Alaska Canada Rail Link Project
Feasibility Study Report
Rail Route Evaluation
Northern and Southern Yukon Routes
Work Package B1(e)

Prepared by:

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May 30, 2006

File Name: F750-002-00-

Kells Bolland
Alaska Canada Rail Link
210, 212 Main Street
Whitehorse, YT V1A 2A9

Dear Mr. Bolland:

Re: Alaska Canada Rail Link Project
Feasibility Study Report
Rail Route Evaluation
Northern and Southern Yukon Routes
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UMA Engineering Ltd. (UMA) is pleased to submit our final copy of the Rail Route Evaluation for the Northern and Southern Yukon Routes (Work Package B1(e). This report provides a comparison of five proposed rail routes through the Yukon and examines the feasibility of the development of each.

We thank you for the opportunity to complete this work on your behalf. Should you have any questions or require additional information, please contact the undersigned at (780) 486-7000.

Sincerely,

UMA Engineering Ltd.

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RHS:mr

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1. Northern and Southern Yukon Routes (WP B1(e))

1.1 Introduction

1.1.1 General

Work package B1 (e) consisted of a technical engineering and construction analysis of proposed rail routes through the Yukon, Canada (Yukon). Five rail routes were identified within this work package:

1. Watson Lake to Whitehorse
2. Watson Lake to Carmacks
3. Whitehorse to the Alaskan Border
4. Carmacks to the Alaskan Border via Ladue River
5. Carmacks to the Alaskan Border via Nisling River

These routes were analyzed using available geologic mapping information to evaluate the difficulty in constructing a rail line along the route. UMA Engineering Ltd. (UMA) developed a system to classify the terrain, construction difficulty, and locate civil structures required to reasonably construct a rail line along a selected route. The results of each route analysis were compared to each other in attempt to identify the most favourable route in terms of engineering and construction feasibility. The information presented in this work was to support the preparation of cost estimates for railway construction in Work Package B1 (g).

1.1.2 Scope of Work

The scope of work for Work Package B1 (e) involved conceptual engineering design for typical rail construction over varying terrain along the selected routes through the Yukon. Information from the ALCAN data warehouse was to be used to assess the routes. A terrain analysis utilizing the available information was performed to identify terrain units, magnitude of construction, and potential location of civil structures such as major bridges, tunnels, and other specialty railway works along each proposed route.

1.2 Methodology

The work methodology consisted of assigning a team of geological engineers and geologists to develop terrain classifications along each specified route. Control points were established to select a horizontal alignment and railway profile. This step was critical for other work packages and this construction evaluation. The routes identified a horizontal alignment on NTS maps at 1:50,000 scale. Additionally, mile markers (5000 ft miles) were used as reference points. A 5000 ft mile was used to account for the variability and optimization of locating the rail line during the next level of study.

The selected routes were compared with publicly available surficial geology maps to assign geological terrain units. Locations of potential ballast and aggregate sources were also identified along or near each proposed route using the available surficial and bedrock geology maps. When insufficient geological mapping sources were available, information obtained from the NTS maps and available satellite imagery were used to estimate the terrain units.

The terrain units in combination with contour density obtained from the NTS maps were used to estimate the magnitude of construction required to develop the route. Although the NTS maps provided elevation contours of 30 m, it was often difficult to interpret the magnitude of construction required. UMA used Google Earth software to aid the classification process and developed flight lines along each route.

For each terrain classification, a specific roadbed design standard was developed. These standards were based on typical construction methods and materials required to construct over the various terrains.

Locations where potential civil structures would be required were identified during the terrain analysis. These areas included unstable ground, tributaries, creeks, rivers, tunnels, and other difficult terrain situations.

Once the terrain analysis was completed, a summary of each route was developed. The results of each route summary were compared to each other in an attempt to identify the most favourable route in terms of construction and engineering feasibility. This information was passed on to work package B1(g) for estimating the costs associated with construction along each proposed route.

1.3 Terrain Classification

1.3.1 General

Nine different terrain units were used to classify the ground along the selected routes. These terrain units included: organics, permafrost, fluvial, alluvial, eolian, colluvial, lacustrine, till, and bedrock deposits.

Each route was analyzed using the 1:50000 NTS and available geological mapping information. Figures 1 and 2 show the identical route alignment plotted over NTS and surficial geology maps respectively.

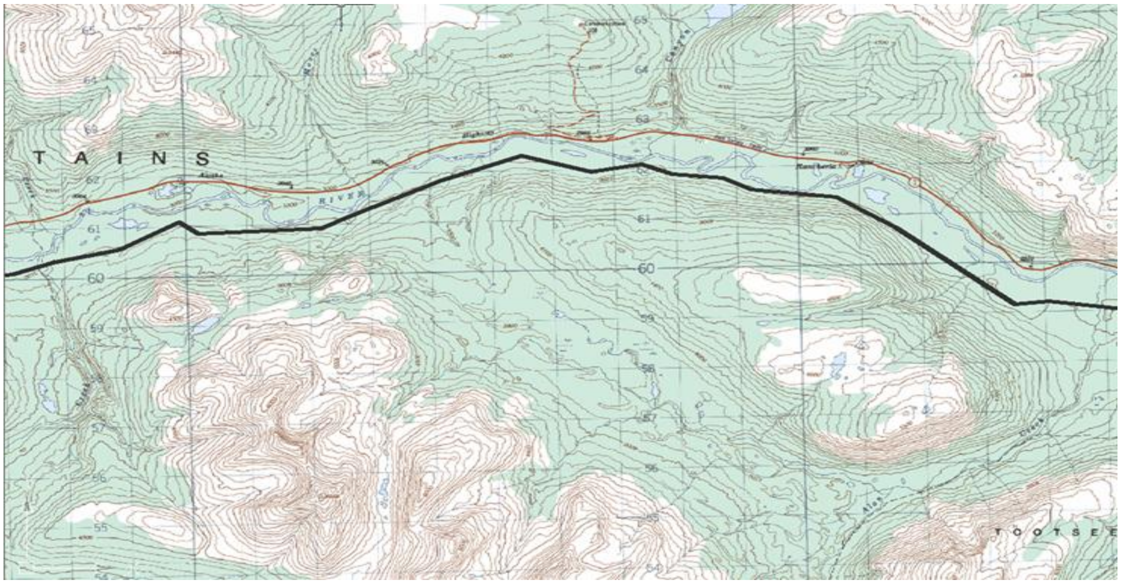


Figure 1: NTS Mapping Alignment

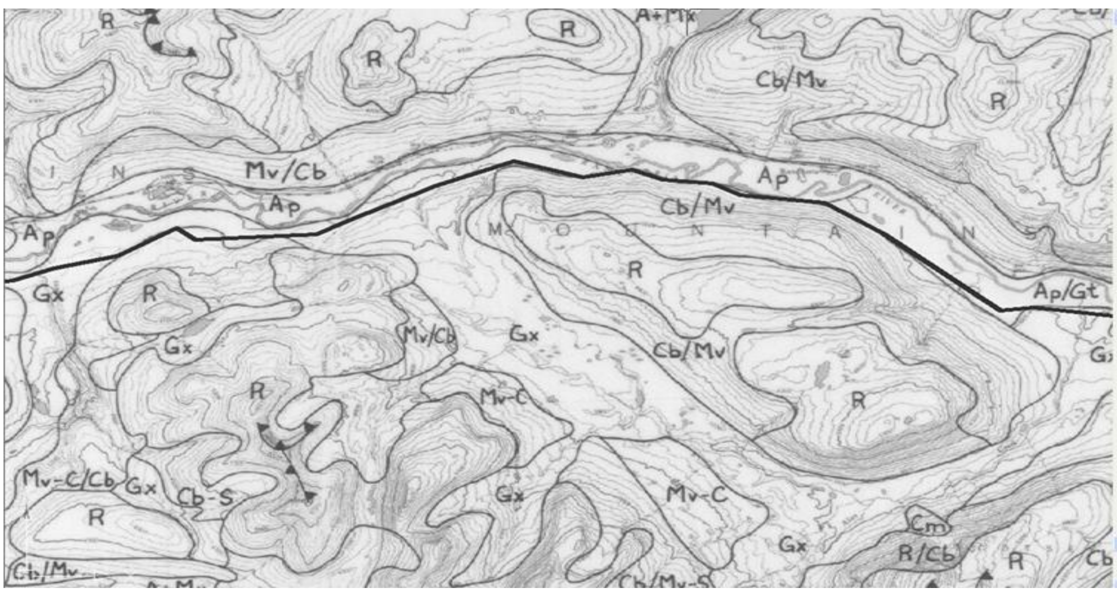


Figure 2: Surficial Geology Mapping Alignment

The terrain types were identified from surficial geology maps obtained from the Earth Sciences Information Centre. When insufficient geological mapping sources were available, information obtained from available satellite imagery were used to estimate the terrain units. The following sections are a summary of each identified terrain unit.

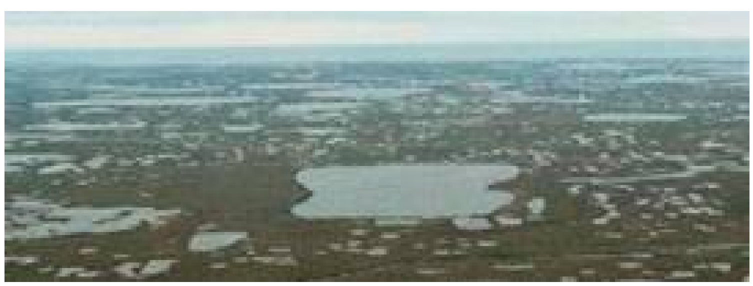
1.3.2 Organic Deposits (Holocene)

The Organic deposits consist of material resulting from vegetative growth, decay, and accumulation in and around closed basins or on gentle slopes, where the rate of accumulation exceeds that of decay. Two types of organic material are recognized. The first are commonly saturated with water and consist mainly of the accumulated remains of mosses, sedges, or other hydrophytic vegetation. The second are rarely saturated with water and consist typically of leaf litter, twigs, branches and mosses (folisols). Picture 1 shows a typical organic deposit.

Picture 1: Organic Deposit

1.3.3 Permafrost

Permafrost forms in locations where the mean annual ground temperature remains below 0^{o}C for several years. Features such as solifluction lobes, thermokarst, and pingos are typical of permafrost terrain. Large portions of the alignments are in the discontinuous permafrost zone. Picture 2 shows typical permafrost terrain.



Picture 2: Permafrost Terrain

1.3.4 Fluvial/Alluvial Deposits (Holocene and Pleistocene)

Fluvial deposits are formed when sediment is transported and deposited by streams and rivers. The term is synonymous with alluvial, however, alluvial deposits are generally referred to when there is a large change in hydrologic flow causing deposition of sediment in fan-like forms. Generally, these deposits consist of gravel and/or sand and/or silt (and rarely clay). Gravel is typically rounded and contains interstitial sand. Fluvial sediment is commonly moderately to well-sorted and displays stratification, although massive, non-sorted fluvial deposits do occur. Fluvial deposits in the large valley bottoms typically have a sandy texture because of the abundance of reworked glaciolacustrine sediment. Pictures 3 and 4 show typical fluvial and alluvial deposits.

Picture 3: Fluvial Deposit

Picture 4: Alluvial Deposit

1.3.5 Eolian (Holocene)

Eolian deposits form when sediment is transported and deposited by wind action. It generally consists of medium to fine sand and coarse silt that is well-sorted, non-compacted, and may contain internal structures such as cross-bedding or ripple laminae, or may be massive. Individual grains may be rounded and exhibit frosting. Eolian landforms may be active or vegetated and inactive. Picture 5 shows a typical eolian deposit.

Picture 5: Eolian Deposit

1.3.6 Colluvial Deposits (Holocene and Pleistocene)

Colluvial deposits are products of mass wastage that have reached their present position by gravity induced movements without the action of wind or water. They generally consist of massive to moderately well stratified, non-sorted to poorly sorted sediments with any range of particle size from clay to boulders and blocks. The character of any particular colluvial deposit depends upon the nature of the material from which it was derived and the specific process by which it was deposited. Talus cones form as a result of rock falls and are also included under this classification. Talus tends to accumulate at the base of a slope and form conical piles along natural ravines in the faces of cliffs as shown in Picture 6.

Picture 6: Colluvial Deposit, Talus Cones

1.3.7 Lacustrine (Pleistocene)

Lacustrine deposits form when sediment is deposited in or along the margins of lakes including sediments that were released by melting or floating ice. Generally glaciolacustrine sediments include: lake bed sediments consisting of stratified fine sand, silt and/or clay. They commonly contain ice-rafted stones and lenses of till and/or glaciofluvial material, and moderately sorted to well sorted, stratified sand and coarser beach sediment transported and deposited by wave action along the margins of lakes. Picture 7 shows a typical lacustrine deposit.

Picture 7: Lacustrine Deposit

1.3.8 Glacial Deposits - Till (Pleistocene)

Till deposits form when sediment is deposited directly by glacier ice without modification by any other agent of transportation. Generally, till can be transported beneath, beside, on, within and in front of a glacier. The mineralogical, textural, structural, and topographic characteristics of till deposits are highly variable and depend upon both the source of material incorporated by the glacier and the mode of deposition. In general, till consists of well compacted to non-compacted material that is non-stratified and contains a heterogeneous mixture of particle sizes, commonly in a matrix of sand, silt and clay. Picture 8 shows a typical till deposit.

Picture 8: Till Deposit

1.3.9 Bedrock (Pre-Quaternary)

Bedrock was defined as any consolidated material unable to be removed using conventional mechanical construction methods. Bedrock was identified as outcrops or areas of rock covered by a thin mantle of unconsolidated or organic materials. Picture 9 shows a typical bedrock deposit.

Picture 9: Bedrock Deposit

1.3.10 Terrain Classification Route Summary

Each route was analyzed and the terrain classified along the proposed alignments. A terrain summary was produced by adding all the areas of similar terrain to determine the total length of each terrain unit. For example, Figure 3 shows a portion of the route over a connected series of surficial geology maps.

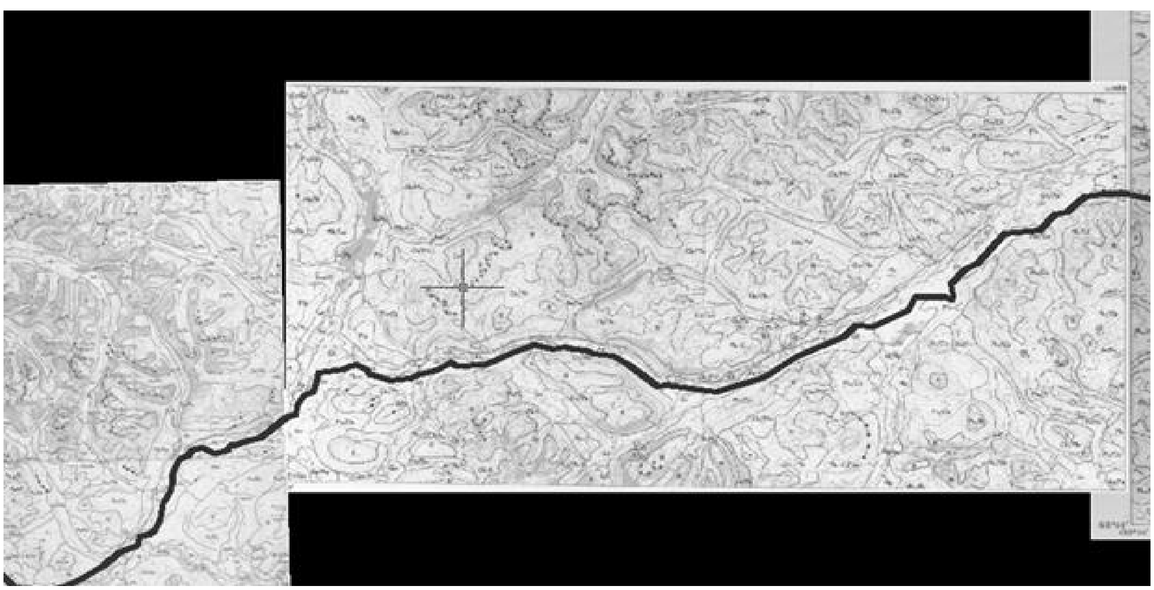


Figure 3: Connected Surficial Geology Maps with Route Alignment

A typical route summary is shown in Table 1:

Terrain Unit	Total Distance (Miles)
Organic	39.3
Permafrost	32.7
Fluvial	122.1
Alluvial	113.2
Eolian	26.4
Colluvial	19.4
Lacustrine	53.2
Till	218.6
Bedrock	12.6

Table 1: Terrain Classification - Typical Route Summary

A detailed analysis and summary for each route evaluation is in Appendix A.

1.4 Construction Classification

1.4.1 General

A construction classification was developed to determine the level of effort required to construct over the terrain. Seven different construction classifications to estimate the degree of difficulty of building over the terrain were used. The seven construction classifications developed included: average, heavy, very heavy grade construction; construction over organics, permafrost, and bedrock; and locations requiring tunnels.

The terrain units in combination with topographic contour density obtained from the NTS maps were used to classify the degree of construction difficulty. Although the NTS maps provided elevation contours of 30 m, it was often difficult to interpret the magnitude of construction required. Figure 4 and Picture10 show the difficulty of interpreting NTS contour information with respect to the actual site condition at a location on the Yukon River, near the Tatchum River, YT.

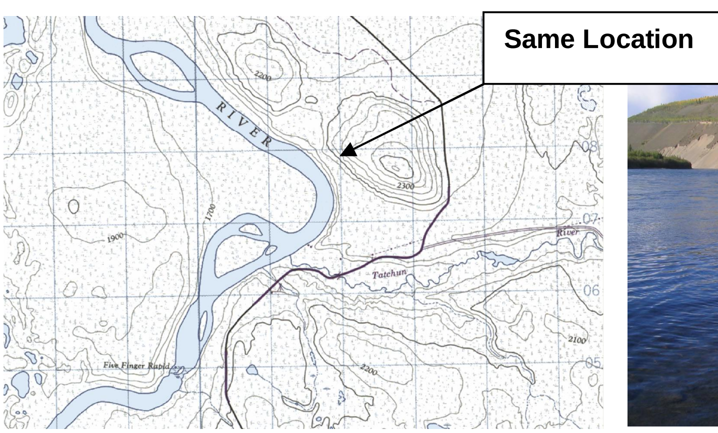
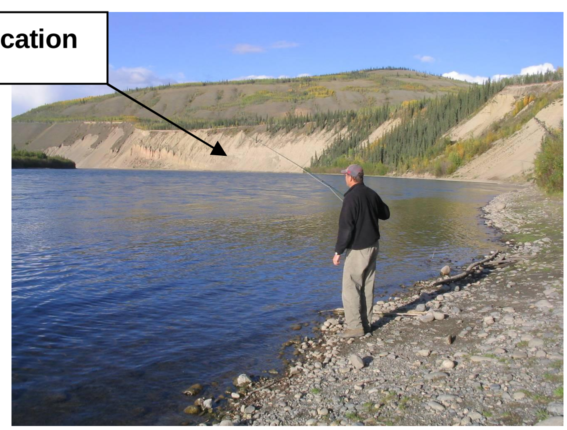
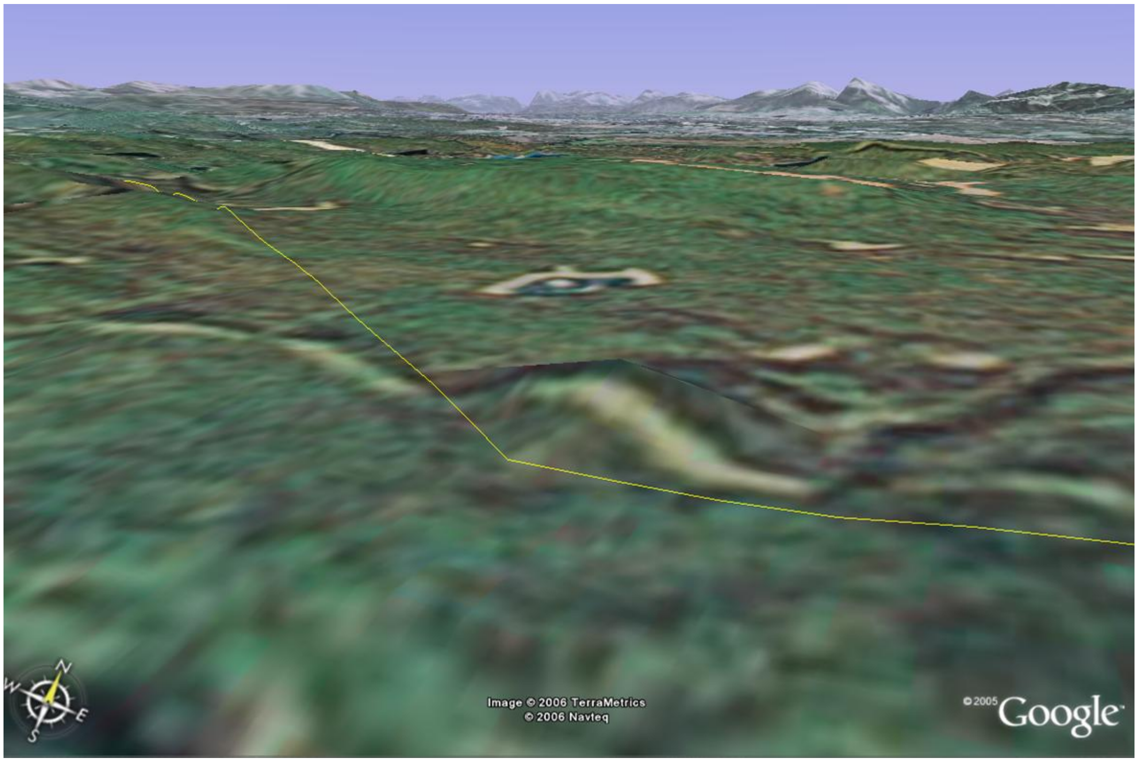


Figure 4: NTS Mapping



Picture 10: Actual Site Conditions

Google Earth software was also used to aid the classification process. This software allowed the view of the terrain to be rotated, and vertically exaggerated to provide for a more comprehensive perception of the actual site conditions. Picture 11 shows the Google Earth rotated and vertically exaggerated terrain surface.



Picture 11: Google Earth Rotated Terrain Image

The Google Earth software also allowed the import of the established control points of the routes over the terrain surface. Once imported, the routes could be flown, rotated at any angle, and zoomed in or out to any desired elevation. UMA also developed flights along each route and recorded these flights onto a DVD which is appended to this report.

1.5 Roadbed Design Standards

1.5.1 General

For each construction classification, a typical roadbed design standard was developed. These design standards were developed by assuming the required construction quantities and materials to construct over the identified terrain. Consideration for the difficulty and volume of cut and fill, small culverts, geosynthetic materials, potential bedrock content, and specialty works associated with each design standard was applied.

These design standards were based on the AREMA construction standards and consistent with the railway standards of major railways.

- Gradients limited to 1 percent against loads and empties.
- Curvature limited to a maximum of 6 degree. Limit to 3 degrees where possible.
- No. 16 turnouts for sidings or passing tracks.
- A minimum railway Right of Way width of 100-200 ft (30.5 - 61.0 m).
- Subgrade roadbed width of 26 ft (7.93 m) (at 2'-6" from the top of rail).
- Embankment slopes or cuts at 2H:1V in soils.
- A standard earth cut width at subgrade level of 64 ft, to provide an adequate ditch width (not applicable in permafrost zones).
- In rock cuts an embankment slope of 1H:5V.
- Ditch Width in rock cuts to be a minimum of 10 ft.
- Earth roadbed embankments along major river systems to be protected against annual floods and erosion by Riprap sized against 1 in 100 year return frequency floods.
- A minimum of 7.5 ft (2.29 m) from centreline of track to edges of bridges, tunnels, rock & snow shed structures.
- Maximum carloads of 286,000 lbs (130,000kg).
- 136 lb (61.8 kg) premium Continuous Welded Rail (CWR).
- 8 ft (2.44 m) long soft wood ties with 14" (350 mm) tie plates on tangent supplemented with hardwood ties on curves.
- Minimum sub-ballast thickness of 12" (300 mm) in combination with a ballast thickness of at least 12" (300 mm) below the ties.

1.5.2 Site Preparation

Typical grade construction over competent subgrade should consider the following:

- A suitable side slope for embankments and cut slopes will generally depend on several factors including, the shear strength (angle of repose) of the soil, ground water conditions, and any structural weakness present in native soils and rock.
- The subgrade fill should consist of well graded soil free of boulders, cobbles, organics, frost or other deleterious materials placed as follows:
  - In areas of new construction all surficial vegetation, topsoil, peat and deleterious material within the footprint of the subgrade fill should be stripped and removed;
  - Following stripping, the exposed surface should be scarified and recompacted to 95 percent Standard Proctor Maximum Dry Density (SPMDD) and moisture conditioned as required.

- The roadbed embankment should have side slopes of 2H:1V or flatter. This will increase the stability of the subgrade and reduce loss of granular material along the shoulder.
- Cut slopes in granular soil or stiff clay will generally support slopes as steep as 2H:1V. Where seepage is noted or in areas with soft to firm clays or loose sand the slopes should be benched or flattened as required to maintain stability.
- Frost susceptible soils such as silt or fine silty sand should be avoided for use as embankment fill where possible.
- The top of subgrade should be crowned in the centre towards the ditch at a minimum slope of 4 percent to provide drainage and reduce ponding of water on the subgrade, which could result in swelling, softening and possible frost heave of the subgrade. In areas of super elevation, a 4 percent cross fall should be used. It is recommended that roadbed grades be maintained as high as possible particularly through low areas.
- The crown of the subgrade should be a minimum of 0.9 m (3 ft) above the ditch bottom.
- Ditch drainage should have adequate capacity to handle storm flows and prevent ponding of water. The width, depth, and gradient of the ditch will depend on the designed flow rate (Q). The flow rate should be fast enough to maintain relatively dry embankment but not too fast to cause erosion of silt into the water course. This may also require installation of culverts or extension of existing culverts at access crossings. In areas where slides or material sloughing is expected, the ditch should be width should be increased so that it does not have to be cleaned out too frequently.

1.5.3 Average Grade Construction

Average grade construction was considered in locations where cut and fill volumes are less than 2.29 m (7.5 ft) in height. Terrain associated with average grade construction is typically located on flat competent ground with a low water table. The roadbed design standard developed to correspond with average grade construction includes the following items:

- Rock excavation (10 percent of common)
- Granular sub-ballast - 300 mm
- Culverts (10 percent of grading)
- Access road, reclamation, slope stabilization (10 percent of grading)
- Additional structures 15 percent

Picture 12 shows a typical average grade construction terrain.

Picture 12: Average Grade Construction

Figures 5 and 6 show the average grade construction roadbed design standards for cut and fill respectively.

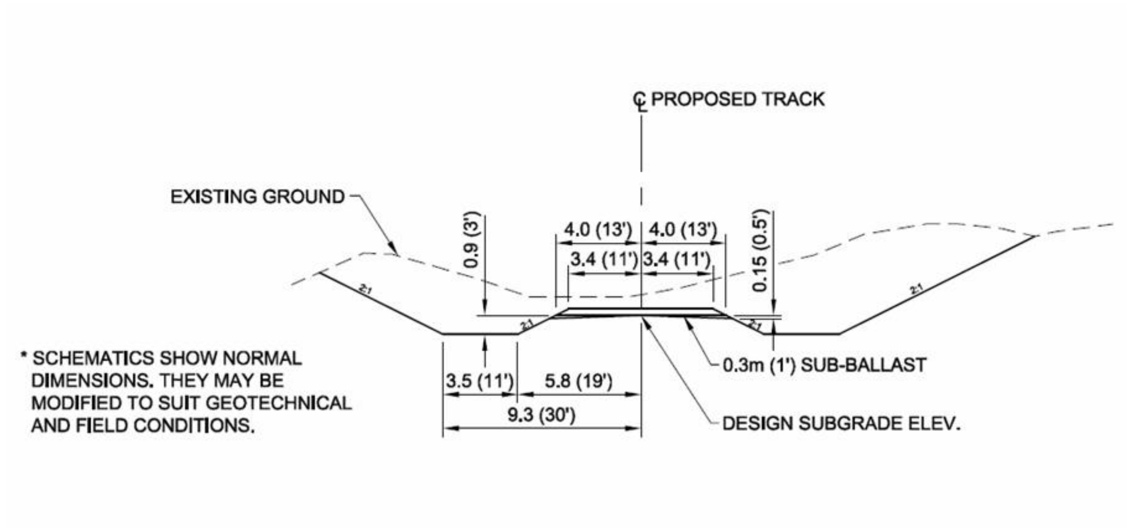


Figure 5: Typical Cut – Average Construction

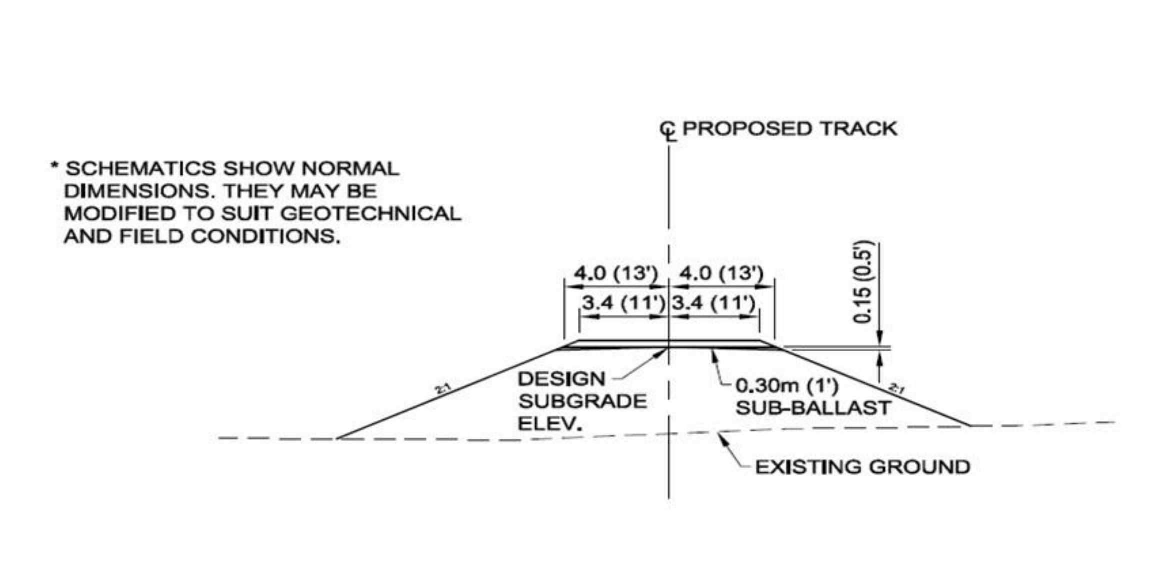


Figure 6: Typical Fill – Average Construction

1.5.4 Heavy Grade Construction

Heavy grade construction was considered in locations where cut and fill volumes average 3.66 m (12 ft) in height. Terrain associated with heavy grade construction is typically located in undulating competent ground with a low water table. The roadbed design standard developed to correspond with heavy grade construction includes the following items:

- Rock excavation (15 percent of common)
- Granular sub-ballast - 300 mm
- Culverts (10 percent of grading)
- Access road, reclamation, slope stabilization (10 percent of grading)
- Additional structures 25 percent

Picture 13 shows a typical heavy grade construction terrain.

Picture 13: Heavy Grade Construction

Figures 7 and 8 show the heavy grade construction roadbed design standards for cut and fill respectively.

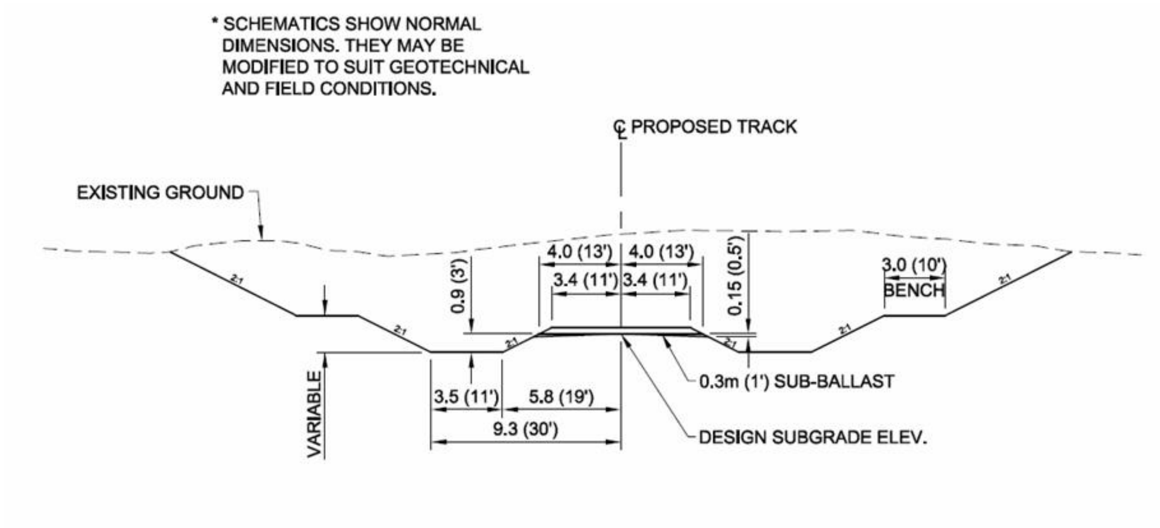


Figure 7: Typical Cut - Heavy Construction

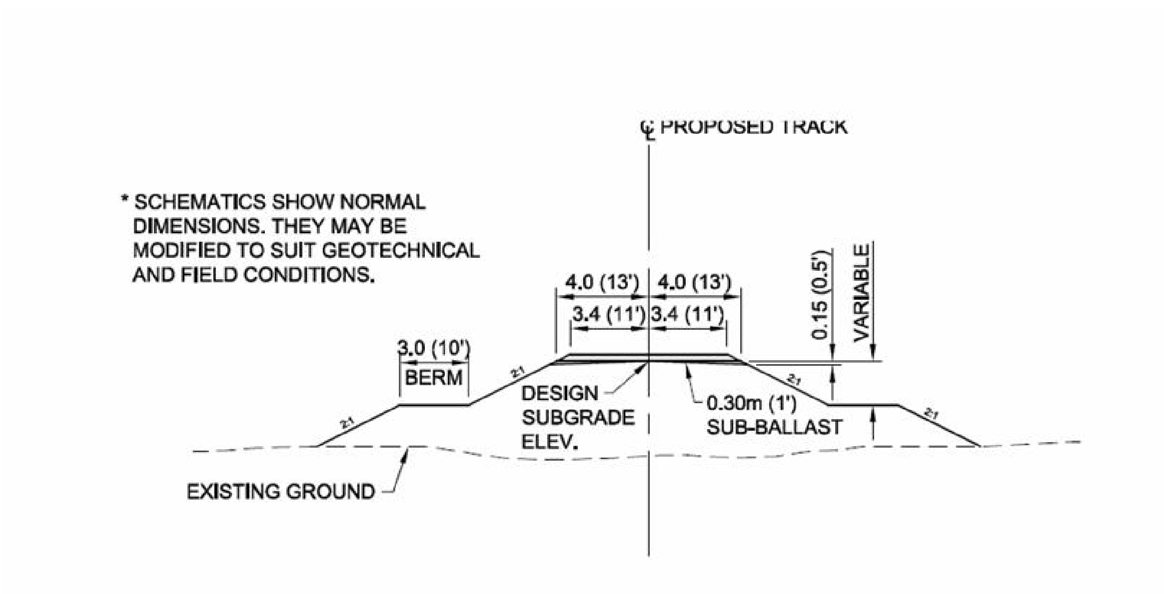


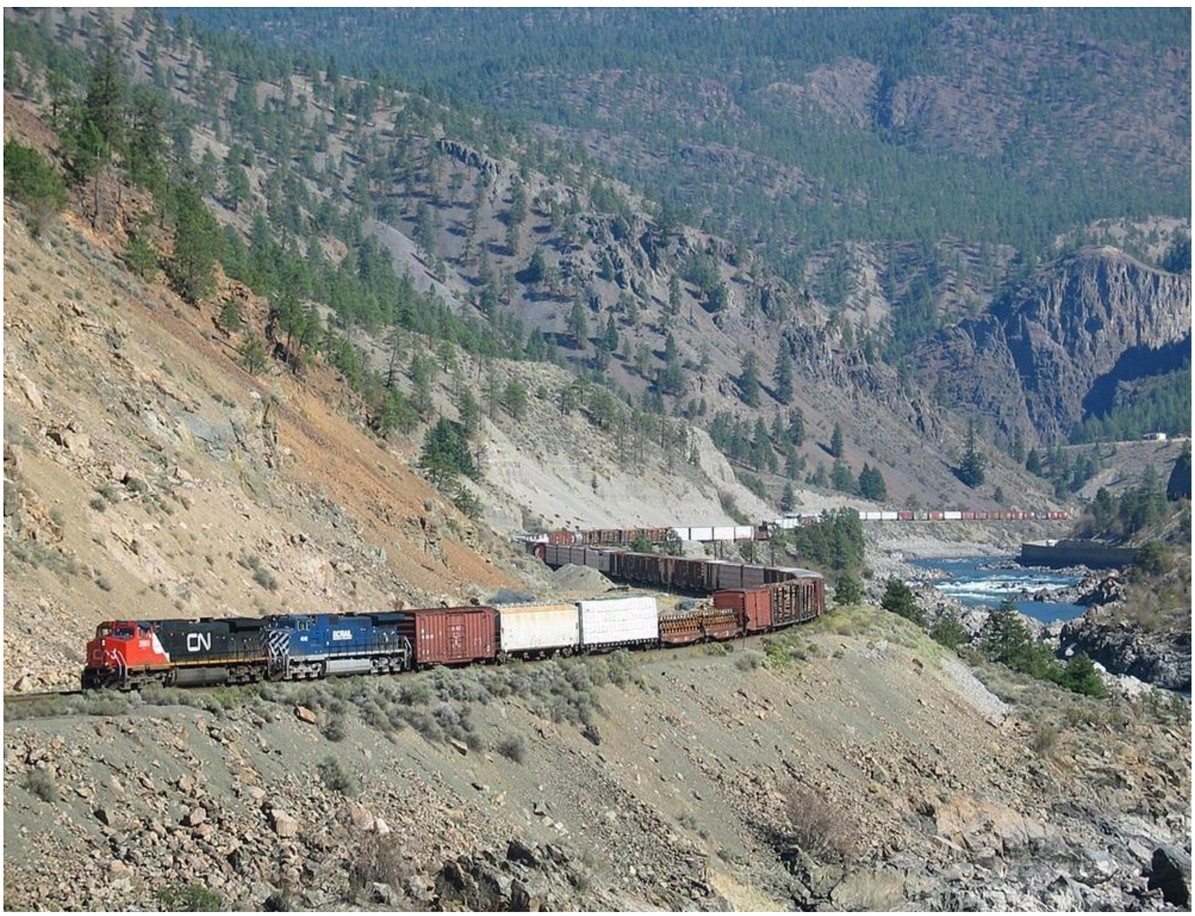
Figure 8: Typical Fill - Heavy Construction

1.5.5 Very Heavy Grade Construction

Very heavy grade construction was considered in locations where cut and fill volumes average 7.3 m (24 ft) in height. Terrain associated with very heavy grade construction is typically located in mountainous or hummocky competent ground with a low water table. The roadbed design standard developed to correspond with very heavy grade construction includes the following items:

- Rock excavation (20 percent of common)
- Granular sub-ballast - 300 mm
- Culverts (10 percent of grading)
- Access road, reclamation, slope stabilization (10 percent of grading)
- Additional structures 35 percent

Picture 14 shows a typical very heavy grade construction terrain.



Picture 14: Very Heavy Grade Construction

Figures 9 and 10 show the very heavy grade construction roadbed design standards for cut and fill respectively.

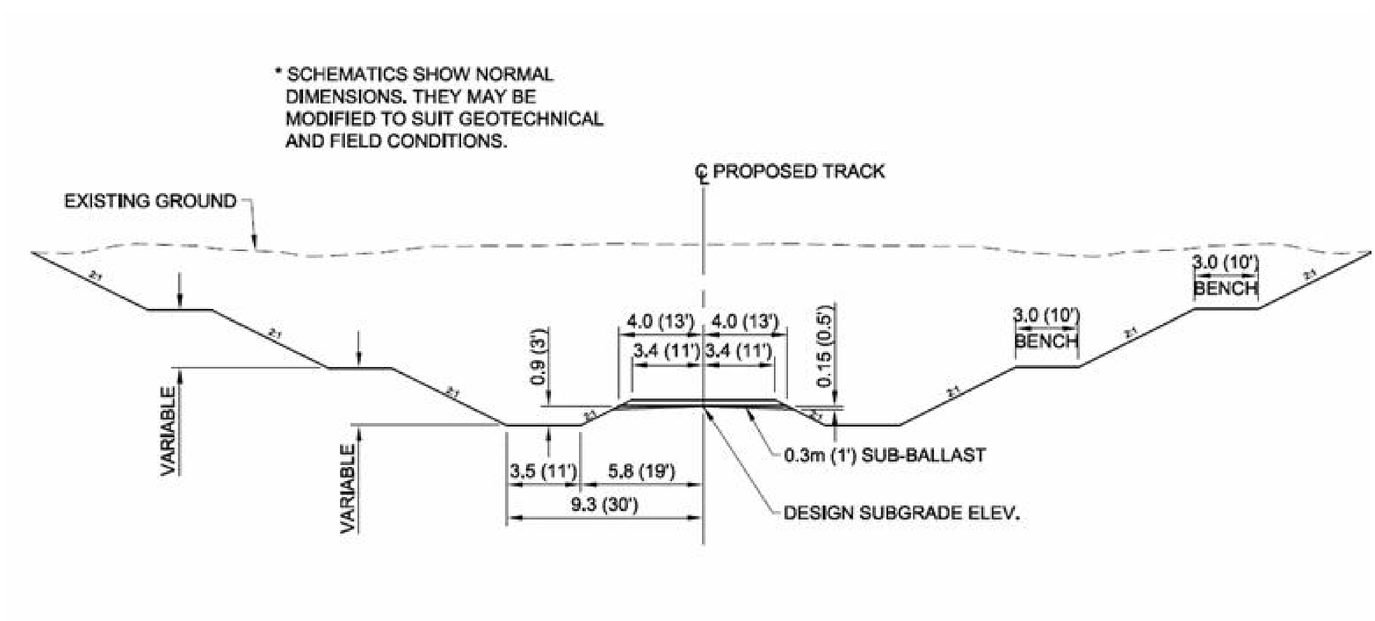


Figure 9: Typical Cut - Very Heavy Construction

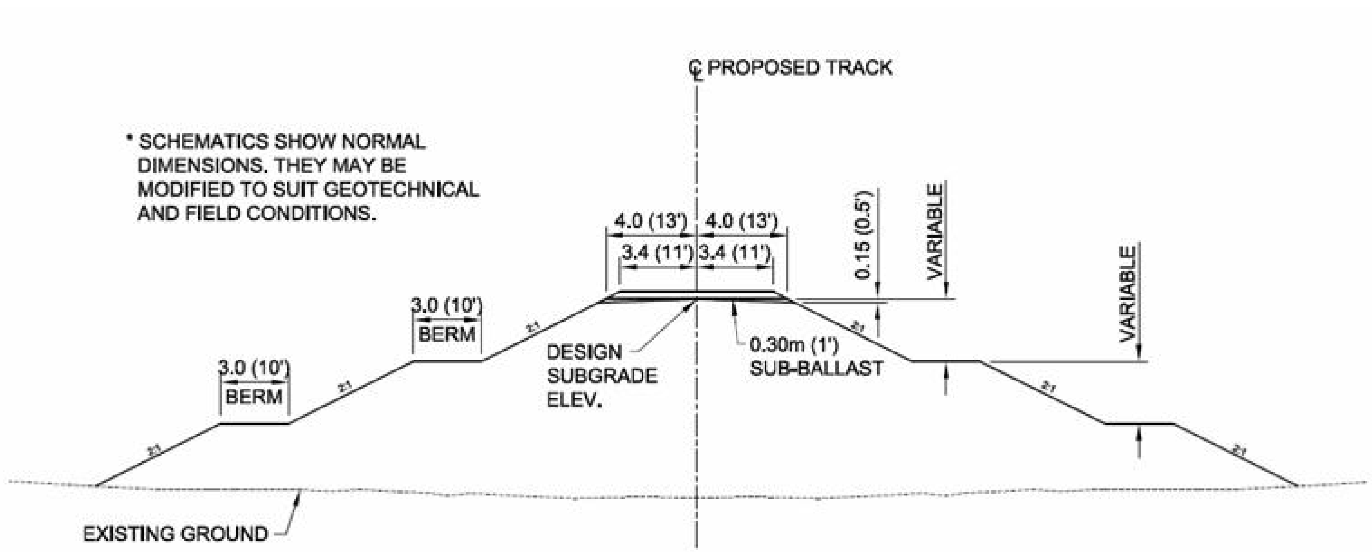


Figure 10: Typical Fill - Very Heavy Construction

1.5.6 Construction over Organics (Peat)

Due to flat grades, railways often find it difficult to avoid organic terrain. Generally, higher class railways with tangent track, flat grades and curves have limited ability to avoid the organic deposits. A floating fill in combination with pre-loading was selected for this preliminary assessment.

Other methods of traversing peat include excavation and replacement, displacement methods and bridging. Excavation and replacement or displacement methods are most suitable where the depth of peat is shallow and can lead to lower long term maintenance costs particularly where competent soils are present underlying the peat. Bridging should only be used where other alternatives are not possible.

Each situation is unique and each of the above noted methods or a combination of methods may be most suitable for different types of peat terrain encountered. At the detailed design stage geotechnical drilling and testing should be conducted, to determine the extent, depth and characteristics of the peat. Drainage ditches should be implemented along the edges of the right of way in advance of construction. Drawdown of the water table will increase the effective weight of the peat and initiate some preconsolidation of the peat itself along with any underlying soft soil. The improved drainage will also strengthen the peat as it dries out. Ditches located along the toe of the embankment will tend to destabilize the fill and should be avoided.

In summary, the following should be considered in peat areas:

- A drainage system should be established a season before actual embankment construction to allow the peat to dry and consolidate.
- The vegetation mat at the surface should be left intact and undisturbed;
- A synthetic geogrid or a timber corduroy should be placed over the ground surface prior to placement of embankment fills;
- It would be preferable to construct the embankment fill in the winter;
- The embankment fill should consist of granular soil such as sand which would facilitate larger lift sizes and winter placement;
- A minimum embankment height of 1.25 m (4 ft) should be maintained where the rail grade will allow. The embankment height is defined as distance between the top of peat and top of subgrade.
- The embankments should maintain a minimum side slope of 4H:1V to distribute the load over the surface of the peat. Alternatively, toe berms at half the embankment height may be considered.

Figure 11 shows the organic grade construction roadbed design standard.

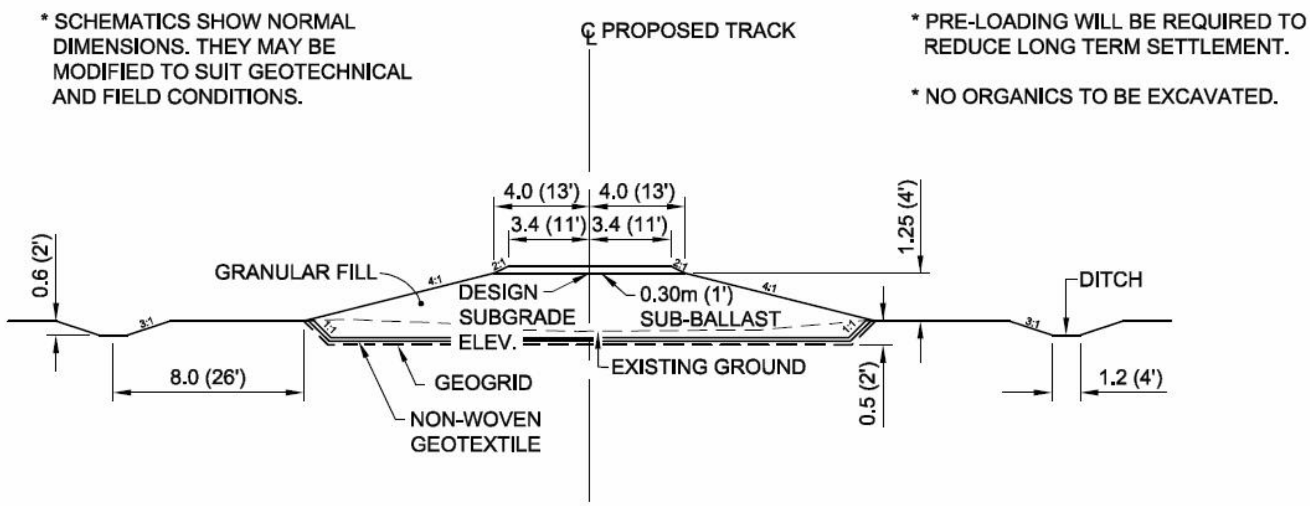


Figure 11: Construction over Organics

1.5.7 Construction over Permafrost

Portions of the routes are within the discontinuous permafrost zone which will present challenges unique to this type of terrain. Generally, extreme care must be taken to prevent thawing of all permanently frozen soils.

- Cuts are to be avoided in permafrost soils due to high ice content.
- The design and placement of fills is critical across this type of terrain. The basis of the design is to prevent degradation of permafrost under the centre of the embankment. Adequate insulation must be provided by the embankment. To prevent degradation of the permafrost, the fill height must be a minimum of 2.4 m (8 ft) along these sections. Alternatively, rigid polystyrene insulation could be used but is not expected to be economical.
- During placement of fill, the upper organic layer must not be disturbed. Removal of this insulating top stratum will cause degradation of the permafrost.
- Drainage structures built through the fills must be designed so as not to impede, funnel or divert natural drainage. If the drainage is impeded, ponding of water adjacent to the embankment will result in degradation of permafrost and erosion of embankment slopes.
- Fill operations should be conducted in the winter to prevent damage to permafrost soils and for easier access. Following completion of construction, maintenance will be required at regular intervals. During the first three to five years, careful inspection and repair work will be necessary periodically, particularly in late summer. Placement of fill and grading will be required on the embankment slopes to fill cracks and maintain a uniform slope.

Figure 12 shows the permafrost grade construction roadbed design standard.

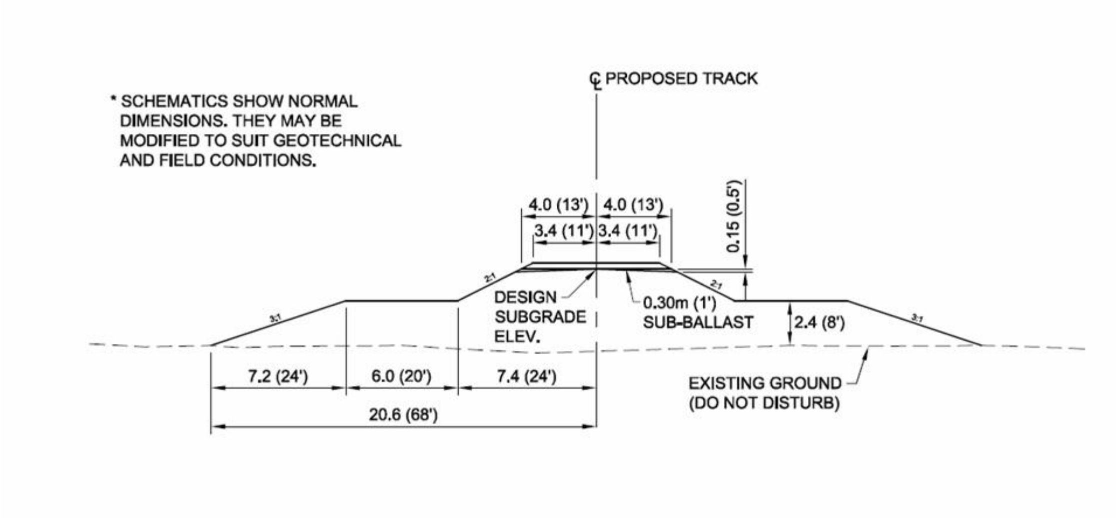


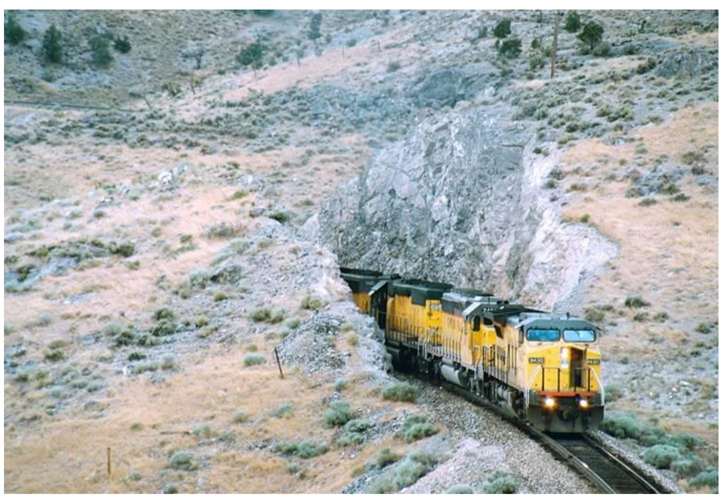
Figure 12: Construction over Permafrost

1.5.8 Rock Grade Construction

Rock grade construction was considered in locations identified as bedrock in the terrain analysis. The roadbed design standard developed to correspond with rock grade construction includes the following items:

- Average 5.5 m high by 11 m wide
- Common Excavation of 15 percent rock
- Granular sub-ballast - 300 mm
- Scaling & Rock Bolting (20 percent of excavation)
- Small Culverts (5 percent of grade)
- Access road, reclamation (5 percent of grading)

Picture 15 shows a typical rock grade construction terrain.



Picture 15: Rock Grade Construction

Figures 13 and 14 show the rock grade construction roadbed design standards for cut and fill respectively.

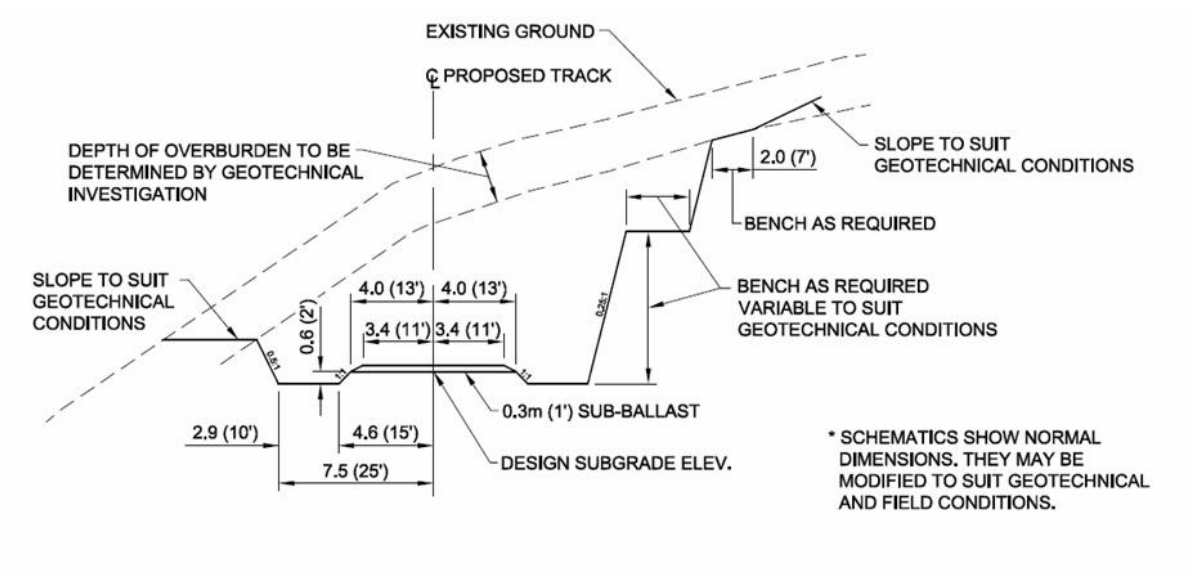


Figure 13: Typical Cut - Rock Grade Construction

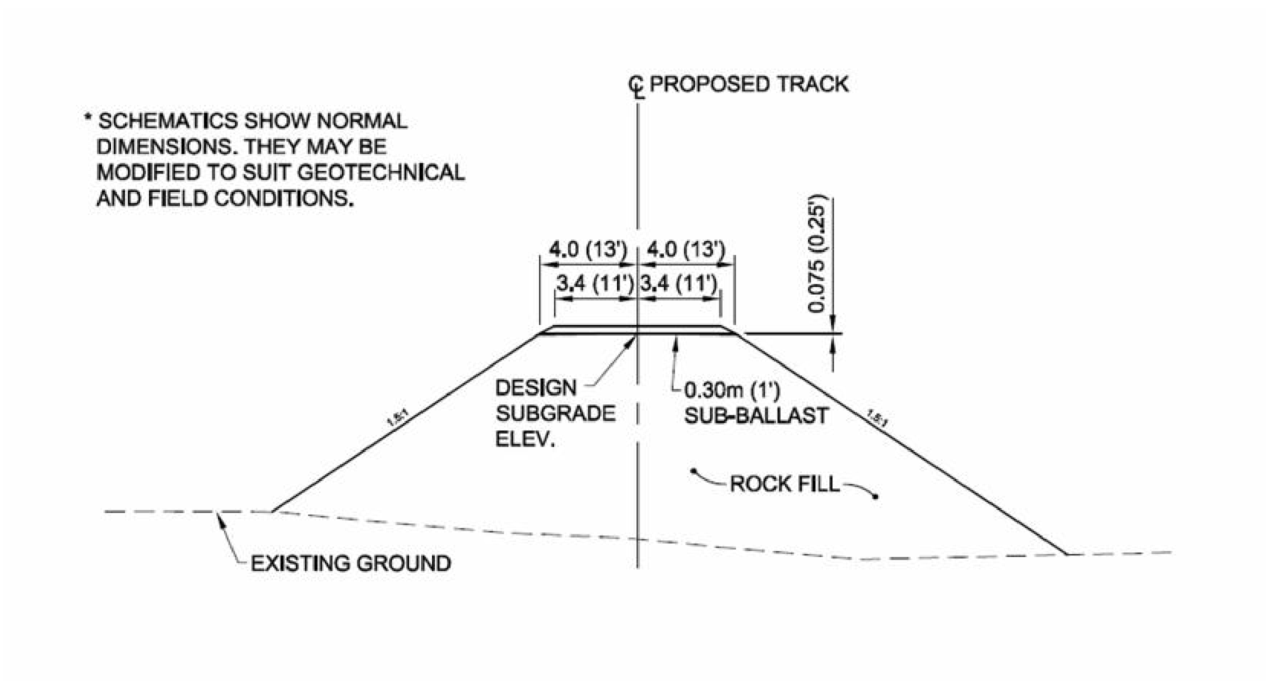


Figure 14: Typical Fill - Rock Construction

1.5.9 Tunnel

Tunnels are used when it is not feasible or economical to construct grade at the required track standards around difficult terrain. The proposed alignments identified locations where tunnels would be required to traverse difficult terrain. The roadbed design standard developed to correspond with tunnel construction includes the following items:

- Designed to accommodate double stack containers
- Constructed using sequential excavation
- Tunnels lined where applicable
- Ventilated where required
- Rock bolted where required
- Emergency access where required

Figure 15 shows the tunnel roadbed design standard.

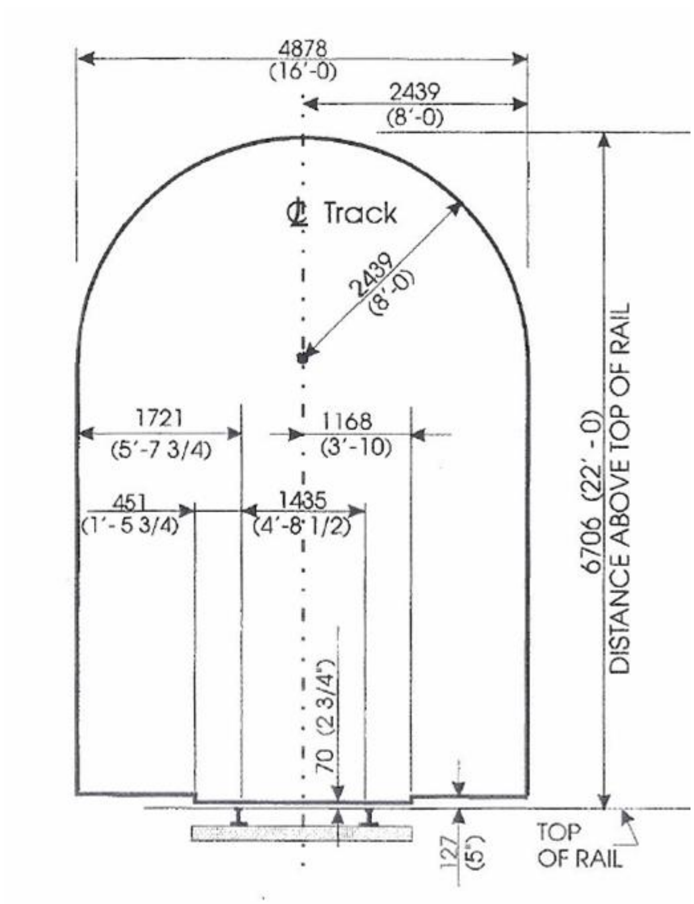


Figure 15: Typical Tunnel Design

Picture 16 shows a typical short tunnel.

Picture 16: Short Tunnel and Buttress at Portal

1.5.10 Construction Classification Route Summary

Each route was analyzed to determine the level of effort required to construct along the proposed alignment. Each route was summarized by adding all the areas of similar construction difficulty to determine the total length of construction classification. A typical construction classification route summary is shown in Table 2:

Construction	Total Distance (Miles)
Average	68.8
Heavy	336.7
Very Heavy	147.4
Organics	39.3
Permafrost	32.7
Rock	9.6
Tunnel	3

Table 2: Construction Classification - Typical Route Summary

A detailed analysis and summary for each route is in Appendix A.

1.6 Seismic Hazards

The seismic risk of constructing a rail line through an active mountainous area is to be considered prior to design of the route. Although the effects of seismic events may pose significant risk to the maintenance of a rail line, the risk can be decreased by engineering for the potential effects. The Canadian Government plotted locations of previous seismic events to identify areas subject to increased risk of seismic events are shown on Figure 16.

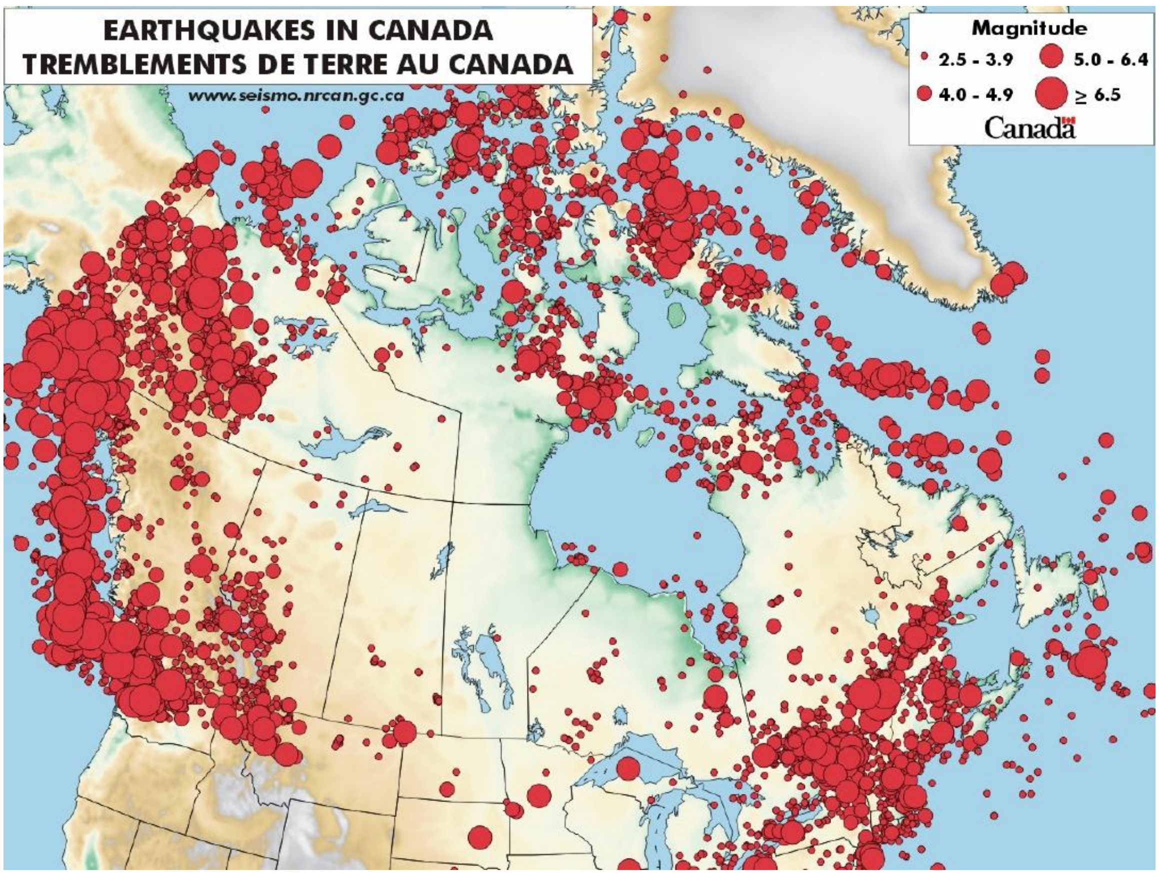


Figure 16: Canadian Earthquakes

The locations of previous earthquakes were used to develop a map indicating the areas of increasing risk of seismic events as shown on Figure 17.

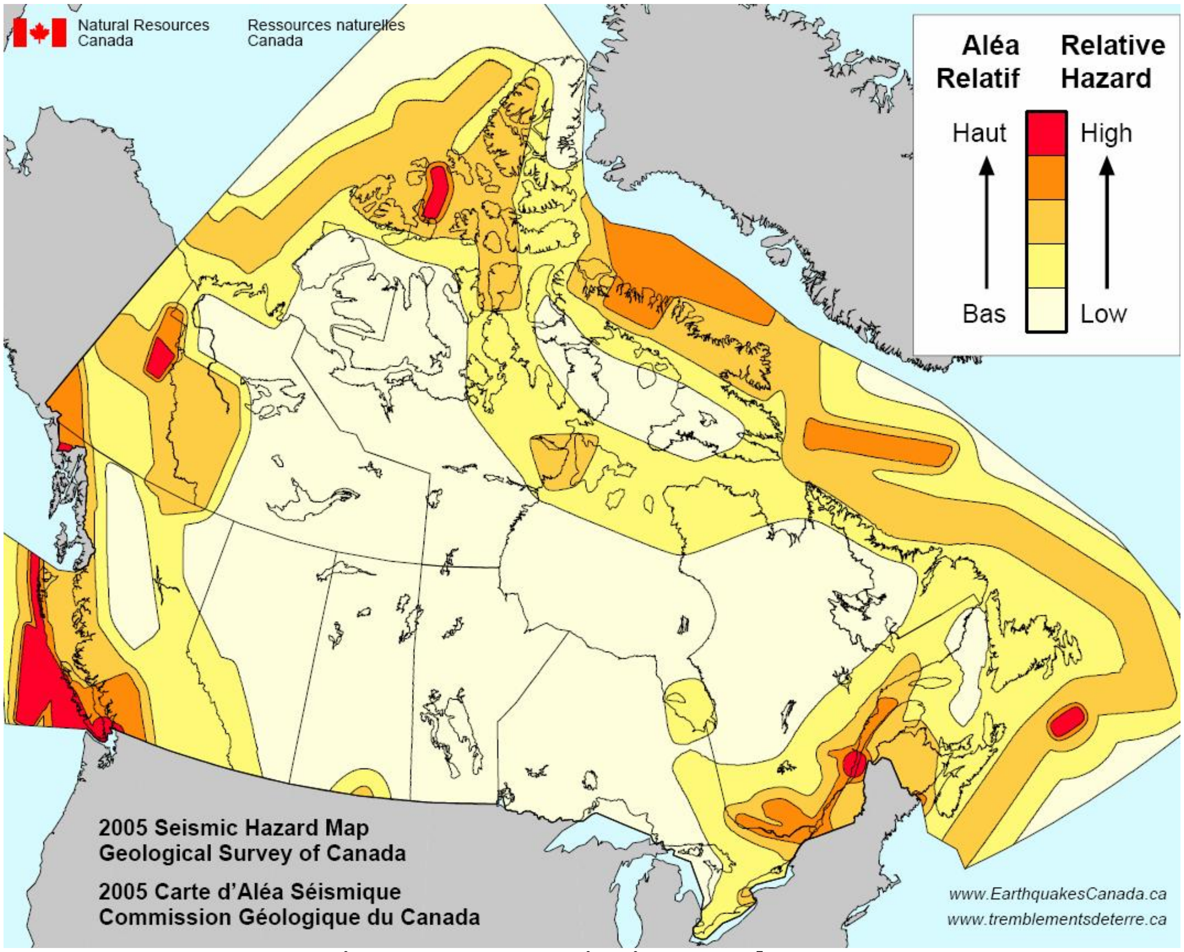
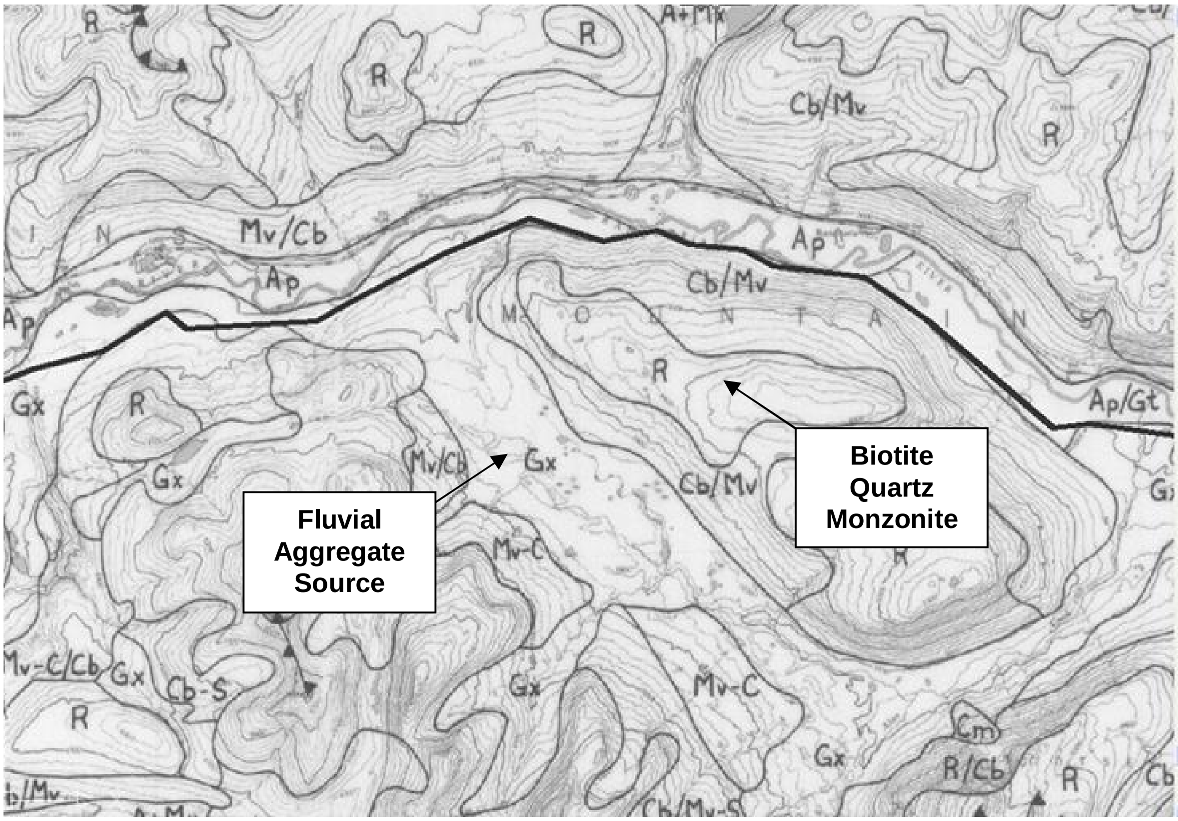


Figure 17: 2005 Seismic Hazard Map

Development of a railway through the areas of increased seismicity should be engineered to reduce the risk associated with potential earthquakes.

1.7 Aggregate Sources



1.7.1 Ballast

A preliminary study was completed to identify locations near the proposed routes as potential ballast sources for rail line construction. The scope of this study consisted of examining published geological maps and selecting areas near to the proposed routes that contain favourable rock types. Areas with favourable rock types were selected are either adjacent to the proposed alignments or within a relatively short truck haul distance from the alignment with no physical barrier (river or lake) between the ballast source and the proposed alignment route.

Ballast is a selected crushed and graded aggregate material which is placed upon the railroad roadbed for the purpose of providing drainage, stability, flexibility, uniform support for the rail, and ties and distribution of the track loadings to the subgrade and facilitating maintenance. To meet the above listed functions of ballast, the preferred aggregate should be a hard, dense, angular particle with sharp corners and cubicle shape with a minimum of flat and elongated pieces. These qualities will provide for proper drainage of the ballast with the angular shape providing interlocking qualities that will grip the ties and provide a stable ballast section. The ballast must have a high wear and abrasive qualities to withstand the impact of traffic loads without excessive degradation. The ballast must also provide high resistance to temperature changes, chemical attack, exhibit a high electrical resistance, low water absorption properties and be free of cementing properties. In addition, the ballast must be free of minerals that may degrade the environment when exposed to air and precipitation.

To meet all of the qualities of good ballast, the source rock of the aggregate should have the following characteristics:

1. ***Mineral Hardness*** - The hardness of the minerals should be at least a 5 on the Moh's Scale of Hardness (a qualitative scale for common rock forming minerals). Minerals with a 5, hardness will withstand the grinding forces that occur between the aggregate particles when subjected to the train load.
2. ***Moderate to High Specific Gravity*** - The rock, and by extension the minerals that compose the rock, should have a specific gravity higher than 2.60. A higher specific gravity will mean the aggregate particles will remain stable in the roadbed under loading.
3. ***Toughness*** - The ability of the rock to withstand the impact forces delivered by the train passing over the ballast. Toughness is primarily imparted by the shape of the minerals; elongated minerals that interlock have a higher toughness than minerals that abut each other.
4. ***Lack of Foliation*** - Foliated rocks have the long axis of the minerals aligned along one principle direction. This reduces the toughness of the rock as well as produces flat and elongated pieces.
5. ***Lack of Porosity*** - Pores within the rock will trap water that will then undergo freeze-thaw cycles that will break-up the rock particles in the ballast.
6. ***Lack of Hydrating Minerals*** - Certain minerals (e.g. chlorite) can absorb water into their crystal structure. These minerals are then susceptible to freeze-thaw and wetting drying degradation.
7. ***Resistance to Chemical Weathering*** - Certain minerals (e.g. calcite) are susceptible to chemical weathering (dissolution) from rainwater. In addition, alteration minerals (i.e. minerals formed from the decomposition of their parent mineral such as chlorite forming from the alteration of hornblende) are susceptible to chemical weathering.
8. ***Lack of Sulphide Minerals*** - Sulphide minerals (such as pyrite) can undergo chemical weathering and produce acidic water that can leach metals out of the rock. This would present an environmental concern particularly if present along a long section of the railway's roadbed.

The rock types that meet the top seven characteristics are found in igneous rocks. Plutonic rocks are preferred as a medium grain size imparts a rough texture to an aggregate particle. Coarse grained rocks can have a lower toughness due to fracturing in the large, elongate minerals within the rock. Volcanic rocks can also acceptable but their fine grain size may make them less stable in the track roadbed. Note that sulphide minerals tend to occur in igneous rocks, hence, a detailed petrographic analysis would be required for any potential ballast source to select a source that does not contain sulphide minerals.

The following is a list of rock types (based on the International Union of Geological Sciences classification scheme) that typically can meet the characteristics of good ballast:

<u>Plutonic Rocks</u>
Gabbro
Diorite
Monzonite
Syenite
Some granodiorites if quartz content is low
Ultramafic rocks such as dunite and pyroxenite

<u>Volcanic Rocks</u>
Basalt
Andesite
Latite
Trachyte
Some dacites if quartz content is low

In addition, a metamorphic rock called amphibolite can have the characteristics of a good ballast rock if it does not contain a high degree of foliation (common in metamorphic rocks).

Tables were developed to identify areas of specific rock types that could produce high quality ballast along the proposed alignments. As the identified rock types may represent a large area, and most are not directly adjacent to the alignment, the referenced mileage provides an approximate location; Mileage 120 may mean rock outcroppings from Mile 115 to 130. As most alignments trend roughly east-west descriptions such as north of the alignment should also be taken as meaning east if in that localized location the alignment is north-south, and south of the alignment will also mean west if the localized location of the alignment is north-south. The ballast source location tables are in Appendix B.

1.7.2 Concrete Aggregates

Areas near the proposed routes for potential concrete aggregate sources were identified. Terrain units known to contain sand and gravel deposits were noted for further investigation during the terrain analysis. Likely sources of concrete aggregate include fluvial, alluvial, and colluvial deposits.

The selection of a concrete aggregate is dependant on the following characteristics:

1. ***Rock Type*** - Shape and texture, gradation, moisture content, and specific gravity are the properties important for high quality aggregate. These are a function of the rock type that comprise the aggregate. Certain rock types will natural form flat or elongated shapes, can contain natural pores that will hold moisture, and have a low specific gravity; all features that are not desirable for concrete aggregate.

2. ***Resistance to Abrasion*** - A good aggregate will be hard, dense and strong and free of soft, porous or friable particles.
3. ***Resistance to Freeze-Thaw and Wetting-Drying*** - Concrete deterioration will be caused by aggregate particles that are susceptible to freeze-thaw or wetting drying cycles. Volume changes to the aggregate from these cycles will cause concrete cracking. Aggregate with a high porosity, permeability and the presence of hydrating minerals will be susceptible to freeze-thaw or wetting drying cycles.
4. ***Presence of Deleterious/Organic Material*** - Clay lumps, shale particles, coal and chert are some materials that are classified as deleterious materials that will perform poorly as a concrete aggregate.
5. ***Reactivity***
    - Alkali-Silica (chert, quartzites) - silica rich minerals can react with the alkali cement to form a silica gel within the cement. This gel has the ability to imbibe considerable amounts of water, which is accompanied by volume expansion.
    - Alkali-Carbonate (dolomites/limestones) - carbonate rocks that contain dolomite (a calcium-magnesium carbonate mineral) and interstitial clay can undergo de-dolimitization in the presence of alkali cement. The de-dolimitization process is expansive' hence causing cracking in the concrete.

1.8 Civil Structures

1.8.1 General

Civil structures are required along all routes to traverse water courses, roads, and along areas subject to stabilization or protection from unstable ground conditions. Available mapping information was used to identify areas that would likely require civil structures along each route. Eight typical civil structures were used to classify the areas subject to additional construction requirements. These included areas requiring bridges, bridge pipes, road crossings, erosion protection, rock/snow sheds, rock fall protection and retaining walls. A description of each civil structure is discussed in the following sections. The locations of civil structures that may be required are identified in the detailed analysis and summary of each route in Appendix A.

1.8.2 Bridges

Bridges are used to cross large water courses, or areas that may be subject to large flows capable of transporting debris. UMA designated all the following areas as requiring bridges:

- Rivers
- Creeks
- Large tributaries capable of transporting debris

Based on the profiles generated from the control points, an estimate of the height and length of the required bridge was noted. Pictures 17 and 18 show a small and large bridge respectively.

Picture 17: Small Bridge over Tributary

Picture 18: Large Bridge over River

1.8.3 Bridge Pipes

Bridge pipes are used to convey surface water under the track when bridges are not cost effective and the location is not subject to large debris flows. All tributaries were designated as requiring bridge pipes unless they appeared to be subject to debris flows, or the traverse was greatly elevated above the alignment profile thus requiring a bridge. Picture 19 shows a typical bridge pipe structure under an existing track.

Picture 19: Bridge Pipe

1.8.4 Road Crossings

The alignment crosses existing roadways at several locations along each alignment. Railway road crossing are required to mitigate the potential of accidents with motorists. Based on the alignment profile developed, road crossings were assigned either as at-grade level road crossing or as requiring a grade separated road crossing. Pictures 20 and 21 show a level road crossing and a grade separated road crossing respectively.

Picture 20: Level Road Crossing

Picture 21: Grade Separated Road Crossing

1.8.5 Erosion Protection

Erosion protection is required to minimize disturbance of slopes subject to river erosion. Riprap protection is typically used to protect slopes, shorelines and bridge abutments from flooding, wave action and erosion of material. Locations where routes follow close proximity to major water courses typically require an abundance of erosion protection. Picture 22 shows typical riprap slope protection. Picture 23 shows the potential effects of not having adequate protection.

Picture 22: Riprap Erosion Protection

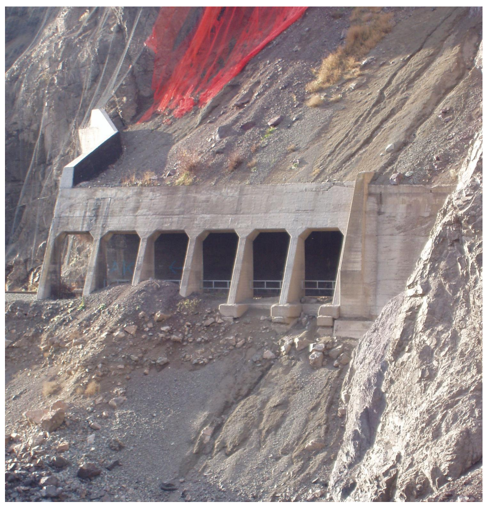
Picture 23: Inadequate Erosion Protection

1.8.6 Rock/Snow Sheds

Rock sheds will be necessary where rock falls can not be controlled by other means. The rock shed is typically a robust reinforced concrete structure with an earthen covered roof. The structure must be sufficiently durable to withstand rock falls and direct them over the track.

Snow sheds are similar to rock sheds and are required in mountainous terrain where avalanche chutes are present along the alignment. These areas are typically identified in air photos as scars in the forest cover where past avalanches were active and have damaged the terrain.

Pictures 24 and 25 show a rock shed and snow shed respectively.



Picture 24: Rock Shed

Picture 25: Snow Shed

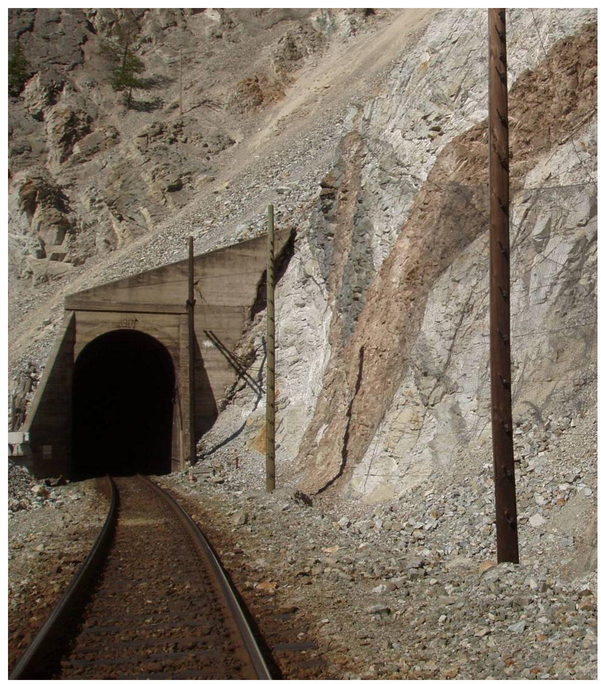
1.8.7 Rock Fall Protection

Rock fall protection typically consists of a wire mesh placed over colluvial material. This is typically required where a veneer of loose rock is present over bedrock. The loose rock or talus will tend to tumble down the slopes and collect in the ditch or on the track.

The goal of the protection is to capture the rock and prevent it from tumbling down the slope and landing on the track. Wire mesh needs to be in close proximity to where rock dislodges in order to contain and dissipate the energy individual rocks collect as they fall. Generally anchors are installed along the slope above the anticipated source. Rock fall signals are often used to warn oncoming trains of fouled track areas.

Pictures 26 and 27 show typical rock fall protection and rock fall signals respectively.

Picture 26: Rock Fall Protection



Picture 27: Rock Fall Signals

1.8.8 Retaining Wall

Retaining walls are used to stabilize the grade or slopes where space is limited. Tie back anchor walls can be used where the colluvial material is relatively thin such as in a veneer or mantle where the bedrock is relatively shallow. However, where soils are present it is often more economical to use gravity walls or mechanically stabilized Earth (MSE) walls. There are a large variety of MSE wall systems with different reinforcement options and facings available. Picture 28 shows a concrete-faced retaining wall, and Figure 18 shows a benched tie-back anchor retaining wall design.

Picture 28: Concrete Retaining Wall

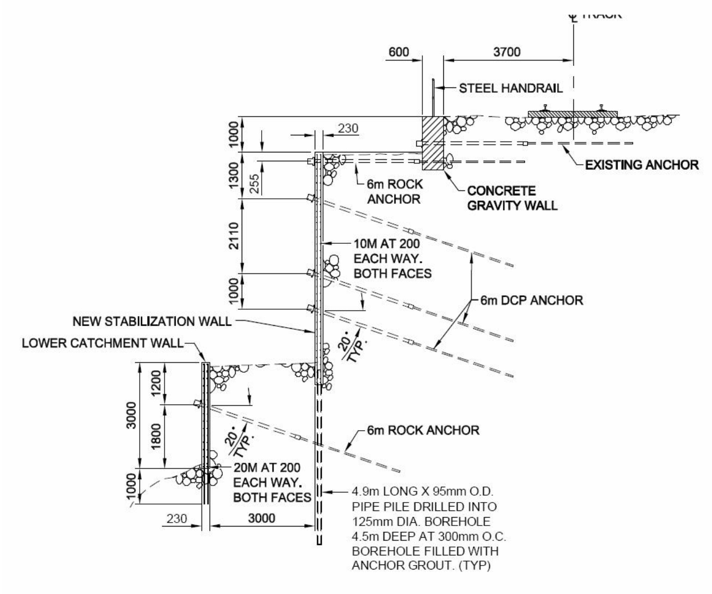


Figure 18: Tie-back Retaining Wall Design

1.8.9 Civil Structures Route Summary

Each route was analyzed to determine the locations that are likely to require civil structures. Locations requiring bridges, bridge pipes, road crossings and stabilization/protection civil structures were identified along the proposed alignment. Each route was summarized into the number and size of bridges and bridge pipes, and the length of stabilization/protection civil structures. A typical civil structure route summary is shown in Table 3.

Civil Structures	Number
Bridge Pipe	146
Level Road Crossing	5
Overpass Road Crossing	2
Bridges	34
Civil Structures	**Length (mile)**
Erosion Protection	7.62
Rock/Snow Sheds	0.5
Rock Fall Protection	8.7
Retaining Walls	0.2

Bridges			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
1	5	30	30
1	6	30	30
3	8	30	90
2	8	60	120
1	8	100	100
2	8	175	350
1	15	120	120
2	15	150	300

Bridge Pipes		
No. Req'd	**Length (m)**	**Total Length**
55	20	1,100
23	28	644
4	32	128
1	36	36
12	40	480
2	44	88
13	68	884
1	74	74

Table 3: Civil Structures - Typical Route Summary

The detailed analysis for each route is in Appendix A

1.9 Route Evaluation

1.9.1 General

Each route was evaluated with respect to the terrain, degree of construction difficulty and location of potential civil structures. Typical route summaries were developed for each route with respect to the classification system. The following sections describe the results of the construction evaluation for all the Yukon routes and a comparison of the results.

It should be noted the length of each railway route segment was determined by manual processes due to delays associated with receiving mapping information in electronic formats. As digital data became available, route mileages were recalculated, which resulted in slight differences in the lengths of routes. Therefore, mileages that describe various route details may differ somewhat from miles shown on the final alignments. Additionally, the alignments selected make no consideration of pipeline and utility crossings or cultural features.

1.9.2 Watson Lake, YT to Whitehorse, YT

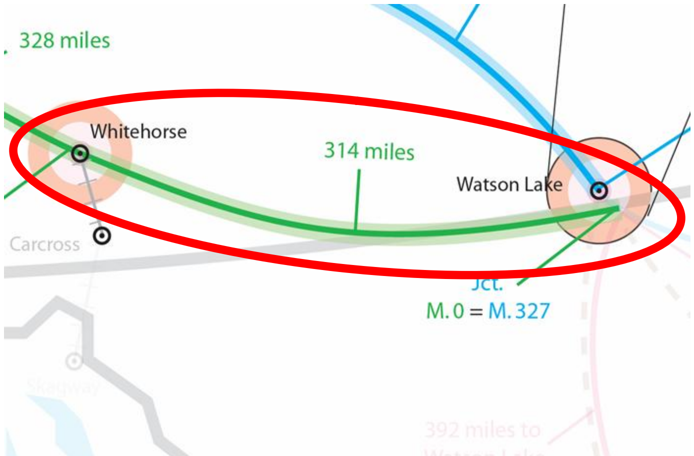


Figure 19: Watson Lake to Whitehorse Diagram

The route alignment from Watson Lake, YT to Whitehorse shown on Figures 19 and 21 (following page) is approximately 314 miles long. Analysis of the route indicated primarily till, and fluvial deposits over terrain requiring mostly heavy to very heavy grade construction. This alignment traverses several major water courses including the Little Rancheria, Tootsie, Swift, Morley, Teslin, and M' Clintock Rivers and also the Nisutlin Bay Inlet. No tunnels are expected to be required along this route. Approximately, 1.5 miles of stabilization/protection civil structures are estimated for construction to minimize hazards and maintenance. Many conflicts are expected with the Alaska Highway and the proposed alignment would require 21 road crossings. An illustrative summary of the Watson Lake to Whitehorse Terrain Analysis are shown on Figure 20.

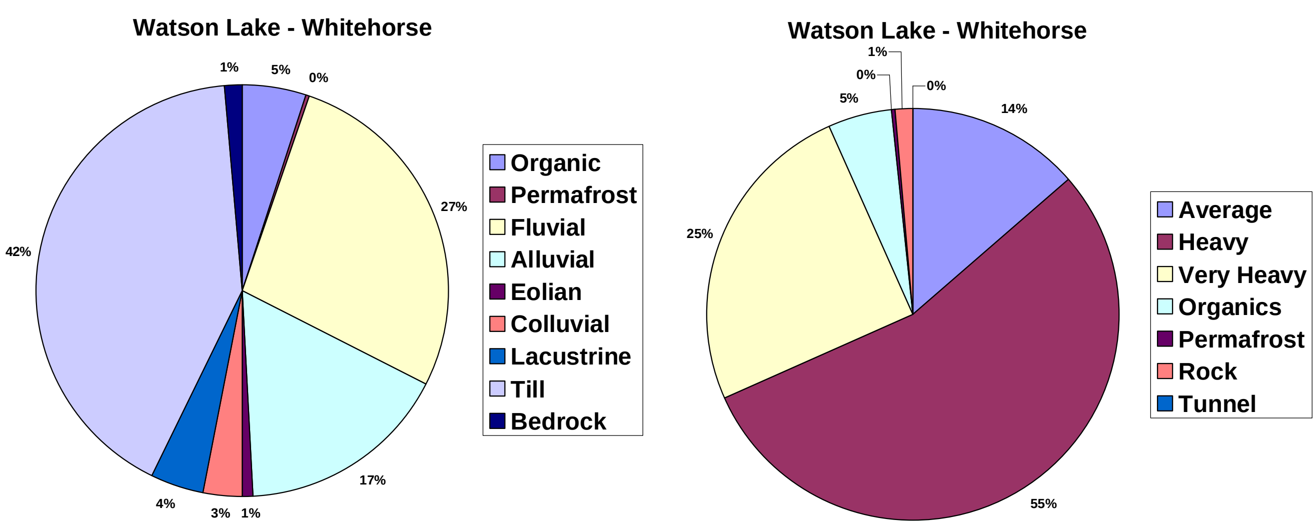


Figure 20: Fort Nelson to Watson Lake Terrain Analysis

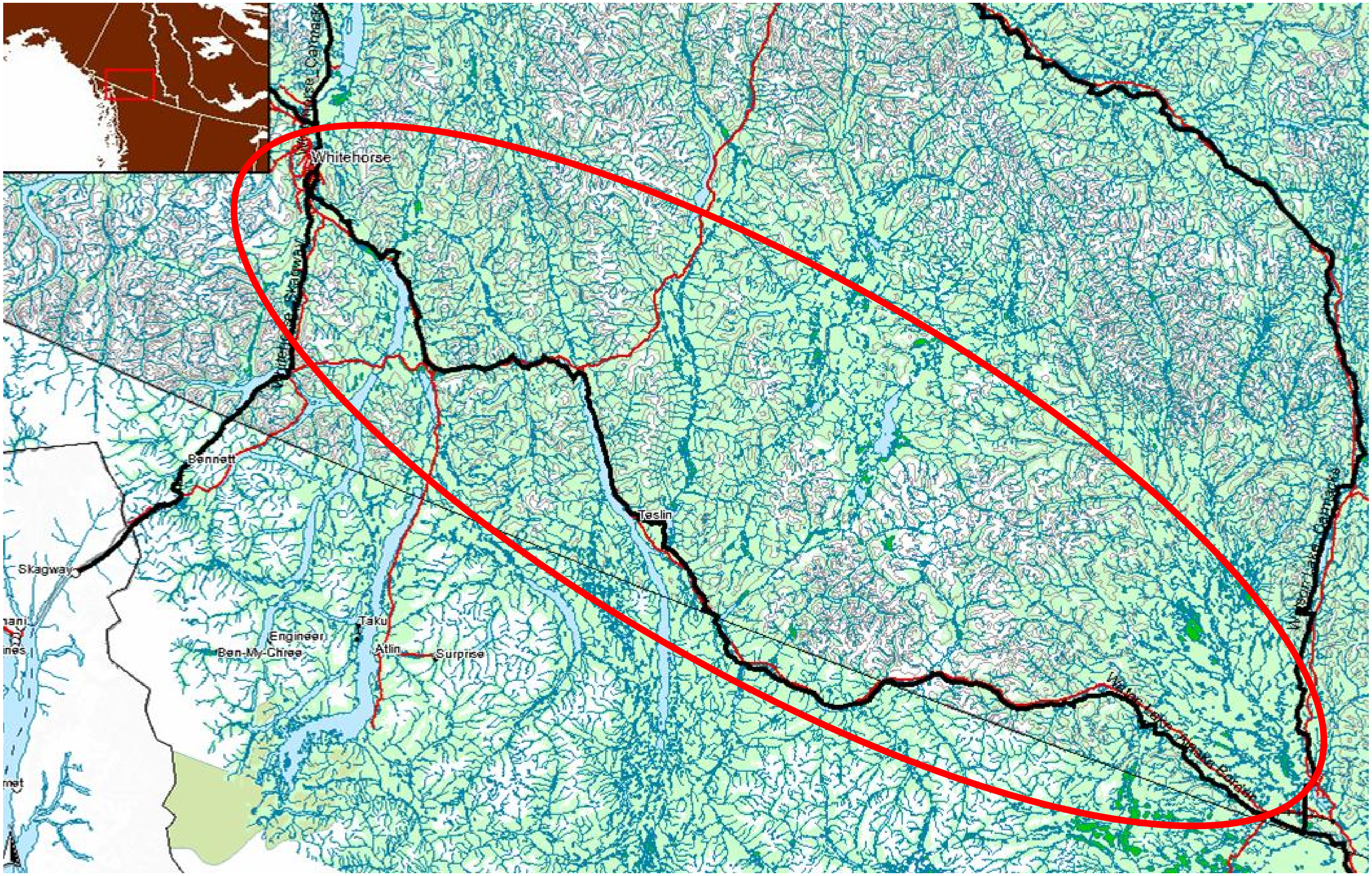


Figure 21: Watson Lake to Whitehorse Alignment

Table 4 shows the complete route summary for the Watson Lake to Whitehorse alignment. A detailed route analysis for the Watson Lake to Whitehorse alignment is in Appendix A.

Terrain Unit	Total Distance
Organic	15.3
Permafrost	1.0
Fluvial	85.3
Alluvial	52.1
Eolian	2.3
Colluvial	9.3
Lacustrine	13.4
Till	129.0
Bedrock	4.3
Total	**312.0**
Construction	**Total Distance**
Average	42.7
Heavy	170.5
Very Heavy	78.2
Organics	15.3
Permafrost	1.0
Rock	4.3
Tunnel	0.0
Total	**312.0**
Civil Structures	**Number**
Bridge Pipe	93
Level Road Crossing	19
Underpass Road Crossing	1
Overpass Road Crossing	1
Bridges	42
Civil Structures	**Length (mile)**
Erosion Protection	0.285
Rock/Snow Shed	0.1
Rock Fall Protection	0.265
Retaining Walls	0.82

Bridges			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
5	6	30	150
6	8	30	180
4	8	60	240
1	8	120	120
1	8	125	125
1	8	225	225
1	9	150	150
1	10	60	60
2	10	150	300
1	11	225	225
1	12	130	130
1	12	140	140
2	14	150	300
1	14	200	200
1	15	150	150
1	15	300	300
1	18	175	175
1	20	175	175
1	20	620	620
1	24	175	175
1	28	350	350
1	31	225	225
1	32	175	175
1	32	350	350
1	46	350	350
2	48	350	700
1	50	400	400
42	**Total Length**		**6,690**

Bridge Pipes		
No. Req'd	**Length (m)**	**Total Length**
29	20	580
33	28	924
1	32	32
3	40	120
1	44	44
1	48	48
5	68	340
3	80	240
1	86	86
1	92	92
5	98	490
3	116	348
1	122	122
1	134	134
1	140	140
2	152	304
1	158	158
1	188	188
93	**Total**	**4,390**

Bridges over Highway			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
1	10	90	90
1	**Total Length**		**90**

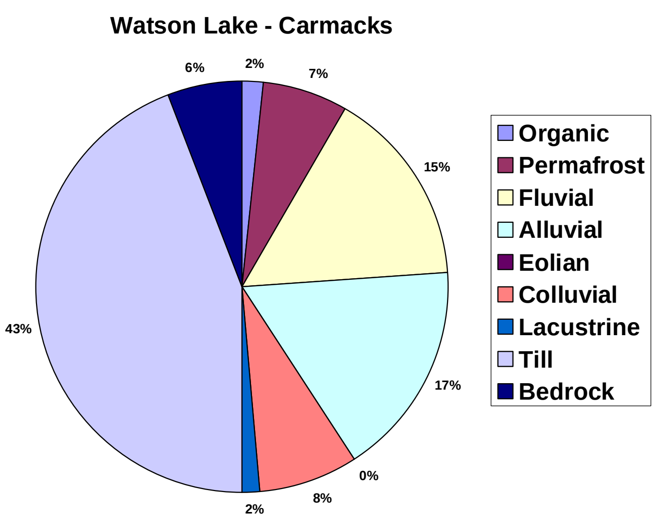
Hwy Bridges over Railway			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
1	7	45	45
1	**Total Length**		**45**

Table 4: Watson Lake to Whitehorse Route Summary

1.9.3 Watson Lake, YT to Carmacks, YT

Figure 22: Watson Lake to Carmacks Diagram

The route alignment from Watson Lake, YT to Carmacks, YT shown on Figures 22 and 24 (following page) is approximately 403 miles long. Analysis of the route indicated primarily till, fluvial deposits and bedrock over terrain requiring mostly heavy, and very heavy construction with some permafrost and rock grade construction. This alignment traverses several major rivers including the Kluatantan, Spatsizi, Stikine, Tanzilla, Cottonwood, and Blue Rivers. No tunnels are expected to be required along this route. Approximately, 14 miles of stabilization/protection civil structures are estimated for construction to minimize hazards and maintenance. Many conflicts are expected with the Robert Campbell Highway requiring 34 road crossings. An illustrative summary of the Watson Lake to Carmacks Terrain Analysis are shown on Figure 23.



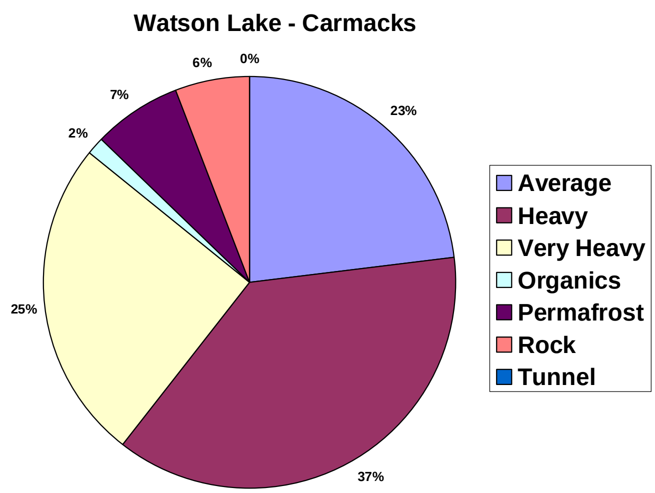


Figure 23: Watson Lake to Carmacks Terrain Analysis

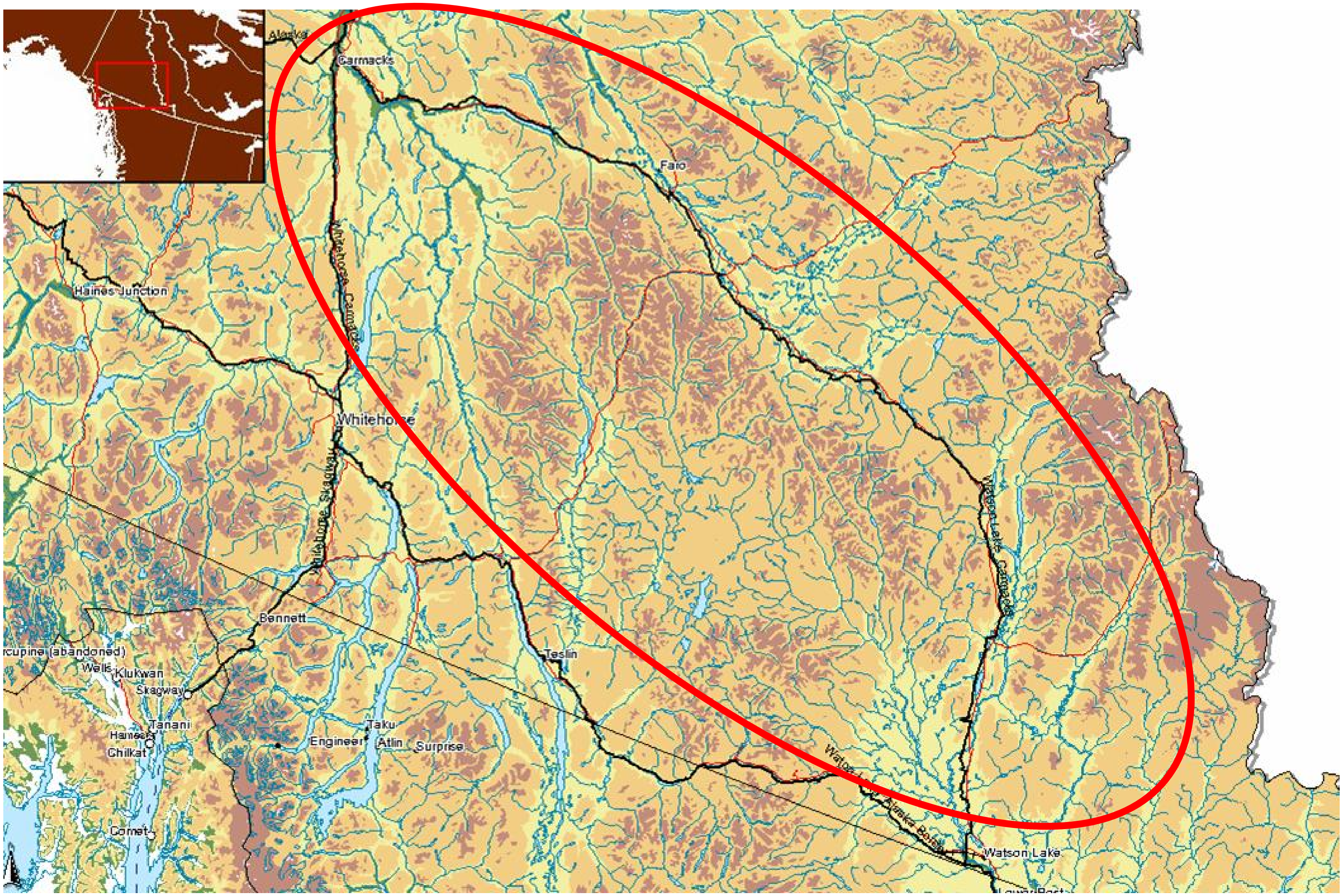


Figure 24: Watson Lake to Carmacks Alignment

Table 5 shows the complete route summary for the Watson Lake to Carmacks alignment. A detailed route analysis for the Watson Lake to Carmacks alignment is in Appendix A.

Terrain Unit	Total Distance
Organic	6.3
Permafrost	27.8
Fluvial	62.2
Alluvial	68.2
Eolian	0
Colluvial	31.1
Lacustrine	6.3
Till	177.7
Bedrock	23.4

Construction	Total Distance
Average	92.8
Heavy	150.9
Very Heavy	101.8
Organics	6.3
Permafrost	27.8
Rock	23.4
Tunnel	0

Civil Structures	Number
Bridge Pipe	190
Level Road Crossing	27
Overpass Road Crossing	7
Bridges	40

Civil Structures	Length (mile)
Erosion Protection	7.65
Rock/Snow Shed	0.52
Rock Fall Protection	5.95
Retaining Walls	0

Bridges			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
3	6	30	90
1	6	125	125
1	7	90	90
2	8	30	60
1	9	125	125
1	10	30	30
1	10	60	60
1	12	150	150
1	13	110	110
1	13	200	200
1	14	225	225
1	15	175	175
1	16	150	150
1	16	200	200
1	17	250	250
1	20	150	150
1	20	175	175
1	20	225	225
1	21	200	200
1	22	190	190
1	23	150	150
1	23	200	200
1	25	150	150
1	25	175	175
1	28	250	250
2	30	200	400
2	30	300	600
1	30	325	325
1	32	350	350
1	33	65	65
1	38	275	275
1	40	300	300
1	53	450	450
1	65	200	200
1	66	450	450
40	**Total Length**		**7,320**

Bridge Pipes		
No. Req'd	**Length (m)**	**Total Length**
19	20	380
1	24	24
95	28	2,660
4	32	128
10	36	360
12	40	480
2	44	88
1	48	48
13	68	884
3	74	222
7	80	560
2	86	172
2	92	184
6	98	588
1	104	104
1	108	108
1	110	110
1	128	128
1	134	134
2	140	280
1	146	146
2	158	316
2	164	328
1	248	248
190	**Total**	**8,680**

Table 5: Watson Lake to Carmacks Route Summary

1.9.4 Whitehorse, YT to Alaskan Border

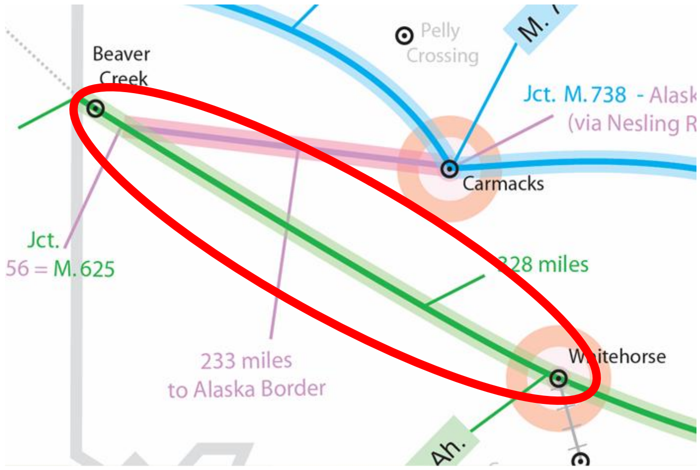


Figure 25: Whitehorse to Alaska Diagram

The route alignment from Whitehorse, YT to the Alaskan border shown on Figures 25 and 27 (following page) is approximately 328 miles long. Analysis of the route indicated primarily till, and fluvial deposits over terrain requiring mostly heavy and very heavy construction with a fair amount of permafrost grade construction. This alignment traverses several major rivers including the Yukon, Takhini, Mendenhall, Aishihik, Jarvis, Slims, Duke, Donjek, and White Rivers. Two tunnels with a total length of 3 miles are expected to be required along this route. Approximately 2.3 miles of stabilization/protection civil structures are estimated for construction to minimize hazards and maintenance. Many conflicts are expected with the Alaskan Highway requiring 17 road crossings. An illustrative summary of the Whitehorse to the Alaskan border are shown on Figure 26.

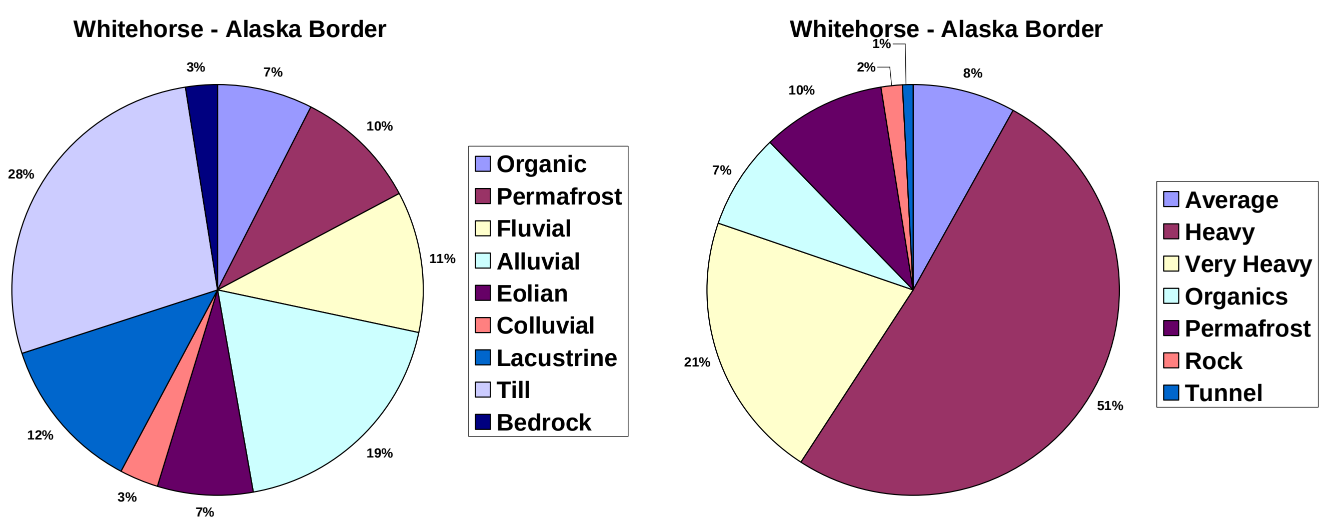


Figure 26: Whitehorse to Alaska Border Terrain Analysis

Figure 27: Whitehorse to Alaska Alignment

Table 6 on the following page shows the complete route summary for the Whitehorse to Alaska alignment. A detailed route analysis for the Whitehorse to Alaska alignment is in Appendix A.

Terrain Unit	Total Distance
Organic	24
Permafrost	31.7
Fluvial	36.8
Alluvial	61.1
Eolian	24.1
Colluvial	10.1
Lacustrine	39.8
Till	89.6
Bedrock	8.3
Total	325.5

Construction	Total Distance
Average	26.1
Heavy	166.2
Very Heavy	69.2
Organics	24
Permafrost	31.7
Rock	5.3
Tunnel	3
Total	325.5

Civil Structures	Number
Bridge Pipe	158
Level Road Crossing	14
Underpass Road Crossing	1
Overpass Road Crossing	2
Bridges	71

Civil Structures	Length (mile)
Erosion Protection	0
Rock/Snow Shed	1.24
Rock Fall Protection	1.06
Retaining Walls	0

Bridges over Water/Debris			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
2	6	30	60
1	6	50	50
2	6	60	120
1	6	100	100
1	7	125	125
1	7	225	225
30	8	30	900
6	8	60	360
2	8	100	200
1	10	100	100
1	10	150	150
1	10	250	250
1	10	400	400
1	10	450	450
1	10	500	500
1	11	230	230
1	12	100	100
1	12	230	230
1	12	300	300
1	12	550	550
1	13	200	200
1	13	225	225
1	13	650	650
1	15	225	225
1	15	230	230
1	15	1100	1,100
1	16	375	375
1	17	200	200
1	23	300	300
1	25	1100	1,100
1	30	1200	1,200
1	45	1350	1,350
1	50	500	500
1	62	450	450
71	**Total Length**		**13,505**

Bridge Pipes		
No. Req'd	**Length (m)**	**Total Length**
67	28	1,876
82	68	5,576
1	74	74
1	92	92
1	98	98
2	116	232
1	128	128
1	140	140
1	152	152
1	176	176
158	**Total**	**8,544**

Bridges over Highway			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
1	7	100	100
1	**Total Length**		**100**

Hwy Bridges over Railway			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
2	7	45	90
2	**Total Length**		**90**

Table 6: Whitehorse to Alaska Border Route Summary

1.9.5 Carmacks YT, to Alaskan Border via Ladue River

Figure 28: Carmacks to Alaska via Ladue River Diagram

The route alignment from Carmacks, YT to the Alaskan border via the Ladue River shown on Figures 28 and 30 (following page) is approximately 223 miles long. Analysis of the route indicated primarily fluvial and colluvial deposits over terrain requiring mostly average and very heavy grade construction. This alignment traverses several major rivers including the Tatchun, Yukon, Selwyn, and White Rivers. No tunnels are expected to be required along this route. Approximately, 77 miles of stabilization/protection civil structures are estimated for construction to minimize hazards and maintenance. Some conflicts are expected with the Klondike Highway requiring 4 road crossings. An illustrative summary of the Carmacks to the Alaskan border via the Ladue River are shown on Figure 29.

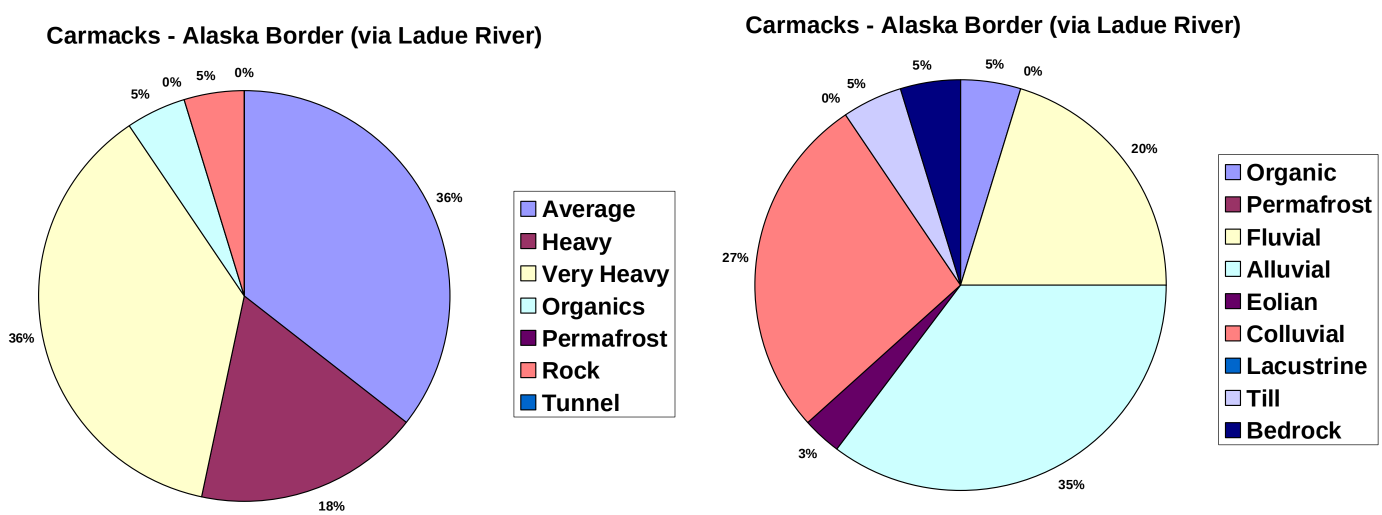


Figure 29: Carmacks to Alaska Border via Ladue River Terrain Analysis

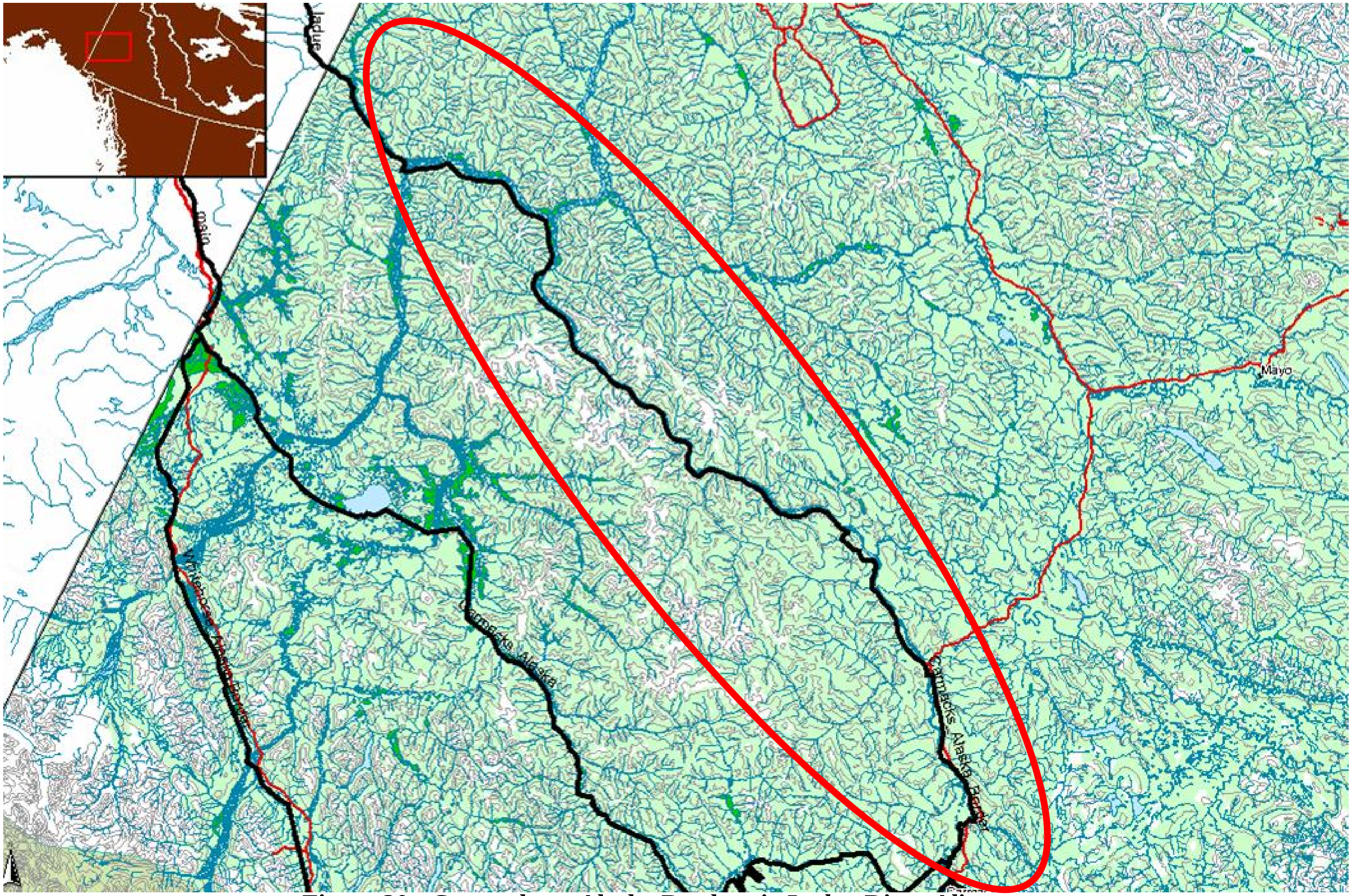


Figure 30: Carmacks to Alaska Border via Ladue River Alignment

Table 7 shows the complete route summary for the Carmacks to Alaska via Ladue River alignment. A detailed route analysis for the Carmacks to Alaska via Ladue alignment is in Appendix A.

Terrain Unit	Total Distance
Organic	10.8
Permafrost	0
Fluvial	45.1
Alluvial	78.8
Eolian	6.8
Colluvial	61.1
Lacustrine	0
Till	10.3
Bedrock	10.6
Total	**223.5**

Construction	Total Distance
Average	79.6
Heavy	39.5
Very Heavy	83
Organics	10.8
Permafrost	0
Rock	10.6
Tunnel	0
Total	**223.5**

Civil Structures	Number
Bridge Pipe	119
Level Road Crossing	3
Overpass Road Crossing	1
Bridges	58

Civil Structures	Length (mile)
Erosion Protection	48.46
Rock/Snow Shed	0.8
Rock Fall Protection	28.2
Retaining Walls	0

Bridges			
Number Required	**Height (m)**	**Length (m)**	**Total Length**
1	6	30	30
1	6	100	100
24	8	30	720
1	8	60	60
2	8	100	200
2	8	150	300
1	9	100	100
1	9	175	175
2	10	100	200
1	10	175	175
8	12	90	720
1	12	100	100
1	13	390	390
1	14	200	200
8	15	100	800
1	16	250	250
1	20	1220	1220
1	25	850	850
58	**Total Length**		**6590**

Bridge Pipes		
Number Required	**Length (m)**	**Total Length**
35	20	700
38	28	1064
2	32	64
6	36	216
8	40	320
9	68	612
2	74	148
5	80	400
2	86	172
1	92	92
5	98	490
1	122	122
1	128	128
2	140	280
1	146	146
1	158	158
119	**Total**	**5112**

Table 7: Carmacks to Alaska Border via Ladue River Route Summary

1.9.6 Carmacks YT, to Alaskan Border via Nisling River

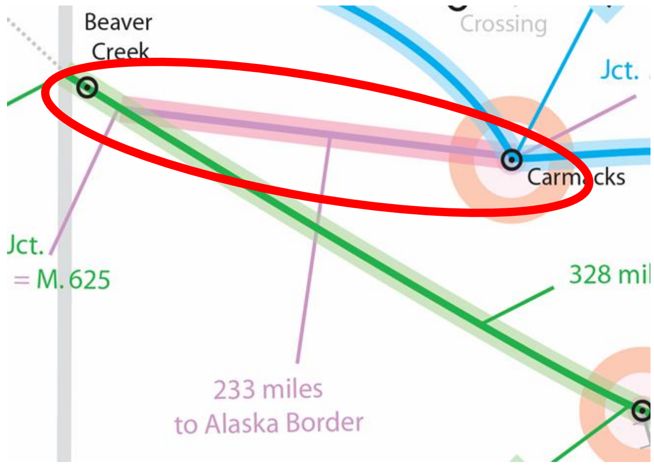


Figure 31: Carmacks to Alaska via Nisling River Diagram

The route alignment from Carmacks, YT to the Alaskan border via the Nisling River shown on Figures 31 and 33 (following page) is approximately 233 miles long. Analysis of the route indicated primarily fluvial and organic deposits over terrain requiring mostly average and organic grade construction with some heavy to very heavy grade construction. This alignment traverses several major rivers including the Yukon, Nisling, and White Rivers. An 8.4 mile tunnel is required just outside Carmacks through Monson and Miller's Ridge for this alignment. Approximately 2 miles of stabilization/protection civil structures are estimated for construction to minimize hazards and maintenance. Very few conflicts are expected with roadways thus requiring only one highway crossing the Alaska Highway, and two gravel road crossings. An illustrative summary of the Carmacks to the Alaskan border via the Nisling River are shown on Figure 32.

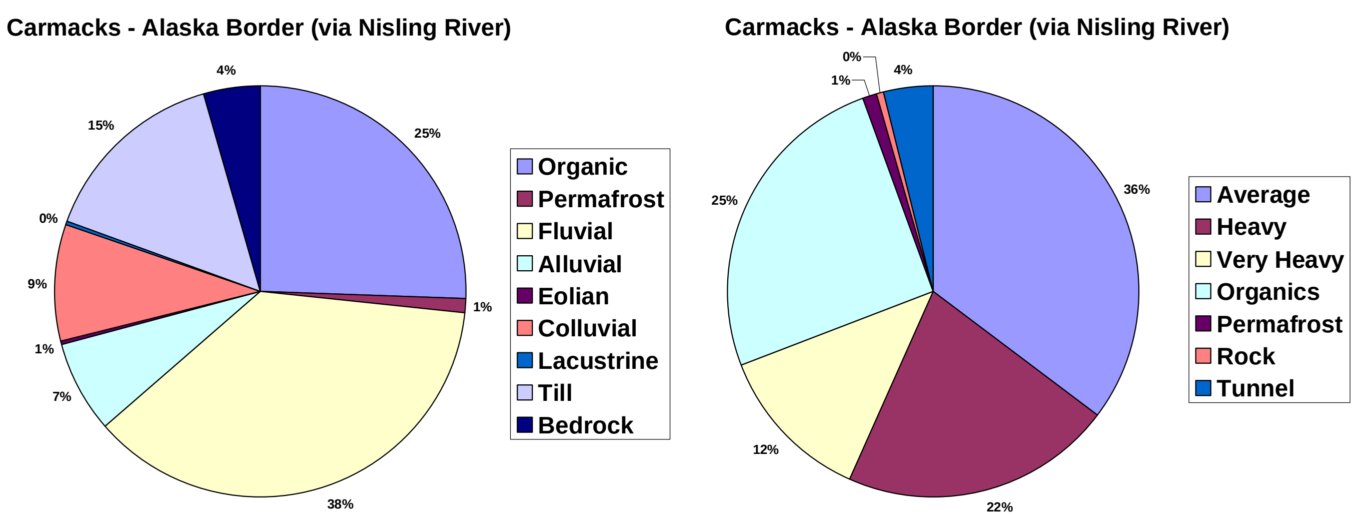


Figure 32: Carmacks to Alaska Border via Nisling River Terrain Analysis

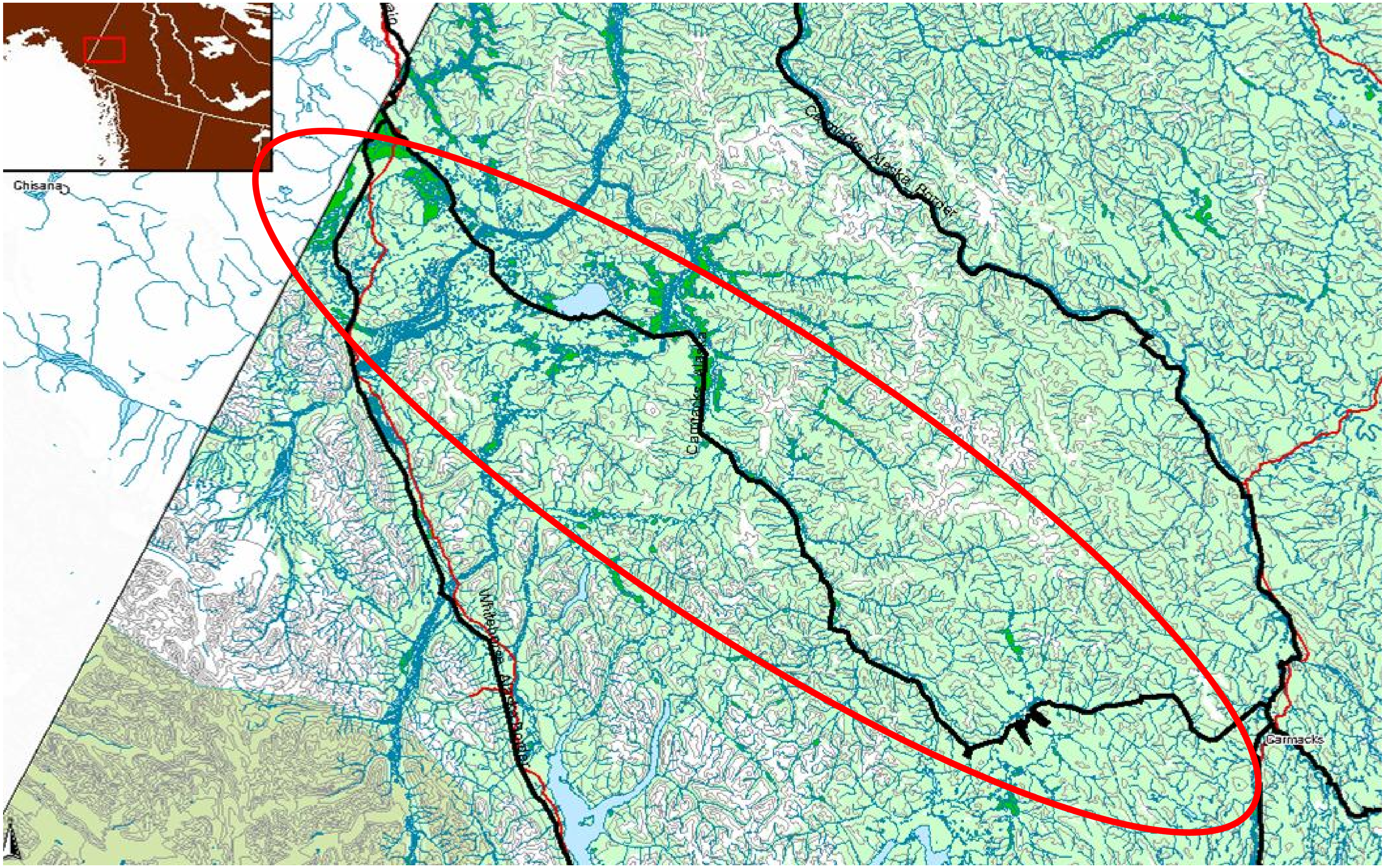


Figure 33: Carmacks to Alaska via Nisling River Alignment

Table 8 shows the complete route summary for the Carmacks to the Alaskan border via the Nisling River. A detailed route analysis for the Carmacks to the Alaskan border via the Nisling River alignment is in Appendix A.

Terrain Unit	Total Distance
Organic	55.5
Permafrost	2.6
Fluvial	80.4
Alluvial	15.7
Eolian	1.1
Colluvial	19.8
Lacustrine	0.4
Till	33.2
Bedrock	9.4
Total	**218.1**

Construction	Total Distance
Average	76.9
Heavy	46.9
Very Heavy	26.8
Organics	55.5
Permafrost	2.6
Rock	1
Tunnel	8.4
Total	**218.1**

Civil Structures	Number
Bridge Pipe	79
Road Crossing	3
Bridges	34

Civil Structures	Length (mile)
Erosion Protection	1.09
Rock/Snow Shed	0.50
Rock Fall Protection	0.36
Retaining Walls	0.10

Bridges			
No. Req'd	**Height (m)**	**Length (m)**	**Total Length**
11	8	30	330
1	8	50	50
3	8	60	180
1	8	90	90
8	10	60	480
1	10	90	90
1	10	150	150
1	10	700	700
1	14	175	175
1	14	180	180
1	15	1125	1,125
2	16	200	400
1	18	150	150
1	32	1200	1,200
34	**Total Length**		**5,300**

Bridge Pipes		
No. Req'd	**Length (m)**	**Total Length**
31	20	620
1	24	24
23	28	644
2	32	64
6	40	240
1	44	44
4	68	272
6	80	480
2	86	172
1	128	128
2	158	316
79	**Total**	**3,004**

Table 8: Carmacks to Alaska Border via Nisling River Route Summary

1.9.7 Route Comparison

Comparison of each route with respect to the terrain, degree of construction difficulty, and potential civil structures is discussed below. It should be noted that each route may have pros and cons in terms of engineering evaluation, however, the length, cultural features, and politics may all affect the decision to select a more favourable or economic route.

Terrain Analysis:

Construction over different terrain units is dependant on many factors. Groundwater, soil composition, density, or stiffness may all affect the difficulty in constructing over different terrain units. For comparison purposes of the terrain units, the analysis is considered to be on flat terrain, with no water table and similar soil consistency. Comparisons of the routes are illustrated in Figure 34.

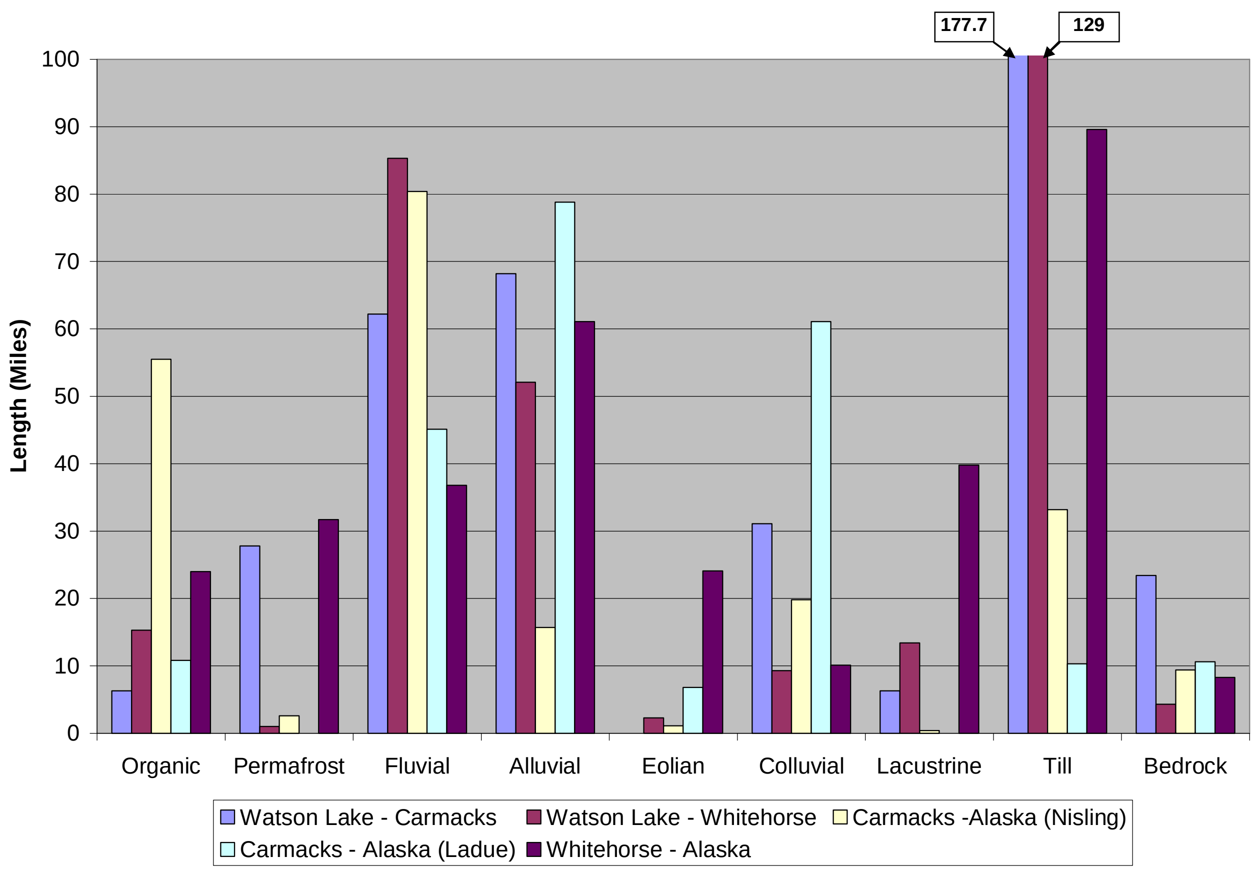


Figure 34: Terrain Analysis Route Comparison

Based on the terrain analysis of all five Yukon routes, the Carmacks Nisling route has the most organic terrain (55 miles); the Whitehorse - Alaska (32 miles) has the most permafrost terrain; and the Watson Lake - Carmacks (23 miles) route has the most bedrock terrain. Fluvial deposits are dominant along all routes with the exception of Watson Lake - Carmacks where till was the dominant terrain unit. The longest alignment analyzed was the Watson Lake to Carmacks Route (403 miles) and the shortest was Carmacks to Alaska via Ladue River (223 miles).

<u>Construction Classification:</u>

Analysis of the routes based on construction classification gives an estimate of the level of effort required to construct railway grade. Comparison of the routes should consider the following table with respect to the level of effort required for different construction classifications.

Construction	Level of Effort
Average	**Decreasing**
Organics	↓
Heavy	
Permafrost	
Very Heavy	
Rock	
Tunnel	**Increasing**

Table 9: Construction Classification Comparison Assessment

Table 9 is for comparison purposes only and is not a direct relationship to cost or consider specific areas requiring greater level of effort, i.e. organic area requiring similar level of effort as very heavy construction. Comparisons of the routes are illustrated in Figure 35.

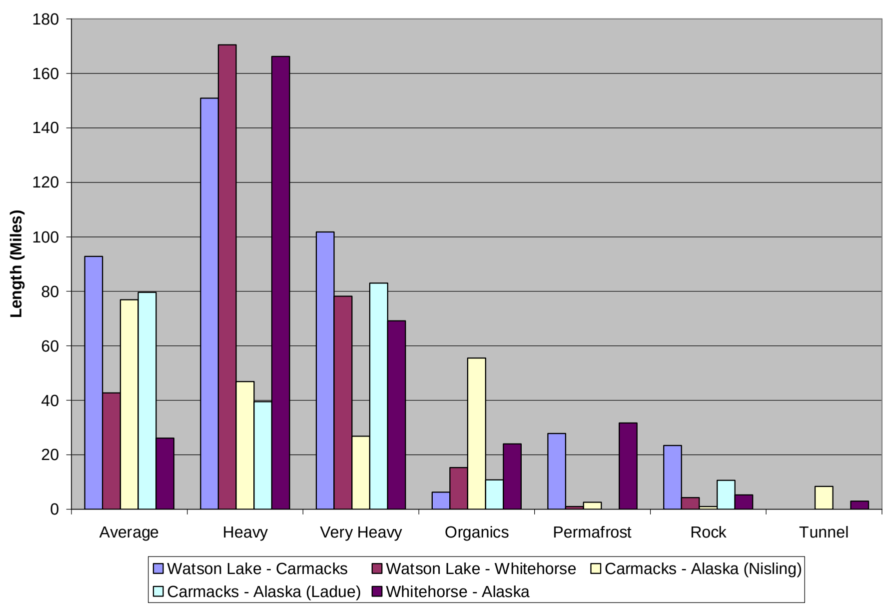


Figure 35: Construction Classification Route Comparison

Based on the construction classification of the Yukon routes, the Watson Lake to Carmacks Route has the most average, very heavy and rock grade construction. Watson Lake to Whitehorse has the most heavy construction, while the Whitehorse to Alaska has the most permafrost grade construction. The Carmacks Nisling Route has the least very heavy construction, however, it has the most organic grade construction and the most tunnelling required. The Carmacks Ladue route has the second most very heavy construction classification.

Civil Structures:

Comparison of required civil structures may be the dominating factor in selecting a more favourable route due to the high costs of civil structures. A route involving several large bridges over average terrain may be discarded when compared to a route over difficult terrain without any bridges. Comparisons of the civil structures required along each route are illustrated on Figure 36.

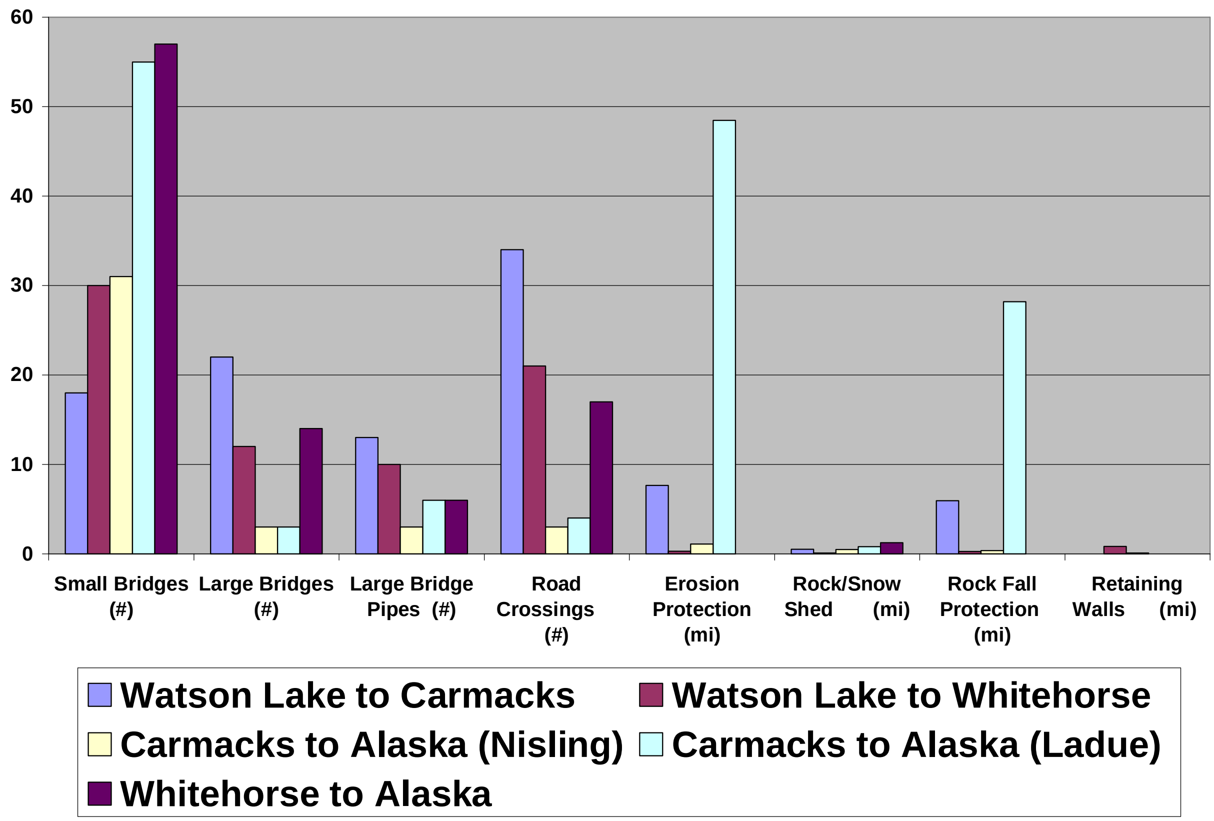


Figure 36: Civil Structure Route Comparison

For comparison purposes, bridges were divided into small bridges (less than 20 m high or 300 m long) and large bridges, and only bridge pipes in excess of 100 m in length were compared.

The results of the civil structures comparison show that the Watson Lake to Carmacks route has the greatest number of large bridges (22), large bridge pipes (13), and conflicts with roadway crossings (34). The Whitehorse to Alaska routes has the most small bridges (57), and second most large bridges (14). The Carmacks to Alaska Ladue Route has the most erosion protection (48 miles) and rock fall protection (28 miles), and second most small bridges (55), but lowest number of large bridges (3). The Watson Lake to Whitehorse route has the third most number of large bridges (12), and second most conflicts with roadway crossings (21). The Carmacks to Alaska Nisling route has the fewest number of large bridges (3), large bridge pipes (3), and conflicts with roadways (3).

1.9.8 Rail Link Comparison through Yukon

Evaluating and comparing each route is also dependant on the overall route selection. Based on our analysis, selecting a route from Watson Lake to Whitehorse requires the selection of the most suitable route segments from Whitehorse to the Alaskan border to complete the rail link through the Yukon. Three alignments linking Alaska to British Columbia can be developed from the evaluated route segments:

1. Watson Lake through Whitehorse to the Alaskan Border (Whitehorse Route)

2. Watson Lake through Carmacks to the Alaskan Border via Nisling River (Nisling Route)

3. Watson Lake through Carmacks to the Alaskan Border via Ladue River (Ladue Route)

Comparison of the final route alignments is discussed below.

<u>Terrain Analysis</u>

Comparison of the rail link terrain analysis is shown on Figure 37 below:

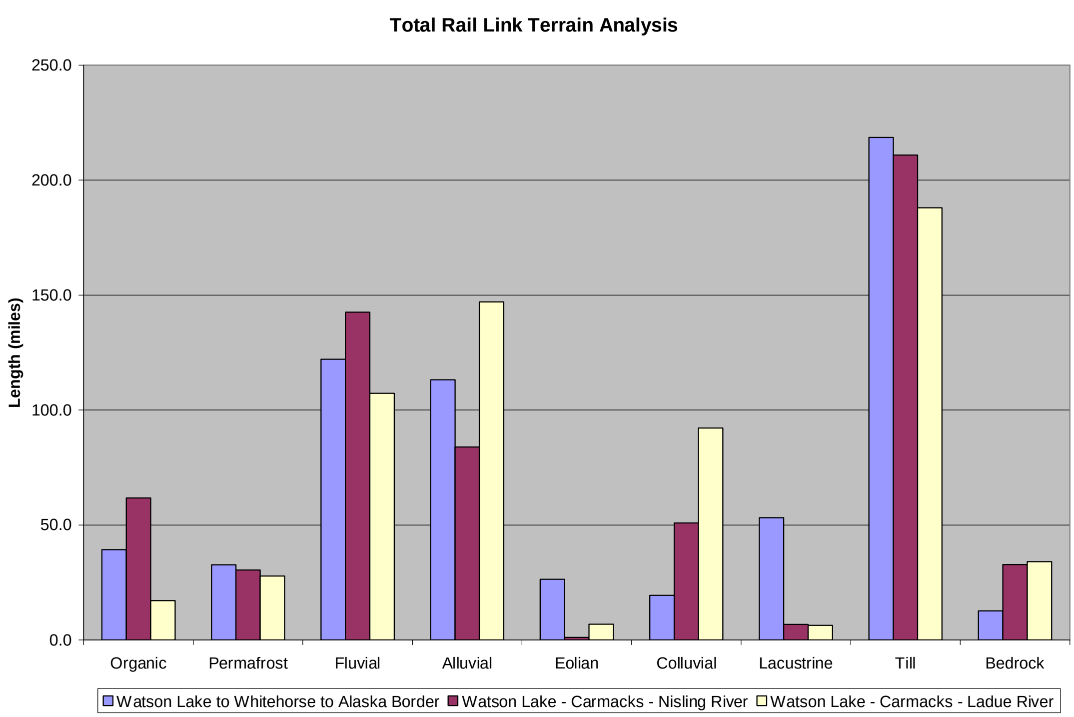


Figure 37: Rail Link Terrain Analysis

Figure 37 shows that the terrain along each route is generally very close in comparison. The Whitehorse Route has the most eolian, lacustrine and till terrain. The Nisling Route has the most organic, and fluvial terrain, and the Ladue Route has the most alluvial, colluvial and bedrock terrain. Total length of the Whitehorse Route is 642 miles. Total length of the Nisling Route is 636 miles. Total length of the Ladue Route is 626 miles.

Construction Analysis

Comparison of the rail link construction analysis is shown in Figure 38 below.

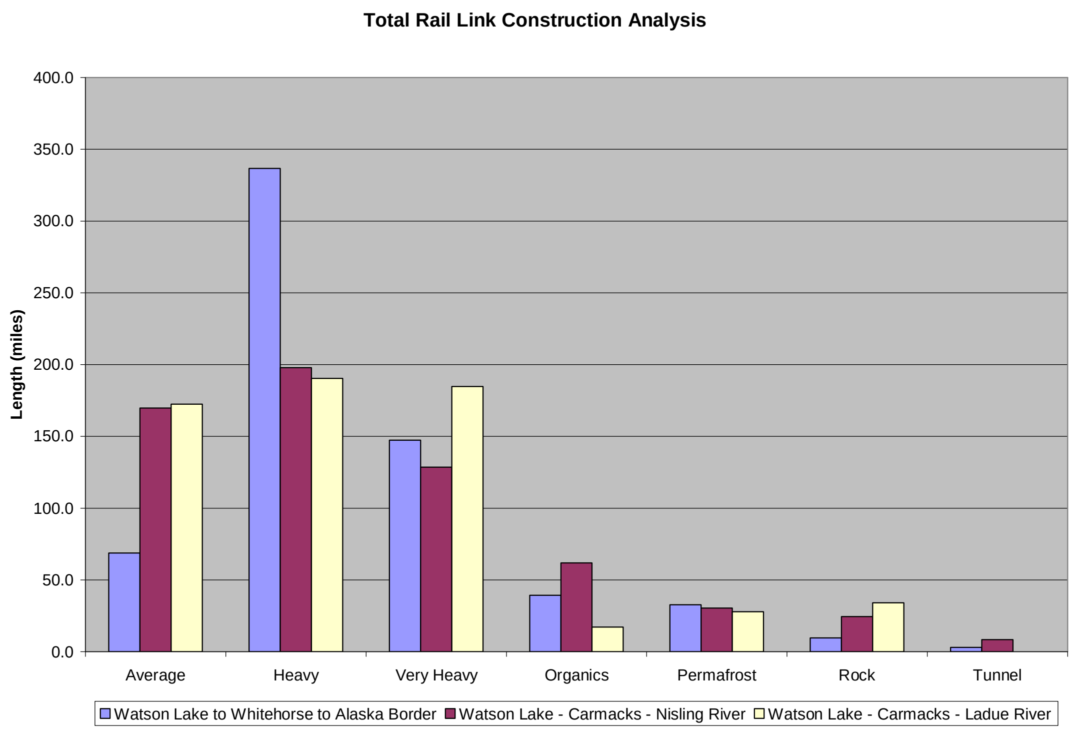


Figure 38: Rail Link Construction Analysis

Figure 38 shows the construction classification along each route is generally very close in comparison. The Whitehorse Route has the most heavy, and permafrost grade construction. The Nisling Route has the most tunnelling and organic grade construction. The Ladue Route has the most average, very heavy, and rock grade construction.

Civil Structure Analysis

Comparison of the rail link construction analysis is shown in Figure 39 below:

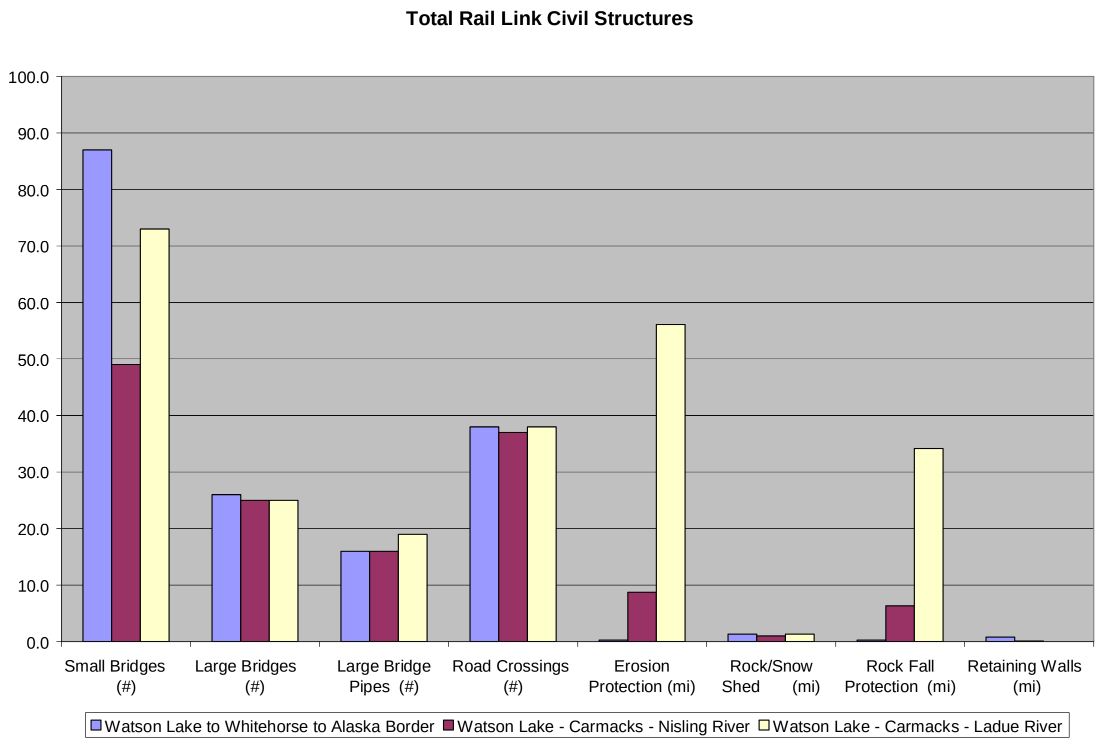


Figure 39: Rail Link Civil Structure Analysis

Figure 39 shows the civil structures along each route is generally very close in comparison. Of note is the almost exact number of large bridges and road crossings along each route. Specific comparison of each link showed the Whitehorse Route has the most total number of bridges and road crossings. The Nisling Route has the least total number of bridges, large bridge pipes, and road crossings. The Ladue Route has the most number of large bridge pipes, road crossings, and track protection structures.

1.10 Conclusion

A classification system was developed to perform an engineering evaluation of potential rail routes through the Yukon using available mapping information. Selected Yukon route alignments were manually plotted by establishing control points on NTS maps at a 1:50,000 scale to develop rail line profiles. These alignments and profiles were analyzed to perform the engineering and construction evaluation of the selected routes. The system developed by UMA included performing a terrain analysis of the surficial geology along the alignment, a construction classification to determines the level of effort required to construct the route, and identification of civil structures that may be required. Analysis of each route was performed and classified according the system using available surficial geology maps, NTS maps, and Google Earth software. Route alignments were digitally plotted over existing mapping information and within the Google Earth software. Flight paths along each route were developed using Google Earth software and recorded onto a DVD appended to this report to support the interpretation of the terrain along each route.

A summary of each route was developed to analyze the total lengths of each terrain unit, construction classification and civil structures. Using the route summaries, comparison of each engineering evaluation was performed. Based on the comparison of all five Yukon routes, the following conclusions have been made for each route:

<u>Watson Lake to Whitehorse</u>:

- Third longest route analyzed (314 miles).
- Least bedrock terrain.
- Most heavy grade construction.
- No tunnels.
- Second most number of roadway crossing conflicts (21), and third most number of large bridges (12).

<u>Watson Lake to Carmacks</u>:

- Longest route analyzed (403 miles).
- Most till and bedrock terrain, least organic and eolian.
- Most very heavy and rock grade construction, least organic.
- No tunnels.
- Most number of large bridges (22) and roadway crossing conflicts (34).

Whitehorse to the Alaska Border:

- Second longest route analyzed (328 miles).
- Most permafrost, eolian, and lacustrine terrain.
- Second most heavy and organic grade construction. Most permafrost grade construction.
- Three miles of tunnelling.
- Most number of total bridges (71) including second most number of large bridges (14).

Carmacks to the Alaska Border via Ladue River:

- Shortest route analyzed (223 miles).
- Most alluvial, and colluvial terrain.
- Second most very heavy and rock grade construction.
- No tunnelling.
- Second most number of total bridges (58), fewest large bridges, most erosion and rock fall protection.

Carmacks to the Alaska Border via Nisling River:

- Second shortest route analyzed (233 miles).
- Most organic grade construction.
- Most tunnelling (8.4 miles) required.
- Fewest total bridges (34) including large bridges (3), fewest total bridge pipes (79) including large bridge pipes (3), and fewest roadway conflicts (3).

Evaluating and comparing each route is also dependant on the overall route selection. Based on our analysis, selecting a route from Watson Lake to Whitehorse requires the selection of the route from Whitehorse to the Alaskan border to complete the rail link through the Yukon. Comparison of the total rail links through the Yukon indicated each route was generally very close in comparison. A summary of each rail link is discussed below:

Watson Lake through Whitehorse to the Alaska Border (Whitehorse Route)

- Longest link (642 miles).
- Most eolian, lacustrine and till terrain.
- The most heavy, and permafrost grade construction.
- 26 large bridges, 87 small bridges, 38 road crossings.

Watson Lake through Carmacks to the Alaska Border via Nisling River (Nisling Route)

- Length of 636 miles.
- Most organic and fluvial terrain.
- Most tunnelling and organic grade construction.
- 25 large bridges, 49 small bridges, 37 road crossings.

Watson Lake through Carmacks to the Alaska Border via Ladue River (Ladue Route)

- Shortest link (626 miles).
- Most alluvial, colluvial and bedrock terrain.
- Most average, very heavy, and rock grade construction.
- 25 large bridges, 73 small bridges, 38 road crossings, 90 miles of track protection features.

Based on the route comparisons and summaries the selection of the most favourable route is inconclusive at this level of study. Each route has advantages and disadvantages in terms of engineering and construction feasibility. Further detailed study is required to verify terrain, construction classification and other issues to determine the most favourable route.

1.11 References

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1.12 Closing

Limitations

This report has been prepared by UMA Engineering Ltd. ("UMA") for the benefit of Alaska Canada Rail Link Project (ALCAN). The information and data contained herein, represents UMA's best professional judgement in light of the knowledge and information available to UMA at the time of preparation.

Except as required by law, this report and the information and data contained herein are to be treated as confidential and, unless otherwise agreed to by UMA and ALCAN, may be used and relied upon only by ALCAN, its officers and employees. UMA denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents without the express written consent of UMA and ALCAN.

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Appendix A -
Detailed Engineering Evaluation of Routes

Watson Lake to Whitehorse

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
0	1.4	1.4	Fluvial	Very Heavy		Large Cuts and Fills, Review for potentail aggregate source																		1.4			
1.4	2.9	4.3	Fluvial	Heavy		Review for potentail aggregate source																	2.9				
4.3	1.7	6	Fluvial	Very Heavy		Large Cuts and Fills, Review for potentail aggregate source																		1.7			
4.8			Bridge Pipe	28	Tributary								28														
6	6	12	Fluvial	Heavy		Review for potentail aggregate source																	6.0				
12	5	17	Alluvial	Very Heavy		Large Cuts and Fills, Review for potentail aggregate source																		5.0			
12.6			Bridge	18 m x 175 m	Creek	Cormier Creek	18	175		574																	
15.3			Bridge Pipe	68 m	Tributary								68														
17	2.5	19.5	Till	Heavy																			2.5				
18.8			Bridge Pipe	92 m	Tributary								92														
19.5	5	24.5	Till	Very Heavy		Large Cuts and Fills																		5.0			
19.8			Bridge Pipe	68 m	Tributary								68														
21.4			Crossing	Overpass 10 m x 90 m	Road	Highway 37 Crossing														90							
21.5			Bridge Pipe	134 m	Tributary								134														
24.5	3.4	27.9	Fluvial	Heavy		Review for potentail aggregate source																	3.4				
24.6			Bridge	9 m x 150 m	Creek	Albert Creek	9	150	492																		
27.9	0.8	28.7	Till	Average																		0.8					
28.7	2.8	31.5	Fluvial	Heavy		Review for potentail aggregate source																	2.8				
30			Bridge Pipe	86 m	Tributary								86														
31.5	0.5	32	Alluvial	Heavy		Review for potentail aggregate source																	0.5				
31.8			Bridge Pipe	20 m	Tributary								20														
32	5	37	Till	Heavy																			5.0				
37	0.8	37.8	Till	Average																		0.8					
37.8	0.3	38.1	Organics	Organics																						0.3	
38.1	0.8	38.9	Till	Average																		0.8					
38.9	0.3	39.2	Organics	Organics																						0.3	
39.2	1.1	40.3	Till	Average																		1.1					
40.3	1	41.3	Organics	Organics																						1.0	
41.3	0.8	42.1	Till	Average																		0.8					
42.1	0.5	42.6	Organics	Organics																						0.5	
42.6	0.4	43	Till	Average																		0.4					
43	1.8	44.8	Organics	Organics																						1.8	
44.8	0.8	45.6	Till	Average																		0.8					
45.6	0.7	46.3	Organics	Organics																						0.7	
46.3	0.9	47.2	Till	Very Heavy		Large Fills																		0.9			
46.5			Bridge	32 m x 350 m	River	Little Rancheria River 200 ft Riprap Erosion Protection	32	350			1,148																
47.2	0.6	47.8	Organics	Organics																						0.6	
47.8	0.8	48.6	Till	Average																		0.8					
48.6	1.2	49.8	Organics	Organics																						1.2	
49.8	0.5	50.3	Till	Average																		0.5					
50.3	0.9	51.2	Alluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		0.9			
50.4			Bridge	48 m x 350 m	Creek	Big Creek 200 ft Riprap Erosion Protection	48	350			1,148																
51.2	0.6	51.8	Till	Average																		0.6					
51.8	0.8	52.6	Till	Heavy																			0.8				
52.1			Bridge Pipe	48 m	Tributary								48														
52.5			Bridge Pipe	20 m	Tributary								20														
52.6	1	53.6	Till	Average																		1.0					
53.6	0.7	54.3	Till	Very Heavy		Large Cuts and Fills																		0.7			
54.3	0.6	54.9	Till	Heavy																			0.6				
54.9	0.4	55.3	Organics	Organics																						0.4	
55.3	0.5	55.8	Till	Average																		0.5					
55.8	0.4	56.2	Alluvial	Very Heavy		Creek Crossing, Review for potentail aggregate source																		0.4			
56			Bridge	48 m x 350 m	Creek	Big Creek 200 ft Riprap Erosion Protection	48	350			1,148																
56.2	0.8	57	Alluvial	Heavy		Review for potentail aggregate source																	0.8				
57	1	58	Till	Heavy																			1.0				
58	2	60	Alluvial	Heavy		Review for potentail aggregate source																	2.0				
59.4			Bridge Pipe	20 m	Tributary								20														
60	4	64	Fluvial	Heavy		Review for potentail aggregate source																	4.0				
62.2			Bridge Pipe	20 m	Tributary								20														
64	1.8	65.8	Till	Heavy																			1.8				
64.6			Bridge Pipe	98 m	Tributary								98														

Watson Lake to Whitehorse

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
65.5			Bridge Pipe	20 m	Tributary								20														
65.8	9.4	75.2	Fluvial	Heavy		Review for potentail aggregate source																	9.4				
67.5			Bridge Pipe	20 m	Tributary								20														
69.3			Bridge Pipe	20 m	Tributary								20														
69.9			Bridge Pipe	20 m	Tributary								20														
71.5			Bridge Pipe	20 m	Tributary								20														
75.2	0.4	75.6	Alluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		0.4			
75.3			Bridge	32 m x 175 m	River	Tootsie River 200 ft Riprap Erosion Protection	32	175			574																
75.6	3.9	79.5	Fluvial	Heavy		Review for potentail aggregate source																	3.9				
76.7			Bridge Pipe	28 m	Tributary								28														
78.5			Bridge Pipe	80 m	Tributary								80														
79.5	6.5	86	Alluvial	Heavy		Review for potentail aggregate source																	6.5				
80.5			Bridge Pipe	20 m	Tributary								20														
81.3			Bridge Pipe	28 m	Tributary								28														
82.3			Bridge Pipe	32 m	Tributary								32														
83.5			Bridge	6 m x 30 m	Creek	Freer Creek	6	30	98																		
84.4			Bridge	6 m x 30 m	Creek	Alan Creek	6	30	98																		
86			Bridge	11 m x 225 m	Tributary	Debris Flow	11	225	738																		
86	5.3	91.3	Colluvial	Very Heavy		Rock Fall Protection (5% of Grade Length)										0.265								5.3			
91.3	2	93.3	Fluvial	Heavy		Review for potentail aggregate source																	2.0				
91.4			Bridge	10 m x 150 m	Tributary	Debris Flow	10	150	492																		
92			Bridge Pipe	28 m	Tributary								28														
93.3			Bridge Pipe	98 m	Tributary								98														
93.3	3	96.3	Till	Heavy																			3.0				
96.3	0.4	96.7	Fluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		0.4			
96.4			Bridge	14 m x 150 m	Creek	Carlick Creek 200 ft Riprap Erosion Protection	14	150	492																		
96.7	2.1	98.8	Fluvial	Heavy		Review for potentail aggregate source																	2.1				
98.6			Bridge Pipe	20 m	Tributary								20														
98.8	1	99.8	Till	Heavy																			1.0				
99.8	3.7	103.5	Fluvial	Very Heavy		Construction Next to Ranchero River, Riprap Protection along 5 % Grade Length, Review for potentail aggregate source								0.185										3.7			
102.5			Bridge Pipe	152 m	Tributary								152														
103.2			Bridge Pipe	40 m	Tributary								40														
103.5	1	104.5	Alluvial	Heavy		Review for potentail aggregate source																	1.0				
103.7			Bridge	10 m x 150 m	Creek	Plate Creek	10	150	492																		
104.5	3	107.5	Fluvial	Heavy		Review for potentail aggregate source																	3.0				
105			Bridge Pipe	20 m	Tributary								20														
107.2			Bridge Pipe	40 m	Tributary								40														
107.5	1.7	109.2	Till	Heavy																			1.7				
109.2	4.1	113.3	Till	Very Heavy		Large Cuts and Fills, Mile 111 500 ft Riprap Erosion Protection along Swift River								0.1										4.1			
109.3			Bridge Pipe	68 m	Tributary								68														
112			Bridge Pipe	44 m	Tributary								44														
113.2			Bridge Pipe	28 m	Tributary								28														
113.3	2.7	116	Till	Heavy																			2.7				
115.7			Bridge Pipe	158 m	Tributary								158														
116	1	117	Permafrost	Permafrost																							1.0
117	1.9	118.9	Alluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		1.9			
117.7			Bridge	14 m x 150 m	Creek	McNaughton Creek Construction on Alluvial Fan, High Water Table	14	150	492																		
118.8			Bridge	8 m x 60 m	River	Swift River 200 ft Riprap Erosion Protection	8	60	197																		
118.9	2.1	121	Alluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		2.1			
121			Bridge	8 m x 30 m	Creek	Screw Creek	8	30	98																		
121	1.3	122.3	Organics	Organics																						1.3	

Watson Lake to Whitehorse

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
122.3	3.7	126	Alluvial	Very Heavy		Construction next to Swan Lake, Review for potentail aggregate source																		3.7			
123			Crossing	Level	Road	Alaska Highway Crossing												1									
123.5			Bridge Pipe	20 m	Tributary								20														
124.5			Bridge Pipe	20 m	Tributary								20														
126	1	127	Organics	Organics																						1.0	
127	6	133	Alluvial	Heavy		Review for potentail aggregate source																	6.0				
127			Crossing	Level	Road	Alaska Highway Crossing												1									
127.4			Bridge Pipe	20 m	Tributary								20														
129.6			Bridge	8 m x 30 m	Creek	Logium Creek	8	30	98																		
131.8			Bridge Pipe	20 m	Tributary								20														
132.5			Bridge Pipe	20 m	Tributary								20														
133	0.8	133.8	Organics	Organics																						0.8	
133.8	0.8	134.6	Alluvial	Heavy		Review for potentail aggregate source																	0.8				
134.4			Bridge Pipe	28 m	Tributary								28														
134.6	0.1	134.7	Alluvial	Very Heavy		River Crossing, Review for potentail aggregate source																		0.1			
134.6			Bridge	14 m x 200 m	River	Swift River 200 ft Riprap Erosion Protection	14	200	656																		
134.7	0.8	135.5	Alluvial	Heavy		Review for potentail aggregate source																	0.8				
135.5	1	136.5	Organics	Organics																						1.0	
136.5	1	137.5	Alluvial	Heavy		Review for potentail aggregate source																	1.0				
136.5			Bridge Pipe	28 m	Tributary								28														
137.5	4	141.5	Lacustrine	Heavy																			4.0				
139.3			Bridge Pipe	140 m	Tributary								140														
141.5	0.8	142.3	Alluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		0.8			
141.8			Bridge	8 m x 225 m	River	Swift River 200 ft Riprap Erosion Protection	8	225	738																		
142.3	1.2	143.5	Fluvial	Heavy		Review for potentail aggregate source																	1.2				
143.5	1.5	145	Lacustrine	Heavy																			1.5				
143.8			Bridge Pipe	80 m	Tributary								80														
145	2	147	Organics	Organics																						2.0	
145.5			Bridge	6 m x 30 m	Creek	Coconino Creek	6	30	98																		
146.5			Bridge	6 m x 30 m	Creek	Coconino Creek	6	30	98																		
147	1.5	148.5	Lacustrine	Average																		1.5					
148.5	0.5	149	Organics	Organics																						0.5	
149	2	151	Lacustrine	Average																		2.0					
150.5			Bridge Pipe	20 m	Tributary								20														
151	2	153	Lacustrine	Heavy																			2.0				
152.8			Bridge Pipe	20 m	Tributary								20														
153	1	154	Organics	Organics																						1.0	
154			Bridge Pipe	20 m	Tributary								20														
154	1	155	Lacustrine	Heavy																			1.0				
154.5			Bridge Pipe	20 m	Tributary								20														
155	2.3	157.3	Till	Heavy																			2.3				
155.5			Bridge Pipe	20 m	Tributary								20														
156.1			Bridge Pipe	68 m	Tributary								68														
157.3	1.7	159	Till	Very Heavy		Large Cuts and Fills																		1.7			
157.9			Bridge	12 m x 130 m	Tributary	Gully Crossing	12	130	427																		
158.6			Bridge	50 m x 400 m	River	Morley River 200 ft Riprap Erosion Protection	50	400			1,312																
158.9			Crossing	Overpass 7 m x 45 m	Road	Alaska Highway Crossing													45								
159	6.2	165.2	Till	Heavy																			6.2				
160.3			Bridge Pipe	28 m	Tributary								28														
163.5			Bridge Pipe	122 m	Tributary								122														
165.1			Bridge	15 m x 150 m	Creek	Strawberry Creek	15	150	492																		
165.2	10.8	176	Till	Average																		10.8					
168.2			Bridge Pipe	28 m	Tributary								28														
176	1.5	177.5	Till	Heavy																			1.5				
176.5			Bridge Pipe	68 m	Tributary								68														
177.5	4.5	182	Till	Very Heavy		Large Cuts and Fills																		4.5			
179			Bridge Pipe	20 m	Tributary								20														
179.3			Bridge Pipe	20 m	Tributary								20														
180.4			Bridge	15 m x 300 m	Tributary		15	300	984																		
181.3			Bridge Pipe	20 m	Tributary								20														
182			Bridge	20 m x 620 m	Bay	Nisutlin Bay Inlet 200 ft Riprap Erosion Protection	20	620		2,034																	
182	0.7	182.7	Lacustrine	Very Heavy																				0.7			
182.7	3.6	186.3	Till	Heavy																			3.6				

Watson Lake to Whitehorse

Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Bridge Dimensions: Height (m)	Bridge Dimensions: Length (m)	Brige Length (ft.) by Height Class: < 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Bridge Pipes Length (m)	Erosion Protection Length (mile)	Rock/Snow Shed Length (mile)	Rock Fall Protection Length (mile)	Retaining Walls Length (mile)	Road: Level Xings	Road: Overpass Length (m)	Road: Rail Bridge Length (m)	Tunnel Length (mile)	Grade Construction: Average Length (mile)	Heavy Length (mile)	Very Heavy Length (mile)	Rock Length (mile)	Organics Length (mile)	Permafrost Length (mile)
186.3	0.4	186.7	Alluvial	Heavy		Review for potentail aggregate source																	0.4				
186.7	0.9	187.6	Organics	Organics																						0.9	
186.8			Bridge	8 m x 30 m	Creek	Fox Creek	8	30	98																		
187.6	0.9	188.5	Alluvial	Heavy		Review for potentail aggregate source																	0.9				
187.9			Crossing	Level	Road	Alaska Highway Crossing												1									
188.5	1.5	190	Till	Very Heavy		Large Cuts and Fills																		1.5			
190	1.4	191.4	Alluvial	Heavy		Review for potentail aggregate source																	1.4				
190.8			Bridge	8 m x 30 m	Tributary	Construction on Alluvial Fan, High Water Table	8	30	98																		
191.4	0.9	192.3	Till	Heavy																			0.9				
192			Crossing	Level	Road	Alaska Highway Crossing												1									
192.3	1	193.3	Alluvial	Heavy		Review for potentail aggregate source																	1.0				
192.5			Bridge Pipe	28 m	Tributary								28														
192.8			Bridge	8 m x 60 m	Creek	Ten Mile Creek Construction on Alluvial Fan, High Water Table	8	60	197																		
193.3	3.2	196.5	Till	Very Heavy		Large Cuts and Fills																		3.2			
193.8			Bridge Pipe	28 m	Tributary								28														
195			Bridge Pipe	28 m	Tributary								28														
195.7			Bridge Pipe	28 m	Tributary								28														
196.5	0.9	197.4	Till	Heavy																			0.9				
196.6			Bridge Pipe	28 m	Tributary								28														
197.4	3.4	200.8	Till	Very Heavy		Retaining Walls (10% of Grade Length)											0.34							3.4			
200.4			Bridge Pipe	28 m	Tributary								28														
200.8	1.5	202.3	Alluvial	Heavy		Review for potentail aggregate source																	1.5				
201			Crossing	Level	Road	Alaska Highway Crossing												1									
202			Bridge	8 m x 30 m	Creek	Deadman Creek Construction on Alluvial Fan, High Water Table	8	30	98																		
202.3	0.4	202.7	Alluvial	Very Heavy		Large Cuts and Fills, Review for potentail aggregate source																		0.4			
202.5			Crossing	Level	Road	Alaska Highway Crossing												1									
202.7	2.2	204.9	Till	Very Heavy		Large Cuts and Fills																		2.2			
203.7			Bridge Pipe	28 m	Tributary								28														
204.8			Bridge Pipe	28 m	Tributary								28														
204.9	0.9	205.8	Alluvial	Heavy		Review for potentail aggregate source																	0.9				
205.5			Bridge	8 m x 30 m	Tributary	Construction on Alluvial Fan, High Water Table	8	30	98																		
205.8	1.5	207.3	Till	Very Heavy		Construction next to Teslin Lake, Retaining Walls(10% of Grade Length)											0.15							1.5			
206.2			Bridge Pipe	28 m	Tributary								28														
207.3	2.2	209.5	Till	Heavy																			2.2				
209.5	0.7	210.2	Alluvial	Heavy		Review for potentail aggregate source																	0.7				
209.7			Bridge	10 m x 60 m	Creek	Brooks Brook Construction on Alluvial Fan, High Water Table	10	60	197																		
210.2	3.3	213.5	Till	Very Heavy		Retaining Walls (10% of Grade Length)											0.33							3.3			
211			Bridge Pipe	28 m	Tributary								28														
212.3			Bridge Pipe	28 m	Tributary								28														
212.5			Bridge Pipe	28 m	Tributary								28														
213.5			Bridge	12 m x 140 m	Tributary		12	140	459																		
213.5	1.3	214.8	Fluvial	Average		Review for potentail aggregate source																1.3					
214.8	1.2	216	Fluvial	Very Heavy		Large Fills, Review for potentail aggregate source																		1.2			
215			Bridge Pipe	98 m	Tributary								98														
215.3			Bridge	28 m x 350 m	River	Teslin River 200 ft Riprap Erosion Protection	28	350		1,148																	
216	0.8	216.8	Fluvial	Average		Review for potentail aggregate source																0.8					
216.8	1.7	218.5	Fluvial	Heavy		Review for potentail aggregate source																	1.7				
217.3			Bridge	46 m x 350 m	Tributary		46	350			1,148																
218.4			Bridge Pipe	188 m	Tributary								188														
218.5	4.8	223.3	Fluvial	Average		Review for potentail aggregate source																4.8					
221.5			Bridge Pipe	98 m	Tributary								98														

Watson Lake to Whitehorse

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
223.3	2.5	225.8	Till	Heavy																			2.5				
224.5			Crossing	Level	Road	Alaska Highway Crossing												1									
225.8	3	228.8	Fluvial	Very Heavy		Large Cuts and Fills over Hummocky Terrain, Review for potentail aggregate source																		3.0			
226.6			Bridge Pipe	20 m	Tributary								20														
227			Bridge Pipe	20 m	Tributary								20														
228.2			Crossing	Level	Road	Alaska Highway Crossing												1									
228.8	0.9	229.7	Alluvial	Very Heavy		Soft Subgrade, High Water Table, Review for potentail aggregate source																		0.9			
229.3			Bridge	24 m x 175 m	Creek	Seaforth Creek Construction on Soft Alluvial/Organic Soil	24	175		574																	
229.7	2.1	231.8	Till	Heavy																			2.1				
231.7			Crossing	Level	Road	Alaska Highway Crossing												1									
231.8	1	232.8	Alluvial	Heavy		Review for potentail aggregate source																	1.0				
232.3			Bridge	6 m x 30 m	Creek	Summit Creek	6	30	98																		
232.7			Crossing	Level	Road	Alaska Highway Crossing												1									
232.8	0.9	233.7	Till	Heavy																			0.9				
233.1			Bridge Pipe	80 m	Tributary								80														
233.7	3.6	237.3	Alluvial	Average		Review for potentail aggregate source																3.6					
234.4			Bridge Pipe	28 m	Tributary								28														
235.3			Bridge Pipe	28 m	Tributary								28														
236			Bridge Pipe	28 m	Tributary								28														
236			Crossing	Level	Road	Alaska Highway Crossing												1									
237.3	1.4	238.7	Till	Heavy																			1.4				
237.8			Crossing	Level	Road	Alaska Highway Crossing												1									
238.7	2.3	241	Till	Very Heavy		Large Cuts and Fills																		2.3			
239			Crossing	Level	Road	Alaska Highway Crossing												1									
239.4			Bridge Pipe	152 m	Tributary								152														
241	2.3	243.3	Colluvial	Heavy																			2.3				
241.1			Bridge Pipe	116 m	Tributary								116														
241.2			Bridge Pipe	116 m	Tributary								116														
243.3	1	244.3	Bedrock	Rock		Rock Fall Protection over 20%, Rock Sheds over 10% of Grade Length									0.1										1.0		
243.6			Bridge	8 m x 60 m	Tributary	Debris Flow	8	60	197																		
244.3			Bridge Pipe	28 m	Tributary								28														
244.3	1.7	246	Colluvial	Very Heavy		Large Cuts and Fills																		1.7			
246	1.3	247.3	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			1.3		
247.2			Crossing	Level	Road	Alaska Highway Crossing												1									
247.3	0.7	248	Till	Heavy																			0.7				
248	6	254	Till	Average																		6.0					
248.4			Bridge Pipe	98 m	Tributary								98														
253			Crossing	Level	Road	Alaska Highway Crossing												1									
254	0.6	254.6	Alluvial	Heavy		Review for potentail aggregate source																	0.6				
254.6	2.4	257	Alluvial	Very Heavy		Cuts and Fills in excess of 30 ft over hummocky terrain, Review for potentail aggregate source																		2.4			
254.6			Bridge	8 m x 60 m	Creek	Judas Creek Construction on Soft Alluvial/Organic Soil	8	60	197																		
255.3			Bridge Pipe	28 m	Tributary								28														
256.1			Crossing	Level	Road	Alaska Highway Crossing												1									
257	7.3	264.3	Till	Heavy																			7.3				
259.8			Crossing	Level	Road	Alaska Highway Crossing												1									
260.5			Bridge Pipe	20 m	Tributary								20														
263			Bridge Pipe	116 m	Tributary								116														
264.3	2.7	267	Fluvial	Heavy		Review for potentail aggregate source																	2.7				
265			Bridge	20 m x 175 m	Creek	Elbow Creek Construction on Soft Alluvial/Organic Soil	20	175		574																	

Watson Lake to Whitehorse

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Size of Civil Structure: Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
267	1	268	Alluvial	Heavy		Review for potentail aggregate source																	1.0				
267.4			Bridge	31 m x 225 m	Creek	Greyling Creek Construction on Soft Alluvial/Organic Soil	31	225			738																
268	5	273	Till	Very Heavy		Large Cuts and Fills																		5.0			
268.3			Bridge Pipe	20 m	Tributary								20														
270.4			Bridge Pipe	40 m	Tributary								40														
273	2.3	275.3	Fluvial	Average		Review for potentail aggregate source																2.3					
275.3	0.7	276	Alluvial	Very Heavy		Review for potentail aggregate source																		0.7			
275.3			Bridge	8 m x 125 m	River	M'Clintock River Construction on Soft Alluvial/Organic Soil	8	125	410																		
276	2	278	Fluvial	Heavy		Review for potentail aggregate source																	2.0				
278	2	280	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			2.0		
278.9			Bridge Pipe	28 m	Tributary								28														
280	4	284	Till	Heavy																			4.0				
280.7			Bridge Pipe	28 m	Tributary								28														
284	8.1	292.1	Fluvial	Heavy		400 ft Riprap Erosion Protection Yukon River, Review for potentail aggregate source																	8.1				
284.5			Crossing	Level	Road	Alaska Highway Crossing												1									
287.8			Bridge Pipe	28 m	Tributary								28														
289			Bridge Pipe	28 m	Tributary								28														
290.7			Bridge Pipe	28 m	Tributary								28														
291.4			Bridge Pipe	28 m	Tributary								28														
292.1	0.1	292.2	Fluvial	Very Heavy		Large Fill over Small Water Body, Review for potentail aggregate source																		0.1			
292.2	6.8	299	Fluvial	Heavy		400 ft Riprap Erosion Protection Yukon River, Review for potentail aggregate source																	6.8				
294			Bridge Pipe	28 m	Tributary								28														
299	7.4	306.4	Till	Heavy																			7.4				
305			Crossing	Level	Road													1									
306.4	2.6	309	Fluvial	Heavy		Review for potentail aggregate source																	2.6				
308.3			Bridge	8 m x 120 m	Creek	Croucher Creek	8	120	394																		
309	2.3	311.3	Eolian	Heavy																			2.3				
311.3	0.7	312	Lacustrine	Average																		0.7					
	312							6,690 m	9,821 ft	4,904 ft	7,216 ft		4,390 m	0.29 M	0.10 M	0.27 M	0.82 M	19 Xings	45 m	90 m		42.7 M	170.5 M	78.2 M	4.3 M	15.3 M	1.0 M
								21,949 ft.	Total bridge length			21,941	14,403 ft.		528 ft		4,330 ft		148 ft.	295 ft.		Total Route Segment Length (miles)					312.0 M
						Count	42	42	30	5	7		93						1	1							
						Check Summary	42	6,690 m	2,995 m	1,495 m	2,200 m		4,390	0.285	0.1	0.265	0.82	19	45	90.0		42.7	170.5	78.2	4.3	15.3	1.0
								21,949 ft.	9,826 ft.	4,905 ft.	7,218 ft.		14,403 ft.														

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
336.4	5.8	342.2	Till	Very Heavy																				5.8			
340.4			Crossing	Rail Overpass	Road	Alaska Highway (14 m x 140 m)														140							
340.5			Crossing	Road Relocation	Road	Town road (Common Structure with Highway overpass)																					
342.2	4	346.2	Till	Average																		4.0					
344.4			Bridge Pipe	28 m	Tributary								28														
346.2	0.2	346.4	Organics	Organic																						0.2	
346.4	0.5	346.9	Till	Average																		0.5					
346.9	0.3	347.2	Organics	Organic																						0.3	
347.2	0.8	348	Till	Average																		0.8					
347.5			Bridge	13 m x 110 m	Creek	Watson Creek	13	110	361																		
348	0.8	348.8	Fluvial	Average		Review for potential aggregate source																0.8					
348.5			Crossing	Rail Overpass	Road	Robert Campbell Highway (7 m x 100 m)														100							
348.7			Bridge	7 m x 90 m	Creek	Watson Creek	7	90	295																		
348.8	0.5	349.3	Organics	Organic																						0.5	
349.3	0.7	350	Fluvial	Average		Review for potential aggregate source																0.7					
350	1.3	351.3	Till	Heavy																			1.3				
351.3	0.2	351.5	Organics	Organic																						0.2	
351.4			Bridge Pipe	80 m	Tributary								80														
351.5	2.5	354	Till	Average																		2.5					
354	3	357	Till	Heavy																			3.0				
357	2	359	Till	Very Heavy																				2.0			
357.5			Bridge Pipe	68 m	Tributary								68														
358			Crossing	Rail Overpass	Road	Robert Campbell Highway (Common Structure with Tom Creek bridge)																					
358.4			Bridge	33 m x 65 m	Creek	Tom Creek	33	65			213																
359	3.6	362.6	Till	Heavy																			3.6				
362.6	5.4	368	Till	Very Heavy																				5.4			
364.9			Bridge Pipe	36 m	Tributary								36														
365.1			Bridge Pipe	40 m	Tributary								40														
365.6			Bridge Pipe	40 m	Tributary								40														
368	0.3	368.3	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
368.2			Bridge	30 m x 200 m	Creek	Cabin Creek	30	200		656																	
368.3	1.9	370.2	Till	Heavy																			1.9				
370.2	0.3	370.5	Organics	Organic																						0.3	
370.5	3.4	373.9	Till	Average																		3.4					
373.9	0.3	374.2	Organics	Organic																						0.3	
374.2	1	375.2	Till	Average																		1.0					
375.2	0.3	375.5	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
375.2	0.3	375.5	Bridge	66 m x 450 m	River	Frances River, 200 ft rip rap erosion protection	66	450				1,476		0.05													
375.5	1	376.5	Till	Average																		1.0					
376.2			Bridge Pipe	28 m	Tributary								28														
376.5	0.4	376.9	Organics	Organic																						0.4	
376.9			Bridge Pipe	28 m	Tributary								28														
376.9	5.1	382	Till	Heavy																			5.1				
378			Bridge Pipe	28 m	Tributary								28														
378.7			Bridge Pipe	28 m	Tributary								28														
380.5			Bridge Pipe	28 m	Tributary								28														
381.6			Bridge Pipe	28 m	Tributary								28														
382	3	385	Bedrock	Rock Grade																					3.0		
382.1			Bridge Pipe	28 m	Tributary								28														
383			Bridge Pipe	28 m	Tributary								28														
385	1.4	386.4	Bedrock	Rock Grade																					1.4		
385.3			Bridge Pipe	110 m	Tributary								110														
386.4	0.2	386.6	Organics	Organic																						0.2	
386.6	5	391.6	Bedrock	Rock Grade																					5.0		
386.9			Bridge	20 m x 150 m	Tributary		20	150		492																	
387.4			Bridge	12 m x 150 m	Tributary		12	150	492																		
387.7			Bridge Pipe	36 m	Tributary								36														
389.4			Bridge Pipe	98 m	Tributary								98														
391.6	1.3	392.9	Alluvial	Heavy		Review for potential aggregate source																	1.3				
391.8			Bridge Pipe	80 m	Tributary								80														
392.5			Bridge Pipe	28 m	Tributary								28														
392.9	0.7	393.6	Bedrock	Rock Grade																					0.7		
393.6	4.4	398	Alluvial	Heavy		Review for potential aggregate source																	4.4				
394			Bridge Pipe	28 m	Tributary								28														
394.5			Bridge Pipe	28 m	Tributary								28														
395.9			Bridge Pipe	92 m	Tributary								92														
397.3			Bridge Pipe	44 m	Tributary								44														
398	4.3	402.3	Bedrock	Rock Grade																					4.3		
398.8			Bridge Pipe	68 m	Tributary								68														

Watson Lake to Carmacks

Terrain Analysis: Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Size of Civil Structure: Bridge Dimensions Height (m)	Bridge Dimensions Length (m)	Brige Length (ft.) by Height Class: < 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Bridge Pipes Length (m)	Erosion Protection Length (mile)	Rock/Snow Shed Length (mile)	Rock Fall Protection Length (mile)	Retaining Walls Length (mile)	Road: Level Xings	Road: Overpass Length (m)	Road: Rail Bridge Length (m)	Tunnel Length (mile)	Grade Construction: Average Length (mile)	Heavy Length (mile)	Very Heavy Length (mile)	Rock Grade Length (mile)	Organic Length (mile)	Permafrost Length (mile)
335	1.4	336.4	Till	Average																		1.4					
399.6			Bridge Pipe	40 m	Tributary								40														
400.3			Bridge Pipe	74 m	Tributary								74														
401.1			Bridge Pipe	86 m	Tributary								86														
402.3	0.4	402.7	Alluvial	Heavy		Review for potential aggregate source																	0.4				
402.5			Bridge	16 m x 150 m	Creek		16	150		492																	
402.6			Bridge Pipe	40 m	Tributary								40														
402.7	2.3	405	Bedrock	Rock Grade																					2.3		
404.8			Bridge Pipe	164 m	Tributary								164														
405	1.5	406.5	Alluvial	Very Heavy		Review for potential aggregate source																		1.5			
405.6			Bridge Pipe	98 m	Tributary								98														
406.3			Bridge Pipe	158 m	Tributary								158														
406.5	9.5	416	Alluvial	Heavy		Review for potential aggregate source																	9.5				
407.4			Bridge Pipe	28 m	Tributary								28														
415.1			Bridge	6 m x 125 m	River	Puchitua River, 200 ft riprap erosion protection	6	125	410					0.05													
416	3	419	Till	Very Heavy										0.5										3.0			
416.1			Bridge Pipe	32 m	Tributary								32														
418.8			Bridge Pipe	68 m	Tributary								68														
419	4.3	423.3	Till	Heavy										0.5									4.3				
419.1			Crossing	level	Road	Robert Campbell Highway												1									
420.4			Bridge Pipe	40 m	Tributary								40														
420.6			Bridge Pipe	28 m	Tributary								28														
422.9			Bridge Pipe	40 m	Tributary								40														
423.3	2.7	426	Organics	Organic																						2.7	
423.6			Bridge Pipe	28 m	Tributary								28														
426	11.8	437.8	Till	Heavy																			11.8				
427.3			Bridge Pipe	80 m	Tributary								80														
429.5			Bridge Pipe	28 m	Tributary								28														
434.8			Bridge Pipe	80 m	Tributary								80														
435			Bridge Pipe	28 m	Tributary								28														
436.2			Bridge Pipe	28 m	Tributary								28														
436.8			Bridge Pipe	28 m	Tributary								28														
437.8	0.2	438	Organics	Organic																						0.2	
438.9			Bridge Pipe	28 m	Tributary								28														
438	4.5	442.5	Till	Heavy																			4.5				
439			Bridge Pipe	28 m	Tributary								28														
442.5	1	443.5	Till	Very Heavy																				1.0			
443.4			Bridge Pipe	68 m	Tributary								68														
443.5	7	450.5	Till	Heavy																			7.0				
444.1			Bridge Pipe	28 m	Tributary								28														
444.8			Bridge Pipe	28 m	Tributary								28														
444.9			Bridge Pipe	28 m	Tributary								28														
447.6			Bridge Pipe	28 m	Tributary								28														
448.8			Bridge Pipe	28 m	Tributary								28														
449.6			Bridge	16 m x 200 m	Tributary		16	200		656																	
450.5	1	451.5	Fluvial	Heavy		Review for potential aggregate source																	1.0				
451.5	1.5	453	Till	Heavy																			1.5				
453	4.7	457.7	Alluvial	Very Heavy		Review for potential aggregate source																		4.7			
453.8			Bridge Pipe	32 m	Tributary								32														
455			Bridge Pipe	28 m	Tributary								28														
455.7			Bridge Pipe	28 m	Tributary								28														
456			Bridge Pipe	28 m	Tributary								28														
456.4			Bridge Pipe	40 m	Tributary								40														
456.7			Bridge Pipe	68 m	Tributary								68														
457.7	0.2	457.9	Bedrock	Rock Grade																					0.2		
457.8			Bridge	65 m x 200 m	Creek	Money Creek	65	200				656															
457.9	0.6	458.5	Till	Very Heavy																				0.6			
458.3			Bridge Pipe	68 m	Tributary								68														
458.5	0.5	459	Organics	Organic																						0.5	
458.8			Bridge Pipe	28 m	Tributary								28														
459	1.3	460.3	Till	Very Heavy																				1.3			
460.3	3.4	463.7	Alluvial	Very Heavy		Review for potential aggregate source																		3.4			
460.6			Bridge Pipe	32 m	Tributary								32														
461.8			Bridge Pipe	28 m	Tributary								28														
462.3			Bridge Pipe	28 m	Tributary								28														
462.5			Bridge Pipe	28 m	Tributary								28														
463			Bridge Pipe	28 m	Tributary								28														
463.3			Bridge Pipe	28 m	Tributary								28														
463.7	0.4	464.1	Permafrost	Permafrost																							0.4
463.8			Bridge Pipe	40 m	Tributary								40														
464			Bridge Pipe	28 m	Tributary								28														
464.1	7.1	471.2	Till	Very Heavy																				7.1			
464.3			Crossing	Road Overpass	Rail	Robert Campbell Highway (12 m x 60 m)													60								
465.9			Bridge Pipe	128 m	Tributary								128														
468.3			Bridge Pipe	108 m	Tributary								108														

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
468.4			Bridge Pipe	28 m	Tributary								28														
471.2	0.6	471.8	Alluvial	Very Heavy		Review for potential aggregate source																		0.6			
471.6			Bridge Pipe	140 m	Tributary								140														
471.8	4.8	476.6	Till	Very Heavy																				4.8			
471.9			Crossing	Rail Overpass	Road	Robert Campbell Highway (10 m x 60 m)														60							
472.1			Bridge Pipe	28 m	Tributary								28														
472.9			Bridge Pipe	28 m	Tributary								28														
473.3			Bridge Pipe	28 m	Tributary								28														
473.5			Bridge Pipe	28 m	Tributary								28														
473.7			Crossing	Level	Road	Robert Campbell Highway												1									
473.7			Bridge Pipe	28 m	Tributary								28														
474			Bridge Pipe	28 m	Tributary								28														
474.5			Bridge Pipe	134 m	Tributary								134														
474.7			Bridge Pipe	28 m	Tributary								28														
475.1			Crossing	Level	Road	Robert Campbell Highway												1									
475.4			Bridge Pipe	28 m	Tributary								28														
476.6	1.1	477.7	Fluvial	Heavy		Review for potential aggregate source																	1.1				
476.8			Bridge Pipe	28 m	Tributary								28														
477.7	0.5	478.2	Alluvial	Heavy		Review for potential aggregate source																	0.5				
477.9			Bridge Pipe	28 m	Tributary								28														
478.2	1	479.2	Till	Heavy																			1.0				
479.2	1.9	481.1	Colluvial	Very Heavy																				1.9			
481.1	1.4	482.5	Alluvial	Heavy		Review for potential aggregate source																	1.4				
481.3			Bridge Pipe	28 m	Tributary								28														
481.8			Bridge	20 m x 175 m	Tributary		20	175		574																	
482.5	2.4	484.9	Colluvial	Very Heavy																				2.4			
484.9	1.7	486.6	Permafrost	Permafrost																							1.7
486.6	0.9	487.5	Alluvial	Heavy		Review for potential aggregate source																	0.9				
487			Bridge Pipe	28 m	Tributary								28														
487.5	2.4	489.9	Permafrost	Permafrost																							2.4
487.9			Bridge Pipe	36 m	Tributary								36														
488.4			Bridge Pipe	68 m	Tributary								68														
489.3			Bridge Pipe	28 m	Tributary								28														
489.9	1.9	491.8	Alluvial	Heavy		Review for potential aggregate source																	1.9				
490.6			Bridge Pipe	80 m	Tributary								80														
490.8			Bridge Pipe	80 m	Tributary								80														
491.3			Bridge Pipe	28 m	Tributary								28														
491.8	14.8	506.6	Permafrost	Permafrost																							14.8
494.3			Bridge Pipe	28 m	Tributary								28														
494.5			Bridge Pipe	28 m	Tributary								28														
495.9			Bridge Pipe	28 m	Tributary								28														
496			Crossing	Level	Road	Robert Campbell Highway												1									
499.1			Bridge Pipe	28 m	Tributary								28														
500.5			Bridge Pipe	28 m	Tributary								28														
501.1			Bridge Pipe	28 m	Tributary								28														
502.2			Bridge Pipe	28 m	Tributary								28														
502.9			Bridge Pipe	28 m	Tributary								28														
503.1			Crossing	Road Overpass	Rail	Robert Campbell Highway (10 m x 60 m)													60								
504.5			Bridge Pipe	28 m	Tributary								28														
505.1			Bridge Pipe	28 m	Tributary								28														
505.3			Bridge Pipe	28 m	Tributary								28														
506.3			Bridge	30 m x 200 m	Creek	Campbell Creek	30	200		656																	
506.6	0.7	507.3	Alluvial	Very Heavy		Review for potential aggregate source																		0.7			
506.9			Bridge Pipe	44 m	Tributary								44														
507.3	0.6	507.9	Bedrock	Rock Grade																					0.6		
507.9	0.4	508.3	Alluvial	Heavy		Review for potential aggregate source																	0.4				
508			Bridge Pipe	40 m	Tributary								40														
508.3	3.7	512	Permafrost	Permafrost																							3.7
512	0.3	512.3	Alluvial	Heavy		Review for potential aggregate source																	0.3				
512.1			Bridge Pipe	68 m	Tributary								68														
512.3	2.2	514.5	Permafrost	Permafrost																							2.2
514.5	1.5	516	Permafrost	Permafrost																							1.5
516	4.7	520.7	Till	Average																		4.7					
517.2			Bridge Pipe	74 m	Tributary								74														
520			Bridge Pipe	164 m	Tributary								164														
520.7	0.2	520.9	Fluvial	Very Heavy		Review for potential aggregate source																		0.2			
520.8			Bridge	15 m x 175 m	Creek	Big Campbell Creek	15	175	574																		
520.9	5.5	526.4	Till	Average																		5.5					
521.7			Bridge Pipe	28 m	Tributary								28														

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure																Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
523.6			Bridge Pipe	74 m	Tributary								74														
526.4	6.6	533	Fluvial	Average		Review for potential aggregate source																6.6					
527.5			Bridge	6 m x 30 m	Creek	Mink Creek	6	30	98																		
528.1			Bridge Pipe	68 m	Tributary								68														
529.7			Bridge Pipe	20 m	Tributary								20														
532.2			Bridge Pipe	98 m	Tributary								98														
533	7.3	540.3	Till	Heavy																			7.3				
536.2			Bridge Pipe	28 m	Tributary								28														
540.3	3	543.3	Fluvial	Average		Review for potential aggregate source																3.0					
540.9			Bridge Pipe	28 m	Tributary								28														
541.4			Bridge Pipe	28 m	Tributary								28														
543.3	1	544.3	Till	Average																		1.0					
544.3	0.4	544.7	Organics	Organic																						0.4	
544.7	0.7	545.4	Till	Average																		0.7					
545.4	0.4	545.8	Fluvial	Very Heavy		Review for potential aggregate source																		0.4			
545.6			Bridge	32 m x 350 m	River	200 ft of riprap along erosion control	32	350			1,148			0.05													
545.8	8.9	554.7	Till	Heavy																			8.9				
552.6			Bridge	30 m x 300 m	Creek	Starr Creek	30	300		984																	
554.7	0.2	554.9	Permafrost	Permafrost																							0.2
554.9	1.6	556.5	Till	Average																		1.6					
556.5	1.3	557.8	Fluvial	Average		Review for potential aggregate source																1.3					
557.8	0.5	558.3	Permafrost	Permafrost																							0.5
558.3	2.1	560.4	Fluvial	Average		Review for potential aggregate source																2.1					
559.2			Bridge Pipe	28 m	Creek	Horton Creek							28														
559.9			Bridge Pipe	28 m	Tributary								28														
560.4	7.1	567.5	Till	Heavy																			7.1				
561.6			Bridge Pipe	28 m	Tributary								28														
563.1			Bridge Pipe	28 m	Tributary								28														
564.2			Bridge Pipe	28 m	Tributary								28														
564.5			Bridge Pipe	28 m	Tributary								28														
565.5			Bridge Pipe	28 m	Tributary								28														
566.4			Bridge Pipe	28 m	Tributary								28														
567.2			Bridge Pipe	28 m	Tributary								28														
567.5	3.4	570.9	Fluvial	Average		Review for potential aggregate source																3.4					
567.8			Bridge Pipe	20 m	Tributary								20														
570.9	0.3	571.2	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
571			Bridge	10 m x 60 m	River	Ketza River, 200 ft riprap erosion control	10	60	197					0.05													
571.2	1.2	572.4	Till	Average																		1.2					
572.4	4.6	577	Fluvial	Average		Review for potential aggregate source																4.6					
572.9			Bridge Pipe	86 m	Tributary								86														
575.1			Bridge Pipe	36 m	Tributary								36														
576.2			Bridge Pipe	20 m	Tributary								20														
577	5.4	582.4	Alluvial	Average		Review for potential aggregate source																5.4					
577.5			Bridge Pipe	20 m	Tributary								20														
579.5			Bridge Pipe	20 m	Tributary								20														
579.9			Bridge Pipe	20 m	Tributary								20														
582.4	0.1	582.5	Organics	Organic																						0.1	
582.5	1.7	584.2	Alluvial	Average		Review for potential aggregate source																1.7					
584.2	0.5	584.7	Fluvial	Very Heavy		Review for potential aggregate source																		0.5			
584.5	0.2	584.7	Bridge	30 m x 325 m	River	Lapie River, 200 ft riprap erosion protection	30	325		1,066				0.05													
584.7	1.5	586.2	Fluvial	Average		Review for potential aggregate source																1.5					
586.2	1.1	587.3	Till	Average																		1.1					
587.3	2.1	589.4	Fluvial	Average		Review for potential aggregate source																2.1					
587.3			Bridge Pipe	20 m	Tributary								20														
589.4	0.2	589.6	Fluvial	Very Heavy		Review for potential aggregate source																		0.2			
589.5			Bridge	17 m x 250 m	Creek	Danger Creek	17	250		820																	
589.6	2.4	592	Till	Heavy																			2.4				
592	0.2	592.2	Alluvial	Heavy		Review for potential aggregate source																	0.2				
592.1			Bridge Pipe	104 m	Tributary								104														
592.2	1.8	594	Till	Very Heavy																				1.8			
594	4.1	598.1	Till	Very Heavy																				4.1			
594.3			Crossing	Rail Overpass	Road	Robert Campbell Highway (12 m x 130 m)													12								

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
595.6			Crossing	Hwy Relocation	Road	Robert Campbell Highway																					
598.1	0.4	598.5	Bedrock	Rock Grade																					0.4		
598.3			Bridge	40 m x 300 m	Creek	Grew Creek	40	300			984																
598.5	15	613.5	Till	Heavy																			15.0				
603.6			Crossing	Level	Road	Robert Campbell Highway												1									
605.8			Bridge Pipe	24 m	Tributary								24														
607.4			Bridge Pipe	28 m	Tributary								28														
609.6			Bridge Pipe	98 m	Tributary								98														
610.3			Crossing	Level	Road	Robert Campbell Highway												1									
611.5			Crossing	Hwy Relocation	Road	Robert Campbell Highway																					
612.5			Crossing	Hwy Relocation	Road	Robert Campbell Highway																					
613.5	0.4	613.9	Permafrost	Permafrost																							0.4
613.9	21	634.9	Till	Heavy																			21.0				
614.1			Bridge Pipe	140 m	Tributary								140														
616.7			Bridge Pipe	36 m	Tributary								36														
618.5			Bridge Pipe	36 m	Tributary								36														
618.8			Bridge Pipe	28 m	Tributary								28														
620			Bridge Pipe	28 m	Tributary								28														
622.8			Crossing	Level		Robert Campbell Highway																					
622.9			Bridge Pipe	68 m	Tributary								68														
625			Bridge Pipe	68 m	Tributary								68														
626.5			Bridge Pipe	28 m	Tributary								28														
629.1			Bridge Pipe	28 m	Tributary								28														
629.5			Crossing	Level	Road	Robert Campbell Highway												1									
629.8			Bridge Pipe	28 m	Tributary								28														
630.3			Bridge Pipe	28 m	Tributary								28														
630.4			Crossing	Level	Road	Robert Campbell Highway												1									
631.2			Bridge Pipe	28 m	Tributary								28														
632.2			Bridge Pipe	28 m	Tributary								28														
632.7			Bridge Pipe	28 m	Tributary								28														
633.8			Bridge Pipe	28 m	Tributary								28														
634.9	0.8	635.7	Alluvial	Heavy		Review for potential aggregate source																	0.8				
635.7	0.3	636	Till	Average																		0.3					
636	3.6	639.6	Alluvial	Average		Review for potential aggregate source																3.6					
636.3			Bridge Pipe	28 m	Tributary								28														
637			Crossing	Level	Road	Robert Campbell Highway												1									
638.4			Bridge Pipe	40 m	Tributary								40														
639.6	1.2	640.8	Colluvial	Heavy																			1.2				
640.2			Crossing	Level	Road	Robert Campbell Highway												1									
640.8	1.7	642.5	Alluvial	Average		Review for potential aggregate source																1.7					
641.3			Bridge Pipe	28 m	Tributary								28														
641.7			Crossing	Level	Road	Robert Campbell Highway												1									
642.3			Bridge Pipe	28 m	Tributary								28														
642.5	0.9	643.4	Colluvial	Average																		0.9					
643.3			Bridge Pipe	40 m	Tributary								40														
643.4	3.7	647.1	Alluvial	Average		Review for potential aggregate source																3.7					
645.9			Crossing	Level	Road	Robert Campbell Highway												1									
646.7			Bridge Pipe	48 m	Tributary								48														
647.1	0.9	648	Till	Heavy																			0.9				
648	2.8	650.8	Colluvial	Very Heavy																				2.8			
648			Bridge	10 m x 30 m	Tributary	debris flow	10	30	98																		
650.5			Bridge Pipe	248 m	Tributary								248														
650.8	0.2	651	Bedrock	Rock Grade		Rock Shed along 50% of grade length									0.1										0.2		
651	2.3	653.3	Colluvial	Very Heavy																				2.3			
653.3	1	654.3	Fluvial	Heavy		Review for potential aggregate source																	1.0				
653.8			Bridge Pipe	40 m	Tributary								40														
654.3	0.3	654.6	Alluvial	Heavy		Review for potential aggregate source																	0.3				
654.5			Bridge Pipe	36 m	Tributary								36														
654.6	2.5	657.1	Till	Heavy																			2.5				
657.1	0.8	657.9	Fluvial	Heavy		Review for potential aggregate source																	0.8				
657.5			Bridge Pipe	146 m	Tributary								146														
657.9	0.4	658.3	Alluvial	Very Heavy		Review for potential aggregate source																		0.4			
658.1			Bridge	53 m x 450 m	Tributary		53	450			1,476																

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
658.3	0.7	659	Fluvial	Heavy		Review for potential aggregate source																	0.7				
658.6			Bridge Pipe	98 m	Tributary								98														
659	4.1	663.1	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										1								4.1			
659.8			Bridge	6 m x 30 m	Tributary	debris flow	6	30	98																		
660.2			Bridge	13 m x 200 m	Tributary	debris flow	13	200	656																		
661.1			Bridge	20 m x 225 m	Tributary	debris flow	20	225		738																	
662			Bridge	14 m x 225 m	Tributary	debris flow	14	225	738																		
663.1	0.4	663.5	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.4			
663.3			Bridge	38 m x 275 m	Tributary	debris flow	38	275			902																
663.5	2.5	666	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.5								2.5			
666	0.4	666.4	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.4			
666.2			Bridge	23 m x 150 m	Tributary	debris flow	23	150		492																	
666.4	0.6	667	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.1								0.6			
667	0.5	667.5	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.5			
667.2			Bridge	23 m x 200 m	Tributary	debris flow	23	200		656																	
667.5	1	668.5	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.2								1.0			
668.5	0.3	668.8	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.3			
668.6			Bridge	25 m x 175 m	Tributary	debris flow	25	175		574																	
668.8	0.8	669.6	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.2								0.8			
669.6	0.4	670	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.4			
669.8			Bridge	28 m x 250 m	Tributary	debris flow	28	250		820																	
670	0.4	670.4	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.1								0.4			
670.4	0.2	670.6	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.05								0.2			
670.5			Bridge	9 m x 125 m	Tributary	debris flow	9	125	410																		
670.6	0.6	671.2	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.1								0.6			
671.2	0.3	671.5	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.3			
671.4			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
671.5	1	672.5	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.2								1.0			
672.5	0.5	673	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.1								0.5			
672.7			Bridge	25 m x 150 m	Tributary	debris flow	25	150		492																	
673	1	674	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										0.2								1.0			

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Size of Civil Structure: Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
674	1.3	675.3	Alluvial	Very Heavy		Rock Fall Protection along 20% of grade length, Review for potential aggregate source										0.2								1.3			
674.3			Bridge	22 m x 190 m	Tributary	debris flow	22	190		623																	
675			Bridge	21 m x 200 m	Tributary	debris flow	21	200		656																	
675.3	3.5	678.8	Colluvial	Very Heavy		Rock Fall Protection along 20% of grade length										1								3.5			
678.8	0.5	679.3	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
679			Bridge Pipe	92 m	Tributary								92														
679.3	1.7	681	Lacustrine	Very Heavy																				1.7			
680.7			Crossing	Level	Road	Robert Campbell Highway												1									
681	2.7	683.7	Lacustrine	Average																		2.7					
681			Bridge Pipe	32 m	Tributary								32														
681.1			Bridge Pipe	28 m	Tributary								28														
681.5			Crossing	Level	Road	Robert Campbell Highway												1									
681.8			Bridge Pipe	28 m	Tributary								28														
682.5			Bridge Pipe	36 m	Tributary								36														
683.7	0.4	684.1	Alluvial	Average		Review for potential aggregate source																0.4					
683.9			Bridge	6 m x 30 m	Creek	Bearfeed Creek	6	30	98																		
684.1	1.9	686	Lacustrine	Average																		1.9					
686	0.2	686.2	Fluvial	Heavy		Review for potential aggregate source																	0.2				
686.1			Bridge Pipe	28 m	Tributary								28														
686.2	4.3	690.5	Fluvial	Average		Review for potential aggregate source																4.3					
688.1			Bridge Pipe	20 m	Tributary								20														
688.9			Crossing	Level	Road	Robert Campbell Highway												1									
690			Crossing	Level	Road	Robert Campbell Highway												1									
690.5	0.5	691	Fluvial	Heavy		Review for potential aggregate source																	0.5				
691	0.6	691.6	Fluvial	Average		Review for potential aggregate source																0.6					
691.6	0.3	691.9	Alluvial	Average		Review for potential aggregate source																0.3					
691.8			Bridge Pipe	68 m	Tributary								68														
691.9	1.6	693.5	Fluvial	Average		Review for potential aggregate source																1.6					
693.5	3.5	697	Alluvial	Heavy		Review for potential aggregate source																	3.5				
697	1.7	698.7	Alluvial	Very Heavy		Review for potential aggregate source																		1.7			
697.2			Bridge Pipe	28 m	Tributary								28														
698.7	2.5	701.2	Fluvial	Average		Review for potential aggregate source																2.5					
701.2	1.7	702.9	Fluvial	Very Heavy		Review for potential aggregate source																		1.7			
701.9			Bridge Pipe	98 m	Tributary								98														
702			Bridge Pipe	20 m	Tributary								20														
702.2			Bridge Pipe	20 m	Tributary								20														
702.7			Crossing	Level	Road	Robert Campbell Hwy												1									
702.9	1.6	704.5	Colluvial	Very Heavy																				1.6			
703			Bridge Pipe	20 m	Tributary								20														
704.5	0.3	704.8	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
704.7			Bridge Pipe	20 m	Tributary								20														
704.8	1.7	706.5	Colluvial	Very Heavy		Rock Fall Protection along 10% of grade length										0.2								1.7			
705.5			Bridge Pipe	28 m	Tributary								28														
706			Bridge Pipe	68 m	Tributary								68														
706.4			Bridge Pipe	158 m	Tributary								158														
706.5	2	708.5	Fluvial	Heavy		Review for potential aggregate source																	2.0				
708.5	1.4	709.9	Fluvial	Average		Review for potential aggregate source																1.4					
709.9	0.3	710.2	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
710			Bridge	8 m x 30 m	Tributary		8	30	98																		
710.2	1	711.2	Fluvial	Average		Review for potential aggregate source																1.0					
711.2	1.3	712.5	Bedrock	Rock Grade		Rock Fall Protection along 10% of grade length, Rock shed 300 ft									0.06	0.1									1.3		

Watson Lake to Carmacks

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
335	1.4	336.4	Till	Average																		1.4					
712.5	0.3	712.8	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
712.7			Bridge	30 m x 300 m	Tributary	debris flow	30	300		984																	
712.8	0.8	713.6	Colluvial	Very Heavy		Rock Fall Protection along 10% of grade length										0.1								0.8			
713.6	0.3	713.9	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
713.7			Bridge Pipe	80 m	Tributary								80														
713.9	0.2	714.1	Bedrock	Rock Grade		Rock Shed 10% along grade length									0.02										0.2		
714.1	1.7	715.8	Alluvial	Heavy		Review for potential aggregate source																	1.7				
714.8			Bridge Pipe	20 m	Tributary								20														
715			Bridge Pipe	20 m	Tributary								20														
715.8	2.3	718.1	Fluvial	Average		Review for potential aggregate source																2.3					
716.4			Crossing	Level	Road	Robert Campbell Hwy												1									
716.5			Bridge Pipe	36 m	Tributary								36														
717.7			Bridge Pipe	28 m	Tributary								28														
718.1	3	721.1	Bedrock	Rock Grade		Rock Fall Protection along 20% of grade length, Rock Shed over 10 % of grade length									0.3	0.6									3.0		
720.5			Crossing	Level	Road	Robert Campbell Hwy												1									
721.1	1.3	722.4	Alluvial	Heavy		Review for potential aggregate source																	1.3				
722.4	0.4	722.8	Bedrock	Rock Grade																					0.4		
722.8	0.8	723.6	Alluvial	Very Heavy		Erosion Control along 50% of grade length										0.4								0.8			
722.9			Crossing	Level	Road	Robert Campbell Hwy												1									
723.3			Bridge Pipe	36 m	Tributary								36														
723.6	0.4	724	Bedrock	Rock Grade		Rock Shed along 10% of grade length, Erosion Control along 100% of grade length								0.4	0.04										0.4		
724	1.5	725.5	Alluvial	Heavy		Review for potential aggregate source																	1.5				
724.4			Crossing	Level	Road	Robert Campbell Hwy												1									
725.5			Crossing	Level	Road	Robert Campbell Hwy												1									
725.5	4.3	729.8	Fluvial	Very Heavy		Erosion Control along 50% of grade length, Review for potential aggregate source								2.1										4.3			
726			Bridge Pipe	20 m	Tributary								20														
727.1			Bridge Pipe	20 m	Tributary								20														
727.5			Crossing	Level	Road	Robert Campbell Hwy												1									
729.8	0.4	730.2	Alluvial	Very Heavy		Review for potential aggregate source																		0.4			
730			Bridge Pipe	20 m	Tributary								20														
730.2	1.8	732	Fluvial	Very Heavy		Erosion Control along 50% of grade length, Review for potential aggregate source								0.9										1.8			
730.5			Crossing	Level	Road	Robert Campbell Hwy												1									
731.8			Bridge Pipe	20 m	Tributary								20														
732	2	734	Fluvial	Heavy		Erosion Control along 50% of grade length, Review for potential aggregate source								1									2.0				
734	4	738	Fluvial	Very Heavy		Erosion Control along 50% of grade length, Review for potential aggregate source								2										4.0			
734.9			Bridge Pipe	20 m	Tributary								20														
735.8			Crossing	Level	Road	Robert Campbell Hwy												1									
736.2			Crossing	Level	Road	Robert Campbell Hwy												1									
								7,320 m	4,721 ft.	12,431 ft.	4,723 ft.	2,132 ft.	8,680 m	7.65	0.52	5.95	0	26 Xings	132 m	300 m	0.0 M	92.8 M	150.9 M	101.8 M	23.4 M	6.3 M	27.8 M
								24,016 ft.	Total bridge length			24,007	28,478 ft.		2,746 ft		0 ft		433 ft.	984 ft.		Total Route Segment Length (miles)					403.0 M
						Count	40	40	15	18	5	2	190						3	3							
						Check Summary		7,320 m	1,440 m	3,790 m	1,440 m	650 m	8,680 m	7.65	0.52	5.95	0	27	7.0			92.8	150.9	101.8	23.4	6.3	27.8
									4,724 ft	12,434 ft	4,724 ft	2,133 ft	28,478 ft					1 Relocation	1 joint under river xing								

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
312	2.3	314.3	Lacustrine	Average																		2.3					
314.3	0.3	314.6	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
314.4			Bridge	45 m x 1350 m	River	Yukon River 200 ft Riprap Erosion Protection	45	1350			4,429																
314.6	0.4	315	Fluvial	Heavy		Review for potential aggregate source																	0.4				
315	1	316	Lacustrine	Heavy																			1.0				
315.4			Bridge Pipe	152 m	Tributary								152														
315.5			Crossing	Overpass 7 m x 100 m	Road	Klondike Highway Crossing														100							
316	0.5	316.5	Fluvial	Heavy		Review for potential aggregate source																	0.5				
316.5	0.8	317.3	Lacustrine	Heavy																			0.8				
317			Bridge Pipe	28 m	Tributary								28														
317.3	5.4	322.7	Fluvial	Heavy		Review for potential aggregate source																	5.4				
318.8			Bridge Pipe	116 m	Tributary								116														
320.8			Bridge	8 m x 30 m	Tributary		8	30	98																		
322.5			Bridge Pipe	68 m	Tributary								68														
322.7	3.3	326	Fluvial	Heavy		Review for potential aggregate source																	3.3				
324.2			Bridge Pipe	28 m	Tributary								28														
324.5			Bridge Pipe	28 m	Tributary								28														
325.5			Crossing	Level	Road	Alaska Highway Crossing												1									
326	4.8	330.8	Lacustrine	Heavy																			4.8				
328.1			Bridge Pipe	28 m	Tributary								28														
329.5			Bridge Pipe	28 m	Tributary								28														
329.8			Bridge Pipe	28 m	Tributary								28														
330.5			Crossing	Level	Road	Alaska Highway Crossing												1									
330.8	4.9	335.7	Permafrost	Permafrost																							4.9
331			Bridge Pipe	28 m	Tributary								28														
333.8			Bridge Pipe	28 m	Tributary								28														
335.7	0.8	336.5	Alluvial	Very Heavy		Review for potential aggregate source																		0.8			
336.1			Bridge	10 m x 400 m	River	Takhini River 200 ft Riprap Erosion Protection	10	400	1,312																		
336.5	1.2	337.7	Lacustrine	Heavy																			1.2				
337.7	8	345.7	Lacustrine	Average																		8.0					
338			Crossing	Level	Road	Alaska Highway Crossing												1									
339.2			Bridge Pipe	68 m	Tributary								68														
342.5			Bridge Pipe	68 m	Tributary								68														
344			Bridge Pipe	68 m	Tributary								68														
345.7	0.8	346.5	Alluvial	Heavy		Review for potential aggregate source																	0.8				
346.2			Bridge	13 m x 200 m	Creek	Stony Creek	13	200	656																		
346.5	2.3	348.8	Lacustrine	Heavy																			2.3				
348.8	0.5	349.3	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
349.3	0.5	349.8	Lacustrine	Heavy																			0.5				
349.8	0.7	350.5	Alluvial	Very Heavy		Review for potential aggregate source																		0.7			
350.3			Bridge Pipe	28 m	Tributary								28														
350.5	2.5	353	Lacustrine	Heavy																			2.5				
352.8			Bridge Pipe	28 m	Tributary								28														
353	4	357	Permafrost	Permafrost																							4.0
355.8			Bridge Pipe	28 m	Tributary								28														
357	1.2	358.2	Lacustrine	Average																		1.2					
357.8			Crossing	Level	Road	Alaska Highway Crossing												1									
358.2	0.4	358.6	Alluvial	Very Heavy		Review for potential aggregate source																		0.4			
358.3			Bridge	10 m x 500 m	River	Mendenhall River 200 ft Riprap Protection	10	500	1,640																		
358.6	3.4	362	Lacustrine	Average																		3.4					
362	1.6	363.6	Eolian	Average																		1.6					
363.3			Bridge Pipe	28 m	Tributary								28														
363.6	0.4	364	Organics	Organics																						0.4	
363.7			Bridge Pipe	28 m	Tributary								28														
364	0.3	364.3	Eolian	Heavy																			0.3				
364.1			Bridge Pipe	28 m	Tributary								28														
364.3	0.7	365	Eolian	Heavy																			0.7				
365	0.6	365.6	Organics	Organics																						0.6	
365.6	0.8	366.4	Eolian	Heavy																			0.8				
366.4	0.2	366.6	Lacustrine	Heavy																			0.2				
366.5			Bridge Pipe	28 m	Tributary								28														
366.6	3.4	370	Eolian	Heavy																			3.4				
368			Bridge Pipe	28 m	Tributary								28														
370	0.4	370.4	Colluvial	Heavy																			0.4				
370.1			Bridge Pipe	92 m	Tributary								92														

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
370.2			Crossing	Level	Road	Alaska Highway Crossing												1									
370.4	1.1	371.5	Eolian	Heavy																			1.1				
371.5	0.5	372	Eolian	Very Heavy																				0.5			
371.8			Bridge	8 m x 30 m	Tributary		8	30	98																		
372	5	377	Eolian	Heavy																			5.0				
377	2.2	379.2	Lacustrine	Heavy																			2.2				
378			Crossing	Level	Road	Alaska Highway Crossing												1									
379.2	0.8	380	Till	Heavy																			0.8				
380	0.5	380.5	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
380.4			Bridge	15 m x 230 m	Creek	Cracker Creek	15	230	755																		
380.5	0.5	381	Eolian	Heavy																			0.5				
381	0.6	381.6	Organics	Organics																						0.6	
381.6	9.4	391	Lacustrine	Heavy																			9.4				
384.6			Bridge Pipe	68 m	Tributary								68														
385.5			Bridge Pipe	68 m	Tributary								68														
388.6			Bridge	10 m x 100 m	Creek	Wagga Creek	10	100	328																		
389.4			Crossing	Level	Road	Aishihik Road												1									
391	1	392	Alluvial	Very Heavy		Large fills																		1.0			
391.6			Bridge	50 m x 500 m	River	Aishihik River 200 ft Riprap Protection	50	500			1,640																
392	1.3	393.3	Eolian	Heavy																			1.3				
393.3	0.3	393.6	Alluvial	Heavy		Review for potential aggregate source																	0.3				
393.5			Bridge Pipe	140 m	Tributary								140														
393.6	0.9	394.5	Eolian	Heavy																			0.9				
394.5	2.3	396.8	Till	Heavy																			2.3				
396.8	1.2	398	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			1.2		
398	2.7	400.7	Till	Heavy																			2.7				
400.7	0.8	401.5	Alluvial	Heavy		Review for potential aggregate source																	0.8				
401.3			Bridge Pipe	68 m	Tributary								68														
401.5	1.1	402.6	Till	Heavy																			1.1				
402.6	0.4	403	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			0.4		
403	1.6	404.6	Till	Heavy																			1.6				
404.3			Bridge	8 m x 30 m	Tributary		8	30	98																		
404.6	0.4	405	Till	Heavy																			0.4				
405	0.3	405.3	Till	Very Heavy		Large Fills																		0.3			
405.1			Bridge	62 m x 450 m	Creek	Marshall Creek	62	450				1,476															
405.3	2.2	407.5	Till	Heavy																			2.2				
407.5	1	408.5	Bedrock	Rock		Rock and Snow Shed Protection on Paint Mountain over 20%, Rock Fall Protection over 20% Grade Length									0.2										1.0		
408.5	1.7	410.2	Till	Very Heavy		Rock and Snow Shed Protection on Paint Mountain over 20% of Grade Length									0.34									1.7			
409			Bridge	8 m x 30 m	Tributary		8	30	98																		
410.2	2.5	412.7	Bedrock	Tunnel	Tunnel	2.5 Mile Tunnel Through Paint Mountain															2.5						
412.7	6.3	419	Till	Very Heavy		Large Cuts and Fills																		6.3			
413.8			Bridge	8 m x 30 m	Tributary		8	30	98																		
415.5			Bridge Pipe	68 m	Tributary								68														
415.9			Bridge Pipe	68 m	Tributary								68														
417.4			Bridge	13 m x 225 m	Creek	Marl Creek	13	225	738																		
419	1	420	Organics	Organics																						1.0	
420	1.2	421.2	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			1.2		
421.2	0.3	421.5	Till	Heavy																			0.3				
421.5	1	422.5	Organics	Organics																						1.0	
422.5	1.3	423.8	Alluvial	Heavy		Review for potential aggregate source																	1.3				
422.5			Bridge Pipe	68 m	Tributary								68														
422.8			Bridge Pipe	128 m	Tributary								128														
423.8	0.5	424.3	Organics	Organics																						0.5	
424.2			Bridge Pipe	68 m	Tributary								68														
424.3	5	429.3	Till	Heavy																			5.0				
426.8			Bridge Pipe	68 m	Tributary								68														
429.2			Bridge Pipe	116 m	Tributary								116														
429.3	5.3	434.6	Permafrost	Permafrost																							5.3
433.4			Bridge	10 m x 450 m	River	Jarvis River 200 ft Riprap Protection, Difficult Foundations, Construction over Permafrost	10	450	1,476																		
434			Bridge Pipe	28 m	Tributary								28														
434.6	5	439.6	Till	Heavy																			5.0				

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
435.5			Bridge Pipe	28 m	Tributary								28														
438.2			Bridge Pipe	28 m	Tributary								28														
439.6	0.6	440.2	Bedrock	Rock		Rock Sheds over 10% of Grade Length, Rock Fall Protection over 20% Grade Length									0.06										0.6		
440.2	2.6	442.8	Till	Heavy																			2.6				
440.6			Bridge Pipe	68 m	Tributary								68														
441.5			Bridge Pipe	68 m	Tributary								68														
441.7			Bridge Pipe	68 m	Tributary								68														
442			Crossing	Level	Road	Alaska Highway Crossing												1									
442.5			Bridge Pipe	28 m	Tributary								28														
442.8	0.2	443	Organics	Organics																						0.2	
443	1.5	444.5	Till	Heavy																			1.5				
443.7			Bridge Pipe	28 m	Tributary								28														
444.4			Bridge Pipe	28 m	Tributary								28														
444.5	5.5	450	Alluvial	Very Heavy		Large Cuts and Fills, Review for potential aggregate source																		5.5			
444.7			Bridge	8 m x 100 m	Creek	Sulphur Creek	8	100	328																		
445.4			Bridge Pipe	28 m	Tributary								28														
447.2			Bridge Pipe	28 m	Tributary								28														
449			Bridge Pipe	28 m	Tributary								28														
449.8			Bridge	8 m x 60 m	Creek	Boutellier Creek	8	60	197																		
450	1	451	Colluvial	Very Heavy		Large Cuts and Fills																		1.0			
451	0.5	451.5	Fluvial	Very Heavy		Large Cuts and Fills, Review for potential aggregate source																		0.5			
451.4			Crossing	Level	Road	Alaska Highway Crossing												1									
451.5	0.5	452	Organics	Organics																						0.5	
452	1	453	Till	Very Heavy		Large Cuts and Fills																		1.0			
453	3.3	456.3	Alluvial	Very Heavy		Large Cuts and Fills, Review for potential aggregate source																		3.3			
454.4			Crossing	Level	Road	Alaska Highway Crossing												1									
454.9			Bridge	16 m x 375 m	Creek	Silver Creek 200 ft Riprap Protection, Glacial Outwash Channel	16	375		1,230																	
455.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
455.7			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
455.8			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
456.3			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
456.3	2.4	458.7	Till	Very Heavy		Large Cuts and Fills																		2.4			
457.3			Bridge	8 m x 60 m	Creek	Topham Creek 200 ft Riprap Protection, Glacial Outwash Channel	8	60	197																		
458.2			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
458.3			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
458.6			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
458.7	2.9	461.6	Colluvial	Very Heavy		Rock Sheds over 10% of Grade Length									0.29									2.9			
458.8			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
459.3			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
460			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
460.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
461.6	3	464.6	Alluvial	Very Heavy		Large Cuts and Fills, Review for potential aggregate source																		3.0			
463.3			Bridge	23 m x 300 m	Creek	Vulcan Creek 200 ft Riprap Protection, Glacial Outwash Channel	23	300		984																	
463.4			Bridge	8 m x 30 m	Tributary	200 ft Riprap Protection, Glacial Outwash Channel	8	30	98																		
464			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
464.4			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
464.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
464.6	0.9	465.5	Bedrock	Rock		Rock Fall Protection over 20% Grade Length																			0.9		
464.6			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
465.5	1.3	466.8	Alluvial	Very Heavy		Large Fills, Review for potential aggregate source																		1.3			
466.1			Bridge	25 m x 1100 m	River	Slims River 200 ft Riprap Protection, Glacial Outwash Channel	25	1100		3,609																	
466.8	3.4	470.2	Alluvial	Heavy		Review for potential aggregate source																	3.4				
467.1			Bridge	8 m x 30 m	Tributary		8	30	98																		

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
467.2			Bridge	8 m x 30 m	Tributary	Construction on Alluvial Fan, High Water Table	8	30	98																		
467.3			Bridge	8 m x 60 m	Creek	Bullion Creek Construction on Alluvial Fan, High Water Table	8	60	197																		
467.9			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
468.2			Bridge	6 m x 60 m	Creek	Coin Creek Construction on Alluvial Fan, High Water Table	6	60	197																		
469.4			Bridge	6 m x 60 m	Creek	Sheep Creek Construction on Alluvial Fan, High Water Table	6	60	197																		
470.2	0.3	470.5	Till	Very Heavy		Large Cuts and Fills																		0.3			
470.5	1.8	472.3	Colluvial	Very Heavy		Rock Sheds over 10% of Grade Length									0.18									1.8			
472			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
472.3	0.5	472.8	Bedrock	Tunnel	Tunnel	0.5 Mile Long Tunnel															0.5						
472.8	1.7	474.5	Till	Very Heavy		Construction Next to Slims Rock Sheds over 10% of Grade Length									0.17									1.7			
473			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
474.5	5.5	480	Alluvial	Very Heavy		Construction Next to Kluane Lake, Review for potential aggregate source																		5.5			
474.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
475.4			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
476.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
477.8			Bridge	17 m x 200 m	Creek	Williseron Creek 200 ft Riprap Protection	17	200		656																	
479.5			Bridge	8 m x 30 m	Tributary	Debris Flow	8	30	98																		
480	4	484	Alluvial	Heavy		Review for potential aggregate source																	4.0				
480.5			Bridge Pipe	176 m	Tributary								176														
482.3			Bridge	15 m x 225 m	Creek	Congden Creek - Beginning of Kluane Game Sanctuary, Construction on Alluvial Fan, Glacial Outwash Area	15	225	738																		
484	1	485	Till	Heavy																			1.0				
485			Bridge Pipe	74 m	Tributary								74														
485	0.8	485.8	Fluvial	Heavy		Review for potential aggregate source																	0.8				
485.8	3.5	489.3	Alluvial	Heavy		Review for potential aggregate source																	3.5				
486.2			Bridge Pipe	68 m	Tributary								68														
486.8			Bridge Pipe	68 m	Tributary								68														
488.2			Bridge	7 m x 125 m	Creek	Nines Creek Large Stream Channel	7	125	410																		
489.3			Bridge	6 m x 30 m	Creek	Mines Creek	6	30	98																		
489.3	1	490.3	Till	Heavy																			1.0				
490.3	2.2	492.5	Alluvial	Average		Review for potential aggregate source																2.2					
490.3			Bridge Pipe	68 m	Tributary								68														
491.3			Bridge	10 m x 150 m	Creek	Back's Creek Large Stream Channel	10	150	492																		
492.5	0.5	493	Till	Heavy																			0.5				
493	4.8	497.8	Alluvial	Heavy		Review for potential aggregate source																	4.8				
493.2			Bridge Pipe	68 m	Tributary								68														
494.2			Bridge	12 m x 230 m	Creek	Cluett Creek	12	230	755																		
496			Bridge Pipe	68 m	Tributary								68														
496.6			Bridge Pipe	68 m	Tributary								68														
497.8	0.9	498.7	Alluvial	Very Heavy		Large Fills over Alluvial Fan with many Tributaries, Review for potential aggregate source																		0.9			
498.3			Bridge Pipe	68 m	Tributary								68														
498.4			Bridge	11 m x 230 m	Creek	Lewis Creek Large Stream Channel	11	230	755																		
498.6			Bridge Pipe	68 m	Tributary								68														
498.7	1.3	500	Till	Heavy																			1.3				
500	1	501	Alluvial	Very Heavy		Large Fills over Alluvial Fan with many Tributaries, Review for potential aggregate source																		1.0			
500.4			Bridge Pipe	68 m	Tributary								68														
500.5			Bridge	10 m x 250 m	Creek	Halfbreed Creek	10	250	820																		
500.9			Bridge Pipe	68 m	Tributary								68														
501	0.8	501.8	Till	Heavy																			0.8				
501.8	0.8	502.6	Alluvial	Heavy		Review for potential aggregate source																	0.8				
502.6	1.3	503.9	Organics	Organics																						1.3	

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
503.4			Bridge Pipe	68 m	Tributary								68														
503.7			Bridge Pipe	68 m	Tributary								68														
503.9	3.7	507.6	Till	Heavy																			3.7				
504.3			Bridge Pipe	68 m	Tributary								68														
504.5			Bridge Pipe	68 m	Tributary								68														
507.6	0.7	508.3	Fluvial	Very Heavy		Large Cut, Review for potential aggregate source																		0.7			
508.3	1	509.3	Alluvial	Very Heavy		Large Fills, Review for potential aggregate source																		1.0			
508.9			Bridge	12 m x 550 m	River	Duke River 200 ft Riprap Protection, Glacial Outwash Channel	12	550	1,804																		
509.3	3.9	513.2	Till	Heavy																			3.9				
511.2			Bridge Pipe	68 m	Tributary								68														
513.2	0.6	513.8	Alluvial	Very Heavy		Large Fills, Review for potential aggregate source																		0.6			
513.5			Bridge	6 m x 50 m	Creek	Burwash Creek Glacial Outwash Channel	6	50	164																		
513.8	2.7	516.5	Till	Heavy																			2.7				
514.5			Bridge Pipe	68 m	Tributary								68														
515.6			Bridge Pipe	68 m	Tributary								68														
516.5	0.5	517	Organics	Organics																						0.5	
516.9			Bridge Pipe	68 m	Tributary								68														
517	0.5	517.5	Till	Heavy																			0.5				
517.3			Bridge Pipe	68 m	Tributary								68														
517.5	1.5	519	Till	Heavy																			1.5				
518.2			Bridge Pipe	68 m	Tributary								68														
518.7			Bridge Pipe	68 m	Tributary								68														
519	1.5	520.5	Till	Heavy																			1.5				
520.5	2.8	523.3	Alluvial	Heavy		Review for potential aggregate source																	2.8				
520.9			Bridge Pipe	68 m	Tributary								68														
521			Crossing	Level	Road	Mining Road												1									
521.1			Bridge	7 m x 225 m	Creek	Quill Creek	7	225	738																		
521.9			Bridge Pipe	68 m	Tributary								68														
522			Bridge Pipe	68 m	Tributary								68														
523.3	0.7	524	Till	Heavy																			0.7				
524	0.5	524.5	Organics	Organics																						0.5	
524.4			Bridge Pipe	68 m	Tributary								68														
524.5	3.5	528	Till	Heavy																			3.5				
524.8			Bridge Pipe	68 m	Tributary								68														
526			Bridge Pipe	68 m	Tributary								68														
526.8			Bridge	12 m x 300 m	Creek	Swede Johnson Creek	12	300	984																		
528	5	533	Permafrost	Permafrost																							5.0
530.8			Bridge Pipe	68 m	Tributary								68														
530.9			Bridge Pipe	68 m	Tributary								68														
532.5			Bridge Pipe	68 m	Tributary								68														
533	3	536	Till	Heavy																			3.0				
533.3			Bridge Pipe	68 m	Tributary								68														
535			Bridge Pipe	68 m	Tributary								68														
536	1.5	537.5	Till	Very Heavy		Large Cuts and Fills																		1.5			
536.7			Bridge Pipe	68 m	Tributary								68														
537.5	2.3	539.8	Fluvial	Very Heavy		Large Cuts and Fills, Review for potential aggregate source																		2.3			
537.6			Bridge	13 m x 650 m	River	Donjek River Tributary 200 ft Riprap Protection, Glacial Outwash Channel	13	650	2,133																		
539.3			Bridge	15 m x 1100 m	River	Donjek River 200 ft Riprap Protection, Glacial Outwash Channel	15	1100	3,609																		
539.8	0.2	540	Eolian	Very Heavy		Large Fills																		0.2			
540	6	546	Eolian	Heavy																			6.0				
540.8			Bridge Pipe	98 m	Tributary								98														
544.5			Bridge Pipe	68 m	Tributary								68														
546	3	549	Alluvial	Heavy		Review for potential aggregate source																	3.0				
546			Bridge Pipe	68 m	Tributary								68														
547			Bridge	6 m x 30 m	Creek	Lake Creek	6	30	98																		
549	4.5	553.5	Permafrost	Permafrost																							4.5
549.2			Bridge Pipe	28 m	Tributary								28														
549.5			Bridge Pipe	28 m	Tributary								28														
551.6			Bridge Pipe	28 m	Tributary								28														
552.5			Bridge Pipe	28 m	Tributary								28														
552.7			Bridge Pipe	28 m	Tributary								28														
553.4			Bridge Pipe	28 m	Tributary								28														
553.5	0.8	554.3	Eolian	Heavy																			0.8				
554.2			Bridge Pipe	28 m	Tributary								28														

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
554.3	0.4	554.7	Fluvial	Heavy		Review for potential aggregate source																	0.4				
554.7	0.1	554.8	Alluvial	Very Heavy		Review for potential aggregate source																		0.1			
554.7			Bridge	8 m x 100 m	River	Koldern River 200 ft Riprap Protection	8	100	328																		
554.8	0.2	555	Fluvial	Heavy		Review for potential aggregate source																	0.2				
555	1	556	Eolian	Heavy																			1.0				
556	8	564	Till	Heavy																			8.0				
556.3			Bridge Pipe	28 m	Tributary								28														
557.4			Bridge Pipe	28 m	Tributary								28														
558.5			Bridge Pipe	28 m	Tributary								28														
560.2			Bridge Pipe	28 m	Tributary								28														
561			Bridge Pipe	28 m	Tributary								28														
561.6			Bridge Pipe	28 m	Tributary								28														
562.8			Bridge Pipe	28 m	Tributary								28														
563.6			Bridge Pipe	28 m	Tributary								28														
563.8			Bridge Pipe	28 m	Tributary								28														
564	13	577	Till	Very Heavy		Large Cuts and Fills																		13.0			
564.8			Bridge Pipe	28 m	Tributary								28														
565.5			Bridge Pipe	68 m	Tributary								68														
565.8			Bridge Pipe	68 m	Tributary								68														
566.5			Bridge Pipe	68 m	Tributary								68														
566.7			Bridge Pipe	68 m	Tributary								68														
567.2			Bridge Pipe	68 m	Tributary								68														
567.8			Bridge Pipe	68 m	Tributary								68														
568.2			Bridge Pipe	28 m	Tributary								28														
568.6			Bridge Pipe	28 m	Tributary								28														
568.8			Bridge Pipe	28 m	Tributary								28														
569.3			Bridge Pipe	28 m	Tributary								28														
569.8			Bridge Pipe	28 m	Tributary								28														
570.2			Bridge Pipe	28 m	Tributary								28														
570.3			Bridge Pipe	28 m	Tributary								28														
570.4			Bridge Pipe	28 m	Tributary								28														
570.6			Bridge Pipe	28 m	Tributary								28														
571.3			Bridge Pipe	28 m	Tributary								28														
571.5			Bridge Pipe	28 m	Tributary								28														
574			Bridge Pipe	68 m	Tributary								68														
576.9			Crossing	Overpass 7 m x 45 m	Road	Alaska Highway Crossing													45								
577	1.3	578.3	Fluvial	Very Heavy		Review for potential aggregate source																		1.3			
577.2			Bridge	30 m x 1200 m	River	White River End Kluane Game Sanctuary 200 ft Riprap Protection, Glacial Outwash Channel	30	1200		3,937																	
578.3	5.7	584	Fluvial	Heavy		Review for potential aggregate source																	5.7				
578.7			Crossing	Overpass 7 m x 45 m	Road	Alaska Highway Crossing													45								
579.5			Bridge Pipe	28 m	Tributary								28														
580.7			Bridge Pipe	28 m	Tributary								28														
581.6			Bridge Pipe	28 m	Tributary								28														
581.8			Bridge Pipe	28 m	Tributary								28														
582			Bridge Pipe	28 m	Tributary								28														
582.5			Bridge Pipe	28 m	Tributary								28														
584			Bridge Pipe	28 m	Tributary								28														
584	2	586	Organics	Organics																						2.0	
584.1			Bridge Pipe	28 m	Tributary								28														
584.6			Bridge Pipe	28 m	Tributary								28														
584.7			Bridge Pipe	28 m	Tributary								28														
586	1	587	Alluvial	Heavy		Review for potential aggregate source																	1.0				
586.2			Bridge	6 m x 100 m	Creek	Sanpete Creek	6	100	328																		
587			Bridge Pipe	68 m	Tributary								68														
587	2	589	Organics	Organics		Likely Permafrost Area																				2.0	
588.5			Bridge Pipe	68 m	Tributary								68														
589	0.7	589.7	Fluvial	Heavy		Likely Permafrost Area, Review for potential aggregate source																	0.7				
589.5			Bridge Pipe	68 m	Tributary								68														
589.7	0.3	590	Organics	Organics		Likely Permafrost Area																				0.3	
589.8			Bridge Pipe	68 m	Tributary								68														
590	1	591	Fluvial	Heavy		Likely Permafrost Area, Review for potential aggregate source																	1.0				
591	4	595	Organics	Organics		Likely Permafrost Area																				4.0	
592			Bridge Pipe	68 m	Tributary								68														
592.6			Bridge Pipe	68 m	Tributary								68														
593.9			Bridge Pipe	68 m	Tributary								68														
594.9			Bridge Pipe	68 m	Tributary								68														

Whitehorse to Alaskan Border

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock	Organics	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
595	4.5	599.5	Fluvial	Heavy		Likely Permafrost Area, Review for potential aggregate source																	4.5				
595.3			Bridge Pipe	68 m	Tributary								68														
595.5			Bridge Pipe	68 m	Tributary								68														
596.3			Bridge Pipe	68 m	Tributary								68														
597.2			Bridge Pipe	68 m	Tributary								68														
597.8			Bridge Pipe	68 m	Tributary								68														
598.8			Bridge Pipe	68 m	Tributary								68														
599.5	1	600.5	Alluvial	Heavy		Review for potential aggregate source																	1.0				
599.5			Bridge Pipe	68 m	Tributary								68														
599.6			Bridge Pipe	68 m	Tributary								68														
600.5	2.5	603	Organics	Organics																						2.5	
601.7			Bridge Pipe	68 m	Tributary								68														
603	1.5	604.5	Fluvial	Heavy		Review for potential aggregate source																	1.5				
604.3			Bridge Pipe	68 m	Tributary								68														
604.5			Bridge Pipe	68 m	Tributary								68														
604.5	0.5	605	Organics	Organics																						0.5	
605	0.8	605.8	Till	Heavy																			0.8				
605.8	0.7	606.5	Organics	Organics																						0.7	
606			Bridge Pipe	68 m	Tributary								68														
606.5	1.5	608	Till	Heavy																			1.5				
608			Bridge Pipe	28 m	Tributary								28														
608	2.2	610.2	Organics	Organics																						2.2	
608.8			Bridge Pipe	28 m	Tributary								28														
609.5			Bridge Pipe	28 m	Tributary								28														
610			Bridge Pipe	28 m	Tributary								28														
610.2	0.2	610.4	Fluvial	Very Heavy		Soft Subgrade, Bridge Fills, Review for potential aggregate source																		0.2			
610.3			Bridge	8 m x 60 m	Creek	Beaver Creek Soft Organic Subgrade	8	60	197																		
610.4	7.4	617.8	Fluvial	Average		Review for potential aggregate source																7.4					
617.8	2.2	620	Organics	Organics																						2.2	
619.2			Bridge	8 m x 60 m	Creek	Snag Creek Soft Organic Subgrade	8	60	197																		
620	0.5	620.5	Colluvial	Heavy																			0.5				
620.5	2	622.5	Alluvial	Heavy		Review for potential aggregate source																	2.0				
622.5	2	624.5	Permafrost	Permafrost																							2.0
624.5	0.5	625	Organics	Organics																						0.5	
624.8			Bridge	12 m x 100 m	Creek	Mirror Creek Soft Organic Subgrade	12	100	328																		
625	2.5	627.5	Colluvial	Very Heavy		Large Cuts and Fills																		2.5			
627			Crossing	Level	Road	Alaska Highway Crossing												1									
627.5	0.8	628.3	Alluvial	Heavy		Review for potential aggregate source																	0.8				
627.8			Bridge Pipe	68 m	Tributary								68														
628.3	0.7	629	Colluvial	Very Heavy		Large Cuts and Fills																		0.7			
628.6			Crossing	Level	Road	Alaska Highway Crossing												1									
629	1.2	630.2	Alluvial	Heavy		Review for potential aggregate source																	1.2				
629.5			Bridge Pipe	68 m	Tributary								68														
630.1			Bridge Pipe	68 m	Tributary								68														
630.2	0.3	630.5	Colluvial	Heavy																			0.3				
630.5	1	631.5	Permafrost	Permafrost																							1.0
631.5	1	632.5	Alluvial	Heavy		Review for potential aggregate source																	1.0				
631.6			Bridge Pipe	68 m	Tributary								68														
631.9			Crossing	Level	Road	Alaska Highway Crossing												1									
632.5	5	637.5	Permafrost	Permafrost																							5.0
634.8			Bridge	8 m x 60 m	Creek	Scottie Creek Permafrost Foundation	8	60	197																		
637.1			Bridge Pipe	68 m	Tributary								68														
	325.5							13,505 m	26,331 ft	10,416 ft	6,069 ft	1,476 ft	8,544 m		1.24 M			14 Xings	90 m	100 m	3.0 M	26.1 M	166.2 M	69.2 M	5.3 M	24.0 M	31.7 M
								44,308 ft.	Total bridge length			44,292	28,031 ft.		6,547 ft				295 ft.	328 ft.		Total Route Segment Length (miles)					325.5 M
						Count	71	71	63	5	2	1	158						2	1							
						Check Summary	71	13,505 m	8,030 m	3,175 m	1,850 m	450 m	8,544		1.24			14	90	100.0	3.0	26.1	166.2	69.2	5.3	24.0	31.7
								44,308 ft.	26,345 ft.	10,417 ft.	6,070 ft.	1,476 ft.	28,031 ft.														

Carmacks to Alaska Border near Ladue River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
738	2	740	Fluvial	Average		Review for potential aggregate source																2.0					
740	1.1	741.1	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Review for potential aggregate source								1.1										1.1			
741.1	3.1	744.2	Alluvial	Heavy		Review for potential aggregate source																	3.1				
744.2	3.3	747.5	Till	Very Heavy		Erosion Protection along 100% of grade length								3.3										3.3			
745			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
747.5	0.9	748.4	Fluvial	Very Heavy		Review for potential aggregate source																		0.9			
748.4	2.1	750.5	Fluvial	Average		Review for potential aggregate source																2.1					
749.9			Bridge Pipe	20 m	Tributary								20														
750.5	0.7	751.2	Fluvial	Heavy		Review for potential aggregate source																	0.7				
751.2	0.6	751.8	Alluvial	Heavy		Review for potential aggregate source																	0.6				
751.3			Bridge	8 m x 150 m	River	Tatchun River, 200 ft riprap erosion protection	8	150	492					0.04													
751.8	1.2	753	Alluvial	Very Heavy		Erosion Protection along 75% of grade length, Review for potential aggregate source								0.9										1.2			
753	4.6	757.6	Fluvial	Heavy		Erosion Protection along 50% of grade length, Review for potential aggregate source								2.2									4.6				
757.6	2.4	760	Eolian	Heavy																			2.4				
758.3			Crossing	Level	Road	Klondike Highway												1									
760	1	761	Fluvial	Average		Review for potential aggregate source																1.0					
760.5			Crossing	Level	Road	Klondike Highway												1									
761	2.2	763.2	Fluvial	Very Heavy		Erosion Protection along 30% of grade length, Review for potential aggregate source								0.7										2.2			
763.2	1	764.2	Fluvial	Heavy		Review for potential aggregate source																	1.0				
764.2	0.4	764.6	Alluvial	Heavy		Review for potential aggregate source																	0.4				
764.4			Bridge	8 m x 150 m	Creek	McGregor Creek	8	150	492																		
764.6	0.9	765.5	Fluvial	Heavy		Review for potential aggregate source																	0.9				
765.5	1.8	767.3	Alluvial	Heavy		Review for potential aggregate source																	1.8				
767.3	1.8	769.1	Alluvial	Average		Review for potential aggregate source																1.8					
768.3			Bridge Pipe	28 m	Tributary								28														
769.1	11.3	780.4	Fluvial	Average		Rock Fall Protection along 1% of grade length, Review for potential aggregate source								0.1								11.3					
769.4			Crossing	Road Overpass	Road Overpass	Klondike Highway (7 m x 45 m)													45								
773.7			Crossing	Level	Road	Klondike Highway												1									
777.2			Bridge	6 m x 30 m	Creek	McCabe Creek	6	30	98																		
780.4	0.5	780.9	Fluvial	Very Heavy		Review for potential aggregate source																		0.5			
780.4			Bridge	25 m x 850 m	River	Yukon River, 200 ft riprap erosion protection	25	850		2,789				0.04													
780.9	1.6	782.5	Till	Heavy																			1.6				
782.5	1	783.5	Fluvial	Heavy		Review for potential aggregate source																	1.0				
783.5	4.4	787.9	Fluvial	Average		Review for potential aggregate source																4.4					
787.9	0.1	788	Alluvial	Very Heavy		Review for potential aggregate source																		0.1			
787.9			Bridge	10 m x 175 m	Creek	Big Creek	10	175	574																		
788	3	791	Fluvial	Average		Review for potential aggregate source																3.0					
791	0.4	791.4	Colluvial	Very Heavy																				0.4			
791.4	0.7	792.1	Fluvial	Very Heavy		Review for potential aggregate source																		0.7			
792.1	1.2	793.3	Alluvial	Average		Review for potential aggregate source																1.2					

Carmacks to Alaska Border near Ladue River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
792.3			Bridge Pipe	20 m	Tributary								20														
793.3	2.2	795.5	Fluvial	Very Heavy		Erosion Protection along 100% of grade length, Review for potential aggregate source								2.2										2.2			
794.6			Bridge Pipe	20 m	Tributary								20														
795			Bridge Pipe	20 m	Tributary								20														
795.5	1.9	797.4	Till	Very Heavy		Erosion Protection along 100% of grade length								1.9										1.9			
796.2			Bridge Pipe	20 m	Tributary								20														
797.4	0.2	797.6	Bedrock	Rock Grade		Erosion Protection along 100% of grade length								0.2											0.2		
797.5			Bridge Pipe	20 m	Tributary								20														
797.6	0.8	798.4	Till	Very Heavy		Erosion Protection along 100% of grade length								0.8										0.8			
798.4	0.2	798.6	Bedrock	Rock Grade		Erosion Protection along 100% of grade length								0.2											0.2		
798.6	0.7	799.3	Till	Very Heavy																				0.7			
798.9			Bridge Pipe	20 m	Tributary								20														
799.3	0.4	799.7	Till	Heavy																			0.4				
799.6			Bridge Pipe	20 m	Tributary								20														
799.7	0.8	800.5	Fluvial	Heavy		Review for potential aggregate source																	0.8				
800.5	0.2	800.7	Alluvial	Heavy		Review for potential aggregate source																	0.2				
800.6			Bridge	6 m x 100 m	Creek	Wolverine Creek	6	100	328																		
800.7	1.6	802.3	Till	Very Heavy		Erosion Protection along 50% of grade length								0.8										1.6			
802.3	0.7	803	Fluvial	Heavy		Review for potential aggregate source																	0.7				
802.9			Bridge Pipe	20 m	Tributary								20														
803	2.4	805.4	Eolian	Average																		2.4					
805.4	1.6	807	Fluvial	Average		Review for potential aggregate source																1.6					
807	1	808	Colluvial	Very Heavy																				1.0			
808	0.3	808.3	Eolian	Average																		0.3					
808.3	0.5	808.8	Fluvial	Average		Review for potential aggregate source																0.5					
808.8	0.4	809.2	Alluvial	Average		Review for potential aggregate source																0.4					
809			Bridge Pipe	128 m	Tributary								128														
809.2	0.6	809.8	Eolian	Average																		0.6					
809.8	0.3	810.1	Organics	Organic																						0.3	
810.1	1.1	811.2	Eolian	Average																		1.1					
811.2	0.6	811.8	Alluvial	Average		Review for potential aggregate source																0.6					
811.4			Bridge Pipe	28 m	Tributary								28														
811.8	1.4	813.2	Fluvial	Average		Review for potential aggregate source																1.4					
812.4			Bridge Pipe	20 m	Tributary								20														
813.2	1.7	814.9	Alluvial	Heavy		Review for potential aggregate source																	1.7				
814.1			Bridge Pipe	140 m	Tributary								140														
814.9	2.4	817.3	Colluvial	Very Heavy		Rock Fall Protection along 40% of grade length, Erosion Protection along 50% of grade length								1.3		1								2.4			
816.2			Bridge Pipe	122 m	Tributary								122														
817.3	0.2	817.5	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Review for potential aggregate source								0.2										0.2			
817.4			Bridge Pipe	86 m	Tributary								86														
817.5	0.5	818	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length								0.5		0.5								0.5			
818	0.3	818.3	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length, Review for potential aggregate source								0.3		0.3								0.3			
818.2			Bridge	12 m x 100 m	Tributary	debris flow	12	100	328																		

Carmacks to Alaska Border near Ladue River

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
818.3	0.7	819	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length								0.7		0.7								0.7			
819	3.1	822.1	Bedrock	Rock Grade																					3.1		
819.4			Bridge Pipe	68 m	Tributary								68														
819.8			Bridge Pipe	28 m	Tributary								28														
821.5			Bridge Pipe	20 m	Tributary								20														
822.1	0.3	822.4	Alluvial	Heavy		Review for potential aggregate source																	0.3				
822.3			Bridge Pipe	20 m	Tributary								20														
822.4	0.6	823	Bedrock	Rock Grade																					0.6		
823	1.3	824.3	Colluvial	Very Heavy		Rock Fall Protection along 25% of grade length										0.3								1.3			
823.9			Bridge Pipe	20 m	Tributary								20														
824.3	1.7	826	Alluvial	Average		Review for potential aggregate source																1.7					
826	0.3	826.3	Alluvial	Heavy		Review for potential aggregate source																	0.3				
826.2			Bridge Pipe	20 m	Tributary								20														
826.3	1.1	827.4	Colluvial	Very Heavy		Rock Fall Protection along 100% of grade length										1.1								1.1			
827.4	0.3	827.7	Alluvial	Heavy		Review for potential aggregate source																	0.3				
827.5			Bridge Pipe	20 m	Tributary								20														
827.7	0.6	828.3	Colluvial	Very Heavy		Rock Fall Protection along 50% of grade length										0.3								0.6			
828.3	0.2	828.5	Alluvial	Very Heavy		Rock Fall Protection along 100% of grade length, Review for potential aggregate source										0.2								0.2			
828.4			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
828.5	1.2	829.7	Colluvial	Very Heavy		Rock Fall Protection along 65% of grade length										0.9								1.2			
829.7	0.3	830	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
829.8			Bridge Pipe	98 m	Tributary								98														
830	1.9	831.9	Colluvial	Very Heavy		Rock Fall Protection along 100% of grade length										1.9								1.9			
830.6			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
831			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
831.9	2.5	834.4	Alluvial	Heavy		Review for potential aggregate source																	2.5				
832			Bridge Pipe	40 m	Tributary								40														
833.4			Bridge Pipe	20 m	Tributary								20														
834.2			Bridge Pipe	36 m	Tributary								36														
834.4	4.4	838.8	Colluvial	Very Heavy		Erosion Protection along 40% of grade length, Landslide area requiring Rock Shed along 5% of grade length (838.5 to 838.8)								1.9	0.3									4.4			
834.7			Bridge Pipe	32 m	Tributary								32														
835.3			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
836.5			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
837.5			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
837.9			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
838.1			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
838.8	0.5	839.3	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Review for potential aggregate source								0.5										0.5			
838.9			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
839.3	0.4	839.7	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								0.4		0.4									0.4		
839.7	0.1	839.8	Colluvial	Very Heavy		Erosion Protection along 100% of grade length								0.1										0.1			
839.8			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
839.8	0.5	840.3	Bedrock	Rock Grade		Erosion Protection along 100% of grade length								0.5											0.5		
840.3	0.3	840.6	Colluvial	Very Heavy		Erosion Protection along 65% of grade length								0.2										0.3			

Carmacks to Alaska Border near Ladue River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
840.6	2.6	843.2	Alluvial	Average		Review for potential aggregate source																2.6					
840.7			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
841.9			Bridge	13 m x 390 m	River	Selwyn River, 200 ft of riprap erosion control	13	390	1,280					0.04													
843.1			Bridge Pipe	68 m	Tributary								68														
843.2	0.8	844	Colluvial	Heavy																			0.8				
843.7			Bridge Pipe	68 m	Tributary								68														
844	4.1	848.1	Colluvial	Very Heavy		Rock Fall Protection along 60% of grade length								2.8										4.1			
844.4			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
845.1			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
845.8			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
846.2			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
847.3			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
848.1			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
848.1	0.5	848.6	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
848.3			Bridge Pipe	40 m	Tributary								40														
848.6	1.4	850	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								1.4		1.4								1.4			
850	0.9	850.9	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								0.9		0.9									0.9		
850.9	0.6	851.5	Colluvial	Heavy																			0.6				
851.5	4	855.5	Alluvial	Average		Review for potential aggregate source																4.0					
852.9			Bridge Pipe	146 m	Tributary								146														
854			Bridge	14 m x 200 m	Creek	Isaac Creek	14	200	656																		
854.2			Bridge Pipe	80 m	Tributary								80														
854.6			Bridge Pipe	68 m	Tributary								68														
855			Bridge Pipe	40 m	Tributary								40														
855.5	0.5	856	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
855.7			Bridge Pipe	40 m	Tributary								40														
856	4.8	860.8	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								4.8		4.8								4.8			
856.3			Bridge	8 m x 60 m	Tributary	debris flow	8	60	197																		
856.6			Bridge Pipe	20 m	Tributary								20														
857.5			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
857.7			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
857.9			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
858.3			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
858.7			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
859.7			Bridge Pipe	68 m	Tributary								68														
860.6			Bridge Pipe	92 m	Tributary								92														
860.8	2.3	863.1	Alluvial	Average		Review for potential aggregate source																2.3					
861.2			Bridge	16 m x 250 m	Creek	Canadian Creek	16	250		820																	
862.6			Bridge Pipe	80 m	Tributary								80														
862.8			Bridge Pipe	80 m	Tributary								80														
863			Bridge Pipe	80 m	Tributary								80														
863.1	4.3	867.4	Colluvial	Very Heavy		Erosion Protection along 75% of grade length, Rock Fall Protection along 75 % of grade length								3.2		3.2								4.3			
863.5			Bridge Pipe	80 m	Tributary								80														
864			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
864.6			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
865.5			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
866.4			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
867.2			Bridge Pipe	28 m	Tributary								28														
867.4	2.5	869.9	Alluvial	Average		Review for potential aggregate source																2.5					
867.9			Bridge Pipe	36 m	Tributary								36														
868.5			Bridge Pipe	36 m	Tributary								36														
869			Bridge Pipe	28 m	Tributary								28														
869.9	1	870.9	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 60 % of grade length								1		0.7									1.0		
870			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		

Carmacks to Alaska Border near Ladue River

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
870.9	0.3	871.2	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Review for potential aggregate source								0.3										0.3			
871			Bridge	8 m x 30 m	Creek	Excelsior Creek	8	30	98																		
871.2	0.8	872	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 50 % of grade length								0.8		0.4									0.8		
872	0.7	872.7	Colluvial	Very Heavy		Erosion Protection along 100% of grade length								0.7										0.7			
872.2			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
872.5			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
872.7	6.6	879.3	Alluvial	Average		Review for potential aggregate source																6.6					
873.2			Bridge Pipe	20 m	Tributary								20														
873.5			Bridge Pipe	20 m	Tributary								20														
874.5			Bridge	9 m x 175 m	Creek	Coffee Creek	9	175	574																		
876.4			Bridge Pipe	28 m	Tributary								28														
877.2			Bridge Pipe	28 m	Tributary								28														
877.5			Bridge Pipe	28 m	Tributary								28														
877.8			Bridge Pipe	20 m	Tributary								20														
878.3			Bridge Pipe	20 m	Tributary								20														
878.7			Bridge Pipe	20 m	Tributary								20														
879.3	3.2	882.5	Colluvial	Very Heavy		Landslide area requiring Rock Shed along 10% of grade length, Erosion Protection along 75% of grade length, Rock Fall Protection along 75% of grade length								2.5	0.4	2.5								3.2			
879.6			Bridge Pipe	28 m	Tributary								28														
880.4			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
881.2			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
882.2			Bridge	8 m x 30 m	Creek	Halfway Creek	8	30	98																		
882.5	0.5	883	Alluvial	Very Heavy		Review for potential aggregate source																		0.5			
883	1	884	Alluvial	Heavy		Review for potential aggregate source																	1.0				
883.2			Bridge Pipe	28 m	Tributary								28														
883.5			Bridge Pipe	28 m	Tributary								28														
883.9			Bridge Pipe	28 m	Tributary								28														
884	6.6	890.6	Alluvial	Average		Review for potential aggregate source																6.6					
884.5			Bridge	8 m x 30 m	Creek	Dan Man Creek	8	30	98																		
885.8			Bridge Pipe	28 m	Tributary								28														
885.9			Bridge Pipe	28 m	Tributary								28														
886.5			Bridge Pipe	28 m	Tributary								28														
887			Bridge Pipe	28 m	Tributary								28														
888.1			Bridge Pipe	28 m	Tributary								28														
888.7			Bridge	8 m x 100 m	Creek	Independence Creek requiring a Medium Bridge	8	100	328																		
890			Bridge Pipe	28 m	Tributary								28														
890.6	0.4	891	Colluvial	Very Heavy																				0.4			
891	5.5	896.5	Alluvial	Average		Review for potential aggregate source																5.5					
892.1			Bridge	9 m x 100 m	Creek	Carlisle Creek	9	100	328																		
893.4			Bridge Pipe	28 m	Tributary								28														
894.2			Bridge Pipe	28 m	Tributary								28														
896.5	0.3	896.8	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
896.7			Bridge	8 m x 100 m	Creek	Los Angeles Creek	8	100	328																		
896.8	0.2	897	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								0.2		0.2									0.2		
897	0.6	897.6	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length, Landslide area requiring Rock shed along 20% of grade length								0.6	0.1	0.6								0.6			
897.6	0.6	898.2	Bedrock	Rock Grade		Erosion Protection along 100% of grade length, Rock Fall Protection along 100 % of grade length								0.6		0.6									0.6		

Carmacks to Alaska Border near Ladue River

Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Bridge Dimensions Height (m)	Bridge Dimensions Length (m)	Brige Length (ft.) by Height Class < 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Bridge Pipes Length (m)	Erosion Protection Length (mile)	Rock/Snow Shed Length (mile)	Rock Fall Protection Length (mile)	Retaining Walls Length (mile)	Road Level Xings	Road Overpass Length (m)	Road Rail Bridge Length (m)	Tunnel Length (mile)	Grade Construction Average Length (mile)	Heavy Length (mile)	Very Heavy Length (mile)	Rock Grade Length (mile)	Organic Length (mile)	Permafrost Length (mile)
898.2	0.4	898.6	Colluvial	Very Heavy		Erosion Protection along 50% of grade length, Rock Fall Protection along 50 % of grade length								0.2		0.2								0.4			
898.6			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
898.6	8.9	907.5	Alluvial	Average		Review for potential aggregate source																8.9					
898.8			Bridge Pipe	28 m	Tributary								28														
899.9			Bridge Pipe	28 m	Tributary								28														
900.5			Bridge Pipe	28 m	Tributary								28														
901			Bridge Pipe	28 m	Tributary								28														
901.1			Bridge Pipe	28 m	Tributary								28														
901.3			Bridge Pipe	28 m	Tributary								28														
902			Bridge Pipe	36 m	Tributary								36														
902.5			Bridge Pipe	68 m	Tributary								68														
903.5			Bridge Pipe	28 m	Tributary								28														
904.3			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
905.1			Bridge Pipe	20 m	Tributary								20														
905.5			Bridge Pipe	20 m	Tributary								20														
906.5			Bridge Pipe	20 m	Tributary								20														
906.7			Bridge Pipe	20 m	Tributary								20														
907.5	2.6	910.1	Colluvial	Very Heavy		Erosion Protection along 100% of grade length								2.6										2.6			
907.6			Bridge Pipe	36 m	Tributary								36														
908.4			Bridge Pipe	86 m	Tributary								86														
909			Bridge Pipe	20 m	Tributary								20														
909.6			Bridge Pipe	28 m	Tributary								28														
910.1	0.3	910.4	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
910.2			Bridge Pipe	20 m	Tributary								20														
910.4	0.6	911	Organics	Organic																						0.6	
911	5.8	916.8	Alluvial	Heavy		Review for potential aggregate source																	5.8				
911.1			Bridge Pipe	20 m	Tributary								20														
911.5			Bridge Pipe	28 m	Tributary								28														
912			Bridge Pipe	28 m	Tributary								28														
913.4			Bridge Pipe	32 m	Tributary								32														
915			Bridge Pipe	40 m	Tributary								40														
915.3			Bridge Pipe	36 m	Tributary								36														
916.4			Bridge Pipe	40 m	Tributary								40														
916.8	1.5	918.3	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length								1.5		1.5								1.5			
917.8			Bridge	12 m x 90 m	Tributary	debris flow	12	90	295																		
918.3	0.3	918.6	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length, Review for potential aggregate source								0.3		0.3								0.3			
918.5			Bridge Pipe	68 m	Tributary								68														
918.6	1.1	919.7	Colluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length								1.1		1.1								1.1			
919.7	0.2	919.9	Alluvial	Very Heavy		Erosion Protection along 100% of grade length, Rock Fall Protection along 100% of grade length, Review for potential aggregate source								0.2		0.2								0.2			
919.8			Bridge	8 m x 30 m	Tributary	debris flow	8	30	98																		
919.9	0.8	920.7	Colluvial	Very Heavy		Erosion Protection along 75% of grade length, Rock Fall Protection along 75% of grade length								0.6		0.6								0.8			
920.3			Bridge Pipe	98 m	Tributary								98														
920.7	1	921.7	Alluvial	Heavy		Review for potential aggregate source																	1.0				
920.9			Bridge Pipe	68 m	Tributary								68														
921.7			Bridge Pipe	20 m	Tributary								20														
921.7	2	923.7	Organics	Organic																						2.0	
922.5			Bridge Pipe	74 m	Tributary								74														
923.7	2.3	926	Alluvial	Average		Review for potential aggregate source																2.3					
924			Bridge Pipe	74 m	Tributary								74														
924.7			Bridge Pipe	98 m	Tributary								98														
925			Bridge Pipe	98 m	Tributary								98														

Carmacks to Alaska Border near Ladue River

Terrain Analysis: Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Size of Civil Structure: Bridge Dimensions: Height (m)	Bridge Dimensions: Length (m)	Brige Length (ft.) by Height Class: < 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Bridge Pipes: Length (m)	Erosion Protection: Length (mile)	Rock/Snow Shed: Length (mile)	Rock Fall Protection: Length (mile)	Retaining Walls: Length (mile)	Road: Level Xings	Road: Overpass Length (m)	Road: Rail Bridge Length (m)	Tunnel: Length (mile)	Grade Construction: Average: Length (mile)	Heavy: Length (mile)	Very Heavy: Length (mile)	Rock Grade: Length (mile)	Organic: Length (mile)	Permafrost: Length (mile)
925.5			Bridge Pipe	68 m	Tributary								68														
926	1	927	Organics	Organic																						1.0	
926			Bridge Pipe	20 m	Tributary								20														
926.4			Bridge Pipe	20 m	Tributary								20														
926.6			Bridge Pipe	20 m	Tributary								20														
927	1	928	Alluvial	Heavy		Review for potential aggregate source																	1.0				
928	1.4	929.4	Bedrock	Rock Grade		Erosion Protection along 70% of grade length, Rock Fall Protection along 100% of grade length								1		1.4									1.4		
929.4	1.8	931.2	Organics	Organic																						1.8	
930			Bridge Pipe	20 m	Tributary								20														
931.2	3.4	934.6	Colluvial	Very Heavy																				3.4			
932			Bridge	15 m x 100 m	Tributary	debris flow	15	100	328																		
934.6	1.4	936	Fluvial	Very Heavy		Review for potential aggregate source																		1.4			
934.9			Bridge	20 m x 1220 m	River	White River, 200 ft riprap erosion control	20	1,220		4,003				0.04													
936	0.4	936.4	Alluvial	Average		Review for potential aggregate source																0.4					
936.4			Bridge Pipe	98 m	Tributary								98														
936.4	0.7	937.1	Bedrock	Rock Grade																					0.7		
937.1	3.8	940.9	Colluvial	Very Heavy																				3.8			
940.9	1.6	942.5	Alluvial	Heavy		Review for potential aggregate source																	1.6				
941.3			Bridge Pipe	40 m	Tributary								40														
942			Bridge Pipe	28 m	Tributary								28														
942.4			Bridge Pipe	28 m	Tributary								28														
942.5	0.5	943	Colluvial	Heavy																			0.5				
943	0.9	943.9	Alluvial	Heavy		Review for potential aggregate source																	0.9				
943.9	1	944.9	Organics	Organic																						1.0	
944			Bridge Pipe	28 m	Tributary								28														
944.6			Bridge	10 m x 100 m	Creek		10	100	328																		
944.9	2.8	947.7	Colluvial	Very Heavy																				2.8			
947.7	0.3	948	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
947.8			Bridge Pipe	140 m	Tributary								140														
948	0.9	948.9	Colluvial	Very Heavy																				0.9			
948.9	0.2	949.1	Alluvial	Very Heavy		Review for potential aggregate source																		0.2			
949			Bridge Pipe	158 m	Tributary								158														
949.1	1.1	950.2	Colluvial	Very Heavy																				1.1			
950.2	0.3	950.5	Alluvial	Very Heavy		Review for potential aggregate source																		0.3			
950.3			Bridge Pipe	40 m	Tributary								40														
950.5	1.1	951.6	Organics	Organic																						1.1	
951.6	0.2	951.8	Fluvial	Average		Review for potential aggregate source																0.2					
951.7			Bridge	10 m x 100 m	Creek		10	100	328																		
951.8	0.6	952.4	Organics	Organic																						0.6	
952.4	0.3	952.7	Alluvial	Average		Review for potential aggregate source																0.3					
952.5			Bridge Pipe	28 m	Tributary								28														
952.7	1.2	953.9	Colluvial	Very Heavy																				1.2			
953.9	1.6	955.5	Organics	Organic																						1.6	
954.4			Bridge Pipe	28 m	Tributary								28														
955.5	4.2	959.7	Colluvial	Very Heavy																				4.2			
955.7			Bridge Pipe	28 m	Tributary								28														
958			Bridge Pipe	28 m	Tributary								28														
958.7			Bridge Pipe	28 m	Tributary								28														
959.7	1	960.7	Alluvial	Heavy		Review for potential aggregate source																	1.0				
960			Bridge Pipe	20 m	Tributary								20														
960.7	0.8	961.5	Organics	Organic																						0.8	
	223.5 M							6,590 m	13,995 ft.	7,612 ft.	0 ft.	0 ft.	5,112 m	48.5 M	0.8 M	28.2 M	0.0 M	3 Xings	45 m	0 m	0.0 M	79.6 M	39.5 M	83.0 M	10.6 M	10.8 M	0.0 M
								21,621 ft.	Total bridge length			21,607 ft.	16,772 ft.		4,224 ft.		0 ft.		148 ft.	0 ft.		Total Route Segment Length (miles)					223.5 M
						Count	58	58	55	3			119	48	3	28	0	3	1					79.6			
						Check Summary		6,590 m	4,270 m	2,320 m			5112	48.46	0.8	28.2	0					79.6	39.5	83.0	10.6	10.8	
									14,009 ft	7,612 ft	0 ft	0 ft	16,772 ft														

Carmacks to Alaskan Border via Nisling River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
738	2	740	Fluvial	Average		Review for potentail aggregate source																2.0					
740	1.2	741.2	Alluvial	Very Heavy		Bridge approach, Review for potentail aggregate source																		1.2			
740.6			Bridge	32 m x 1200 m	River	Yukon River 200 ft riprap erosion protection	32	1,200			3,937			0.04													
741.2	0.8	742	Fluvial	Average		Review for potentail aggregate source																0.8					
741.8			Crossing	Level	Road	Freegold Road (gravel)												1									
742	0.1	742.1	Colluvial	Very Heavy	Landslide	Rock shed, rock fall protection 100% of grade due to slide at tunnel portal								0.10	0.10									0.1			
742.1	8.4	750.5	Bedrock	Tunnel		Tunnel under mount Monson and Miller's Ridge															8.4						
750.5	0.3	750.8	Alluvial	Very Heavy		At tunnel portal, Review for potentail aggregate source																		0.3			
750.6			Bridge	14 m x 180 m	Creek	Rowlinson Creek Bridge at tunnel portal	14	180	591																		
750.8	13.2	764	Organics	Organic																						13.2	
752.8			Bridge Pipe	80 m	Tributary								80														
753.2			Bridge Pipe	86 m	Tributary								86														
754.6			Bridge Pipe	158 m	Tributary								158														
754.7			Bridge Pipe	158 m	Tributary								158														
754.9			Bridge	10 m x 150 m	Creek	Rowlinson Creek Bridge over meander in creek	10	150	492																		
755.5			Bridge Pipe	24 m	Tributary								24														
755.7			Bridge Pipe	68 m	Tributary								68														
756.2			Bridge	14 m x 175 m	Creek	Rowlinson Creek	14	175	574																		
756.5			Bridge Pipe	68 m	Tributary								68														
757.1			Bridge Pipe	28 m	Tributary								28														
757.3			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
787.5			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
787.7			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
787.8			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
758			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
758.1			Bridge	8 m x 30 m	Creek	Rowlinson Creek	8	30	98																		
759.6			Bridge	8 m x 30 m	Tributary	Bridge for debris flow	8	30	98																		
759.9			Bridge Pipe	28 m	Tributary								28														
761.2			Bridge	8 m x 50 m	Creek	Rowlinson Creek	8	50	164																		
762.1			Bridge Pipe	28 m	Tributary								28														
763.1			Bridge Pipe	28 m	Tributary								28														
763.8			Bridge Pipe	28 m	Tributary								28														
764	0.5	764.5	Eolian	Heavy																			0.5				
764.5	7.3	771.8	Colluvial	Very Heavy		Meltwater channel, rock fall protection along 5% of grade									0.40	0.36								7.3			
766.5			Bridge	16 m x 200 m	Tributary	Debris flow	16	200		656																	
768.8			Bridge Pipe	128 m	Tributary								128														
771.8	0.7	772.5	Alluvial	Very Heavy		Review for potentail aggregate source																		0.7			
772.5	0.7	773.2	Alluvial	Heavy		Review for potentail aggregate source																	0.7				
773.2	0.6	773.8	Eolian	Heavy																			0.6				
773.8	0.4	774.2	Lacustrine (NTS)	Very Heavy																				0.4			
774.2	5.8	780	Fluvial (NTS)	Heavy		Review for potentail aggregate source																	5.8				
774.6			Bridge	10 m x 60 m	River	Nisling River, 200 ft riprap erosion protection	10	60	197					0.04													
775.1			Bridge Pipe	28 m	Tributary								28														
776.1			Bridge Pipe	28 m	Tributary								28														
777.5			Bridge	10 m x 60 m	Tributary	Valley requiring a bridge	10	60	197																		
779.8			Bridge Pipe	20 m	Tributary								20														
780	6.3	786.3	Colluvial (NTS)	Heavy		Along South valley slope																	6.3				
780.1			Bridge Pipe	20 m	Tributary								20														
781.3			Bridge	10 m x 60 m	Tributary	Bridge across stream valley	10	60	197																		
786.3	1.1	787.4	Organics (NTS)	Organic																						1.1	
787.4	0.3	787.7	Fluvial (NTS)	Very Heavy		Bridge approach, Review for potentail aggregate source																		0.3			
787.4			Bridge	10 m x 60 m	Creek	Unnamed Creek 200 ft riprap erosion protection	10	60	197					0.04													
787.7	4.1	791.8	Colluvial (NTS)	Very Heavy																				4.1			

Carmacks to Alaskan Border via Nisling River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	Miles	End M.P.	Terrain Unit	Construction	Features Requiring Civil Structures	Comments	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
791.8	0.2	792	Alluvial (NTS)	Very Heavy		Bridge approach, Review for potentail aggregate source																		0.2			
791.9			Bridge	16 m x 200 m	Tributary	Deep valley requiring a bridge	16	200		656																	
792	2	794	Colluvial (NTS)	Very Heavy																				2.0			
794	0.3	794.3	Alluvial (NTS)	Very Heavy		Bridge approach, Review for potentail aggregate source																		0.3			
794.1			Bridge	10 m x 90 m	Tributary	Tributary in a valley, debris flow	10	90	295																		
794.3	3.3	797.6	Till	Heavy																			3.3				
797.6	0.4	798	Alluvial (NTS)	Very Heavy		Stream Crossing, Review for potentail aggregate source																		0.4			
797.9			Bridge	18 m x 150 m	Tributary	Debris flow	18	150		492																	
798	2.1	800.1	Till (NTS)	Very Heavy		Large cuts and fills																		2.1			
799.2			Bridge Pipe	20 m	Tributary								20														
800.1	0.9	801	Till	Very Heavy																				0.9			
801	0.5	801.5	Till (NTS)	Very Heavy																				0.5			
801.5	0.5	802	Organics (NTS)	Organic																						0.5	
802	1	803	Till (NTS)	Heavy																			1.0				
803	1.9	804.9	Organics (NTS)	Organic																						1.9	
804.9	0.6	805.5	Alluvial (NTS)	Very Heavy		Bridge approach, Review for potentail aggregate source																		0.6			
805.5	4.4	809.9	Till (NTS)	Heavy																			4.4				
807.8			Bridge Pipe	28 m	Tributary								28														
809.9	0.2	810.1	Alluvial	Very Heavy		Approach to bridge culvert, Review for potentail aggregate source																		0.2			
810			Bridge	8 m x 60 m	Tributary	Valley, debris flow	8	60	197																		
810.1	2.1	812.2	Till (NTS)	Heavy																			2.1				
812.2	9.5	821.7	Fluvial (NTS)	Average		Along Nisling River, Review for potentail aggregate source																9.5					
813.1			Bridge	8 m x 90 m	Creek	Stevens Creek	8	90	295																		
814.5			Bridge Pipe	20 m	Tributary								20														
814.9			Bridge Pipe	20 m	Tributary								20														
816			Bridge Pipe	80 m	Tributary								80														
816.2			Bridge Pipe	80 m	Tributary								80														
817.9			Bridge Pipe	20 m	Tributary								20														
820.1			Bridge Pipe	20 m	Tributary								20														
821.7	1.1	822.8	Organics (NTS)	Organic																						1.1	
822.8	2.2	825	Fluvial (NTS)	Average		Along Nisling River, Review for potentail aggregate source																2.2					
823.1			Bridge	8 m x 30 m	Tributary	Debris flow	8	30	98																		
824.1			Bridge Pipe	20 m	Tributary								20														
824.5			Bridge Pipe	20 m	Tributary								20														
825	2	827	Organics (NTS)	Organic		Along Nisling River																				2.0	
826.4			Bridge Pipe	20 m	Tributary								20														
827	5	832	Fluvial (NTS)	Average		Review for potentail aggregate source																5.0					
828.9			Bridge	10 m x 60 m	Creek	Tyrrell Creek	10	60	197																		
830.2			Bridge Pipe	20 m	Tributary								20														
831.9			Bridge Pipe	20 m	Tributary								20														
832	2	834	Alluvial	Heavy		Review for potentail aggregate source																	2.0				
832.4			Bridge	10 m x 60 m	Creek	Unnamed Creek	10	60	197																		
834	1.7	835.7	Fluvial	Heavy		Review for potentail aggregate source																	1.7				
834.5			Bridge Pipe	80 m	Tributary								80														
835.7	3.8	839.5	Organics (NTS)	Organic																						3.8	
836.2			Bridge Pipe	28 m	Tributary								28														
836.8			Bridge	10 m x 60 m	Creek	Rhyolite Creek	10	60	197																		
839.5	1.5	841	Alluvial (NTS)	Heavy		Along Nisling River, Review for potentail aggregate source																	1.5				
839.6			Bridge Pipe	20 m	Tributary								20														
840.9			Bridge Pipe	80 m	Tributary								80														
841	1	842	Bedrock (NTS)	Rock Grade		Nisling Range, Rockfall protection and Riprap Erosion protection along 50% of grade, retaining walls along 10% of grade								0.50			0.10								1.0		
842	3	845	Fluvial (NTS)	Very Heavy		Next to Nisling River erosion protection 10% of grade, Review for potentail aggregate source								0.30										3.0			
844.3			Bridge	8 m x 30 m	Tributary	Tributary in a valley, debris flow	8	30	98																		

Carmacks to Alaskan Border via Nisling River

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
845	2	847	Organics (NTS)	Organic																						2.0	
845.1			Bridge Pipe	20 m	Tributary								20														
847	7.7	854.7	Fluvial (NTS)	Average		Review for potentail aggregate source																7.7					
847.7			Bridge Pipe	28 m	Tributary								28														
849.3			Bridge Pipe	68 m	Tributary								68														
850.1			Bridge Pipe	20 m	Tributary								20														
852.5			Bridge Pipe	20 m	Tributary								20														
854.4			Bridge Pipe	80 m	Tributary								80														
854.7	1	855.7	Organics (NTS)	Organic																						1.0	
855.7	5.3	861	Fluvial (NTS)	Average		Review for potentail aggregate source																5.3					
857.8			Bridge Pipe	20 m	Tributary								20														
859.5			Bridge Pipe	20 m	Tributary								20														
861	2.3	863.3	Organics (NTS)	Organic																						2.3	
863.3	4.4	867.7	Fluvial	Average		Review for potentail aggregate source																4.4					
863.8			Bridge Pipe	28 m	Tributary								28														
864.5			Bridge Pipe	68 m	Tributary								68														
866			Bridge	8 m x 60 m	Creek	Unnamed Creek	8	60	197																		
867.5			Bridge Pipe	40 m	Tributary								40														
867.7	0.4	868.1	Alluvial	Heavy		Review for potentail aggregate source																	0.4				
868			Bridge Pipe	40 m	Tributary								40														
868.1	2.2	870.3	Fluvial	Average		Review for potentail aggregate source																2.2					
870.3	0.2	870.5	Organics	Organic																						0.2	
870.5	2.9	873.4	Fluvial	Heavy		Review for potentail aggregate source																	2.9				
870.6			Bridge	10 m x 60 m	Creek	Onion Creek	10	60	197																		
873.4	0.7	874.1	Organics	Organic																						0.7	
874.1	0.9	875	Fluvial	Average		Review for potentail aggregate source																0.9					
874.8			Bridge	8 m x 30 m	Tributary	Debris flow	8	30	98																		
875	0.9	875.9	Alluvial	Average		Review for potentail aggregate source																0.9					
875.4			Bridge Pipe	20 m	Tributary								20														
875.9	0.7	876.6	Organics	Organic																						0.7	
876.5			Bridge Pipe	20 m	Tributary								20														
876.6	2.6	879.2	Fluvial	Average		Review for potentail aggregate source																2.6					
876.7			Bridge Pipe	20 m	Tributary								20														
876.9			Bridge Pipe	20 m	Tributary								20														
879.2	8.9	888.1	Organics	Organic																						8.9	
879.3			Bridge	8 m x 30 m	Tributary	Debris flow	8	30	98																		
888.1	4.3	892.4	Fluvial	Average		Review for potentail aggregate source																4.3					
892.4	2.9	895.3	Organics	Organic																						2.9	
895.3	0.3	895.6	Fluvial	Average		Review for potentail aggregate source																0.3					
895.6	0.6	896.2	Fluvial	Very Heavy		Review for potentail aggregate source																		0.6			
895.9			Bridge	10 m x 700 m	River	Donjek River, 200 ft riprap erosion protection	10	700	2,297					0.04													
896.2	0.6	896.8	Fluvial	Average		Review for potentail aggregate source																0.6					
896.8	1.8	898.6	Organics	Organic																						1.8	
898.6	0.5	899.1	Fluvial	Average		Review for potentail aggregate source																0.5					
899.1	2.9	902	Organics	Organic																						2.9	
902	2	904	Fluvial	Heavy		Review for potentail aggregate source																	2.0				
904	0.5	904.5	Organics	Organic																						0.5	
904.5	0.7	905.2	Fluvial	Heavy		Review for potentail aggregate source																	0.7				
905.2	0.3	905.5	Organics	Organic																						0.3	
905.5	1.9	907.4	Fluvial	Average		Review for potentail aggregate source																1.9					
906.3			Bridge Pipe	86 m	Tributary								86														
907.4	0.9	908.3	Alluvial	Average		Review for potentail aggregate source																0.9					
907.6			Bridge Pipe	28 m	Tributary								28														
908.1			Bridge Pipe	28 m	Tributary								28														
908.3	1.1	909.4	Fluvial	Average		Review for potentail aggregate source																1.1					
909.4	0.8	910.2	Alluvial	Heavy		Review for potentail aggregate source																	0.8				
909.5			Bridge Pipe	28 m	Tributary								28														
910.1			Bridge Pipe	40 m	Tributary								40														
910.2	0.9	911.1	Till	Heavy																			0.9				
911.1	0.3	911.4	Alluvial	Heavy		Review for potentail aggregate source																	0.3				
911.3			Bridge Pipe	40 m	Tributary								40														

Carmacks to Alaskan Border via Nisling River

Terrain Analysis							Size of Civil Structure															Grade Construction					
							Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
911.4	1.9	913.3	Fluvial	Average		Review for potentail aggregate source																1.9					
913.3	0.3	913.6	Alluvial	Heavy		Review for potentail aggregate source																	0.3				
913.5			Bridge Pipe	44 m	Tributary								44														
913.6	1.1	914.7	Fluvial	Average		Review for potentail aggregate source																1.1					
914.5			Bridge Pipe	20 m	Tributary								20														
914.7	1.7	916.4	Organics	Organic																						1.7	
915.5			Bridge Pipe	40 m	Tributary								40														
916.3			Bridge Pipe	20 m	Tributary								20														
916.4	1.1	917.5	Till	Heavy																			1.1				
916.8			Bridge Pipe	20 m	Tributary								20														
917.5	1.8	919.3	Organics	Organic																						1.8	
917.9			Bridge Pipe	20 m	Tributary								20														
918.4			Bridge Pipe	20 m	Tributary								20														
919.1			Bridge Pipe	20 m	Tributary								20														
919.3	2.3	921.6	Fluvial	Heavy		Review for potentail aggregate source																	2.3				
921.6	0.3	921.9	Organics	Organic																						0.3	
921.9	0.6	922.5	Till	Average																		0.6					
922.4			Bridge Pipe	20 m	Tributary								20														
922.5	0.2	922.7	Organics	Organic																						0.2	
922.7	0.9	923.6	Till	Average																		0.9					
923.6	0.6	924.2	Organics	Organic																						0.6	
924.2	1.3	925.5	Fluvial	Average		Review for potentail aggregate source																1.3					
925.5	0.2	925.7	Organics	Organic																						0.2	
925.7	2.8	928.5	Till	Heavy																			2.8				
928.5	0.4	928.9	Organics	Organic																						0.4	
928.9	0.8	929.7	Till	Heavy																			0.8				
929.7	0.2	929.9	Fluvial	Average		Review for potentail aggregate source																0.2					
929.9	0.4	930.3	Organics	Organic																						0.4	
930.3	0.4	930.7	Fluvial	Average		Review for potentail aggregate source																0.4					
930.7	0.8	931.5	Fluvial	Very Heavy		Review for potentail aggregate source																		0.8			
931.1			Bridge	15 m x 1125 m	River	White River, 200 ft riprap erosion protection	15	1,125	3,691					0.04													
931.5	0.2	931.7	Fluvial	Very Heavy		Review for potentail aggregate source																		0.2			
931.7	1.4	933.1	Fluvial	Average		Review for potentail aggregate source																1.4					
932.9			Crossing	Level	Road	James Trail												1									
933.1	0.4	933.5	Organics	Organic																						0.4	
933.5	2.1	935.6	Fluvial	Average		Review for potentail aggregate source																2.1					
935.6	0.3	935.9	Till	Average																		0.3					
935.9	0.2	936.1	Organics	Organic																						0.2	
936.1	1.2	937.3	Till	Average																		1.2					
937.3	0.4	937.7	Fluvial	Average		Review for potentail aggregate source																0.4					
937.7	0.6	938.3	Alluvial	Very Heavy		Review for potentail aggregate source																		0.6			
937.9			Bridge	8 m x 60 m	Creek	Snag Creek	8	60	197																		
938.3	1	939.3	Till	Average																		1.0					
939.3	2.1	941.4	Alluvial	Average		Review for potentail aggregate source																2.1					
939.5			Bridge Pipe	40 m	Tributary								40														
941.1			Bridge Pipe	32 m	Tributary								32														
941.3			Bridge Pipe	32 m	Tributary								32														
941.4	1.5	942.9	Organics	Organic																						1.5	
942.2			Bridge Pipe	20 m	Tributary								20														
942.5			Bridge Pipe	20 m	Tributary								20														
942.9	5.6	948.5	Till	Average																		5.6					
948.3			Bridge Pipe	28 m	Tributary								28														
948.5	1.7	950.2	Till	Heavy																			1.7				
950.2	0.3	950.5	Alluvial	Average		Review for potentail aggregate source																0.3					
950.5	0.5	951	Till	Average																		0.5					
951	1	952	Alluvial	Average		Review for potentail aggregate source																1.0					
951.7			Bridge Pipe	28 m	Tributary								28														
952	0.5	952.5	Till	Average																		0.5					
952.2			Crossing	Level	Road	Alaska Highway												1									
952.5	2.6	955.1	Permafrost	Permafrost																							2.6
952.5			Bridge Pipe	28 m	Tributary								28														
954.4			Bridge Pipe	28 m	Tributary								28														
955.1	1	956.1	Till	Average																		1.0					
955.2			Bridge Pipe	28 m	Tributary								28														
955.3			Bridge Pipe	28 m	Tributary								28														
955.5			Bridge Pipe	28 m	Tributary								28														
955.6			Bridge Pipe	28 m	Tributary								28														

Carmacks to Alaskan Border via Nisling River

Terrain Analysis							Size of Civil Structure: Bridge Dimensions		Brige Length (ft.) by Height Class				Bridge Pipes	Erosion Protection	Rock/Snow Shed	Rock Fall Protection	Retaining Walls	Road			Tunnel	Grade Construction: Average	Heavy	Very Heavy	Rock Grade	Organic	Permafrost
Start M.P.	**Miles**	**End M.P.**	**Terrain Unit**	**Construction**	**Features Requiring Civil Structures**	**Comments**	Height (m)	Length (m)	< 50' high	51' - 100' high	101' - 200' high	201' - 300' high	Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Level Xings	Overpass Length (m)	Rail Bridge Length (m)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)	Length (mile)
955.8			Bridge Pipe	28 m	Tributary								28														
	218.1 M							5,300 m	11,644 ft.	1,804 ft.	3,937 ft.		3,004 m	1.09	0.50	0.36	0.10	3 Xings			8.4 M	76.9 M	46.9 M	26.8 M	1.0 M	55.5 M	2.6 M
								17,388 ft.	Total bridge length			17,385 ft.	9,856 ft.		2,640 ft		528 ft				Total Route Segment Length (miles)						218.1 M
						Count	34	34	30	3	1		79	8	2	1	1				1						
						Check Summary		5,300	3,550	550	1,200		3,004					3			8.4	76.9	46.9	26.8	1.0	55.5	2.6
									11,647 ft	1,804 ft	3,937 ft		9,856 ft														

Appendix B -
Potential Ballast Source Locations

Watson Lake to Carmacks Alignment

Mileage	Direction from Alignment	Distance from Alignment (km)	Rock Type
415	North	22	Biotite-hornblende granodiorite and quartz diorite
480	South	2	Gabbro
485	South	Adjacent	Interbedded greenstone, metasediments, gabbro and diorite
505	North	15	Basalt
600	North	1	Basalt
605	South	5	Biotite-hornblende granodiorite and quartz diorite
622	South	Adjacent	Biotite-hornblende granodiorite and quartz diorite
645	North	Adjacent	Biotite granodiorite and quartz monzonite
660	North	Adjacent	Interbedded greenstone, metasediments, gabbro and diorite
676	North	Adjacent	Biotite granodiorite and quartz monzonite
685	North	1.5	Biotite-hornblende granodiorite and quartz monzonite
690	North	Adjacent	Biotite-hornblende granodiorite and quartz monzonite
698	North	2	Biotite-hornblende granodiorite and quartz monzonite
704	North	Adjacent	Andesite and basaltic flows, breccias and tuffs
709	North	Adjacent	Andesite and basaltic flows, breccias and tuffs

Carmacks to Alaska Border via Ladue River Alignment

Mileage	Direction from Alignment	Distance from Alignment (km)	Rock Type
755	North	5	Diorite
760	North	Adjacent	Porphyritic basalt
765	North	2.5	Porphyritic basalt
774	North	Adjacent	Hornblende granodiorite
778	North	Adjacent	Porphyritic basalt
784	South	2	Porphyritic basalt
795	South	Adjacent	Hornblende granodiorite
801	South	3	Hornblende granodiorite
814	North	1	Porphyritic basalt
817	South	Adjacent	Porphyritic basalt
830	South	Adjacent	Hornblende granodiorite
845	South	Adjacent	Hornblende granodiorite
896	South	9	Gabbro
936	South	1.5	Hornblende granodiorite
950	South	Adjacent	Hornblende granodiorite

Watson Lake to Whitehorse Alignment

Mileage	Direction from Alignment	Distance from Alignment (km)	Rock Type
90	South	Adjacent	Biotite quartz monzonite and granodiorite
132	North	3	Greenstone
196	North	2.5	Peridotite, porphyritic basalt, greenstone
197	North	2.5	Peridotite, porphyritic basalt, greenstone
199	North	1.5	Peridotite, porphyritic basalt, greenstone
205	North	2	Porphyritic basalt
211	North	1	Porphyritic basalt
213	North	2.5	Porphyritic basalt
218	South	2	Peridotite
223	South	Adjacent	Diorite
227	North	1.5	Peridotite and diorite
233	North	2	Diorite
235	North	2	Peridotite
250	North	1	Metavolcanics
253	South	3.5	Metavolcanics
255	North	Adjacent	Metavolcanics
256	South	2	Metavolcanics
270	North	Adjacent	Metavolcanics
280	North	Adjacent	Metavolcanics
290	North	6	Hornblende diorite
310	North	6	Hornblende diorite

Whitehorse to Alaska Border Alignment

Mileage	Direction from Alignment	Distance from Alignment (km)	Rock Type
337	North	3.5	Hornblende-biotite granodiorite
355	North	3	Hornblende-biotite granodiorite
365	North	3	Hornblende-biotite granodiorite
368	North	3	Hornblende-biotite granodiorite
371	North	4.5	Hornblende-biotite granodiorite
410	South	Adjacent	Hornblende-biotite granodiorite
420	North	2.5	Hornblende-biotite granodiorite
440	North	Adjacent	Hornblende-biotite granodiorite
527	North	4.5	Hornblende-biotite granodiorite
537	North	6	Hornblende-biotite granodiorite
544	North	3	Hornblende-biotite granodiorite
550	North	2.5	Hornblende-biotite granodiorite
555	North	2.5	Hornblende-biotite granodiorite
580	South	4	Hornblende-biotite granodiorite
582	South	Adjacent	Greenstone
590	South	6	Quartz monzonite
600	North	Adjacent	Gabbro
603	North	Adjacent	Dunite
605	North	Adjacent	Greenstone

Carmacks to Alaska Border via Nisling River Alignment

Mileage	Direction from Alignment	Distance from Alignment (km)	Rock Type
750	South	Adjacent	Basalt and andesite flows and breccias
763	North	3.5	Basalt and andesite flows and breccias and diorite
765	South	4.5	Porphyritic quartz monzonite
790	South	Adjacent	Amphibolite
850	South	Adjacent	Hornblende-biotite granodiorite
880	South	1	Tuff and breccias
890	South	1	Tuff and breccias
913	South	1	Tuff and breccias
917	North	6	Greenstone