The registered title owner of Lot 520 since June 2022, is the City of Whitehorse. At the time of the reconnaissance on June 3, 2022, the Subject Site comprised forested vacant land and is used by the public as a recreational walking area and thoroughfare.

An on-site groundwater well was observed in the southwest (on Lot 520). Based on discussions with the City of Whitehorse Water & Waste Services, it is understood that the well is used to assess local groundwater and the performance of the rock pit on Lot 520, which receives surface drainage from the residential properties to the west of the Subject Site. The City of Whitehorse advised that any future development on the Subject Site will need to consider surface water drainage and the incorporation of the monitoring well and rock pit located on Lot 520.

Neighbouring and upgradient land use since 1995 has comprised forested areas up until residential development began.
A fuel storage tank is located at the Continuing Care Facility (60 Lazulite Road, Whitehorse, YT), approximately 160 m away. Based on the distance with no reports of spills, the fuel storage tank is not considered an APEC to the Subject Site.

No on-site or off-site APECs were identified. Based on the Phase I ESA results, there is **low potential** [1] that current or past land use activities at the Subject Site or on neighbouring properties have resulted in contamination of soil and/or groundwater, alongside vapour risk, at the Subject Site, with respect to Park (PL) and Residential Land Uses (RL) standards. Further investigation (i.e., Phase II Environmental Site Assessment) is not warranted.

This executive summary is subject to the limitations presented in the Disclaimer provided in section 12 of this report.

[1] **High potential** means there is either physical or visual/olfactory or very recent factual evidence of contamination on site. **Moderate potential** means there is evidence of past or current land uses or infrastructure with potential to release contaminant/s into the environment. **Low potential** means there is little or no evidence of sources of contamination.

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LIST OF ABBREVIATIONS

AST	aboveground storage tank
APEC	area of potential environmental concern
AW	CSR groundwater standards for the protection of aquatic life
CSA	Canadian Standards Association
CSR	*Contaminated Sites Regulation*
DW	CSR groundwater standards for the protection of drinking water
ECCC	Environment and Climate Change Canada
EOR	Environmental Offenders Registry
ESA	Environmental Site Assessment
ERIS	Environmental Risk Information Services
FCSI	Federal Contaminated Sites Inventory
FST	fuel storage tank
ID	Identification
IW	CSR groundwater standards for the protection of irrigation water
LW	CSR groundwater standards for the protection of livestock water
NPRI	National Pollutant Release Inventory
PCOC	potential contaminant of concern
PL	The CSR soil Standards for Park Land Uses (PL)
PS	Public Services
RL	CSR soil standards for residential land use
RR	Restricted Residential Detached
RS	Residential Single Detached
UST	underground storage tank
YCSI	Yukon Contaminated Sites Inventory

Units & Symbols

°C	degrees Celsius
bgs	below ground surface
km	kilometre
L	litre
m	metre
m^2	square metre
m^3	cubic metre
masl	metres above sea level

1 INTRODUCTION

Associated Environmental Consultants Inc. (Associated) was retained by the Government of Yukon, Community Services Land Development Branch in May 2022 to conduct a Phase I Environmental Site Assessment (ESA) at two land parcels located at Lot 520 and Lot 519 in the Copper Ridge Subdivision of the City of Whitehorse, Yukon (the Subject Site) (Figure 1), to support the potential development of the Subject Site.

2 OBJECTIVE

The objective of the Phase I ESA was to determine if areas of potential environmental concern (APECs) and potential contaminants of concern (PCOC) exist for the Subject Site. The potential risk level of soil, vapour, and/or groundwater contamination was qualitatively assessed based on the past, current, or intended land use(s) at the Subject Site and neighbouring properties.

This report describes the methods and results of the Phase I ESA and, in consideration of the results, presents conclusions and recommendations.

3 SCOPE

The Phase I ESA was conducted in accordance with the general requirements of the Yukon *Contaminated Sites Regulation* (CSR) (O.I.C. 2002/171) of the Yukon *Environment Act* (RSV 2002, c.76) and followed the general protocols defined in the Canadian Standards Association (CSA) Z768-01 (R2022) – Phase I ESA standard (CSA 2022).

The scope of work included the following activities:

- Review of records;
- Interviews of individuals with knowledge of current and/or historical activities on the Subject Site and neighbouring properties;
- Visual inspection of the Subject Site and adjacent properties visible from either the Subject Site or public property, and
- Preparation of this Phase I ESA report, which includes a discussion of the risk of soil, groundwater, and vapour contamination at the Subject Site with respect to territorial standards for the current or intended land use.

The scope of work for a Phase I ESA does not include sampling or testing of any kind, including that of soil, groundwater, surface water, sediment, vapour, or building materials.

4 SITE DESCRIPTION

4.1 Location, Zoning and Land Use

The Subject Site comprises two legal lots located in the Copper Ridge Subdivision of Whitehorse, Yukon Territory (Figure 1), one land parcel is zoned Public Services and the second is zoned Parks and Recreation (the City of Whitehorse. 2022) (Table 4-1).

The Subject Site is irregular in shape and is bounded by Lot 518 (zoned Public Services) and Diamond Way to the north, Falcon Drive (road) to the east and south, and residential development to the west. The surrounding land use is predominantly residential (Figure 2).

A copy of the Survey Plan 83103 CLSR YT (dated December 14, 1999) (Government of Canada 2022a.) is enclosed in Appendix A.

Table 4-1
Subject Site Description

	Lot 519 Description	Lot 520 Description
Civic Address	The lot does not have a civic address.	From June 2022: 2121 Second Avenue, Whitehorse, Yukon Y1A 1C2.
Legal Land Description	Lot 519, Parcel ID: 8056308, Copper Ridge Subdivision. 99-0224 LTO YT. Plan number: 83103 CLSR YT.	Lot 520, Parcel ID: 8056309, Copper Ridge Subdivision. 99-0224 LTO YT. Plan number: 83103 CLSR YT.
Size	39,329.26 m^2	20,184.46 m^2
Zoning (land use)	Public Services with special modifications (PSx(c)). The special modification is that only schools, parks and outdoor participant recreation services, community recreation services and religious assemblies are permitted as a principal use, and only accessory buildings/structures are permitted as a secondary use.	Parks and Recreation (PR)
Site Use	Vacant	Vacant

4.1.1 Climate

The Subject Site is within the Upper Yukon-Stikine Basin climatic zone Cordilleran climatic region, characterized by long, cold winters and warm and dry summers (Yukon Ecoregions Working Group 2004). The nearest climate station (Whitehorse Airport – Climate ID: 2101300) is located approximately 2 km east of the Subject Site at an elevation of 706 masl. The station is currently active, and climate data are available for the years 1981 to 2010. The monthly average temperatures range from -15.2°C in January to 14.3°C in July. The mean annual precipitation is 262 mm, with 161 mm falling as rain and the rest as snow (ECCC 2022).

4.1.2 Geology

The bedrock geology of the Subject Site consists of Cretaceous period granodiorite, quartz diorite and diorite (Government of Yukon. 2022a). Depth to bedrock at the Subject Site is unknown; however, the depth to bedrock recorded during the drilling of groundwater wells in the surrounding area indicates that bedrock is at approximately 50 m bgs (Government of Yukon. 2022b.). The surficial geology of the area comprises fluvial deposits consisting of gravel, sand and clayey silt (Government of Yukon. 2022b).

4.1.3 Surface Waterbodies

Surface waterbodies located within a 1 km radius of the Subject Site comprise an unnamed stream, located approximately 560 m to the north (Government of Yukon. 2022b) and inferred up-gradient from the Subject Site.

4.1.4 Groundwater Wells

A search of the Yukon Water Well Registry (Government of Yukon. 2022b.) identified one registered groundwater well located within a 1.5 km radius of the Subject Site. The well is used as a test well and is not for potable water extraction. The Subject Site is not located within water well capture zone or a groundwater aquifer area.

A copy of the search is enclosed in Appendix B.

4.1.5 Topography and Inferred Surface Water and Groundwater Flow

Surface topography can influence the direction of contaminant migration at ground level. The local topography slopes to the east and towards the Yukon River (i.e., east from the Subject Site) (Government of Canada. 2022b.).

Groundwater is a common pathway for contaminant transport. Based on regional topography and the location and flow of surface waterbodies, groundwater beneath the Subject Site is inferred to flow in a generally east direction towards the Yukon River (Figure 2). The inferred groundwater flow direction for the general area is a good approximation; however, localized variations in actual flow direction may exist due to unverified subsurface features, temporal variation, and influence from surface waterbodies. Surveyed groundwater elevation measurements would be required to determine the actual groundwater flow direction. A topographic map is enclosed in Appendix B.

5 RELEVANT STANDARDS

Legislation applicable to contaminated sites was enacted under the *Environmental Act* (RSY 2002, c.76), which includes the CSR (O.I.C. 2002/171). The Subject Site is zoned Public Services (PSx(c)) and Parks and Recreation (PR) (City of Whitehorse 2012), and the immediate surrounding area is zoned predominantly residential; therefore, the CSR Standards for Park (PL) and Residential Land Uses (RL) are applicable for the Subject Site.

5.1 Soil Standards

Generic numerical soil standards (i.e., one value for each type of land use) are listed in CSR Schedule 1 and matrix numerical soil standards (i.e., different values dependent on possible exposure pathways) are listed in Schedule 2. The most stringent applicable matrix standards were used for all site-specific factors and included the following pathways for contamination to be exposed to human or environmental receptors:

- Intake of contaminated soils;
- Toxicity to soil invertebrates and plants; and
- Groundwater flow to surface water used by aquatic life.

5.2 Groundwater Standards

The applicable standards for groundwater at the Subject Site are provided in CSR Schedule 3.

Based on the results of the registry search (Government of Yukon. 2022b.) and municipal drinking water being supplied to the area from public groundwater supply wells within the Selkirk Aquifer system, and surface water from Schwatka and Hidden Lakes (over 2 km away), drinking water (DW) standards do not apply at the Subject Site.

Surface waterbodies located within a 1 km radius of the Subject Site comprise one unnamed stream, located approximately 560 m to the north and inferred up-gradient (Government of Yukon. 2022b.); therefore, standards for the protection of Aquatic Life (AW) do not apply.

No agricultural properties are located within a 1.5 km radius of the Subject Site; therefore, standards for the protection of Irrigation Water (IW) and Livestock Water (LW) do not apply.

6 METHODS

6.1 Records Review

The information typically reviewed for a Phase I ESA includes any available records, databases, maps, and reports relevant to the Subject Site and surrounding area (Table 6-1).

Table 6-1
Records Reviewed for Phase I ESA

Record	Purpose
Yukon GeoYukon Digital Online Maps database (Aerial photographs – Yukon Government Library). Google Earth aerial photographs	Aerial photographs provide a visual history of the Subject Site and surrounding area and typically show site features (e.g., buildings) and how the area has developed over time.
Land Zoning	Land zoning information for the Subject Site and surrounding area is obtained from the City of Whitehorse Zoning Bylaw 2012-20 Schedule A Zoning Map. Land zoning is used to determine current use and CSR Standard(s) for the Subject Site.
Land Titles Search	Land Titles indicate the registered owners of the Subject Site over time.
City Directories	Reverse Directories indicate who has operated at an address over time (search by address). Telephone Directories indicate who has operated at an address over time, but the search input is by a business or a person's name.
Yukon Water Well Registry	The Water Well Registry identifies groundwater well records, well water capture zones, and basins.
Yukon Government, Public Registry of Contaminated Sites	The Site Registry provides environmental records for sites in Yukon with known occurrences of soil, groundwater or vapour contamination and documents any remediation efforts.
Environment and Climate Change Canada (ECCC) National Pollutant Release Inventory (NPRI)	The NPRI is a legislated record of pollutant releases (i.e., to air, land and water), disposables, and transfers for recycling. It comprises information reported by facilities and published by ECCC, as per sections 46 to 50 of the *Canadian Environmental Protection Act, 1999* (SC 1999, c. 33), as well as emission summaries and trends for key air pollutants based on facility-reported data and emission estimates for other sources, such as motor vehicles, residential heating, forest fires, and agriculture. Data is currently only available for the years 1993 to 2020.
Federal Contaminated Sites Inventory (FCSI)	The FCSI is an online database of contaminated sites, which includes information on all known federal contaminated sites under the custodianship of departments, agencies and consolidated Crown corporations, as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment (Government of Canada 2019).
Environmental Offenders Registry (EOR)	The Environmental Offenders Registry contains information on convictions of corporations obtained under certain federal environmental laws.
Storage Tank Permits	The Yukon Government Fire Marshals Office provides information pertaining to underground storage tank permits for the Subject Site.

Record	Purpose
Environmental Risk Information Services (ERIS)	ERIS conducted searches of several databases for detailed environmental risk data and records of properties that may present environmental risks. The following reports were obtained from ERIS: • Designated Material Permits (DMP) • Fuel Storage Tanks (FST) • Spills (SPL) • Scott's Manufacturing Directory (SCT) • Waste Receivers (REC) • Relocation Permits (REL) • Special Waste Permits (SWP)
Previous Reports (if available)	Previous environmental reports can determine if (or to what degree) environmental work has been conducted on the Subject Site and neighbouring properties.

6.2 Site Interviews

Associated interviewed the following individuals to obtain anecdotal and/or documented accounts of current and past uses of the Subject Site and neighbouring properties:

- Mathieu Marois (Senior Planner with the City of Whitehorse)
- Taylor Eshpeter (Engineering Services Manager with the City of Whitehorse)
- Arcadio Rodriguez (Water and Waste Services Assistant Manager with the City of Whitehorse)

The results of the interviews are discussed in Section 8.

6.3 Site Visit

On June 3, 2022, Associated conducted a reconnaissance of the Subject Site and an overview of the surrounding areas. The purpose of the site visit was to aid in the determination of APECs both on and off the Subject Site.

The site reconnaissance involved a visual assessment of the grounds and buildings and of neighbouring properties visible from the Subject Site or public property. The following, if observed, were examined and noted during the reconnaissance: surface and sub-surface drainage patterns, chemical storage and handling, non-hazardous and hazardous waste, air and water discharges, stockpiling/dumping/landfilling activities, and evidence of contamination (e.g., odours and staining), materials and waste product handling, use, disposal methods and storage vessels (e.g., sumps and aboveground and underground storage tanks).

Results of the site reconnaissance are provided in Section 9, and select site photographs are provided in Appendix C.

7 RECORDS REVIEW

The following sections provide the results of the records review. Indications of any environmental risks are described in Section 10.

7.1 Aerial Photographs and Satellite Imagery

The results of the aerial photograph review are provided in Table 7-1. Aerials for years between the 1920s to 1980s were not available for the Subject Site. However, based on anecdotal information, the development of the area did not begin until the mid-1990s.

Table 7-1
Interpretation of Aerial Photographs

Date of Photograph	Subject Site	Surrounding Area
1995	Undeveloped and forested. A thoroughfare intersects the Subject Site from the southeast to the northwest.	Road infrastructure has been constructed (similar to 2022). Surrounding areas are forested. Residential development is observed to the east of Hamilton Boulevard, approximately 370 m northeast of the Subject Site.
2019	No significant changes.	The area around the road infrastructure has been developed as residential. The Copper Ridge Pump House to the east and retirement home to the north have been constructed.
2020	No significant changes.	No significant changes.
2022	No significant changes.	No significant changes.

Note:
*All distances from the Subject Site are approximations.

7.2 Current and Historical Land Titles

A current and historical land title search completed on June 8, 2022, confirmed Lot 519 to be untitled. The registered title owner of Lot 520 since June 2022 is the City of Whitehorse. The land title for Lot 520 is provided in Appendix D.

7.3 City Directories

No city or telephone directories were available for review.

7.4 Permitting

The City of Whitehorse External Planning Theme (City of Whitehorse. 2022) was searched, and 0 permits were identified in connection to the Subject Site.

7.5 Previous Environmental Reports

No previous environmental reports were available for review.

7.6 Federal Contaminated Sites Inventory

A search of the FCSI identified 0 contaminated sites under federal jurisdiction within an approximate 250 m radius of the Subject Site (Government of Canada. 2022c.). The FCSI search is enclosed in Appendix E.

7.7 Yukon Contaminated Sites Inventory

Associated reviewed the YCSI database and identified 0 records within an approximate 250 m radius of the Subject Site (Government of Yukon. 2022c.). The YCSI search is enclosed in Appendix F.

7.8 National Pollutant Release Inventory

A search of the NPRI identified 0 records within a 250 m radius of the Subject Site (Government of Canada. 2022d.).

7.9 Environmental Offenders Registry

A search of the EOR identified 0 records within a 250 m radius of the Subject Site (Government of Canada. 2022e.).

7.10 Storage Tanks

7.10.1 Storage Tank Permits

Associated contacted the Deputy Fire Marshall, Community Services, on May 25, 2022, to request information pertaining to any former or present USTs on the Subject Site and adjacent properties. Associated received a response on May 25, 2022; 0 records were found. A copy of the email communication is provided in Appendix G.

7.11 Environmental Risk Information Service

Associated submitted a request to ERIS for a review of various databases as they pertain to the Subject Site and surrounding properties. The ERIS Database identified 0 records for the Subject Site and two records for one property located within a 250 m radius of the Subject Site in relation to fuel storage tanks.

The two off-site records are summarized below. A copy of the ERIS report is provided in Appendix H.

7.11.1 Fuel Storage Tanks

A search of the Fuel Storage Tanks (FST) database for the years 1997 to October 2021 returned 2 records for a property located within a 250 m radius of the Subject Site (Table 7-2).

Table 7-2
Fuel Storage Tanks

Company and Location	Permit Details	Permit Date	Direction and Distance from Subject Site[1]
Continuing Care Facility 60 Lazulite Road, Whitehorse, YT.	Permit for the installation of a commercial fuel tank (permit number 01012).	Issued: May 2001, expired: December 2001	160 m northwest (inferred downgradient)
	Permit for the operation of a commercial fuel tank (permit number 01057).	Issued: December 2001, expired: January 2005	

Note:
[1] Distances are approximations from the closest property boundary.

7.12 Third-Party Reports

No third-party reports were obtained for the Subject Site.

8 SITE INTERVIEWS

Associated interviewed Mathieu Marois, a Senior Planner with the City of Whitehorse, on June 10, 2022, to obtain anecdotal and/or documented accounts of current and past uses of the Subject Site and neighbouring properties. Information obtained from the interview is included in Section 9.0.

Associated also contacted Taylor Eshpeter (Engineering Services Manager) and Arcadio Rodriguez (Water and Waste Services Assistant Manager) at the City of Whitehorse on June 10, 2022, for information regarding the groundwater well identified on the Subject Site (Lot 520).

8.1 Groundwater Monitoring Well

Associated received a response from the City of Whitehorse Engineering Services Manager on June 17, 2022, and Water & Waste Services on June 18, 2022. Engineering Services did not have any information in relation to the groundwater monitoring well, and Water & Waste Services provided the following information:

- The groundwater monitoring well is used to assess local groundwater and the performance of the nearby rock pit.
- The monitoring well is 8.0 m bgs.
- The rock pit receives surface drainage from the back of the residential buildings located adjacent to the west of the Subject Site.
- Future development on the Subject Site will need to consider surface water drainage and the incorporation of the monitoring well and rock pit.

9 SUBJECT SITE RECONNAISSANCE

Associated conducted a reconnaissance of the Subject Site on June 3, 2022. The reconnaissance was documented with notes and photographs, and the results are discussed below. Select photographs of features noted during the reconnaissance are provided in Appendix C. There were no access limitations during the site visit.

9.1 Site Operations

The Subject Site is currently vacant. The Subject Site is used by the public as a recreational area for walking and as a thoroughfare; dirt trails were observed during the site visit.

9.2 Grounds

The grounds at the Subject Site are described in Table 9-1. Key features observed are shown in Figure 2.

Table 9-1
Observations of Subject Site Grounds

Subject Site Grounds	Comments/Observations
Ground cover	Bare ground and vegetation, including mature trees (forested). Fire pits were observed (*photograph 7 and 8 (Appendix C)*).
Roads, Parking, Rights of Way	A thoroughfare dirt track is located between Falcon Drive to the south and Copper Ridge Place to the north (*photograph 5*). There are also several smaller dirt trails throughout, which are used for recreation and as thoroughfares.
Overhead and/or underground lines	Overhead and underground utility lines surround the Subject Site.
Potential noise sources	None identified at the time of the site visit.
Vegetation	Vegetation appears to be within seasonal norms.
Visual or olfactory signs of contamination	None observed.
Fill Materials	None observed.
Storage Tanks (aboveground or underground)	No evidence of ASTs or USTs.
Evidence of underground structures	No evidence of underground structures.
Groundwater wells	One groundwater monitoring well was observed the southwest of the Subject Site (on Lot 520), close to Falcon Drive (*photograph 2*).
Non-hazardous waste generation and handling	Waste is not being generated on the Subject Site.
Hazardous materials/chemical and fuel storage	None observed.
Drains/Sumps/Oil water separators	None observed.
Pits, lagoons	None observed.
Wastewater or other discharges	None observed.
Surface waterbodies, ditches or standing water	A rock pit was observed in the southwest corner of the Subject Site (on Lot 520) (*photograph 4*). The pit was dry at the time of the site visit. The pit receives and temporarily holds excess stormwater from adjacent residential properties, which infiltrates into the underlying soil.
Drainage	Surface water drainage is through infiltration into underlying soils.

9.3 Buildings and Structures

No buildings or permanent structures were observed on the Subject Site.

9.4 Neighbouring Properties

Properties surrounding the Subject Site are predominantly residential. Table 9-2 lists the neighbouring properties at the time of the site reconnaissance, and Figure 2 shows the locations of neighbouring properties.

Table 9-2
Neighbouring Properties

Direction Relative to Subject Site	Description
North (Inferred cross-gradient)	**North adjacent:** - Vacant vegetated land - Copper Ridge Place (retirement home at 60 Lazulite Road) (zoned (PS) Public Services - (Lot 518)) (photograph 6) - 160 m north - Diamond Way (road) **Northeast adjacent:** - Falcon Drive (road) - Beyond Falcon Drive: Developed residential (zoned (RS) Residential Single Detached) **Northwest adjacent:** - Developed with residential buildings (zoned RS) - Beyond residential area: Tigereye Crescent (road) and developed residential (zoned RS)
East (Inferred down-gradient)	**East adjacent:** - Falcon Drive (road) - Beyond Falcon Drive: Developed residential (zoned RS) and Copper Ridge Pump House (photograph 1).
South (Inferred cross-gradient)	**South adjacent:** - Falcon Drive (road) - Beyond Falcon Drive: Developed residential (zoned (RR) Restricted Residential Detached) **Southwest adjacent:** - Developed residential (zoned RS) and Falcon Drive (road) **Southeast adjacent:** - Developed residential (zoned RS) and Falcon Drive (road)
West (Inferred up-gradient)	**West adjacent:** - Public right of way (footpath) - Developed with residential buildings (zoned RS) - Beyond residential area: Tigereye Crescent (road) and developed residential (zoned RS)

Note: *distances are approximations from the closest property boundary.
Zoning information is from the City of Whitehorse. 2022.

10 INDICATIONS OF ENVIRONMENTAL RISK

The potential for soil, groundwater, and/or vapour concentrations exceeding territorial standards is derived from current and historical land uses on the Subject Site. Neighbouring properties can also pose environmental risks based on their current and past uses and their distance and relative position to the Subject Site with respect to the groundwater flow gradient. Upgradient sites are generally associated with higher risk because of the potential for groundwater transport of contaminants to downgradient locations.

The environmental risk at the Subject Site, and associated rationale, is described below.

10.1 Subject Site

The Subject Site is in a predominantly residential area. Based on available aerial photographs dating back to 1995 to the present day, the Subject Site appears forested with no signs of development. A current and historical land title search confirmed Lot 519 to be untitled. The registered title owner of Lot 520 since June 2022 is the City of Whitehorse.

At the time of the site visit on June 3, 2022, the Subject Site was comprised of forested vacant land and is used by the public for recreational walking and thoroughfare.

An on-site groundwater well was observed in the southwest (on Lot 520). The well is not listed on the Water data catalogue (Government of Yukon. 2022d.) or the Groundwater water well registry (Government of Yukon. 2022b) however, based on discussions with the City of Whitehorse Water & Waste Services, it is understood that the well is used to assess local groundwater (flow and level monitoring) and the performance of the rock pit on Lot 520, which receives surface drainage from the residential properties to the west of the Subject Site.
The City of Whitehorse advised that any future development on the Subject Site will need to consider surface water drainage and the incorporation of the monitoring well and rock pit located on Lot 520.

No on-site APECs were identified.

10.2 Neighbouring Properties

The surrounding area has been predominantly residential since 1995, with forested areas.

The fuel storage tank located at the Continuing Care Facility (Copper Ridge Place, 60 Lazulite Road, Whitehorse, YT) is not an APEC to the Subject Site, due to distance and no reports of spills.

No off-site APECs were identified.

11 CONCLUSIONS AND RECOMMENDATIONS

Based on the Phase I ESA results, there is **low potential** [2] that current or past land use activities at the Subject Site or on neighbouring properties have resulted in contamination of soil and/or groundwater, alongside vapour risk, at the Subject Site, with respect to Park (PL) and Residential Land Uses (RL) standards. Further investigation (i.e., Phase II Environmental Site Assessment) is not warranted.

12 DISCLAIMER

STANDARD DISCLAIMER FOR CONTAMINATED SITE INVESTIGATIONS, MONITORING AND CONFIRMATION OF REMEDIATION SERVICES

Subject to the following conditions and limitations, the investigation described in this report has been conducted by Associated Environmental Consultants Inc. (Associated) for **Government of Yukon, Community Services Land Development Branch** (the Client).

1. The scope of the investigation described in this report has been limited by the budget set for the investigation in the work program. The scope of the investigation has been reasonable having regard to that budget constraint.
2. The investigation described in this report has been limited to the scope of work described in the work program.
3. The investigation described in this report has relied upon information provided by third parties concerning the history of the site. Except as stated in this report and subject to the standard of care stated in the contract, we have not made an independent verification of such historical information.
4. The investigation described in this report has been made in the context of existing government regulations generally promulgated at the date of this report. Except as specifically noted, the investigation did not take account of any government regulations not in effect at the date of this report.
5. The findings and conclusions are valid only for the specific site identified in the report.
6. Since site conditions may change over time, the conclusions in the report may not be valid due to a change in site conditions.
7. This report is intended for the use of the Client, including all successors and assigns. The material in it reflects Associated's best judgement, in light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report and makes no representation of fact or opinion of any nature whatsoever to any person or entity other than the Client.

[2] **High potential** means there is either physical or visual/olfactory or very recent factual evidence of contamination on site. **Moderate potential** means there is evidence of past or current land uses or infrastructure with potential to release contaminant/s into the environment. **Low potential** means there is little or no evidence of sources of contamination.

13 CLOSING

This Phase I ESA report was prepared for Government of Yukon, Community Services Land Development Branch, to determine if APECs and PCOCs exist for the Subject Site. The potential risk level of soil, vapour, and/or groundwater contamination was qualitatively assessed based on the past, current or intended land use(s) at the Subject Site and neighbouring properties.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

We trust this completes the assignment to your satisfaction. Please feel free to contact the undersigned if you have any questions.

This report was prepared by:
Associated Environmental Consultants Inc.

Gemma Simmons, M.Sc.
Project Manager

The report was reviewed by:
Associated Environmental Consultants Inc.

Trevor Roste, P.Ag.
Environmental Scientist

14 QUALIFICATIONS OF ASSESSORS

Gemma Simmons, M.Sc.
Role: Environmental Scientist, Project Manager
Experience: Gemma is an Environmental Scientist with over nine years of experience in environmental consulting both overseas and in Canada. Gemma has experience working on and managing a variety of small to large-scale contaminated site projects, from inception through to completion. Past project experience includes environmental and geotechnical site assessments, hazardous building materials assessments, risk assessments, soil and groundwater sampling, earthworks and soil and groundwater remediation.

Trevor Roste, P.Ag.
Role: Environmental Scientist
Experience: Trevor is an Environmental Scientist with 19 years of experience in environmental consulting. He specializes in contaminated sites projects, ranging from preliminary and detailed site investigations, site remediation, risk assessments, soil vapour assessment, and groundwater investigations. Trevor has managed hundreds of contaminated sites projects, ranging from small-scale to large complex sites. His main clients have included several large upstream and downstream oil and gas companies, provincial and municipal governments, commercial business owners, First Nation Bands, and private property owners. The project scopes that he has managed include emergency spill response, preliminary and detailed site investigations, site remediation, risk assessments, soil vapour assessments, background soil and groundwater investigations and site closures. Trevor has a thorough understanding of the BC Contaminated Sites Regulations and the regulatory close process. He has recently assisted with the acquisition of over 15 regulatory closures (Certificates of Compliance or Determinations) of properties across BC. He has also facilitated the acquisition of over 50 regulatory closures (Certificates of Restoration Part 1) of former oil and gas well sites in northeast BC. Trevor is a Professional Agrologist (P.Ag.) with BC Institute of Agrologists (#3139).

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Year	Photo Identification Number	Year	Photo Identification Number
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2020	No ID	1995	No ID

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Yukon Fire Marshal. Email communication May 25 to 27, 2022.

FIGURES

Associated Environmental

Legend:

- Site Location

FIGURE 1

PHASE I ESA'S COPPER RIDGE, HILLCREST AND HEMLOCK WHITEHORSE YT

COPPER RIDGE SITE LOCATION

AE PROJECT No.	2022-8202
SCALE	1:25,000
APPROVED	
DATE	2022JUN07
REV	
DESCRIPTION	ISSUED FOR DRAFT

Associated Environmental

Legend:

- Subject Site Boundary
- Elevation

Land Use

- FP Future Planning
- PE Environmental Protection
- PG Greenbelt
- PR Parks and Recreation
- PS Public Services
- RM Residential Multiple Housing
- RR Restricted Residential Detached
- RS Residential Single Detached

- Groundwater well
- Surface water drainage ditch
- Inferred groundwater flow: east to northeast

FIGURE 2

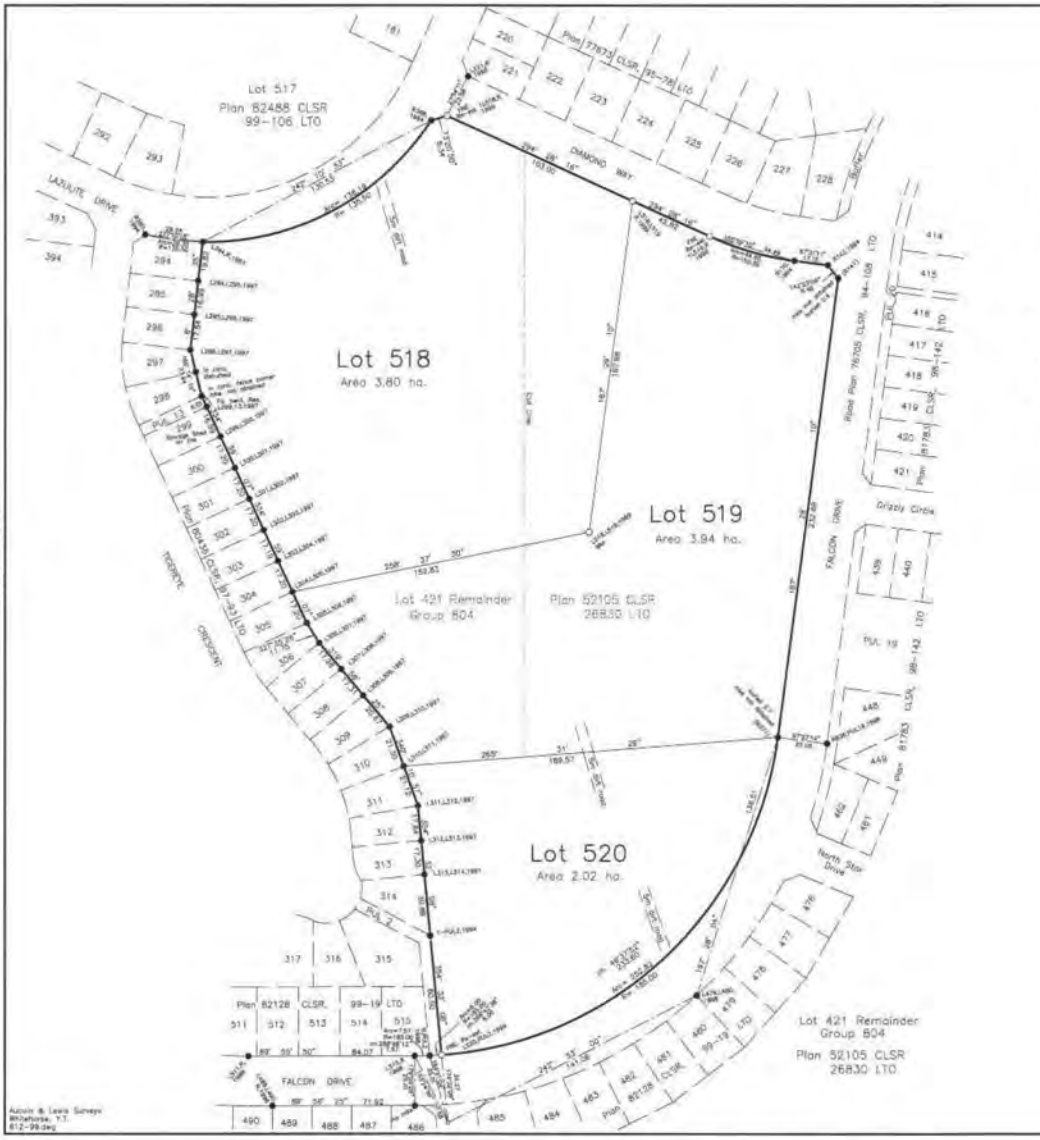
PHASE I ESA'S COPPER RIDGE, HILLCREST AND HEMLOCK WHITEHORSE YT

COPPER RIDGE LANDUSE

AE PROJECT No.	2022-8202
SCALE	1:3,000
APPROVED	
DATE	2022JUN06
REV	
DESCRIPTION	ISSUED FOR DRAFT

SAVE DATE: 6/6/2022 5:19:09 PM SAVED BY:
DRAWING PATH: C:\2022-8202_Phase1_CR_HC_HW\Mxd\Landuse\fig2_CopperRidge_Landuse.mxd
DATA SOURCE: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS;

APPENDIX A – SURVEY PLANS



CANADA LANDS SURVEYS RECORDS				
8	3	1	0	3
DECEMBER		14		1999

A copy of this plan is filed in the Land Titles Office at Whitehorse, YT as 99-0224 LTO on December 14, 1999

PLAN AND FIELD NOTES
OF SURVEY OF

LOTS 518, 519 AND 520

COPPER RIDGE SUBDIVISION

Comprising part of Lot 421 Remainder, Group 804
Plan 52105 CLSR, 26830 LTO.

CITY OF WHITEHORSE
YUKON TERRITORY

SCALE 1:1000

THIS SURVEY WAS EXECUTED DURING THE PERIOD SEPTEMBER 17 TO 24 AND NOVEMBER 19, 1999, BY GABRIEL AUCOIN, C.L.S.

LEGEND:

Bearings are UTM grid derived from the bearing 187° 29' 10" for the line between found CLS77's R141 and R371, Plan 76705 CLSR, 94-108 LTO, and according to that Plan are referred to the Central Meridian of UTM Zone 8 (135° West Long.)

Distances shown are horizontal at general ground level and are expressed in metres

CLS 77 posts found shown thus ●
CLS 77 posts placed shown thus ○
Traverse lines and stations shown thus
Lands dealt with by this plan shown thus

CERTIFIED CORRECT: Nov 29 1999

Gabriel Aucoin, CLS

Gabriel D. Aucoin
Commission No. 165

THIS SURVEY AND PLAN ARE SATISFACTORY

Commissioner of the Yukon Territory

Department of Natural Resources
Re: Section 29, Canada Lands Surveys Act
CONFIRMED: December 14, 1999

Brian Thompson, Head, Cadastral Services
Yukon Territory, Legal Surveys Division

CLSR 83103

APPENDIX B – TOPOGRAPHIC MAP, SURFACE WATER AND GROUNDWATER INFORMATION

The Atlas of Canada - Toporama

Government of Canada | Gouvernement du Canada

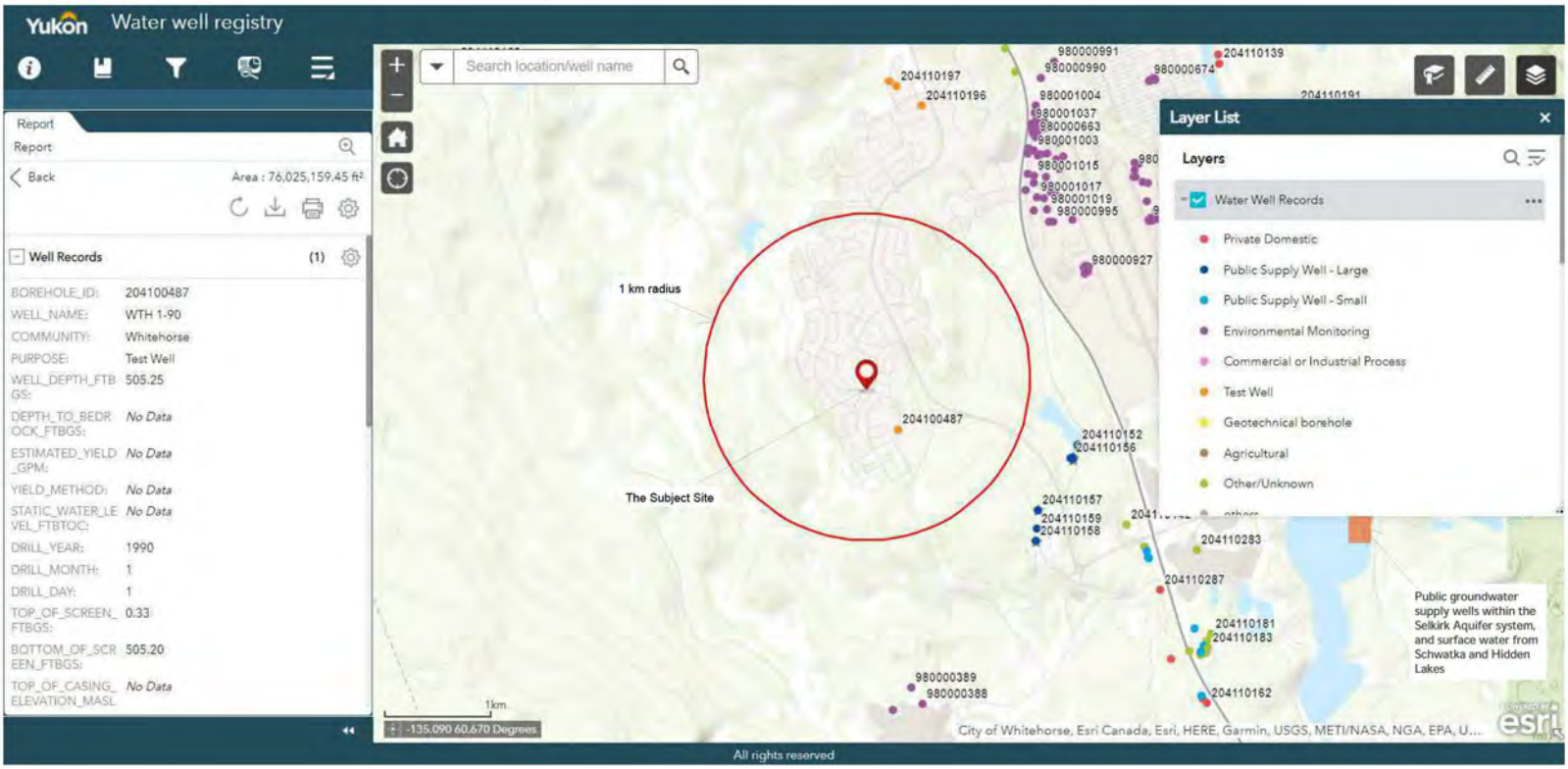
Instructions: Keyboard Navigation

Toporama

Menu

Position: 60° 41' 55" N | 135° 11' 19" W
60.699 N | 135.189 W

0 0.5 1km

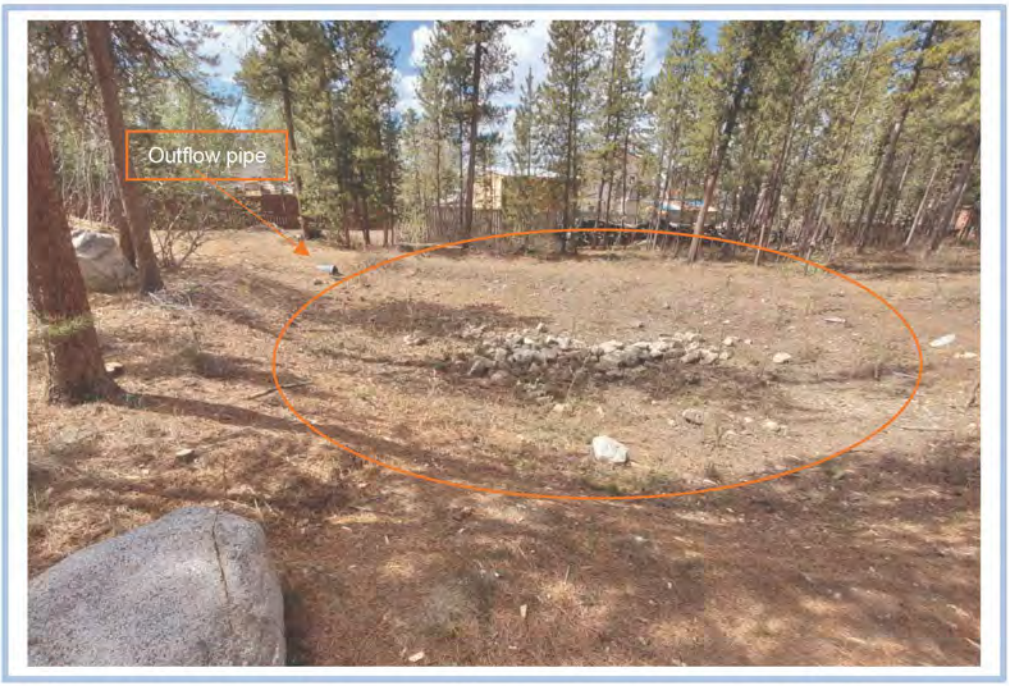

Yukon
Water well registry
Report
Report
Back
Area : 76,025,159.45 ft²
Well Records (1)
BOREHOLE_ID: 204100487
WELL_NAME: WTH 1-90
COMMUNITY: Whitehorse
PURPOSE: Test Well
WELL_DEPTH_FTBGS: 505.25
DEPTH_TO_BEDROCK_FTBGS: No Data
ESTIMATED_YIELD_GPM: No Data
YIELD_METHOD: No Data
STATIC_WATER_LEVEL_FTBTOC: No Data
DRILL_YEAR: 1990
DRILL_MONTH: 1
DRILL_DAY: 1
TOP_OF_SCREEN_FTBGS: 0.33
BOTTOM_OF_SCREEN_FTBGS: 505.20
TOP_OF_CASING_ELEVATION_MASL: No Data
Search location/well name
1 km radius
The Subject Site
204100487
204110197
204110196
980000991
980000990
980000674
204110139
980001004
980001037
980000663
980001003
980001015
980001017
980001019
980000995
980000927
204110152
204110156
204110157
204110159
204110158
204110283
204110287
204110181
204110183
204110162
980000389
980000388
Layer List
Layers
Water Well Records
Private Domestic
Public Supply Well - Large
Public Supply Well - Small
Environmental Monitoring
Commercial or Industrial Process
Test Well
Geotechnical borehole
Agricultural
Other/Unknown
Public groundwater supply wells within the Selkirk Aquifer system, and surface water from Schwatka and Hidden Lakes
1km
-135.090 60.670 Degrees
City of Whitehorse, Esri Canada, Esri, HERE, Garmin, USGS, METI/NASA, NGA, EPA, U...
All rights reserved

APPENDIX C – PHOTOGRAPHS

Photograph 1: *Pumphouse located on Falcon Drive to the south of the Subject Site (looking southeast) (June 3, 2022).*

Photograph 2: *a groundwater monitoring well (circled), was observed in the southwest of the Subject Site and close to Falcon Drive in the south. The well was locked. (June 3, 2022).*

Photograph 3: *a dirt trail in the west is used as a throughfare between Falcon Drive and residential buildings on Tigereye Crescent (June 3, 2022).*



Photograph 4: *Surface water drainage ditch with outflow pipe (circled) located in the southwest corner of the Subject Site (looking west) – source of water from drainage pipe is unknown (likely from the south) (June 3, 2022).*

Photograph 5: *a throughfare goes though the Subject Site between Falcon Drive and Copper Ridge Place (retirement home), (looking north from the southern boundary of the Subject Site) (June 3, 2022).*

Photograph 6: *Copper Ridge Place located north of the Subject Site (looking north) (June 3, 2022).*

Photograph 7: *fire pits were observed on the Subject Site (June 3, 2022).*

Photograph 8: *empty diesel bottles – possibly used as a fire igniter (June 3, 2022).*

Photograph 9: *residential properties located along the western boundary of the Subject Site (looking west) (June 3, 2022)*

Photograph 10: *areas have been cleared, with stacked log piles seen on the Subject Site (June 3, 2022)*

Photograph 11: *Falcon Drive to the south, with residential buildings and Iron Horse Drive (looking southeast from the corner of the southwest Subject Site boundary) (June 3, 2022)*

Photograph 12: *view of the eastern portion of the Subject Site and Copper Ridge Place to the north (looking west from Diamond Way) (June 3, 2022)*

APPENDIX D – LAND TITLES

CERTIFICATE OF TITLE

Yukon • Canada

[redacted]

FEE SIMPLE

[redacted]

Title #: 100250345
Title Status: Active
Parcel Value: $1.00
Title Value: $1.00
Last Title Transfer Value: $1.00
Converted Title #: 2000Y0615
Previous Title #: 2000Y0615
Title Creation Packet: 100210486

As of: 08 Jun 2022 09:58:16.000
Last Amendment Date: 03 Jun 2022 09:15:11.647
Issued: 03 Jun 2022 09:15:11.630
Community: City of Whitehorse
CLSR #: 83103
Grant #: 146732
Parcel Type: Surface Parcel
Parcel Class: Unknown

This is to certify that

CITY OF WHITEHORSE

is the registered owner of an estate in fee simple in

> **Legal Land Description:**
> Parcel #100170706; or
> Lot 520 Copper Ridge, City of Whitehorse, YT, Plan No. 99-0224

Subject to the encumbrances, liens and interests notified by memorandum underwritten or endorsed hereon, or which may hereafter be made in the Register.

Mailing Address:

Owner Name:	**Address:**
CITY OF WHITEHORSE Client #: 100005758	2121 SECOND Avenue, WHITEHORSE, Yukon Territory, Canada, Y1A1C2

Registrar's Notes:

This certificate is to be read subject to the provisions of section 59 of the Land Titles Act, 2015 SY 2015, c.10 and may be affected by sections 11-14 and 17 of the Territorial Lands (Yukon) Act SY 2003, c.17.

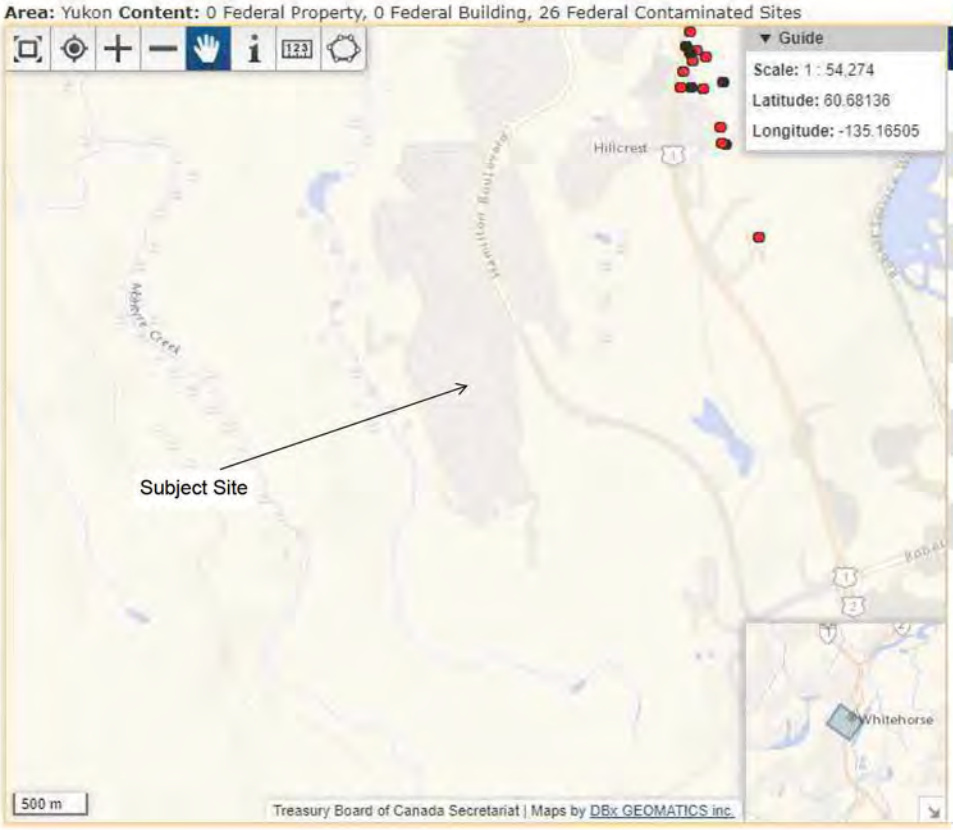
Registrar

This certificate is to be read subject to the provisions of section 59 of the Land Titles Act, 2015 SY 2015, c.10 and may be affected by sections 11-14 and 17 of the Territorial Lands (Yukon) Act SY 2003, c.17.

APPENDIX E – FEDERAL CONTAMINATED SITES INVENTORY

DFRP/FCSI - Map Navigator

Area: Yukon **Content:** 0 Federal Property, 0 Federal Building, 26 Federal Contaminated Sites



Layers | Search | Information

Control layers and labels visibility with the checkboxes. Control the base map with the select list. Actions will automatically update the map.

	Visibility	Labels
Federal Properties	[1]	
Federal Buildings	[1]	
Federal Contaminated Sites	[1, 2]	
Economic Region		
Census Divisions		
Census Subdivisions		
Metropolitan Areas		
Federal Electoral Districts		
Treaty Areas		

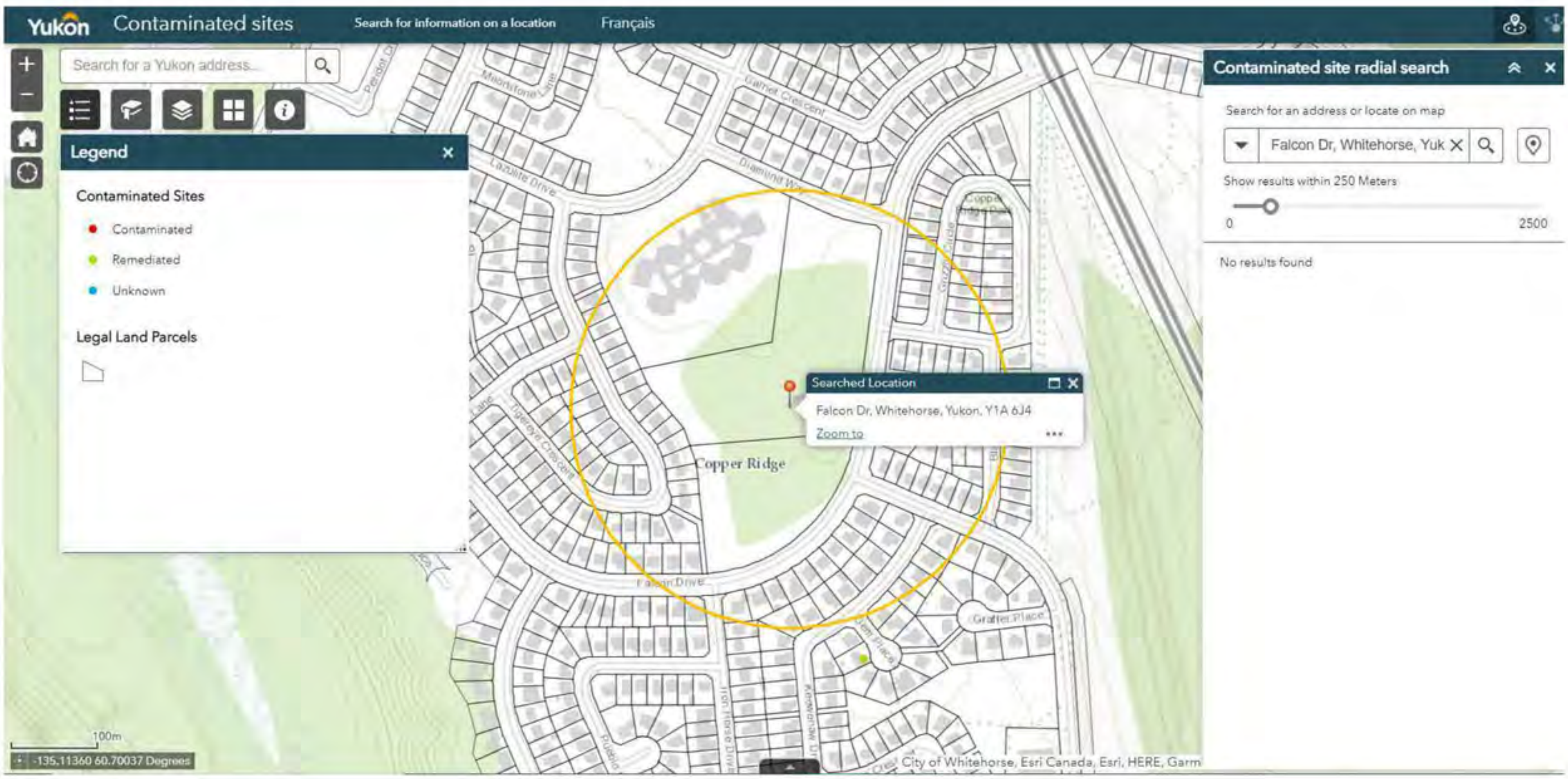
Base map: Standard [3]

[1] This layer is visible only when the map scale is smaller than 1:3,000,000.

[2] Suspected Active Closed

[3] Google base maps are only available when the map scale is smaller than 1:60,000.

APPENDIX F – YUKON CONTAMINATED SITES INVENTORY



Yukon
Contaminated sites
Search for information on a location
Français
Search for a Yukon address...
Legend
Contaminated Sites
Contaminated
Remediated
Unknown
Legal Land Parcels
Contaminated site radial search
Search for an address or locate on map
Falcon Dr, Whitehorse, Yuk
Show results within 250 Meters
0
2500
No results found
Searched Location
Falcon Dr, Whitehorse, Yukon, Y1A 6J4
Zoom to
Copper Ridge
Falcon Drive
Diamond Way
Lazulite Drive
Garnet Crescent
Grafter Place
Iron Horse Drive
100m
-135.11360 60.70037 Degrees
City of Whitehorse, Esri Canada, Esri, HERE, Garm

APPENDIX G – UNDERGROUND STORAGE TANK PERMITS

G

Grace.Waugh@yukon.ca
To Gemma Simmons
Cc Ursula.Geisler@yukon.ca

Follow up. Start by May 25, 2022. Due by May 25, 2022.
You replied to this message on 2022-05-25 6:16 PM.

Hi Gemma,

I have taken over from Ursula to look into these for you!

I was unable to find any records for both

Lot 519
Parcel IDL 8056308
Plan: 82488 CLSR YT
LTO: 99- 0224 LTO YT

and

Lot 520
Parcel ID: 8056309
Plan: 82488 CLSR YT
LTO: 99-0224 LTO YT

Thank you!
Grace

Yukon

Grace Sheardown Waugh
Administrative Assistant
Community Services | Fire Marshal's Office
|F 867-667-3165 | Yukon.ca

APPENDIX H - ERIS REPORT

ERIS

DATABASE REPORT

Project Property:	*Copper Ridge Infill Site* *Lot 519, Parcel ID: 8056308 and Lot 520, Parcel ID: 8056309, Copper Ridge Subdivision.* *Whitehorse YT*
Project No:	*2022-8202.001*
Report Type:	*Standard Select Report*
Order No:	*22053101045*
Requested by:	*Associated Environmental Consultants Inc.*
Date Completed:	*June 2, 2022*

Environmental Risk Information Services
A division of Glacier Media Inc.
1.866.517.5204 | info@erisinfo.com | erisinfo.com

Table of Contents

Executive Summary

Property Information:

Project Property:	*Copper Ridge Infill Site* *Lot 519, Parcel ID: 8056308 and Lot 520, Parcel ID: 8056309, Copper Ridge Subdivision. Whitehorse YT*
Project No:	*2022-8202.001*

Coordinates:

Latitude:	*60.6979085*
Longitude:	*-135.1080608*
UTM Northing:	*6,729,144.64*
UTM Easting:	*494,100.02*
UTM Zone:	*8V*

Elevation:	*2,536 FT* *773.00 M*

Order Information:

Order No:	*22053101045*
Date Requested:	*May 31, 2022*
Requested by:	*Associated Environmental Consultants Inc.*
Report Type:	*Standard Select Report*

Historical/Products:

Aerial Photographs	*Aerials - National Collection*
ERIS Xplorer	*ERIS Xplorer*
Land Title Search	*Current Land Title Search*

Executive Summary: Report Summary

Database	Name	Searched	Project Property	Within 0.25 km	Total
AIR	Air Emission Permits	N	-	-	-
AUWR	Automobile Wrecking & Supplies	N	-	-	-
CDRY	Dry Cleaning Facilities	N	-	-	-
CHM	Chemical Register	N	-	-	-
CNG	Compressed Natural Gas Stations	N	-	-	-
CS	Contaminated Site Inventory	N	-	-	-
DMP	Designated Material Permits	Y	0	0	0
EHS	ERIS Historical Searches	N	-	-	-
EIIS	Environmental Issues Inventory System	N	-	-	-
FCS	Contaminated Sites on Federal Land	N	-	-	-
FRST	Federal Identification Registry for Storage Tank Systems (FIRSTS)	N	-	-	-
FST	Fuel Storage Tanks	Y	0	2	2
GEN	Waste Generators	N	-	-	-
GHG	Greenhouse Gas Emissions from Large Facilities	N	-	-	-
HIS	Historic Sites Inventory	N	-	-	-
IAFT	Indian & Northern Affairs Fuel Tanks	N	-	-	-
LTF	Land Treatment Facilities	N	-	-	-
MINE	Canadian Mine Locations	N	-	-	-
MNR	Mineral Occurrences	N	-	-	-
NATE	National Analysis of Trends in Emergencies System (NATES)	N	-	-	-
NDWD	National Defence & Canadian Forces Waste Disposal Sites	N	-	-	-
NEBI	National Energy Board Pipeline Incidents	N	-	-	-
NEBT	National Energy Board Wells	N	-	-	-
NEES	National Environmental Emergencies System (NEES)	N	-	-	-
NPCB	National PCB Inventory	N	-	-	-
NPRI	National Pollutant Release Inventory	N	-	-	-
ODS	Ozone Depleting Substances & Other Halocarbons	N	-	-	-
OGWE	Oil and Gas Wells	N	-	-	-
PCFT	Parks Canada Fuel Storage Tanks	N	-	-	-
PES	Pesticide Register	N	-	-	-
REC	Waste Receivers	Y	0	0	0
REL	Relocation Permits	Y	0	0	0
RST	Retail Fuel Storage Tanks	N	-	-	-
SCT	Scott's Manufacturing Directory	Y	0	0	0
SPL	Spills	Y	0	0	0
SWP	Special Waste Permits	Y	0	0	0

Database	Name	Searched	Project Property	Within 0.25 km	Total
WDS	***Waste Disposal Sites***	*Y*	*0*	*0*	*0*
YOGW	***Yukon Oil and Gas Wells***	*N*	-	-	-
		Total:	*0*	*2*	*2*

Executive Summary: Site Report Summary - Project Property

Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev diff (m)	Page Number

No records found in the selected databases for the project property.

Executive Summary: Site Report Summary - Surrounding Properties

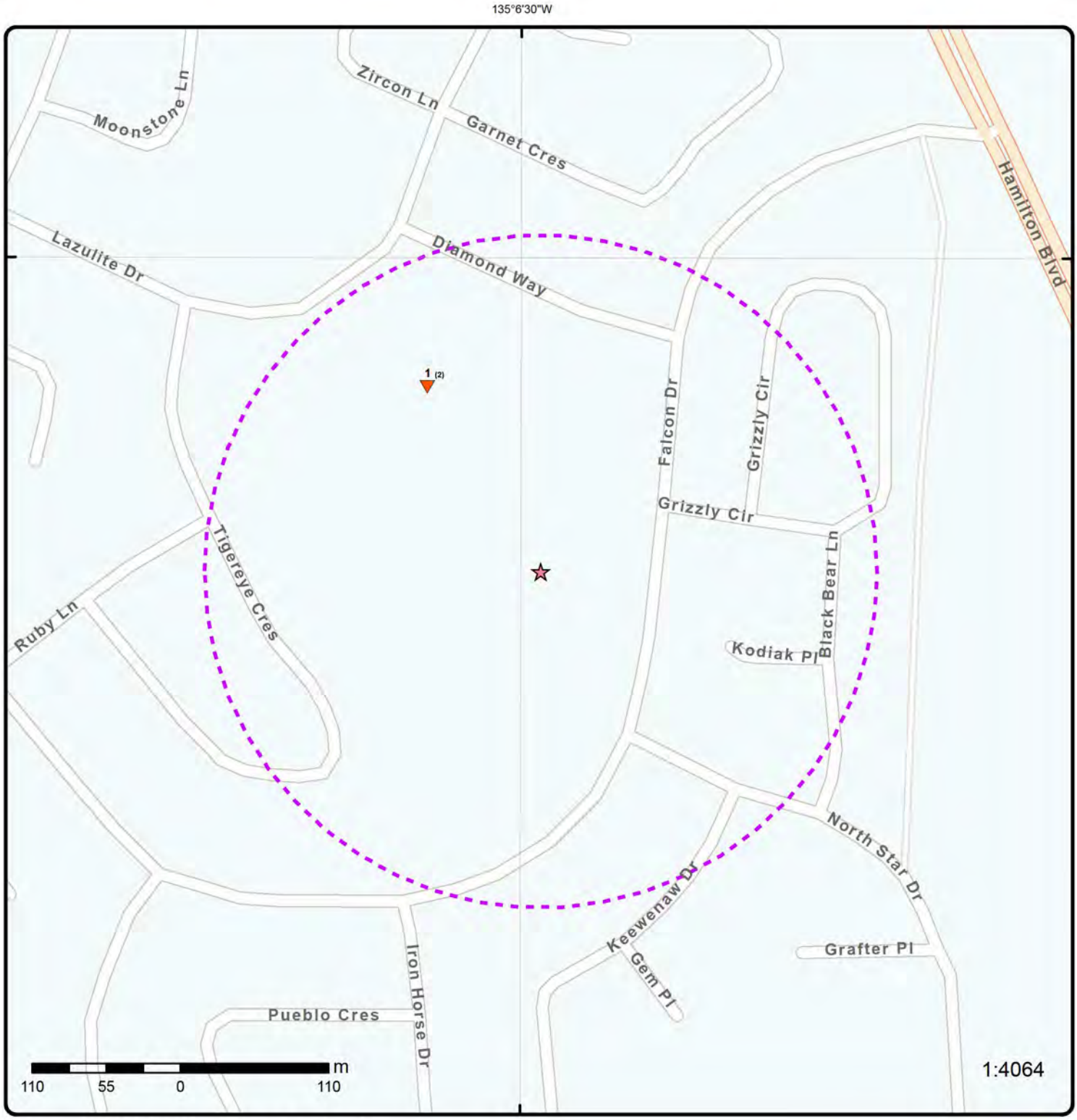
Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev Diff (m)	Page Number
1	FST	YTG - Property Management	Continuing Care Facility (60 Lazulite Road) Whitehorse YT	NW/161.0	-3.03	12
1	FST	Keith's Plumbing & Heating Ltd.	Continuing Care Facility (60 Lazulite Road) Whitehorse YT	NW/161.0	-3.03	12

Executive Summary: Summary By Data Source

FST - Fuel Storage Tanks

A search of the FST database, dated 1997-Oct 2021 has found that there are 2 FST site(s) within approximately 0.25 kilometers of the project property.

Lower Elevation	Address	Direction	Distance (m)	Map Key
Keith's Plumbing & Heating Ltd.	Continuing Care Facility (60 Lazulite Road) Whitehorse YT	NW	161.02	1
YTG - Property Management	Continuing Care Facility (60 Lazulite Road) Whitehorse YT	NW	161.02	1



Map: 0.25 Kilometer Radius

Order Number: 22053101045

Address: Lot 519, Parcel ID: 8056308 and Lot 520, Parcel ID: 8056309, Copper Ridge Subdivision., Whitehorse, YT

- Project Property
- Buffer Outline
- Eris Sites with Higher Elevation
- Eris Sites with Same Elevation
- Eris Sites with Lower Elevation
- Eris Sites with Unknown Elevation
- Freeways; Highways
- Traffic Circle; Ramp
- Major Arterial; Minor Arterial
- Local Road
- Service Road; Traffic Circle; Ramp
- Rail
- Beach
- Airport
- Industrial Area
- Military Base
- Aircraft Roads
- Native Reservation
- Hospital
- Shopping & Sports Area
- University/College
- Cemetery; Golf Course
- Parkt (National)
- Park (City/County)

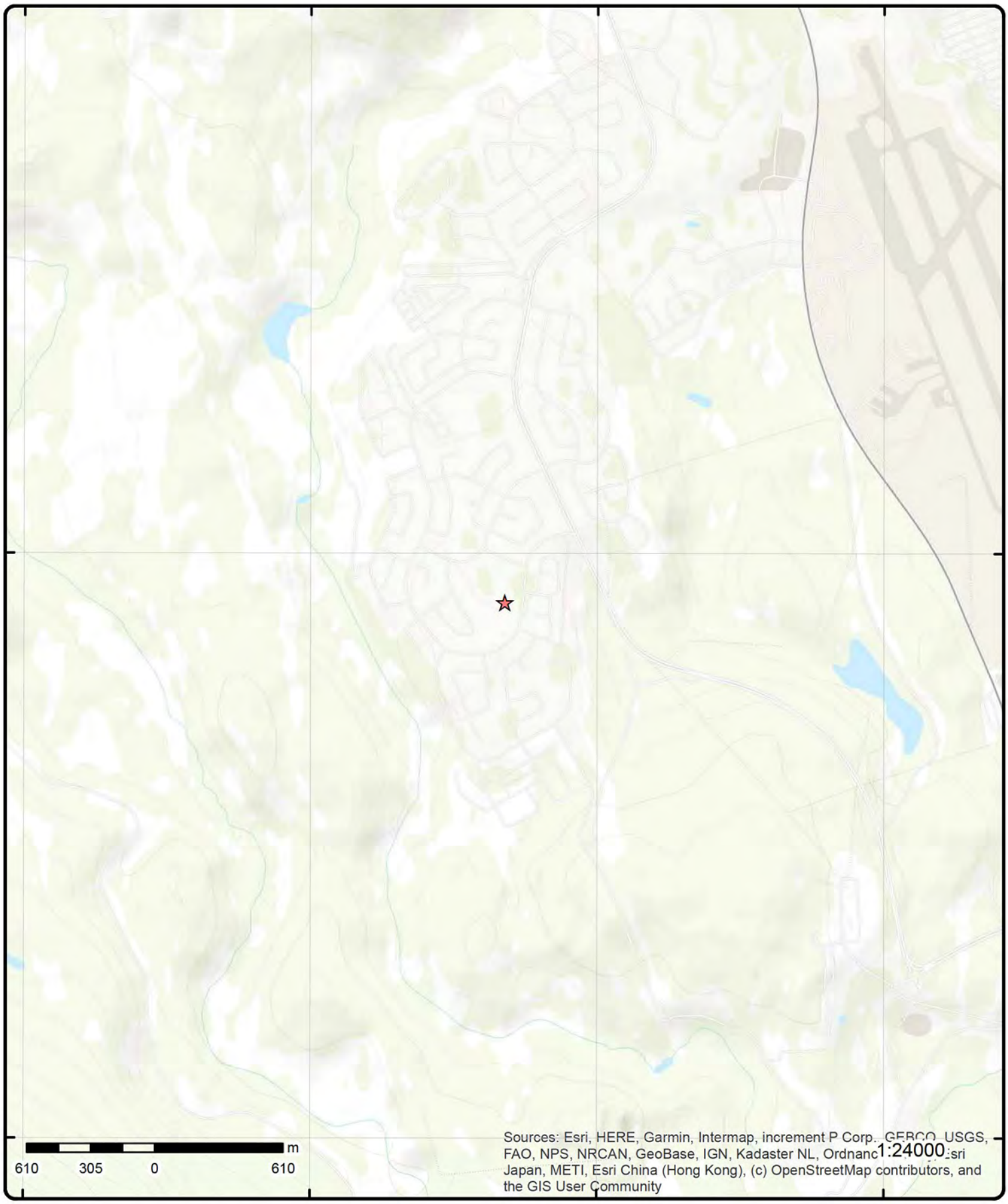
Source: © 2021 ESRI StreetMap Premium.

Aerial **Year: 2020**

Order Number: 22053101045

Address: Lot 519, Parcel ID: 8056308 and Lot 520, Parcel ID: 8056309, Copper

Source: ESRI World Imagery



Topographic Map

Order Number: 22053101045

Address: Lot 519, Parcel ID: 8056308 and Lot 520, Parcel ID: 8056309, Copper

Source: ESRI World Topographic Map

Detail Report

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
1	1 of 2	NW/161.0	770.0 / -3.03	YTG - Property Management Continuing Care Facility (60 Lazulite Road) Whitehorse YT	FST

Permit No:	01057	**Inspection Status:**	
Permit Status:	Issued	**Inspection Date:**	
Permit Type:	Operate	**Inspection By:**	
Permit Expiry:	1/31/2005	**Fee:**	255
Permit Issued:	12/6/2001	**RENEXP:**	
App Received:		**Contact:**	Nick Barnett
Permit Received:		**Phone:**	867-667-3588
Tank Type:		**Source Year:**	
Tank Size:	Not provided	**File Type:**	Commercial Fuel Tanks
Product:	Not provided	**Update Type:**	
Legal Desc:	Lot 518; Plan 99-0224		
Column 1:			
Extra:			
Record Source:			

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
1	2 of 2	NW/161.0	770.0 / -3.03	Keith's Plumbing & Heating Ltd. Continuing Care Facility (60 Lazulite Road) Whitehorse YT	FST

Permit No:	01012	**Inspection Status:**	
Permit Status:	Issued	**Inspection Date:**	
Permit Type:	Install	**Inspection By:**	
Permit Expiry:	12/31/2001	**Fee:**	255
Permit Issued:	5/14/2001	**RENEXP:**	
App Received:		**Contact:**	Keith Tegart
Permit Received:		**Phone:**	867-668-6611
Tank Type:		**Source Year:**	
Tank Size:	Not provided	**File Type:**	Commercial Fuel Tanks
Product:	Not provided	**Update Type:**	
Legal Desc:	Lot 518; Plan 99-0224		
Column 1:			
Extra:			
Record Source:			

Unplottable Summary

Total: 0 Unplottable sites

DB	Company Name/Site Name	Address	City	Postal

Unplottable Report

No unplottable records were found that may be relevant for the search criteria.

Appendix: Database Descriptions

Environmental Risk Information Services (ERIS) can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to ERIS at the time of update. ***Note:*** *Databases denoted with " * " indicates that the database will no longer be updated. See the individual database description for more information.*

Air Emission Permits: Territorial AIR

The Department of Renewable Resources maintains a database of companies/organizations who have acquired a permit under the "Air Emissions Regulation", for the operation of the following types of activities. These include the manufacturing of asphalt; production and exploration of oil and natural gas; quarrying, crushing and screening of stone/clay/ shale /coal/ minerals; processing or handling of coal; equipment capable of generating/burning/using heat energy; use of incinerators; the use of equipment for incineration of special waste; electrical generating facilities; and the storage/other handling of solid, liquid or gaseous materials. The database provides information pertaining to the permit number, expiry date, status and the type of permit.

Government Publication Date: 1998- May 31, 2021

Automobile Wrecking & Supplies: Private AUWR

This database provides an inventory of known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

Government Publication Date: 1999-Sep 30, 2021

Dry Cleaning Facilities: Federal CDRY

List of dry cleaning facilities made available by Environment and Climate Change Canada. Environment and Climate Change Canada's Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements) Regulations (SOR/2003-79) are intended to reduce releases of tetrachloroethylene to the environment from dry cleaning facilities.

Government Publication Date: Jan 2004-Dec 2019

Chemical Register: Private CHM

This database includes a listing of locations of facilities within the Province or Territory that either manufacture and/or distributes chemicals.

Government Publication Date: 1999-Sep 30, 2021

Compressed Natural Gas Stations: Private CNG

Canada has a network of public access compressed natural gas (CNG) refuelling stations. These stations dispense natural gas in compressed form at 3,000 pounds per square inch (psi), the pressure which is allowed within the current Canadian codes and standards. The majority of natural gas refuelling is located at existing retail gasoline that have a separate refuelling island for natural gas. This list of stations is made available by the Canadian Natural Gas Vehicle Alliance.

Government Publication Date: Dec 2012 -Apr 2022

Contaminated Site Inventory: Territorial CS

Yukon INAC Contaminated Sites Inventory is an inventory of sites of potential environmental concern compiled by Indian and Northern Affairs Canada. These sites on this inventory may or may not be contaminated and some might also be sites with solid waste/debris, old mining structures, etc. Inclusion on this list should not be taken as confirmation of contamination. Similarly, sites not included on this list should not be assumed to be free of contamination. For information on any of the sites listed below, contact the Environmental Programs Branch.

Government Publication Date: 1998-Nov 2020

Designated Material Permits: Territorial DMP

The Designated Material Regulations, under the Yukon Environment Act, mandates that anyone who is a retailer or depot operator of "designated materials" must obtain a permit. Where a depot operator has acquired a Solid Waste permit and it addresses the deport location, a designated materials permit is not required. As of May 2004, only tires are considered "designated materials". The provincial inventory provides information on the registered facility, location, permit number, status and expiry date.

Government Publication Date: Jul 2003-May 31, 2021

ERIS Historical Searches: Private EHS

ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Government Publication Date: 1999-Mar 31, 2022

Environmental Issues Inventory System: Federal EIIS

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Government Publication Date: 1992-2001*

Contaminated Sites on Federal Land: Federal FCS

The Federal Contaminated Sites Inventory includes information on known federal contaminated sites under the custodianship of departments, agencies and consolidated Crown corporations as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment. The inventory also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. It does not include sites where contamination has been caused by, and which are under the control of, enterprise Crown corporations, private individuals, firms or other levels of government. Includes fire training sites and sites at which Per- and Polyfluoroalkyl Substances (PFAS) are a concern.

Government Publication Date: Jun 2000-Apr 2022

Federal Identification Registry for Storage Tank Systems (FIRSTS): Federal FRST

A list of federally regulated Storage tanks from the Federal Identification Registry for Storage Tank Systems (FIRSTS). FIRSTS is Environment and Climate Change Canada's database of storage tank systems subject to the Storage Tank for Petroleum Products and Allied Petroleum Products Regulations. The main objective of the Regulations is to prevent soil and groundwater contamination from storage tank systems located on federal and aboriginal lands. Storage tank systems that do not have a valid identification number displayed in a readily visible location on or near the storage tank system may be refused product delivery.

Government Publication Date: May 31, 2018

Fuel Storage Tanks: Territorial FST

The Yukon Department of Renewable Resources maintains an inventory of fuel storage tanks within the Territory. The tanks are registered to the department pursuant to Storage Tank Regulations, Environment Décret 1996/194 with permits. The Storage Tank Regulations came into effect on January 1, 1997. The regulations include requirements for the storage of hazardous substances, including petroleum products, pursuant to Part 10 of the Environment Act. This database applies to new tanks that are being installed or constructed; and existing tanks that undergo major renovations after January 1, 1997. Fuel storage tanks not found in this database include: those that have a capacity of 4,000 litres or less and are used to supply comfort heating systems; tanks that are used to store crude oil, and tanks used for aboveground storage of hazardous substances (other than petroleum products) with a capacity of less than 2000 litres.

Government Publication Date: 1997-Oct 2021

Waste Generators: Territorial GEN

List of waste generators included in waste manifest data made available by Environment Yukon.

Government Publication Date: 1997-Nov 2019

Greenhouse Gas Emissions from Large Facilities: Federal GHG

List of greenhouse gas emissions from large facilities made available by Environment Canada. Greenhouse gas emissions in kilotonnes of carbon dioxide equivalents (kt CO2 eq).

Government Publication Date: 2013-Dec 2019

Historic Sites Inventory: Territorial HIS

The Heritage Branch of the Yukon government maintains an inventory of historic sites within the Territory. The database provides information on history, condition, ownership, location, resource type, and date of construction. Please note that even though the inventory was initiated in 1987, the database does contain records where the date of construction of a historic site was previous to 1895. The list of historic sites is no longer available from the Yukon government.

Government Publication Date: 1987-Aug 2002*

Indian & Northern Affairs Fuel Tanks: Federal IAFT

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

Government Publication Date: 1950-Aug 2003*

Land Treatment Facilities: Territorial LTF

The Yukon's Contaminated Sites Regulation mandates that permits must be acquired for the construction and operation of Land Treatment Facilities - for the purpose of restoring and rehabilitating contaminated soil, sediment, snow or other similar media. The provincial inventory provides information on the registered facility, location, permit number, status and expiry date.

Government Publication Date: 2002-May 31, 2021

Canadian Mine Locations: Private MINE

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

Government Publication Date: 1998-2009*

Mineral Occurrences: Territorial MNR

The Yukon Geology Program maintains an inventory of 2577 separate mineral occurrences in the Yukon, which document metallic, industrial mineral and coal deposits. Information within the database pertains to owner/operator, year, name, claim name, status, deposit type, mining district, tectonic element and commodity.

Government Publication Date: 1900-Feb 2022

National Analysis of Trends in Emergencies System (NATES): Federal NATE

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

Government Publication Date: 1974-1994*

National Defence & Canadian Forces Waste Disposal Sites: Federal NDWD

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

Government Publication Date: 2001-Apr 2007*

National Energy Board Pipeline Incidents: Federal NEBI

Locations of pipeline incidents from 2008 to present, made available by the Canada Energy Regulator (CER) - previously the National Energy Board (NEB). Includes incidents reported under the Onshore Pipeline Regulations and the Processing Plant Regulations related to pipelines under federal jurisdiction, does not include incident data related to pipelines under provincial or territorial jurisdiction.

Government Publication Date: 2008-Jun 30, 2021

National Energy Board Wells: Federal NEBT

The NEBW database contains information on onshore & offshore oil and gas wells that are outside provincial jurisdiction(s) and are thereby regulated by the National Energy Board. Data is provided regarding the operator, well name, well ID No./UWI, status, classification, well depth, spud and release date.

Government Publication Date: 1920-Feb 2003*

National Environmental Emergencies System (NEES): Federal NEES

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for previous Environment Canada spill datasets. NEES is composed of the historic datasets ' or Trends ' which dates from approximately 1974 to present. NEES Trends is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

Government Publication Date: 1974-2003*

National PCB Inventory: Federal NPCB

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. Federal out-of-service PCB containing equipment and PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites. Some addresses provided may be Head Office addresses and are not necessarily the location of where the waste is being used or stored.

Government Publication Date: 1988-2008*

National Pollutant Release Inventory: Federal NPRI

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers for recycling for more than 300 listed substances.

Government Publication Date: 1993-May 2017

Ozone Depleting Substances & Other Halocarbons: Territorial ODS

The Yukon's Ozone Depleting Substances & Other Halocarbon (ODS) Regulations regulate the handling, use and sale of Ozone Depleting Substances (ODS) in the Yukon. The release of ODS's are prohibited, with certain exemptions found in s.2 (2) of the Regulations. Ozone depleting substances are considered to be CFC's, Halons, Chlorocarbon compounds and Hydro chlorofluorocarbons. Other Halocarbons refer to Hydrofluorocarbons and Perfluorocarbons. The provincial inventory provides information on the registered facility, location, permit number, status and expiry date.

Government Publication Date: 1998- May 31, 2021

Oil and Gas Wells: Private OGWE

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickle's database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at www.nickles.com.

Government Publication Date: 1988-Feb 28, 2022

Parks Canada Fuel Storage Tanks: Federal PCFT

Canadian Heritage maintains an inventory of known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

Government Publication Date: 1920-Jan 2005*

Pesticide Register: Territorial PES

This is a database of individuals who apply for a "service", "vendor" or "usage" license for those specific pesticides and fertilizers that require a permit. The database is maintained by the Department of Renewable Resources, and provides information pertaining to the permit number, expiry date, status and the type of permit.

Government Publication Date: 1998-May 31, 2021

Waste Receivers: Territorial REC

The Department of Renewable Resources maintains a "Waste Manifest" which details information regarding waste transfers from generating facilities to registered Receivers. The provincial inventory provides information on the waste receiving facility name, location, physical state (solid/liquid), waste type, amount/quantity received and the degree of danger.

Government Publication Date: 1997-Nov 2019

Relocation Permits: Territorial REL

The Yukon's Contaminated Sites Regulation mandates that permits must be acquired in order to move contaminated material from one site to another. The provincial inventory provides information on the registered facility, location, permit number, permit type, and status.

Government Publication Date: May 2004- May 2021

Retail Fuel Storage Tanks: Private RST

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks.

Government Publication Date: 1999-Sep 30, 2021

Scott's Manufacturing Directory: Private SCT

Scott's Directories is a data bank containing information on over 200,000 manufacturers across Canada. Even though Scott's listings are voluntary, it is the most comprehensive database of Canadian manufacturers available. Information concerning a company's address, plant size, and main products are included in this database.

Government Publication Date: 1992-Mar 2011*

Spills: Territorial SPL

Environment Canada maintains an inventory of known spills that have occurred throughout the Yukon and are reported under the Yukon Spills Regulations. The database identifies spill source, substance discharged, amount of discharge, reason for spill and approximate location of occurrence within the Yukon.

Government Publication Date: 1972-2000

Special Waste Permits: Territorial SWP

The Special Waste Regulations, under the Yukon Environment Act, mandate that anyone who generates, stores, handles, mixes, transports, disposes or releases special wastes is to acquire a "Special Waste" permit. Permits are required for both special waste generators and special waste facilities. The provincial inventory provides information on the generating/waste receiving facility, location, permit number, permit type (generator, facility), status and types of waste generated/received.

Government Publication Date: 1998-May 2021

Waste Disposal Sites: Territorial WDS

This inventory pertains to active, regulated waste disposal sites within the Yukon, where registered sites hold a permit for acceptance of different forms of solid waste. This database provides information in regard to permit number, type of waste accepted, status and permit type. Please note that references within the database to SPW and AER, are in regard to the Special Waste Regulation and Air Emissions Regulation respectively.

Government Publication Date: 2000-May 31, 2021

Yukon Oil and Gas Wells: Territorial YOGW

The Yukon Oil and Gas Resources Branch is responsible for maintaining a database of all oil and gas wells drilled in the Yukon. All well locations were provided by the National Energy Board and verified through branch field inspections. The database details information on well owner/operator, well name, location, drill date, well id, status, elevation, class, and depth of the well.

Government Publication Date: Apr 1957-Mar 2022

Definitions

Database Descriptions: This section provides a detailed explanation for each database including: source, information available, time coverage, and acronyms used. They are listed in alphabetic order.

Detail Report: This is the section of the report which provides the most detail for each individual record. Records are summarized by location, starting with the project property followed by records in closest proximity.

Distance: The distance value is the distance between plotted points, not necessarily the distance between the sites' boundaries. All values are an approximation.

Direction: The direction value is the compass direction of the site in respect to the project property and/or center point of the report.

Elevation: The elevation value is taken from the location at which the records for the site address have been plotted. All values are an approximation. Source: Google Elevation API.

Executive Summary: This portion of the report is divided into 3 sections:

'Report Summary'- Displays a chart indicating how many records fall on the project property and, within the report search radii.

'Site Report Summary'-Project Property'- This section lists all the records which fall on the project property. For more details, see the 'Detail Report' section.

'Site Report Summary-Surrounding Properties'- This section summarizes all records on adjacent properties, listing them in order of proximity from the project property. For more details, see the 'Detail Report' section.

Map Key: The map key number is assigned according to closest proximity from the project property. Map Key numbers always start at #1. The project property will always have a map key of '1' if records are available. If there is a number in brackets beside the main number, this will indicate the number of records on that specific property. If there is no number in brackets, there is only one record for that property.

The symbol and colour used indicates 'elevation': the red inverted triangle will dictate 'ERIS Sites with Lower Elevation', the yellow triangle will dictate 'ERIS Sites with Higher Elevation' and the orange square will dictate 'ERIS Sites with Same Elevation.'

Unplottables: These are records that could not be mapped due to various reasons, including limited geographic information. These records may or may not be in your study area, and are included as reference.

Desktop Geotechnical Assessment
Vacant Lots 519 and 520, Copper Ridge
Whitehorse, YT

Photo credit: Aidan Allen

Prepared for:

Government of Yukon, Community Services, Land Development Branch
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Project No. 106908-01

Prepared by:

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July 4, 2022

EXECUTIVE SUMMARY

Hemmera Envirochem Inc. (Hemmera) was retained by the Government of Yukon, Community Services, Land Development Branch to conduct a desktop geotechnical investigation for development of 2 vacant parcels of land located west of Falcon Drive and south of Diamond Way at 60°41'52.9"N 135°06'29.8"W, in the Copper Ridge Neighborhood, Whitehorse, Yukon, herein referred to as the Site.

The vacant lots being considered for development are located within the City of Whitehorse approximately 4 km southwest of the city center. The vacant lots are located on a plateau southwest of the Whitehorse airport at approximately 780m above sea level. The Site is 5.9ha in size, unoccupied, with a slight slope to the north, and covered with spruce and pine trees. It does not seem to have been previously disturbed except for a cutline that runs from Falcon Drive North northwest to the Copper Ridge Place Long Term Care Facilities and a narrow cutline running south from Diamond Way to Falcon Drive south of North Star Drive.

Findings

The findings of the assessment are summarized as follows:

- The surficial geological conditions at the site consist of Glaciofluvial Morainal Till with mixed fragmented sand, mud and Gravel. The morainal or glacial till deposits generally consist of an unsorted mixture of clay, sand and gravel derived from the erosion, transport, and deposition of material by moving historical ice.
- The geomorphology or regional physiography at the site is the Yukon plateau and the bedrock geology of the site consists of granodiorite, quartz diorite, and diorite.
- Based on the site visit and available data there are no severe natural Hazards Risk to the site. Drainage is expected to be good on-site with the natural slope to the north. Nearby groundwater wells within 500m of the site have had groundwater observed between 4.5 and 6.5 mbgs.
- The zoning around the site is predominantly residential single detached with some restricted residential detached, residential multiple housing, parks and recreation, greenbelt, and neighbourhood commercial.
- No features were identified that would warrant any geotechnical setbacks. There is a light slope towards the North on-site.
- Water and sewer are serviced to the area by subsurface city utilities along Falcon Drive and Diamond Way.
- Power and internet are serviced to the area by subsurface utilities owned and operated by ATCO Electric Yukon and Northwestel with utility boxes noted near the parcel.
- The available data does not suggest that any geotechnical conditions would negatively effect building foundations.
- There are no visible geotechnical constraints to road or building construction.

Recommendations

The recommendations of the assessment are summarized as follows:

- Prior to development a geotechnical investigation should be conducted to determine the subsurface soil stratigraphy, depth to bedrock, and properties as they impact the proposed work. This investigation should be completed after the development plan has been drafted but prior to detailed design and should include the presence and condition of permafrost, potential for thaw settlement, presence of bedrock and design parameters for foundation design.

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated May 3, 2022 (Contract). This report has been prepared by Hemmera, based on research conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch. In performing this work, Hemmera has relied in good faith on information provided by others and has assumed that the information provided by those individuals is both complete and accurate. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

This Executive Summary is not intended to be a stand-alone document, but a summary of findings as described in the following Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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1.0 INTRODUCTION

Hemmera Envirochem Inc. (Hemmera) was retained by Government of Yukon, Community Services, Land Development Branch to conduct a desktop geotechnical investigation for development of 2 vacant parcels of land located west of Falcon Drive and south of Diamond Way at 60°41'52.9"N 135°06'29.8"W, in the Copper Ridge Neighborhood, Whitehorse, Yukon, herein referred to as the Site. A site location figure is attached (**Figure 1**). Photos are included in **Appendix A**.

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated May 3, 2022 (Contract). This report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch. In performing this work, Hemmera has relied in good faith on information provided by others and has assumed that the information provided by those individuals is both complete and accurate. This work was performed to current industry standard practice for similar geotechnical work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the report was produced. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

1.1 Site Description

The vacant lots being considered for development are located within the City of Whitehorse approximately 4 km southwest of the city center and Yukon River. The vacant lots are located on a plateau southwest of the Whitehorse airport at approximately 780 meters above sea level (masl) in elevation. A map showing the site location is attached (**Figure 1**).

The Site is 5.9ha in size, unoccupied, with a downwards slope towards the North-West away from a high point in the middle of the east side. The vacant parcel is covered with spruce trees, pine trees, and some low-lying willows (Photos 7 in **Appendix A**). Other that recent fire smart maintenance it does not seem to have been previously disturbed except for a cutline that runs from Falcon Drive North northwest to the Copper Ridge Place Long Term Care Facilities and a narrow cutline running south from Diamond Way to Falcon Drive south of North Star Drive. The cutlines can be seen in aerial images before Copper Ridge was developed as far back at the 1980s. The Site is abutted by residential properties immediately to the west and urban roads to the north and east. To the northwest is the Copper Ridge Place Facilities and property. There is no commercial property in the area. A map showing the details of the surrounding properties is attached (**Figure 5**).

1.2 Scope of Work

Based on discussions with Government of Yukon, and our review of the available information, the objectives and scope of the Work were as follows:

- Conduct desktop research to investigate site geotechnical characteristics
- Perform a site visit to confirm topography and general site layout
- Document the investigation activities and findings in a report
- Provide recommendations for additional geotechnical investigation.

2.0 FIELD ACTIVITIES

2.1 Site Visit

The field site visit was carried out on June 14, 2022, by Aidan Allen of Hemmera. The visit consisted of a site walkthrough and general assessment. The site has a high point on the South-East side and is generally sloped towards the North-East but does not have any apparent limiting geological features. There is a monitoring well on-site on the South side of the parcel (Photo 9 in **Appendix A**). On the South-West side of the site there is also a small infiltration drainage depression (Photo 8 in **Appendix A**).

The vacant parcel is accessible from anywhere along the South to South-East side from Falcon Drive as well as directly from Diamond Way to the North-East. There were no limitations to performing the site visit.

Select photographs from the site visit are included in **Appendix A**. A map showing some site features is also attached (**Figure 6)**.

3.0 SITE CHARACTERISTICS

3.1 Surficial Geological Conditions

According to the Yukon geological surveys data, the surficial geological conditions at the site consist of Glaciofluvial Morainal Till with mixed fragmented sand, mud and Gravel. The glaciofluvial Morainal till is from the McConnell Glacial meltwater channel. Approximately 1km South of the site is primarily Morainal till surface geological conditions with sand and mud also from the McConnell Glacial meltwater channel. Approximately 1km North-East of the site are Eolian Morainal Till geological conditions with Eolian Veneer mud, sand, and gravel plain conditions.

The Atlas of Canada further expands stating that morainal or glacial till deposits generally consist of an unsorted mixture of clay, sand and gravel derived from the erosion, transport, and deposition of material by moving ice. These deposits are typically rolling and hummocky due the presence of ice with the materials during deposition. The moraine deposits are generally 4 to 10m thick.

A map showing the surface geological condition is attached (**Figure 2**).

3.2 Geomorphology and Bedrock Geology

As per the geomatics Yukon's open data, the geomorphology or regional physiography at the site is the Yukon plateau. The larger region is the Western Canada Cordillera region within the Northern plateau and mountain area. A map showing the geomorphology is attached (**Figure 3**).

According to the Yukon geological surveys data, the bedrock geology of the site consists of granodiorite, quartz diorite, and diorite. To the South-West of the site approximately 3km the bedrock geology changes to green and red greywacke, pebble conglomerate, and mudstone. A map showing the bedrock geology is attached (**Figure 4**).

3.3 Natural Hazards Risk

Based on the site visit and available data there are no severe natural Hazards Risk to the site. Flooding is a low risk because the site appears to have good drainage. For fire the site is moderately vegetated with Spruce and Pine trees (Photos 7 in **Appendix A**) but is surrounded by at least 250 m of residential development (from natural forested areas) and is not considered at risk. According to the topographic data and available soils data there is negligible risk of slope or ground movement. Drainage is expected to be good on-site with the natural slope to the north.

According to historical data from a study in 2014 which included the monitoring well on-site, groundwater was never observed in the 7.7m deep well. Nearby wells from the same study within 500m of the site have had groundwater observed between 4.5 and 6.5 meters below ground surface (mbgs).

According to a study completed in 2021 on a site 600 m away adjacent to Hamilton Blvd, there was a risk of thaw settlement due to melting of ice rich subsurface soils at that location. The presence of permafrost and ice rich soils will need to be investigated prior to development. Some frost susceptible soils are anticipated in this area, but only typical building precautions will be required to mitigate this concern.

The soils would likely be classified as Class D for seismic response based on the National Building Code of Canada (2020).

3.4 Zoning, Claims and Land Dispositions

The current zoning of lot 519 (Northern parcel on-site) is public services while lot 520 (Southern parcel on-site) is zoned parks and recreation. The zoning directly to the North-West of the site is approximately 3.7ha of public services land use. Further to the North and surrounding the property, West, South, and East is approximately 212ha of predominantly residential single detached with some restricted residential detached, residential multiple housing, parks and recreation, greenbelt, and neighbourhood commercial.

There are 3 Quartz Claim groupings in the general area. To the West, 1.8km away, there is a group of claims approximately 240ha in size. To the South, 2.4km away, there is a group of claims approximately 180ha in size. To the South-West, 2.4km, away there is a group of claims approximately 64ha in size.

The only land disposition near the site is the roadway land disposition, about 475m East of the site, is for Hamilton Boulevard. There are also Airport and institutional land dispositions in the area.

A map showing the zoning, claims, and land dispositions is attached (**Figure 5**).

3.5 Geotechnical and Development Setbacks

During the site visit the vacant parcel was examined for potential geotechnical features that would require setbacks. The site was generally flat, and no features were identified that would warrant any geotechnical setbacks. The slope away from the high point is less than 5% and should not be a limiting factor to development.

Development setbacks will vary depending on the classification that is used for the site. All development setbacks should follow the City of Whitehorse Zoning Bylaw.

3.6 Current Regional Development and Classification

There is development on all properties directly adjacent to the site. To the North-West bordering the site there is a public services property occupied by the Copper Ridge Place retirement home. On the North, West, South and East bordering the site are residential single detached properties currently developed with houses built on all the surrounding lots. Further to the South of the site there is some area developed as restricted residential detached. On the Northern border of the site is Diamond Way and on the Eastern to Southern border of the site is Falcon Drive.

The surrounding region on all sides is predominantly developed as residential single detached, restricted residential, and residential multiple housing. There is some public use further North currently occupied by Ecole Emilie-Tremblay. The region far West and East of the site is designated as environment protection.

According to the City of Whitehorse Zoning Bylaw, the classification of the surrounding sites is residential single detached. Based on the size of the lot, location, and surrounding use the site could be classified as residential single detached, residential multiple housing, restricted residential detached, or residential single detached 2.

A map showing the surrounding development is attached (**Figure 6**).

3.7 Surface and Subsurface Utilities

Water and sewer are serviced to the area by subsurface city utilities. The city water and sewer mains travel along Diamond Way and Falcon Drive so they could be easily accessible from the North, East, and South sides of the site.

Power and internet are serviced to the area by subsurface utilities owned and operated by ATCO Electric Yukon and Northwestel, respectively. ATCO Electric and Northwestel do not have open data for their subsurface utilities, but service boxes were noted surrounding the vacant site and it is assumed that they could service the site.

The anticipated soil stratigraphy at this site should not pose any challenges to the installation of subsurface and surface utilities. Utilities should be designed and installed in accordance with City of Whitehorse Servicing Standards Manual.

A map showing the water, sanitary, Northwestel, and ATCO electrical boxes is attached (**Figure 6**).

3.8 Building Foundations

It appears that the surficial geotechnical conditions on site are typical for development in the Whitehorse area. Typical building foundations could be strip or spread footings, pile foundations or raft slabs depending on geotechnical investigation and the type and size of buildings. As noted in section 3.3 natural hazards risk, if found, the presence of permafrost and ice rich soils would affect foundation design and installation.

Geotechnical investigations and foundation design should be undertaken by the property owner before construction of any buildings. Building foundations should be designed in accordance with the National Building Code of Canada (2020).

3.9 Preliminary Subdivision Development

From the site visit, area development, and the anticipated surficial geology there are no geotechnical hinderances to residential road and housing construction.

It is anticipated that underground utilities can be constructed with standard residential methods and materials. All City of Whitehorse servicing standards should be followed.

4.0 RECOMMENDATIONS

4.1 Additional Geotechnical Evaluation

4.1.1 Geotechnical Drilling

Prior to development a geotechnical investigation should be conducted to determine the subsurface soil stratigraphy, depth to bedrock and properties as they impact the proposed development. This investigation should be completed after the development plan has been drafted but prior to detailed design and should include the presence and condition of permafrost, potential for thaw settlement, presence of bedrock, and design parameters for foundation design.

Building/housing foundations should be designed in accordance with the National Building Code of Canada (2020).

5.0 CLOSURE

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned.

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6.0 STATEMENT OF LIMITATIONS

This work was performed in accordance with a Consultant Services Agreement between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Government of Yukon, Community Services, Land Development Branch (Client), dated May 3, 2022 (Contract). This report has been prepared by Hemmera, based on research conducted by Hemmera, for sole benefit and use by Government of Yukon, Community Services, Land Development Branch.

The conclusions and recommendations given in this report are based on information determined from desktop research. Subsurface conditions at this site have not been investigated and may vary from those anticipated in the desktop site investigation. It is recommended practice that a geotechnical investigation be conducted and a Geotechnical Engineer be retained during construction to determine the subsurface conditions specific to each construction location.

The comments made in this report are intended only for the guidance. The parties undertaking the construction should make their own interpretation of the information presented and draw their own conclusions as to how the conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

7.0 REFERENCES

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FIGURES

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Site Location

Legend

- Site Boundary
- Property Line

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Yukon Territory
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

N

1:5,000

0 50 100 150 200 250

Metres

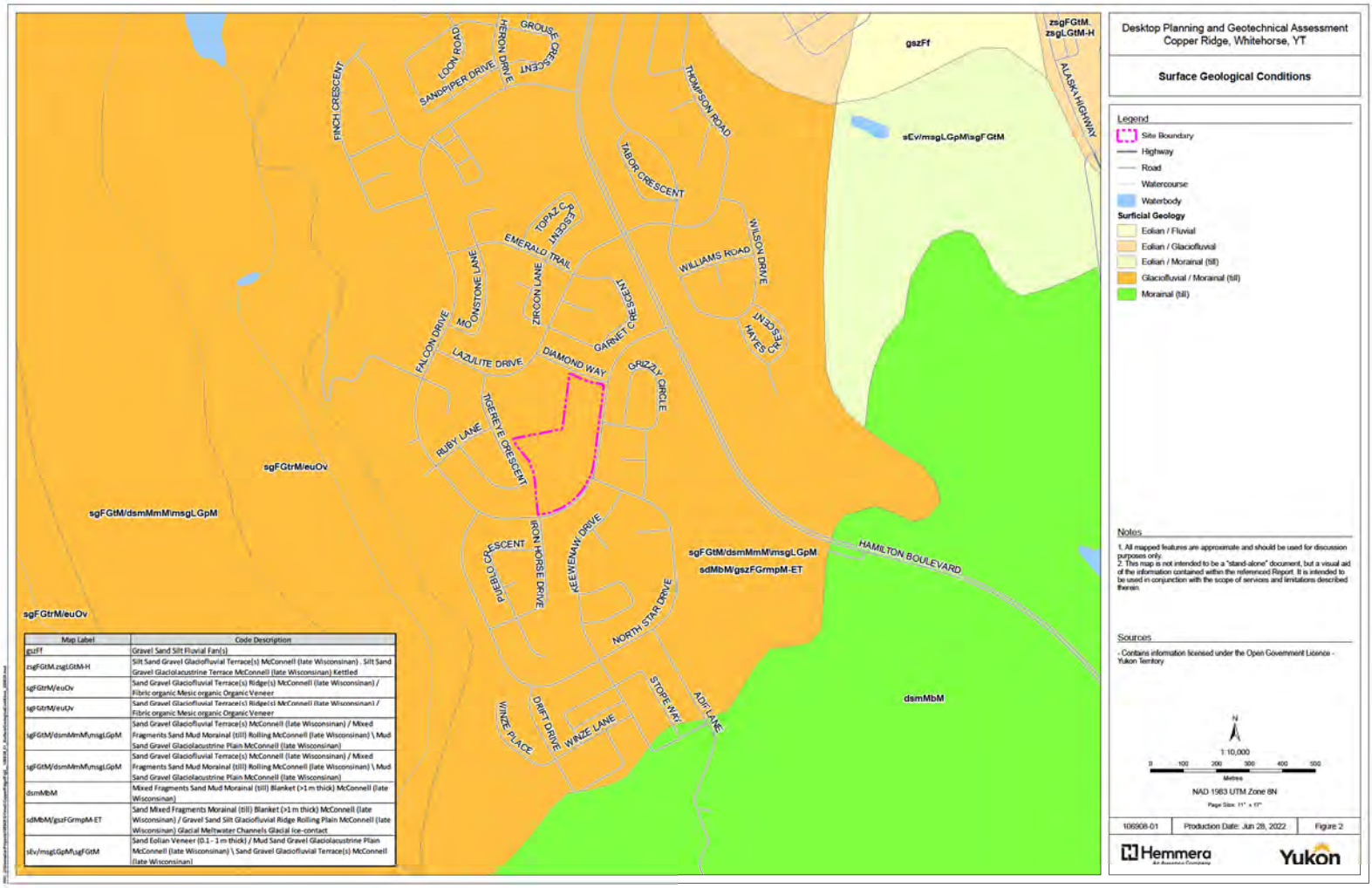
NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 1

Hemmera
An Ausenco Company

Yukon



Map Label	Code Description
gzFf	Gravel Sand Silt Fluvial Fan(s)
zsgFGtM,zsgLGtM-H	Silt Sand Gravel Glaciofluvial Terrace(s) McConnell (late Wisconsinan) . Silt Sand Gravel Glaciolacustrine Terrace McConnell (late Wisconsinan) Kettled
sgFGtrM/euOv	Sand Gravel Glaciofluvial Terrace(s) Ridge(s) McConnell (late Wisconsinan) / Fibric organic Mesic organic Organic Veneer
sgFGtrM/euOv	Sand Gravel Glaciofluvial Terrace(s) Ridge(s) McConnell (late Wisconsinan) / Fibric organic Mesic organic Organic Veneer
sgFGtM/dsmMmM\msgLGpM	Sand Gravel Glaciofluvial Terrace(s) McConnell (late Wisconsinan) / Mixed Fragments Sand Mud Morainal (till) Rolling McConnell (late Wisconsinan) \ Mud Sand Gravel Glaciolacustrine Plain McConnell (late Wisconsinan)
sgFGtM/dsmMmM\msgLGpM	Sand Gravel Glaciofluvial Terrace(s) McConnell (late Wisconsinan) / Mixed Fragments Sand Mud Morainal (till) Rolling McConnell (late Wisconsinan) \ Mud Sand Gravel Glaciolacustrine Plain McConnell (late Wisconsinan)
dsmMbM	Mixed Fragments Sand Mud Morainal (till) Blanket (>1 m thick) McConnell (late Wisconsinan)
sdMbM/gszFGrmpM-ET	Sand Mixed Fragments Morainal (till) Blanket (>1 m thick) McConnell (late Wisconsinan) / Gravel Sand Silt Glaciofluvial Ridge Rolling Plain McConnell (late Wisconsinan) Glacial Meltwater Channels Glacial Ice-contact
sEv/msgLGpM\sgFGtM	Sand Eolian Veneer (0.1 - 1 m thick) / Mud Sand Gravel Glaciolacustrine Plain McConnell (late Wisconsinan) \ Sand Gravel Glaciofluvial Terrace(s) McConnell (late Wisconsinan)

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Surface Geological Conditions

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody

Surficial Geology

- Eolian / Fluvial
- Eolian / Glaciofluvial
- Eolian / Morainal (till)
- Glaciofluvial / Morainal (till)
- Morainal (till)

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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N

1:10,000

0 100 200 300 400 500

Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 2

Hemmera

Yukon

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Geomorphology

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody

Regional Physiography

- Plateau

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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N

1:10,000

0 100 200 300 400 500

Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 3

Hemmera An Ausenco Company

Yukon

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Bedrock Geology

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody

Bedrock Geology

- mKgW: WHITEHORSE SUITE: Bt-Hbl granodiorite, Hbl quartz diorite and Hbl diorite
- uTrAK3: MANJUANNA: green and red greywacke and pebble conglomerate, mudstone
- uTrAK2: HANCOCK: massive to thick-bedded limestone

Notes

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Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 4

Hemmera
An Ausenco Company

Yukon

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Zoning, Claims & Land Dispositions

Legend

- Site Boundary
- Highway
- Road
- Watercourse
- Waterbody

Mining Claim

- Active Quartz Claim

Land Deposition Purpose

- Airport
- Institutional
- Roadway

Land Use Zoning

- Highway Commercial
- Neighbourhood Commercial
- Future Planning
- Airport
- Environment Protection
- Greenbelt
- Parks and Recreation
- Public Services
- Residential Multiple Housing
- Residential Mobile Home Park
- Restricted Residential Detached
- Residential Single
- Residential Single Detached 2

Notes

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Sources

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- Land Use Zoning: Whitehorse, 2019

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Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 5

Hemmera

Yukon

Desktop Planning and Geotechnical Assessment
Copper Ridge, Whitehorse, YT

Development Potential

Legend

- Monitoring Well Location
- Slope Direction
- Topographic Contour
- Site Boundary
- Site Feature
- -SAN- Sanitary Sewer Line
- -W- Water Line
- Property Line

Notes

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2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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- Aerial Image: ESRI World Imagery

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1:2,000

0 20 40 60 80 100

Metres

NAD 1983 UTM Zone 8N

Page Size: 11" x 17"

106908-01	Production Date: Jun 28, 2022	Figure 6

Hemmera An Ausenco Company

Yukon

APPENDIX A
Site Photos

Photo 1 View of vacant parcel site facing South-West during site visit (June 15, 2022).

Photo 2 View of vacant parcel site facing North during site visit (June 15, 2022).

Photo 3 View of vacant parcel site facing West along Falcon Dr. during site visit (June 15, 2022).

Photo 4 View of North-East edge of vacant parcel site along Diamond Way during site visit (June 15, 2022).

Photo 5 View of North West side of vacant parcel site facing towards Copper Ridge Center during site visit (June 15, 2022).

Photo 6 View of cutline on vacant parcel site facing North-West during site visit (June 15, 2022).

Photo 7 View of vegetation on vacant parcel site facing North during site visit (June 15, 2022).

Photo 8 View of infiltration depression on South end of vacant lot during site visit (June 15, 2022).

Photo 9 View of stickup monitoring well on South side of vacant lot during site visit (June 15, 2022).

Heritage Resources Impact Assessment for Copper Ridge Lots 519 & 520 – Public Version

Permit 22-20ASR

July 25, 2022

Prepared for:

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Project Number: 123222106

Limitations and Sign-off

This document entitled Heritage Resources Impact Assessment for Copper Ridge Lots 519 & 520 was prepared by Stantec Consulting International Ltd. (“Stantec”) for the account of Government of Yukon, Community Services (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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Executive Summary

This report details the results of the heritage resources impact assessment (HRIA) undertaken by Stantec Consulting Ltd. (Stantec) for Copper Ridge Lots 519 and 520, located within the City of Whitehorse, Yukon. The study area is within the traditional territory of Kwanlin Dün First Nation (KDFN) and Ta'an Kwäch'än Council (TKC). Stantec undertook the HRIA at the request of Government of Yukon, Community Services, Land Development Branch, to support planning in advance of proposed residential development of the lots. The HRIA was carried out under Class 2 Yukon Archaeological Sites Regulation Permit 22-20ASR.

Fieldwork was conducted on July 7th, 2022, by a crew consisting of two Stantec archaeologists and one KDFN field technician. Pedestrian survey was undertaken throughout the study area to identify heritage resources or areas of potential (AOPs) for subsurface heritage resources. One AOP was recorded and assessed through shovel testing. No heritage resources were identified.

No further heritage work is recommended for the study area, which is assessed as low heritage potential.

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Abbreviations

AOP	area of potential
asl	above sea level
ASR	Archaeological Sites Regulations
bs	below surface
GPS	global positioning system
HRIA	heritage resources impact assessment
KDFN	Kwanlin Dün First Nation
TKC	Ta'an Kwäch'än Council
YESAB	Yukon Environmental and Socio-economic Assessment Board

1.0 INTRODUCTION

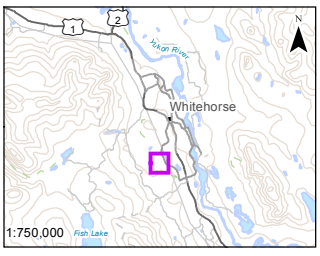
This report details the results of the heritage resources impact assessment (HRIA) undertaken by Stantec Consulting Ltd. (Stantec) for Copper Ridge Lots 519 and 520, located within the City of Whitehorse. The study area is within the traditional territory of Kwanlin Dün First Nation (KDFN) and Ta'an Kwäch'än Council (TKC). Stantec undertook the HRIA at the request of Government of Yukon, Community Services, Land Development Branch. The HRIA was carried out under Class 2 Yukon Archaeological Sites Regulation Permit 22-20ASR.

Government of Yukon is planning residential development of Lots 519 and 520, located in Copper Ridge. The HRIA was requested to support planning for the proposed development. No heritage work has taken place within the proposed development area.

Fieldwork was undertaken on July 7, 2022, by a crew consisting of two Stantec archaeologists and one KDFN field technician. Pedestrian survey was undertaken throughout the study area to identify heritage resources or areas of potential (AOPs) for subsurface heritage resources.

The objectives of the HRIA were to identify heritage resources and areas of potential for buried heritage resources within the study area, assess potential impacts that heritage resources could sustain because of the proposed development, and to make recommendations concerning the future management of those resources.

Heritage site location information has been removed from this report so it can be made publicly available (e.g., through submission to the Yukon Environmental and Socio-economic Assessment Board [YESAB] Online Registry).



First Nation Settlement Land
Project Area

0 100 200 300 400 m
1:10,000 (at original document size of 8.5x11)

Stantec Yukon

Project Location:
Whitehorse
NTS:105D/11

Project Number: 123222106
Prepared by MYOUNG on 20220712
Requested by MYOUNG on 20220712
Checked by SMACKENZIE on 20220713

Client/Project/Report
Government of Yukon, Community Services
HRIA for Copper Ridge Lots 519 and 520
Permit 22-20ASR

Figure No.
1

Title
Overview Map

Notes
1. Coordinate System: NAD 1983 Yukon Albers
2. Data Sources: Conservation Areas Reporting and Tracking System; Natural Resources Canada

1.1 LEGISLATIVE REFERENCES

Several acts, agreements, and regulations apply to heritage resources within the study area. These include the *Historic Resources Act* (Government of Yukon 2002) and Archaeological Sites Regulation (Government of Yukon 2003a), the *Yukon Territorial Lands Act* Land Use Regulations (Government of Yukon 2003b), the Umbrella Final Agreement (Government of Canada et al. 1993), and the *Yukon Environmental and Socio-economic Assessment Act* (Government of Canada 2003).

The *Historic Resources Act* (Government of Yukon 2002) and Archaeological Sites Regulation (Government of Yukon 2003a) contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public lands, and archaeological and historical resources that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.

The *Yukon Territorial Lands Act* Land Use Regulation (Government of Yukon 2003b) contains regulations regarding operations around, and the discovery of archaeological sites. Section 9(a) of the Regulations stipulates that “no permittee shall, unless expressly authorized in their permit or expressly authorized in writing by an inspector, conduct a land use operation within 30 m of a known monument or a known or suspected archaeological site or burial ground.” Furthermore, section 15 states that “Where, during a land use operation, a suspected archaeological site or burial ground is unearthed or otherwise discovered, the permittee shall immediately (a) suspend the land use operation on the site; and (b) notify the engineer or an inspector of the location of the site and the nature of any unearthed materials, structures, or artifacts.”

Other pertinent legislation includes the *Yukon Environmental and Socio-economic Assessment Act* (Government of Canada 2003) which requires that potential effects to heritage resources are considered during review of proposed projects. The Heritage Resource Information Requirements for Land Application Proposals Policy (Operational Policy No. 2011-01) developed by the Yukon Environmental and Socio-Economic Assessment Board outlines the requirement for a heritage resource assessment to be included with any proposal that includes disposition of land.

1.2 FIRST NATIONS REFERRAL AND CORRESPONDENCE

The study area is within the traditional territory of KDFN and TKC. KDFN and TKC were notified of the study prior to undertaking the HRIA. Frank Jim (KDFN) participated in the HRIA fieldwork. No TKC field technicians were available to participate in the HRIA.

2.0 HERITAGE ASSESSMENT DESCRIPTION

The objective of an HRIA is to identify above-and-below-ground heritage resources (such as pre-contact or post-contact heritage sites) and to make recommendations concerning the future management of those resources. The specific objectives of an HRIA are as follows:

- Identify and evaluate heritage resources within the study area.
- Identify and assess impacts to heritage resources which might result from the proposed development.
- Recommend viable alternatives for managing unavoidable adverse impacts, including a preliminary program to:
  - Implement impact management actions, and where necessary
  - Undertake surveillance and/or monitoring

HRIA methods are outlined in Section 4.0, results are discussed in Section 5.0 and displayed on Figure 2. Management recommendations are included in Section 6.0. Digital files containing relevant spatial data were provided to the client, Heritage Resources Unit, KDFN, and TKC to facilitate project planning and heritage resource management.

3.0 STUDY AREA

3.1 STUDY AREA LOCATION

The study area is in the Southern Lakes region of Yukon, within the City of Whitehorse, in the Copper Ridge Subdivision. The nearest significant hydrological feature is McIntyre Creek (1.5 km east).

Terrain within the study area is generally rolling or hummocky. Vegetation in the project area includes recently thinned (fire-smart) pine and spruce forest with recently planted deciduous and occasional willow. Ground cover in the area consists of labrador tea, soapberry, kinnikinic, fireweed, sphagnum moss, lichens, and lupine. Prior ground disturbances within and adjacent to the study area include those associated with road construction and recreational use of the area, including walking paths and recreational vehicle (e.g., ATV) trails.

3.2 PALAEOENVIRONMENTAL BACKGROUND

Glaciation and deglaciation, are primary determinants of contemporary Yukon environment throughout the territory, resulted in complex regionally specific outcomes wherein the environmental and physical conditions both shaped and were shaped by numerous glacial events and processes. A succession of as many as six glaciations and deglaciations are known to have occurred in the Whitehorse area throughout the Late Quaternary (Bond 2004; Duk-Rodkin 2001). Glacial stratigraphy, however, begins with the Late Wisconsin McConnell Glaciation (approximately 20,000 years ago) and the lack of pre-McConnell deposits suggests they have been eroded or buried by subsequent glaciations (Wheeler 1961).
The Whitehorse area is defined by the three geophysical sub-regions (City of Whitehorse 2017, 2018) that were formed by and interacted with the stages of the McConnell Glaciation—the Yukon River valley bottom, the upland terrace/escarpment, and a complex of post-glacial lakes (CoW 2017, 2018).
These landscape features variably interacted with the dynamic glacial history of southwestern Yukon.

3.2.1 Glacial History

According to radiocarbon and palaeobotanical records, the Late Wisconsin McConnell Glaciation occurred from approximately 23,900 to 10,700 years before present, at which time the ice had fully retreated, and vegetation was re-established in the Whitehorse region (Bond 2004). The onset of the glacial advance is assumed to have initiated with the accumulation of ice in the cirques of the Coast Mountains. Alpine glaciers then coalesced creating vast glaciers in major river valleys including the Wheaton River, Bennet Lake, upper Watson River, Takhini River, and Primrose River valleys, which would later coalesce forming the Coast Mountains lobe (Bond 2004). Simultaneously, ice from the Cordilleran Ice Sheet was advancing northward from the Cassiar Mountains of south-central Yukon and northern British Columbia—forming the Cassiar Lobe (Jackson and MacKay 1990).

The first stage of the McConnell glaciation is the onset of glaciation. This is estimated to have begun in the Whitehorse Region between 29,000 and 26,000 years ago (Bond 2004). During stage two, the

Glacial Maximum, ice covered all southern and eastern Yukon. The ice sheet covering the Whitehorse area is estimated to have exceeded 1350 m (Bond 2004). The third stage is Deglaciation, at which time a series of deglaciations and readvances each effectively formed various landscape features in the Whitehorse area (Bond 2004). These events significantly affected sediment deposition, particularly in riverine valleys while also resulting in systems of pro-glacial lakes surrounding the retreating Cassiar Lobe. The Cassiar re-advance resulted in the development of Glacial Lake Champagne when the Cassiar Lobe retreated from the Takhini River valley in the east and blockage of the Dezadeash River drainage by St. Elias ice occurred to the west. Glacial Lake Laberge formed during a subsequent ice recession in the Yukon Valley, reaching elevations of 716 m (88 m above modern Lake Laberge levels) (Birdeau et al. 2011).

During the Ibex sub-stage, Glacial Lake Laberge and Glacial Lake Champagne increased in size while the Ibex River and Fish Lake valleys were dammed creating Glacial Lake McIntyre and Glacial Lake Ibex (Bond 2004). A series of smaller pro-glacial lakes also developed in the Wheaton and Watson River valleys. The subsequent Chadburn sub-stage was another period of stagnation in deglaciation correlating to the development of Chadburn Lake, Lewes Lake and Annie Lake (Bond 2004). Glacial lakes Champagne and Laberge joined following the recession of the Cassiar Lobe from the Takhini River Valley. During the Cowley sub-stage, glacial lake drainages were redirected. Most prominently, Glacial Lake Watson begun draining into the Yukon River (Bond 2004). The Bennett sub-stage is marked by further retreat of the Cassiar Lobe, signifying the height of coverage for glacial lakes in the Whitehorse region (Bond 2004). Lake Laberge was connected with Lake M'Clintock, adding volume and complexity to an already dynamic glacial lake system. The M'Clintock sub-stage is the final stage of deglaciation wherein ice retreated from the Bennett Lake/Windy arm area.

Stage four, the Early Holocene stage is marked by the drainage of the glacial lakes, riverine downcutting into the glaciolacustrine deposits, and aeolian activity (Bond 2004). First, sediment dams built up and were repeatedly incised around Glacial Lake Laberge, resulting in the erosion of the Late Wisconsin glacial deposits in the Yukon River valley bottom (Birdeau et al. 2011). As the Glacial Lake Laberge water level retreated, the Yukon River downcut the glaciolacustrine and morainal deposits to the south (Bond 2004). Meanwhile, drainage of Glacial Lake Champagne is hypothesized to have occurred sometime between 12,500 and 9,000 (Heffner 2008). Additionally, the southern shoreline of the Yukon River delta receded north, depositing deltaic sands over the glaciolacustrine deposits. The Whitehorse dune field, located north of the city, developed from the reworking of these deltaic sands via aeolian processes (Wolfe et al. 2011).

3.3 MODERN ENVIRONMENTAL BACKGROUND

3.3.1 Physical Geography

The Whitehorse area can be categorized by the Yukon River valley bottom, the upland terrace/escarpment, and a complex of post-glacial lakes (CoW 2017 2018). The valley bottom is a fluvial plane with basal sediments of glaciolacustrine silts sometimes overlain by alluvial sands and gravels. Bedrock has not been observed throughout much of the valley bottom but, has been encountered at

depths of nearly fifty metres below ground (CoW 2017 2018). Small wetlands are found in the area and the water table is typically encountered one to two metres below ground. The modern valley bottom was mostly shaped by deglaciation when significant deposition of glaciolacustrine sands and silts occurred.

The upland terrace is an approximately fifty metres high, glaciolacustrine bluff or escarpment bordering the river valley. The southern portion of the terrace is a relatively level plain with basal glaciolacustrine sediments of sands and gravels overlain by silty sand. The terrace was formed simultaneous to the formation of Glacial Lake Laberge which at its maximum height deposited the sediments in the silt bluffs (Barnes 1997; Mouget 1997 and 1998). The northern portion of the upper terrace is characterized by undulating hummocky terrain.

The post-glacial lake complex is composed of glacial outwash sands and gravels forming steep hummocky terrain characterized by remnant pothole lakes, particularly the Ear Lake complex south of the city. These lakes are remnant of deglaciation of the area, specifically a period stagnation in the recession of the Cassiar Lobe.

3.3.2 Climate, Vegetation, and Wildlife

The high mountain ranges surrounding the Whitehorse Region block mild, moist Pacific air from reaching the Yukon interior, producing a rain shadow effect (Wahl and Goos 1987). Consequently, the climate is Subarctic continental, being dominated by the cold, dry Arctic air masses for most of the year, with only occasional intrusions of Pacific air, despite its close proximity to the Pacific coast. Mean annual temperature lies between -2 and -5°C and mean annual precipitation is only 250–300 mm/year (Smith et al. 2004). These environmental factors limit the vegetation to those species that can withstand both cold and dry conditions.
White spruce (Picea glauca) and trembling aspen (Populus tremuloides) are the dominant tree species and have an understory of various shrubs, herbs, and grasses. Woodland areas are punctuated by sedge and grass meadows. In many places one can find grass-covered south-facing slopes while northern exposures are vegetated with closed spruce forests growing on permafrost. Elevation also exerts considerable influence on vegetation patterns (Murray and Douglas 1980). A montane forest zone can be found on the valley bottoms extending upslope to a height of 1300 m asl. At this elevation, trees give way to a subalpine zone of shrubs, which gradually is replaced by an alpine community of low-growing plants above 1500 m asl.

The southwest Yukon's variable environments are mirrored by a diversity of wildlife that is unusual in northern areas (Hoefs 1980). Most vegetation zones have associated mammal communities. Dall sheep (Ovis dalli), mountain goats (Oreamnos americanus), grizzly bears (Ursus arctos), cougars (Felis concolor), marmots (Marmota caligata), and pika (Ochotona collaris) are present in the alpine zone; mule deer (Odocoileus hemionus) and various rodents live near the forest edge; and moose (Alces alces), caribou (Rangifer tarandus), black bear (Ursus americanus), and wolves (Canis lupus) inhabit forested areas. Snowshoe hare (Lepus americanus) and arctic ground squirrels (Citellus parryi) can be found throughout the region and are the basis for much of the higher food chain (Krebs 1980). Fish species occurring in this region include lake whitefish (Coregonus clupeaformis), round whitefish (Prosopium cylindraceum), lake trout (Salvelinus namaycush), northern pike (Esox lucius), and arctic grayling (Thymallus arcticus).

Species found in the territory that occur only in the Yukon River watershed include inconnu (Stenodus leucichthys), broad whitefish (Coregonus nasus), and least cisco (Coregonus sardinella). Only two species of salmon can be found in the upper Yukon system and these salmon bearing streams are located only in the northern reaches of the southwest Yukon (McClellan 1963; Hayes 1892 in Workman 1978:87). Chinook salmon (Oncorhynchus tshawytscha) are reported to spawn in small numbers along the lower portion of McIntyre Creek (CPAWS Yukon 2020:26).

3.4 ETHNOGRAPHY

The study area is within the traditional territory of the KDFN and TKC. KDFN and TKC identify linguistically as Southern Tutchone (KDFN 2021; TKC 2021).

3.4.1 Southern Tutchone Ethnography and Ethnohistory

The following general review of Southern Tutchone ethnography is based on McClellan's (1964, 1975, 1981a, 1987) extensive research with the Southern Tutchone. Emphasis has been placed on the seasonal round and subsistence strategies that are most likely to have left physical evidence of past human use and may have influenced the archaeological record of the study area.

The Southern Tutchone are members of the Athapaskan language family which is broadly distributed throughout large areas of northwestern North America. The primary social groupings of the Crow and the Wolf moieties determined patterns of matrilineal descent, marriage, residency and the allocation of hunting and fishing grounds. The Southern Tutchone did not have a primary political unit, and family groupings were regionally defined by geographical characteristics, even when families may not have lived together for the entire year. The leader or "Chief" of this social unit was often determined by knowledge and hunting ability (McClellan 1975).

The Southern Tutchone seasonal subsistence round involved the summer aggregation of the group at selected fishing camps chosen for the availability of migrating salmon. The main rivers in the Southern Tutchone territory are the Alsek and its tributaries, which drain to the Pacific Ocean; and the Takhini, the upper Yukon, Donjek, Kluane and Nisling, all of which drain into the Bering Sea via the Yukon drainage basin. The five major lakes of Sekelmun, Aishihik, Kusawa, Laberge, and Kluane, along with numerous smaller water bodies, feed the Yukon-White River system. Settlement near these locations involved several families returning to established summer fishing locations each year. A variety of berries and roots were available and constituted an important food source for harvest and storage while at fishing stations and summer base camps.

By late summer, groups dispersed into the upland region to supplement and replenish food stores with a focus on securing game for winter provisions. Meat was generally dried or smoked on racks and stored in caches near the main dwellings (McClellan 1981a). Caribou, moose, mountain goat, sheep, and bear were principal sources of both food and clothing, although smaller species such as hare and marten were also trapped or hunted for their food and fur. In December and January people usually regrouped to share stored foods but once again dispersed in late winter to find game.

The Southern Tutchone traditionally built conical or rectangular lean-tos with a tied pole framework, brush walls and roofs of moss, bark or skin. These structures often housed several families sharing a central fireplace. By the late nineteenth century, some Southern Tutchone began constructing coastal-style rectangular houses of logs or split planks (McClellan 1981a). Several smaller structures were typically erected near the main dwellings, including meat and fish drying racks, racks for boat frames and toboggans, and frames for skin tanning and smoking, as well as small huts for menstruants and parturients. No excavation was required for a main foundation, and evidence of postholes and central hearths are the primary features most likely to be found archaeologically for such structures. Domed tents of caribou or moose hide stretched over sapling frameworks were used by smaller late winter family groups.

A wide variety of implements were used for hunting, fishing and gathering plant foods. Stone tools such as projectile points, knives, scrapers, and flaking debris are commonly recovered from archaeological contexts. The larger suite of implements made of less durable materials including antler, bone, leather, wood and perishable fiber are not well-represented archaeologically due to poor preservation in acidic soil conditions. Many kinds of traps, snares, corrals and hunting blinds were used during ethnographic and historical times and still can be seen on the landscape today. Box and funnel traps were utilized in conjunction with weirs to catch salmon, trout, pike, and large whitefish. Dip nets, gill nets, leisters, hooks, gaffs, spears, and lines were also used to catch fish (McClellan 1981a).

Prior to European contact, interior Tutchone people maintained trade networks with Coastal Tlingit of Alaska and northern BC. Trails and river corridors facilitated the movement of dentalium, copper, Chilkat blankets, eulachon, seaweed, and cedar baskets to the interior in exchange for meat, goat fur, and other goods (McClellan 1964). Russian fur traders introduced a new exchange market in the late 1700s and early 1800s, which was readily incorporated into pre-existing trade networks and focused on sea otter and other fur-bearing mammal pelts. This trade brought kettles, needles, blankets, and eventually guns to the southwest Yukon.

3.5 POST-CONTACT HISTORY

Early European exploration in the southwest Yukon began with those of Frederick Schwatka, who in 1883 undertook a geological and geographical survey for the Unites States military (Schwatka 1898). William Ogilvie and George Dawson also travelled along the Yukon River in southwest Yukon during their explorations for the Geological Survey of Canada in 1887 to 1888 (Dawson 1887).

European settlement began in the region during the Klondike Gold Rush in 1897. The first settlements in the area included Canyon City, above Miles Canyon, and Closeleigh, which was situated across the river from where downtown Whitehorse is today (Sack 1970). These settlements were dependent on Norman Macauley's tramway which provided the sole means of portage around Miles Canyon and the Whitehorse rapids. Between 1898 and 1900 the White Pass & Yukon Route Railway was built between Skagway and Whitehorse. Once the White Pass railroad was built, the settlements surrounding the tramway were abandoned, with settlement moving to the end of the rail line at Whitehorse. Whitehorse thrived during the Klondike Gold Rush being situated at the end of the rail line and beginning of the steam ship routes to Dawson (Sack 1970).

The next influx of people into the region came with the Second World War and the construction of the Alaska Highway. The construction of the Alaska Highway altered settlement patterns in the area as people moved to higher populated areas for access to schools, wage-labour jobs and medical services. The large influx of military personnel into the Yukon associated with the construction of the highway and the Whitehorse airport also required considerable development for housing (Sack 1970). Many of these housing developments and residential areas became the subdivisions seen in and around Whitehorse today.

3.6 PREVIOUS HERITAGE ASSESSMENTS

No prior heritage assessments have been completed within the study area, and few have taken place in Copper Ridge. There is one previously recorded site nearby the project area, recorded earlier this year (2022) by Stantec under permit 22-07ASR.

The Whitehorse area hosts several important archaeological occurrences, some of which can be dated to the early Holocene. Sites commonly occur on elevated and well drained landforms near hydrological features, such as rivers, lakes, or creeks. McIntyre Creek is approximately 1.5 km west of the project area, flowing north and northeast before meeting with the Yukon River near Whitehorse. Numerous pre-contact heritage sites, including some that have yielded microblades and microblade cores, have been recorded on along McIntyre Creek (CPAWS Yukon, personal communication with Ty Heffner, 2020; Thomas 2005; Rutherford 1997).

3.7 YUKON CULTURE HISTORY

The most comprehensive culture history for the Yukon was compiled by Workman (1978), and the following description follows his work, except where otherwise cited. Major differences between Workman's chronology and that in use today include the conception of a Northern Cordilleran tradition (Clark 1991, 1983; Clark and Clark 1993; Clark and Morlan 1982; Gotthardt 1990; Hare 1995), the recognition of the mid-Holocene Annie Lake Complex (Greer 1993; Hare 1995), and the combination of Workman's Aishihik and Bennett Lake Phases into the Late Prehistoric Period (Hare 1995).

3.7.1 Northern Cordilleran Tradition (>7,000 BP[1])

Increasing evidence for a pre-microblade technological tradition in the Yukon has led many researchers to adopt the Northern Cordilleran tradition as a viable construct in Yukon archaeology. Clark and Clark (1993) would classify any interior site older than 7,000–8,000 BP and lacking microblades as Northern Cordilleran. In many places this technological tradition existed contemporaneously with users of the microblade technology of the Little Arm Phase, and this appears to have been the case in the southern Yukon (Hare 1995). Characteristic artifact forms included large bifaces, blades from informal cores, tools on blades (e.g., transverse notched burins, and burin/scraper/notch combinations), and large, convex based and side notched or lobate stemmed Kamut points (Gotthardt 1990). To this list can be added elongate stone knives (Clark 1991) and bipoints (Hare 1995). The basal occupation of the Canyon

[1] Conventional format for radiocarbon dating, where 'BP' means years 'before present' and 0 BP is defined as AD 1950.

site (JfVg-1), which is radiocarbon dated to 7,195 ± 130 BP, as well as Moose Lake (KaVn-2), which is dated to between 10,670 ± 80 BP and 10,130 ± 50 BP, have both been identified as Northern Cordilleran occupations (Hare 1995).

3.7.2 Little Arm Phase (8,000–5,000 BP)

After about 8,000 BP a distinctive microblade technology spread to many areas of the Yukon and, while it was thought that this technology disappeared after around 5,000 BP, reevaluations suggest that it was present much later (Hare 1995; Hare and Hammer 1997). Clark (1991) accounted for these later microblade assemblages by suggesting that they resulted from hybridization with subsequent cultures. This phase was characterized by microblades, tabular and wedge-shaped microcores, burins, geometric round-based points, and the absence of Taye Lake diagnostics (see below). There were no notched points, and large bifaces and other heavy implements were very rare or absent. Endscrapers were large and narrow, but not abundant, and gravers also occurred. Sites probably represented short stays by small groups, and evidence suggests that the subsistence base was much like the early Taye Lake Phase, and included bison, caribou, moose, and birds.

3.7.3 Annie Lake Complex (5,100–4,600 BP)

Greer (1993) reviewed evidence of a distinctive technological complex in southwestern Yukon that consisted of concave based lanceolate projectile points. She noted that these points have morphological similarities to McKean points on the Plains and Shuswap points from the Plateau and suggested that this may represent a broad cultural interaction sphere. During initial excavations at the Annie Lake site (JcUr-3) Greer (1993) could provide bracketing dates of 4,900–2,000 BP for this complex. With additional work at the site, Hare (1995) determined that the complex dated between 6,200–2,900 BP and is likely restricted to 5,100–4,600 BP (Hare 1995: 130), although he feels that this is tentative. Hare (1995) also added the use of high quality lithic materials and highly curated multipurpose tools as traits of the complex.

3.7.4 Taye Lake Phase (6,000–1,250 BP)

Part of the widespread Northern Archaic Tradition, which Clark (1991) believes developed out of the Northern Cordilleran tradition, the Taye Lake Phase consists of all archaeological materials that are younger than 5,000 BP but predate the White River Ash. This phase was characterized by notched or lanceolate points with straight or slightly concave bases, an abundance of large bifaces, thick unifaces, a variety of endscrapers, and a developed bone industry. Ground stone was present but native copper was not in use. Burins were rare, and gravers were only found sporadically. End scrapers were profuse, of either rounded or angular form, possibly with multiple working edges. This was the only phase where endscrapers had been prepared for hafting. Workman suggested a division of this phase at 3,000–3,500 BP with late traits being tabular schist bifaces and stone wedges, and early traits being notched cobbles and shaped, beveled blades. He saw this division as coincidental with the onset of neoglaciation, the resulting formation of proglacial lakes, and the probable disappearance of grasslands and bison. Large, rich sites were suggestive of seasonal return to favourable locations over a long period of time. Trapping, fishing, and bird hunting likely supplemented big game hunting. On technological grounds, Workman proposed a

population replacement or absorption at the beginning of this phase to explain the many differences and very few similarities between it and the Little Arm Phase but, as Hare (1995: 104–105) noted, technological traditions are not the equivalent of cultural traditions, so population movements are not necessary to account for the differences.

The Taye Lake Phase is somewhat arbitrarily separated from the Late Prehistoric Period by the White River Ash, a useful stratigraphic marker, and, while Workman (1978) saw a great deal of cultural continuity across this horizon, he also felt that the ashfall had catastrophic effects on the people living in the southwest Yukon at the time of the eruption. Coincidental with the eruption, people were coping with other significant changes to the landscape; neoglacial ice had restricted access to the mountains and had caused flooding of the valleys, while at the same time salmon were prevented from reaching the interior, and bison, an important resource, may have disappeared (Workman 1973). As a result, he believed that the area was probably abandoned for several years and people dispersed either north or south, out of the path of the ash.
This proposed exodus may have caused hostility with neighboring groups, whose territory was restricted by the newcomers. Workman (1973, 1978, and 1979) also believed that the migrations, which resulted in the arrival of Athapaskan speakers to the American Pacific Coast and Southwest, were triggered by this eruption. Moodie et al. (1992) offered corroborating evidence by recording oral traditions among Mackenzie Dene that tell of a large volcanic eruption, widespread ashfall, and of their coming to the Mackenzie Valley from over the western mountains. Otherwise, Workman's arguments for cultural upheaval because of the volcanic explosion remain circumstantial.

3.7.5 Late Prehistoric Period (1,250–50 BP)

This period postdates the fall of the White River Ash and includes the introduction of European trade goods near its terminus. It was characterized by native copper implements and flaked stone to a lesser degree. Characteristic artifact types included endscrapers with rounded outlines and thin working edges, and bifaces and unifaces with thin working edges. Burins were absent or very rare, and tabular bifaces and stone wedges (pièces esquillées) reached maximum frequency. Unique traits were native copper, abraded cobbles, multi-barbed bone points, small stemmed Kavik-like points, small side-notched points, and slate pieces with thick, flat ground edges. Those types shared with the Taye Lake Phase were geometric and notched points, multi-barbed bone points, stone wedges, boulder spalls, two endscraper types, flake blade cores, blunted discoids, tabular bifaces, stemless points, broad, thin endscrapers, discoidal flake cores, and other general traits. Small sites probably reflected the ethnographic settlement pattern. Workman (1978) agreed with MacNeish (1964) that forest expansion was probably responsible for the decrease in site size and number but, unlike that author, saw no evidence for increased fishing and trapping at the expense of large game hunting.

Near the end of the Late Prehistoric Period an elaborate bone industry and a growing significance of European trade goods were in evidence. Expected characteristics of this phase included the increased use of metal tools at the expense of stone and native copper, the use of metal pots instead of skin or bark bags and boiling stones, an increase in axe-chopped bones with fewer calcined fragments, an increased

emphasis on fur-bearing animals because of the fur trade, and increased sedentism with log cabin villages being occupied at least seasonally.

4.0 METHODS

The following section describes the methods used for the HRIA. Proposed HRIA methods were outlined in the Class 2 Archaeologist Permit application submitted for the study. Details of the survey transects, surface inspection, and heritage resources identified during fieldwork are discussed in Section 5.0.

4.1 PEDESTRIAN SURVEY

Pedestrian survey was conducted by one crew consisting of three people (approximately 10–15 m apart, with 30–40 m visibility) across the entire study area.

Field personnel surveyed for historical features, surface exposures (e.g., previously disturbed areas, tree throws, cut banks, wind exposures, and areas with limited soil development), prominent topographic features (e.g., saddles, knolls, terraces, and ridge tops), and standing and fallen trees with the potential for cultural modification, to identify above-ground or exposed subsurface heritage artifacts and features. Pedestrian survey was undertaken in snow-free conditions and included a surface inspection of exposures from previously disturbed areas and trails.

Preference was given to stable, well-drained landforms, or sheltered areas situated near water bodies or with vantages of the surrounding terrain. One location was noted as an AOP, which consisted of a well-drained, level area, with vantages of surrounding terrain. The AOP, shovel tests, and survey transects were recorded using GPS and their details were documented in digital notes.

4.2 SUBSURFACE TESTING

Judgmentally placed shovel tests were excavated at the AOP and spaced judgmentally at approximately 5 m. The intent of testing was to determine the presence of subsurface heritage resources where none were visible on the ground surface. Subsurface tests were excavated by shovel and measured approximately 35 cm by 35 cm. Tests were terminated when glacial till or bedrock was encountered. A subsurface stratigraphy log was maintained with representative stratigraphy recorded at the AOP.

Sediments were passed through ¼ inch mesh screen. Subsurface test locations were recorded using a handheld GPS unit.

5.0 RESULTS

This section presents the results of HRIA, including details of the work undertaken at the identified AOP.

5.1 HRIA RESULTS

HRIA fieldwork focused initially on pedestrian survey of the study area to identify surface heritage resources (e.g., culturally modified trees, artifacts visible in disturbed or eroding areas) and to record areas with potential (AOPs) to contain subsurface heritage resources (e.g., buried cultural materials).

One marginal AOP was recorded during pedestrian traverses of the study area, as detailed in Table 1 and depicted on Figure 2. The AOP (Photo 1 and Photo 2) was fully tested and negative for cultural materials. A total of 10 shovel tests were excavated during the HRIA. The study area is within Copper Ridge and there are numerous signs of contemporary use including walking and motorized vehicle trails, vegetation clearing for fire management (fire-smart), recent tree planting, and push piles associated with adjacent roads and trails. The remainder of the study area is characterized by level undifferentiated, hummocky terrain (Photo 3).

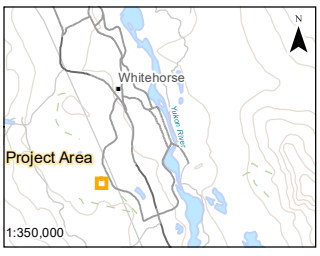
Vegetation in the study area includes recently thinned pine and spruce forest with recently planted deciduous and occasional willow. Ground cover in the area consists of labrador tea, soapberry, kinnikinic, fireweed, sphagnum moss, lichens, and lupine.

Table 1 HRIA Results

AOP Label	Description	Results	Dimensions
AOP 1	Marginal AOP consisting of a moderately elevated knoll approximately 2 m above terrain to the southwest and 3-5 m above terrain to the north and northwest. The knoll-top slopes west generally 2-5°. Intact sides of the feature are undefined and slope gradually toward lower terrain at 5-10°. The eastern edge of the AOP is cut by Falcon Drive, and likely extended east prior to the development of the road. There are no hydrological features in the vicinity of the AOP.	Ten (10) shovel tests excavated, all negative.	34 m north-south x 16 m east-west

5.2 LIMITATIONS OF THE HERITAGE ASSESSMENT

Although a thorough attempt was made to identify heritage resources within the study area, as with all archaeological studies the possibility exists that unidentified resources are present. As such, when viewing the HRIA results it is important to note that low potential does not mean *no* potential.



Surveyed Land Parcel
Project Area
Area of Potential / Shovel Test Area

0 25 50 75 100 m
1:2,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 8N
2. Data Sources: Conservation Areas Reporting and Tracking System; Natural Resources Canada

Stantec Yukon

Project Location:
Whitehorse
NTS:105D/11

Project Number: 123222106
Prepared by MYOUNG on 20220711
Requested by MYOUNG on 20220711
Checked by SMACKENZIE on 20220713

Client/Project/Report
Government of Yukon, Community Services
HRIA for Copper Ridge Lot 519 and 520
Permit 22-20ASR

Figure No.
2

Title
Results Map
Copper Ridge Lot 519 and 520

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6.0 RECOMMENDATIONS

No further heritage work is recommended for the study area, which is assessed as having low heritage potential.

7.0 CLOSURE

Heritage resources are protected from non-permitted alterations or disturbances in the Yukon by the *Historic Resources Act* (Government of Yukon 2002) and the Archaeological Sites Regulation (Government of Yukon 2003a).

To address the discovery of unanticipated heritage resources, it is recommended that, if heritage resources are encountered, the proponent inform their personnel and contractors that all development activities near the heritage resources must be suspended immediately. Information on the identification of commonly encountered heritage resources can be found in the Government of Yukon publication entitled *Handbook for the Identification of Heritage Sites and Features* (Gotthardt and Thomas 2005).

This study was an HRIA and was not intended to evaluate or comment on First Nation traditional use of the study area. The results of this study, therefore, should not be considered valid for that purpose.

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APPENDIX A

Photographs

Appendix A PHOTOGRAPHS

A.1 LIST OF PHOTOGRAPHS

Appendix A Photographs
July 25, 2022

Photo 1 View East to AOP 1

Photo 2 View Southeast from AOP 1

Photo 3 View South from Northern Portion of Project Area

GOVERNMENT OF YUKON

COPPER RIDGE LOT 519 & 520

MUNICIPAL SERVICING ASSESSMENT

SEPTEMBER 30, 2022

CONFIDENTIAL

COPPER RIDGE LOT 519 & 520

MUNICIPAL SERVICING ASSESSMENT

GOVERNMENT OF YUKON

CONFIDENTIAL

PROJECT NO.: 221-05315-00
DATE: SEPTEMBER 30, 2022

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Date 2022-09-30
PERMIT NUMBER PP150
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PROFESSIONAL ENGINEER YUKON TERRITORY
2022-09-30

Eric Seinen, P.Eng.

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1 INTRODUCTION

1.1 OVERVIEW

The Government of Yukon retained WSP Canada Inc. (WSP) to develop a municipal servicing assessment report for Copper Ridge Lot 519 & 520. The intent of this report is to determine the maximum additional residential density achievable with the existing infrastructure and to identify the threshold where feasible infrastructure upgrades would be required.

The project site is shown in **Figure 1-1** and is located in the southwest region of the City of Whitehorse. The site is bounded by Diamond Way and Copper Ridge Place to the north, Falcon Drive to the east and south, and Tigereye Crescent to the west. The site is surrounded by existing developments where existing utilities are present, and the proposed development would tie into these existing utilities.

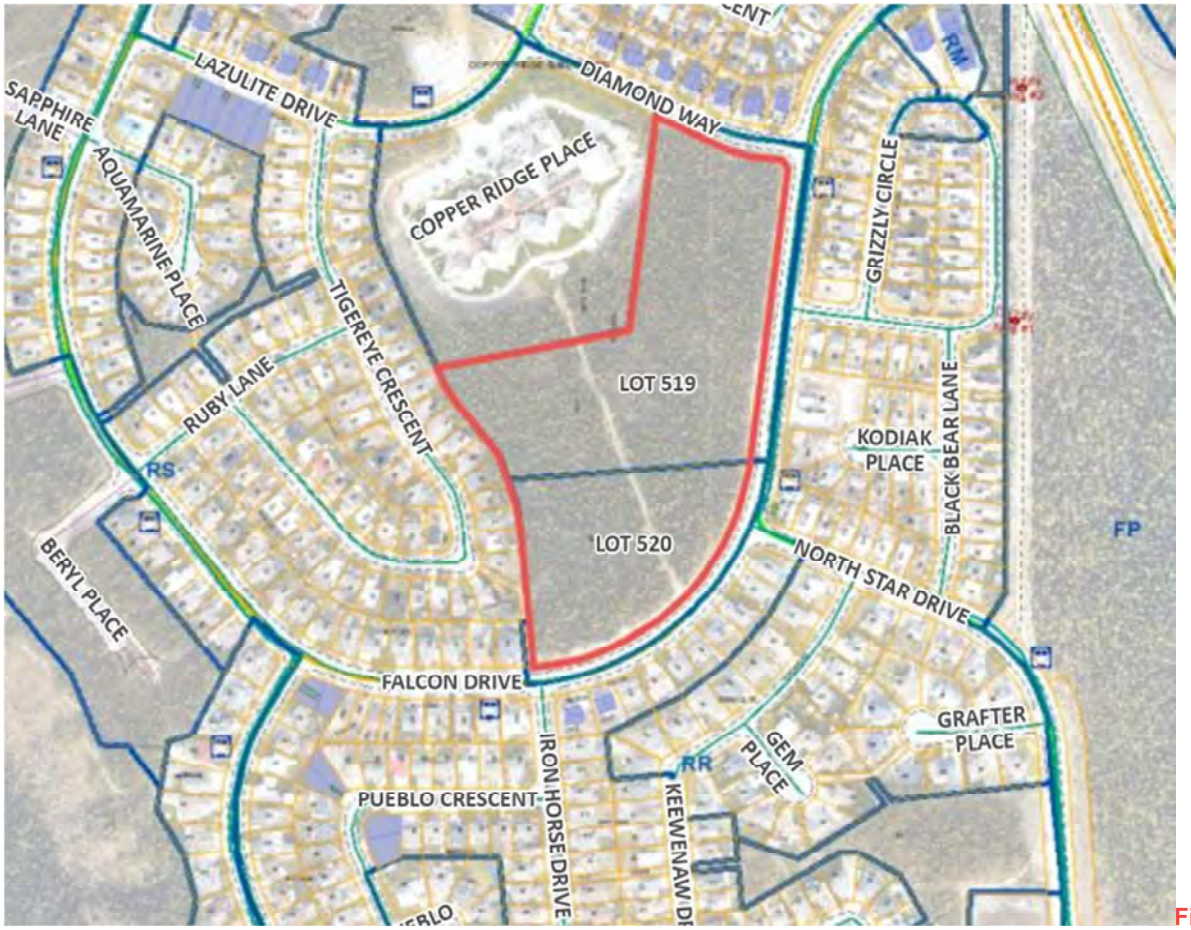


Figure 1-1 Copper Ridge Lot 519 & 520 (City of Whitehorse, 2022)

1.2 DATA COLLECTION AND BACKGROUND REVIEW

Various information including record drawings, studies, and datasets were provided by the City of Whitehorse, Yukon Government, ATCO Electric Yukon, and Northwestel, and are presented in **Table 1-1**.

Table 1-1 Data Summary

DATA	YEAR	DESCRIPTION
City of Whitehorse Open Data Portal Sanitary, Storm, and Water Datasets	2016	Shapefiles containing lines representing road centerlines, road right of ways; sanitary mains, manholes, outfalls, stations, valves; storm catchbasins, catchbasin manholes, culverts, ditches, mains, manholes, outfalls, stations; and water hydrants, mains, manholes, valves in the City of Whitehorse.
City of Whitehorse Open Data Portal LiDAR 1-meter data	2013	Point files of high-accuracy and high-resolution DEM processed into 1-meter post spacing within WH-67, 68, 77 and 78.
City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.3 – Water Distribution System	2020	Design criteria for water distribution systems within the City of Whitehorse.
City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.4 – Sanitary Sewer System	2020	Design criteria for sanitary sewer systems within the City of Whitehorse.
City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.5 – Storm Drainage System	2020	Design criteria for storm sewer systems within the City of Whitehorse.
Government of Yukon Territory Predesign Report for Hillcrest Area "D" Subdivision in Whitehorse, Yukon – Final Report	1993	The Government of Yukon retained UMA Engineering Ltd. to prepare a detailed conceptual layout plan and pre-design engineering plan for the Hillcrest expansion area. The report discusses existing off-site infrastructure; design criteria for the proposed water distribution system, sanitary sewer system, roadways and drainage, shallow utilities; and a cost estimate.
City of Whitehorse Water Model	Year not provided	An EPANET model of the water distribution system within the City of Whitehorse.
Copper Ridge AutoCAD Drawing	Year not provided	AutoCAD drawing of lot lines, roadwork, sanitary sewer, storm sewer, and watermain infrastructure within the Copper Ridge subdivision.
Copper Ridge Infill Site Dataset	Year not provided	Shapefile containing lines representing the Copper Ridge Infill Site boundary.
Copper Ridge Existing Telecommunications Infrastructure Model	2022	PDF of existing telecommunications infrastructure within the Copper Ridge subdivision.
Copper Ridge Lot 519 & 520 Existing Power Infrastructure CAD Drawing	Year not provided	AutoCAD drawing of existing power infrastructure within the Copper Ridge subdivision.

Copper Ridge Subdivision Phase 2 – Stage 8 Utilities and Roadworks AutoCAD Drawing	1998	AutoCAD drawing of lot lines, roadwork, sanitary sewer, storm sewer, watermain, and electrical infrastructure within Phase 2 Stage 8 of the Copper Ridge subdivision.
Copper Ridge Subdivision Phase 2 – Stage 9 As-builts	2003	AutoCAD drawing of as-builts taken within Phase 2 Stage 9 of the Copper Ridge subdivision.
Copper Ridge Subdivision Phase 3 – Utilities & Roadworks Predesign AutoCAD Drawing	1998	AutoCAD drawing of lot lines, sanitary sewer, storm sewer, and watermain infrastructure within Phase 3 of the Copper Ridge subdivision.
Copper Ridge Subdivision Phase 5 AutoCAD Drawing	2000	AutoCAD drawing of lot lines within Phase 5 of the Copper Ridge subdivision.
Record Drawings	1994-2005	Record drawings of sanitary sewer, storm sewer and watermain infrastructure along Diamond Way, Falcon Drive, Grizzly Circle, Lazulite Drive, Tigereye Crescent, and within the Winze Place Lift Station.

1.3 ASSUMPTIONS AND LIMITATIONS

- All assessments are based on information provided by the City (no field visits or surveys conducted).
- The storm and sanitary sewer capacity will be assessed by analyzing the provided sewer models or flows and pipe information up to the nearest discharge location or trunk main (whichever is nearest).
- The proposed development will not be restricted to low density residential. If a higher density residential development on the proposed site is deemed feasible, any servicing restrictions and recommendations on infrastructure improvements will be provided. Condition assessment of the sanitary and storm sewer pipes is outside the scope of work. All pipes are assumed to be in good operating condition with no capacity limiting issues.
- The City's GIS water infrastructure datasets differed from the City's water distribution model. The model was assumed to be accurate.

2 EXISTING CONDITIONS

The regional topography, existing infrastructure, and existing land use within and surrounding the project site is illustrated in **Figure 2-1**, **Figure 2-2 to Figure 2-4**, and **Figure 2-5** respectively.

2.1 TOPOGRAPHY

Ground elevations within the project site range from 789 m in the south to 778 m in the north. This indicates that the topography within the project site slopes from south to north towards Diamond Way and Copper Ridge Place, a long-term care facility, then Lazulite Drive.

2.2 SANITARY SEWER SYSTEM

Upstream of the project site, the flows from lots to the south of North Star Drive discharge into the lift station on Winze Place. Based on the information provided by the City's Operations Team, the pumps in the lift station run alternatively after each pump cycle. The flows from the lift station continue north within the forcemain and discharge into the manhole at the North Star Drive & Drift Drive intersection. The flows from the lift station and the lots between North Star Drive and Falcon Drive discharge into Manhole S-86 and Manhole S-302 at the North Star Drive & Falcon Drive intersection and Manhole S-305 at the Iron Horse Drive & Falcon Drive intersection. From these manholes, the flows continue north along the 300 mm PE sanitary line on Falcon Drive and discharge into Manhole S-90. A 300 mm PE sanitary line runs northwest along Diamond Way from S-90 to S-92. The flows from Copper Ridge Place and the lots along Diamond Way discharge into this line. From S-92, a 350 mm PE sanitary trunk main runs northeast along Lazulite Drive. The contributing area to the lift station and trunk main, and the sanitary route described are shown in **Figure 3-1**.

2.3 STORMWATER SEWER SYSTEM

North of the project site, two catchbasins (CB-12A and CB-12B) are installed on each side of Diamond Way. 250 mm concrete CB leads connect the catchbasins to Manhole D-12 and from this manhole, a 300 mm concrete storm sewer runs northwest along Diamond Way and connects to Manhole D-11 at the Diamond Way & Lazulite Drive intersection. A 300 mm concrete storm line runs along Lazulite Drive, from Tigereye Crescent to Diamond Way, connecting to D-11. For Copper Ridge Place, a network of 150 to 250 mm storm sewers connect and discharge into the 300 mm concrete storm line along Lazulite Drive. A 300 mm CSP storm sewer stub connects to D-11 from the west. From D-11, a 450 mm HDPE storm trunk main runs northeast along Lazulite Drive.

2.4 WATER NETWORK

Key water distribution infrastructure in the area includes the Copper Ridge Pump Station, which is east of the proposed development site (across Falcon Drive). Additional existing infrastructure near the project site includes the following:

- A 200 mm ductile iron watermain on Diamond Way.
- Two (parallel) 250 mm ductile iron watermains on Falcon Drive between Iron Horse Drive and the Copper Ridge Pump Station (**Figure 2-2A**). The watermain nearest to the north/west end of Falcon Drive services the Tigereye Crescent and Ruby Lane area and includes one service ('Servicing Point 1') to the proposed development site approximately 15 m east of Iron Horse Drive. The other watermain (south/west end of Falcon Drive) services the area generally south of Falcon Drive (refer to **Section 3.3** for information on potential 'Servicing Point 3').
- A 250 mm ductile iron watermain on Falcon Drive approximately between the Copper Ridge Pump Station and Diamond Way. This watermain includes three services (considered as one service or 'Servicing Point 2') to the proposed development site, two of which are within 30 m of the Copper Ridge Pump Station and the final one, about 30 m south of Diamond Way.

Figure 2-2A Existing watermains on Falcon Drive (between Iron Horse Drive and North Star Drive)

The City provided the current water distribution model for assessing the impact of the proposed development on the existing system. Model results for typical water demand scenarios (scenarios and design criteria explained in **Section 3**) under existing conditions are summarized in Table 2-1. Model screenshots showing results are also provided **Appendix C**.

Table 2-1 Existing conditions model results

MODEL NODE	APPROXIMATE LOCATION	SIMULATED PRESSURES (KPA)						
		ADD	MDD	MDD+100 L/S FF[1]	MDD+180 L/S FF[1]	PHD	NFD – FILLING	NFD – THERMAL
20700	Iron Horse Drive and Falcon Drive (south/east 250 mm watermain)	369.3	364.2	177.7	<0	358.8	371.6	373.3
20510	Iron Horse Drive and Falcon Drive (north/west 250 mm watermain)	405.2	385.6	111.7	<0	367.2	413.4	419.7
20010	Falcon Drive and Diamond Way (200 mm watermain)	322.3	290.1	<0	<0	259.7	335.8	346.3

Notes:

1 A fire flow of 100 or 180 L/s was applied at each model node evaluated.

The existing conditions model results indicate that the water distribution system could support up to a low-density residential development in the project site (subject to finished ground elevations within the project site). The 250 mm watermain on the south/east end of Falcon Drive provides the best alternative to service the project site (based on fire flow scenario results).

2.5 POWER

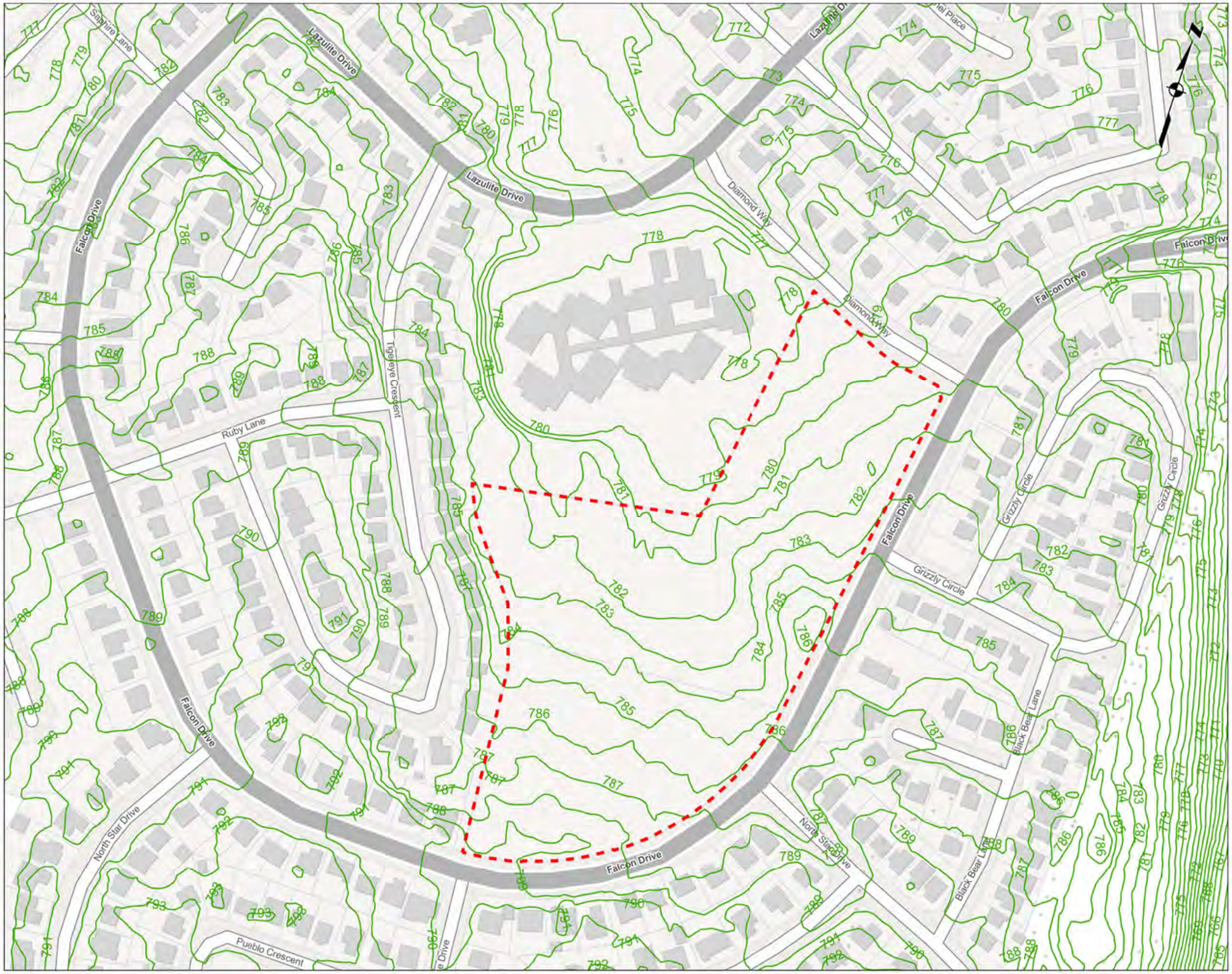
Figure 2-3 shows the existing power infrastructure in the surrounding neighborhood. Power is currently supplied by ATCO Electric Yukon in the surrounding neighborhood. The siteis located in an overhead rear lot serviced area. Services are not currently provided to the project site.

North of the project site, 25 kV numbered underground lines run along Lazulite Drive, and 14 kV underground lines and secondary underground lines run along Diamond Way. West of the project site, 25 kV underground lines and secondary underground lines run along Tigereye Crescent. East and south of the project site, 14 kV underground lines and secondary underground lines run along Grizzly Circle, Iron Horse Drive, Keewenaw Drive, and the southern portion of Falcon Drive. 25 kV underground lines and secondary underground lines run along North Star Drive and the northern portion of Falcon Drive.

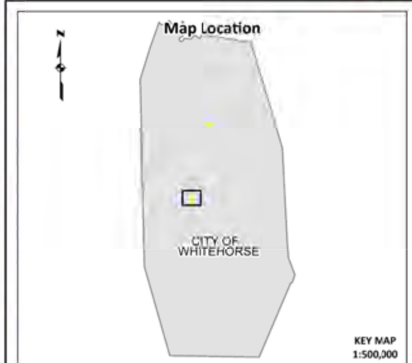
Copper Ridge Place and the lots surrounding the project site are serviced by service drop underground lines.

2.6 TELECOMMUNICATIONS

Figure 2-4 shows the existing telecommunications infrastructure in the surrounding neighorhood. Telecommunications is currently supplied by Northwestel in the surrounding neighborhood. The existing infrastructure in the surrounding neighborhood is underground. Services are not currently provided to the project site.



Legend
Project Boundary
1m Elevation Contour



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 2-1: Copper Ridge Lot 519 & 520
Regional Topography
City of Whitehorse
Yukon, Canada

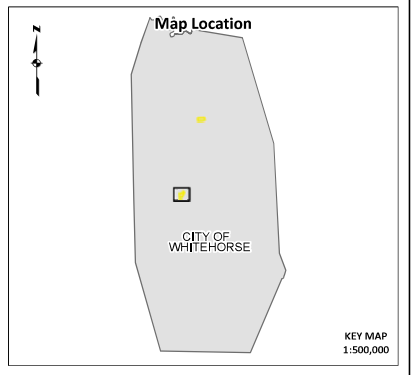
0 15 30 60 90 120 Meters

Report By: JC
Drawn By: JC
Reviewed By: CG, ES
Date: Sept 15, 2022

Notes: LiDAR Data provided by the City of Whitehorse Open Data Portal

Legend

- Project Boundary
- Water Mains
- Water Manholes
- Water Hydrants
- Water Valves
- Copper Ridge Pump House
- Storm Mains
- Storm Culverts
- Storm Ditches
- Storm Catch Basins
- Storm Catch Basin Manholes
- Storm Manholes
- Storm Outfalls
- Sanitary Mains
- Sanitary Manholes
- Sanitary Stations
- Figure 2-2A Detail



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 2-2: Copper Ridge Lot 519 & 520 Existing Infrastructure

City of Whitehorse
Yukon, Canada

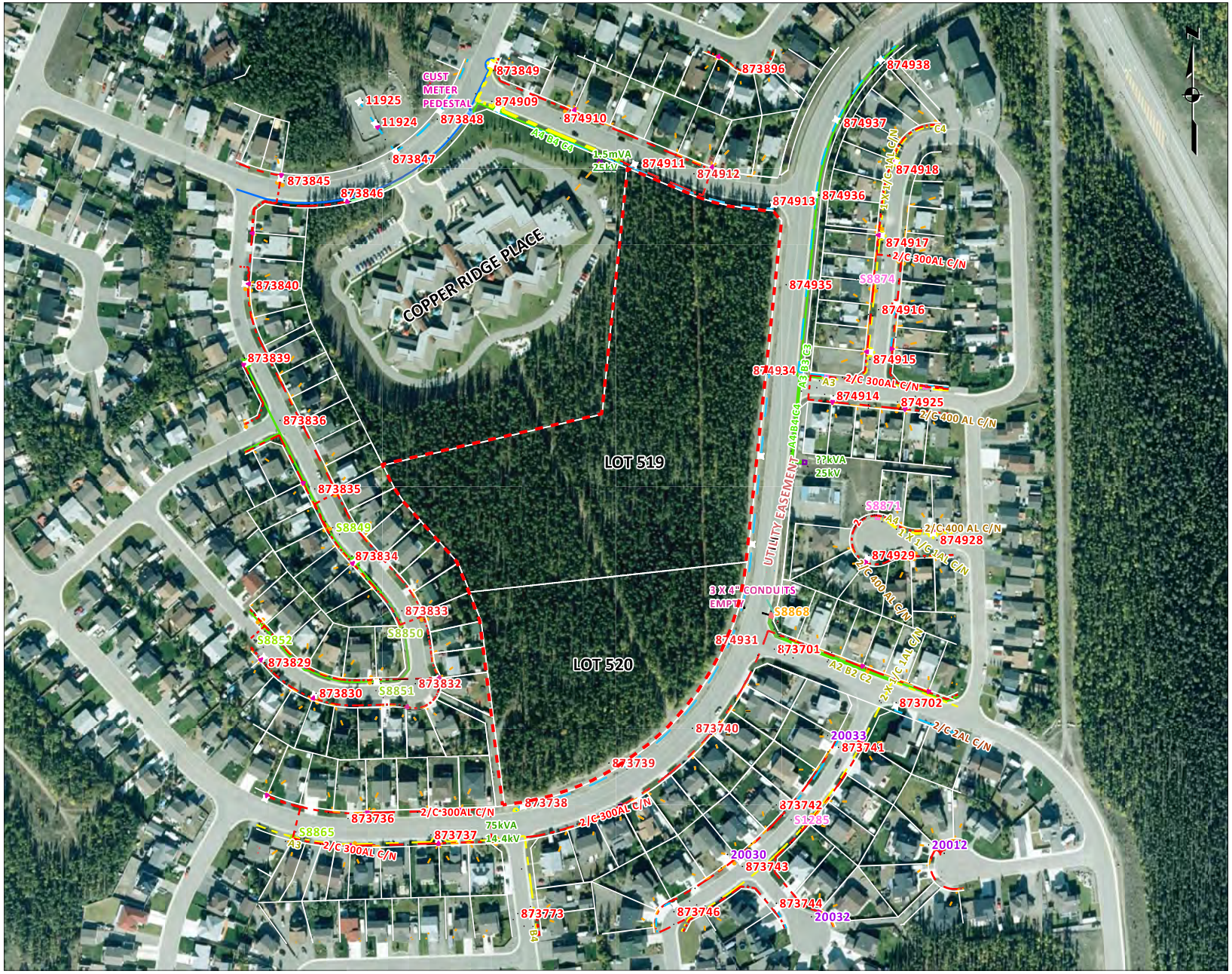
Scale: 1:5,000

0 30 60 120 180 240 Meters

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

Report By: JC	WSP Job #: 221-05315-00
Drawn by: JC	Date: Sept 19, 2022
Reviewed By: GG, ES	Office: Edmonton

Notes: GIS data provided by the City of Whitehorse Open Data Portal



Legend

- Project Boundary
- 14 kV 1 Phase Underground Transformer
- 14 kV Underground Lines
- 25 kV 1 Phase Underground Transformer
- 25 kV 3 Phase Underground Transformer
- 25 kV 3 Phase Switch Cubicle
- 25 kV Numbered 3 Phase Switch Cubicle
- 25 kV Numbered Underground Lines
- 25 kV Underground Lines
- Conduit Only
- Easement
- HPS Steel
- Land Parcel
- Leader
- LED Steel Streetlight
- Pedestal
- Secondary Underground Isolation Point
- Secondary Underground Lines
- Service Drop Underground Lines
- Streetlight Abandoned Lines
- Streetlight Underground Lines
- Warning Lights

Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 2-3: Copper Ridge Lot 519 & 520 Existing Power Infrastructure

City of Whitehorse
Yukon, Canada

Scale: 1:2,500

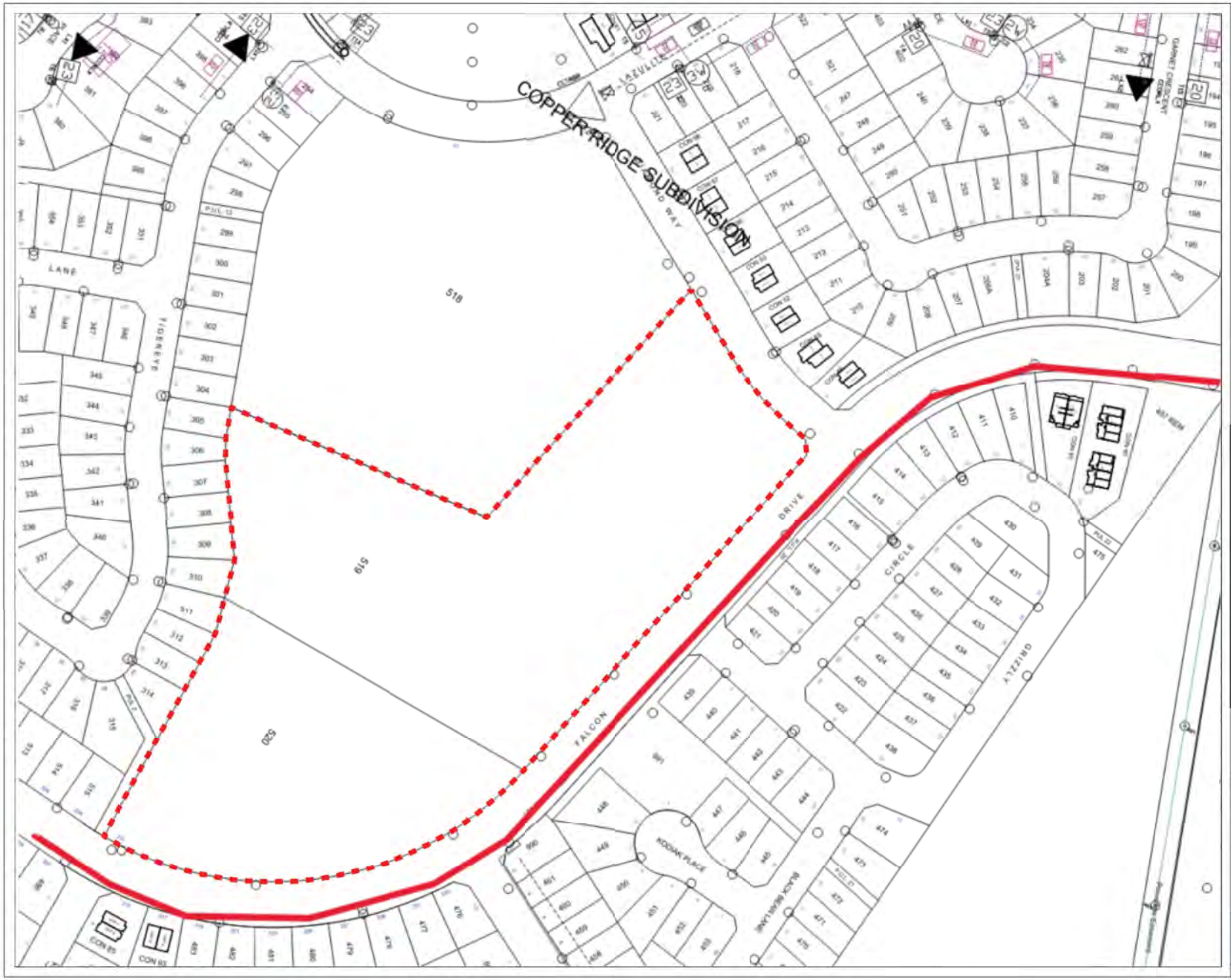
0 15 30 60 90 120 Meters

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

Report By: JC
Drawn by: JC
Reviewed By: GG, ES

WSP Job #: 221-05315-00
Date: Sept 22, 2022
Off be: Edmonton

Notes: Shapef les provided by ATCO Electric Yukon

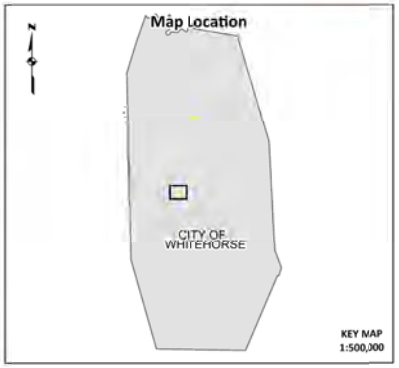


Legend

- Project Boundary
- Underground Infrastructure

Draft

Map Location



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 2-4: Copper Ridge Lot 519 & 520
Existing Telecommunications Infrastructure

City of Whitehorse
Yukon, Canada

Scale: NTS

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

WSP

Report By: JC
Drawn By: JC
Reviewed By: CG, ES

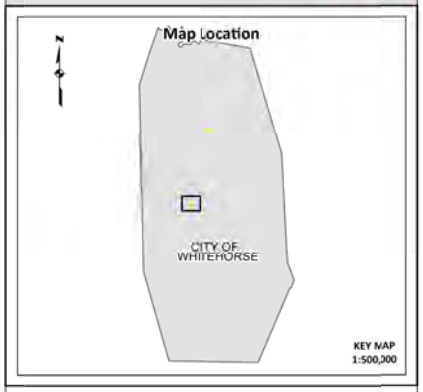
WSP Job #: 221-05315-00
Date: Sept 21, 2022
Office: Edmonton

Notes: Figure provided by Northwestel

Legend

- Project Boundary
- FP (Future Planning)
- PG (Greenbelt)
- PR (Parks and Recreation)
- PS (Public Services)
- RM (Residential Multiple Housing)
- RR (Restricted Residential Detached)
- RS (Residential Single Detached)
- Roads

Draft



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 2-5: Copper Ridge Lot 519 & 520 Existing Land Use

City of Whitehorse
Yukon, Canada

Scale 1:2,500

0 15 30 60 90 120 Meters

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

WSP

Report By: JC
Drawn By: JC
Reviewed By: DG, ES

WSP Job #: 221-08315-00
Date: Sept 20, 2022
Office: Edmonton

Notes: LiDAR Data provided by the City of Whitehorse Open Data Portal

3 ASSESSMENT

3.1 SANITARY SEWER SYSTEM

3.1.1 DESIGN CRITERIA

The scope of the sanitary sewer system assessment extends from upstream of the project site and up to the nearest downstream trunk main which is assumed to be the 350 mm PE sanitary sewer running along Lazulite Drive from S-108. It is assumed that the Copper Ridge Lot 519 & 520 sanitary sewer system will tie into S-91, and that the sanitary sewer system downstream of S-108 has the capacity to handle additional flows from the post-development condition of the project site. Flow monitoring can be conducted downstream of Manhole S-108 to confirm flow rates within the downstream system in order to validate this assumption.

The following parameters were used in the assessment and sourced from Section 2.3 and Section 2.4 of the City of Whitehorse Servicing Standards Manual:

- Capacity of Winze Place Lift Station Sewage Pump — 15 L/s
- Population Density (Residential) — 40 persons/ha
- Average Flow (90% of water consumption rate) — 450 L/c/d
- Peaking Factor (Residential) — 4.0
- Peaking Factor (Commercial, Industrial, Institutional) — 3.0
- Infiltration Allowance — 6000 L/ha/d

As per Kishchuk (2018), the average number of persons per dwelling within the City of Whitehorse averaged 2.34 persons in 2016. We used a conservative population density of 3 persons/home to determine the flows contributed by the existing residential lots.

3.1.2 RESULTS

Detailed calculations for the sanitary sewer system capacity can be found in **Appendix A**. Capacity calculations were completed for two downstream pipes: the 300 mm PE sanitary sewer running from S-91 to S-92 and the 300 mm PE sanitary sewer running from S-92 to S-108 (**Table 3-1**).

As per the Winze Place Lift Station record drawing and based on the assumption that one pump is running at a time, the capacity of the lift station equates the capacity of the sewage pump which discharges at a rate of 15 L/s. Therefore, the capacity of the lift station is considered to be 15 L/s which is below the calculated peak inflow rate of 17.22 L/s. To be conservative, 17.22 L/s was used in the calculations. The City's Operations Team noted that the pump at the lift station is running at capacity. The pump outflow rate could not be confirmed with the City's Operations Team as the flow is not monitored at the lift station. It is recommended that the City's Operations Team install temporary flow monitoring to determine the peak outflow rate prior to development of the project site.

The flows discharging from the residential lots downstream of the lift station and upstream of the project site, and contributing to the downstream pipes was considered (referred to as the Downstream Pipe Basin Boundary in **Figure 3-1**). Peak flows and inflow & infiltration were accounted for in the calculations. The total peak flow contributed by the lots is 18.20 L/s.

The flows discharging from Copper Ridge Place and contributing to the pipe section from S-92 to S-108 was also considered. As per the Government of Yukon (2022), there are 96 service beds in Copper Ridge Place. A maximum capacity of 96 persons was assumed and an allowance of 20 persons was included for staffing. Peak flows and

inflow & infiltration were accounted for in the calculations. The total peak flow contributed by Copper Ridge Place is 5.05 L/s.

The capacity of the pipe section from S-91 to S-92 was determined using the Manning Equation. The full flow capacity of the downstream pipe is 174.58 L/s. The remaining capacity in the downstream pipe was determined by subtracting the flows contributed by the lift station and residential lots from the capacity of the downstream pipe. The remaining capacity in the downstream pipe is 139.16 L/s which yields a population potential of 6,659 persons for Copper Ridge Lot 519 & 520.

The capacity of the pipe section from S-92 to S-108 was determined using the Manning Equation. The full flow capacity of the downstream pipe is 166.30 L/s. The remaining capacity in the downstream pipe was determined by subtracting the flows contributed by the lift station, residential lots, and Copper Ridge Place from the capacity of the downstream pipe. The remaining capacity in the downstream pipe is 125.83 L/s which yields a population potential of 6,019 persons for Copper Ridge Lot 519 & 520.

Table 3-1 Summary of Downstream Pipe Capacities

PIPE SECTION		SIZE	SLOPE	FULL FLOW CAPACITY	CONTRIBUTING FLOW	REMAINING CAPACITY	POPULATION POTENTIAL
FROM MH	TO MH	(MM)	(%)	(L/S)	(L/S)	(L/S)	(PERSONS)
S-91	S-92	300	3.78	174.58	35.42	139.16	6,659
S-92	S-108	300	3.43	166.30	40.47	125.83	6,019

The pipe section from S-92 to S-108 is the limiting pipe as it has a lower slope and a higher contributing flow, resulting in lower capacity. Therefore, the population potential of Copper Ridge Lot 519 & 520 is 6,019 persons based on the available pipe capacities calculated. This does not mean that the site or the downstream trunk sewer system can accommodate a population of 6,019 people. It more identifies that the existing sanitary sewer system from Manhole S-91 to the 375 mm trunk sewer is not the limiting factor for the site development potential.

The total capacity of the limiting pipe section from Manhole S-92 to S-108 is 166.30 L/s. The pre-design flow is 40.47 L/s, which results in a remaining capacity of 125.83 L/s. Based on a population density of 40 persons/ha and an area of 6.20 ha, Copper Ridge Lot 519 & 520 could accommodate a population of 248 persons. The 248 persons would contribute an additional flow of 5.59 L/s to the downstream pipe, resulting in a post-design flow of 46.07 L/s and a remaining capacity of 120.23 L/s.

As Copper Ridge Lot 519 & 520 is sloping towards Diamond Way, the implementation of an on-site gravity sanitary sewer system will be required and will tie into Manhole S-91. The implementation of a new lift station on the project site will likely not be required.

3.2 STORMWATER SEWER SYSTEM

3.2.1 DESIGN CRITERIA

The scope of the storm sewer system assessment extends from the project site and up to the nearest trunk main which is assumed to be the 450 mm HDPE storm sewer on Lazulite Drive running from D-11. It is assumed that the storm sewer system currently handles runoff from the pre-development condition of the project site during a 1:5 year rainfall event.

The following parameters were used in the assessment and sourced from the City of Whitehorse Rainfall Intensity Duration Data and Section 2.5 of the City of Whitehorse Servicing Standards Manual:

- Land Use of Copper Ridge Lot 519 & 520 — Open Space
- Runoff Coefficient — 0.15
- Time of Concentration (Inlet Time) — 15 min

- Intensity 19.41 mm/h

3.2.2 RESULTS

Detailed calculations for the storm sewer system capacity can be found in **Appendix B**.

From the LiDAR data, runoff from the site will flow towards Diamond Way, and will enter the storm sewer system via CB-12A. It is assumed that there is no cross-lot drainage so that the stormwater runoff from Copper Ridge Lot 519 & 520 will not flow into the Copper Ridge Place lot. The implementation of a swale between Lot 519 & the Copper Ridge Place lot may be required to direct the runoff from the project site to Diamond Way.

It is assumed that the post-development release rate will be required to match the pre-development flow rate for the 1:5 year rainfall event. The pre-development flow rate of the project site runoff was determined using the Rational Method. The pre-development flow rate for Copper Ridge Lot 519 & 520 is calculated at 50 L/s; therefore, the post-development release rate for Copper Ridge Lot 519 & 520 will need to be restricted to 50 L/s. Onsite stormwater sewer infrastructure, including stormwater management and storage, will likely be required in order to maintain pre-development flow rates. The implementation of an onsite sewer and storage system will likely require a storm sewer main extension along Diamond Way from Manhole D-11 to the project site. These sewer infrastructure upgrades may eliminate or lessen the need for the swale between Lot 519 & the Copper Ridge Place lot. Specific stormwater management and storm sewer extension requirements should be reviewed and confirmed to meet the post-development release rate during detailed design of the site.

It is not recommended to tie a portion of the onsite storm sewer system to the existing infrastructure in Grizzly Circle as the natural drainage patterns of the Copper Ridge site flow towards the Copper Ridge Place lot and Diamond Way. By tying a portion of the system to Grizzly Circle, an increase of flows would be introduced to the infrastructure along Grizzly Circle which were likely not accounted for in its original design. Additionally, as the site currently has significant crossfall to the northwest, a large amount of grading revisions would be required to redirect flow to Grizzly Place and would lead to challenges with pipe inverts.

The City noted that there is a history of drainage issues in the Copper Ridge Lot 519 & 520 area. The implementation of onsite storm sewer infrastructure will need to be reviewed during detailed design to ensure that the area is protected from flooding.

The City's Operations Team also noted that two rock pits are located along the west side of the development and that it receives runoff from dwellings along this side. The implementation or modification of storm services will need to be reviewed during detailed design to ensure that the dwellings are protected from flooding. It was also noted that there is a monitoring well used for groundwater surveillance located at the southwest corner of the site and that this well needs to be kept post-development.

3.3 WATER NETWORK

3.3.1 DESIGN CRITERIA

Section 2.3 of the City of Whitehorse Servicing Standards Manual was referenced for evaluating the impact of the proposed development on the existing water distribution system. The City standards require that analyses are conducted for Average Day Demand (ADD), Maximum Day Demand (MDD), Peak Hour Demand (PHD), MDD plus fire flow and Night Filling Demand (NFD). Relevant design criteria from the City standards are listed below:

- Average Daily Demand (ADD) 500 L/c/d
- Maximum Daily Demand (MDD) 2 x ADD
- Peak Hour Demand (PHD) 3 x ADD
- Fire Flow Low Density Residential (Single 100 L/s

Family, Duplex and Triplex)

- Fire Flow Medium Density Residential (Multiple Housing) — 180 L/s
- Fire Flow High Density Residential (Multiple Housing – 50 or more units) — 225 L/s
- Minimum Allowable Velocity — 0.15 m/s
- Maximum Allowable Velocity — 3.50 m/s
- Maximum Allowable Operating Pressure — 550 kPa
- Minimum Residual Pressure (PHD) — 280 kPa
- Minimum Residual Pressure (MDD + FF) — 140 kPa

The NFD scenarios represent the lowest system demand period (highest system pressures) and are usually simulated to analyze reservoir filling capabilities and flow circulation. These scenarios were configured based on Stantec Consulting Ltd. (2005) and are summarized below:

- NFD – Reservoir Filling — 0.6 x ADD
- NFD – Thermal Analysis — 0.3 x ADD

3.3.2 APPROACH

The impact of the proposed development on the existing system was evaluated using the City's current model, last updated on January 25, 2022. The model was used without modification except for splitting pipes at the approximate servicing points (described in **Section 2.4**) to add the water demands for the proposed development. In addition to the existing water services to the project site, a new servicing point ('Servicing Point 3' in **Figure 2-2A**) from the 250 mm watermain on the south/east end of Falcon Drive was also evaluated. A new watermain (also 250 mm) was added between the 250 mm watermains on Falcon Drive to assess the impact of looping the system through the project site. Parameters for the proposed infrastructure were based on the existing topography, model scale (for pipe lengths) and an assumed pipe roughness (Hazen-Williams C factor) of 150 (typical for PVC and HDPE pipe).

Water consumption areas, population values, and demands for the proposed development under various scenarios are summarized in **Table 3-2**. The assumed finished ground elevation in the project site was 789 m, about the same elevations at the south end of Falcon Drive and up to 9 m higher than at Falcon Drive and Diamond Way.

Table 3-2 Water Demands for the proposed development

ZONING	AREA (HA)	POP'N (PEOPLE)[1]	ADD (L/S)	MDD (L/S)	PHD (L/S)	NFD – FILLING (L/S)	NFD – THERMAL (L/S)
R	6.20	248	1.435	2.870	4.305	0.861	0.431

Notes:

1 Based on a population density of 40 persons/ha as outlined in Section 2.4 of the City of Whitehorse Servicing Standards.

3.3.3 MODEL RESULTS

Table 3-3 presents the model results for each servicing point evaluated for the proposed development. Screenshots of the model results are provided in **Appendix C**, and a digital file of the water model, including the new watermain and development demands, will be provided separately.

Table 3-3 Model results

SERVICING POINT	SIMULATED PRESSURES (KPA)							
	ADD	MDD	MDD+100 L/S FF[2]	MDD+180 L/S FF[2]	MDD+225 L/S FF[2]	PHD	NFD – FILLING	NFD – THERMAL[1]
1	409.0	387.2	115.8	<0	<0	366.4	418.2	425.3
2	230.4	193.1	<0	<0	<0	159.4	245.9	258.3
3	372.0	364.7	169.2	<0	<0	356.9	374.9	377.3
3 & south/east 250 mm watermain on Falcon Drive	394.3	385.1	288.4	160.7[3]	70.4	375.6	398.0[4]	400.7[4]

Notes:

1 Pipe velocities for the NFD – Thermal Analysis scenario were greater than 0.15 m/s near the proposed development site.
2 Pipe velocities were below 3.5 m/s near the proposed development site.
3 A model node (20010) near Falcon Drive and Diamond Way experienced pressures less than 140 kPa under this scenario.
4 Looping the system through the site leads to the areas generally around Valerie Crescent, Grizzly Circle and North Star Drive, now experiencing pipe velocities less than 0.15 m/s in low-demand scenarios.

Based on the model results, a medium-density residential development could be supported by the existing network by looping the system between Servicing Point 3 (south/end 250 mm watermain on Falcon Drive) and the north/west 250 mm watermain also on Falcon Drive. Although under the 180 L/s fire flow demand scenario, the system experiences pressures under 140 kPa at Falcon Drive and Diamond Way. The existing system can supply approximately up to about 170 L/s of fire flow at the project site such that pressures elsewhere are above 140 kPa. Looping the system through the project site does lead to pipe velocities less than 0.15 m/s around Valerie Crescent, Grizzly Circle and North Star Drive under low-demand scenarios.

A high-density residential development fire flow demand of 225 L/s was also evaluated with the new system loop. However, the existing system could not supply the required flows.

Model results should be updated when the proposed development zoning, road and lot layout, and rough grading are in more advanced stages. Fire hydrant flow testing is recommended to confirm model results.

3.3.4 EXISTING SYSTEM IMPROVEMENTS

System pressures and minimum pipe velocities could be improved if the Copper Ridge Pumphouse infrastructure is reconfigured or a direct feed from the station is provided to the project site. The system could also support a high-density residential development if these updates were implemented. However, changes to the pumphouse infrastructure were not evaluated as it requires a detailed review of the existing facility and coordination with City operations staff. Reconfiguration of the pumphouse infrastructure should be evaluated in future stages depending on the preferred type of residential development at the project site.

3.4 POWER

Based on a population density of 40 persons/ha and an area of 6.20 ha, Copper Ridge Lot 519 & 520 could accommodate a population of 248 persons. Assuming a population of 248 persons, an average of 3 residents per building, and zoning of single family, duplex or triplex lots, ATCO Electric Yukon would be able to service the site with front lot underground servicing. This servicing would include, but would not be limited to the installation of new single phase padmount transformers, single phase pedestals, street lights, switch cubicles, primary underground wires, and secondary underground wires. This work would not include individual servicing to each building. ATCO Electric Yukon would provide a single conduit stub to each lot that has the potential to be serviced with secondary voltage (120/240V single phase) from new pedestals in the area. This servicing would be consistent with the surrounding existing development and would require a utility corridor in the road right of way before any infrastructure is installed.

The required upgrades for a higher density residential development cannot be confirmed until specific details of the proposed development have been established and provided to ATCO Electric Yukon. This would depend on the proposed lot layout and if the utility corridor supplied meets the requirements for the servicing styles described in the previous paragraph.

3.5 TELECOMMUNICATIONS

Based on a population density of 40 persons/ha and an area of 6.20 ha, Copper Ridge Lot 519 & 520 could accommodate a population of 248 persons. Assuming a population of 248 persons, there is currently no capacity to service the project site at a low density residential development. To service the site at a low density, utility extensions and upgrades would be required for the existing telecommunications infrastructure. This may include a conduit fiber build which consists of ground level duct pedestals, as well as the addition of electronic equipment and joint trench shallow utilities to service the lots. The conduit system would tie into the existing infrastructure along Falcon Drive.

The required upgrades for a higher density residential development cannot be confirmed until specific details of the proposed development have been established and provided to Northwestel.

3.6 TRANSPORTATION

Figure 3-2 and **Figure 3-3** shows the proposed access points for Copper Ridge Lot 519 & 520. There are potentially two layouts for the access points.

The first layout would shift the existing intersections along Falcon Drive from three-legged to four-legged, both of which are generally preferred. The proposed four-legged intersections along Falcon Drive would meet the typical minimum spacing of 60 m between adjacent intersections along a collector road (i.e. Falcon Drive), a road on which traffic movement and access have similar importance.

The second option includes the implementation of three-legged intersections along Falcon Drive. The proposed intersections along Falcon Drive would meet the typical minimum spacing of 60 m between adjacent intersections along a collector road (i.e. Falcon Drive).

Both options include an access point along Diamond Way. This three-legged intersection meets the typical minimum spacing of 60 m between adjacent intersections along a collector road (i.e. Diamond Way).

A minimum of two points of ingress and egress should be provided in order to meet emergency servicing requirements. The City's Fire Department also requires that National Building Code of Canada and National Fire Code of Canada considerations and minimum are factored into the development.

At the time of application, the development will be assessed for compliance through a Development Review Process lead by the City's Land and Building Services Division. As part of this process, consultation with the City's Transportation Maintenance team will be required to ensure that access and street maintenance (if public) is captured with their operational envelope.

Basic data related to location, user volumes (e.g., vehicular, cyclist, and pedestrian), design speed, and posted speed should be assembled, and function characteristics should be determined prior to detailed design (Transportation Association of Canada, 2017). The feasibility of the access points will need to be further reviewed against the City of Whitehorse policies and confirmed during detailed design of the site.

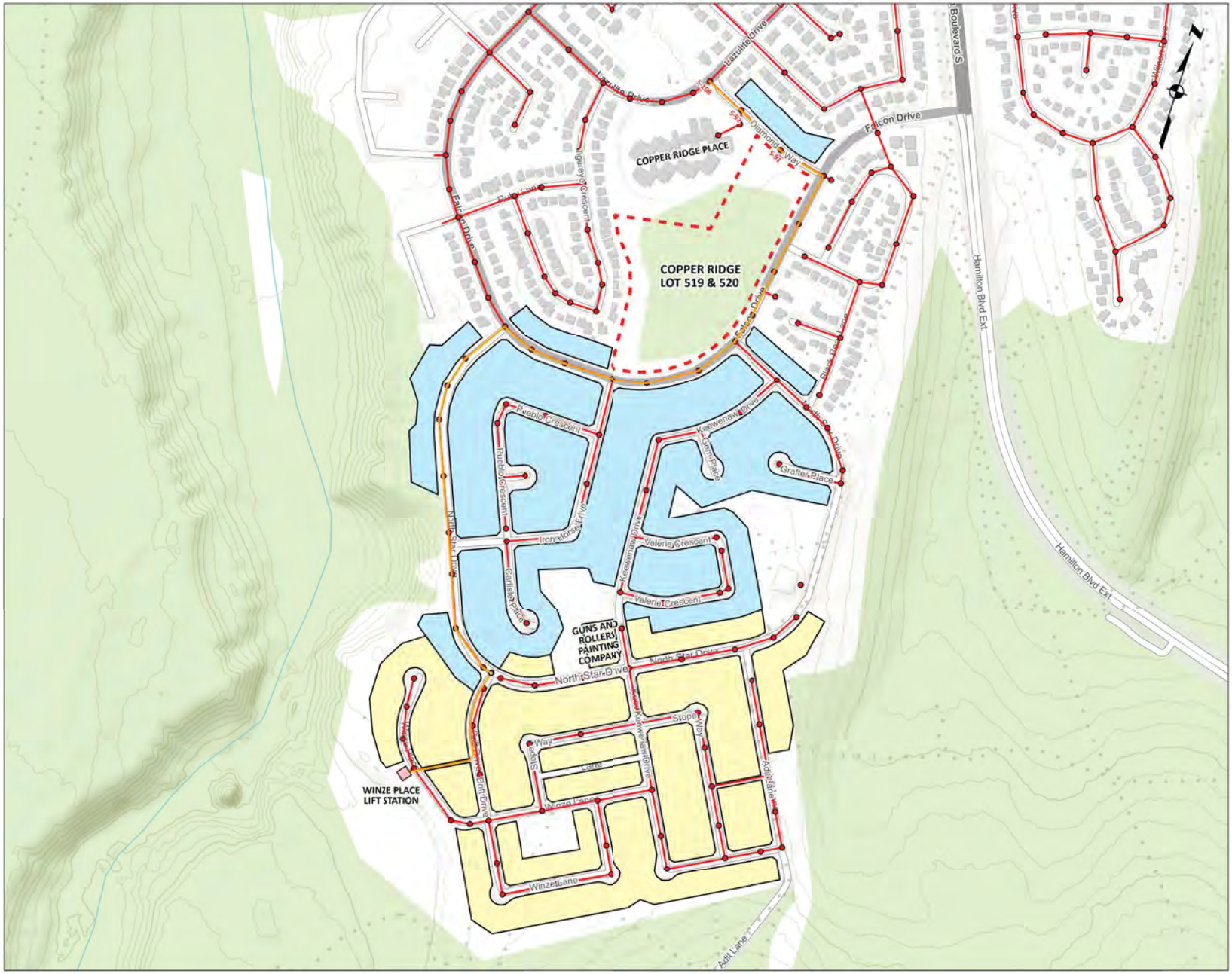
3.7 COST ESTIMATE

An order of magnitude cost estimate was completed for the development of Copper Ridge Lot 519 & 520 and is summarized in **Table 3-4**. Due to the level of information provided, a few assumptions were made:

- Approximately 500m of sewermain, watermain, and road would be installed across the project site. This is assuming a low density residential development.
- The extended price for sanitary sewer infrastructure is all inclusive (pipes, service pipes, tie-in to existing, manholes).
- The extended price for storm sewer infrastructure is all inclusive (pipes, service pipes, tie-in to existing, catchbasins, catchbasin manholes, manholes).
- The extended price for water infrastructure is all inclusive (pipes, service pipe, tie-in to existing, gate valves, curb stops, fire hydrants).
- The extended price for road infrastructure is all inclusive (excavation, reshaping, subbase, base, asphalt)
- The unit prices used for the cost estimate were taken from a City of Whitehorse project completed in 2021, and a 50% contingency was provided for the recent rise in material pricing.

Table 3-4 Cost Estimate for Copper Ridge Lot 519 & 520 Development

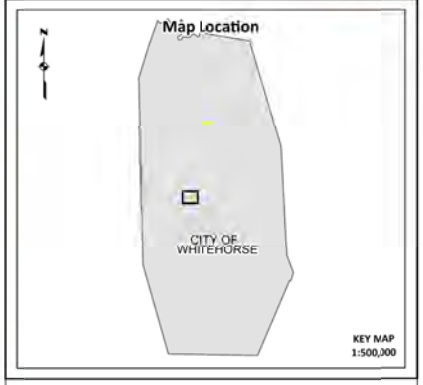
ITEM DESCRIPTION	EXTENDED PRICE
Mobilization	$300,000
Sanitary Sewer	$1,000,000
Storm Sewer	$1,000,000
Watermain	$1,000,000
Roads	$500,000
SUB-TOTAL	**$3,800,000**
50% Contingency	$1,900,000
TOTAL	**$5,700,000**



Legend

- Project Boundary
- Sanitary Manholes
- Sanitary Mains
- Sanitary Outfalls
- Sanitary Valves
- Sanitary Stations
- Downstream Pipe Basin Boundary
- Lift Station Basin Boundary
- Main Sanitary Route
- Forcemain Discharge Point

Draft



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 3-1: Copper Ridge Lot 519 & 520 Basin Boundaries

City of Whitehorse
Yukon, Canada

Scale: 1:5,000

0 40 80 160 240 320 Meters

Universal Transverse Mercator Zone 8N
North American Datum 1983

wsp

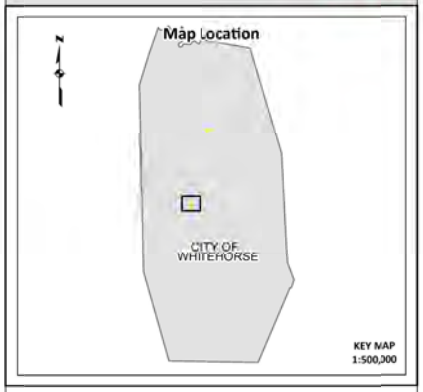
Report By: JC
Drawn by: JC
Reviewed By: CG, ES
WSP Job #: 221-06815-00
Date: Sept 19, 2022
Office: Edmonton

Notes: GIS data provided by the City of Whitehorse Open Data Portal

Legend

- Project Boundary
- Proposed Three-Legged Intersection
- Proposed Four-Legged Intersection

Draft



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 3-2: Copper Ridge Lot 519 & 520
Proposed Access Points - Option #1

City of Whitehorse
Yukon, Canada

Scale 1:3,500

0 15 30 60 90 120 Meters

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

WSP

Report By: JC
Drawn By: JC
Reviewed By: CG, ES

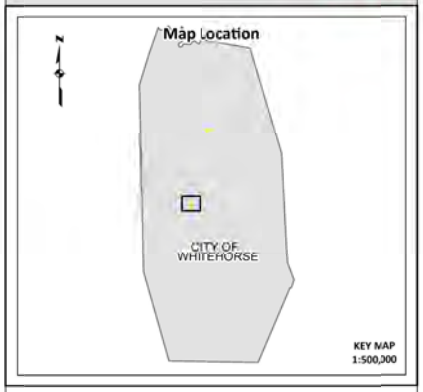
WSP Job #: 221-06815-00
Date: Sept 21, 2022
Office: Edmonton

Notes: LiDAR Data provided by the City of Whitehorse Open Data Portal

Legend

- Project Boundary
- Proposed Three-Legged Intersection

Draft



Copper Ridge Lot 519 & 520
Municipal Servicing Assessment

Figure 3-3: Copper Ridge Lot 519 & 520
Proposed Access Points - Option #2
City of Whitehorse
Yukon, Canada

Scale 1:3,500
0 15 30 60 90 120 Meters

Universal Transverse Mercator (Zone 8N)
North American Datum (1983)

WSP

Report By: JC
Drawn By: JC
Reviewed By: DG, ES
WSP Job #: 221-06815-00
Date: Sept 21, 2022
Office: Edmonton

Notes: LiDAR Data provided by the City of Whitehorse Open Data Portal

4 SUMMARY

The following section provides a summary of the results of the assessment completed for Copper Ridge Lot 519 & 520.

4.1 SANITARY SEWER SYSTEM

- The site is limited by the 300 mm PE sanitary sewer from S-92 to S-108. The remaining capacity of this pipe section yields a population potential of 6,019 persons for Copper Ridge Lot 519 & 520. While it is highly unlikely that the physical site or the larger downstream trunk sewer system can accommodate a population of 6,019 people, it does confirm that the existing sanitary sewer system from S-91 to the 375 mm trunk sewer main is not the limiting factor for site development potential.
- As Copper Ridge Lot 519 & 520 is sloping towards Diamond Way, the implementation of an on-site gravity sanitary sewer system will be required and will tie into Manhole S-91. The implementation of a new lift station on the project site will likely not be required.

4.2 STORMWATER SEWER SYSTEM

- There is currently no stormwater sewer system on the project site.
- The implementation of onsite stormwater sewer infrastructure, including a stormwater management/storage system, will be required to address the likely increase in post development runoff rate. This will also likely require a storm sewer main extension along Diamond Way from Manhole D-11 to the project site.

4.3 WATER NETWORK

- The City's current water model was used for the water network assessment based on design criteria outlined in the standards.
- Based on the model results, the existing water distribution system can support up to a low-density residential development (fire flow demand of 100 L/s) on the project site.
- A new watermain was assumed to be required through the project site with connections to both watermains on Falcon Drive. A 250 mm watermain can provide the required fire flows for a medium-density residential development at the project site. However, this leads to residual pressures of less than 140 kPa near Falcon Drive and Diamond Way. Furthermore, under low-demand scenarios, pipe velocities are less than 0.15 m/s around Valerie Crescent, Grizzly Circle and North Star Drive. Model results should be updated when the proposed development zoning and population, road and lot layout, and rough grading are in more advanced stages. Fire hydrant flow testing is recommended to confirm model results.
- System pressures and pipe velocities could be improved By reconfiguring the Copper Ridge Pumphouse infrastructure or providing a direct feed from the station to the project site. The system could also support a high-density residential development if these updates were implemented. Changes to the pumphouse infrastructure were not evaluated as this requires a detailed review of the existing facility and coordination with City operations staff.

4.4 POWER

- WSP did not assess power servicing at the project site but liaised with ATCO Electric Yukon to seek the necessary information and confirm requirements.

- Based on a population of 248 persons, an average of 3 residents per building, and zoning of single family, duplex or triplex lots, ATCO Electric Yukon would be able to service the site with front lot underground servicing and provide a single conduit stub to each lot that has the potential to be serviced with secondary voltage.
- The required upgrades for a higher density cannot be confirmed until specific details of the proposed development have been established and provided to ATCO Electric Yukon.

4.5 TELECOMMUNICATIONS

- WSP did not access telecommunications servicing at the project site but liaised with Northwestel to seek the necessary information and confirm requirements.
- Utility extensions and upgrades would be required such as a conduit fiber build and joint trench shallow utilities.
- The required upgrades for a higher density cannot be confirmed until specific details of the proposed development have been established and provided to Northwestel.

4.6 TRANSPORTATION

- Two options were considered for the proposed access points. The first option considers four-legged intersections along Falcon Drive, and the second option considers three-legged intersections along Falcon Drive.
- A minimum of two points of ingress and egress should be provided to the site in order to meet emergency servicing requirements.
- The City's Fire Department requires that National Building Code of Canada and National Fire Code of Canada considerations and minimums are factored into the development.

4.7 COST ESTIMATE

- The total of the cost estimate for the development of Copper Ridge Lot 519 & 520 is $5,700,000.

4.8 CONCLUSION

Based on the assessments completed for the sanitary, storm, and water system, the limiting factor for the site is the water network and the availability of fire flows. The site would be limited to low density residential development as the existing system is not be able to provide the fire flow demand of 180 L/s for medium density residential development without improvements (or lowering of the fire flow requirements). Based on a population density of 40 persons/ha for a low density residential development, and an area of 6.20 ha, Copper Ridge Lot 519 & 520 could accommodate a population of 248 persons.

5 REFERENCES

City of Whitehorse. (2022). *GIS Interactive Maps*. Retrieved from External Planning Theme: https://gisext.whitehorse.ca/Html5Viewer/index.html?viewer=PlanningViewer

Government of Yukon. (2022). *Copper Ridge Place*. Retrieved from Yukon: https://yukon.ca/en/places/copper-ridge-place

Kishchuk, P. (2018). *City of Whitehorse Official Community Plan Update: Demographic and Aconomic Analysis of Housing Demand - 2018 Update.* City of Whitehorse: City of Whitehorse Planning and Development Services.

Stantec Consulting Ltd. (2005). *The City of Whitehorse - EPANET 2.0 Water and Thermal Model - User's Manual.* Edmonton.

Transportation Association of Canada. (2017). *Geometric Design Guide for Canadian Roads.* Ottawa, ON: Transportation Association of Canada.

Transportation of Canada. (2017). *Geometric Design Guide for Canadian Roads.* Ottawa, ON: Transportation of Canada.

APPENDIX

A SANITARY SEWER CALCULATIONS

SANITARY SEWER CAPACITY SAMPLE CALCULATIONS (S-92 TO S-108)

FLOW FROM GUNS AND ROLLERS PAINTING COMPANY

Assuming a maximum service capacity of 25 persons based on the parking stalls in Google Maps, the **Population** of Guns and Rollers Painting Company is 25 persons, and the **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Average Sewage Flow**:

$$Average\ Sewage\ Flow = Population \times Average\ Flow = \frac{25\ persons \times 450\ L/c/d}{24 \times 60 \times 60} = 0.13\ L/s$$

The **Peaking Factor** is 3.0 [1]. To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Peaking\ Factor \times Average\ Sewage\ Flow = 3.0 \times 0.13\ L/s = 0.39\ L/s$$

The **Area** of the Guns and Rollers Painting Company lot is 0.37 ha, and the **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{0.37\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 0.03\ L/s$$

To determine **Total Peak Flow (Peak Wet Weather Flow)**:

$$Total\ Peak\ Flow = Peak\ Sewage\ Flow + I/I = 0.39\ L/s + 0.03\ L/s = 0.42\ L/s$$

FLOW FROM LOTS (LIFT STATION BASIN BOUNDARY)

The **Number of Homes** contributing flow to the lift station is 249 (within the lift station basin boundary in **Figure 2-4**) and the **Population Density** is assumed to be 3 persons/home. To determine **Population:**

$$Population = Number\ of\ Homes \times Population\ Density = 249\ homes \times 3\ persons/home = 747\ persons$$

The **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Average Sewage Flow**:

$$Average\ Sewage\ Flow = Population \times Average\ Flow = \frac{747\ persons \times 450\ L/c/d}{24 \times 60 \times 60} = 3.89\ L/s$$

The **Peaking Factor** is 4.0 [1]. To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Peaking\ Factor \times Average\ Sewage\ Flow = 4.0 \times 3.89\ L/s = 15.56\ L/s$$

The **Area** of the lots contributing flow to the downstream pipe is 17.91 ha. The **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{17.91\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 1.24\ L/s$$

To determine **Total Peak Flow (Peak Wet Weather Flow)**:

$$Total\ Peak\ Flow = Peak\ Sewage\ Flow + I/I = 15.56\ L/s + 1.24\ L/s = 16.81\ L/s$$

FLOW FROM WINZE PLACE LIFT STATION

As per the Winze Place Lift Station record drawing and based on the assumption that one pump is running at a time, the capacity of the lift station equates the capacity of the sewage pump which discharges at a rate of 15 L/s [3]. The capacity of the lift station is considered to be 15 L/s and the calculated peak inflow rate is 17.22 L/s (sum of **Flow from Lots** and **Flow from Guns and Rollers Painting Company**). To be conservative, 17.22 L/s was used for **Flow from Winze Place Lift Station**.

---

[1] City of Whitehorse (2020). *City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.4 – Sanitary Sewer System.*
[2] City of Whitehorse (2020). *City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.3 – Water Distribution System.*
[3] Quest Engineering Group Inc. (2006). *Copper Ridge Subdivision Phase 2 – Stage 11 Lift Station & Standby Generator.*

FLOW FROM COPPER RIDGE PLACE

Assuming a maximum service capacity of 96 persons and an allowance of 20 persons for staffing, the **Population** of Copper Ridge Place is 116 persons, and the **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Average Sewage Flow**:

$$Average\ Sewage\ Flow = Population \times Average\ Flow = \frac{116\ persons \times 450\ L/c/d}{24 \times 60 \times 60} = 0.60\ L/s$$

The **Peaking Factor** is 4.0 [1]. To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Peaking\ Factor \times Average\ Sewage\ Flow = 4.0 \times 0.60\ L/s = 2.42\ L/s$$

The **Area** of the Copper Ridge Place lot is 37.93 ha, and the **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{37.93\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 2.63\ L/s$$

To determine **Total Peak Flow (Peak Wet Weather Flow)**:

$$Total\ Peak\ Flow = Peak\ Sewage\ Flow + I/I = 2.42\ L/s + 2.63\ L/s = 5.05\ L/s$$

FLOW FROM LOTS (DOWNSTREAM PIPE BASIN BOUNDARY)

The **Number of Homes** contributing flow to the downstream pipe is 269 (within the downstream pipe basin boundary in **Figure 2-4**) and the **Population Density** is assumed to be 3 persons/home. To determine **Population:**

$$Population = Number\ of\ Homes \times Population\ Density = 269\ homes \times 3\ persons/home = 807\ persons$$

The **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Average Sewage Flow**:

$$Average\ Sewage\ Flow = Population \times Average\ Flow = \frac{807\ persons \times 450\ L/c/d}{24 \times 60 \times 60} = 4.20\ L/s$$

The **Peaking Factor** is 4.0 [1]. To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Peaking\ Factor \times Average\ Sewage\ Flow = 4.0 \times 4.20\ L/s = 16.81\ L/s$$

The **Area** of the lots contributing flow to the downstream pipe is 19.93 ha. The **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{19.93\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 1.38\ L/s$$

To determine **Total Peak Flow (Peak Wet Weather Flow)**:

$$Total\ Peak\ Flow = Peak\ Sewage\ Flow + I/I = 16.81\ L/s + 1.38\ L/s = 18.20\ L/s$$

DOWNSTREAM PIPE CAPACITY (FROM S-92 TO S-108)

The **Diameter** of the downstream pipe is 300 mm [4]. To determine the **Area** of the pipe:

$$Area = \frac{\pi \times Diameter^2}{4} = \frac{\pi \times (0.300\ m)^2}{4} = 0.071 m^2$$

It is assumed that the pipe is flowing at full capacity, meaning that θ is 180 degrees and 2θ is 360 degrees. To determine the **Wetted Perimeter** of the pipe:

$$Wetted\ Perimeter = Diameter \times \theta = 0.300\ m \times 180 \times \frac{\pi}{180} = 0.942\ m$$

---

[4] Yukon Government Engineering & Development (1995). *Plan/Profile Diamond Way STA. 0-011.25 to STA 0+227.691.*

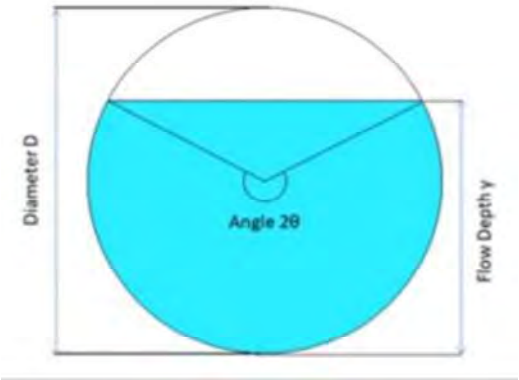


Figure 1 Manning's Equation Full Pipe [5]

To determine the **Hydraulic Radius** of the pipe:

$$Hydraulic\ Radius = \frac{Area}{Wetted\ Perimeter} = \frac{0.071m^2}{0.942m} = 0.075m$$

The **Slope** and **Manning's n** of the downstream pipe is 3.43% [4] and 0.014 [1], respectively. To determine the **Velocity** through the pipe:

$$Velocity = \frac{Hydraulic\ Radius^{2/3} \times Slope^{1/2}}{n} = \frac{(0.075\ m^2)^{2/3} \times (0.0343\ m/m)^{1/2}}{0.014} = 2.353\ m/s$$

To determine the **Discharge** through the pipe:

$$Discharge = Velocity \times Area = 2.353\ m/s \times 0.071\ m^2 \times \frac{1000\ L}{1\ m^3} = 166.30\ L/s$$

POPULATION POTENTIAL OF COPPER RIDGE LOT 519 & 520

To determine the **Remaining Capacity** in the downstream pipe:

$$\begin{aligned} Remaining\ Capacity \\ &= Downstream\ Pipe\ Capacity - Flow\ from\ Winze\ Place\ Lift\ Station \\ &- Flow\ from\ Copper\ Ridge\ Place \\ &- Flow\ from\ Lots\ (Downstream\ Pipe\ Basin\ Boundary) \\ &= 166.30\ L/s - 17.22\ L/s - 5.05\ L/s - 18.20\ L/s = 125.83\ L/s \end{aligned}$$

The **Area** of Copper Ridge Lot 519 & 520 is 6.20 ha, and the **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{6.20\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 0.43\ L/s$$

To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Remaining\ Capacity - I/I = 125.83\ L/s - 0.43\ L/s = 125.40\ L/s$$

The **Peaking Factor** is 4.0 [1]. To determine **Average Sewage Flow**:

$$Average\ Sewage\ Flow = \frac{Peak\ Sewage\ Flow}{Peaking\ Factor} = \frac{125.40\ L/s}{4.0} = 31.35\ L/s$$

The **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Population Potential**:

---

[5] Dwivedi, Dhaval (2020). *Flow through a circular channel using Manning's formula*. https://www.youtube.com/watch?v=Rcnr8qhtvMs.

$$Population\ Potential = \frac{Average\ Sewage\ Flow}{Average\ Flow} = \frac{31.35\ L/s \times 24 \times 60 \times 60}{450\ L/c/d} = 6{,}019\ persons$$

FLOW FROM COPPER RIDGE LOT 519 & 520

Based on a population density of 40 persons/ha and an area of 6.20 ha, the **Population** is:

$$Population = Area \times Population\ Density = 6.20\ ha \times 40\ persons/ha = 248\ persons$$

The **Average Flow** is 450 L/c/d [1] which is 90% of the water consumption rate of 500 L/c/d [2]. To determine the **Average Sewage Flow**:

$$Average\ Sewage\ Flow = Population \times Average\ Flow = \frac{248\ persons \times 450\ L/c/d}{24 \times 60 \times 60} = 1.29\ L/s$$

The **Peaking Factor** is 4.0 [1]. To determine **Peak Sewage Flow (Peak Dry Weather Flow)**:

$$Peak\ Sewage\ Flow = Peaking\ Factor \times Average\ Sewage\ Flow = 4.0 \times 1.29\ L/s = 5.16\ L/s$$

The **Area** of Copper Ridge Lot 519 & 520 is 6.20 ha. The **Infiltration Allowance** is 6000 L/ha/d [1]. To determine **Inflow/Infiltration (I/I)**:

$$I/I = Area \times 6000\ L/ha/d = \frac{6.20\ ha \times 6000\ L/ha/d}{24 \times 60 \times 60} = 0.43\ L/s$$

To determine **Total Peak Flow (Peak Wet Weather Flow)**:

$$Total\ Peak\ Flow = Peak\ Sewage\ Flow + I/I = 5.16\ L/s + 0.43\ L/s = 5.59\ L/s$$

To determine **Total Post-Design Flow**:

$$\begin{aligned} Total\ Post\ Design\ Flow \\ &= Flow\ from\ Winze\ Place\ Lift\ Station + Flow\ from\ Copper\ Ridge\ Place \\ &+ Flow\ from\ CopperRidge\ Lot\ 519\ \&\ 520 = 17.22\ L/s + 5.05\ L/s + 5.59\ L/s = 46.07\ L/s \end{aligned}$$

To determine **Remaining Capacity**:

$$\begin{aligned} Remaining\ Capacity = Downstream\ Pipe\ Capacity - Total\ Post\ Design\ Flow = 166.30\ L/s - 46.07\ L/s \\ = 120.23\ L/s \end{aligned}$$

Table A-1 *Copper Ridge Lot 519 & 520 Sanitary Sewer Capacity* (S-91 to S-92)

FLOW FROM GUNS AND ROLLERS PAINTING COMPANY		
Population	25	Persons
Average Flow	450	L/c/d
Average Sewage Flow	0.13	L/s
Peaking Factor	3.0	
Peak Sewage Flow (PDWF)	0.39	L/s
Area	0.37	ha
Inflow / Infiltration @ 6000 L/ha/d	0.03	L/s
Total Peak Flow (PWWF)	0.42	L/s
FLOW FROM LOTS (LIFT STATION BASIN BOUNDARY)		
Number of Homes	249	Homes
Population Density	3	Persons/home
Population	747	Persons
Average Flow	450	L/c/d
Average Sewage Flow	3.89	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	15.56	L/s
Area	17.91	ha
Inflow / Infiltration @ 6000 L/ha/d	1.24	L/s
Total Peak Flow (PWWF)	16.81	L/s
FLOW FROM WINZE PLACE LIFT STATION		
Capacity (Given)	15.00	L/s
Capacity (Calculated)	17.22	L/s
FLOW FROM LOTS (DOWNSTREAM PIPE BASIN BOUNDARY)		
Number of Homes	269	Homes
Population Density	3	Persons/home
Population	807	Persons
Average Flow	450	L/c/d
Average Sewage Flow	4.20	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	16.81	L/s
Area	19.93	ha
Inflow / Infiltration @ 6000 L/ha/d	1.38	L/s
Total Peak Flow (PWWF)	18.20	L/s
DOWNSTREAM PIPE CAPACITY (FROM S-91 TO S-92)		
Diameter	0.300	m
Area	0.071	m^2
θ	3.142	radians
Wetted Perimeter	0.942	m
Hydraulic Radius	0.075	m
Slope	0.0378	m/m
Manning's n	0.014	
Velocity	2.470	m/s
Discharge	0.175	m^3/s
Discharge	174.58	L/s
POPULATION POTENTIAL OF COPPER RIDGE LOT 519 & 520		
Remaining Capacity	139.16	L/s
Area	6.20	ha
Inflow / Infiltration @ 6000 L/ha/d	0.43	L/s
Peak Sewage Flow (PDWF)	138.73	L/s
Peaking Factor	4.0	
Average Sewage Flow	34.68	L/s
Average Flow	450	L/c/d
Population Potential	6659	Persons

Table A-2 *Copper Ridge Lot 519 & 520 Sanitary Sewer Capacity* (S-92 to S-108)

FLOW FROM GUNS AND ROLLERS PAINTING COMPANY		
Population	25	Persons
Average Flow	450	L/c/d
Average Sewage Flow	0.13	L/s
Peaking Factor	3.0	
Peak Sewage Flow (PDWF)	0.39	L/s
Area	0.37	ha
Inflow / Infiltration @ 6000 L/ha/d	0.03	L/s
Total Peak Flow (PWWF)	0.42	L/s
FLOW FROM LOTS (LIFT STATION BASIN BOUNDARY)		
Number of Homes	249	Homes
Population Density	3	Persons/home
Population	747	Persons
Average Flow	450	L/c/d
Average Sewage Flow	3.89	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	15.56	L/s
Area	17.91	ha
Inflow / Infiltration @ 6000 L/ha/d	1.24	L/s
Total Peak Flow (PWWF)	16.81	L/s
FLOW FROM WINZE PLACE LIFT STATION		
Capacity (given)	15.00	L/s
Capacity (calculated)	17.22	L/s
FLOW FROM COPPER RIDGE PLACE		
Population	116	Persons
Average Flow	450	L/c/d
Average Sewage Flow	0.60	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	2.42	L/s
Area	37.93	ha
Inflow / Infiltration @ 6000 L/ha/d	2.63	L/s
Total Peak Flow (PWWF)	5.05	L/s
FLOW FROM LOTS (DOWNSTREAM PIPE BASIN BOUNDARY)		
Number of Homes	269	Homes
Population Density	3	Persons/home
Population	807	Persons
Average Flow	450	L/c/d
Average Sewage Flow	4.20	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	16.81	L/s
Area	19.93	ha
Inflow / Infiltration @ 6000 L/ha/d	1.38	L/s
Total Peak Flow (PWWF)	18.20	L/s
DOWNSTREAM PIPE CAPACITY (FROM S-92 TO S-108)		
Diameter	0.300	m
Area	0.071	m^2
θ	3.142	radians
Wetted Perimeter	0.942	m
Hydraulic Radius	0.075	m
Slope	0.0343	m/m
Manning's n	0.014	
Velocity	2.353	m/s
Discharge	0.166	m^3/s
Discharge	166.30	L/s
POPULATION POTENTIAL OF COPPER RIDGE LOT 519 & 520		
Remaining Capacity	125.83	L/s
Area	6.20	ha
Inflow / Infiltration @ 6000 L/ha/d	0.43	L/s
Peak Sewage Flow (PDWF)	125.40	L/s
Peaking Factor	4.0	
Average Sewage Flow	31.35	L/s
Average Flow	450	L/c/d
Population Potential	6019	Persons
FLOW FROM COPPER RIDGE LOT 519 & 520		
Area	6.20	ha
Population Density	40	Persons/ha
Population	248	Persons
Average Flow	450	L/c/d
Average Sewage Flow	1.29	L/s
Peaking Factor	4.0	
Peak Sewage Flow (PDWF)	5.16	L/s
Inflow / Infiltration @ 6000 L/ha/d	0.43	L/s
Total Peak Flow (PWWF)	5.59	L/s
Total Post-Design Flow	46.07	L/s
Remaining Capacity	120.23	L/s

APPENDIX

B STORM SEWER CALCULATIONS

STORM SEWER CAPACITY SAMPLE CALCULATIONS

The **Land Use, Area (A), and Runoff Coefficient (C)** of Copper Ridge Lot 519 & 520 is Open Space, 6.20 ha, and 0.15, respectively [1]. To determine **AxC**:

$$A \times C = 6.20\ ha \times 0.15 = 0.93\ ha$$

To determine **Sum AxC**:

$$Sum\ A \times C = 0.93\ ha$$

The **Time of Concentration** at CB-12A is the inlet time of 15 minutes [1]. The **Intensity** was selected when the corresponding value for the **Duration** (i.e., Time of Concentration) lands on the line for the 5-year return period. Therefore, an **Intensity** of 19.41 mm/h was determined from **Figure 1**.

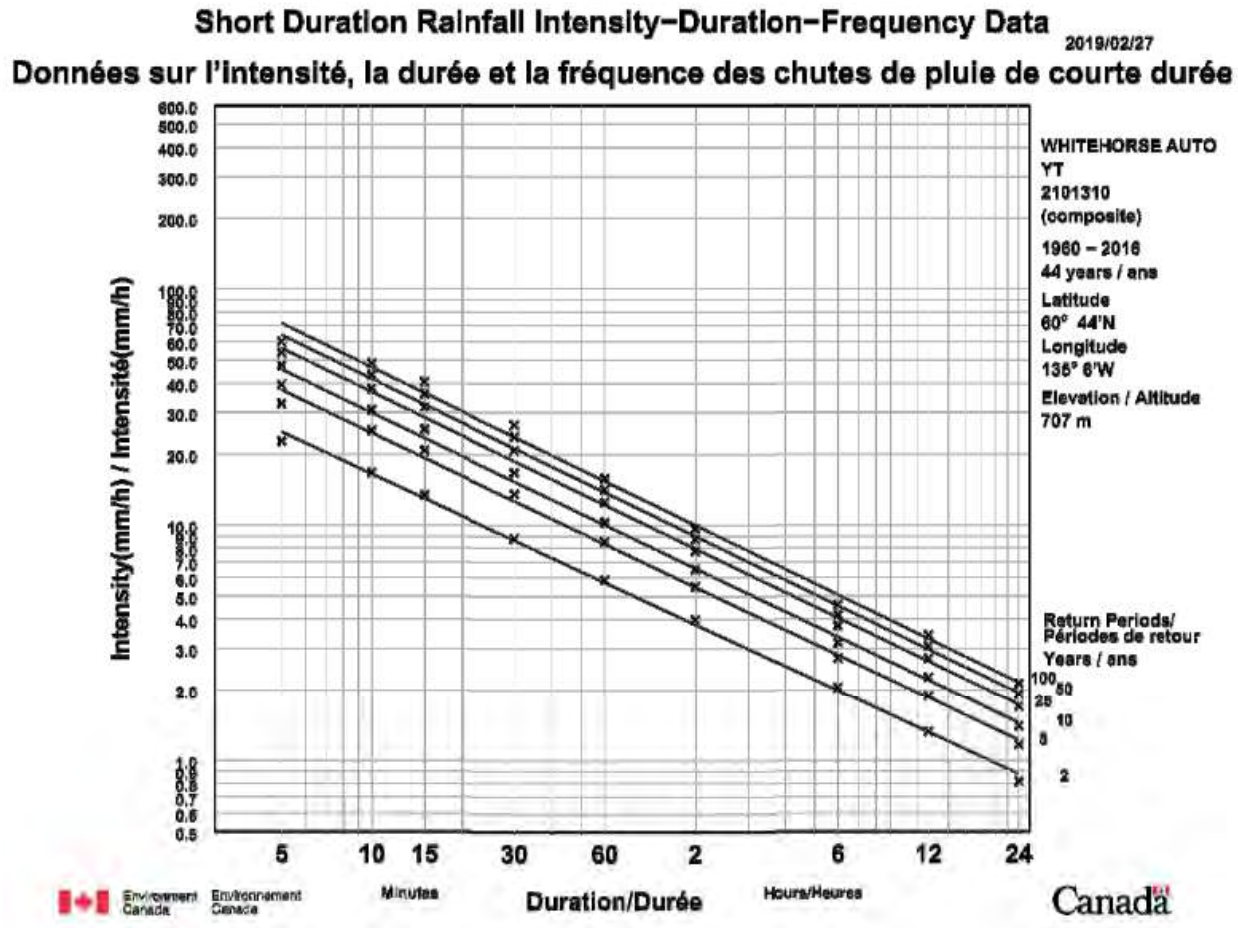


Figure 1 Short Duration Rainfall IDF Data [2]

To determine the **Pre-development Flow Rate (Q)**:

$$Q = \frac{(Sum\ A \times C) \times i}{360} = \frac{0.93 \times 19.41\ mm/h}{360} = 0.050\ m^3/s = 50\ L/s$$

---

[1] City of Whitehorse (2020). *City of Whitehorse Servicing Standards Manual: Part 2 – Construction Design Criteria: Section 2.5 – Storm Drainage System.*

[2] City of Whitehorse (2020). *Rainfall Intensity – Duration Data. Whitehorse, Yukon.*

Table B-1 *Copper Ridge Lot 519 & 520 Storm Sewer Capacity*

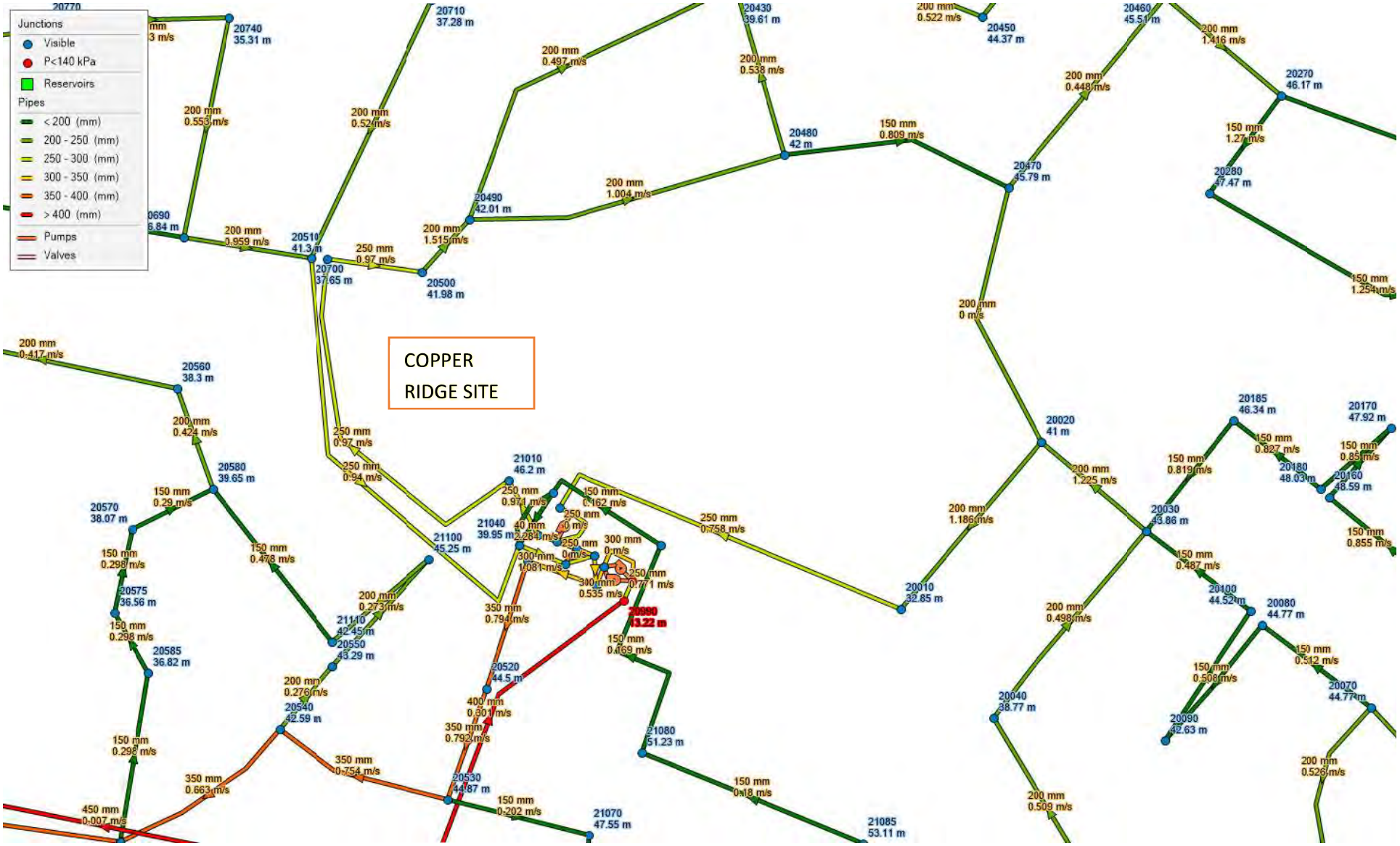
FROM MH	TO MH	LAND USE	AREA ADDED, A (HA)	C	AxC (HA)	SUM AxC (HA)	TIME OF CONC (MIN)	i (mm/hr)
CB-12A	D-12	Open Space	6.20	0.15	0.93	0.93	15.00	19.41

APPENDIX

C WATER MODEL RESULTS

MODEL RESULTS FOR EXISTING CONDITIONS

ADD



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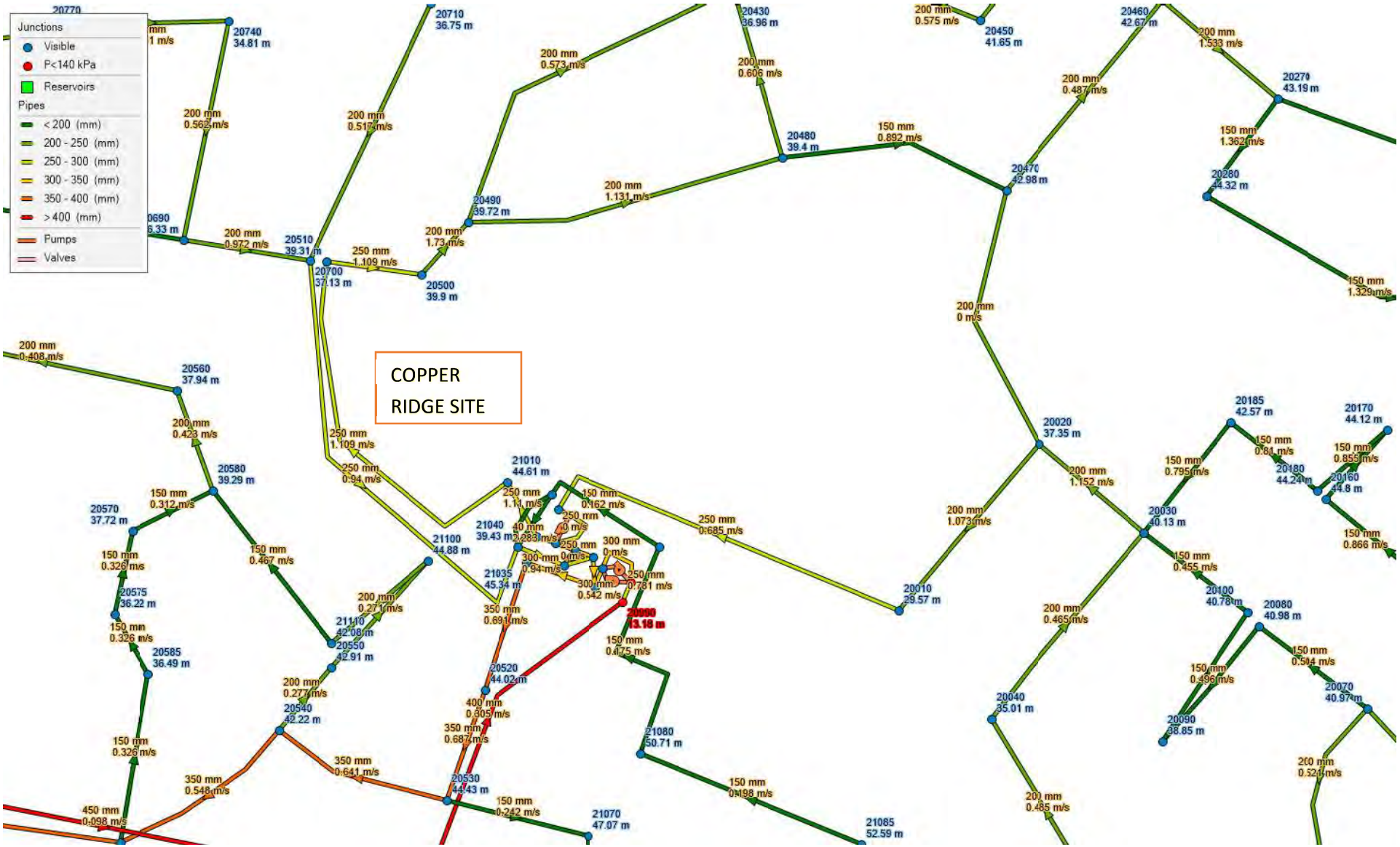
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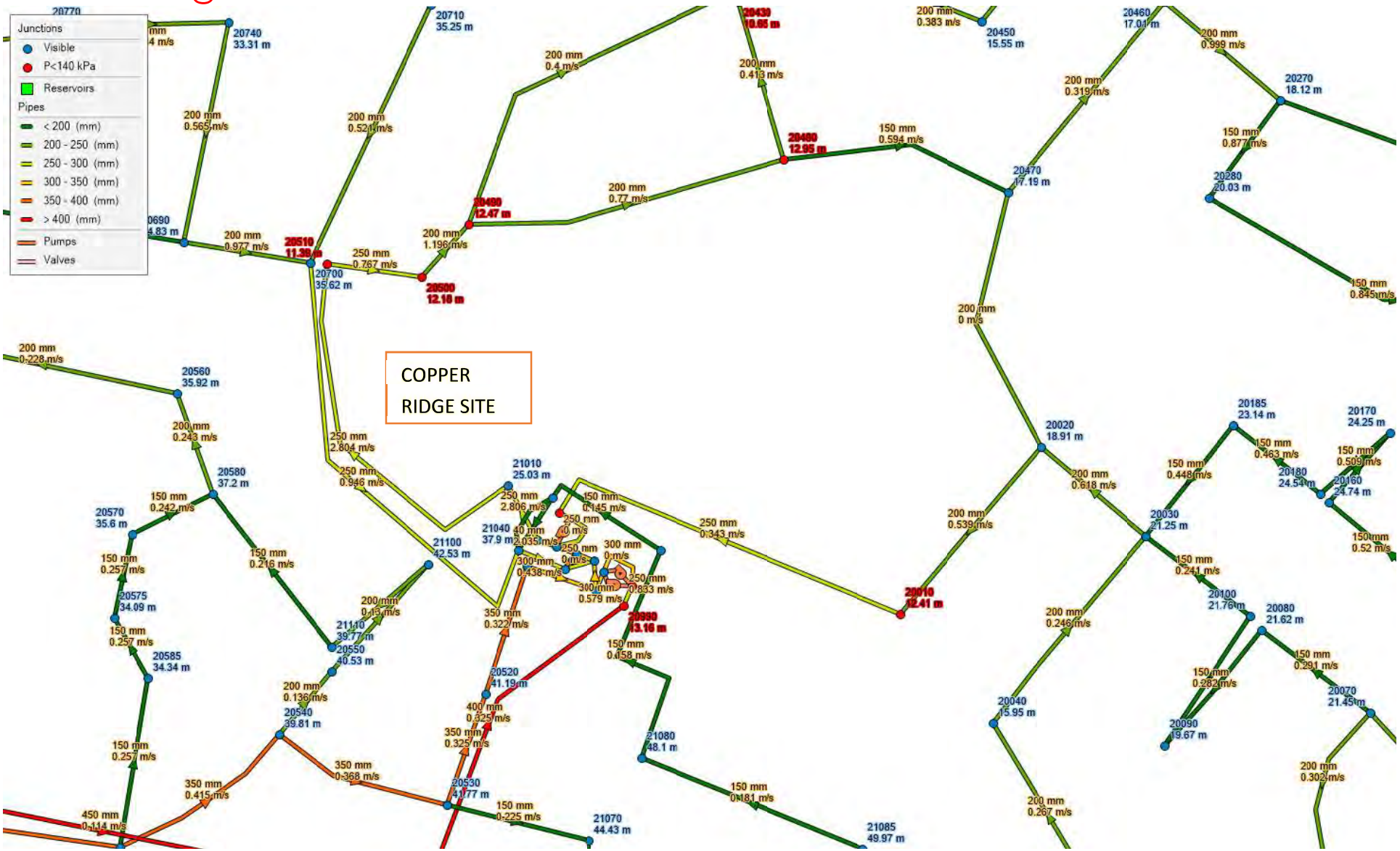
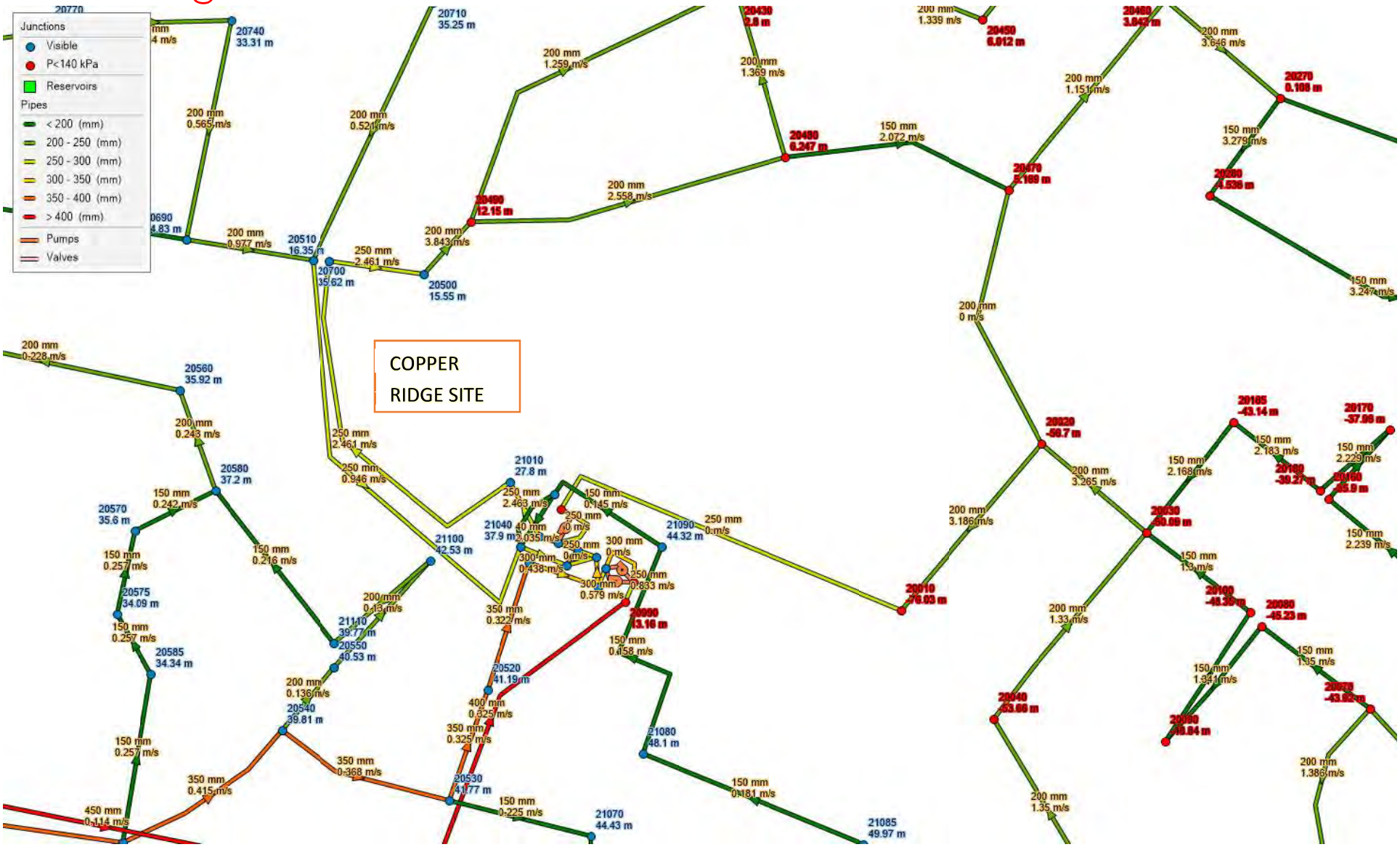
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE

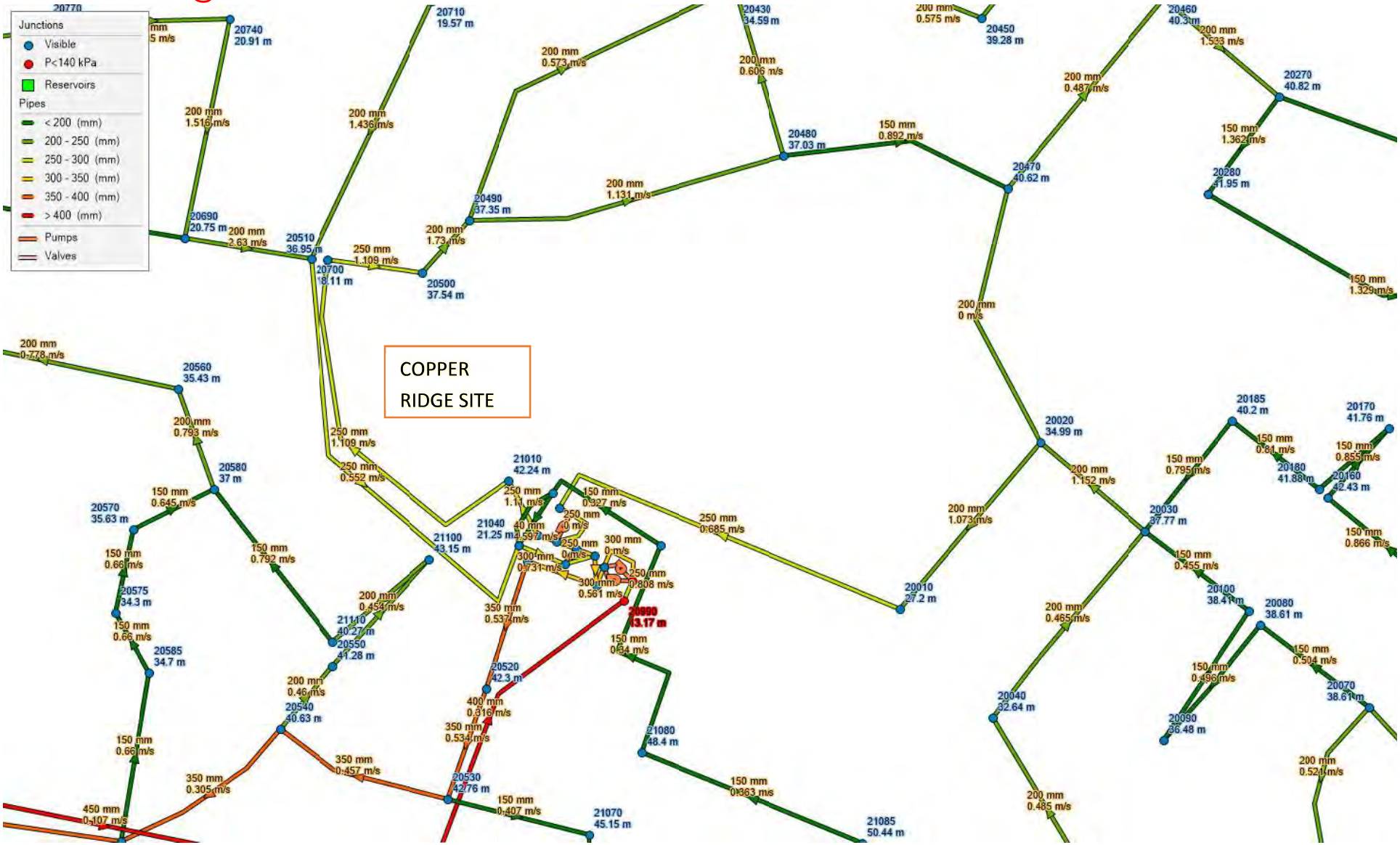
MDD+100 L/S FF @ MODEL NODE 20510



MDD+100 L/S FF @ MODEL NODE 20010



MDD+100 L/S FF @ MODEL NODE 20700



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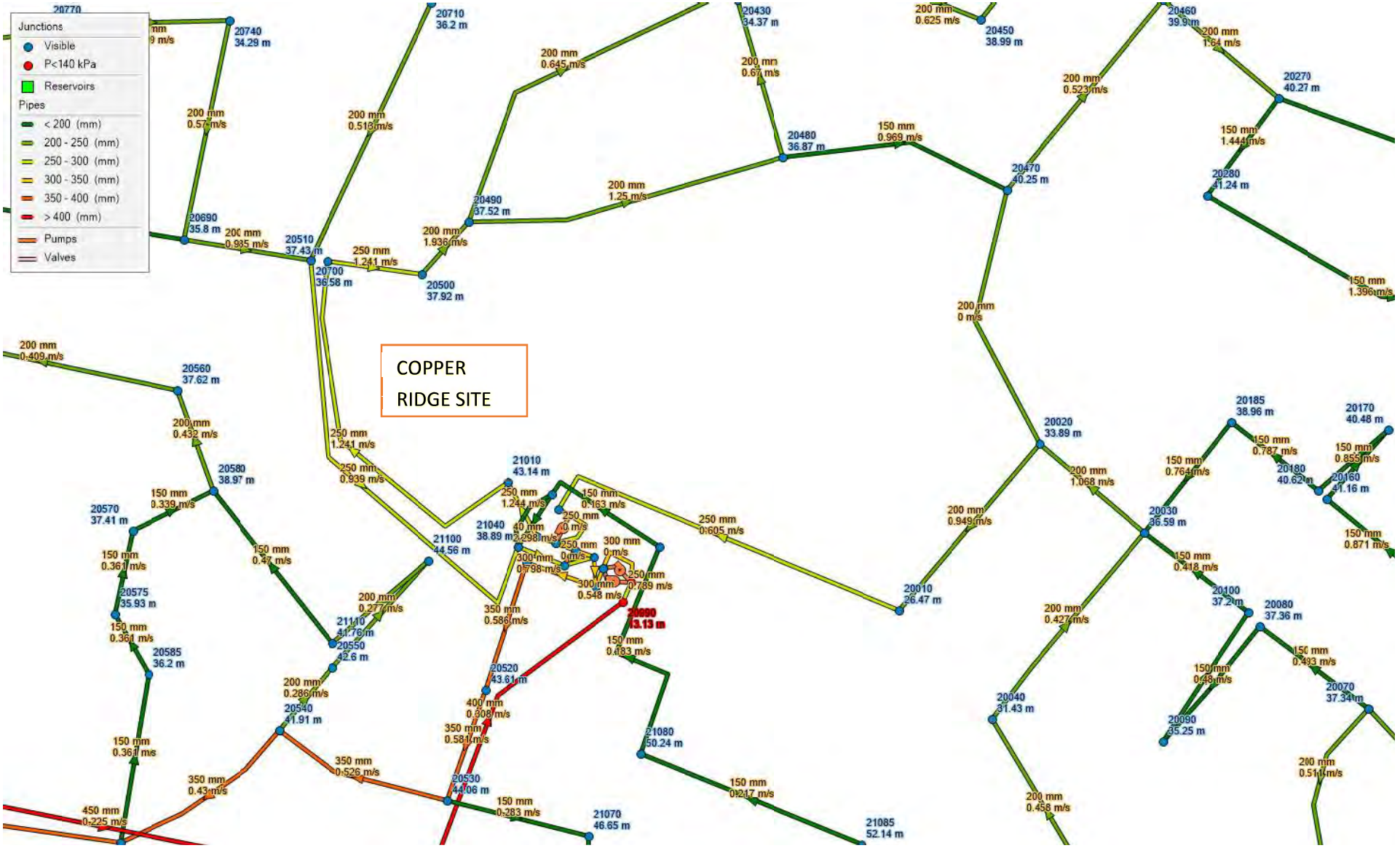
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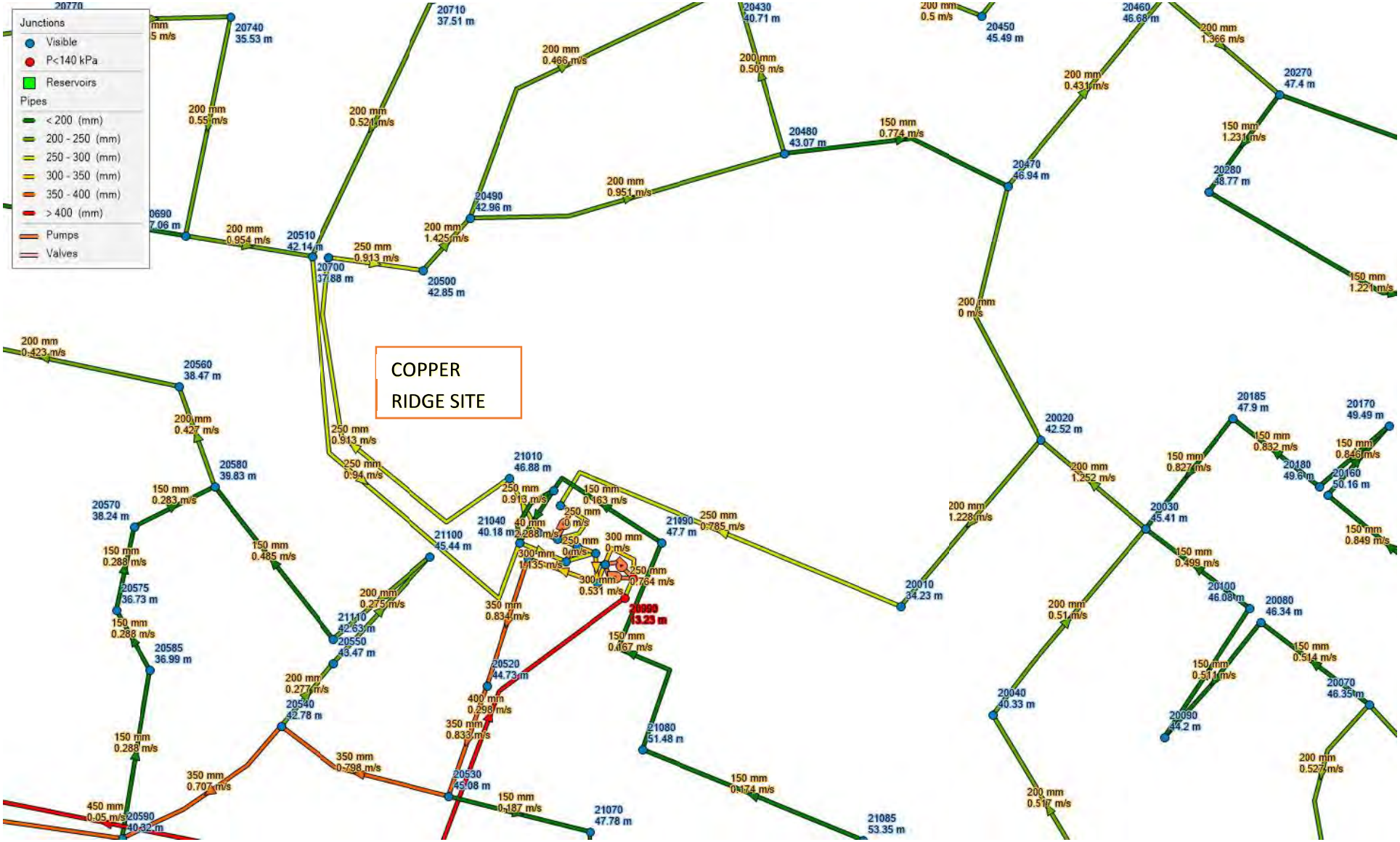
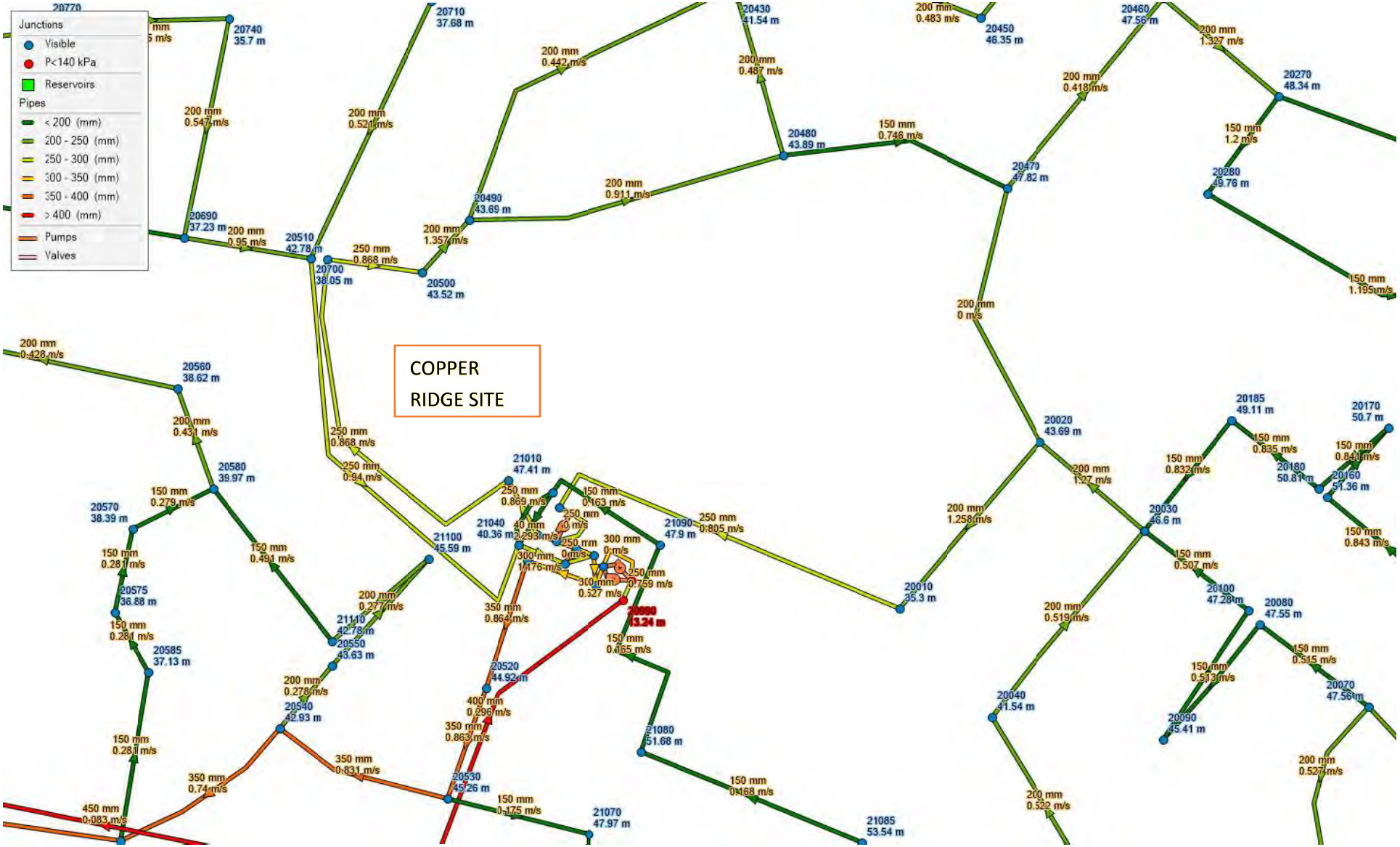
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE

NFD – RESERVOIR FILLING ANALYSIS

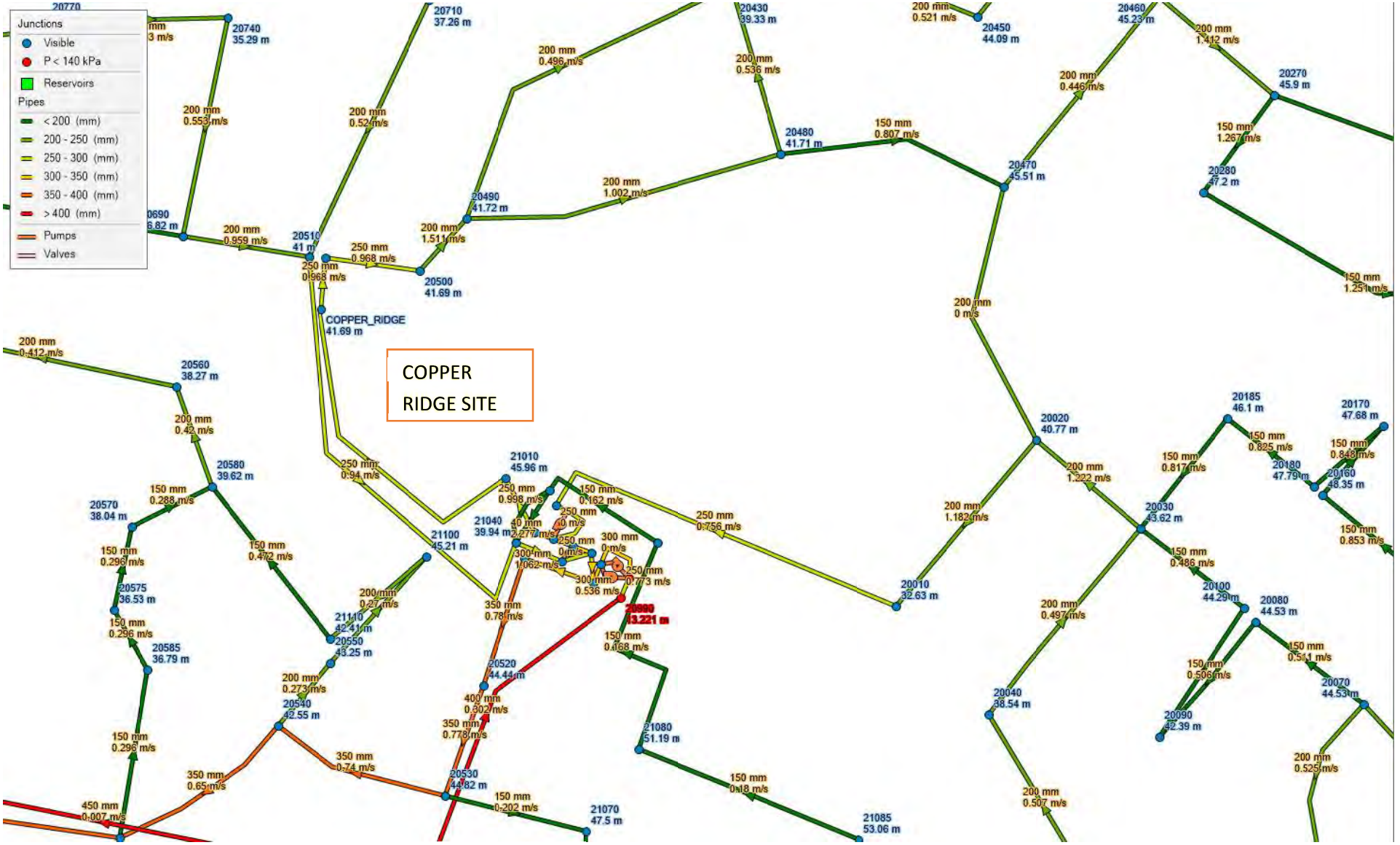


NFD – THERMAL ANALYSIS



MODEL RESULTS FOR CONNECTION TO SERVICING POINT 1

ADD



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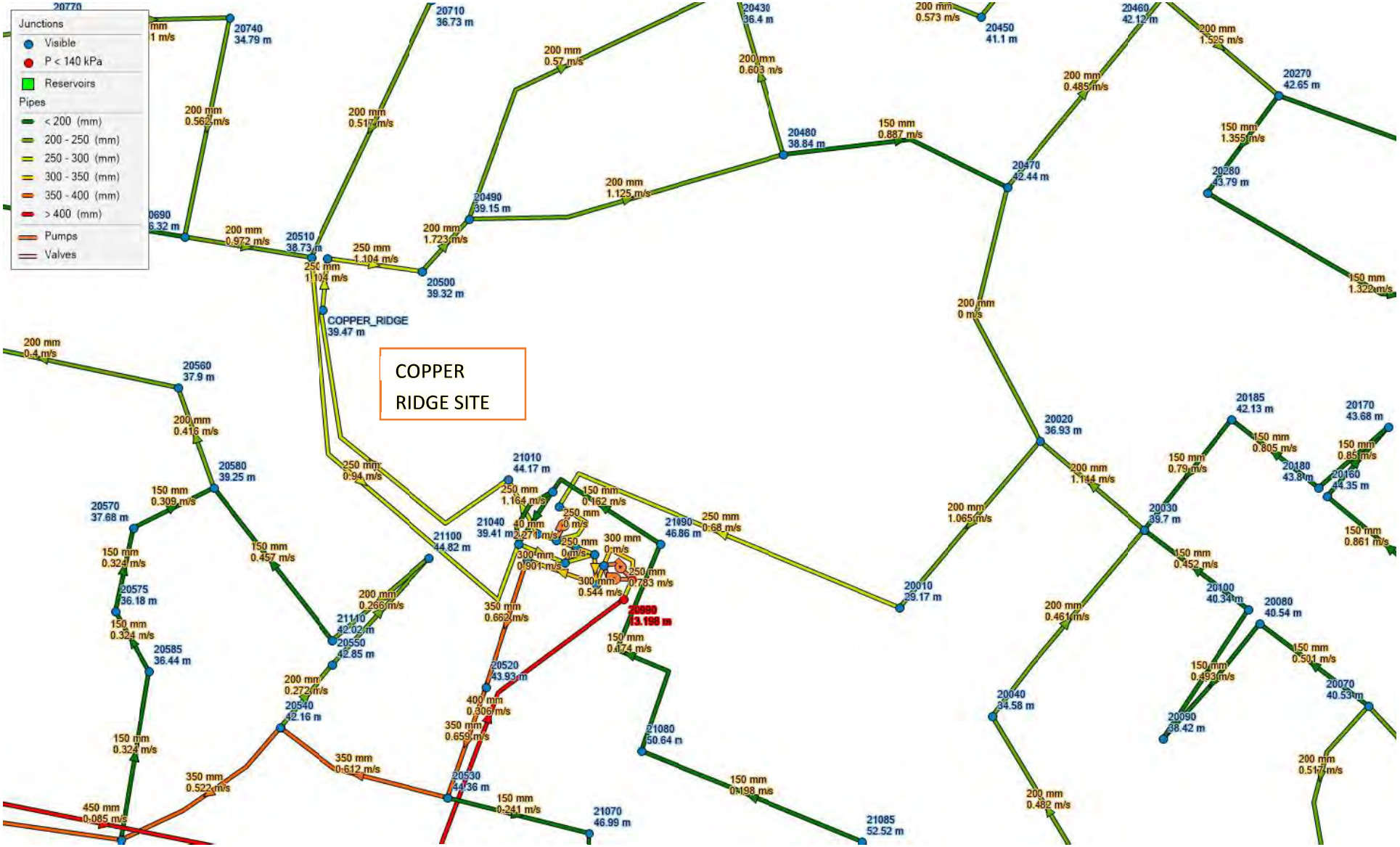
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Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
COPPER_RIDGE
39.47 m
20510
38.73 m
20500
39.32 m
20490
39.15 m
20480
38.84 m
20470
42.44 m
20460
42.12 m
20450
41.1 m
20430
36.4 m
20710
36.73 m
20740
34.79 m
20690
6.32 m
20560
37.9 m
20580
39.25 m
20570
37.68 m
20575
36.18 m
20585
36.44 m
20540
42.16 m
20550
42.85 m
21110
42.02 m
21100
44.82 m
21040
39.41 m
21010
44.17 m
21090
46.86 m
20010
29.17 m
20020
36.93 m
20030
39.7 m
20185
42.13 m
20170
43.68 m
20180
43.8 m
20160
44.35 m
20270
42.65 m
20280
43.79 m
20100
40.34 m
20080
40.54 m
20070
40.53 m
20090
38.42 m
20040
34.58 m
20520
43.93 m
20530
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50.64 m
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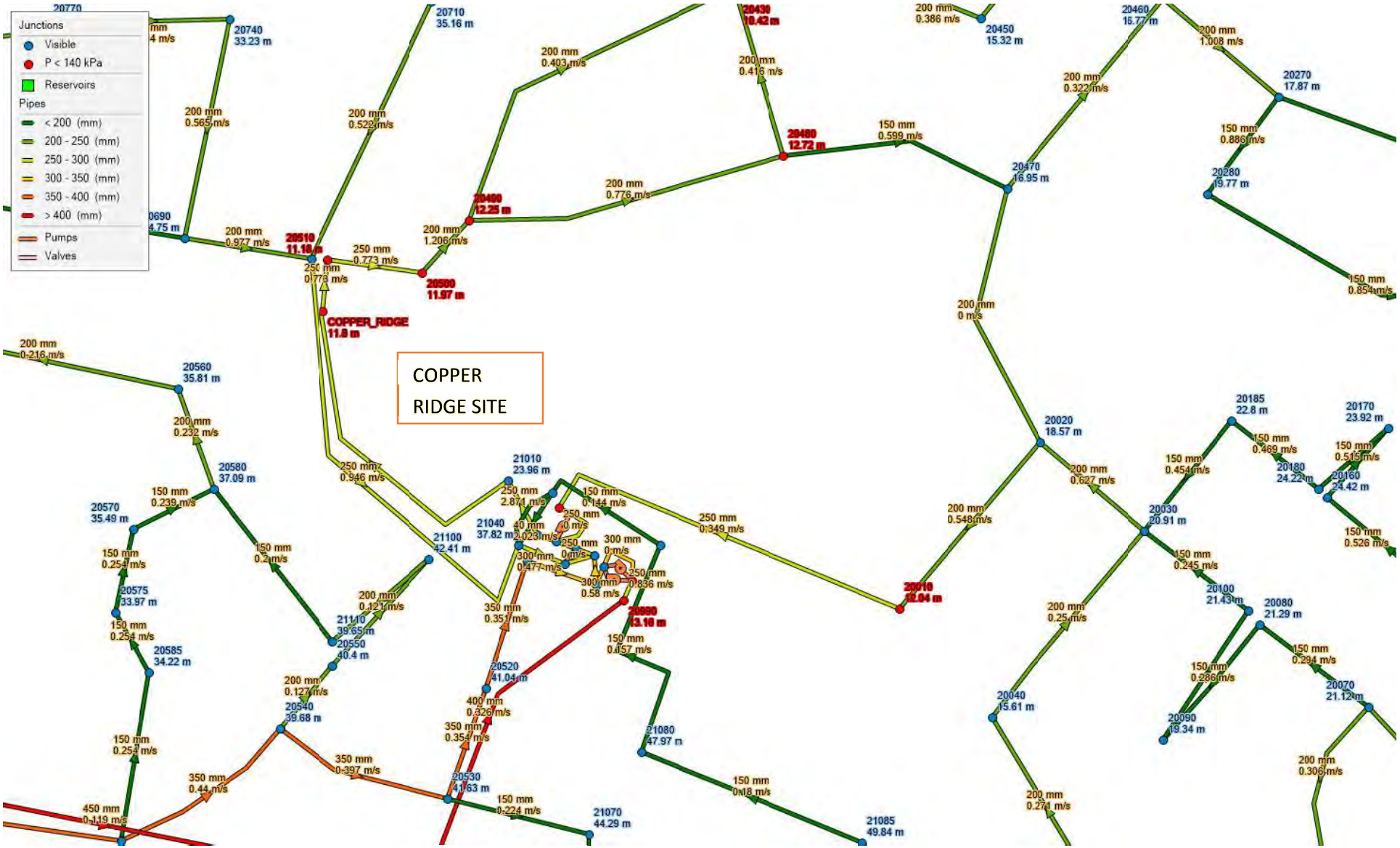
46.99 m
21085
52.52 m
20990
13.198 m

MDD+100 L/S FF


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER RIDGE SITE
COPPER_RIDGE
11.8 m
20510
11.18 m
20500
11.97 m
20480
12.72 m
20430
10.42 m
20710
35.16 m
20740
33.23 m
20690
4.75 m
20450
15.32 m
20460
16.77 m
20270
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20575
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20585
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20540
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20550
40.4 m
21110
39.65 m
21100
42.41 m
21040
37.82 m
21010
23.96 m
20520
41.04 m
20530
41.63 m
20990
13.16 m
20910
12.04 m
21080
47.97 m
21070
44.29 m
21085
49.84 m
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200 mm 0.522 m/s
200 mm 0.403 m/s
200 mm 0.416 m/s
200 mm 0.386 m/s
200 mm 0.322 m/s
200 mm 1.008 m/s
150 mm 0.599 m/s
150 mm 0.886 m/s
200 mm 0.776 m/s
200 mm 1.206 m/s
200 mm 0.977 m/s
250 mm 0.773 m/s
250 mm 0.778 m/s
150 mm 0.854 m/s
200 mm 0 m/s
200 mm 0.216 m/s
200 mm 0.232 m/s
250 mm 0.946 m/s
250 mm 0.349 m/s
250 mm 2.871 m/s
150 mm 0.144 m/s
250 mm 0 m/s
40 mm 2.023 m/s
250 mm 0 m/s
300 mm 0 m/s
300 mm 0.477 m/s
250 mm 0.836 m/s
300 mm 0.58 m/s
200 mm 0.627 m/s
200 mm 0.548 m/s
150 mm 0.454 m/s
150 mm 0.469 m/s
150 mm 0.515 m/s
150 mm 0.526 m/s
150 mm 0.239 m/s
150 mm 0.254 m/s
150 mm 0.2 m/s
150 mm 0.254 m/s
150 mm 0.245 m/s
200 mm 0.421 m/s
350 mm 0.351 m/s
150 mm 0.457 m/s
200 mm 0.25 m/s
150 mm 0.294 m/s
150 mm 0.286 m/s
200 mm 0.127 m/s
400 mm 0.326 m/s
350 mm 0.354 m/s
350 mm 0.397 m/s
350 mm 0.44 m/s
150 mm 0.254 m/s
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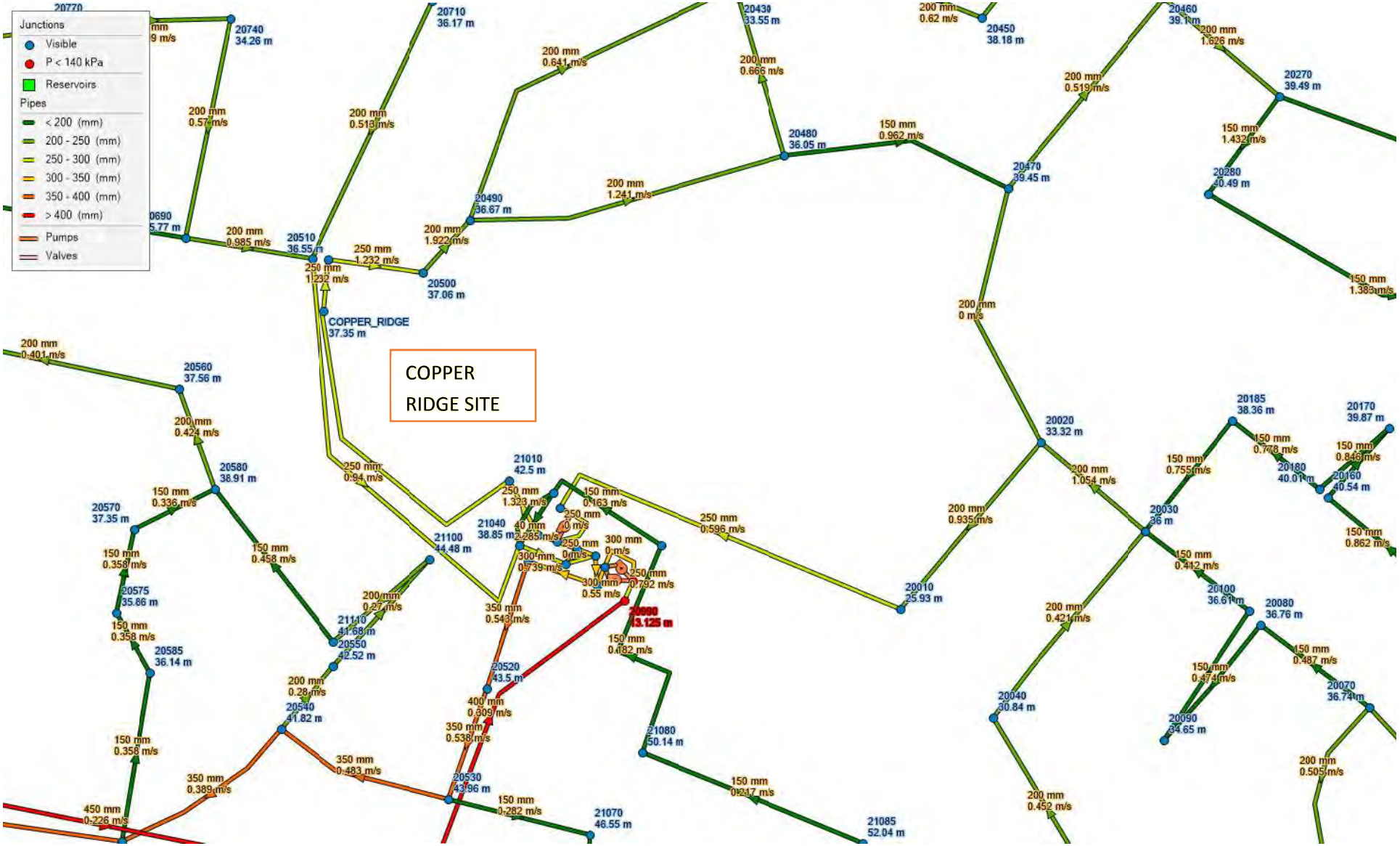
150 mm 0.18 m/s
450 mm 0.119 m/s
200 mm 0.306 m/s
200 mm 0.274 m/s

PHD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Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
COPPER_RIDGE
37.35 m
20740
34.26 m
20710
36.17 m
20490
36.67 m
20510
36.55 m
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39.45 m
20460
39.1 m
20270
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20280
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20560
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20570
37.35 m
20575
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20585
36.14 m
21010
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21040
38.85 m
21100
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21110
41.68 m
20550
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43.5 m
20530
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25.93 m
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33.32 m
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36 m
20185
38.36 m
20170
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40.01 m
20160
40.54 m
20100
36.61 m
20080
36.76 m
20090
34.65 m
20070
36.74 m
20040
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200 mm
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200 mm
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200 mm
0.641 m/s
200 mm
0.666 m/s
200 mm
0.62 m/s
200 mm
0.519 m/s
200 mm
1.626 m/s
150 mm
1.432 m/s
150 mm
1.383 m/s
150 mm
0.962 m/s
200 mm
1.241 m/s
200 mm
1.922 m/s
250 mm
1.232 m/s
200 mm
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200 mm
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200 mm
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200 mm
0.424 m/s
250 mm
0.94 m/s
250 mm
1.323 m/s
150 mm
0.163 m/s
250 mm
0 m/s
40 mm
2.285 m/s
250 mm
0 m/s
300 mm
0 m/s
300 mm
0.739 m/s
250 mm
0.792 m/s
300 mm
0.55 m/s
250 mm
0.596 m/s
200 mm
0.935 m/s
200 mm
1.054 m/s
150 mm
0.755 m/s
150 mm
0.778 m/s
150 mm
0.846 m/s
150 mm
0.862 m/s
150 mm
0.336 m/s
150 mm
0.358 m/s
150 mm
0.358 m/s
150 mm
0.458 m/s
200 mm
0.27 m/s
350 mm
0.543 m/s
150 mm
0.482 m/s
200 mm
0.28 m/s
400 mm
0.309 m/s
350 mm
0.538 m/s
350 mm
0.483 m/s
350 mm
0.389 m/s
150 mm
0.282 m/s
150 mm
0.247 m/s
450 mm
0.226 m/s
150 mm
0.412 m/s
150 mm
0.474 m/s
150 mm
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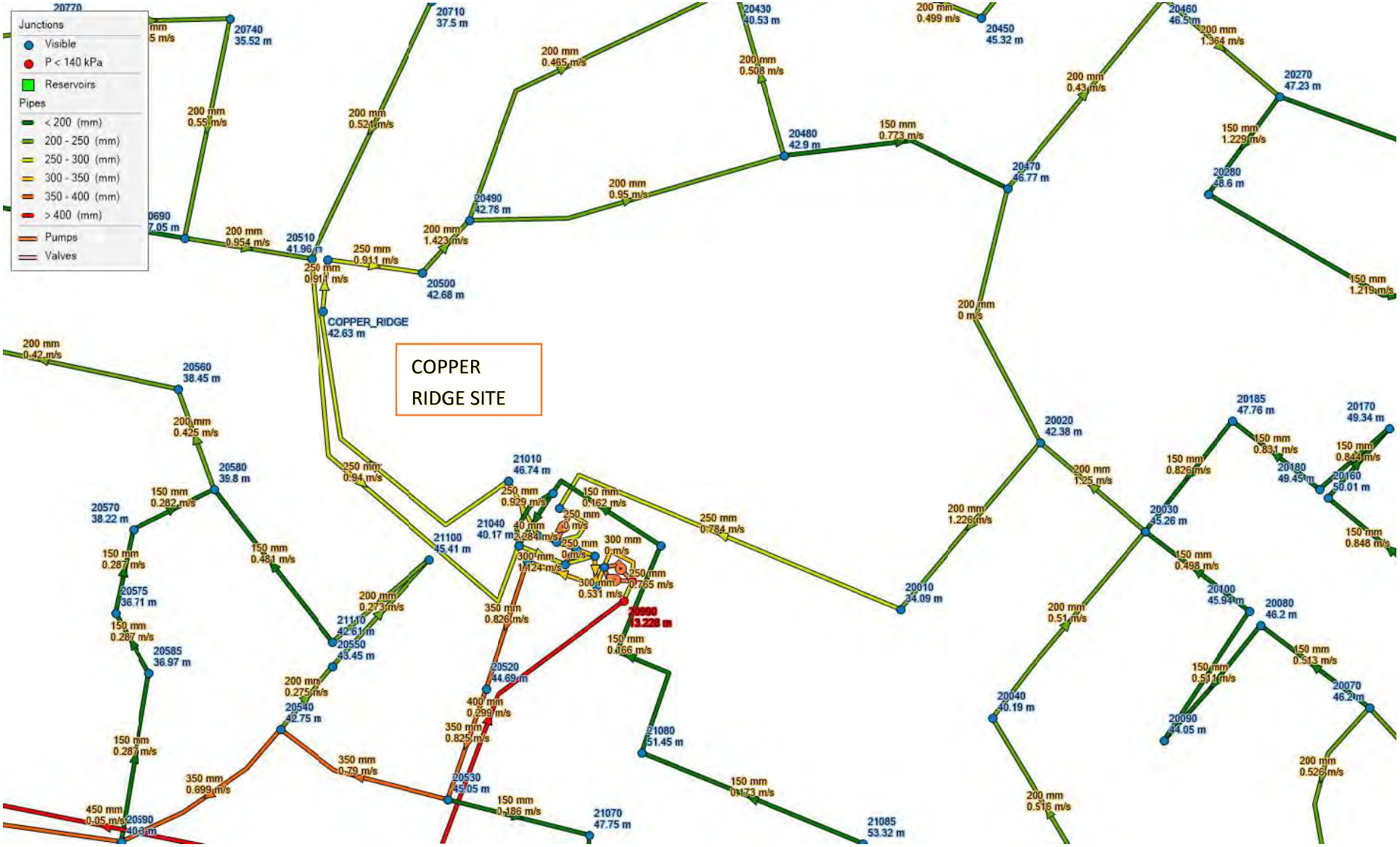
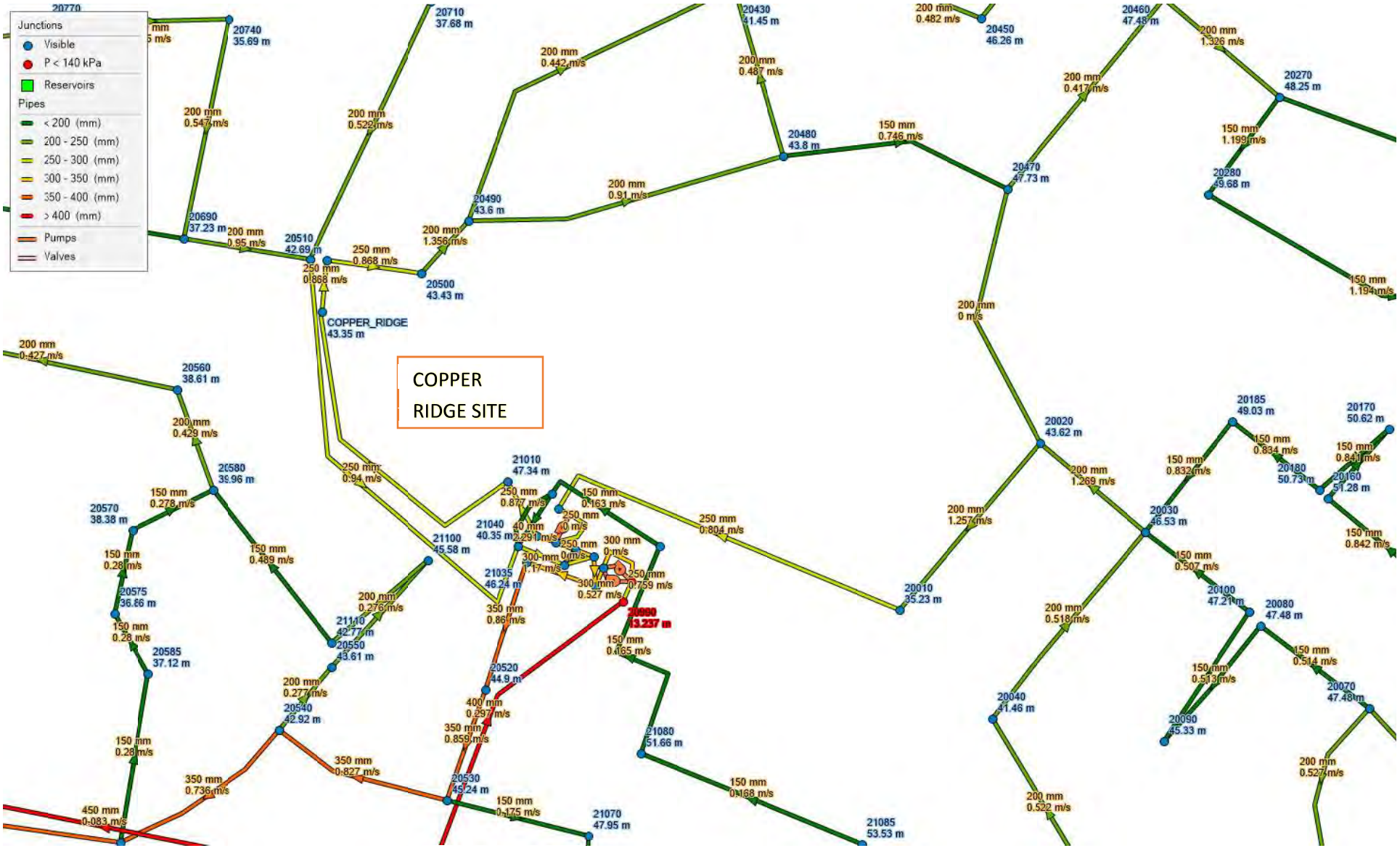
200 mm
0.505 m/s

NFD – RESERVOIR FILLING ANALYSIS



NFD – THERMAL ANALYSIS



MODEL RESULTS FOR CONNECTION TO SERVICING POINT 2

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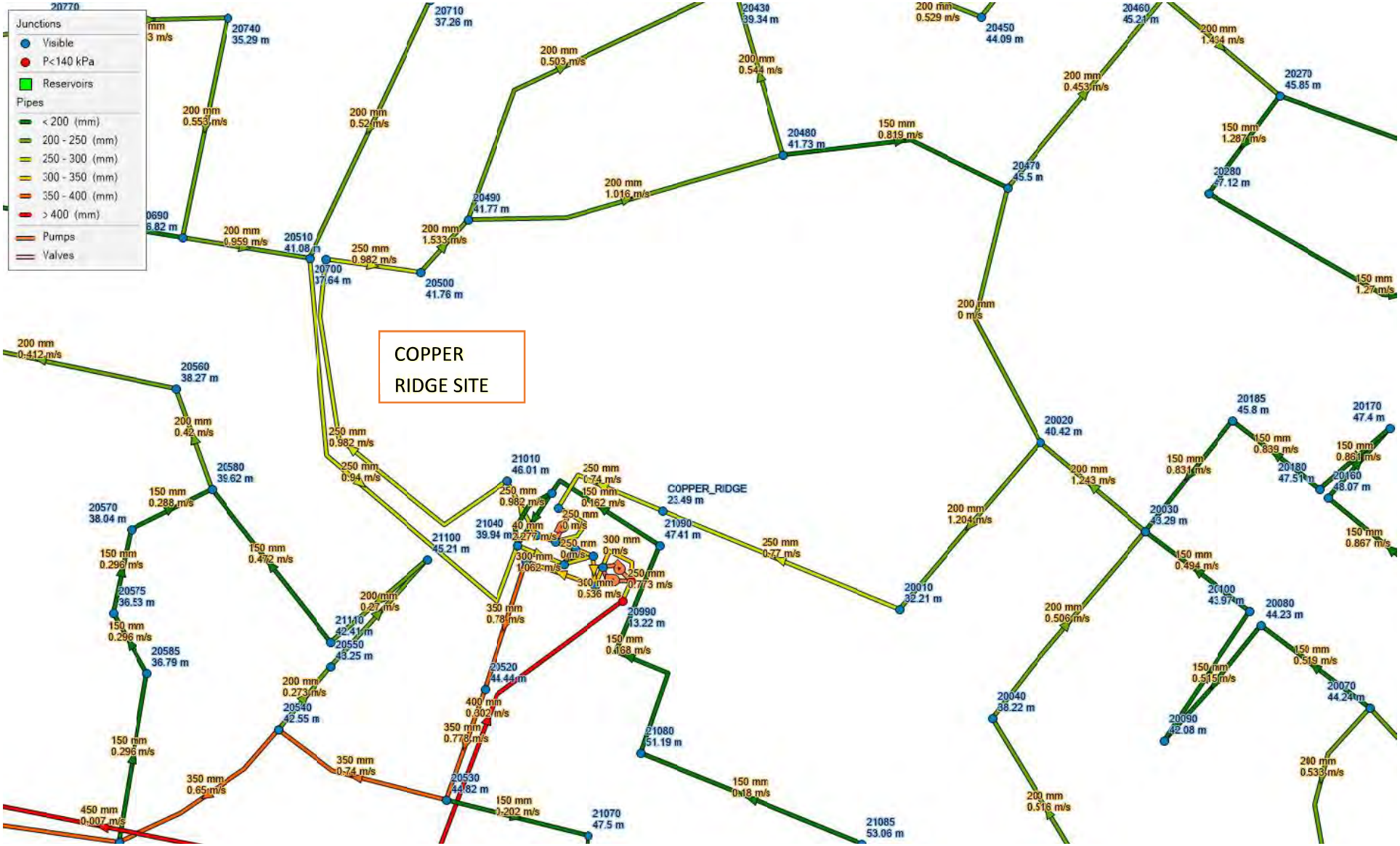

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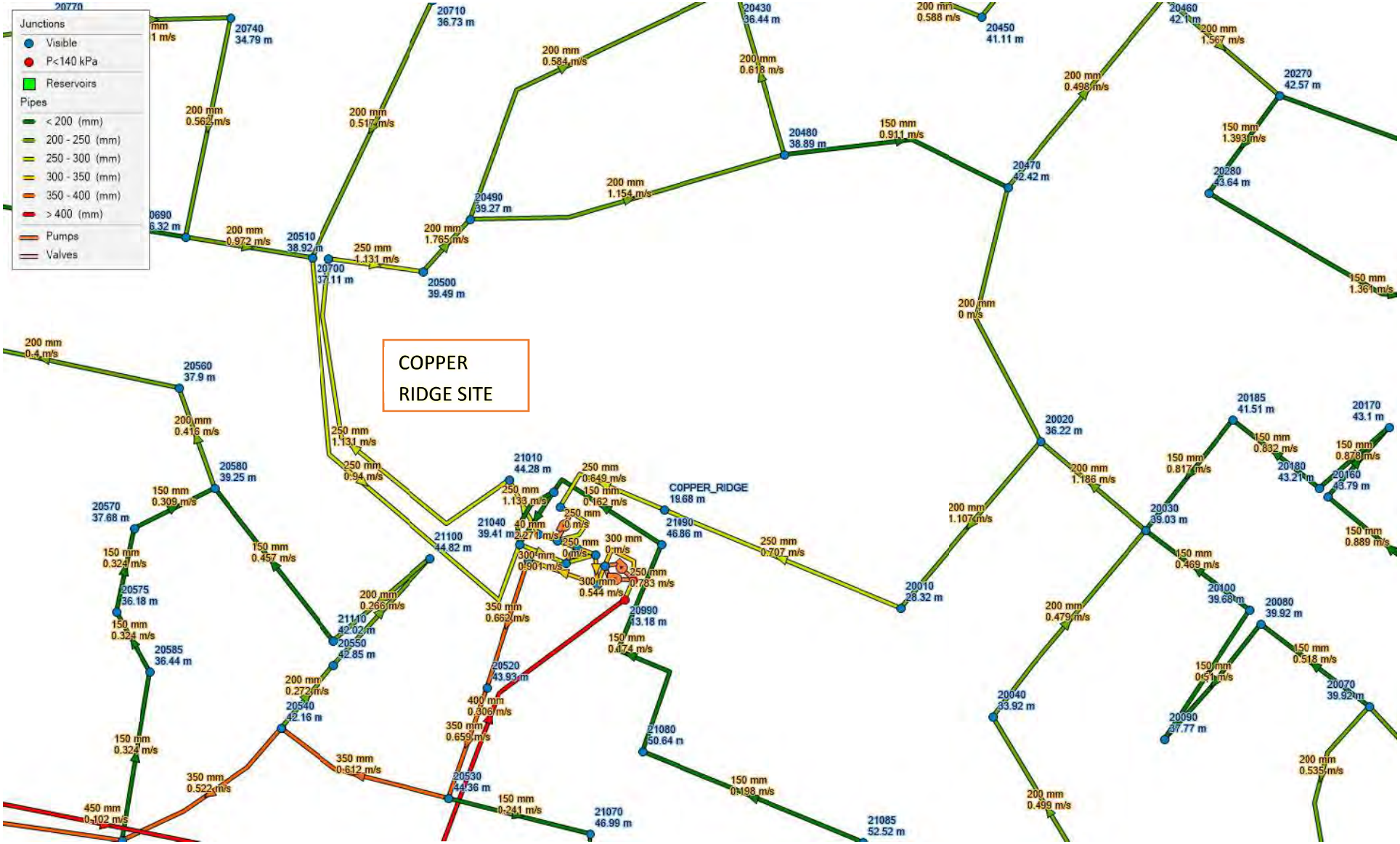
Junctions
Visible
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Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER RIDGE SITE
COPPER_RIDGE
19.68 m
20740
34.79 m
20710
36.73 m
20430
36.44 m
20450
41.11 m
20460
42.1 m
20270
42.57 m
20280
43.64 m
20480
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46.99 m
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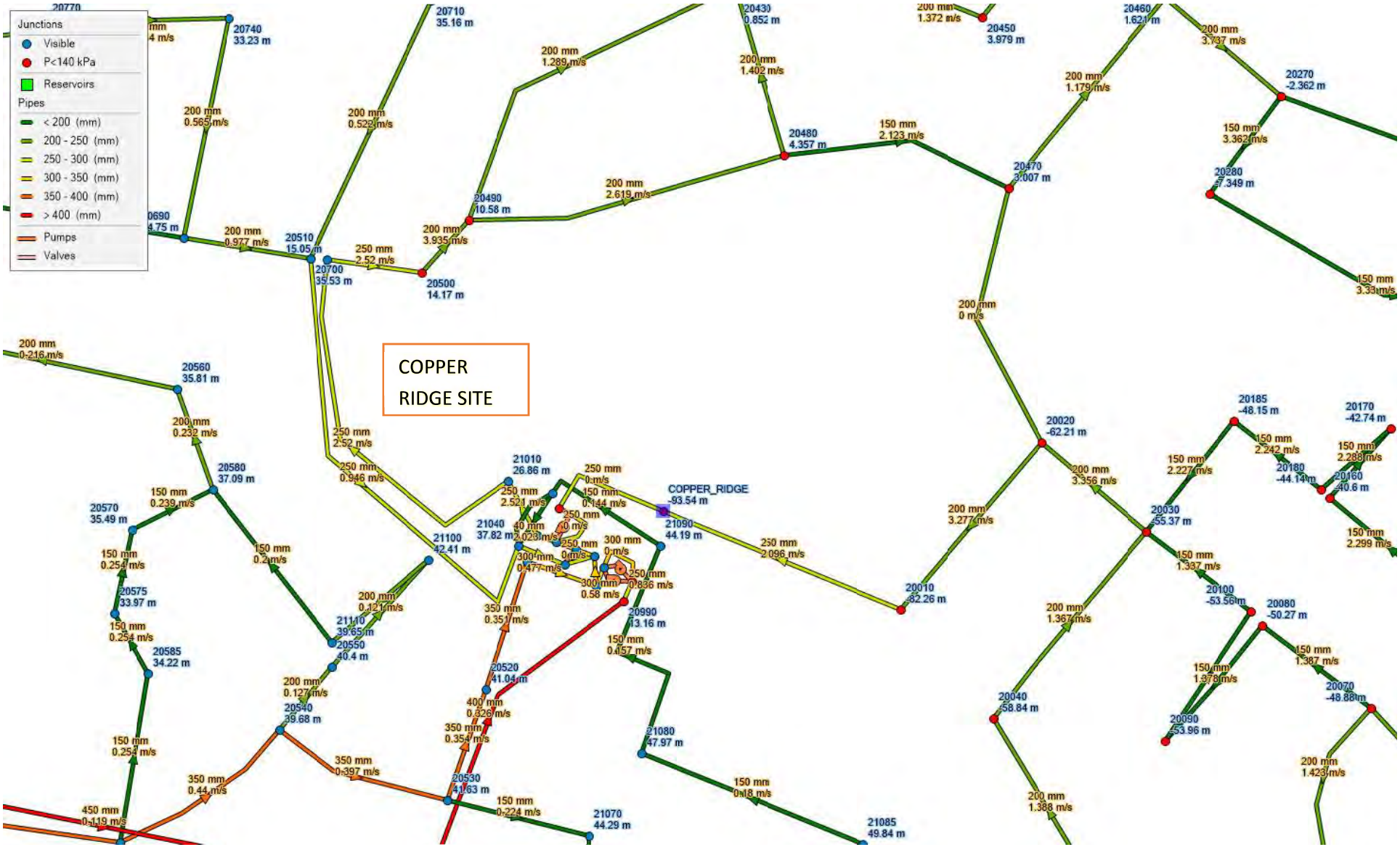
52.52 m

MDD+100 L/S FF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Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
COPPER_RIDGE
-93.54 m
20710
35.16 m
20740
33.23 m
20690
4.75 m
20510
15.05 m
20700
35.53 m
20500
14.17 m
20490
10.58 m
20430
0.852 m
20450
3.979 m
20480
4.357 m
20460
1.621 m
20270
-2.362 m
20280
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20470
3.007 m
20560
35.81 m
20580
37.09 m
20570
35.49 m
20575
33.97 m
20585
34.22 m
20540
39.68 m
21010
26.86 m
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20080
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20070
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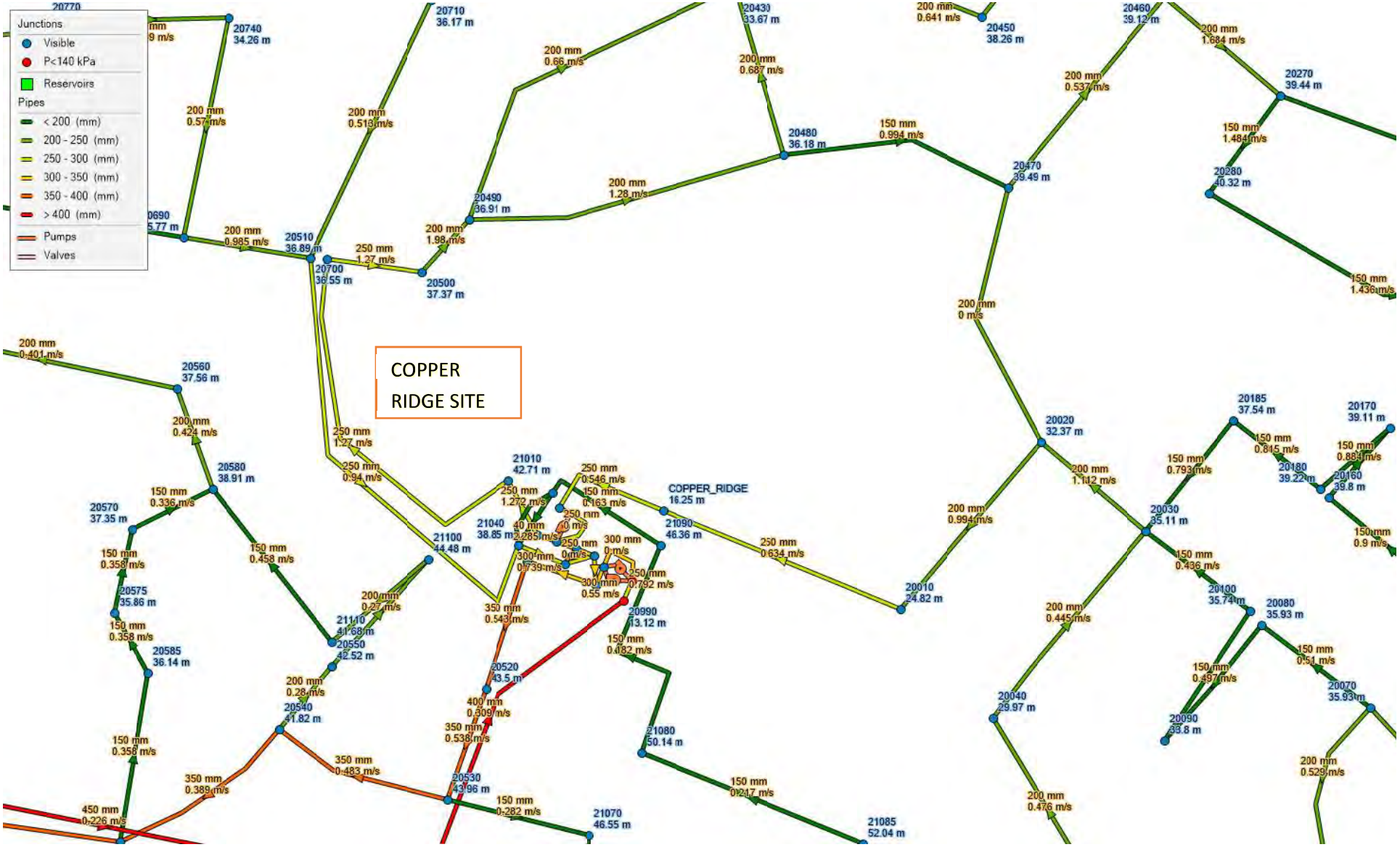
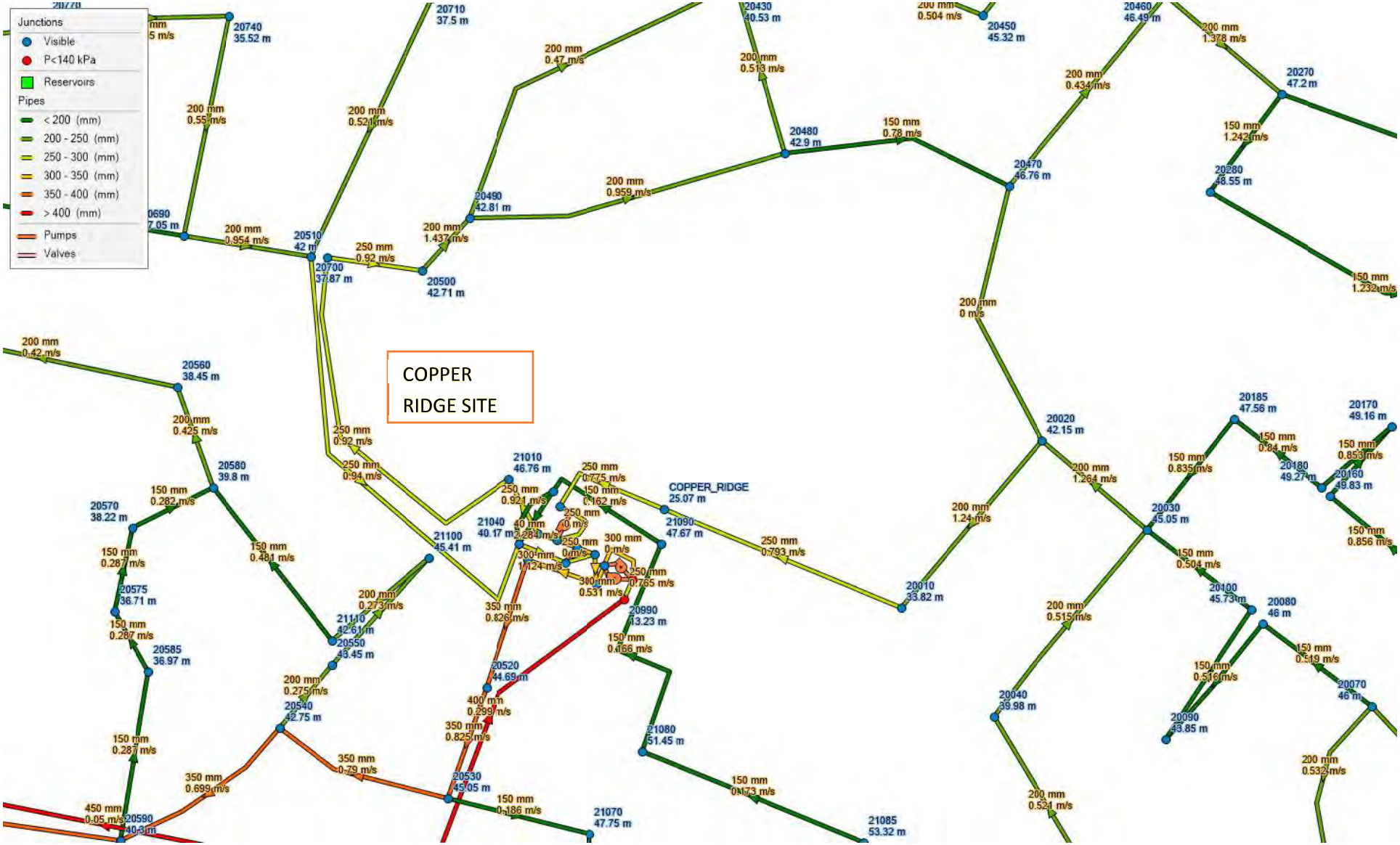
20040
-58.84 m
20090
-53.96 m

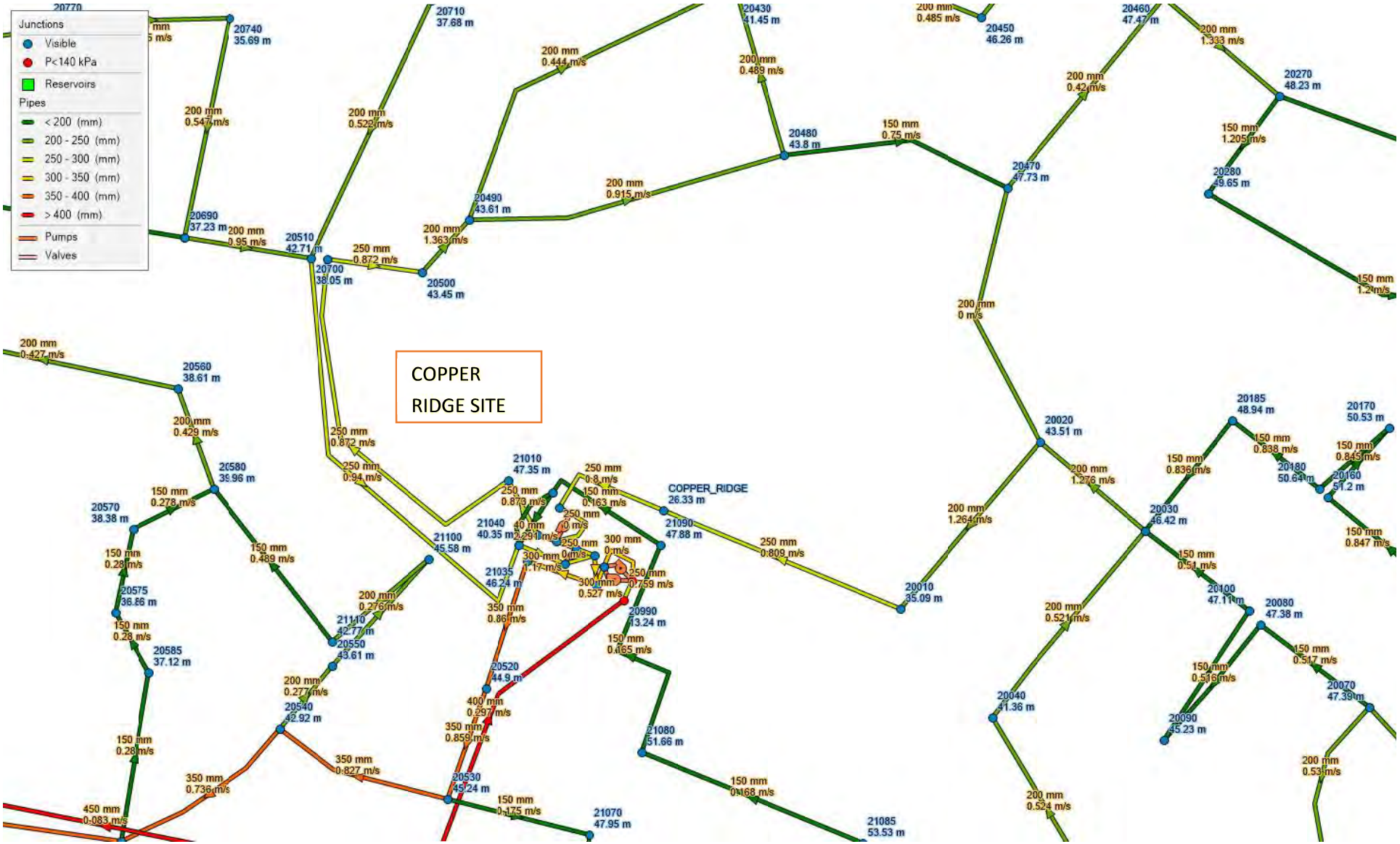
PHD


Junctions
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
COPPER_RIDGE
16.25 m
20740
34.26 m
20710
36.17 m
20430
33.67 m
20450
38.26 m
20460
39.12 m
20270
39.44 m
20280
40.32 m
20480
36.18 m
20490
36.91 m
20470
39.49 m
20510
36.89 m
20700
36.55 m
20500
37.37 m
20560
37.56 m
20580
38.91 m
20570
37.35 m
20575
35.86 m
20585
36.14 m
20540
41.82 m
20550
42.52 m
21100
44.48 m
21110
41.68 m
21010
42.71 m
21040
38.85 m
21090
46.36 m
20010
24.82 m
20020
32.37 m
20185
37.54 m
20170
39.11 m
20180
39.22 m
20160
39.8 m
20030
35.11 m
20100
35.74 m
20080
35.93 m
20070
35.93 m
20040
29.97 m
20090
33.8 m
20990
43.12 m
20520
43.5 m
20530
43.96 m
21080
50.14 m
21070
46.55 m
21085
52.04 m

NFD – RESERVOIR FILLING ANALYSIS

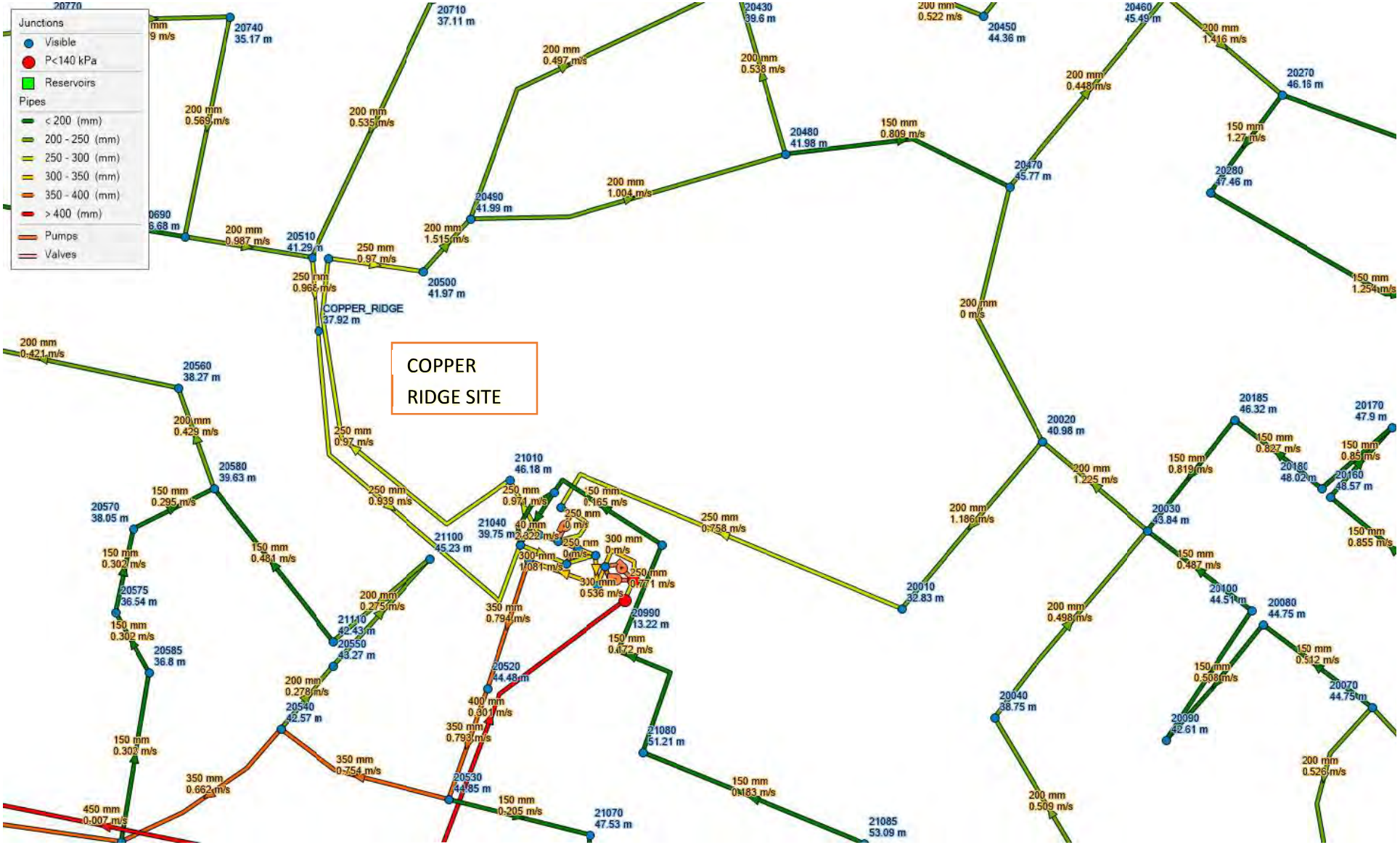


NFD – THERMAL ANALYSIS

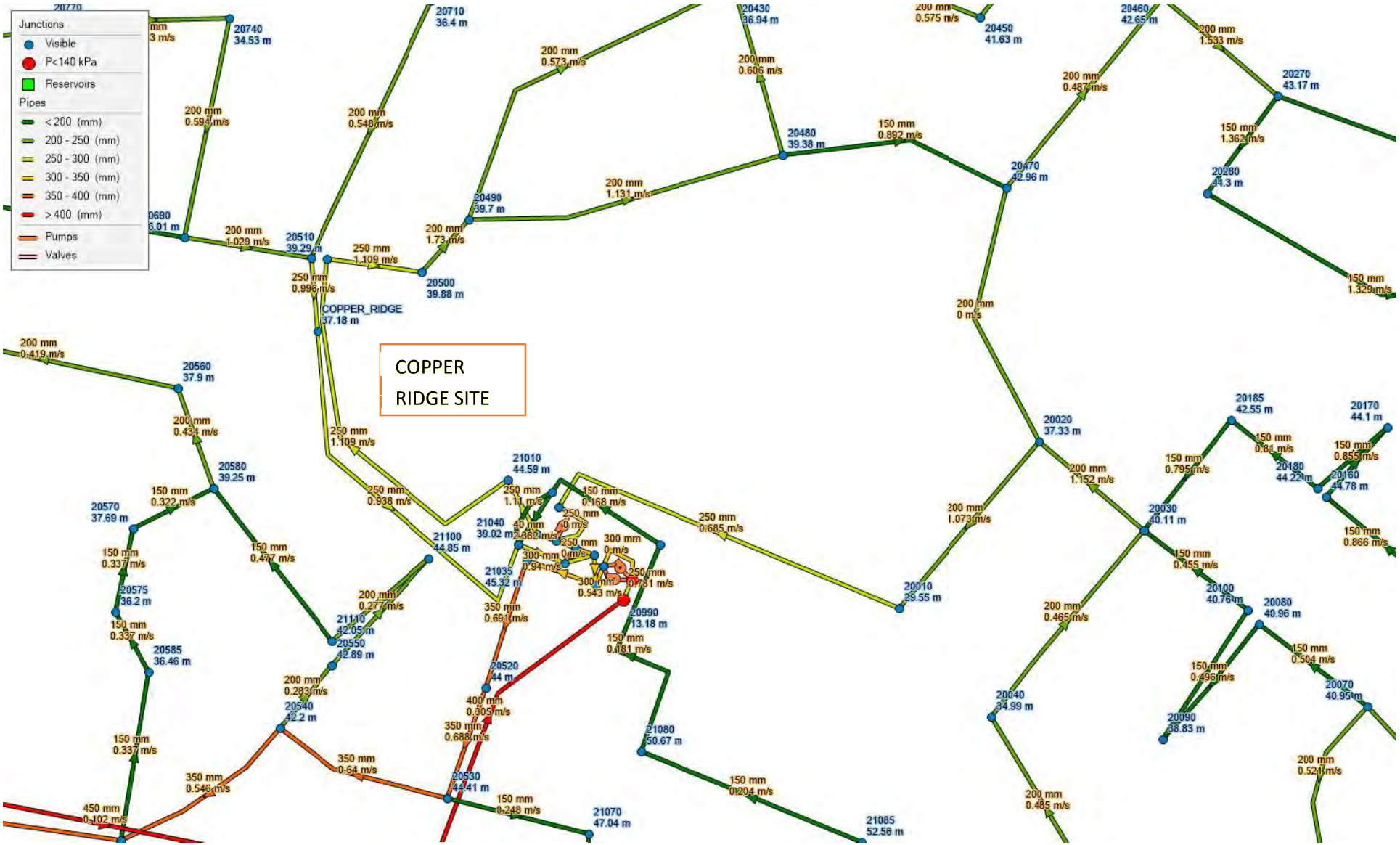


MODEL RESULTS FOR CONNECTION TO SERVICING POINT 3

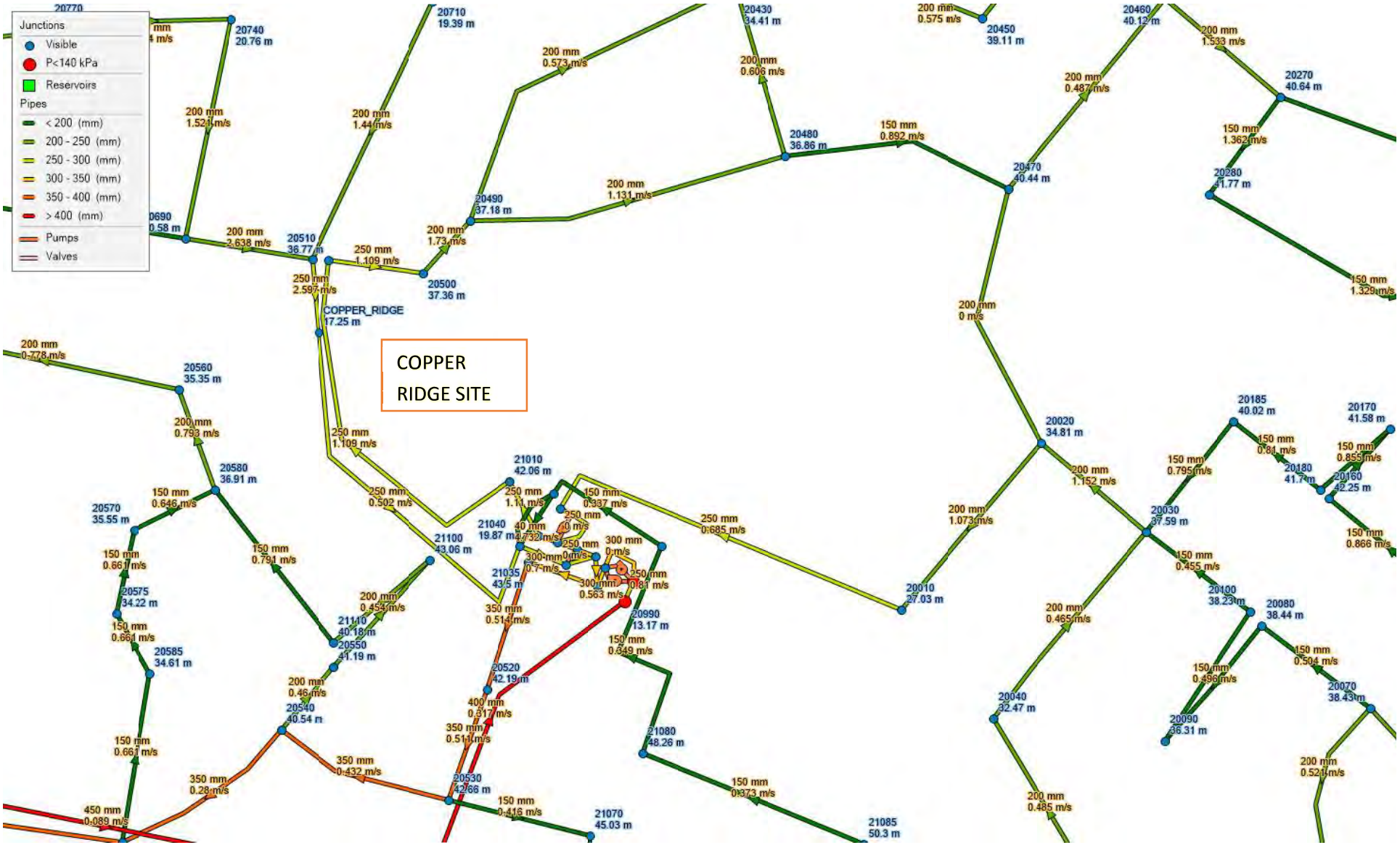
ADD



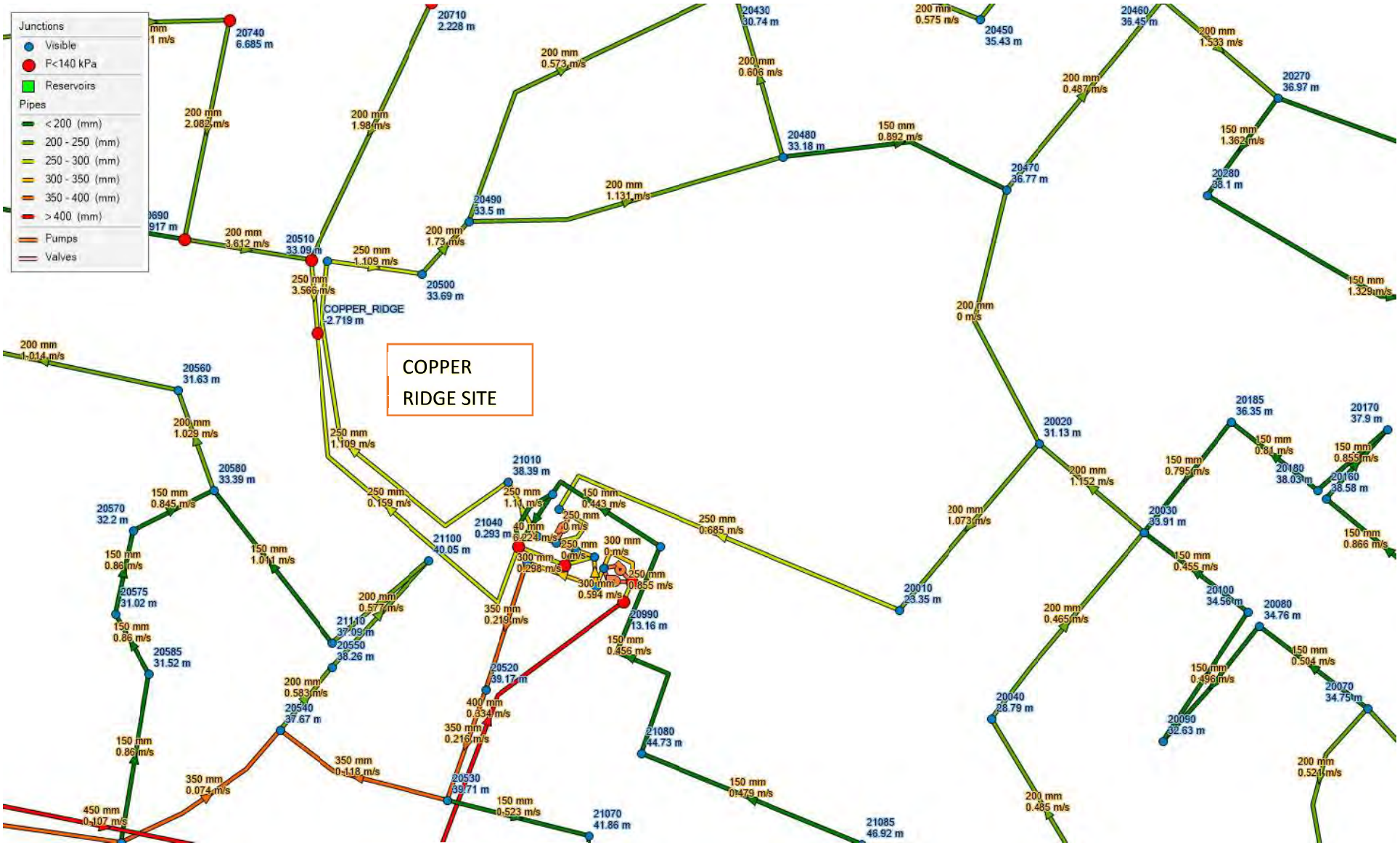
MDD


Junctions
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER_RIDGE
37.18 m
COPPER
RIDGE SITE

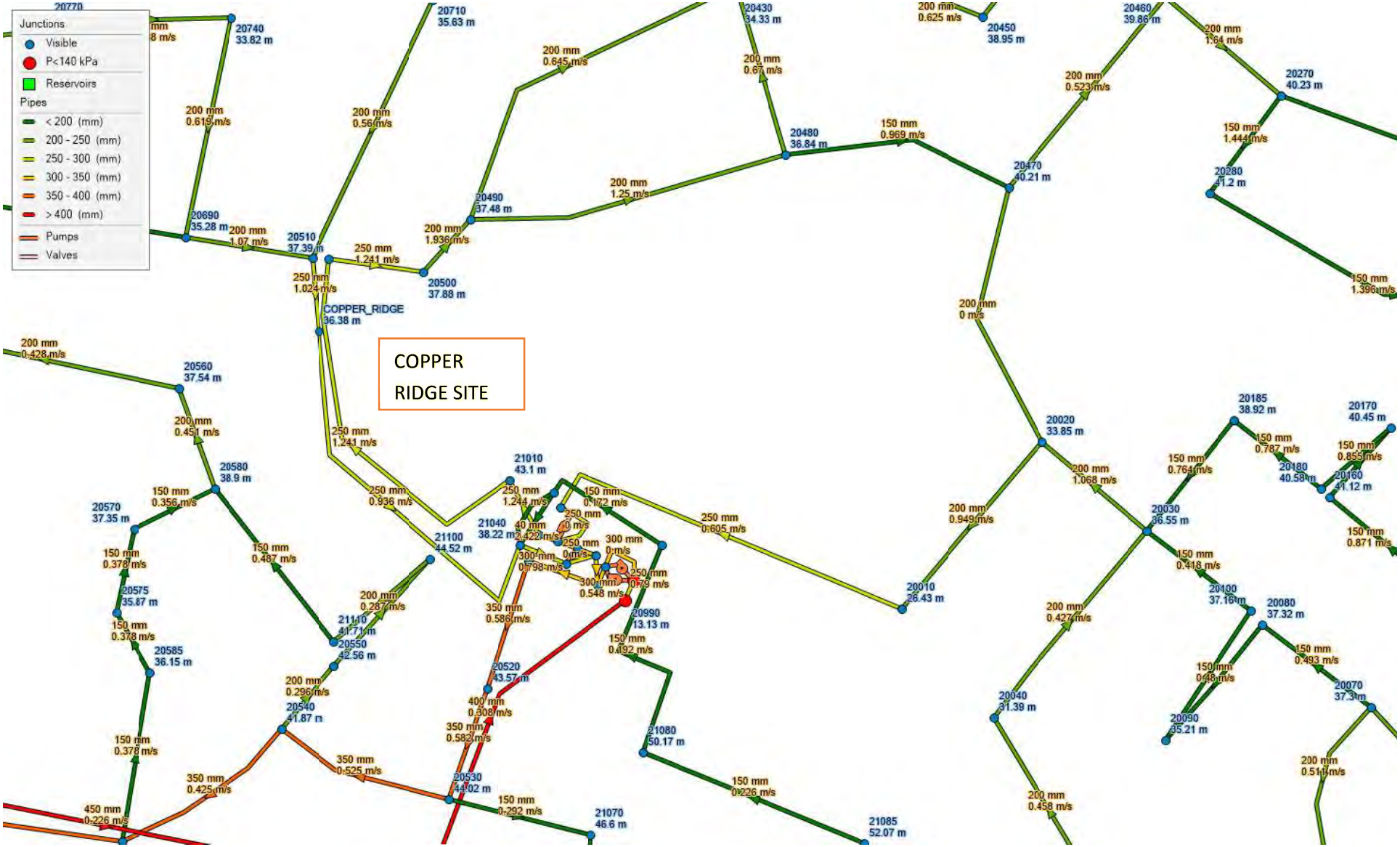
MDD+100 L/S FF


Junctions
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER RIDGE SITE
COPPER_RIDGE
17.25 m
20510
36.77 m
20500
37.36 m
20490
37.18 m
20480
36.86 m
20470
40.44 m
20460
40.12 m
20450
39.11 m
20430
34.41 m
20710
19.39 m
20740
20.76 m
20270
40.64 m
20280
41.77 m
20020
34.81 m
20030
37.59 m
20010
27.03 m
20185
40.02 m
20170
41.58 m
20180
41.7 m
20160
42.25 m
20100
38.23 m
20080
38.44 m
20070
38.43 m
20090
36.31 m
20040
32.47 m
20560
35.35 m
20580
36.91 m
20570
35.55 m
20575
34.22 m
20585
34.61 m
20550
41.19 m
20540
40.54 m
21010
42.06 m
21040
19.87 m
21100
43.06 m
21035
43.5 m
21110
40.18 m
20520
42.19 m
20530
42.66 m
20990
13.17 m
21080
48.26 m
21070
45.03 m
21085
50.3 m

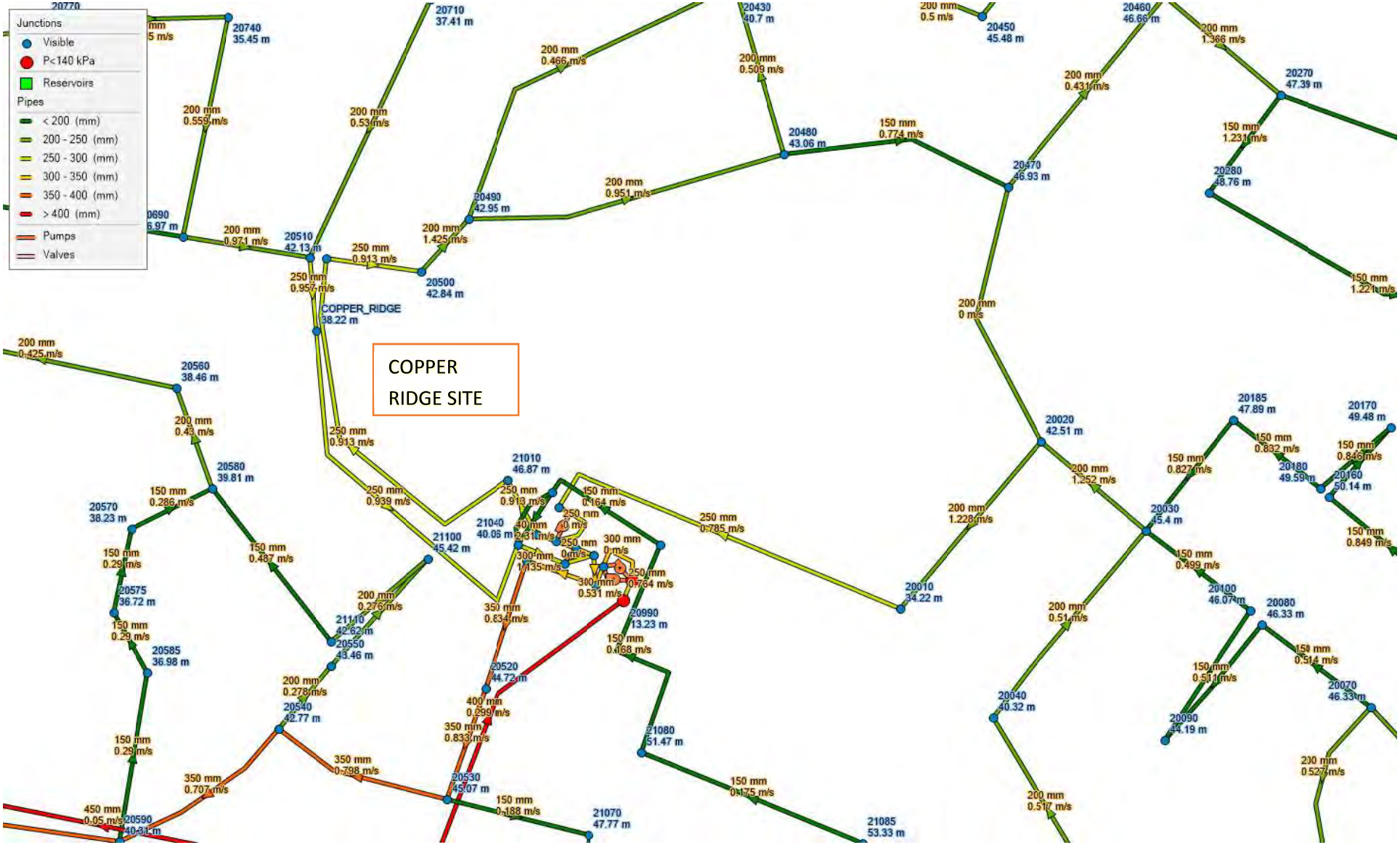
MDD+180 L/S FF


Junctions
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER_RIDGE
2.719 m
COPPER
RIDGE SITE
20740
6.685 m
20710
2.228 m
20430
30.74 m
20450
35.43 m
20460
36.45 m
20270
36.97 m
20280
38.1 m
20470
36.77 m
20480
33.18 m
20490
33.5 m
20510
33.09 m
20500
33.69 m
20560
31.63 m
20580
33.39 m
20570
32.2 m
20575
31.02 m
20585
31.52 m
20550
38.26 m
20540
37.67 m
20530
39.71 m
21010
38.39 m
21040
0.293 m
21100
40.05 m
21110
37.09 m
20520
39.17 m
20990
13.16 m
21080
44.73 m
21070
41.86 m
21085
46.92 m
20010
23.35 m
20020
31.13 m
20185
36.35 m
20170
37.9 m
20180
38.03 m
20160
38.58 m
20030
33.91 m
20100
34.56 m
20080
34.76 m
20070
34.75 m
20090
32.63 m
20040
28.79 m

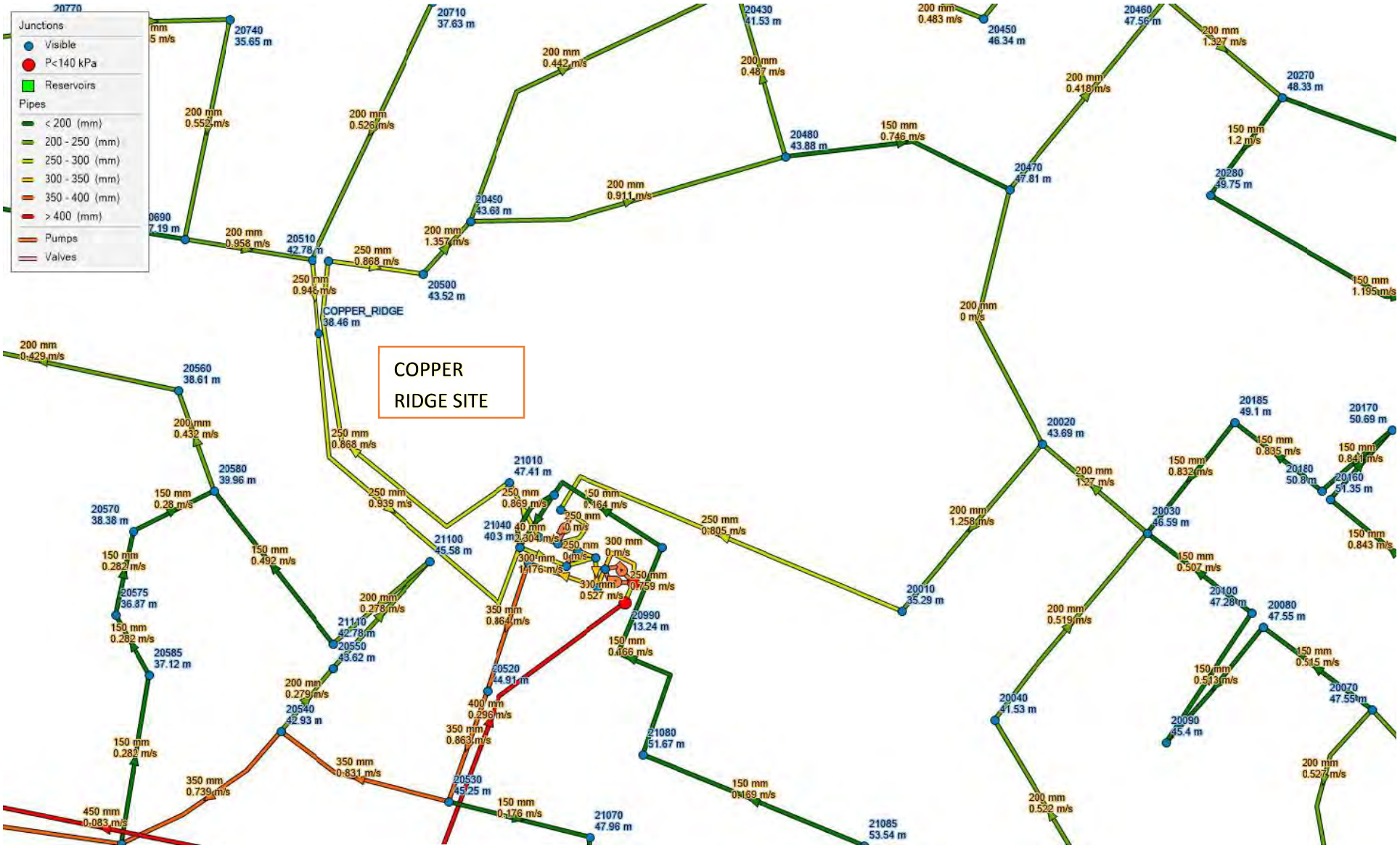
PHD


Junctions
Visible
P<140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER RIDGE SITE
COPPER_RIDGE
36.38 m
20510
37.39 m
20500
37.88 m
20490
37.48 m
20480
36.84 m
20470
40.21 m
20460
39.86 m
20450
38.95 m
20430
34.33 m
20710
35.63 m
20740
33.82 m
20690
35.28 m
20270
40.23 m
20280
41.2 m
20020
33.85 m
20030
36.55 m
20010
26.43 m
20185
38.92 m
20170
40.45 m
20180
40.58 m
20160
41.12 m
20100
37.16 m
20080
37.32 m
20070
37.3 m
20090
35.21 m
20040
31.39 m
20560
37.54 m
20580
38.9 m
20570
37.35 m
20575
35.87 m
20585
36.15 m
20550
42.56 m
20540
41.87 m
20530
44.02 m
21010
43.1 m
21040
38.22 m
21100
44.52 m
21110
41.71 m
20520
43.57 m
20990
13.13 m
21080
50.17 m
21070
46.6 m
21085
52.07 m
200 mm 0.625 m/s
200 mm 0.645 m/s
200 mm 0.67 m/s
200 mm 0.523 m/s
200 mm 1.64 m/s
200 mm 0.619 m/s
200 mm 0.56 m/s
150 mm 0.969 m/s
150 mm 1.444 m/s
200 mm 1.25 m/s
200 mm 1.07 m/s
200 mm 1.936 m/s
250 mm 1.241 m/s
250 mm 1.024 m/s
150 mm 1.396 m/s
200 mm 0 m/s
200 mm 0.428 m/s
200 mm 0.451 m/s
250 mm 1.241 m/s
250 mm 0.936 m/s
250 mm 1.244 m/s
150 mm 0.172 m/s
250 mm 0 m/s
40 mm 2.422 m/s
250 mm 0 m/s
300 mm 0 m/s
300 mm 0.798 m/s
250 mm 0.79 m/s
300 mm 0.548 m/s
250 mm 0.605 m/s
200 mm 0.949 m/s
200 mm 1.068 m/s
150 mm 0.764 m/s
150 mm 0.787 m/s
150 mm 0.855 m/s
150 mm 0.871 m/s
150 mm 0.418 m/s
150 mm 0.356 m/s
150 mm 0.378 m/s
150 mm 0.487 m/s
200 mm 0.287 m/s
350 mm 0.586 m/s
150 mm 0.492 m/s
200 mm 0.427 m/s
150 mm 0.493 m/s
150 mm 0.48 m/s
200 mm 0.296 m/s
400 mm 0.308 m/s
350 mm 0.582 m/s
150 mm 0.226 m/s
200 mm 0.458 m/s
200 mm 0.51 m/s
350 mm 0.525 m/s
350 mm 0.425 m/s
150 mm 0.292 m/s
450 mm 0.226 m/s

NFD – RESERVOIR FILLING ANALYSIS

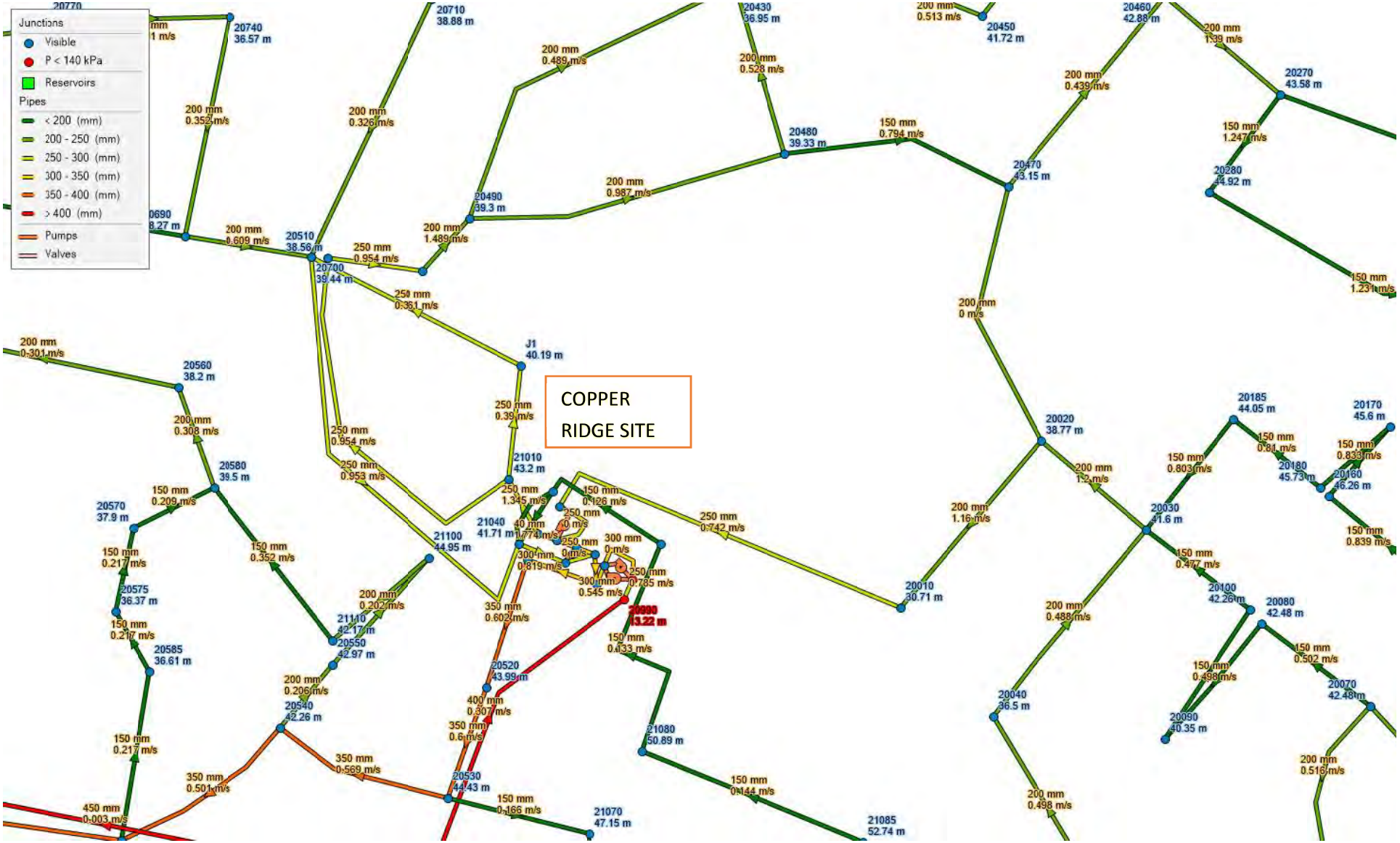


NFD – THERMAL ANALYSIS

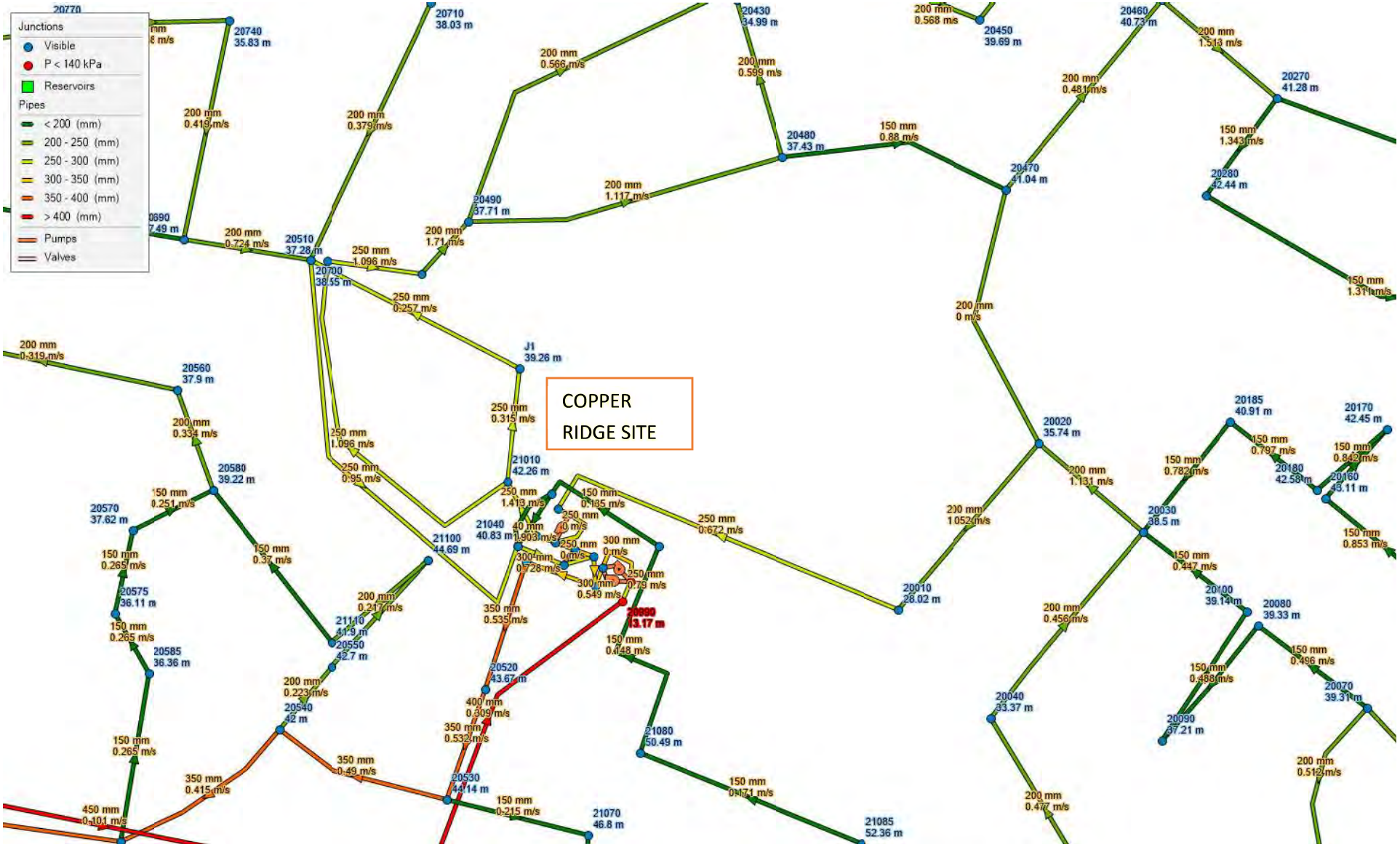


MODEL RESULTS FOR CONNECTION TO SERVICING POINT 3 AND SOUTH/EAST 250 MM WM ON FALCON

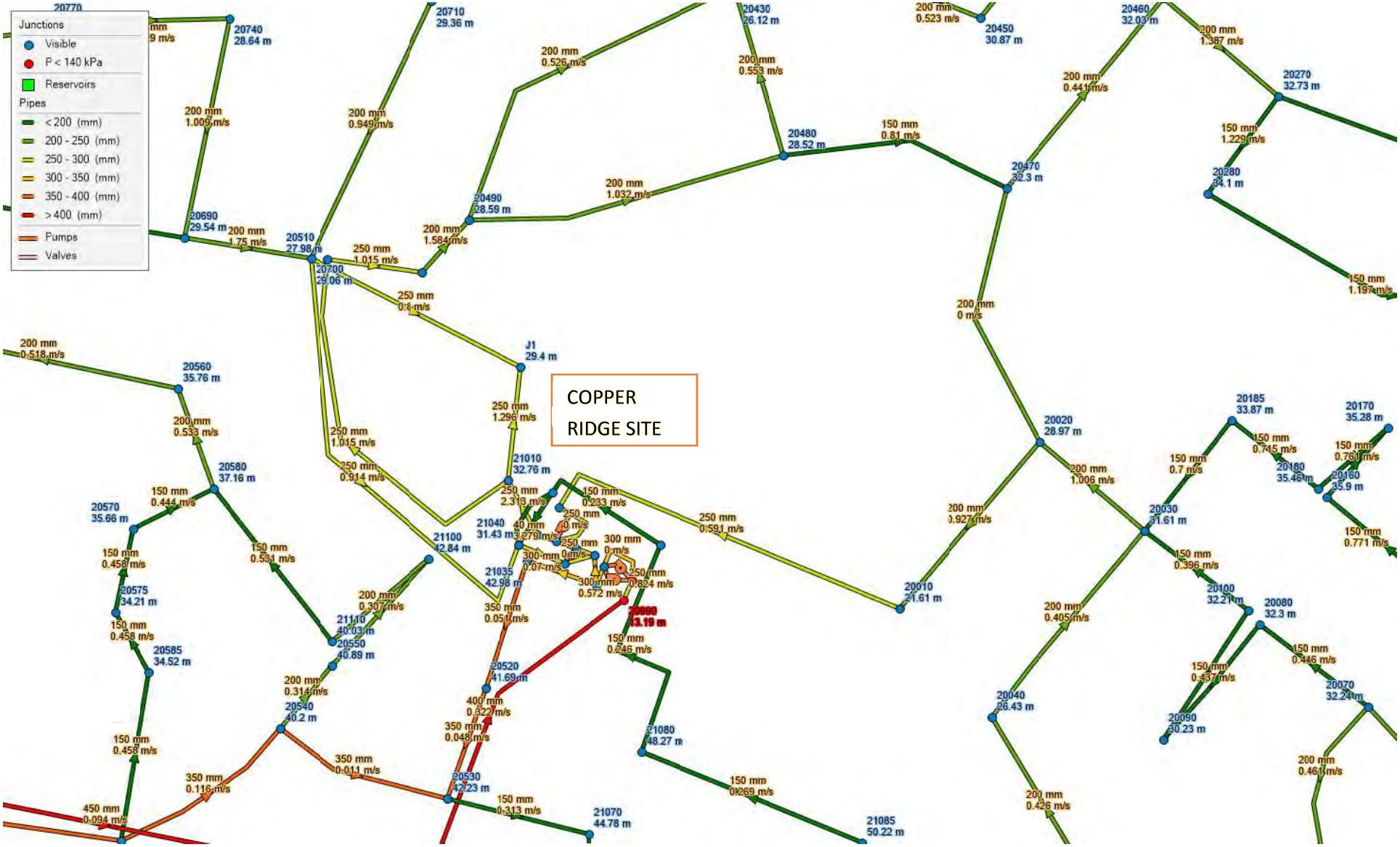
ADD



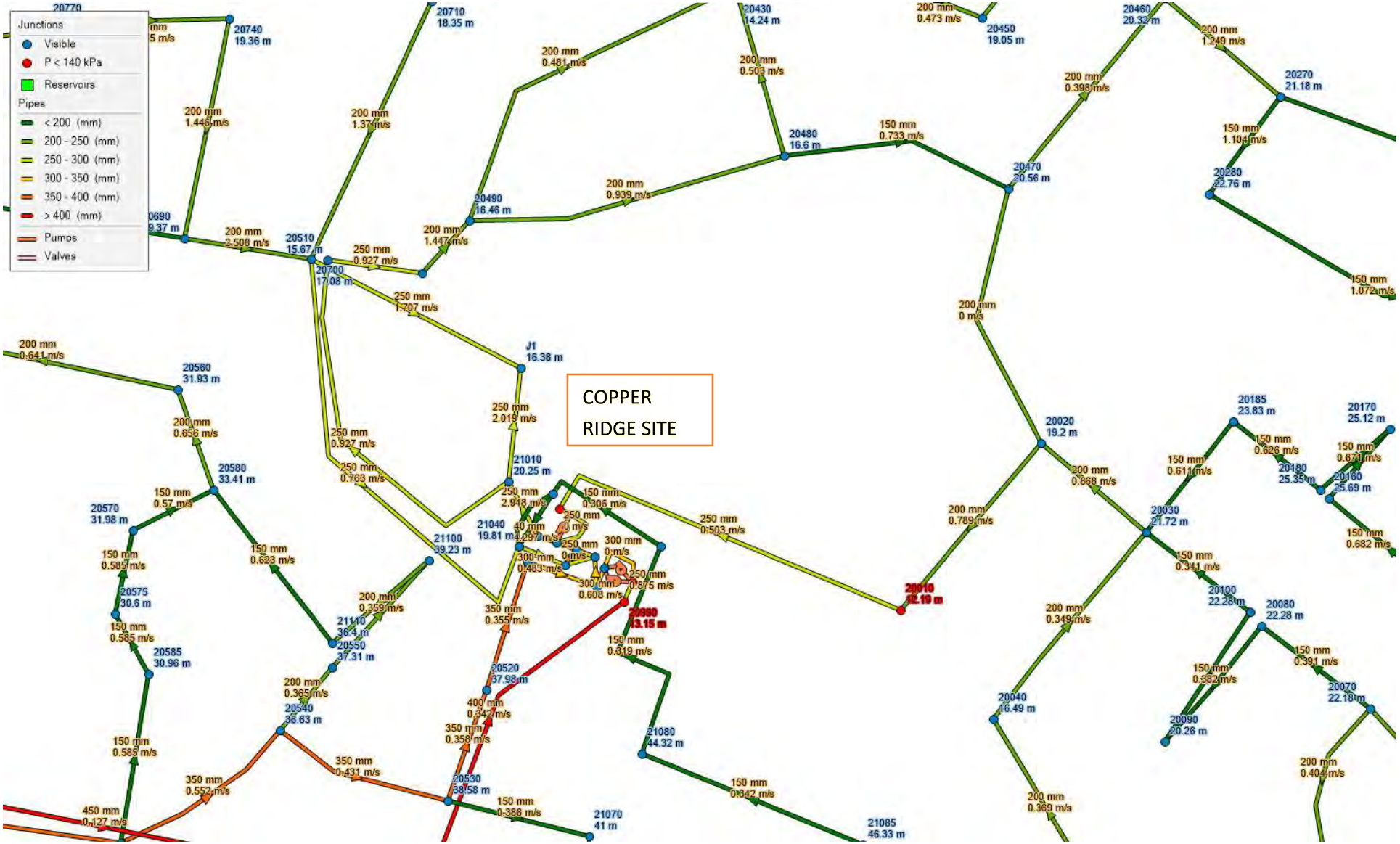
MDD


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
20710 38.03 m
20740 35.83 m
20430 34.99 m
20450 39.69 m
20460 40.73 m
20270 41.28 m
20280 42.44 m
20480 37.43 m
20470 41.04 m
20490 37.71 m
20510 37.28 m
20700 38.55 m
J1 39.26 m
20560 37.9 m
20580 39.22 m
20570 37.62 m
20575 36.11 m
20585 36.36 m
20540 42 m
20550 42.7 m
21010 42.26 m
21040 40.83 m
21100 44.69 m
21110 41.9 m
20520 43.67 m
20530 44.14 m
21070 46.8 m
21080 50.49 m
21085 52.36 m
20020 35.74 m
20010 28.02 m
20185 40.91 m
20170 42.45 m
20180 42.58 m
20160 43.11 m
20030 38.5 m
20100 39.14 m
20080 39.33 m
20040 33.37 m
20090 37.21 m
20070 39.31 m
200 mm 0.568 m/s
200 mm 0.566 m/s
200 mm 0.599 m/s
200 mm 0.481 m/s
200 mm 1.513 m/s
200 mm 0.419 m/s
200 mm 0.379 m/s
150 mm 0.88 m/s
150 mm 1.343 m/s
200 mm 1.117 m/s
200 mm 0.724 m/s
200 mm 1.71 m/s
250 mm 1.096 m/s
250 mm 0.257 m/s
150 mm 1.311 m/s
200 mm 0 m/s
200 mm 0.319 m/s
250 mm 0.315 m/s
200 mm 0.334 m/s
250 mm 1.096 m/s
250 mm 0.95 m/s
250 mm 1.413 m/s
150 mm 0.185 m/s
250 mm 0 m/s
40 mm 1.903 m/s
250 mm 0 m/s
300 mm 0 m/s
300 mm 0.728 m/s
250 mm 0.79 m/s
300 mm 0.549 m/s
250 mm 0.672 m/s
200 mm 1.052 m/s
200 mm 1.131 m/s
150 mm 0.782 m/s
150 mm 0.797 m/s
150 mm 0.842 m/s
150 mm 0.853 m/s
150 mm 0.447 m/s
150 mm 0.251 m/s
150 mm 0.265 m/s
150 mm 0.37 m/s
200 mm 0.217 m/s
350 mm 0.535 m/s
150 mm 0.148 m/s
200 mm 0.456 m/s
150 mm 0.496 m/s
150 mm 0.488 m/s
200 mm 0.223 m/s
400 mm 0.309 m/s
350 mm 0.532 m/s
350 mm 0.49 m/s
350 mm 0.415 m/s
150 mm 0.215 m/s
150 mm 0.171 m/s
200 mm 0.477 m/s
200 mm 0.512 m/s
450 mm 0.101 m/s

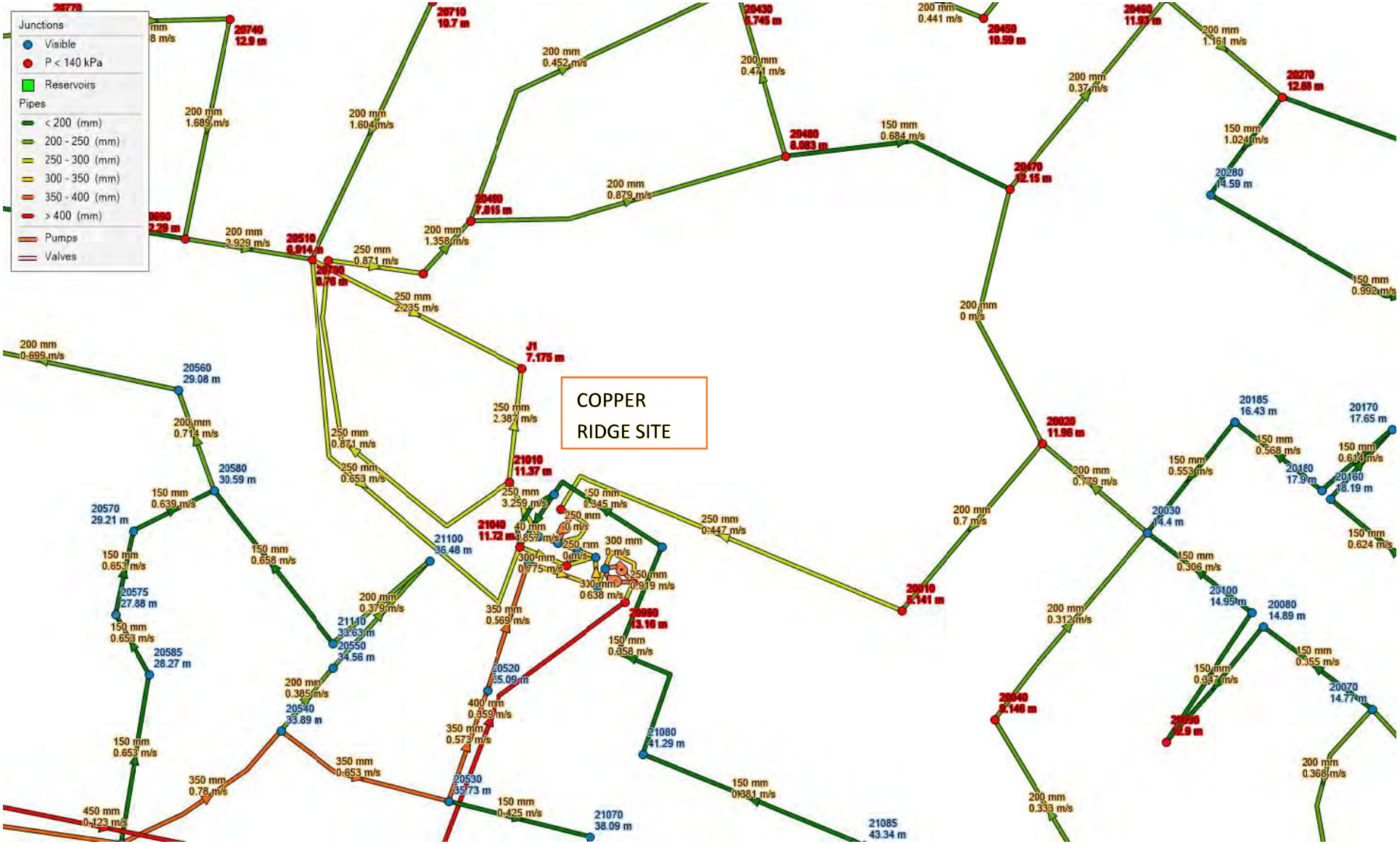
MDD+100 L/S


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE

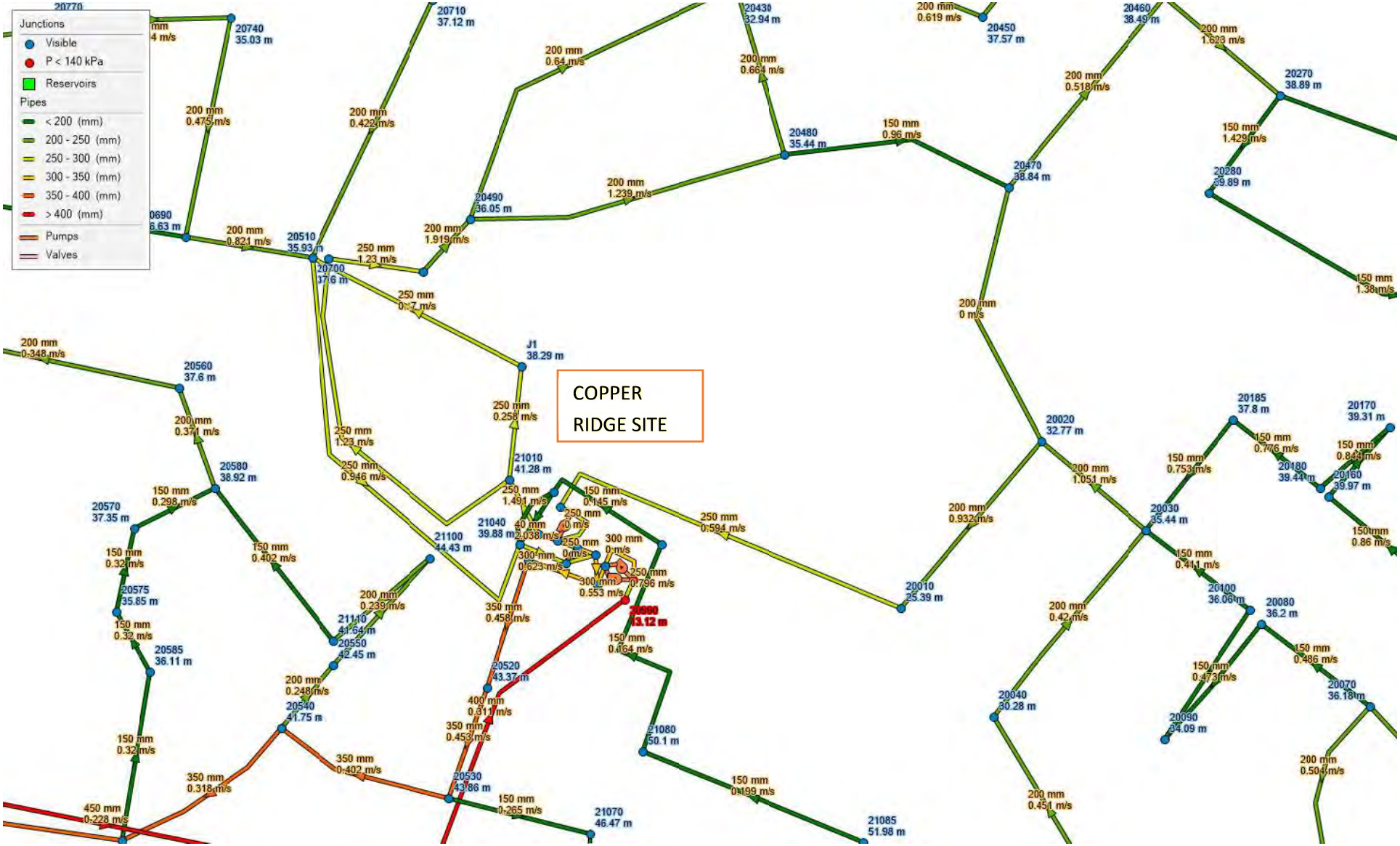
MDD+180 L/S


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
20740 19.36 m
20710 18.35 m
20430 14.24 m
20450 19.05 m
20460 20.32 m
20270 21.18 m
20280 22.76 m
20480 16.6 m
20470 20.56 m
20490 16.46 m
20510 15.67 m
20700 17.08 m
J1 16.38 m
20560 31.93 m
20580 33.41 m
20570 31.98 m
20575 30.6 m
20585 30.96 m
20550 37.31 m
20540 36.63 m
20530 38.58 m
21010 20.25 m
21040 19.81 m
21100 39.23 m
21110 36.4 m
20520 37.98 m
21080 44.32 m
21070 41 m
21085 46.33 m
20020 19.2 m
20030 21.72 m
20185 23.83 m
20170 25.12 m
20180 25.35 m
20160 25.69 m
20100 22.28 m
20080 22.28 m
20070 22.18 m
20040 16.49 m
20090 20.26 m
200 mm 1.446 m/s
200 mm 1.37 m/s
200 mm 0.481 m/s
200 mm 0.503 m/s
200 mm 0.473 m/s
200 mm 0.398 m/s
200 mm 1.249 m/s
150 mm 0.733 m/s
150 mm 1.104 m/s
200 mm 0.939 m/s
200 mm 1.447 m/s
200 mm 2.508 m/s
250 mm 0.927 m/s
250 mm 1.707 m/s
150 mm 1.072 m/s
200 mm 0 m/s
200 mm 0.641 m/s
200 mm 0.656 m/s
250 mm 2.019 m/s
250 mm 0.927 m/s
250 mm 0.763 m/s
150 mm 0.57 m/s
250 mm 2.948 m/s
150 mm 0.306 m/s
250 mm 0 m/s
250 mm 0.503 m/s
200 mm 0.868 m/s
200 mm 0.789 m/s
150 mm 0.611 m/s
150 mm 0.626 m/s
150 mm 0.671 m/s
150 mm 0.682 m/s
40 mm 4.297 m/s
250 mm 0 m/s
300 mm 0 m/s
300 mm 0.483 m/s
250 mm 0.875 m/s
300 mm 0.608 m/s
150 mm 0.585 m/s
150 mm 0.623 m/s
150 mm 0.585 m/s
200 mm 0.359 m/s
350 mm 0.355 m/s
150 mm 0.619 m/s
150 mm 0.341 m/s
200 mm 0.349 m/s
150 mm 0.391 m/s
150 mm 0.382 m/s
200 mm 0.365 m/s
400 mm 0.342 m/s
350 mm 0.358 m/s
150 mm 0.585 m/s
350 mm 0.552 m/s
350 mm 0.431 m/s
150 mm 0.386 m/s
150 mm 0.342 m/s
450 mm 0.127 m/s
200 mm 0.369 m/s
200 mm 0.404 m/s

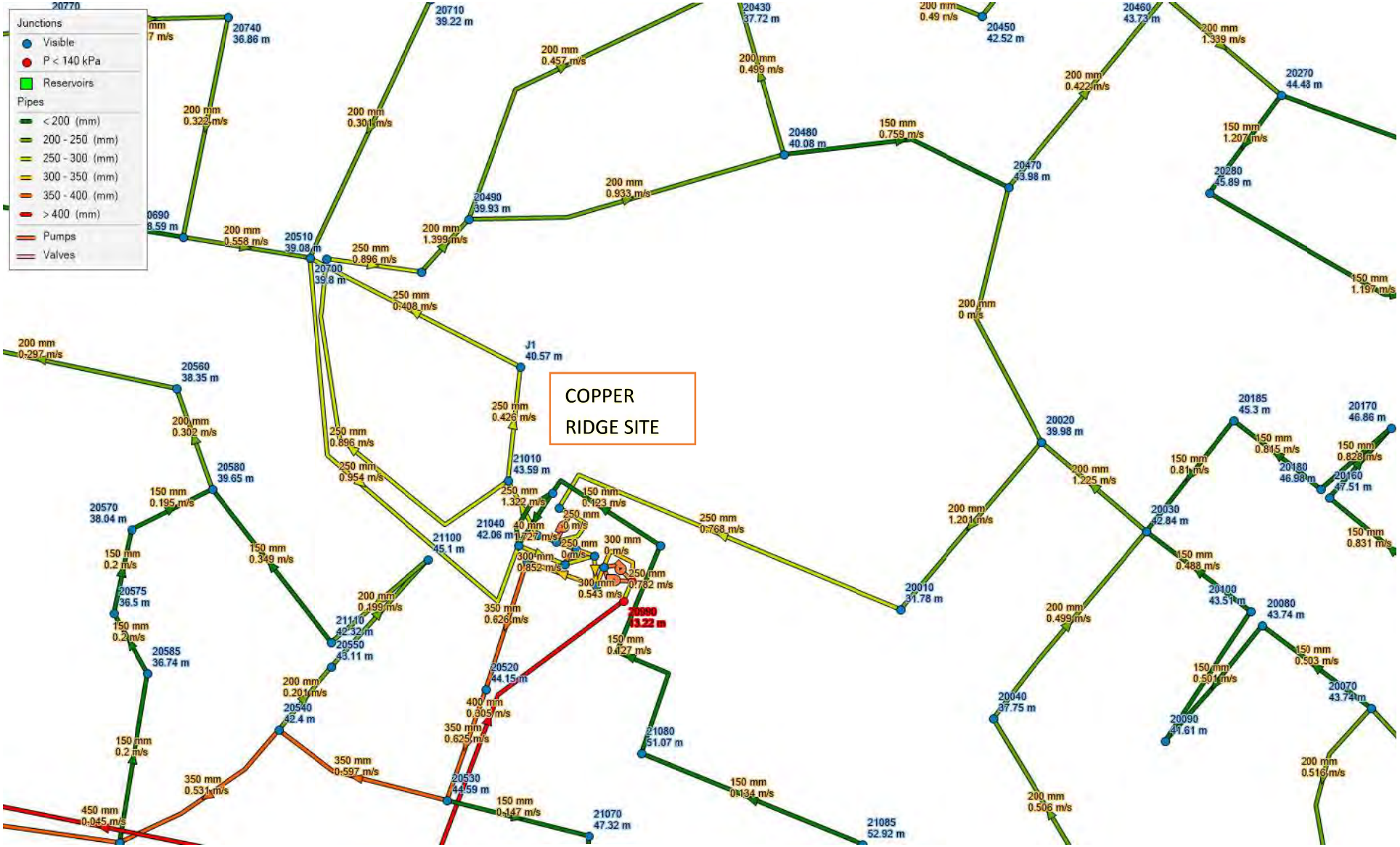
MDD+225 L/S


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE

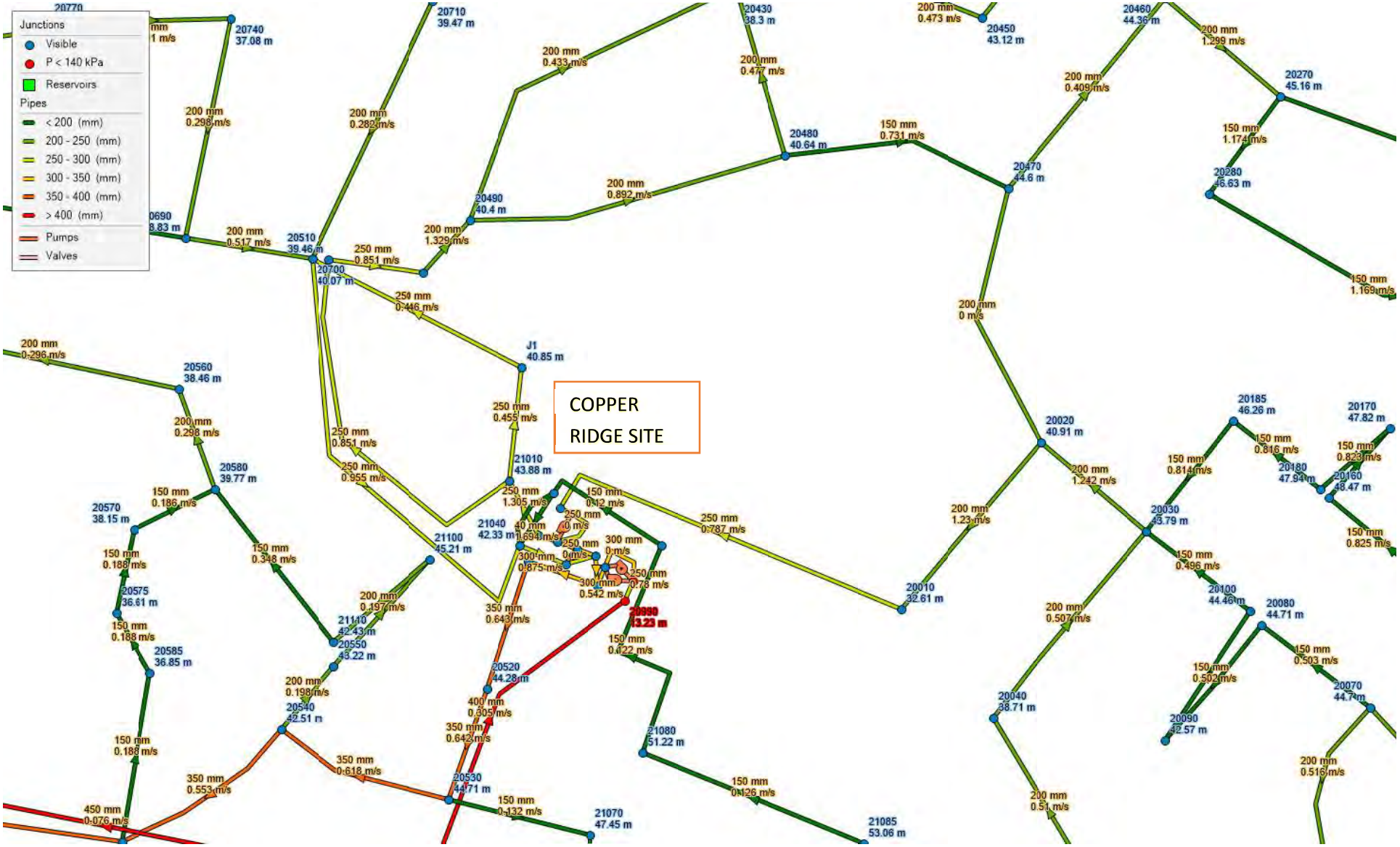
PHD


Junctions
Visible
P < 140 kPa
Reservoirs
Pipes
< 200 (mm)
200 - 250 (mm)
250 - 300 (mm)
300 - 350 (mm)
350 - 400 (mm)
> 400 (mm)
Pumps
Valves
COPPER
RIDGE SITE
20740 35.03 m
20710 37.12 m
20430 32.94 m
20450 37.57 m
20460 38.49 m
20270 38.89 m
20280 39.89 m
20480 35.44 m
20490 36.05 m
20510 35.93 m
20700 37.6 m
20470 38.84 m
J1 38.29 m
20560 37.6 m
20580 38.92 m
20570 37.35 m
20575 35.85 m
20585 36.11 m
21010 41.28 m
21040 39.88 m
21100 44.43 m
21110 41.64 m
20550 42.45 m
20540 41.75 m
20520 43.37 m
20530 43.86 m
20990 43.12 m
21080 50.1 m
21070 46.47 m
21085 51.98 m
20010 25.39 m
20020 32.77 m
20185 37.8 m
20170 39.31 m
20180 39.44 m
20160 39.97 m
20030 35.44 m
20100 36.06 m
20080 36.2 m
20070 36.18 m
20040 30.28 m
20090 34.09 m

NFD – RESERVOIR FILLING ANALYSIS



NFD – THERMAL ANALYSIS



Appendix D. Hillcrest Area “D” Land Use Plan

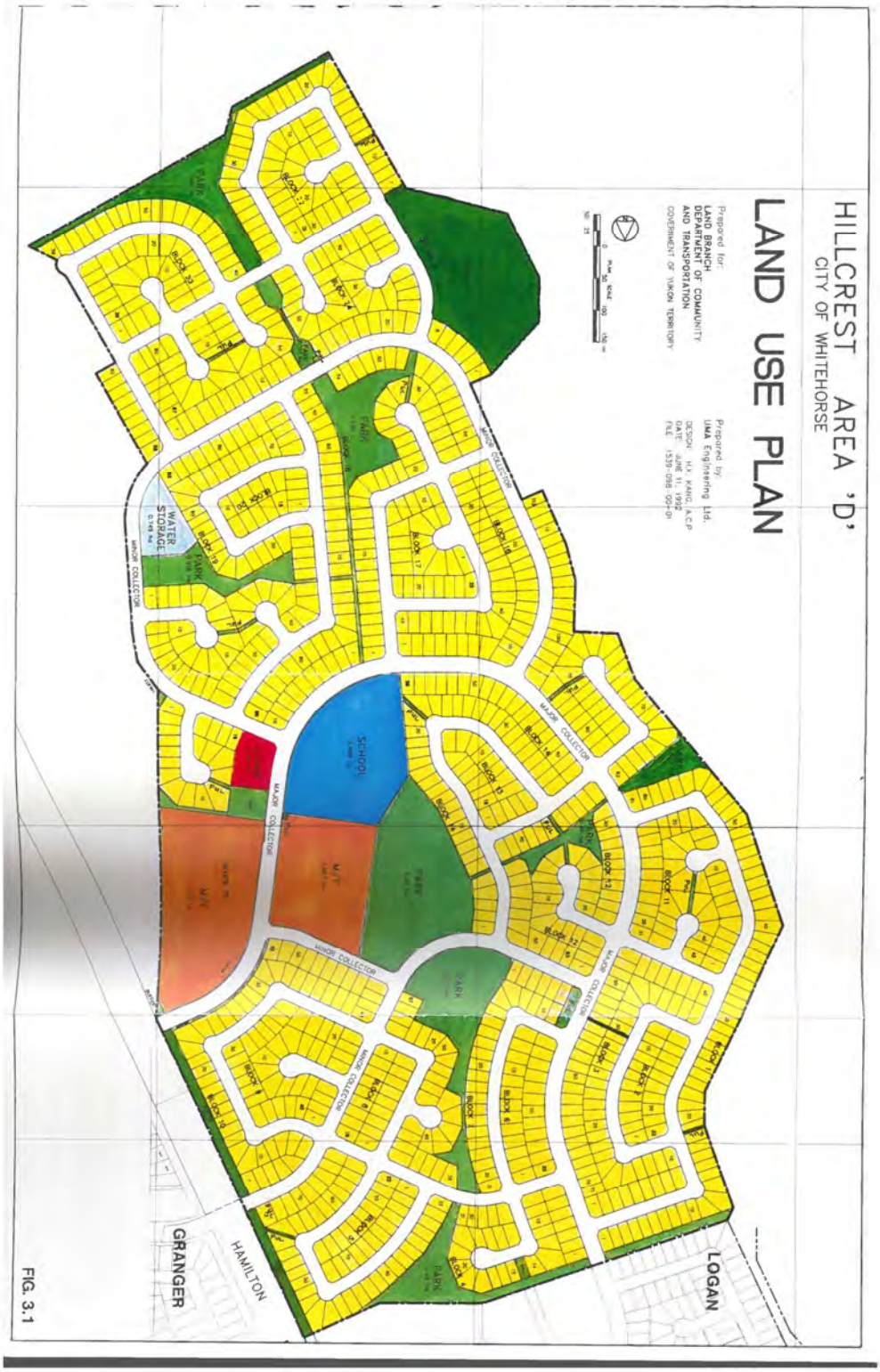


FIG. 3.1