Ministry of Transportation and Infrastructure

HIGHWAY 97 PEACHLAND TRANSPORTATION PLANNING STUDY

Phase I Final Report

July 2019

PARSONS

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Executive Summary

Phase I of the Highway 97 Peachland Transportation Planning Study explored options to improve safety and mobility along the highway corridor. The objective of this study involved the identification of two potential improved alignment options for Highway 97 through the District of Peachland; one on the existing route and one on an alternate route. The key study activities therefore involved an assessment of the existing and projected future conditions along the existing corridor, development of potential improvement options for the existing route and alternate route, screening the options to identify the front-runners, and then undertaking a multiple account evaluation (MAE) process to identify one preferred option for the existing route and one preferred option for the alternate route. Refinements were then made to the preferred options for both routes to address MAE findings, advance technical development, and address stakeholder and Indigenous considerations.

With the primary role of Highway 97 in the Central Okanagan to connect communities, regional / provincial activity centres, and other provincial highways, the improvement options were developed and evaluated based on several high-level guiding principles as highlighted below:

- Provide a safe, functional, and efficient corridor.
- Create a multi-modal transportation corridor.
- Utilize a coordinated approach to planning and network improvements.

E1 STUDY AREA

The study area falls within the District of Peachland and Regional District of Central Okanagan (RDCO). Existing route options focus on the Highway 97 corridor within the District of Peachland while alternate route options fall within both the District of Peachland and RDCO boundaries.

The south extent of the study area is south of the Antler's Beach area and the north extent is around the Highway 97C/97 Drought Hill Interchange.

The extents of the study area are illustrated in *Figure E.1*.

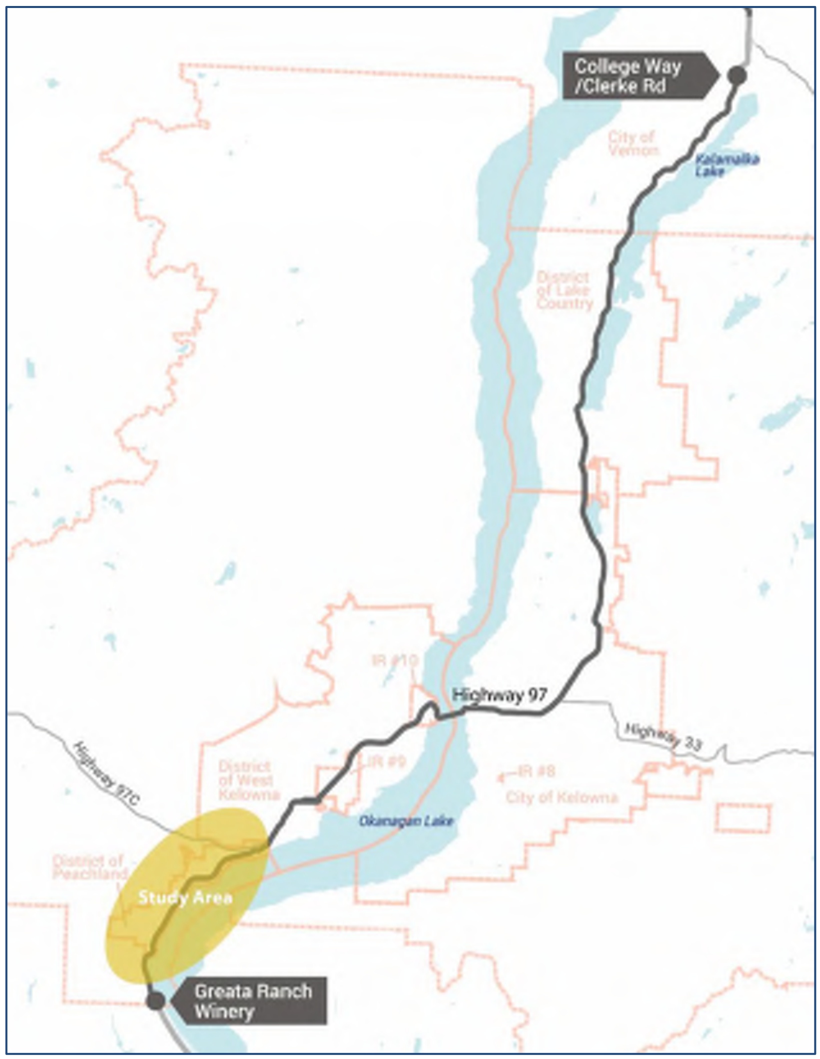


Figure E.1: Highway 97 Peachland Transportation Planning Study Area

E2 PROBLEM DEFINITION

An assessment of the existing and future conditions along the Highway 97 corridor through Peachland identified deficiencies with respect to existing and future traffic operations and safety performance. Key findings of the assessment suggest that the Highway 97 corridor through Peachland will approach capacity for a two lane highway by 2040, will experience decreasing levels of service based on an anticipated reduction in average speeds during the afternoon peak period, and access to the highway will become more problematic at the unsignalized intersections.

OVERALL CORRIDOR

It is anticipated that the highway corridor through Peachland will be approaching capacity for a two-lane/two-way highway by 2040. Currently, most of the two-lane sections operate at Level of Service (LOS) D during peak hours, representing moderate levels of congestion. However, the frequent intersections and relatively high turning volumes when compared with a more rural environment contribute to current operating conditions, meaning the roadway does not always operate as well as the level of service analysis suggests. In addition, long weekends and special events attract significant additional traffic to Highway 97 in Peachland. During these times, significant congestion may occur. By 2040, the level of service is expected to drop to LOS E for much of the corridor in the PM peak hour. At LOS E, driving can be frustrating with drivers spending 80% or more the time following and with the average travel speed dropping to under 65 km/h. This means that even small increases in traffic will create congestion, and the number of hours per year that congestion is experienced will increase.

Within the study corridor, most collisions have been recorded at the intersections, which is typical of most highway corridors. In the 10-year period from 2004 to 2014, the highest number of collisions occurred at the intersection of the highway with Clements Crescent (18) and Princeton Avenue (19). Traffic signals were added at Clements Crescent in late 2011; however there has been no significant change in the number or type of collisions since that time.

INDIVIDUAL INTERSECTIONS

Although there are mobility and safety problems identified for highway sections, the root causes of these problems can be traced back to the performance at individual intersections. None of the intersections have an identified safety problem, but the collisions at the intersections combine to create a collision rate problem. Similarly, the corridor mobility is impacted by turning movements at intersections and the most significant delays are incurred by traffic attempting to enter or cross Highway 97 at intersections.

With current traffic volumes, particularly in peak periods during the high season, it is difficult to find gaps in traffic at unsignalized intersections. This creates delays getting on and across the highway at some of the unsignalized intersection in Peachland. As traffic increases on the highway, delays for side street traffic will increase.

The challenges in accessing or crossing Highway 97 are most pronounced in the PM peak hour. Delays at some intersections are already very high. Most notably, drivers at Huston Road can expect delays of several minutes. By 2040, drivers will experience major delays (>50 secs) when trying to turn onto or across the highway at several more intersections, including Renfrew Road, Todd Road / Chidley Road, and Buchanan Road West. These challenges make driving uncomfortable and may lead to risk-taking as drivers attempt to cross or make turns onto the highway.

E.3 OPTION DEVELOPMENT

In developing improvement options for the existing route and options for potential alternate routes, consideration was given to various shaping influences, desired long-term functional characteristics, design functional classification, design criteria, and proposed cross section. Initial improvement concepts were developed based on a number of shaping influences including:

- Concepts to address defined problems – both current and future;
- Previous historical options;
- Local transportation master plans, future transit plans, active transportation plans and other relevant planning documents; and
- Discussions with Regional District, Indigenous groups, and municipal staff and Council.

The following general features and / or goals were considered in the development of the improvement options along the existing route as well as in the development of several potential alternate route options:

Existing Route

- Long term removal of traffic signals.
- Reduction in conflicts at high collision locations.
- Enhance local connections across the highway as much as possible.
- Accommodate uncongested, reliable transit on the highway.
- Support active transportation.

Alternate Route

- Diversion of enough traffic away from the existing corridor to provide relief from intersection delays.
- Connection points to the existing corridor influence traffic diversion.
- Topography governs the alignment of alternate corridor – maximum grade of 6% (similar to the recent Winfield-Oyama section of Highway 97).

EXISTING ROUTE OPTIONS

The existing route was partitioned into smaller sections in order to focus on specific corridor issues. From north to south, the sections are identified as depicted in ***Figure E.3***:

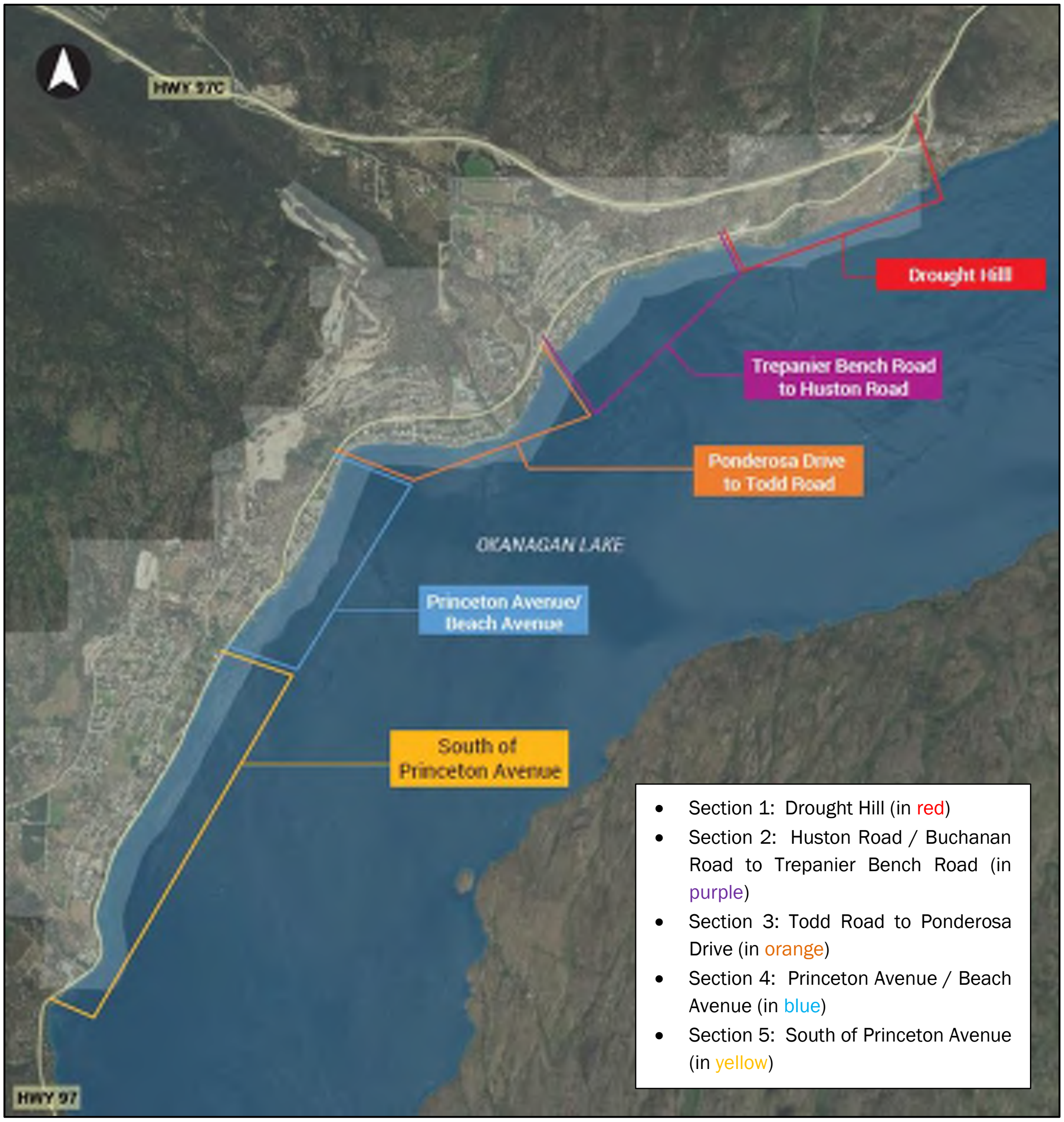


Figure E.3: Peachland Existing Route Option Sections

In some existing route options, traffic signals have been removed from the corridor and replaced by a grade-separated highway crossing to address identified problems and to achieve the long term planning objectives for the corridor. Other options include realignment of the highway, reconfigurated or relocated local road connections (including retention and/or addition of signalized intersections), and changes to the alignment of some local road network elements. It is important to note that for all existing corridor options, Highway 97 is widened to a four-lane cross section to reflect the needs for the long-term planning horizon.

ALTERNATE ROUTE OPTIONS

Five options were developed for the potential alternate route and these are depicted in ***Figure E.4.***:

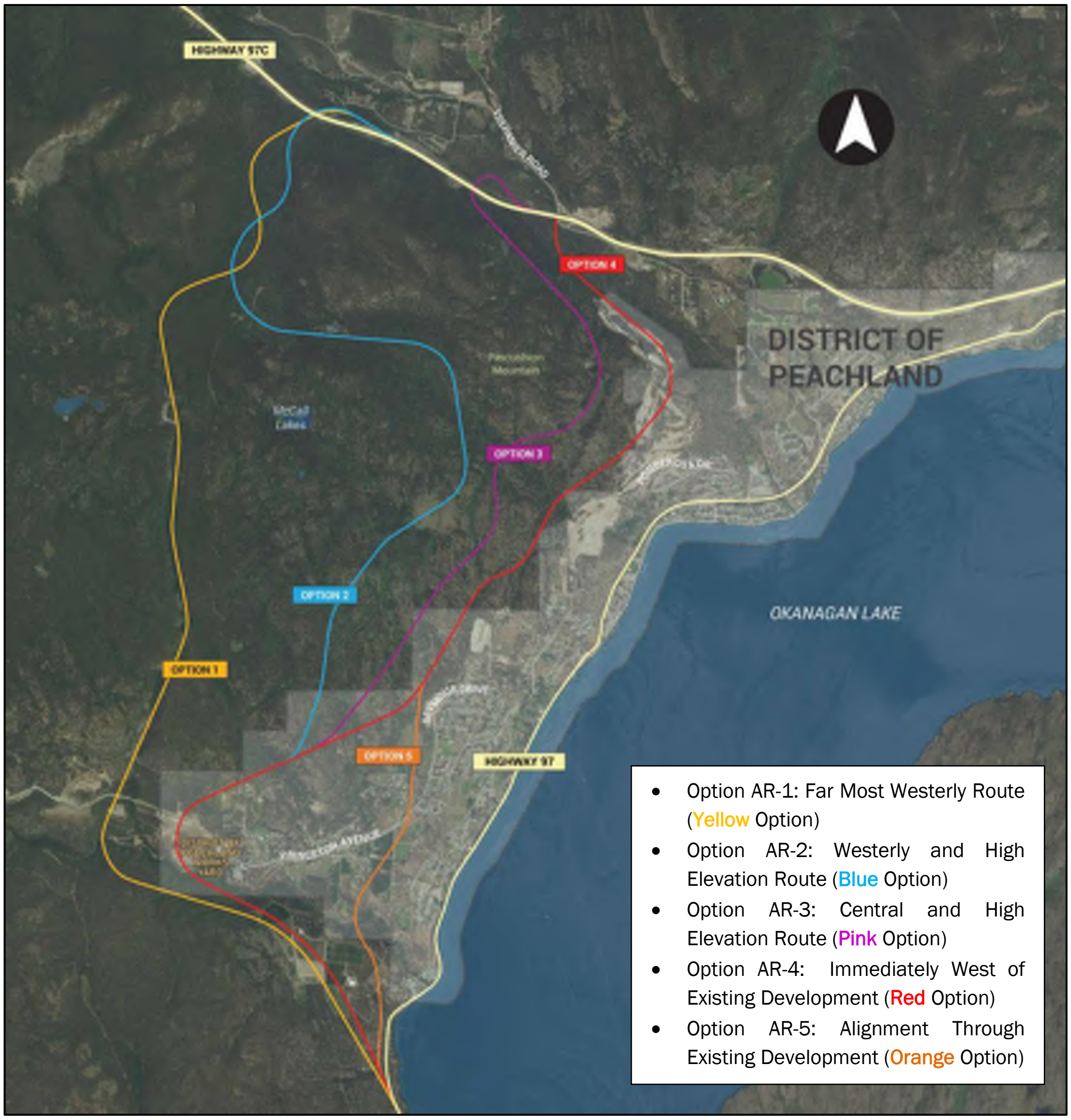


Figure E.4: Alternate Route Options

E.4 ENGAGEMENT

Improvement options were developed and reviewed with the participation of Peachland residents, stakeholders, and Indigenous groups. Participation by key stakeholders and Indigenous groups included:

- District of Peachland Council.
- Technical Advisory Group – that includes staff-level expertise from the District of Peachland, the Regional District of Central Okanagan, and participating Indigenous groups.

- Community Liaison Committee – members who reflect a cross-section of Peachland citizens and stakeholder groups including BC Transit.
- Penticton Indian Band – Chief and Council.
- General Public.

Two Public Open Houses events were held at the Peachland Community Centre to present and obtain input at various development stages of the highway corridor improvement planning. The objectives of the two events are described below.

- Public Open House #1: Held on June 21, 2016 to provide citizens with a summary of the analysis conducted to date. The event presented information on the project team's understanding of the corridor. The project team also sought to identify feedback from participants regarding considerations that may have been overlooked in the technical data collection process. A total of 350 participants attended the open house. A project website was launched to coincide with the public open house.
- Public Open House #2: Held on November 21, 2016 was a key engagement and consultation milestone. The open house was designed to present several possible options for a bypass or existing corridor improvement, and gather public input on the issues, concerns, and opportunities associated with each option. The input received will be considered in the evaluation and refinement of the routes down to one or two preferred options for the existing corridor, and one or two preferred options for the bypass corridor. A total of 640 people attended the open house.

E.5 OPTION SCREENING

Prior to submitting the existing route and alternate route options for more detailed evaluation, a screening process was conducted to reduce the set of options to a more manageable number which will focus the analysis requirements during the subsequent option evaluation process. By screening the options as this stage, only the most promising options are taken forward for detailed evaluation.

OPTION SCREENING CRITERIA

The intent of the option screening process is to identify short comings that may exist in one or more options previously generated and presented at the last public consultation event in the fall of 2016. In identifying short comings in one or more options, some options can be eliminated from further consideration. Only the most feasible or practical short-listed options would be taken forward for a more detailed assessment using the MAE framework. The screening process would be applied separately to both the existing route options and alternate route options with the goal of short listing no more than three options for each existing route section and no more than three alternate route options.

The option screening is also the start of the option evaluation process, so some of the information generated in the screening assessment will be carried forward, where appropriate, in the more detailed option evaluation process. Noting the characteristics of the options being considered and the environment in which the options pass through, the following screening criteria were considered:

- Environmental;
- Social / Community;
- Traffic and Travel Demand;
- Engineering; and
- Costs.

OPTIONS AND OPTION PACKAGES

The outcome of the option screening process resulted in an option being deemed possible, or due to issues, challenges or impacts, being deemed not preferred. The short-listed options which were deemed to be technically possible, were advanced for further detailed analysis and evaluation using a comprehensive multiple account evaluation process.

For the existing route options (option packages), it is noted that up to three options were shortlisted for each of the five route sections which could result in 72 possible option combinations. At the multiple account evaluation stage, no more than three options (option packages) are anticipated to be evaluated. Therefore, the option packages were developed in a manner that allows alternative options to be isolated and potentially complementary options to be combined while reducing the overall combinations to just three. Based on this approach, three option packages for the existing route were assembled with the general themes of the three option packages being:

- Option package ER-A is comprised of route section options that mostly include at-grade intersections.
- Option packages ER-B and ER-C are comprised of route section options that mostly include grade-separated junctions or crossings.

The selection rational for the option packages for the existing route is shown in ***Table E.1***. As shown, the existing route option packages are assembled as follows:

- ER-A is comprised of route section options ER-1A, ER-2D, ER-3B, ER-4B and ER-5A.
- ER-B is comprised of route section options ER-1B, ER-2A, ER-3A, ER-4A and ER-5B.
- ER-C is comprised of route section options ER-1C, ER-2B, ER-3A, ER-4A and ER-5B.

Table E.1: Existing Route Option Packages

AREA	OPTION	OPTION SCREEENING DISPOSITION	ADVANCED TO MAE	ALIGNMENT OPTION PACKAGE
Drought Hill	ER-1A Drought Hill Expressway	• Possible	✓	ER-A
	ER-1B Drought Hill Expressway with Drought Road Overpass	• Possible	✓	ER-B
	ER-1C Seclusion Bay Road and Drought Road Overpasses	• Possible	✓	ER-C
Trepanier Bench Road to Huston/Buchanan Road	ER-2A Overpass at Lang Road	• Possible	✓	ER-B
	ER-2B Extension of Shaw Road and Huston Road	• Possible	✓	ER-C
	ER-2C Trepanier Road Over Highway 97	• Not preferred • Design and constructability concerns associated with proposed overpass	X	
	ER-2D Signal at Trepanier Bench Road	• Possible	✓	ER-A
	ER-2E Signal at Huston/Buchanan Road	• Not Preferred • This option is not consistent with District of Peachland objectives.	X	
Ponderosa Drive to Todd Road	ER-3A Todd and 13 Crossings	• Possible	✓	ER-B & ER-C
	ER-3B Retain Signals at Clement Crescent and Ponderosa Drive	• Possible	✓	ER-A
Princeton Ave / Beach Ave	ER-4A Interchange at Princeton	• Possible	✓	ER-B & ER-C
	ER-4B Retain Signal at Princeton	• Possible	✓	ER-A
South of Princeton Avenue	ER-5A Realignment at Antlers Beach	• Possible	✓	ER-A
	ER-5B Short Bypass	• Possible	✓	ER-B & ER-C

For the alternate route options, the short-listed options which were deemed to be technically possible are to be advanced for further detailed analysis and evaluation using a comprehensive multiple account evaluation process. The selection rational for the three short-listed alternate route options is summarized in ***Table E.2***.

For the purposes of simplifying route naming for the multiple account evaluation process such that the short-listed options remain sequential with no gaps between the identifiers, AR-2 (Westerly and High Elevation Route) is renamed AR-A, AR-3 (Central and High Elevation Route) is renamed AR-B, and AR-5 (Lower Elevation Route) is renamed AR-C.

Table E.2: Alternate Route Options

OPTION	OPTION SCREENING DISPOSITION	ADVANCED TO MAE	ALTERNATE ROUTE OPTION
AR-1: Far Most Westerly Bypass Route (Yellow)	• Not preferred • Highest potential environmental (riparian) impacts and moderate impacts to species at risk. • Low traffic demand and travel time savings. • Remove from further consideration.	X	
AR-2: Westerly and High Elevation Bypass Route (Blue)	• Possible	✓	AR-A
AR-3: Central and High Elevation Bypass Route (Pink)	• Possible	✓	AR-B
AR-4: Bypass Route Immediately West of Existing Development (Red)	• Not preferred • High environmental impacts to south slopes. • Some travel time savings and but demonstrates slightly higher demand in the PM peak hour compared to AM peak hour. • Remove from further consideration as this option has higher environmental impacts and lower benefits compared to similar option AR-5.	X	
AR-5: Lower Elevation Route (Orange)	• Possible	✓	AR-C

E.6 OPTION EVALUATION

The more detailed option evaluation process will involve the application of a comprehensive evaluation framework to the three existing route option packages and the three alternate route options. In this section, the proposed evaluation framework is introduced and then followed by a description of the option evaluation for the existing route option packages and then the alternate route options.

EVALUATION FRAMEWORK

In order to compare and contrast the relative merits and impacts of each option, a set of high level evaluation criteria was developed based on the MAE methodology typically used for BC Ministry of Transportation and Infrastructure (BC MoTI) planning studies. For this study, the following accounts and criteria were applied:

CUSTOMER SERVICE ACCOUNT

- Traffic Mobility
- Predicted Road Safety Performance
- Network Travel Time & Vehicle Operation Cost Savings
- Pedestrian and Cycling Accommodation

SOCIO COMMUNITY ACCOUNT

- Property Impacts
- Noise Impacts
- Visual Impacts
- Community Severance
- Consistency with Community Plans

ENVIRONMENTAL ACCOUNT

- Terrestrial Impacts
- Aquatic Impacts
- Archaeological / Historical Impacts
- Greenhouse Gas Emission Benefits

FINANCIAL ACCOUNT

- Capital Cost
- Property Costs
- Maintenance and Rehabilitation Cost
- Salvage Value (not including property)

Subsequent work as part of the Phase II study will involve more detailed analysis of the preferred existing route option and the preferred alternate route option. Given the high level nature of the Phase I study, the Economic Development Account was not considered; however, this account will be evaluated as part of the Phase II study.

The proposed criteria under each account are a combination of quantitative and qualitative indicators that have been selected to provide sufficient comparative information that will assist in determining a preferred option within the existing alignment or for an alternate alignment. It is noted that for each criterion, the comparison of the option is against a Base Case scenario. The qualitative evaluation is used when specific measurements cannot readily be made, but there are obvious benefits or impacts as compared to the Base Case. For the purposes of this study and the comparative evaluation, the Base Case represents the existing physical conditions with no improvements into the future planning horizon. These qualitative evaluations are more prominent in the Customer Service, Socio-Community, and Environmental Accounts. To evaluate qualitative scoring consistently, a five-level rating system was applied as shown in ***Table E.3***.

Table E.3: Qualitative Scoring Format

SCORE	MEANING
○	Significantly Worse
◔	Somewhat Worse
◑	Similar to Base Case / Neutral
◕	Somewhat Better
●	Significantly Better

The descriptions below each proposed criterion include a summary of the criterion characteristics and rationale, as well as a range of evaluation output. For consistency with business case development, a 25-year analysis period has been assumed for quantitative criteria. For those criteria that are reported in monetized values, the values have been brought back to Present Value (PV) 2018$ for comparison purposes using a 6% annual discount rate.

The level of detail that was considered within each criterion in the option evaluation framework is related to the level of development of the options being considered. Most options being considered have been developed to a single-line sketch level of detail. However, layout plans, vertical profiles, and typical cross-sections were only generated for selected options (e.g. alternate routes) where it was considered necessary to augment the basic information contained in the single-line sketches.

EVALUATION RESULTS

The results of the multiple account evaluation of the existing route options are summarized in ***Table E.4***. The results of the multiple account evaluation of the alternate route options are summarized in ***Table E.5***.

Table E.4: Multiple Account Evaluation Summary – Existing Route

CRITERIA	UNITS	OPTION ER-A	OPTION ER-B	OPTION ER-C
CUSTOMER SERVICE ACCOUNT				
Traffic Mobility	v/c Ratio Travel Time (Min)	v/c ratio AM 0.4 to 0.6; v/c ratio PM 0.4 to 0.9 Route Average Travel Time Savings per trip: AM 1 to 3 min., PM 3 to 5 min.	v/c ratio AM 0.2 to 0.4; v/c ratio PM 0.3 to 0.6 Route Average Travel Time Savings per trip: AM 2 to 4 min., PM 4 to 7 min.	v/c ratio AM 0.2 to 0.4, PM 0.3 to 0.6 Route Average Travel Time Savings per trip: AM 2 to 4 min., PM 4 to 7 min.
Predicted Road Safety Performance	Crashes $(PV)	2025: 61.42 predicted crashes, $18.5M total crash costs 2043: 84.81 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$20.3 Million	2025: 46.9 predicted crashes, $15.5M total crash costs 2043: 67.76 predicted crashes, $21.9M total crash costs Total Safety Benefits: $3.2 Million	2025: 48.85 predicted crashes, $16.1M total crash costs 2043: 70.88 predicted crashes, $21.7M total crash costs Total Safety Benefits: -$2.1 Million
Network Travel Time & Vehicle Operation Cost Savings	$M (PV)	$64M	$79M	$79M
Pedestrian and Cycling Accommodation	Qualitative	New shoulder, but higher speeds and volumes. One new traffic signal. Somewhat better ◕	New shoulder, but higher speeds and volumes. Five new grade separations from Highway 97. One less traffic signal. Somewhat better ◕	New shoulder, but higher speeds and volumes. Six new grade separations from Highway 97. One less traffic signal. Somewhat better ◕
SOCIO COMMUNITY ACCOUNT				
Property Impacts	# of Properties	Partial Property Takes > 90; Full Property Takes > 15	Partial Property Takes > 80; Full Property Takes > 30	Partial Property Takes > 85; Full Property Takes > 35
Noise Impacts	Qualitative	Somewhat worse ◔	Somewhat worse ◔	Somewhat worse ◔
Visual Impacts	Qualitative	Visual impacts from any significant cut / fill. Minor impacts at least two intersection realignments along the corridor. Significant impacts anticipated at Antlers Beach. Somewhat worse ◔	Visual impacts from any significant cut / fill. Potential for significant impacts from three intersection realignments and overpass structures along the corridor. Impacts from bypass at south end of corridor. Significantly worse ○	Visual impacts from any significant cut / fill. Potential for significant impacts from three intersection realignments and overpass structures along the corridor. Impacts from bypass at south end of corridor. Significantly worse ○
Community Severance	Qualitative	Higher volumes and speeds and wider pavement. Six new right-in, right out intersections. Two closed Highway 97 accesses. Three new local road connections. One new traffic signal. Somewhat worse ◔	Higher volumes and speeds and wider pavement. Three new right-in, right out intersections. Four closed Highway 97 accesses. Two new local road connections. Three new grade separated crossings. Neutral ◑	Higher volumes and speeds and wider pavement. Three new right-in, right out intersections. Two closed Highway 97 accesses. Two new local road connections. Six new grade separated crossings. Neutral ◑
Consistency with Community Plans	Qualitative	Little or no impact on OCP. Neutral ◑	New road between Ponderosa Dr and Clements Cr is proposed in OCP. Neutral ◑	New road between Ponderosa Dr and Clements Cr is proposed in OCP. Neutral ◑
ENVIRONMENTAL ACCOUNT				
Terrestrial Impacts	Qualitative	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔
Aquatic Impacts	Qualitative	Potential impacts to eight watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. Somewhat Worse ◔	Potential impacts to nine watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. May also require modification to lake shoreline near the Princeton segment. Somewhat Worse ◔	Potential impacts to nine watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. May also require modification to lake shoreline near the Princeton segment. Somewhat Worse ◔
Archaeological / Historical Impacts	Qualitative	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔
Greenhouse Gas Emission Benefits	$M (PV)	$0.5M	$0.5M	$0.5M
FINANCIAL ACCOUNT				
Capital Cost	Range	$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)
Property Costs	Range	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)
Maintenance and Rehabilitation Cost	Range	$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)
Salvage Value (not including property)	Range	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)

Table E.5: Multiple Account Evaluation Summary – Alternate Route

CRITERIA	UNITS	OPTION AR-A	OPTION AR-B	OPTION AR-C
CUSTOMER SERVICE ACCOUNT				
Traffic Mobility	v/c Ratio Travel Time (Min)	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.8 to 1.3 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.0 Route Average Travel Time Savings per trip: Alternate Route: AM -2 to -4 min.: PM -1 to 2 min	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.9 to 1.3 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.0 Route Average Travel Time Savings per trip: Alternate Route: AM -1 to -3 min.; PM -1 to 2 min.	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.9 to 1.2 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.1 Route Average Travel Time Savings per trip: Alternate Route: AM 0 to 2 min.; PM 3 to 6 min.
Predicted Road Safety Performance	Crashes $(PV)	2025 – 67.68 predicted crashes, $25.0M total crash costs 2043 – 89.87 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$0.5 Million	2025 – 67.77 predicted crashes, $22.1M total crash costs 2043 – 90.31 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$0.6 Million	2025 – 67.13 predicted crashes, $22.9M total crash costs 2043 – 88.83 predicted crashes, $21.7M total crash costs Total Safety Benefits: -$0.5 Million
Network Travel Time & Vehicle Operation Costs	$M (PV)	$34M	$42M	$63M
Pedestrian and Cycling Accommodation	Qualitative	New route with shoulder but prohibitive grades and lack of amenities Neutral ◑	New route with shoulder but prohibitive grades and lack of amenities Neutral ◑	New route with shoulder which may be viable alternative Somewhat better ◕
SOCIO COMMUNITY ACCOUNT				
Property Impacts	# of Properties	Partial Property Takes > 10; Full Property Takes < 5	Partial Property Takes > 15; Full Property Takes < 5	Partial Property Takes > 20; Full Property Takes > 5
Noise Impacts	Qualitative	Neutral ◑	Neutral ◑	Somewhat worse ◔
Visual Impacts	Qualitative	Option is set back from most developments and therefore minimal affect on adjacent residents, however large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔	Option is set back from most developments and therefore minimal effect on adjacent residents, however large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔	Option is set back from most developments, although does pass closer to the limits of Peachland, and therefore is anticipated to have some effect on adjacent residents. Large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔
Community Severance	Qualitative	Little to no impact. Neutral ◑	Little to no impact. Neutral ◑	Creates additional severance in developed areas. Somewhat worse ◔
Consistency with Community Plans	Qualitative	Little to no impact. Neutral ◑	Some impacts on existing developments and rural land uses. Neutral ◑	Impact on existing developments and future land use. Somewhat worse ◔
ENVIRONMENTAL ACCOUNT				
Terrestrial Impacts	Qualitative	Highest level of impact to conservation status and sensitivity of terrestrial ecosystems. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○	High level of impact to conservation status and sensitivity of terrestrial ecosystems, although less impact than AR-A. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○	High level of impact to conservation status and sensitivity of terrestrial ecosystems, although less impact than AR-A or AR-B. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○
Aquatic Impacts	Qualitative	Crosses seven watercourses, and parallels a watercourse for almost five kilometers in a manner that could create a direct loss of habitat. Several watercourses are fish bearing. Significantly Worse ○	Crosses eight watercourses; several of which are fish bearing. Significantly Worse ○	Crosses nine watercourses; several of which are fish bearing. Significantly Worse ○
Archaeological / Historical Impacts	Qualitative	Slightly over half the alignment considered to have high or moderate archaeological potential. One recorded archaeological site within the alignment. Significantly Worse ○	Slightly over half the alignment considered to have high or moderate archaeological potential. Significantly Worse ○	Slightly over half the alignment considered to have high or moderate archaeological potential. Significantly Worse ○
Greenhouse Gas Emission	$M (PV)	$0.4	$0.4	$0.1
FINANCIAL ACCOUNT				
Capital Cost	Range	$$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)
Property Costs	Range	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)
Maintenance and Rehabilitation Cost	Range	$$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: ($ (<$1 Million) → $$$$$ ($5 Million))	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)
Salvage Value (not including property)	Range	$$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$$ Range: ($ (<$20 Million) → $$$$$ ($100 Million))	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)

E.7 TECHNICAL FINDINGS

Based on these initial findings key findings from the evaluation of the existing route options and the alternate route options, recommendations have been made to identify a preferred existing route option and an alternate route option. These preferred route options were then reviewed with the key study stakeholders and Indigenous groups to confirm the findings and to identify the need for any refinements prior to proceeding to the next study phase.

EXISTING ROUTE

From the multiple account evaluation, the following key findings can be derived:

- Option ER-A:
    - Is the least expensive of the three existing route options.
    - Provides the least amount of benefits in terms of travel time savings and mobility, however, these are only moderately less than the other two existing route options.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Creates some highway access and intra-community connectivity issues in the northern portion of the corridor due to the changes in the permitted movements of several intersections.
    - Creates some highway access issues in the southern portion of the corridor (Antlers Beach area) due to the short realignment of the highway.
    - Has the least amount of property impacts in terms of the number of properties impacted.
- Option ER-B:
    - Has slightly greater travel time and mobility benefits than Option ER-A.
    - Has more property impacts as compared to Option ER-A.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Has significant property impacts at the Princeton Avenue Interchange and potentially some environmental issues due to the proximity to the lakeshore.
- Option ER-C:
    - Has the highest construction costs of the three existing route options.
    - Generates slightly greater travel time and mobility benefits than Option ER-A, and similar benefits to Option ER-B.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Has the most property impacts in terms of the number of properties impacted.

Based on the outcome of the multiple account evaluation and the key findings above, it is recommended that Option ER-A be taken forward for further consideration as part of Phase II of the Highway 97 Peachland Transportation

Planning Study. Components of Option ER-A can be found in ***Figure E.5***. However, it is also acknowledged that the evaluation process identified the need for refinements to Option ER-A in order to improve connectivity and accessibility as the conversion of many intersections to right in, right out configurations has reduced access to, from and across the highway in many areas. Therefore, prior to Option ER-A being advanced to Phase II, the option package was updated with some additional refinements, to address the weaknesses of the option highlighted in the evaluation process, as well as the refinements resulting from engagement with the key study stakeholders and Indigenous groups.

ALTERNATE ROUTE

From the multiple account evaluation, the following key findings can be derived:

- Option AR-A and Option AR-B:
    - Are the more costly options.
    - Have environmental impacts.
    - Have low trip attraction from the existing Highway 97 corridor during the peak.
    - Have the fewest impacts to developed properties within Peachland.
- Option AR-C:
    - Significantly less costly than the other two options.
    - Highest volume attraction away from the c volumes of the three alternate route options. Due to the slightly shorter travel length, Option AR-C does actually attract some traffic from Highway 97 with origins / destinations to the north of Peachland. Options AR-A and AR-B only divert traffic from Highway 97C.
    - Some environmental impacts, but fewest impacts of the three alternate route options.
    - Impacts some developed properties within Peachland whereas the other two alternate route options are largely located in undisturbed forested areas.

All alternate route options provide marginal benefits, which are largely accrued on the existing route due to a slight diversion in traffic to the alternate route. Of the three alternate route options, AR-C has the least impacts and greatest benefits. It is therefore recommended that Option AR-C be taken forward for further consideration in the Phase II study. However, it should be noted that due to the lack of diversion of traffic from the existing route to this alternate route, many of the underlying traffic safety and operations issues along the existing Highway 97 corridor remain. As such, further consideration of this alternate route option is required to encourage use of the alternate route. Therefore, prior to Option AR-C being advanced to Phase II, the option was subjected to further refinements. These refinements encompass both technically-driven refinements to further confirm the scope of the design concept as well as the refinements resulting from engagement with the key study stakeholders and Indigenous groups.

It is acknowledged that without an increase in anticipated traffic diversion away from the existing route and towards the alternate route, there may also be a need to expand the scope of the alternate route option(s) to include focused improvements along the exiting highway corridor to address the remaining identified deficiencies. These potential focused improvements to the existing route will be identified in Phase II.

E.8 REFINEMENTS TO RECOMMENDED OPTIONS

Although Option ER-A was recommended as the preferred option from among the existing route option packages, the option evaluation processes identified a number of negative impacts associated with this option. Similarly, opportunities were noted for further technically-driven refinements to further confirm the scope of the design concept for the preferred alternate route option, AR-C. Subsequent to the development of these refinements, a series of engagement workshops to review the existing and alternate route concepts were held internal BC MoTI stakeholders, the Technical Advisory Committee (TAC), the Community Liaison Committee (CLC), the Peachland District Council; and the Penticton Indian Band.

These workshops yielded further feedback and suggestions for refinements to both the existing route and alternate route options. Further documentation of the engagement process can be found in the *Phase I - Preferred Route Options What We Heard Report*. The refinements to the recommended existing route option and recommended alternate route option (AR-C) are provided below.

EXISTING ROUTE

As noted, the evaluation of the existing route options resulted in Option ER-A being identified as the recommended option package along the existing alignment. However, while Option ER-A was the overall strongest-performing option, the evaluation process identified several negative impacts caused by this summation of the section options within the option package. These impacts related primarily to the cumulative effects of the access management strategy elements of the option, and specifically with respect to a lack of connectivity from the community to and from Highway 97 as well as intra-community connectivity across the highway corridor. Therefore, a series of refinements to mitigate these issues without fundamentally changing the overall premise of option package ER-A (i.e. primarily consisting of access control measures and signalized at-grade intersections) were identified. Each of the five option sections was reviewed, and in some cases, alternative section options are identified for consideration of incorporation into a “refined” ER-A option package, while in other cases concepts have been newly-developed (or refined) as part of this review.

Feedback from stakeholders and Indigenous groups resulted in a variety of refinements to address considerations related to road safety, walking (including safe routes to school), transit, emergency service accessibility, impacts to parks and open spaces, local road alignments, and environmental considerations. The resultant refined option package ER-A is provided in Appendix A.

ALTERNATE ROUTE

As a first step refining the preferred alternate route option, AR-C, further design development was undertaken to optimize the horizontal and vertical alignment geometry with respect to cuts, fills and structure locations in order to improve cost and constructability.

Feedback from stakeholders and Indigenous groups resulted in a variety of refinements to address considerations related to trail and recreational area access, terrestrial wildlife impacts such as highway crossing opportunities and access to drinking water, impacts to community connectivity, impacts to parks and impacts to agricultural lands. It is also acknowledged that the alternate route falls within the Penticton Indian Band South Okanagan Commonage land claim. At a broader level, several stakeholders expressed concerns regarding the overall choice of the preferred alternate route in this area, and advocated for an alternative corridor further up the hillside and away from the community to be considered instead. Therefore, alternate route AR-4, which was previously screened-out as part of the option screening assessment in Table E.2, was reintroduced for more detailed consideration as part of Phase II. Alternate route AR-4 broadly follows the same alignment as the recommended option, other than in the vicinity of Princeton Avenue and across Deep Creek, where it diverts further inland. Opportunities for a connection between the alternate route highway and Princeton Avenue will also be investigated.

The resultant refined option package AR-C is provided in Appendix B, while a drawing package of the segment of AR-4 where the alignment diverges from AR-C is provided in Appendix C. Although not specifically shown in the design concept, based on feedback from the engagement process, an assumption was made that posted speed limit on the existing highway corridor would be lowered to 60 km/h.

1. Introduction

The Central Okanagan area has experienced strong economic and population growth accompanied by increasing highway traffic volumes. As the only north-south link connecting Okanagan communities, Highway 97 is vital to the region's economy. The segment through Peachland is the last remaining two-lane highway between Penticton and Vernon.

This study, the Highway 97 Peachland Transportation Planning study, explored options to improve future safety and mobility for the corridor. As part of the Okanagan Lake Second Crossing project, the study examined current and projected conditions on the Highway 97 corridor, and considered demographics, community plans, existing and future traffic, as well as safety reports.

In addition to shorter-term improvements considerations which will be identified in subsequent work, this first phase of the Highway 97 Peachland Transportation Planning Study aims to identify two potential longer-term highway improvement options:

- One preferred option using the existing route; and
- One preferred option using an alternate route.

1.1 Objectives

The objective of this study is to identify two potential improved Highway 97 alignment options through the District of Peachland; one on the existing route and one on an alternate route. The intent of this report is to provide a description of the existing and projected future conditions, describe the potential improvement options for the existing route and alternate route, document a screening process to identify front-runner options, and then submit these options to a multiple account evaluation process to identify two options, one option related to the existing route and one option related to the alternate route, for further consideration.

With the primary role of Highway 97 in the Central Okanagan to connect communities, regional / provincial activity centres, and other provincial highways, the various improvement options have been developed and evaluated based on several high-level guiding principles as highlighted below:

- Provide a safe, functional, and efficient corridor.
- Create a multi-modal transportation corridor.
- Utilize a coordinated approach to planning and network improvements.

1.2 Study Area

The study area falls within the District of Peachland and Regional District of Central Okanagan (RDCO). Existing route options focus on the Highway 97 corridor within the District of Peachland while alternate route options fall within both the District of Peachland and RDCO boundaries. The south extent of the study area is around the Antler's Beach area and the north extent is around the Highway 97C/97 interchange. These extents were selected as it is anticipated that these would be the areas where an alternate route would connect back in to the existing route.

The segment of Highway 97 from Greata Ranch through Peachland to the Highway 97C/97 interchange is the only remaining section of highway between Penticton and Armstrong that is not at least four lanes. It is anticipated that regardless of whether an existing route or alternate route option is ultimately selected between Antler's Beach and the Highway 97C/97 interchange, the four kilometre segment of the existing route between Antler's Beach and Greata Ranch would also be widened to complete the four-laning of the highway. ***Figure 1.1*** illustrates the study area in the context of the broader Central Okanagan area.

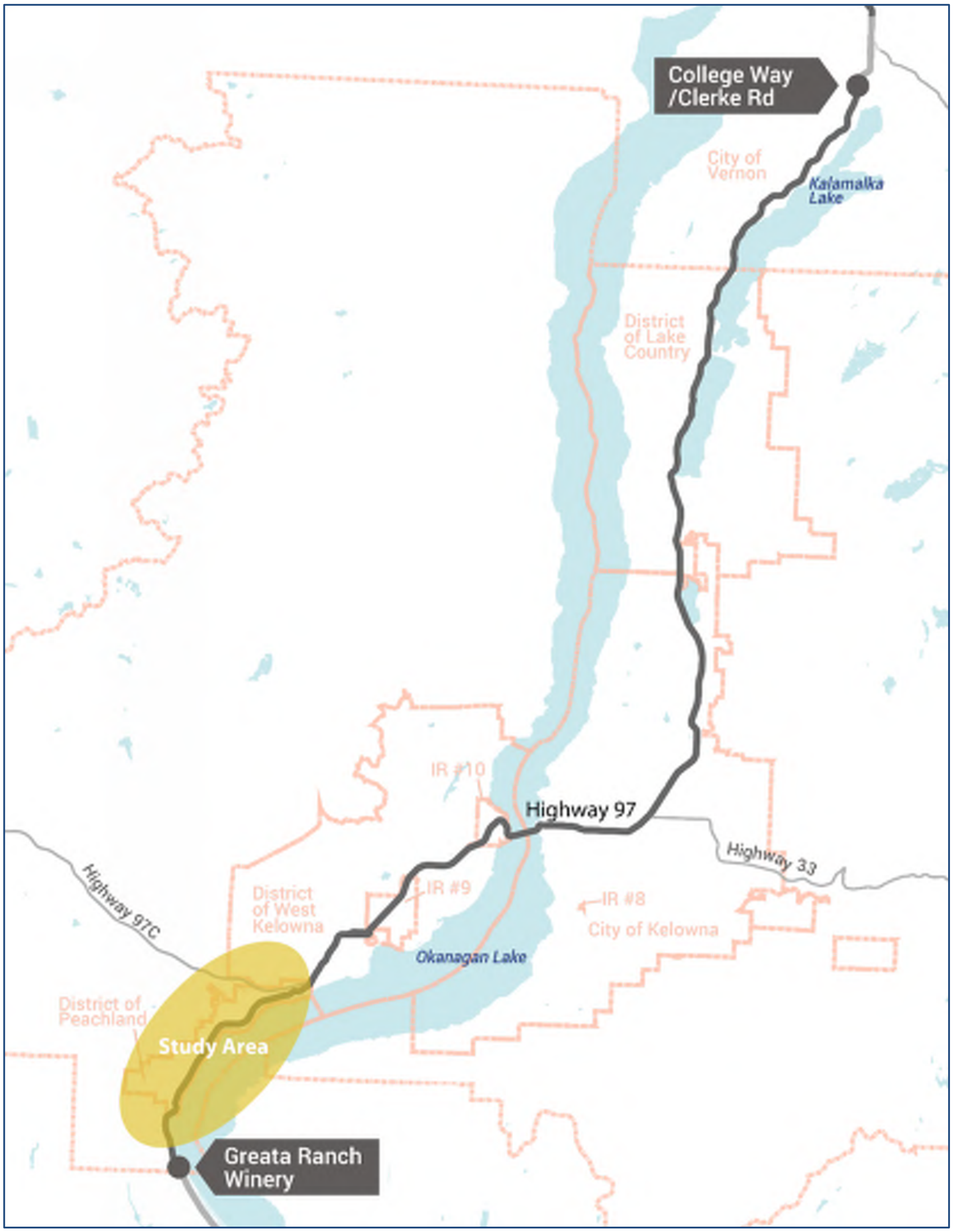


Figure 1.1: Highway 97 Peachland Transportation Planning Study Area

2. Problem Definition

This section provides a summary of existing and future traffic, and safety conditions on Highway 97 through Peachland, and an assessment of the problems resulting from traffic operations and safety performance.

2.1 Existing Infrastructure

The highway is a two-lane, two-way facility for most of its length, with a combination of signalized and stop-controlled intersections, and a full grade-separated interchange with Highway 97C at the north end. The highway from Greata Ranch through Peachland is the only section between Penticton and Armstrong that is not at least four lanes.

The highway is constrained by mountainous terrain to the west and Okanagan Lake to the east, necessitating rock cuts and major embankments if any widening is to be considered. The alignment has generally remained unchanged since the 1960s when it was shifted from Beach Avenue to its current alignment north of Princeton Avenue.

2.1.1 Geometry

The horizontal geometry of Highway 97 through Peachland is winding and generally follows the west shoreline of Okanagan Lake. There are several sharp curves with radii of approximately 250 metres, which is the minimum radius required for the design speed of 80 km/h.

The vertical alignment of Highway 97 has its steepest grade, approximately 6%, between the Highway 97C Interchange and east of the Huston Road / Buchanan Road interaction, after which the roadway runs nearly at level grade to the Trepanier Bench Road intersection. The highway then continues south and west at gentler grades between Trepanier Bench Road and Hardy Street before climbing at approximately 4% towards the southern limit of the study area.

All intersections on Highway 97 through Peachland are at-grade intersections with several streets (Municipal Roads) intersecting Highway 97 at skewed angles, which generally causes sightline constraints for some maneuvers. There also exist sharp turning approaches on several side streets, namely Drought Road, Huston Road, Buchanan Road, Trepanier Bench Road / Desert Pine Avenue, Ponderosa Drive, Princeton Avenue, Beach Avenue and Renfrew Road. This geometry is likely to cause difficulty in turning maneuvers, particularly for large vehicles, semi-trailer trucks and recreation vehicles. Likewise, several cross streets have steep approach grades, forming another common concern prevalent at intersections within Peachland.

2.1.2 Physical Highway Characteristics

The following provides a brief description of the highway characteristics with respect to the number of lanes, posted speed, intersection and traffic control, shoulders, cycling infrastructure, pedestrian sidewalks and pathways, transit, pavement conditions, bridge structures, and utilities.

Laning

There is one primary lane in each direction through Peachland, with a 1,260 metre long southbound passing lane starting at Renfrew Road, and a 1,500 metre long northbound passing / climbing lane ending at the transition to the four-lane section at Highway 97C. The current laning is graphically shown in ***Figure 2.1***.

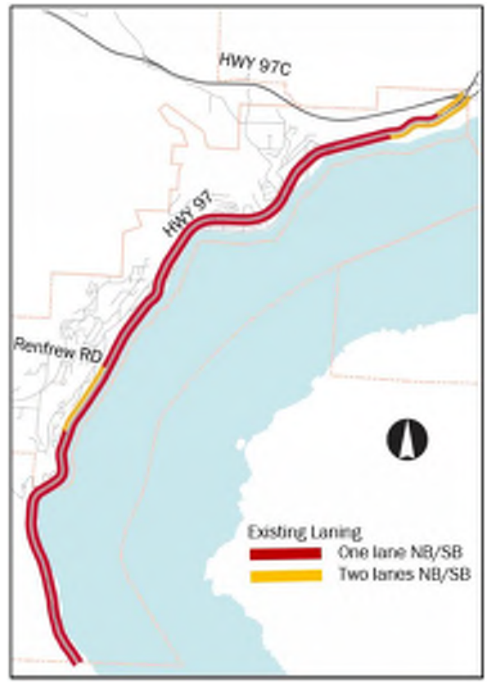


Figure 2.1: Existing Laning

Posted Speed

Posted speeds range from 90 km/h at the north end of Peachland to 70 km/h through the central portion of the study corridor. A section of 90 km/h posted speed is located at the southern limits of the study area. The transition between 90 km/h on Drought Hill to 70 km/h occurs about 165 metres north of the Buchanan Road West intersection. The current posted speeds are shown in ***Figure 2.2***.

Figure 2.2: Current Posted Speed

Intersection and Traffic Control

There are several intersections and private driveways accessing the highway corridor through Peachland. *Table 2.1* summarizes the major intersecting streets and associated traffic control.

Table 2.1: Intersecting Streets and Traffic Control

INTERSECTING STREET	TYPE OF INTERSECTION	TRAFFIC CONTROL	TURN LANES FROM HIGHWAY
Hardy Street	T (local street west leg)	Stop	None
Renfrew Road	T (local street west leg)	Stop	SB Right
Princeton Avenue / Beach Avenue	4-way	Signal	NB Right, NB Left, SB Left
Ponderosa Drive / 13 Street	4-way	Signal	SB Right, NB Right, SB Left, NB Left
Clements Crescent	T (local street west leg)	Signal	SB Right, NB Left
Chidley Road / Todd Road	4-way*	Stop	SB Right (very short)
Trepanier Bench Road	T (local street west leg)	Stop	SB Right (taper only), NB Left
Buchanan Road South	T (local street east leg)	Stop	None
Buchanan Road / Huston Road	4-way	Stop	SB Right (very short), SB Left, NB Left
Drought Road	T (local street east leg)	Stop	None
Seclusion Bay Road	Protected-T (local street east leg)	Stop	SB Left

* Chidley Road and Todd Road are offset and eastbound movements across the highway are not permitted.

At many of the intersections, turn lanes are very short, limited to only a taper or are non-existent.

Traffic signals were installed at the Clements Crescent intersection in December 2011 and at Ponderosa Drive / 13 Street in July 2012. The signalization of Ponderosa Drive / 13 Street also included a full reconstruction of the intersection and extension of Ponderosa Drive to align with 13 Street. Prior to 2012, Ponderosa Drive and 13 Street were configured as T – Intersections, offset by approximately 100 metres.

Princeton Avenue is a designated truck route. The existing laning and traffic control at the major intersections is shown in *Figure 2.3*.

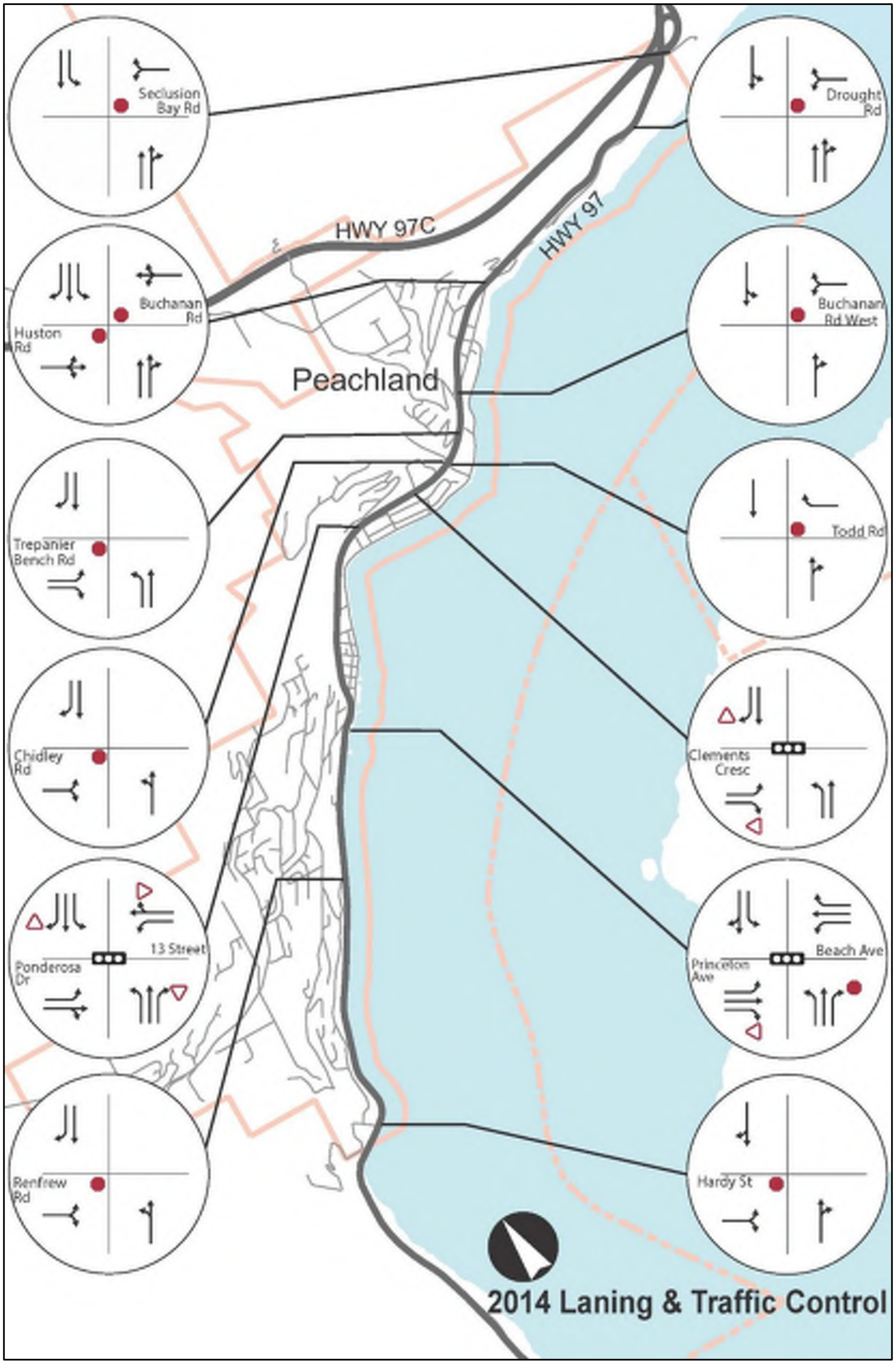


Figure 2.3: Existing Laning & Traffic Control

Shoulders

The highway through Peachland is a rural cross section, with shoulders and open drainage. Shoulder widths are typically 2.0 m but vary throughout. Narrow shoulders exist in some locations, such as:

- Southbound in the area of the southbound passing lane (1.0 – 1.8 m);
- Both directions at the pedestrian underpass near Todd Road (1.0 m); and
- North and south of Drought Road where the barrier exists (1.0 – 1.5 m).

A wider gravel shoulder is noted alongside the highway corridor near Clements Avenue. The added shoulder width in this area, over a distance of approximately 800 metres, has attracted vehicle parking given the shopping area on the west side of the highway and access provided via the signalized intersection and marked cross walk.

Cycling Infrastructure

There are no designated cycling facilities along the highway. In most areas, shoulders are sufficiently wide to allow for cycling on the shoulders but given the relatively high speed and nature of the traffic, it is not a comfortable cycling environment. The Centennial Way Pathway (a multi-use lakeside trail) has recently been provided along much of Beach Avenue, however, this pathway is not intended for general cycling use. Instead, it is primarily intended for small children on bicycles, as well as pedestrians and wheelchair users. General cycling use is encouraged on-street along Beach Avenue, which is generally comfortable given the low traffic volume and lower speed environment. Beach Avenue provides a more convenient and desirable north-south cycling connection, parallel to Highway 97, although Beach Avenue does not extend the full length of the study area.

Pedestrian Sidewalks and Pathways

There are no sidewalk facilities along Highway 97. There is a short section of multi-use pathway parallel to the highway between Ponderosa Drive / 13 Street and Todd Road, through Lambly Park. At the east end, this pathway connects to a pedestrian underpass below Highway 97.

There are no marked crosswalks along Highway 97 south of Princeton Avenue or north of Clements Crescent. The designated and marked crossings are listed in ***Table 2.2***.

Table 2.2: Existing Pedestrian Crossings

LOCATION	CHARACTERISTICS
Princeton Avenue	Signalized intersection, with no pedestrian crosswalks or signal and no sidewalks on Princeton Avenue approaches. However, a pedestrian underpass / culvert is located under Highway 97 immediately to the north of the intersection at Princeton Avenue.
13 Street / Ponderosa Drive	Signalized intersection, marked pedestrian crossing and signal on the west side connected to sidewalks.
Clements Crescent	Signalized intersection, marked pedestrian crossing and signal on the west side connected to a multi-use pathway on the south side. No sidewalk on the north side; Pedestrians must cross Clements Crescent to access the sidewalk into the Peachland Shopping Centre.
West of Todd Road	Pedestrian underpass below Highway 97, at the Trepanier Creek Bridge.

Transit

There are no bus stops along Highway 97. Route 22 operates on, and parallel to Highway 97, providing service between Westbank Town Centre and Princeton Avenue, via Huston Road, Trepanier Creek Road, Clements Crescent, 13 Street, Beach Avenue and Princeton Avenue. Service frequency is variable throughout the day, with headways ranging from 20 to 90 minutes.

Pavement Condition

Table 2.3 summarizes the observed pavement condition of Highway 97 through Peachland as of 2014. The pavement conditions assessment provides only a general description, noting that these representative descriptions do not fully describe all conditions of the roadway surface.

Table 2.3: Existing Pavement Condition

SECTION	OBSERVED PAVEMENT CONDITION
Hardy Street to Princeton Avenue	Areas of mat joint and longitudinal joint cracking primarily along southbound lanes. Localized areas of multiple longitudinal cracking along outside southbound lane wheel paths with some severe raveling of northbound shoulder near start of segment.
Princeton Avenue to Buchanan Road	Areas of longitudinal wheel track and alligator cracking noted along north and southbound lanes, more so for southbound wheel paths with crack sealing between mats.
Buchanan Road to Highway 97C Interchange	Areas of patched multiple longitudinal cracking along southbound lane wheel paths and outer northbound lane wheel paths. Localized areas of severe alligator cracking along outside wheel path along southbound lane adjacent to rock cut sections.

Bridge Structures

BC MoTI maintains an online Bridge Management Information System (BMIS) database for bridges, culverts, tunnels, sign structures, and retaining walls. Within the BMIS, the province is divided into 28 “Contract Areas”. The BMIS has access to all pertinent structure data, including previous reports, structure layout, geometry, images, drawings, and assessments. Based on the information reviewed, there are three bridge structures located along Highway 97 within Peachland:

- Drought Hill Overpass;
- Trepanier Creek; and
- Deep Creek / Peachland Creek.

The condition of these structures has been assessed as fair to good.

Utilities

The presence of utilities, either located within the corridor right-of-way or crossing the corridor, can potentially form a constraint or challenge to any future corridor improvement.

A summary of major utilities that are currently crossing or running within the existing route right-of-way are summarized in ***Table 2.4***. The summary table provides a description of the utility type and size, owner, and location referenced to the Landmark Kilometre Inventory (LKI).

Table 2.4: Existing Major Utility Infrastructure

NEAREST LKI	OWNER	UTILITY	TYPE	SIZE	CROSSING / PARALLEL	STREET
49.87	District of Peachland	Storm	CMP	600 mm	Crossing	200 m south of Lilly Street
50.03	District of Peachland	Storm	CMP	600 mm	Crossing	70 m north of Lilly Street
50.12	District of Peachland	Sanitary	PVC	450 mm	Crossing	Princeton Avenue
50.12	District of Peachland	Storm	CMP	600 mm	Crossing	Princeton Avenue
50.12	District of Peachland	Storm	PVC	1050 mm	Crossing	Princeton Avenue
51.51	District of Peachland	Storm	PVC	600 mm	Crossing	350 m north of 8th Street
53.9	District of Peachland	Storm	CMP	600 mm	Crossing	South of Eyre Place

2.2 Traffic Demand

The existing traffic demand characteristics along the corridor and at key intersections are discussed in this section.

2.2.1 Mode of Transportation

Based on the 2011 National Housing Survey from Statistics Canada ***Figure 2.4*** shows the mode of transportation for the work force in Peachland.

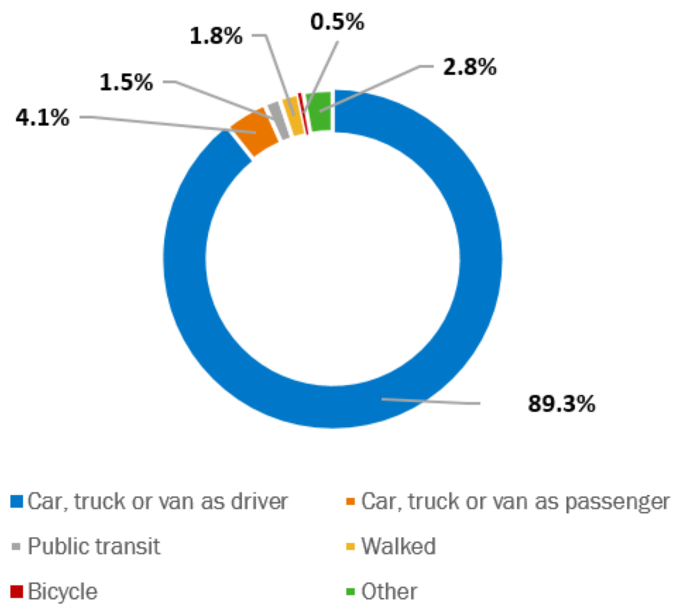


Figure 2.4: 2011 Peachland Commuting to Work Ridership

Figure 2.4 only includes work trips. Trips to school, leisure or other purposes are not measured. Trips by private car accounts for the 93.4% of the total number of trips, trips by public transit account for 1.5%, and active transport, as the sum of Bicycle and Walk trips, represents 2.3% of the total number of trips.

2.2.2 Existing Corridor Volumes

BC MoTI maintains a permanent count station (P-25-12NS) on Highway 97 south of Highway 97C. As shown in *Figure 2.5*, traffic volumes have gradually increased in recent years, from slightly over 15,000 vehicles daily (Annual Average Daily Traffic) south of Drought Hill in 2006, to approximately 17,700 in 2013. This increase in daily traffic translates into an average annual growth rate of approximately 2.2% from 2006 to 2013.

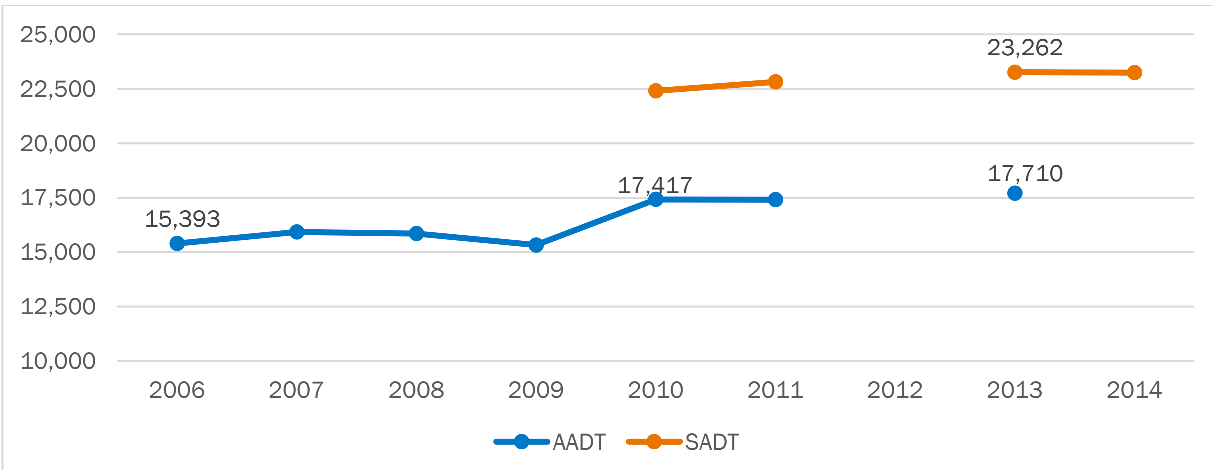


Figure 2.5: Average Annual Daily Traffic (AADT) & Summer Average Daily Traffic (SADT) Volumes (vpd) Hwy 97 South of Hwy 97C (2006 - 2014)

Traffic volumes during summer months are much higher than in other seasons. The Summer Average Daily Traffic (SADT) in 2013 was about 31% higher than the AADT. In August, the Monthly Average Daily Traffic (MADT) volume was about 34% higher than the annual average, and is about 85% higher than January volumes, as illustrated in *Figure 2.6*.

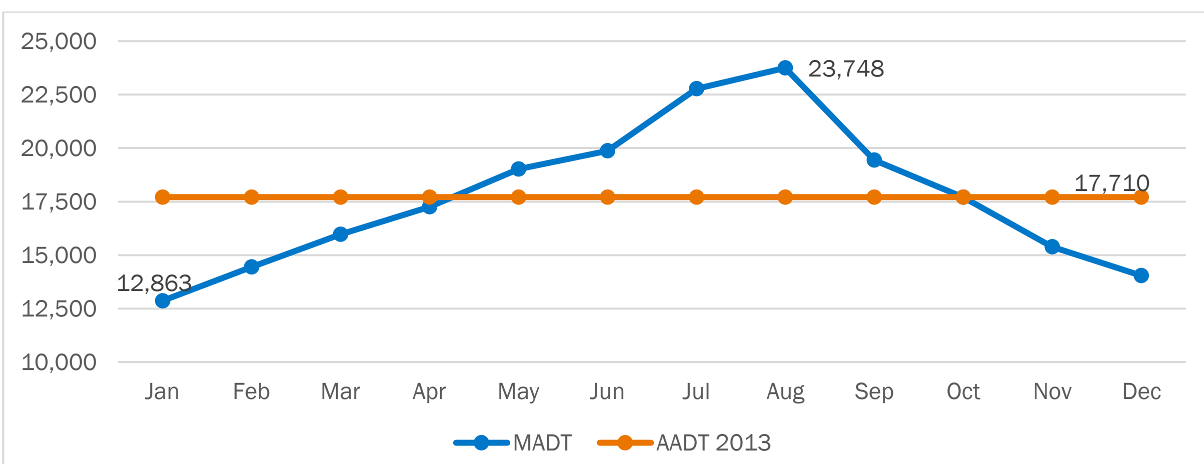


Figure 2.6: Monthly Average Daily Traffic (MADT - vpd), Hwy 97 South of Hwy 97C, 2013

2.2.3 Intersection Turning Movements

Existing (2014) turning movement volumes were derived from various previous counts and factored as necessary to represent 2014 AM and PM peak hour conditions. The turning movements were also balanced between intersections. The year 2014 will represent the base year or existing conditions.

The future (2040) volumes were developed using the regional travel demand model for the future trend land use. The difference between the modeled values for 2014 and 2040 were added to the balanced 2014 turning movement volumes to create the 2040 forecast turning movement volumes.

The 2014 and 2040 volumes used for analysis are shown in ***Figure 2.7*** and ***Figure 2.8***.

2.2.4 Hourly Traffic Distribution

In most communities, travel from home to work and back again represents a major portion of the daily travel within the community. Peachland is different. The proportion of employment to residential land use is very low, and the retired / non-working population in Peachland is considerably higher than most of the rest of the region and province. As a result, travel patterns in Peachland are somewhat unique.

Peak traffic in the morning occurs later than in most communities; without a high number of commuters, peak traffic in the morning coincides with the opening of services, shopping and other activities at around 10 am. The typical weekday hourly traffic distribution is shown in ***Figure 2.9***. Weekend traffic volumes are slightly higher than weekdays, with the highest level occurring in early afternoon. The typical hourly distribution for weekend traffic is shown in ***Figure 2.10***.

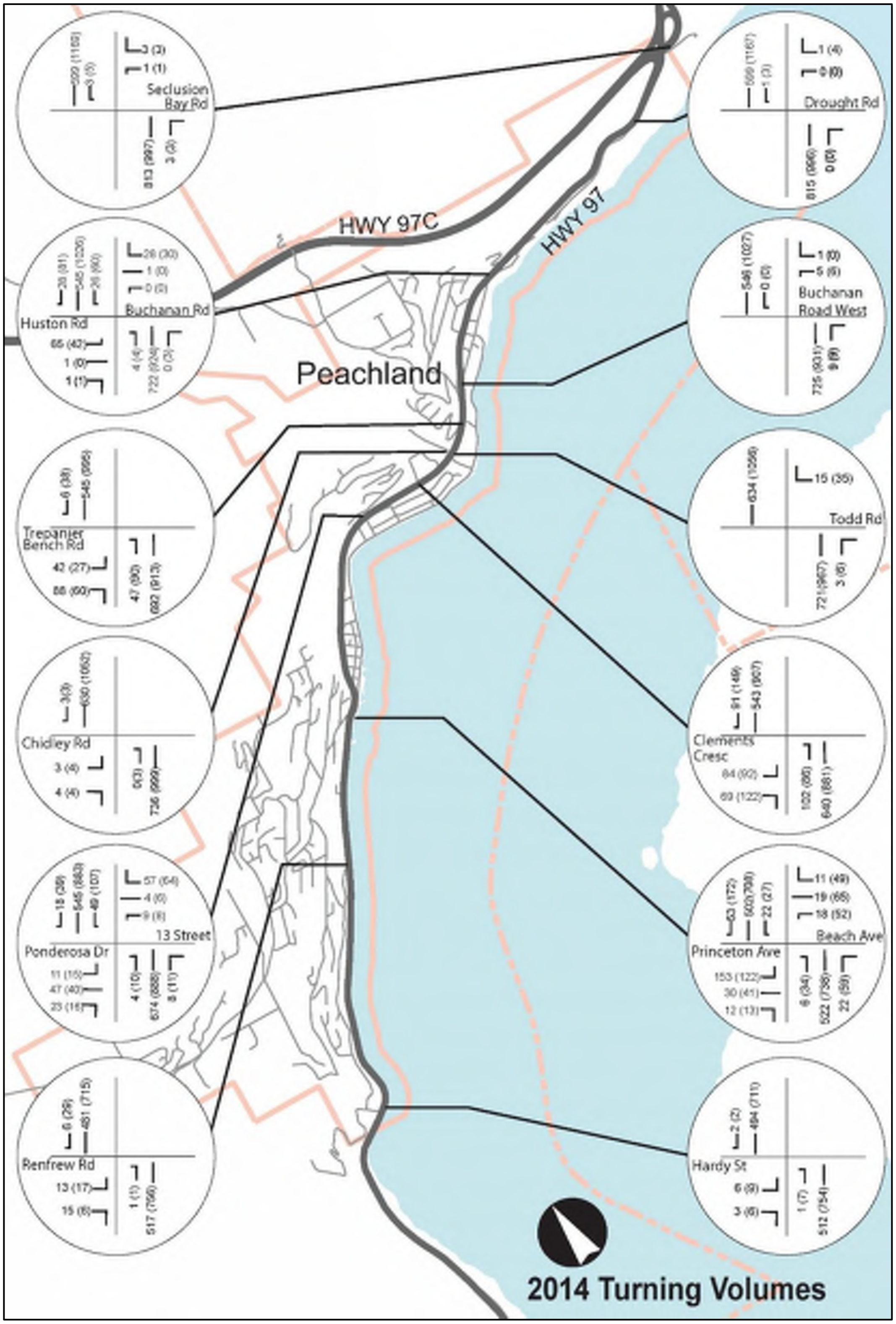


Figure 2.7: Existing (2014) Turning Movement Volumes – AM (PM)

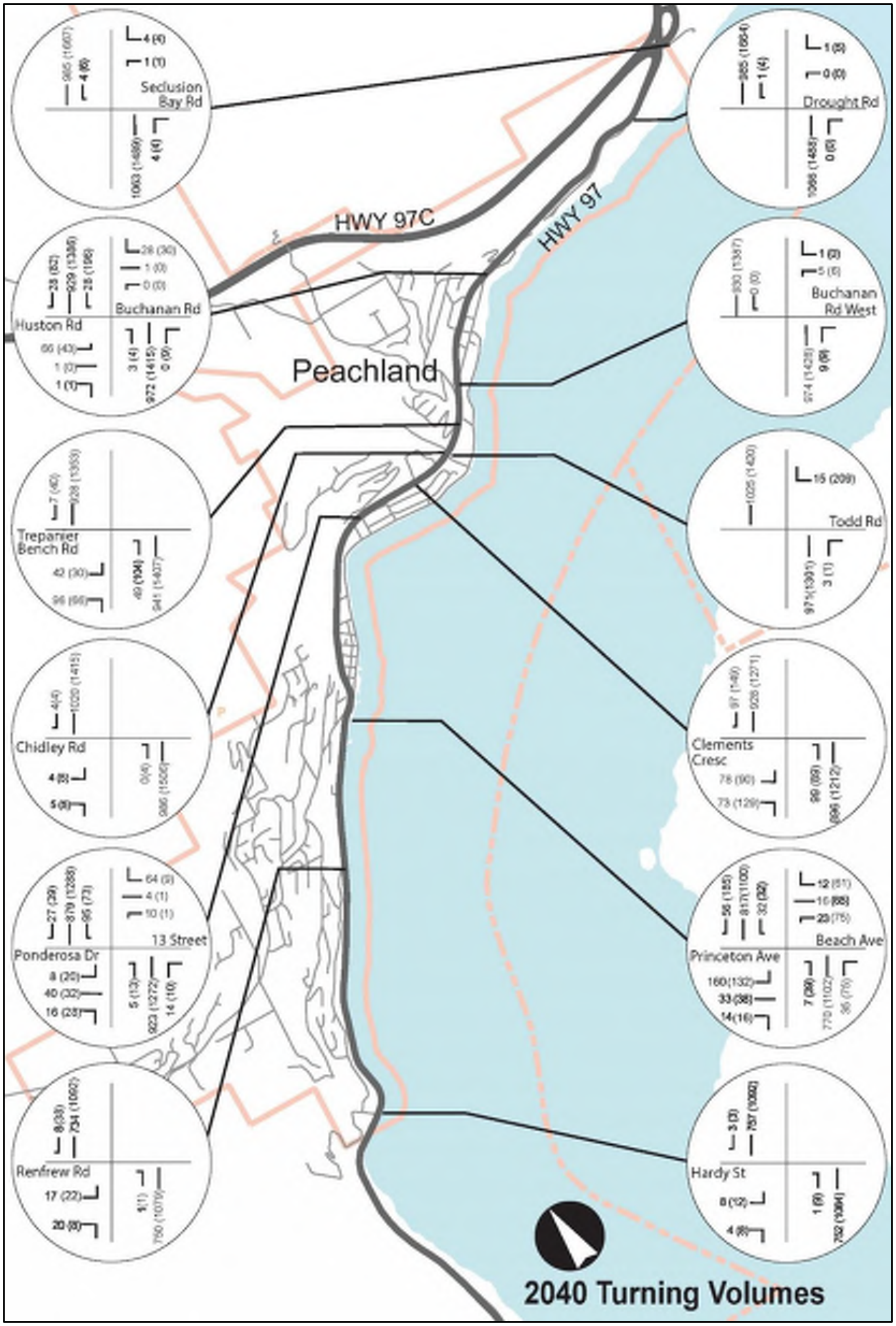


Figure 2.8: Forecast (2040) Peak Hour Tuning Movement Volumes – AM (PM)

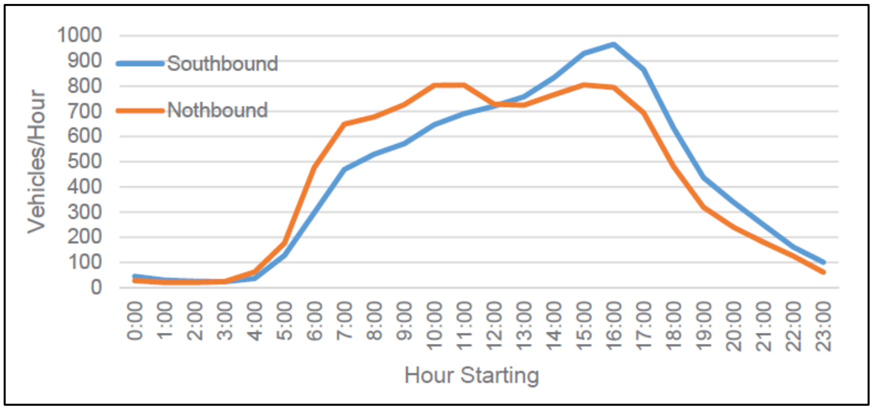


Figure 2.9: Weekday Hourly Traffic Distribution, Hwy 97 South of Hwy 97C, September 2015

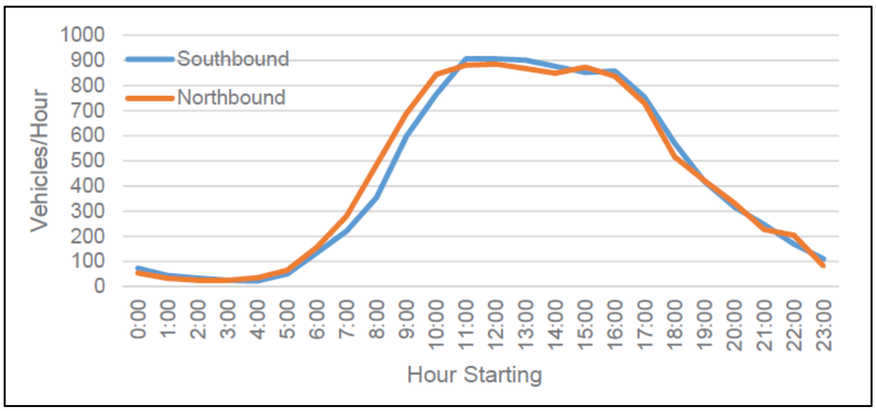


Figure 2.10: Weekend Hourly Traffic Distribution, Hwy 97 South of Hwy 97C, September 2015

2.3 Travel Patterns

The source of traffic on Highway 97 provides insight into who is using the highway. An extensive origin-destination survey for Highway 97 through the entire Central Okanagan region was completed during a two-week period in August 2014. This data was a key input in the development of a regional travel demand model, which in turn was used to characterize origin-destination patterns for 2014 and 2040.

This section provides a summary of travel patterns associated with traffic using Highway 97 in Peachland, with a focus on the 2040 AM and PM peak hours.

2.3.1 Current (2014) External Trips

The August 2014 survey showed that the majority of traffic entering Peachland on Highway 97 is passing through. Based on 24-hour data for the two weeks of the survey, only 12% of traffic originating from the south and 9% of the traffic originating from the north is destined for Peachland. The data shows that through travellers may stop and use services in Peachland, but then continue to an ultimate destination beyond.

Most traffic entering Peachland from the south is destined north of the Highway 97C interchange (77%), while just under half (40%) of traffic from north of the Highway 97C interchange is destined for south of Peachland. These external travel patterns are illustrated in ***Figure 2.11***.

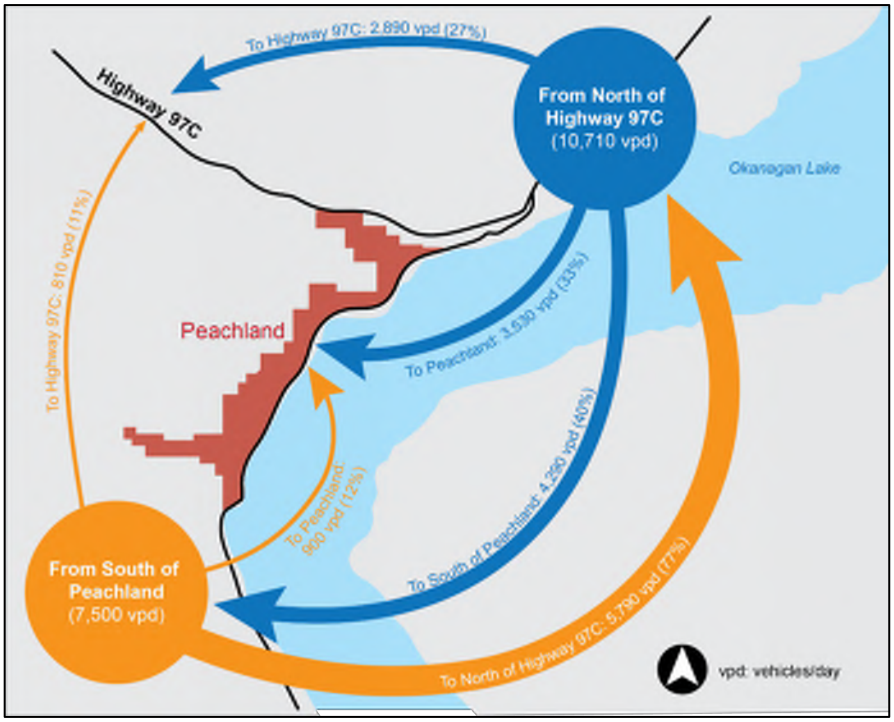


Figure 2.11: Destinations of Traffic Entering Peachland, August 2014

2.3.2 Existing (2014) Peachland Generated Trips

Based on the regional travel demand model, it is estimated that 29% of AM peak trips and 37% of PM peak trips in 2014 that start in Peachland also have a destination in Peachland. Most trips leaving Peachland have a destination north of Peachland via Highway 97 (69% in the morning; 61% in the afternoon). Only 2% of traffic originating in Peachland in the morning or afternoon peak hours have a destination south of Peachland. The internal trip destinations are illustrated in ***Figure 2.12***.

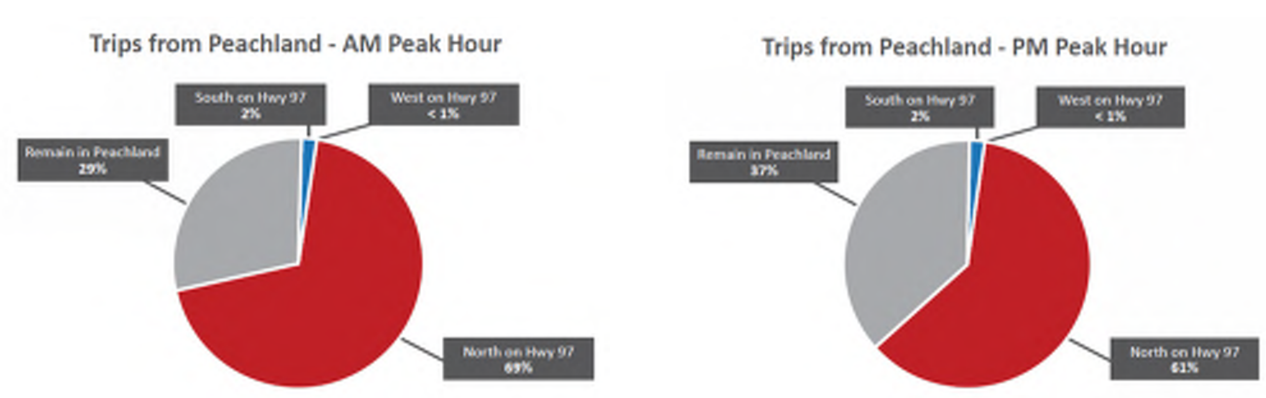


Figure 2.12: Destinations of Trips Generated in Peachland, 2014

The 2014 Origin-Destination matrices for the AM and PM peak hours are shown in *Table 2.5* and *Table 2.6* respectively. The data shown are peak hour trips based on the regional model outputs.

Table 2.5: 2014 AM Peak Hour Origin-Destination Matrix (vph)

	LOCATION	DESTINATIONS				
ORIGINS		Hwy 97 South of Peachland	Hwy 97C	Hwy 97 North of Hwy 97C	Peachland	Total
	Hwy 97 South of Peachland	0	0	506	5	510
	Hwy 97C	89	0	176	2	267
	Hwy 97 North of Hwy 97C	565	368	0	258	1,191
	Peachland	12	0	398	166	576
	Total	666	368	1,089	431	2,544

Table 2.6: 2014 PM Peak Hour Origin-Destination Matrix (vph)

	LOCATION	DESTINATIONS				
ORIGINS		Hwy 97 South of Peachland	Hwy 97C	Hwy 97 North of Hwy 97C	Peachland	Total
	Hwy 97 South of Peachland	0	0	693	12	706
	Hwy 97C	82	0	391	6	479
	Hwy 97 North of Hwy 97C	692	299	0	488	1,478
	Peachland	11	0	431	263	705
	Total	785	299	1,515	769	3,368

2.3.3 Future (2040) Peak Hour Trip Patterns

Within the regional travel demand model, there are 10 traffic analysis zones (TAZ) within Peachland. These traffic analysis zones are graphically shown in *Figure 2.13*.

Figure 2.14 shows the total traffic generated within each TAZ in the AM and PM peak hours. Each of the primarily residential neighbourhoods generates a similar volume of trips, with little difference in the total trips generated in the AM and PM peak hours. This limited difference between the AM and PM peak period trip generation indicates that there is not a high commuter influence on travel patterns.

TAZ 7060 includes much of the town centre area along Beach Avenue. The number of trips generated in the afternoon peak hour is much higher than in the AM, which reflects the high number of businesses and restaurants in the area. In the 2040 base trend, development in New Monaco (TAZ 7000) is expected to be small when compared with the established areas of Peachland.

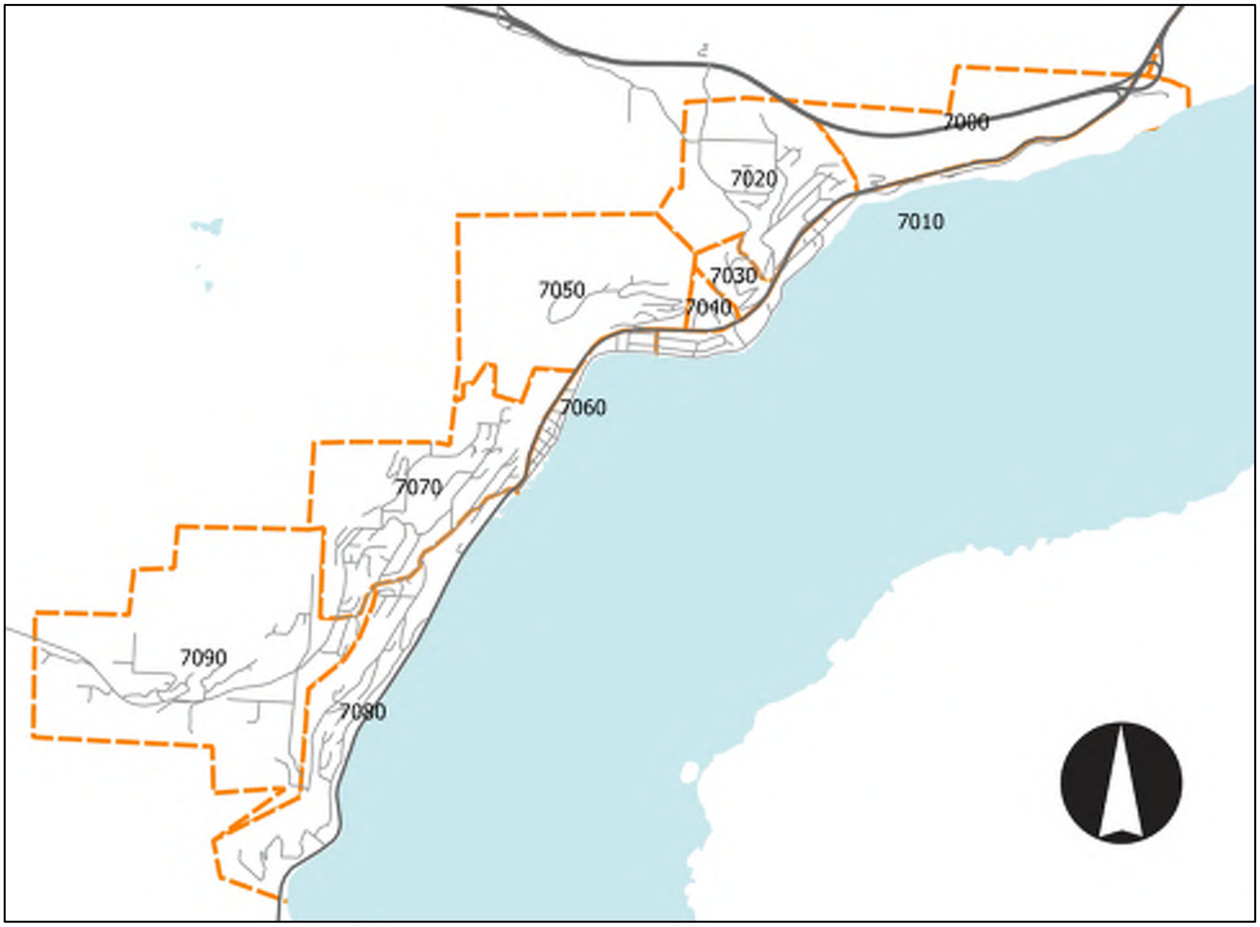


Figure 2.13: Peachland Traffic Analysis Zones

TAZ	AM	PM
7000	1	1
7010	70	47
7020	76	58
7030	22	14
7040	70	91
7050	52	64
7060	56	254
7070	81	62
7080	75	68
7090	75	47

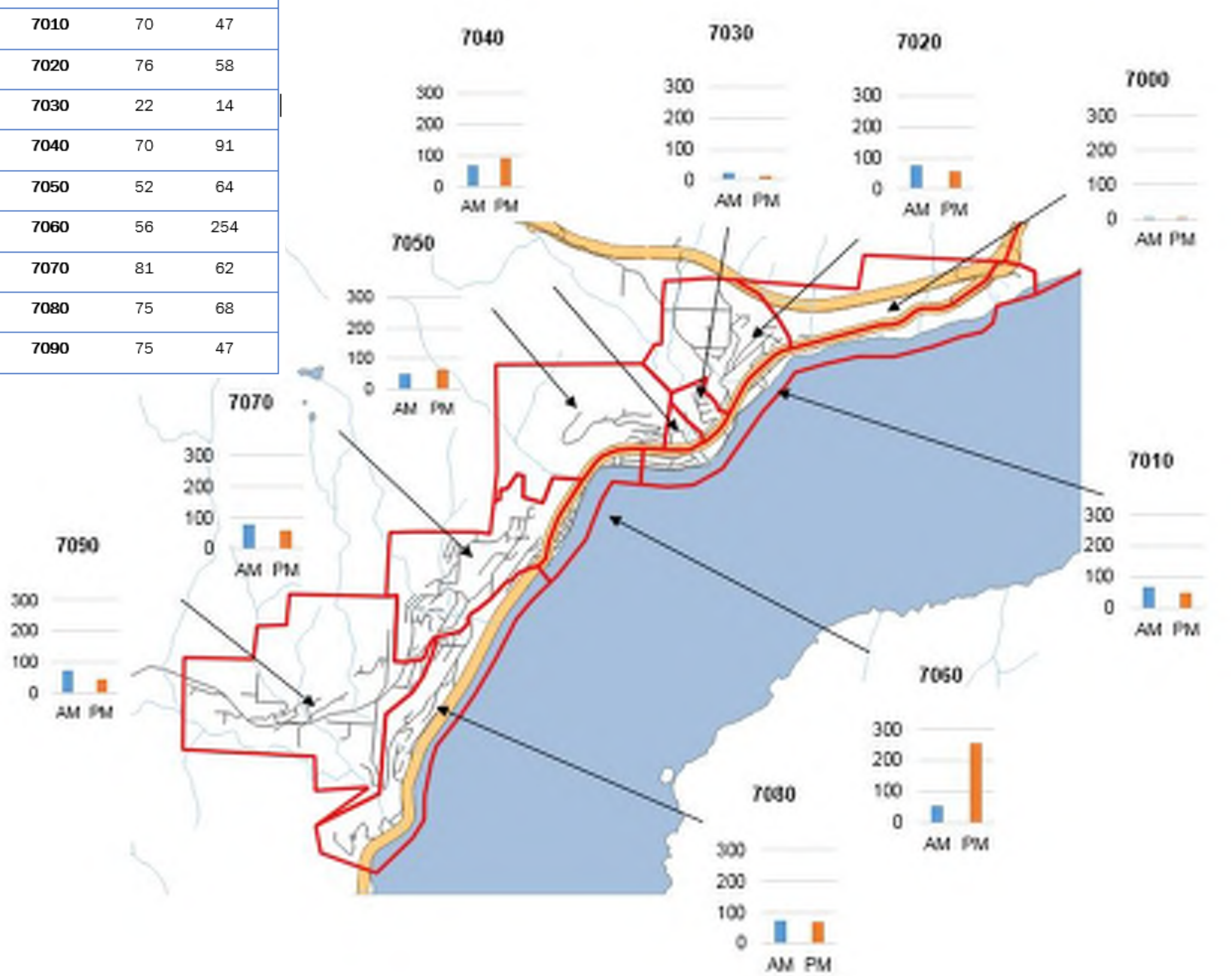


Figure 2.14: Trips Generated (Origins) by Traffic Analysis Zone, 2040 AM and PM Peak Hours (all values are vehicles per hour (vph))

Figure 2.15 shows the destinations of trips generated within each TAZ for the 2040 AM peak hour.

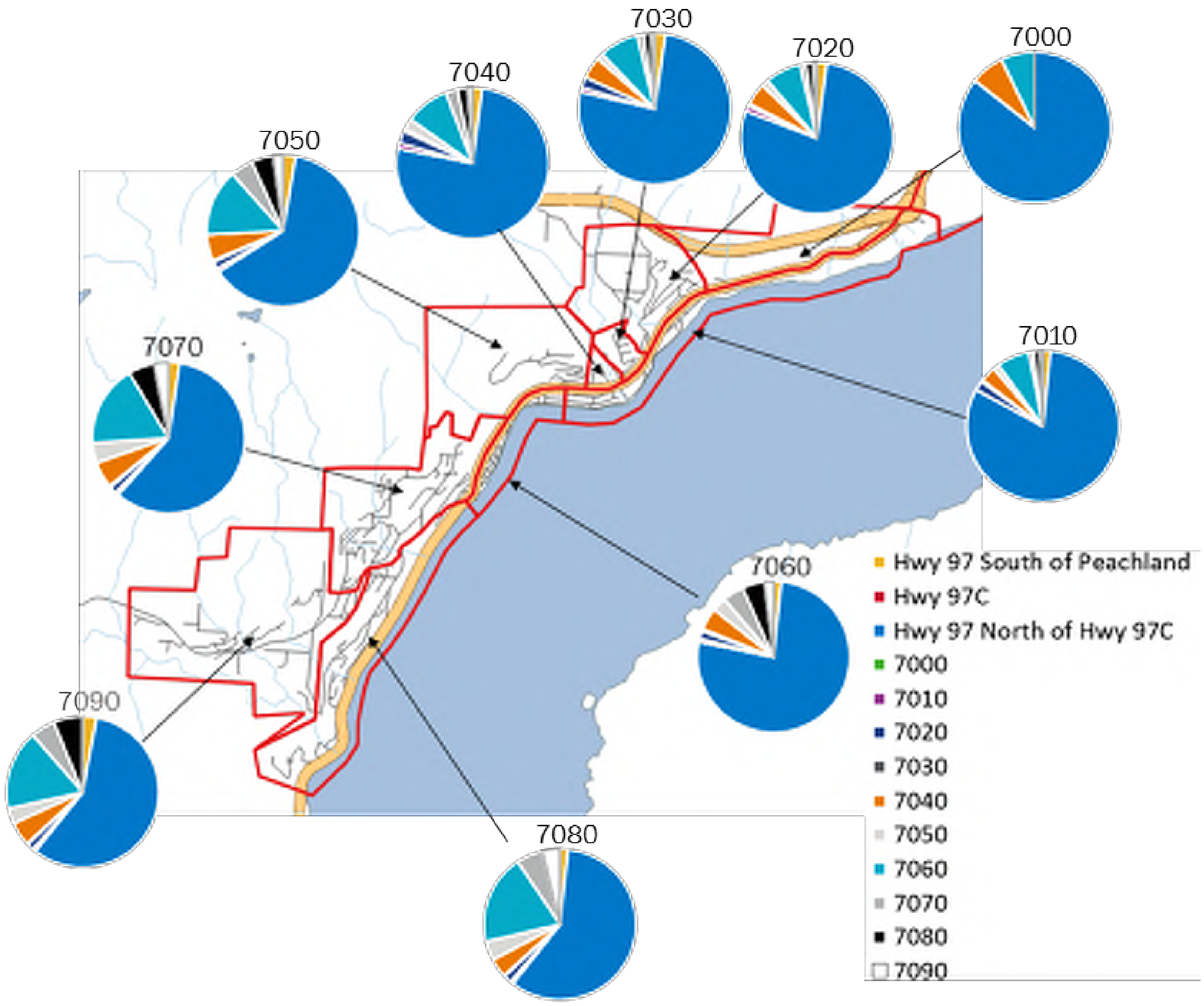


Figure 2.15: 2040 AM Peak Hour Destinations from Peachland TAZs

For the AM peak period, Highway 97 north of Highway 97C is the most common destination for trips generated in each Peachland TAZ. Although overall daily travel patterns in Peachland do not have a strong commuter influence, the significant connection to West Kelowna and Kelowna suggests that the trips taking place in the AM peak hour will be highly affected by commuting traffic. The PM period is not shown is this report, but it has similar patterns revealing Highway 97 north of Highway 97C as the main destination.

In order to illustrate the travel patterns within Peachland, the external destinations were removed, allowing the destinations within Peachland from each zone to be highlighted. ***Figure 2.16*** and ***Figure 2.17*** show the 2040 AM and PM internal (Peachland) destinations from each Peachland TAZ.

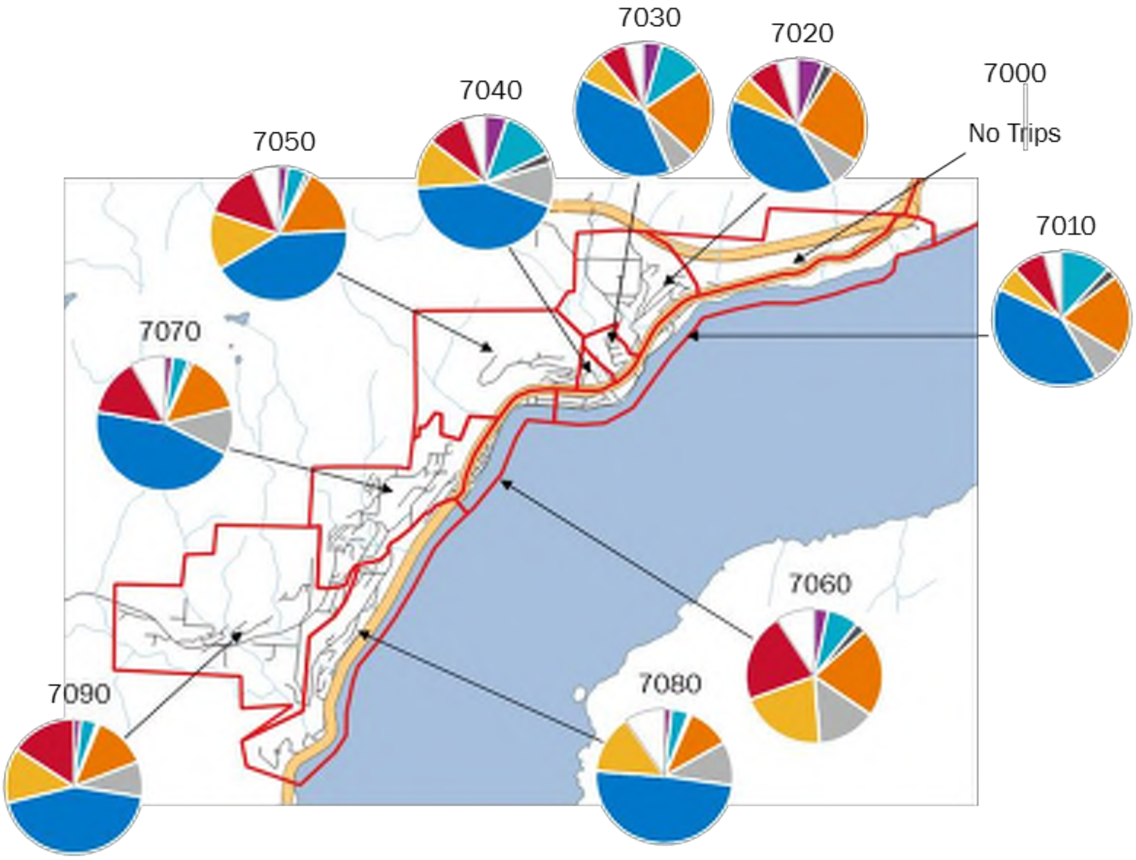


Figure 2.16: 2040 AM Peak Hour Peachland Destinations from Each TAZ

In the morning peak, TAZ 7060 (town centre) is the most common destination, with TAZ 7040 (Clements Crescent), also being a notable destination, reflecting the shopping centre and school as key destinations in the morning. However, TAZ 7070 (Lower Princeton) and TAZ 7080 (Renfrew Road area) are also significant destinations, despite being primarily residential.

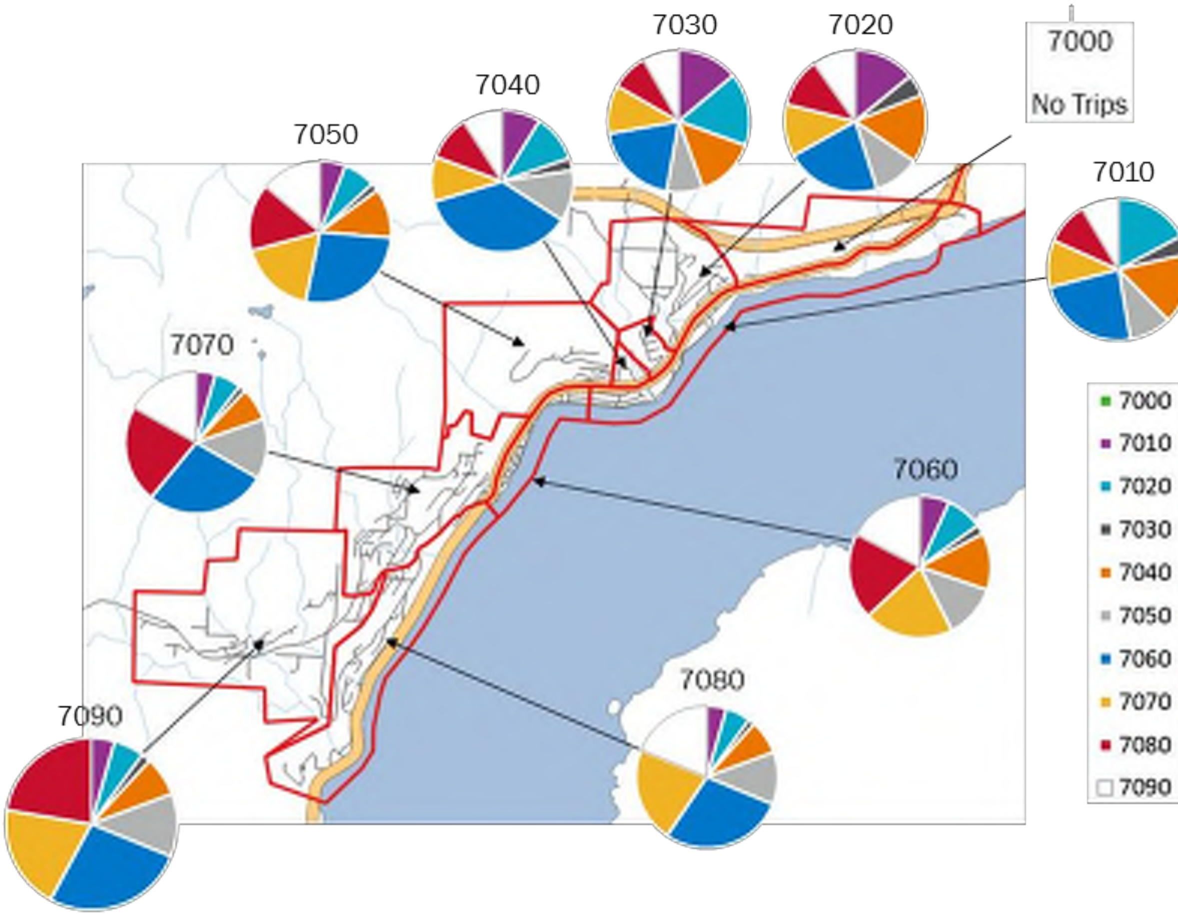


Figure 2.17: 2040 PM Peak Hour Peachland Destinations from Each TAZ

The destinations in the PM peak are more evenly distributed throughout Peachland as PM destinations are more typically related to residential destination patterns. The TAZs with higher populations tend to attract more trips, and commercial areas are not as significant a destination in the PM peak hour when compared with the AM peak hour.

2.4 Highway Mobility

This section provides an assessment of the existing and future performance of the two-lane / two-way rural highway through Peachland.

2.4.1 Performance Criteria

The performance is measured based on Level of Service (LOS) criteria as defined in the Highway Capacity Manual. The desired performance is LOS C or better, described as ≤65% time-following for a Class 1 Highway.

2.4.2 Performance Assessment

Analysis of the mainline was undertaken using the latest version of the Highway Capacity Software (HCS 2010), for 2014 and 2040 forecasted AM and PM peak hour volumes. The mainline level of service is shown in ***Figure 2.18*** and summarized in ***Table 2.7***.

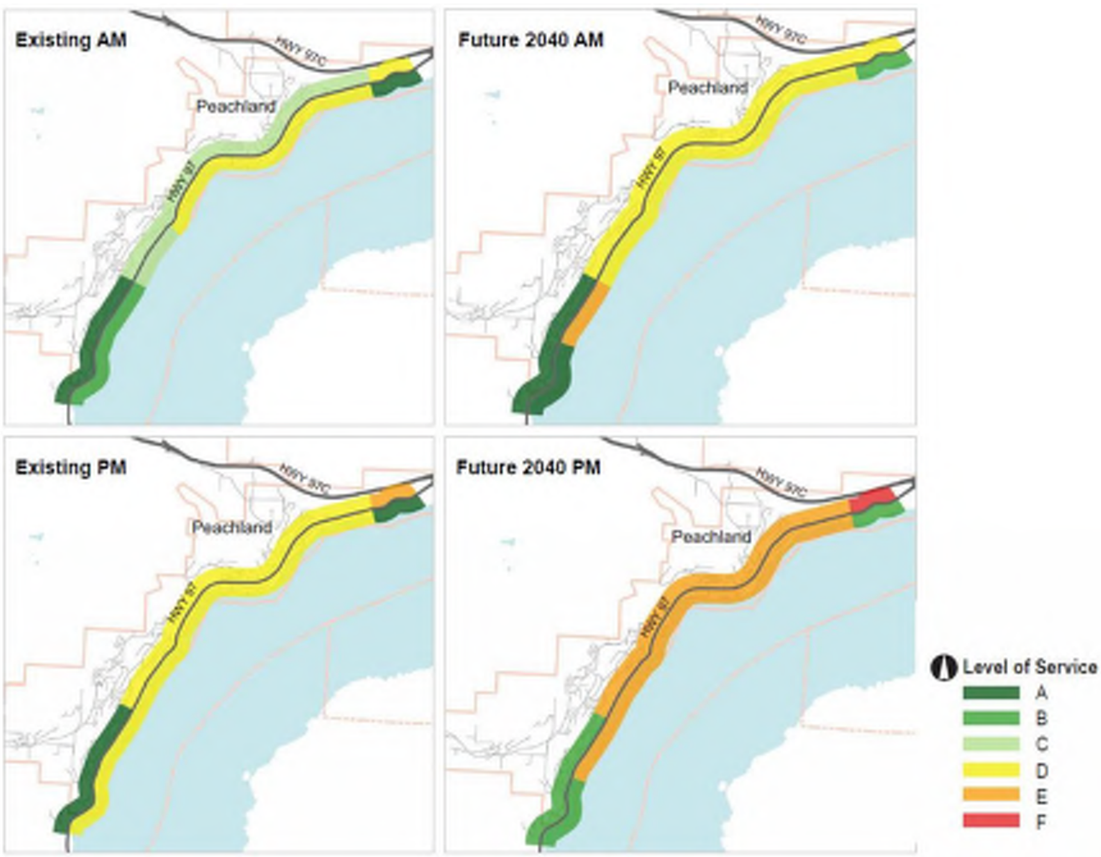


Figure 2.18: Two-Lane Two-Way Level of Service, AM and PM Peak Hours (2014 and 2040)

Table 2.7: Peak Hour Mainline Level of Service, 2014 and 2040

PEAK	DIRECTION	LANES	FROM	TO	2014 LOS	2040 LOS
AM	NB	1	1 km North of Hardy Road	Renfrew Road	B	E
AM	NB	1	Renfrew Road	700 m south of Ponderosa Dr	C	D
AM	NB	1	700 m south of Ponderosa Dr	900 m north of Huston Road	D	D
AM	NB	2	900 m north of Huston Road	Highway 97C	A	B
AM	SB	1	Highway 97C	900 m north of Huston Road	D	D
AM	SB	1	900 m north of Huston Road	700 m south of Ponderosa Dr	C	D
AM	SB	1	700 m south of Ponderosa Dr	Renfrew Road	C	D
AM	SB	2	Renfrew Road	1 km North of Hardy Road	A	A
PM	NB	1	1 km North of Hardy Road	Renfrew Road	D	E
PM	NB	1	Renfrew Road	700 m south of Ponderosa Dr	D	E
PM	NB	1	700 m south of Ponderosa Dr	900 m north of Huston Road	D	E
PM	NB	2	900 m north of Huston Road	Highway 97C	A	B
PM	SB	1	Highway 97C	900 m north of Huston Road	E	F
PM	SB	1	900 m north of Huston Road	700 m south of Ponderosa Dr	D	E
PM	SB	1	700 m south of Ponderosa Dr	Renfrew Road	D	E
PM	SB	2	Renfrew Road	1 km North of Hardy Road	A	B

The mainline travel times do not change dramatically between 2014 and 2040. ***Figure 2.19*** compares 2014 and 2040 AM and PM peak hour travel times on Highway 97 through Peachland – between Highway 97C interchange and approximately Greata Ranch Road. As shown, the greatest increase in travel time between 2014 and 2040 is approximately three (3) minutes in the northbound direction in the PM peak, representing about a 30% increase in travel time compared with existing conditions.

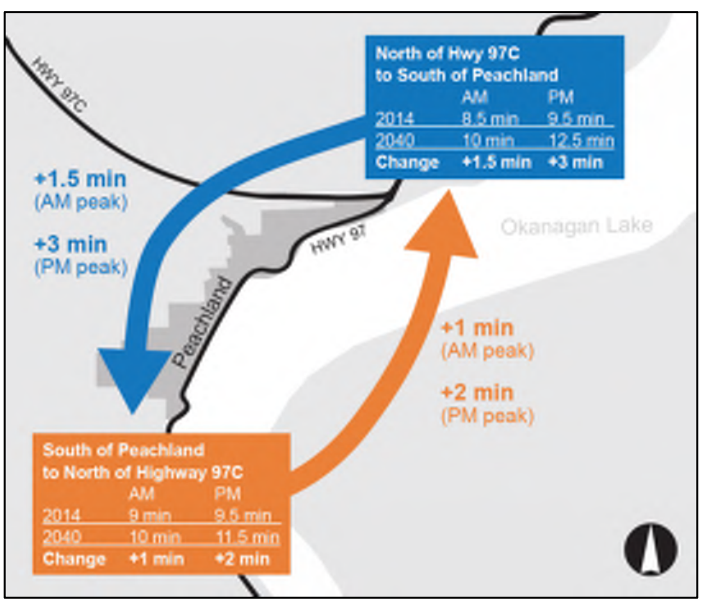


Figure 2.19: Existing and Future Mainline Travel Times

Expected average travel speeds, between Highway 97C and approximately Greata Ranch Road, in 2014 and 2040 are shown in *Table 2.8*. The highest decrease in travel speeds are observed in the southbound direction in the PM peak for 2040 as compared with 2014 conditions.

Table 2.8: Expected Travel Speeds, 2014 and 2040

SEGMENT		AVERAGE SPEED AM PEAK (KM/H)	AVERAGE SPEED PM PEAK (KM/H)
Northbound	2014	75 km/h (76 km/h)	72 km/h (75 km/h)
	2040	64 km/h	54 km/h
Southbound	2014	73 km/h (76 km/h)	67 km/h (69 km/h)
	2040	55 km/h	43 km/h

Note: average speeds are based on outputs from the regional travel demand model. The average speeds shown in grey text and parenthesis are based on traffic data collected for this study, and demonstrate that the regional travel demand model is closely calibrated to existing conditions.

2.5 Intersections

Most intersections in Peachland are unsignalized. Until the signalization of Ponderosa Drive / 13 Street and Clements Crescent in 2012, the only traffic signal along the study corridor was at the intersection with Princeton Avenue.

2.5.1 Performance Criteria

Performance targets are adapted from the BC MoTI Southern Interior Region General Mobility Performance Criteria (February 2014). These targets are also consistent with guidelines contained within the BC MoTI Planning and Designing Access to Developments (PDAD) public document. The performance targets for intersections are summarized in *Table 2.9*.

Table 2.9: Intersection Performance Criteria

INTERSECTION TYPE	APPROACH/MOVEMENT TYPE	THRESHOLD
Signalized	Mainline Through	LOS C or better; v/c ratio < 0.85
	Mainline Turning	LOS D or better; v/c ratio < 0.90
	Side Streets, All Turns	LOS E or better; v/c ratio < 0.90
	Queues / Storage	Sufficient length to contain 95th percentile queue lengths
Unsignalized	Mainline Through / Turning	LOS C or better; v/c ratio < 0.85
	Side Streets, All Turns	LOS D or better; v/c ratio < 0.90
	Queues / Storage	Sufficient length to contain 95th percentile queue lengths

Synchro Version 8.0 intersection capacity analysis software and methodology were applied using the existing and forecasted 2040 traffic volumes. The software uses existing and forecasted intersection turning movements, heavy vehicle composition, peak hour factors, lane geometry and signal timing parameters as its key inputs, and produces estimates of delay per vehicle, LOS, and volume to capacity ratios as its key outputs. Queuing at signalized intersections was assessed using SimTraffic with a 10-minute seeding interval, 60-minute recording interval, and three runs for statistical randomness. The analysis was undertaken in accordance with BC MoTI issued guidelines.

2.5.2 Performance Assessment

All nine intersections on Highway 97 within Peachland were analyzed to determine current traffic performance characteristics and to identify any deficiencies. AM and PM peak hour conditions for 2014 and 2040 were used as the analysis period.

Volume to capacity ratios at the corridor intersections for the years 2014 and 2040 are summarized in ***Table 2.10***. Results that do not meet the performance criteria threshold are highlighted in red. For consistency purposes, the individual movement results are reported assuming Highway 97 movements are oriented northbound / southbound.

Similarly, the 2014 and 2040 level of service and 95th Percentile Queue results are shown in ***Table 2.11*** and ***Table 2.12*** respectively. The queue lengths are calculated using SimTraffic and are based on the average of three runs where random seeds were applied. The 95th percentile queue lengths that exceed the existing storage bay lengths are highlighted in orange and indicate the potential for turn bay blockage and more extensive combined queuing and delays.

Table 2.13 provides a summary of the results that have exceeded the performance criteria thresholds.

Table 2.10: V/C Ratios, AM and PM Peak Hours (2014 and 2040)

Intersection (Hwy 97 at)	Control Type	2014 V/C – Unsignalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	0.03	-	0.03	-	-	-	0	0	-	-	0.32	0.32	0.1	-	0.1	-	-	-	0.01	0.01	-	-	0.46	0.46
Renfrew Road	Stop Controlled	0.09	-	0.09	-	-	-	0	0	-	-	0.47	0.01	0.17	-	0.17	-	-	-	0	0	-	-	0.46	0.02
Todd Road	Stop Controlled	-	-	-	-	-	0.04	-	0.46	0.46	-	0.41	-	-	-	-	-	-	0.15	-	0.62	0.62	-	0.68	-
Chidley Road	Stop Controlled	0.03	-	0.03	-	-	-	0	0	-	-	0.62	0.01	0.11	-	0.11	-	-	-	0.2	0.2	-	-	0	0
Trepanier Bench Road	Stop Controlled	0.33	-	0.19	-	-	-	0.05	0.44	-	-	0.35	0	0.77	-	0.24	-	-	-	0.16	0.58	-	-	0.64	0.02
Buchanan Road (West)	Stop Controlled	-	-	-	0.04	-	0.04	-	0.47	0.47	0.01	0.01	-	-	-	-	0.12	-	0.12	-	0.6	0.6	0	0	-
Buchanan / Huston Road	Stop Controlled	0.76	0.76	0.76	-	0.09	0.09	0	0.46	-	0.03	0.35	0.02	1.99	-	1.99	-	-	0.11	0.01	0.59	0.59	0.09	0.66	005
Drought Road	Stop Controlled	-	-	-	0	-	0	-	0.35	0.35	0	0	-	-	-	-	-	-	0.01	-	0.42	0.42	0.01	0.01	-
Seclusion Bay Road	Stop Controlled	-	-	-	0.02	-	0.02	-	0.35	0.18	0	0.38	-	-	-	-	0.04	-	0.04	-	0.42	0.21	0.01	0.75	-

Intersection (Hwy 97 at)	Control Type	2014 V/C – Signalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	0.46	0.07	0.03	0.15	0.12	0.06	0.02	0.52	0.02	0.06	0.54	0.54	0.35	0.09	0.03	0.33	0.3	0.19	0.35	0.72	0.06	0.15	0.88	-
Ponderosa Drive	Signalized	0.1	0.42	0.42	0.08	0.29	0.29	0.01	0.59	0.01	0.11	0.43	0.02	0.14	0.37	0.37	0.08	0.35	0.35	0.03	0.82	0.01	0.35	0.66	0.03
Clements Crescent	Signalized	0.49	-	0.33	-	-	-	0.2	0.51	-	-	0.53	0.09	0.49	-	0.43	-	-	-	0.29	0.68	-	-	0.8	0.14

Intersection (Hwy 97 at)	Control Type	2040 V/C – Unsignalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	0.06	-	0.06	-	-	-	0	0.32	-	-	0.32	0.16	0.2	-	0.2	-	-	-	0.02	0.46	-	-	0.47	0.23
Renfrew Road	Stop Controlled	0.22	-	0.22	-	-	-	0	0	-	-	0.47	0.01	0.65	-	0.65	-	-	-	0	0	-	-	0.7	0.02
Todd Road	Stop Controlled	-	-	-	-	-	0.07	-	0.62	0.62	-	0.66	-	-	-	-	-	-	3.86	-	0.83	0.83	-	0.91	-
Chidley Road	Stop Controlled	0.11	-	0.11	-	-	-	0	0	-	-	0.65	0.01	0.51	-	0.51	-	-	-	0.01	0.01	-	-	0.9	0
Trepanier Bench Road	Stop Controlled	0.91	-	0.35	-	-	-	0.08	0.6	-	-	0.59	0	4.01	-	0.45	-	-	-	0.25	0.9	-	-	0.87	0.03
Buchanan Road (West)	Stop Controlled	-	-	-	0.09	-	0.09	-	0.63	0.63	0	0	-	-	-	-	0.47	-	0.47	-	0.92	0.92	0	0	-
Buchanan / Huston Road	Stop Controlled	2.5	2.5	2.5	-	0.13	0.13	0	0.62	0.62	0.05	0.59	0.02	27.87	-	27.87	0.23	-	0.23	0.01	0.91	0.91	0.49	0.89	0.05
Drought Road	Stop Controlled	-	-	-	0	-	0	-	0.45	0.45	0	0	-	-	-	-	0.02	-	0.02	-	0.63	0.63	0.01	0.01	-
Seclusion Bay Road	Stop Controlled	-	-	-	0.04	-	0.04	-	0.45	0.23	0.01	0.63	-	-	-	-	0.22	-	0.22	-	0.63	0.32	0.02	1.07	-

Intersection (Hwy 97 at)	Control Type	2040 V/C – Signalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	0.48	0.07	0.04	0.18	0.1	0.06	0.07	0.77	0.04	0.18	0.85	0.85	0.33	0.07	0.03	0.43	0.27	0.22	0.47	1.17	0.09	0.44	1.39	1.39
Ponderosa Drive	Signalized	0.08	0.36	0.36	0.09	0.33	0.33	0.01	0.82	0.01	0.32	0.69	0.02	0.18	0.39	0.39	0.01	0.06	0.06	0.19	1.11	0.01	0.33	0.97	0.03
Clements Crescent	Signalized	0.47	-	0.35	-	-	-	0.39	0.72	-	-	0.87	0.1	0.49	-	0.45	-	-	-	0.41	0.94	-	-	1.12	0.14

Thresholds for Signalized Intersections:

NBT, SBT ≥ 0.85

All other movements ≥ 0.90

Thresholds for Unsignalized Intersections:

NBL, NBT, NBR, SBL, SBT, SBR ≥ 0.85

All other movements ≥ 0.90

Table 2.11: Level of Service (LOS), AM and PM Peak Hours (2014 and 2040)

Intersection (Hwy 97 at)	Control Type	2014 LOS – Unsignalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	C	-	C	-	-	-	A	A	-	-	A	A	D	-	D	-	-	-	A	A	-	-	A	A
Renfrew Road	Stop Controlled	C	-	C	-	-	-	A	A	-	-	A	A	E	-	E	-	-	-	A	A	-	-	A	A
Todd Road	Stop Controlled	-	-	-	-	-	B	-	A	A	-	A	-	-	-	-	-	-	C	-	A	A	-	A	-
Chidley Road	Stop Controlled	C	-	C	-	-	-	A	A	-	-	A	A	F	-	F	-	-	-	A	A	-	-	A	A
Trepanier Bench Road	Stop Controlled	E	-	B	-	-	-	A	A	-	-	A	A	F	-	C	-	-	-	B	A	-	-	A	A
Buchanan Road (West)	Stop Controlled	-	-	-	D	-	D	-	A	A	A	A	-	-	-	-	F	-	F	-	A	A	A	A	-
Buchanan / Huston Road	Stop Controlled	F	F	F	C	C	C	A	A	A	A	A	A	F	-	F	-	-	C	B	A	A	B	A	A
Drought Road	Stop Controlled	-	-	-	B	-	B	-	A	A	A	A	-	-	-	-	B	-	B	-	A	A	A	A	-
Seclusion Bay Road	Stop Controlled	-	-	-	C	-	C	-	A	A	A	A	-	-	-	-	E	-	E	-	A	A	B	A	-

Intersection (Hwy 97 at)	Control Type	2014 LOS – Signalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	C	B	A	D	C	A	A	B	A	A	B	B	C	B	A	D	D	A	C	C	A	B	C	C
Ponderosa Drive	Signalized	D	C	C	D	B	B	A	B	A	A	A	A	D	C	C	D	B	B	A	C	A	A	A	A
Clements Crescent	Signalized	D	-	B	-	-	-	A	A	-	-	B	A	D	-	B	-	-	-	A	A	-	-	B	A

Intersection (Hwy 97 at)	Control Type	2040 LOS – Unsignalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	C	-	C	-	-	-	A	A	-	-	A	A	E	-	E	-	-	-	A	A	-	-	A	A
Renfrew Road	Stop Controlled	D	-	D	-	-	-	A	A	-	-	A	A	F	-	F	-	-	-	A	A	-	-	A	A
Todd Road	Stop Controlled	-	-	-	-	-	C	-	A	A	-	A	-	-	-	-	-	-	F	-	A	A	-	A	-
Chidley Road	Stop Controlled	E	-	E	-	-	-	A	A	-	-	A	A	F	-	F	-	-	-	A	A	-	-	A	A
Trepanier Bench Road	Stop Controlled	F	-	C	-	-	-	B	A	-	-	A	A	F	-	E	-	-	-	C	A	-	-	A	A
Buchanan Road (West)	Stop Controlled	-	-	-	F	-	F	-	A	A	A	A	-	-	-	-	F	-	F	-	A	A	A	A	-
Buchanan / Huston Road	Stop Controlled	F	F	F	C	C	C	B	A	A	B	A	A	F	-	F	E	-	E	B	A	A	C	A	A
Drought Road	Stop Controlled	-	-	-	B	-	B	-	A	A	A	A	-	-	-	-	C	-	C	-	A	A	A	A	-
Seclusion Bay Road	Stop Controlled	-	-	-	D	-	D	-	A	A	B	A	-	-	-	-	F	-	F	-	A	A	B	A	-

Intersection (Hwy 97 at)	Control Type	2040 LOS – Signalized intersections																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	C	B	A	D	C	A	B	C	A	B	C	C	C	B	A	D	D	A	D	F	A	C	F	F
Ponderosa Drive	Signalized	D	C	C	D	B	B	A	B	A	A	A	A	D	C	C	C	C	C	B	F	A	B	B	A
Clements Crescent	Signalized	D	-	B	-	-	-	B	A	-	-	C	A	D	-	B	-	-	-	B	B	-	-	F	A

Thresholds for Signalized Intersections:

NBT, SBT = E, F

All other movements= F

Thresholds for Unsignalized Intersections:

NBL, NBT, NBR, SBL, SBT, SBR = D, E, F

All other movements = E, F

Table 2.12: Queues, AM and PM Peak Hours (2014 and 2040)

Intersection (Hwy 97 at)	Control Type	2014 95th Percentile Queues																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	8.6	-	8.6	-	-	-	2.9	2.9	-	-	0	0	11.3	-	11.3	-	-	-	4.7	4.7	-	-	0	0
Renfrew Road	Stop Controlled	11.2	-	11.2	-	-	-	0	0	-	-	0	0	10.2	-	10.2	-	-	-	1.4	1.4	-	-	0	0
Todd Road	Stop Controlled	-	-	-	-	-	3	-	0	0	-	0	-	-	-	-	-	-	4.3	-	-	-	-	-	-
Chidley Road	Stop Controlled	5.5	-	5.5	-	-	-	0	0	-	-	0	0	7.2	-	7.2	-	-	-	7.8	7.8	-	-	-	-
Trepanier Bench Road	Stop Controlled	15.5	-	15.1	-	-	-	11.1	0	-	-	0	0	17.4	-	15.5	-	-	-	19.4	23.4	-	-	-	1.2
Buchanan Road (West)	Stop Controlled	-	-	-	8.4	-	8.4	-	0	0	0	0	-	-	-	-	7	-	7	-	0	0	0	0	-
Buchanan / Huston Road	Stop Controlled	17.7	17.7	17.7	12.4	12.4	12.4	1.7	0	0	6.5	0	0	107.3	107.3	107.3	105.6	105.6	105.6	6.3	0.8	0.8	22.5	328.9	34
Drought Road	Stop Controlled	-	-	-	2.3	-	2.3	-	0	0	0	0	-	-	-	-	6	-	6	-	0	0	2.5	2.5	-
Seclusion Bay Road	Stop Controlled	-	-	-	2.3	-	2.3	-	0	0	5.4	0	-	-	-	-	5.1	-	5.1	-	0	0	4.6	0	-

Intersection (Hwy 97 at)	Control Type	2014 95th Percentile Queues																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	28.2	19.6	0	9.4	15.2	14.8	7.1	66.6	0	10.8	62	62	27.2	21.7	0	18.1	27.7	15.6	24.5	119.9	32.4	18.2	155.4	155.4
Ponderosa Drive	Signalized	8.8	23.7	23.7	9.2	9.3	9.3	2.6	50.1	0	13.5	29.7	0.3	10.8	10.8	23.1	9.5	14.7	14.7	7.5	11.5	-	22.9	135	-
Clements Crescent	Signalized	30.6	-	4.2	-	-	-	18	39	-	-	47.9	3.1	29.4	-	19.5	-	-	-	19.2	111.1	-	-	69.3	5.4

Intersection (Hwy 97 at)	Control Type	2040 95th Percentile Queues																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Hardy Street	Stop Controlled	10.5	-	10.5	-	-	-	5.7	5.7	-	-	0	0	15.6	-	15.6	-	-	-	19.2	19.2	-	-	0	0
Renfrew Road	Stop Controlled	13.1	-	13.1	-	-	-	2.9	2.9	-	-	0	0	12.7	-	12.7	-	-	-	5.2	5.2	-	-	0	0
Todd Road	Stop Controlled	-	-	-	-	-	0	-	0	0	-	0	-	-	-	-	-	-	123.5	-	267	267	-	29.9	-
Chidley Road	Stop Controlled	8.5	-	8.5	-	-	-	0	0	-	-	0	0	65.6	-	65.6	-	-	-	66.3	66.3	-	-	185.5	17.9
Trepanier Bench Road	Stop Controlled	24.8	-	20.1	-	-	-	12.8	0	-	-	0	0	33.6	-	36.4	-	-	-	31.9	157.4	-	-	214.6	17.1
Buchanan Road (West)	Stop Controlled	-	-	-	5.3	-	5.3	-	0	0	0	0	-	-	-	-	6.3	-	6.3	-	0	0	117.8	117.8	-
Buchanan / Huston Road	Stop Controlled	33.4	33.4	33.4	12.6	12.6	12.6	3.5	0	0	8.2	0	0	106.1	106.1	106.1	15	15	15	3.8	0	0	36.5	458.2	19
Drought Road	Stop Controlled	-	-	-	3.7	-	3.7	-	0	0	4.4	4.4	-	-	-	-	7.1	-	7.1	-	0	0	21.7	21.7	-
Seclusion Bay Road	Stop Controlled	-	-	-	5.3	-	5.3	-	0	0	4.1	0	-	-	-	-	5.8	-	5.8	-	0	0	6.2	6.2	-

Intersection (Hwy 97 at)	Control Type	2040 95th Percentile Queues																							
		AM												PM											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Princeton/Beach Avenue	Signalized	32.4	32.8	-	9.1	12.3	8.9	4	103.5	27.6	18.8	150.7	150.7	26.6	17.8	-	23.9	34.3	15.2	33.8	380.5	62.7	20.9	221	221
Ponderosa Drive	Signalized	9.8	21.5	21.5	10.6	10.3	10.3	4.9	87.8	0	22.8	122.7	0.3	10.6	27.9	27.9	1.6	0	0	50.5	375.1	23.5	117.3	326.4	55.2
Clements Crescent	Signalized	27.6	-	6.2	-	-	-	20.7	112.3	-	-	82.2	3.1	34.5	-	46.9	-	-	-	55	236.3	-	-	392	163.7

Threshold:

95th Percentile Queue > Storage Bay Length

Table 2.13: Summary of Movements with Performance Criteria Thresholds Exceeded

INTERSECTION (HWY 97 AT)	V/C RATIOS		LEVEL OF SERVICE		95TH PERCENTILE QUEUE	
	2014	2040	2014	2040	2014	2040
AM PEAK						
Hardy Street						
Renfrew Road						
Princeton/Beach Avenue		SBT			EBL WBR	EBL WBR
Ponderosa Drive						
Clements Cres.		SBT				
Todd Road						
Chidley Road				EBL EBR		
Trepanier Bench Road		EBL	EBL	EBL		
Buchanan Road (West)			WBL WBR	WBL WBR		
Buchanan / Huston		EBL EBT EBR	EBL EBT EBR	EBL EBT EBR		
Seclusion Bay Road						
PM PEAK						
Hardy Street				EBL EBR		
Renfrew Road			EBL EBR	EBL EBR		
Princeton/Beach Avenue	SBT SBR	NBT SBT SBR		NBT SBT SBR	EBL WBR	EBL WBL WBR NBL NBR SBL
Ponderosa Drive		NBT SBT		NBT		
Clements Cres.		NBT SBT		SBT		SBR
Todd Road		WBR SBT		WBR		
Chidley Road		SBT	EBL	EBL		
Trepanier Bench Road		EBL NBL SBT	EBL	EBL EBR		NBL
Buchanan Road (West)		NBT NBR	WBL WBR	WBL WBR		
Buchanan / Huston	EBL EBR	EBL EBR NBT NBR SBT	EBL EBR	EBL EBR WBR		SBL
Seclusion Bay Road		SBT	WBL WBR	WBL WBR		

2.6 Safety

Local residents have identified safety as a key concern on the existing corridor, with recent high-profile fatal collisions raising the level of concern. In addition, turns from many of the unsignalized intersections are uncomfortable for drivers, creating a perception of a safety problem where historical collision data may not support an observed safety problem.

2.6.1 Performance Criteria

Safety performance was assessed using the most recent five years of available Collision Information System (CIS) reports along Highway 97, from 2010 to 2014. Safety performance was assessed for the full Highway 97 corridor in Peachland and at each intersection. The safety performance criteria are summarized in ***Table 2.14***.

Table 2.14: Safety Performance Criteria

MEASURE	THRESHOLD	REFERENCE
Collision Rate and Frequency	• Collision Rate > Critical Collision Rate AND Collision Frequency > 15	The collision rate / severity thresholds are referenced from page 2 of the CMP Safety Review Guidelines (November 2010) found on BC MoTI's website.
Collision Severity and Frequency	• Collision Severity Index > Average Collision Severity Index for similar facility • AND Collision Frequency > 15	

Where the critical rate is exceeded, the observed rate is considered to be worse than the provincial average rate for similar facilities throughout British Columbia. The critical rate adjusts for locations with low volumes where rates can be overstated due to a small number of collisions.

The critical rate is calculated as follows:

$$CR = AR + k\sqrt{\frac{AR}{EXP}} + \frac{1}{2(EXP)}$$

Where:

CR – Critical Rate (collisions/MVK for sections; collisions/MEV for intersections)
AR – Provincial Average Collision Rate for similar sections/intersections
EXP – Exposure (million vehicle-km for sections; million entering vehicles for intersections)
k – Constant (k=1.645 using a 95% confidence interval)

Collision Severity Index (CSI) is weighting of all collisions by severity, calculated as follows:

$$CSI = \frac{\#\,Fatal \times 100 + \#\,Injury \times 10 + \#\,PDO \times 1}{TotalCollisions}$$

2.6.2 Performance Assessment

Calculation of collision rates and severities are based on the five-year period from 2010 to 2014 inclusive for ease of comparisons with provincial averages, and in alignment with accepted MoTI analysis procedures. However, a longer period from 2004 to 2014 has also been reviewed to identify trends in collision frequency and types.

Although there are some locations where changes to intersection operations or geometry have occurred since 2010, deficiencies have been identified in the performance assessment to highlight a need for more detailed review or further monitoring to determine if the safety deficiency has been mitigated.

Corridor Sections

The collision frequency for 2004 to 2014 is summarized in ***Figure 2.20***.

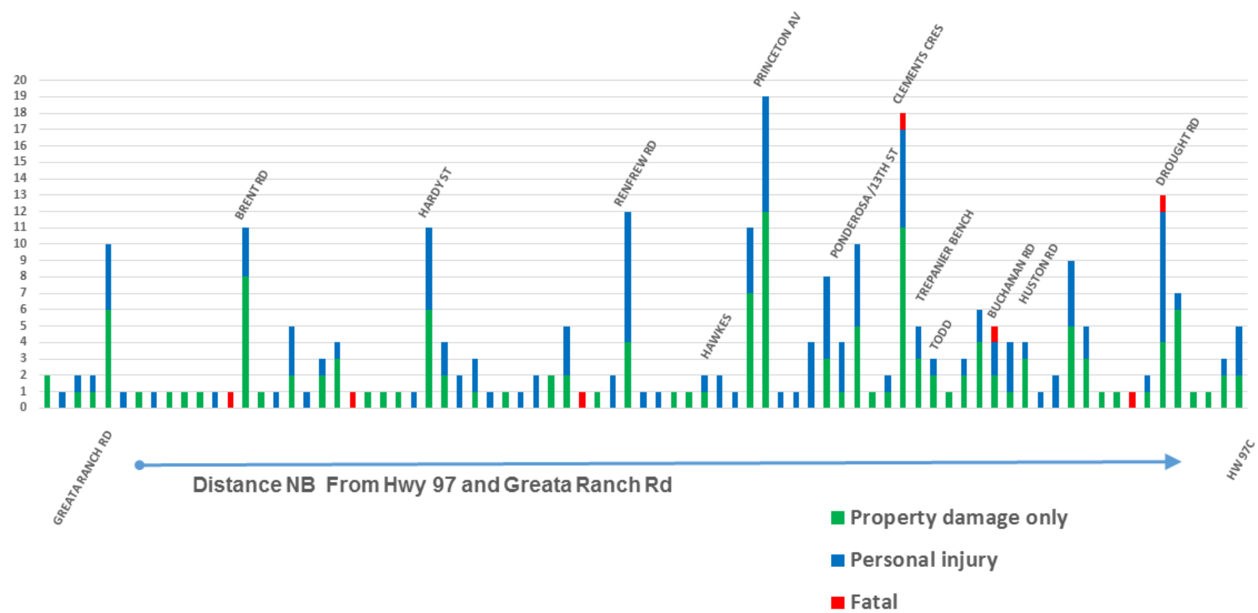


Figure 2.20: Collision Frequency, Greata Ranch Road to Highway 97C, 2004-2014

The corridor was split into two sections to calculate historical safety performance:

- Highway 97C to Princeton Avenue; and
- Princeton Avenue to Greata Ranch Road.

Greata Ranch Road is beyond the Peachland boundary, but the section south to Greata Ranch Road was included to capture the full two-lane section. Collision frequency and types for the period 2010 to 2014 inclusive is summarized in ***Table 2.15***.

Table 2.15: Section Frequency, Rate and Severity, 2010-2014

SECTION	LENGTH (KM)	5-YEAR AVERAGE AADT	MVK	FREQUENCY				CSI
				FATAL	INJURY	PDO	TOTAL	
Princeton Avenue to Highway 97C	6.8	17,700	219.7	2	28	26	56	9.0
Greata Ranch Road to Princeton Avenue	8.8	15,500	249.8	0	19	22	41	5.2

Intersections

The entering vehicles at an intersection per year, observed historical crash frequencies by severity, and crash severity index are shown in ***Table 2.16***.

Table 2.16: Intersection MEV, Crash Frequency and CSI, 2010-2014

INTERSECTION	MEV	FREQUENCY				CSI
		FATAL	INJURY	PDO	TOTAL	
Seclusion Bay Road	36		1		1	10.00
Drought Road	38		4	2	6	7.00
Huston Road / Buchanan Road	36		3	3	6	5.50
Buchanan Road (West)	35		2		2	10.00
Trepanier Bench Road	35			3	3	1.00
Todd Road	33		1	1	2	5.50
Clements Crescent	33	1	5	4	10	15.40
Ponderosa Drive /13 Street	33		10	6	16	6.63
Princeton Avenue	31		3	4	7	4.86
Hawkes Road	28		1	1	2	5.50
Renfrew Road	27		4	2	6	7.00
Hardy Street	24		1	4	5	2.80
Brent Road	24		2	4	6	4.00

The observed historical collision rates, provincial average rate, and CSI (based on 2010 – 2014 crash data) are compared with the performance thresholds in ***Table 2.17***.

Table 2.17: Intersection Rates, CSI and Threshold Attainment (2010-2014)

INTERSECTION	OBSERVED COLLISION RATE (COLL/MEV)	PROVINCIAL AVERAGE COLLISION RATE (COLL/MEV)	CRITICAL COLLISION RATE (COLL/MVK)	PROVINCIAL AVERAGE CSI	RATE THRESHOLD EXCEEDED?	CSI THRESHOLD EXCEEDED?
Seclusion Bay Road	0.03	0.15	0.27	8.47	NO	NO
Drought Road	0.16	0.15	0.27	8.47	NO	NO
Huston Road/ Buchanan Road	0.17	0.15	0.27	8.47	NO	NO
Buchanan Road (West)	0.06	0.15	0.27	8.47	NO	NO
Trepanier Bench Road	0.09	0.15	0.27	8.47	NO	NO
Todd Road	0.09	0.15	0.27	8.47	NO	NO
Clements Crescent	0.06	0.36	0.28	8.47	NO	NO
Ponderosa Drive /13 Street	0.30	0.36	0.55	5.35	NO	YES
Princeton Avenue	0.49	0.36	0.55	5.35	NO	NO
Hawkes Road	0.22	0.15	0.55	5.35	NO	NO
Renfrew Road	0.07	0.15	0.29	8.47	NO	NO
Hardy Street	0.22	0.15	0.29	8.47	NO	NO
Brent Road	0.21	0.15	0.30	8.47	NO	NO

2.7 Problem Definition Summary

This subsection summaries the identified problems for the overall corridor and specific intersection locations based on the findings of the traffic and safety assessments summarized in the previous sections. As discussed below, the Highway 97 corridor through Peachland will approach capacity for a two lane highway by 2040, will experience decreasing levels of service based on an anticipated reduction in average speeds during the afternoon peak period, and access to the highway will become more problematic at the un-signalized intersections.

2.7.1 Overall Corridor

The highway corridor through Peachland will be approaching capacity for a two-lane/two-way highway by 2040. Currently, most of the two-lane sections operate at LOS D. However, the frequent intersections and relatively high turning volumes when compared with a more rural environment contribute to current operating conditions, meaning the roadway does not always operate as well as the level of service analysis suggests. In addition, long weekends and special events attract significant additional traffic to Highway 97 in Peachland. During these times, significant congestion may occur. ***Figure 2.21*** shows the top 100 hourly ranked volumes in 2013.

By 2040, the level of service is expected to drop to LOS E for much of the corridor in the PM peak hour. At LOS E, driving can be frustrating with drivers spending 80% or more the time following and with the average travel speed dropping to under 65 km/h. This means that even small increases in traffic will create congestion, and the number of hours per year that congestion is experienced will increase.

With current traffic volumes, particularly in peak periods during the high season, it is difficult to find gaps in traffic at unsignalized intersections. This creates delays getting on and across the highway at some of the unsignalized intersection in Peachland. As traffic increases on the highway, delays for side street traffic will increase.

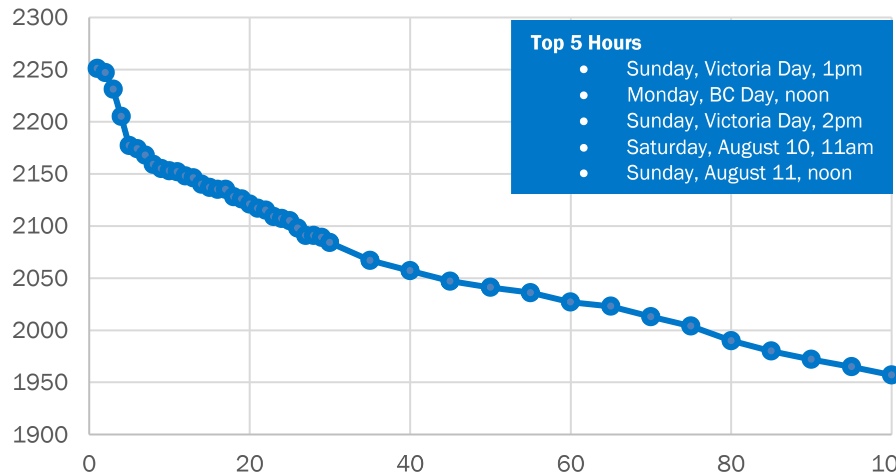


Figure 2.21: Top 100 Hourly Ranked 2-Way Volumes, Hwy. 97 South of Hwy. 97C, 2013

The challenges in accessing or crossing Highway 97 are most pronounced in the PM peak hour. Delays at some intersections are already very high. Most notably, drivers at Huston Road can expect delays of several minutes. By 2040, drivers will experience major delays (>50 secs) when trying to turn onto or across the highway at several more intersections, including Renfrew Road, Todd Road / Chidley Road, and Buchanan Road West. These challenges make driving uncomfortable and may lead to risk-taking as drivers attempt to cross or make turns onto the highway. ***Figure 2.22*** shows the delays for side street approaches to Highway 97 in the PM peak hour.

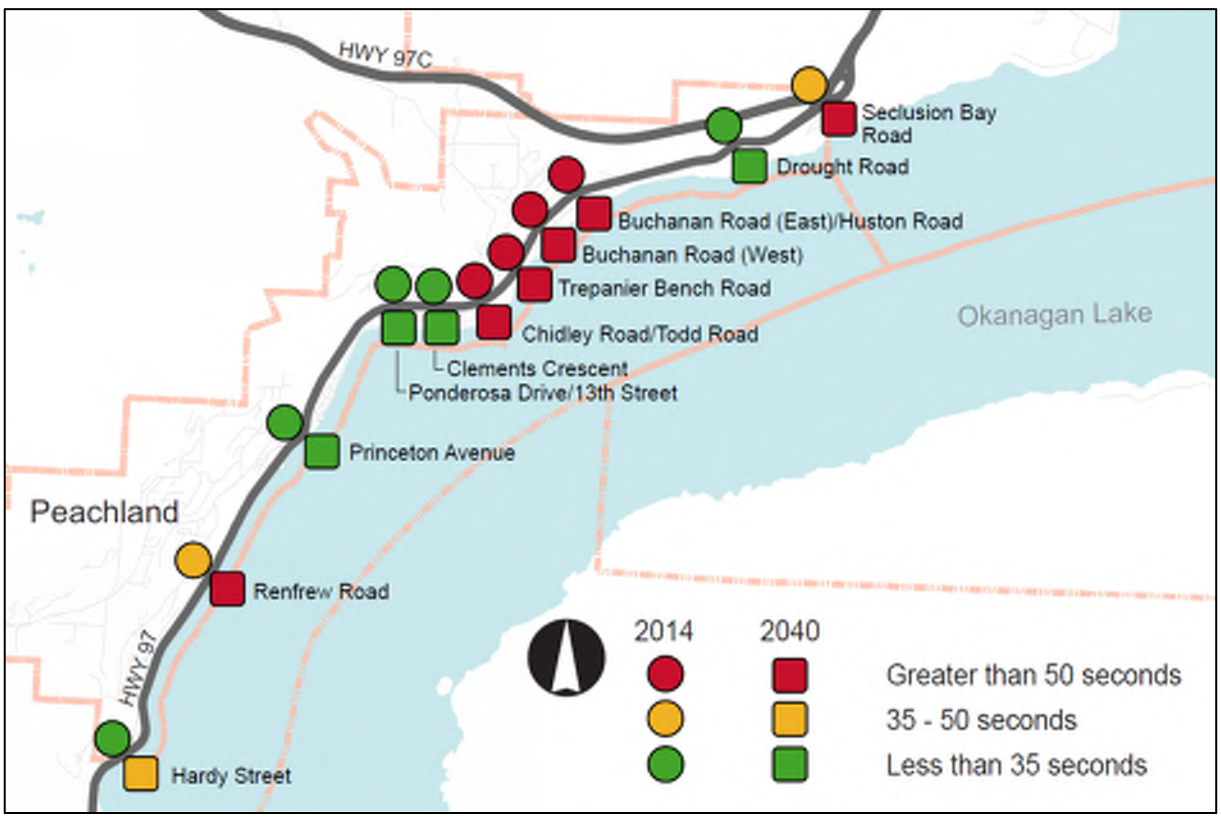


Figure 2.22: Side Street Approach Level of Service, PM Peak Hour

Within the study corridor, most collisions have been recorded at the intersections, which is typical of most highway corridors. In the 10-year period from 2004 to 2014, the highest number of collisions occurred at Clements Crescent (18) and Princeton Avenue (19). Traffic signals were added at Clements Crescent in late 2011, but there has been no significant change in the number or type of collisions since then.

There are several intersections with a high proportion of collisions involving injuries and fatalities, including two collisions involving fatalities in 2015 that are not reflected in the data analysed for 2004 to 2014. Based on the available data for the corridor, "Driver Inattentive" was reported as the most common first contributing factor, accounting for 22% of injury and fatal collisions.

The collision rate performance threshold has been exceeded for the section between Greata Ranch Road and Princeton Avenue. ***Figure 2.23*** and ***Figure 2.24*** respectively show the reported First Contributing Factor and Collision Types for the section from Princeton Avenue to Highway 97C.

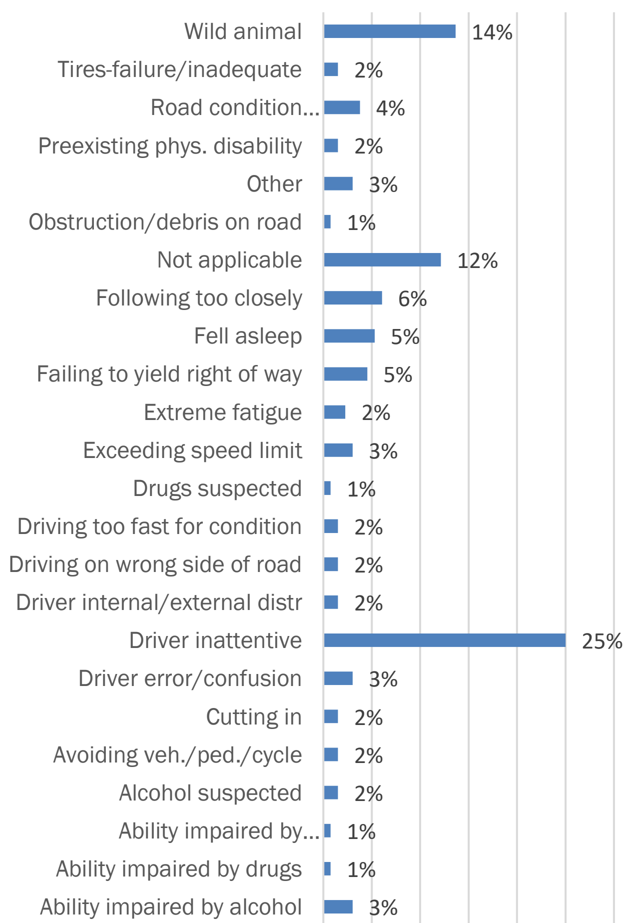


Figure 2.23: First Contributing Factor, Princeton Avenue to Hwy. 97C, 2004-2014

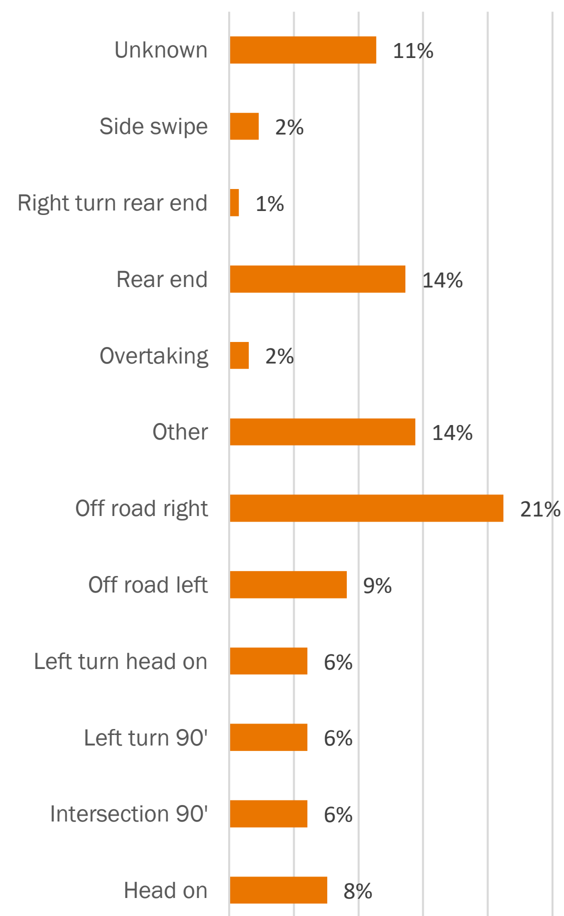


Figure 2.24: Collision Type, Princeton Avenue to Hwy. 97C, 2004-2014

“Driver Inattentive” is the most common first contributing factor, followed by “Wild Animal”. “Driver Inattentive” is commonly associated with intersection collisions, particularly when related to the high number of collision types (rear end, left turn head-on, left turn 90°, intersection 90°, right turn rear end) that are also associated with intersections.

2.7.2 Individual Intersections

Although there are mobility and safety problems identified for highway sections, the root causes of these problems can be traced back to the performance at individual intersections. None of the intersections have an identified safety problem, but the collisions at the intersections combine to create a collision rate problem. Similarly, the corridor mobility is impacted by turning movements at intersections and the most significant delays are incurred by traffic attempting to enter or cross Highway 97 at intersections.

The following describes the potential causes of problems. Identified problems related to performance thresholds that have been exceeded and potential safety problems in locations where rate and severity have exceeded the critical rate or provincial average respectively have been noted.

Seclusion Bay Road

Identified Problems:

- 2040 Mainline V/C, PM
- 2014/2040 Side Street LOS, PM
- 2040 Side Street LOS, AM/PM

Like most of the unsignalized intersections, there are significant delays on the Seclusion Bay Road approaches to Highway 97, caused by the volume and lack of gaps in the highway traffic. By 2040, the highway volumes will result in the v/c ratio exceeding 1.0 for southbound movements in the PM peak, indicating that there will be virtually no opportunities for left turns from Seclusion Bay Road, regardless of the demand for that movement.

Buchanan Road / Huston Road

Identified Problems:

- 2014/2040 Side Street V/C, PM
- 2040 Side Street V/C, AM
- 2040 Mainline V/C, PM
- 2014/2040 Side Street LOS, AM/PM
- 2040 Mainline Queues, PM

Buchanan Road / Huston Road is the only unsignalized, four-leg intersection in Peachland. Delays on the Huston Road approaches are high in the AM and PM peak, and on the Buchanan Road approach in the PM peak. This indicates that delays are caused by a combination of side street demand and highway volumes, particularly in the AM peak. By 2040, the highway volumes and lack of gap availability will become the primary factor associated with the poor operation of the intersection. In addition, the southbound left turn queue will extend beyond the available storage by 2040, further impacting southbound through movements. Further to the operational issues associated with queue spillovers, there are safety concerns at this particular location as the intersection is located within the 90 km/h posted speed zone at the bottom of a long hill.

Buchanan Road (West)

Identified Problems:

- 2040 Mainline V/C, PM
- 2014/2040 Side Street LOS, PM
- 2040 Side Street LOS, AM

The identified problems are similar to Trepanier Bench Road, despite side street volumes at Buchanan Road (West) being lower. The problems are related to the significant highway volumes and lack of gaps for turning traffic. By 2040, the delays for traffic turning onto Highway 97 will be excessive in both peak hours.

Trepanier Bench Road

Identified Problems:

- 2040 Side Street V/C, PM
- 2040 Mainline V/C, PM
- 2014/2040 Side Street LOS, AM/PM
- 2040 Mainline Queues, PM

Drivers currently experience excessive delays turning onto the highway from Trepanier Bench Road in both peak hours. By 2040, the highway will also be operating near capacity for through movements and northbound left turn queues will extend beyond the available storage, causing further interruption to highway traffic, beyond what would be noted through the v/c ratio.

Chidley Road / Todd Road

Identified Problems:

- 2040 Side Street V/C, PM
- 2040 Mainline V/C, PM
- 2014/2040 Side Street LOS, PM
- 2040 Side Street LOS, AM

These intersections are offset, but through movements across the highway are permitted. The Chidley Road approach currently operates at LOS F in the PM peak hour, despite the low demand for the movement. Chidley Road is a cul-de-sac, and thus this intersection is the only access to property along the road. The poor alignment of the intersection and the steep approaches likely make the actual operation of this intersection worse than is reflected in the capacity analysis. By 2040, volumes on the highway will have increased to the point that the Chidley Road approach will be also be operating at a LOS F in the AM peak. Although the traffic signal at Clements Crescent creates some gaps in the northbound traffic, the higher southbound volume in the PM peak hour and the limited sight distance to the north minimize the benefits created by this adjacent signalized intersection.

Clements Crescent

Identified Problems:

- 2040 Mainline V/C, PM
- 2040 Mainline Queues, PM

Potential Safety Problems:

- Collision Severity

Since being signalized in 2012, issues with side street delays have been addressed, though this will likely lead to future issues associated with v/c ratios on the highway and the length of the southbound right turn queue. While the historical collision frequency is not high enough to deem the collision severity to be a problem, an increase in traffic will eventually lead to the frequency being high enough to meet the threshold of three collisions/year. The current average is two collisions / year. The collision severity index is considerably higher than the provincial average.

Since the intersection was signalized, the number of collisions per year has dropped. The most common types of collisions prior to signalization were Intersection 90° and Off Road Right. Since signalization, rear-end collisions have become most common. The increase in rear-end collisions is an expected result of signalization. Like Ponderosa Drive / 13 Street, a limited (two year) data set since the signals were installed is insufficient to indicate a long-term trend.

Ponderosa Drive / 13 Street

Identified Problems:

- 2040 Mainline V/C, PM
- 2040 Mainline LOS, PM
- Collision Severity

Potential Safety Problems:

- Collision Rate

While addition of signals and the reconfiguration of these intersections has improved turning and crossing movements, delays for through movements have increased. By 2040, the northbound through movement will be operating at LOS F. The remaining movements are expected to continue operating well. Since the intersection was realigned and signalized, there has been an increase in the number of collisions annually, however there has only been two years of data since the signals were installed, which is not enough to suggest an increasing trend.

Princeton Avenue / Beach Avenue

Identified Problems:

- 2014/2040 Mainline V/C, PM
- 2040 Mainline V/C, AM
- 2014/2040 Side Street Queues, AM / PM
- 2040 Mainline Queues, PM

This signalized intersection currently operates well, with delays within an acceptable range. Although delays are acceptable, the volume to capacity ratios for the Highway 97 approaches are high. The high v/c ratios will make it difficult to address future side street delays and queues through timing and phasing changes, as there is limited ability to reallocate green time from the north/south (Highway 97) movements.

Renfrew Road

Identified Problems:

- 2014/2040 Side Street LOS, PM

Delays in the PM peak are excessive and will continue to grow as fewer gaps are available in the Highway 97 traffic. Highway 97 southbound is two lanes at this location, meaning more gaps are generally available for right turning traffic, but left-turning traffic must join the single lane on the highway in the northbound direction.

Hardy Street

Identified Problems:

- 2040 Side Street LOS, PM

Turning volumes are not expected to increase significantly by 2040, but the increase in traffic on Highway 97 in the PM peak will reduce the availability of gaps for left-turning traffic, leading to excessive delays.

3. Option Development

This section describes the various improvement options that have been developed to mitigate the issues identified in the previous section. In keeping with the study objectives, improvement options have been developed for the existing route and several alternate route options have also been developed.

3.1 Option Development Considerations

In developing improvement options for the existing route and options for potential alternate routes, consideration was given to various shaping influences, desired long-term functional characteristics, design functional classification, design criteria, and proposed cross section.

3.1.1 Option Shaping Influences

Initial improvement concepts were developed based on a number of shaping influences including:

- Concepts to address defined problems – both current and future;
- Previous historical options;
- Local transportation master plans, future transit plans, active transportation plans and other relevant planning documents; and
- Discussions with Regional District, Indigenous groups, and municipal staff and Council.

The following general features and / or goals were considered in the development of the improvement options along the existing route as well as in the development of several potential alternate route options:

Existing Route

- Long-term removal of traffic signals.
- Reduction in conflicts at high collision locations.
- Enhance local connections across the highway as much as possible.
- Accommodate uncongested, reliable transit on the highway.
- Support active transportation.

Alternate Route

- Diversion of enough traffic away from the existing corridor to provide relief from intersection delays.
- Connection points to the existing corridor influence traffic diversion.
- Topography governs the alignment of alternate corridor – maximum grade of 6% (similar to the recent Winfield-Oyama section of Highway 97).

3.1.2 Desired Functional Characteristics

Stemming from the parallel Central Okanagan Planning Study, ***Table 3.1*** provides some general guidance with regard to the highway characteristics that support conceptual option development. These represent desired characteristics for Highway 97 through the Central Okanagan Region. The achieved highway characteristics will be influenced by existing conditions, adjacent land use and future development plans, and will not strictly adhere to the characteristics identified in the table.

Table 3.1: Desired Highway Characteristics

FUNCTION	PHYSICAL AND OPERATING CONDITIONS
Mobility	• High speed between communities • Moderate speed within communities
Access	• Good access to major employment centres, central business districts, large residential areas • No direct property access • Moderate access density; intersection spacing in the order of 0.8-2 km, depending on conditions • Generally, grade-separated connections (signalized or side street stop-controlled), but some at-grade intersections (signalized or side street stop-controlled) at minor access points
Network Hierarchy	• Connects to major municipal streets • Continuous parallel local routes
Transit	• Supports regional rapid transit (i.e. BRT) on-highway where practical and beneficial
Cycling	• On shoulders in rural areas • On multi-use pathways adjacent to the corridor, or in marked cycle or shared lanes on parallel routes
Pedestrians	• Safe, comfortable crossings • Grade-separated crossings in high-speed areas • Separated sidewalks and pathways (e.g. green buffer, barrier, etc.)

3.1.3 Road Design Functional Classification

In rural areas within the Central Okanagan Region, the Rural Arterial (Divided) classification applies, with modifications to support transit, cycling and pedestrian movements. In suburban areas, either an expressway or a rural arterial can be used depending on the adjacent land use and local network connectivity.

The cross-section should share elements throughout. For example, median separation or provision for median separation; a minimum of four basic lanes, provision for cyclists and community cross-connections across are important to all sections.

The proposed functional classification provides initial values for the highway components. The three-letter two-number system developed by the Transportation Association of Canada (TAC) designates:

- Adjacent Land Use - Urban (U) or Rural (R);
- Service Function – Local (L), Collector (C), Arterial (A), Expressway (E) or Freeway (F);
- Divided/Undivided – Divided roadway (D) or Undivided roadway (U); and
- The number represents the desired design speed (km/h).

Two functional classifications are proposed for Highway 97 through the Central Okanagan Region: Urban Expressway Divided (UED) and Rural Arterial Divided (RAD). UED allows for both at-grade intersections and grade-separated interchanges. Similarly, RAD allows for at-grade and grade-separated connections although grade-separated connections are less likely in rural areas as they are unlikely to have high enough traffic volume to warrant interchanges. For the purpose of developing improvement options for the Peachland section of Highway 97, these two functional classifications will be applied.

The "urban" designation of land use reflects the nature of most land along the corridor within Peachland, especially between Huston Road / Buchanan Road and Princeton Avenue. Almost none of the adjacent land use of the corridor is completely rural in nature. It should be noted that many potential existing route improvement options will be "retrofit" of an existing roadway, and strict adherence to a single functional classification is neither practical nor desirable. In these cases, the minimum classification that should be considered is UAD-60. However, through the option development process, there should be an initial attempt to achieve the UED-80 guidelines.

The functional classification is intended to provide guidance and will need to be applied with a degree of flexibility in order to allow key objectives to be met.

For alternate routes in rural areas, a RAD classification and design speed of 100 km/h is proposed as this is consistent with other reconstructed and widened sections of Highway 97 north of Kelowna and south of Peachland. Within more developed urban areas, the UED-80 classification will be more appropriate.

The desired classifications for the section of Highway 97 through Peachland are summarized in ***Table 3.2***. This table shows the desired guidelines for options on or near the existing route, as well as for significant alternate route options.

Table 3.2: Summary of Desired Functional Classifications – Peachland Section of Highway 97

CLASSIFICATION FOR EXISTING ROUTE OPTIONS	CLASSIFICATION FOR ALTERNATE ROUTE OPTIONS
UED-80	RAD-100

3.1.4 Road Design Criteria

This subsection describes the road design criteria proposed for the existing route and alternate route options.

A. Posted Speeds and Design Speed

The 80 km/h design speed is a reasonable compromise speed providing mobility between communities and slower posted speeds through towns and built up areas. Posted and design speeds of greater than 80 km/h are viewed by many motorists as high-speed facilities. In the higher speed facilities, the operating speed of the faster vehicles will often be more than 20 km/h over the posted speed. A higher speed facility will exhibit operational problems in trying to accommodate transit and cyclists. The 80 km/h posted speed is slow enough to allow the drivers to be aware of the roadside environment while allowing the active transportation users a certain level of comfort with respect to the speed of passing vehicles.

For the alternate route options, it is assumed that 100 km/h posted and design speeds will be used.

At the regional level, a consistent posted speed and design speed of 80 km/h or greater between communities will encourage consistent driver behavior and allow for desired mobility. However, it may be necessary to reduce posted and design speeds within communities to allow for strategic access and to reduce the community severance effects to the greatest degree practical, the operating characteristics including speed should remain consistent to maximize safety and mobility benefits. For the purposes of this study, these considerations will be applied to the existing route options for the section of Highway 97 through Peachland.

B. Basic Number of Lanes

The number of lanes will be established based on capacity requirements. At the regional level, the corridor will include four primary lanes, and additional lanes may be necessary in some urban and suburban areas, particularly through Kelowna. However, for the Peachland section of Highway 97, four primary lanes are considered appropriate for both the existing route and the alternate route options. Auxiliary lanes, in addition to the basic lanes, will be considered as operating conditions dictate.

C. Intersection Minimum Intersection/Interchange Spacing

Direct property access will be eliminated, however to be practical, strategic access to communities and key activity centres will be provided via junctions (at-grade intersections or grade-separated interchanges) with the municipal street network or other provincial highways. The desired minimum spacing is 800 metres which applies primarily to intersections. In order to provide reasonable access opportunities, it is expected that spacing will generally be no more than 2.0 kilometres, but this will be determined based on specific needs along the corridor. The intersection spacing will consider reasonable pedestrian crossing opportunities. To the greatest degree possible, active transportation crossings will avoid the need for pedestrians and cyclists to change grade. Similarly, access to transit will also seek to be provided with changes in elevation for transit riders minimized.

D. Minimum Horizontal Radius

The minimum horizontal radius is a direct outcome of design speed. Assuming a maximum rate of superelevation of 6%, the BC MoTI guideline lists the minimum curve radius of 250 metres for 80 Km/h and 440 metres for 100 km/h in Table 330.A.

E. Minimum K Factors Vertical Curves

The upper end of the value for sag curves under headlight control of K= 32 for 80 km/h and K= 50 for 100 km/h. The values are based on headlight control and could be reduced slightly in illuminated sections.

The upper end of the value for Crest curves under headlight control of K= 36 for 80 km/h and K= 74 for 100 km/h. The values are based on tail light control as space for rock fall is assumed to be provided where applicable.

F. Grades

A maximum grade of 5% is desirable, but given the topographic constraints associated with any alternate route alignments, a more realistic guideline is 6% (maximum in BC Supplement to TAC).

G. Superelevation

The maximum superelevation is 6%.

H. Stopping Site Distance

Stopping sight distance is generally a control of the design speed. In areas of high driver workload, decision sight distance should be considered.

I. Lane Widths

The BC MoTI supplement guideline value for lanes widths along an 80 km/h expressway is 3.7 metres. Where the cross-section is constrained, 3.6 metre lanes may be acceptable in an 80 km/h design environment.

J. Shoulder Width Outside

The BC Expressway standard for shoulders has a generous width of 3.0 metres. This width for shoulders will accommodate bicycles and roadside emergencies. However, the constrained and urban nature of most of the existing corridor suggests that a minimum outside shoulder width of 2.5 metres is more likely achievable and is consistent with existing sections already developed to a comparable standard.

K. Shoulder Width Inside and Median

The inside shoulder shy distance is 1.0 metres for a four-lane facility. Where conventional concrete median barrier (CMB) is used, a total median width of 2.6 metres is appropriate. However, a modified median width or other solution will be considered when Stopping Sight Distance (SSD) is not met by the above dimensions.

L. Clear Zone Offset Width and Recoverable Side Slopes

The BC MoTI offset width for 80 km/h is 8.5 metres, measured from the edge of the outside lane to any fixed object. The clear zone for 100 km/h is over 11 metres. These offsets provide room for adjacent multi-use pathways. The desired side slope is 4:1 or flatter.

M. Catchment for Rock Cuts

Additional space of 1.25 metres should be provided for spalling rocks where geotechnical conditions require.

N. Design Vehicle

The largest vehicle which is anticipated for the corridor is a WB-24. Most of the other design vehicles will fit into the turning paths required for a WB-24.

3.1.5 Proposed Road Design Cross Section

The treatment of the road side design should consider contextual environment. In some of the urban and suburban areas within the Central Okanagan Region, different roadside arrangements of the road side may be required. An urban cross-section with curb and gutter at the roadside with a boulevard separating a sidewalk or multi-use pathway may be more appropriate to the local context. A generalized cross-section for the Highway 97 corridor through the Central Okanagan Region is provided in ***Figure 3.1a*** below.

Figure 3.1a: Generalized Cross Section

For this study, and specific to the contextual environment through Peachland, the generalized cross-section for both the existing route and the alternate route options is shown below in ***Figure 3.1b***. This generalized cross-section is consistent with the applicable design criteria discussed above.

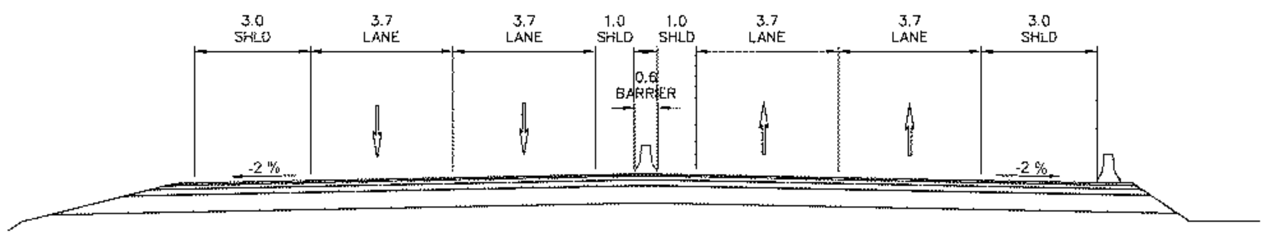


Figure 3.1b: Generalized Cross Section – Peachland

3.2 Options

This subsection discusses the improvement options generated for the existing route and alternate route.

3.2.1 Existing Route Options

The existing route was partitioned into smaller sections in order to focus on specific corridor issues. From north to south, the sections are identified as follows and depicted in ***Figure 3.2***:

- Section 1: Drought Hill (in red on the map)
- Section 2: Huston Road / Buchanan Road to Trepanier Bench Road (in purple)
- Section 3: Todd Road to Ponderosa Drive (in orange)
- Section 4: Princeton Avenue/Beach Avenue (in blue)
- Section 5: South of Princeton Avenue (in yellow)

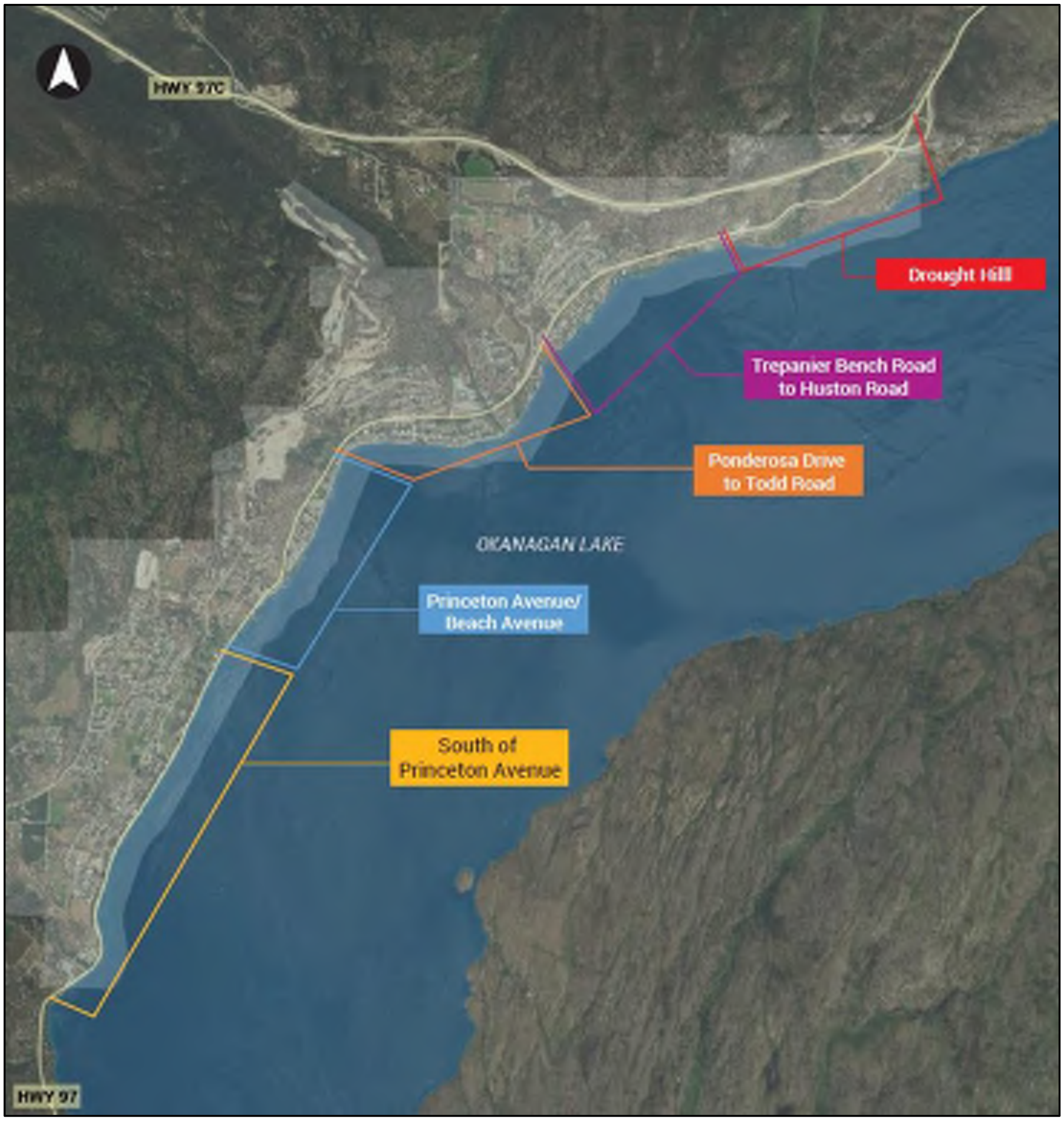


Figure 3.2: Peachland Existing Route Option Sections

Descriptions of the options developed for each section along the existing corridor through Peachland are described on the following pages. In some options, traffic signals have been removed from the corridor and replaced by a grade-separated highway crossing to address identified problems and to achieve the long term planning objectives for the corridor. Other options include realignment of the highway, reconfigured or relocated local road connections, and changes to the alignment of some local road network elements.

It is important to note that for all existing corridor options, Highway 97 is widened to a four-lane cross section to reflect the needs for the long-term planning horizon. Expanding the highway capacity to four lanes increases the number of vehicles that can move through the corridor.

Section 1: Drought Hill Options

Drought Hill options create a parallel local network which separates local traffic from traffic travelling through this section of the highway corridor. Key considerations for these options included addressing the issues related to future delays getting onto the highway from this location, and delays on the highway due to higher traffic volumes.

Option ER-1A Drought Hill Expressway

This option extends the Drought Road connection with Seclusion Bay Road and Robinson Place. This extension forms a parallel local road network. Right-in and right-out movements would be permitted between Seclusion Bay Road and Highway 97. Right-in and right-out movements would also be permitted between Drought Road and Highway 97. Highway 97 would be widened to a four lane cross section. Option ER-1A is illustrated in ***Figure 3.3*** below.

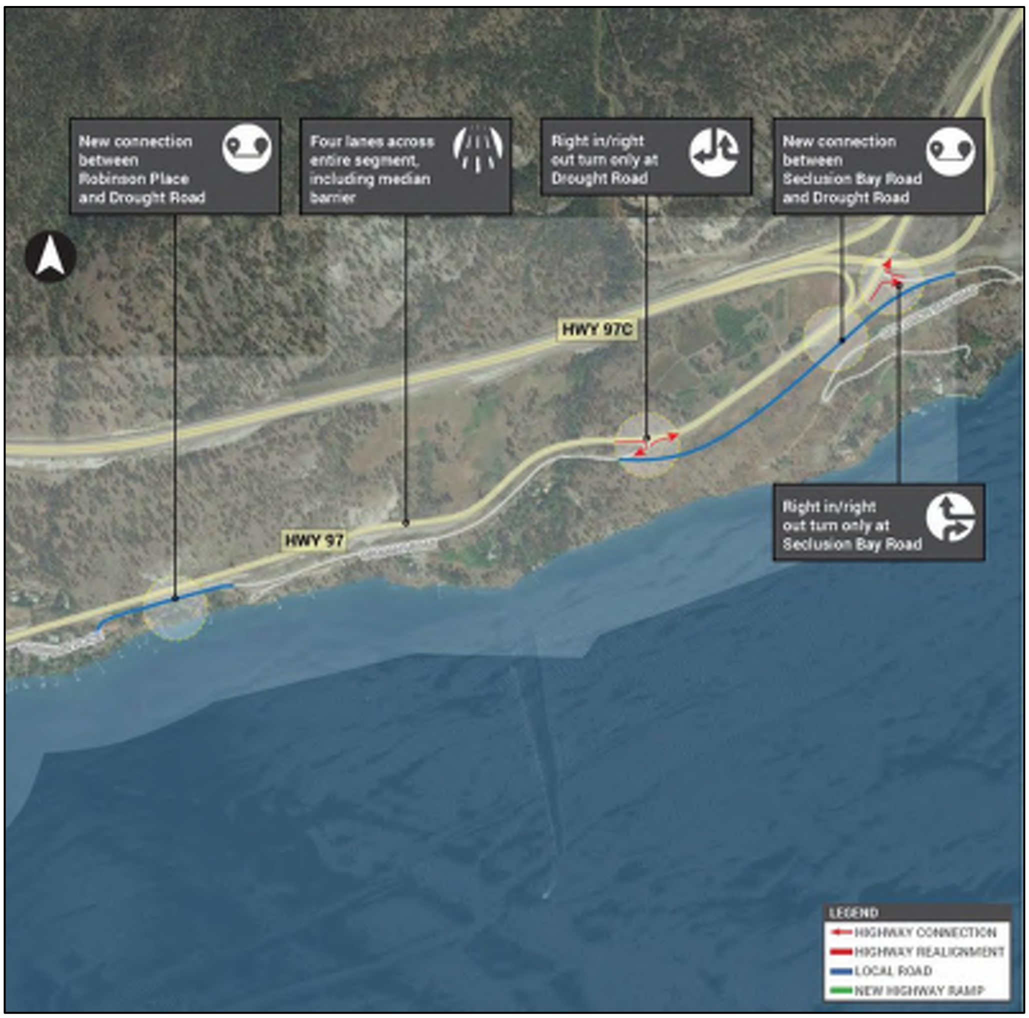


Figure 3.3: ER-1A Drought Hill Expressway

Option ER-1B Drought Hill Expressway with Drought Road Overpass

This option also creates a parallel local road network by extending Drought Road to Seclusion Bay Road and also further south to Robinson Place. The existing intersection of Seclusion Bay Road and Highway 97 would be closed in this option. Right-in and right-out movements would be permitted between Highway 97 and Drought Road. Southbound connections to / from the highway are provided by on and off ramps along the highway. Highway 97 would be widened to a four lane cross section. *Figure 3.4* illustrates Option ER-1B.

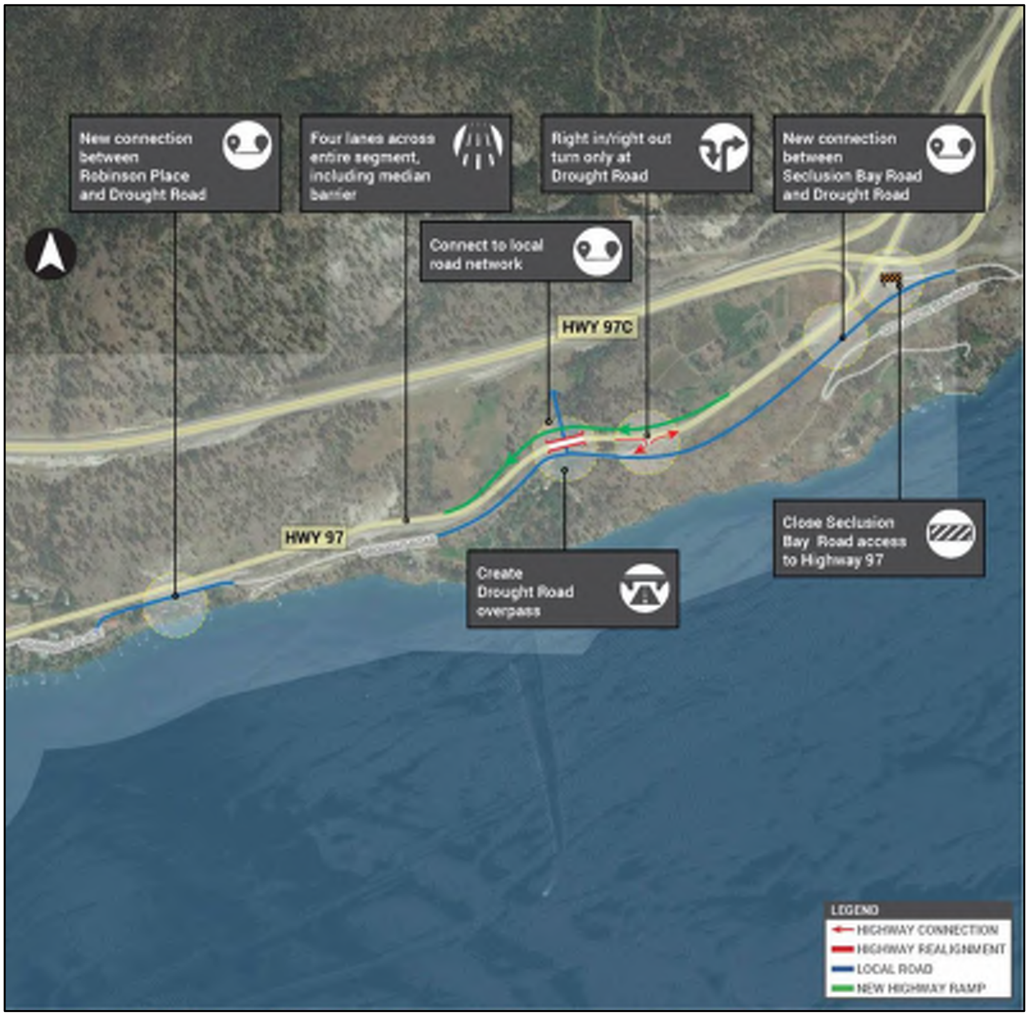


Figure 3.4: ER-1B Drought Hill Expressway with Drought Road Overpass

Option ER-1C Seclusion Bay Road and Drought Road Overpasses

This option connects Drought Road, underneath Highway 97, to a new Seclusion Bay Road extension on the north side of Highway 97. The existing intersection of Seclusion Bay Road and Highway 97 would be closed. This option includes a grade separation of Highway 97 at two locations along Drought Road.

Right-in and right-out movements would be permitted at the existing intersection of Drought Road and Highway 97 as well as at the north-side extension of Seclusion Bay Road. Consistent with the previous options for this segment, Drought Road would extend to connect to Robinson Place. Highway 97 would be widened to a four lane cross section. ***Figure 3.5*** illustrates Option ER-1C.

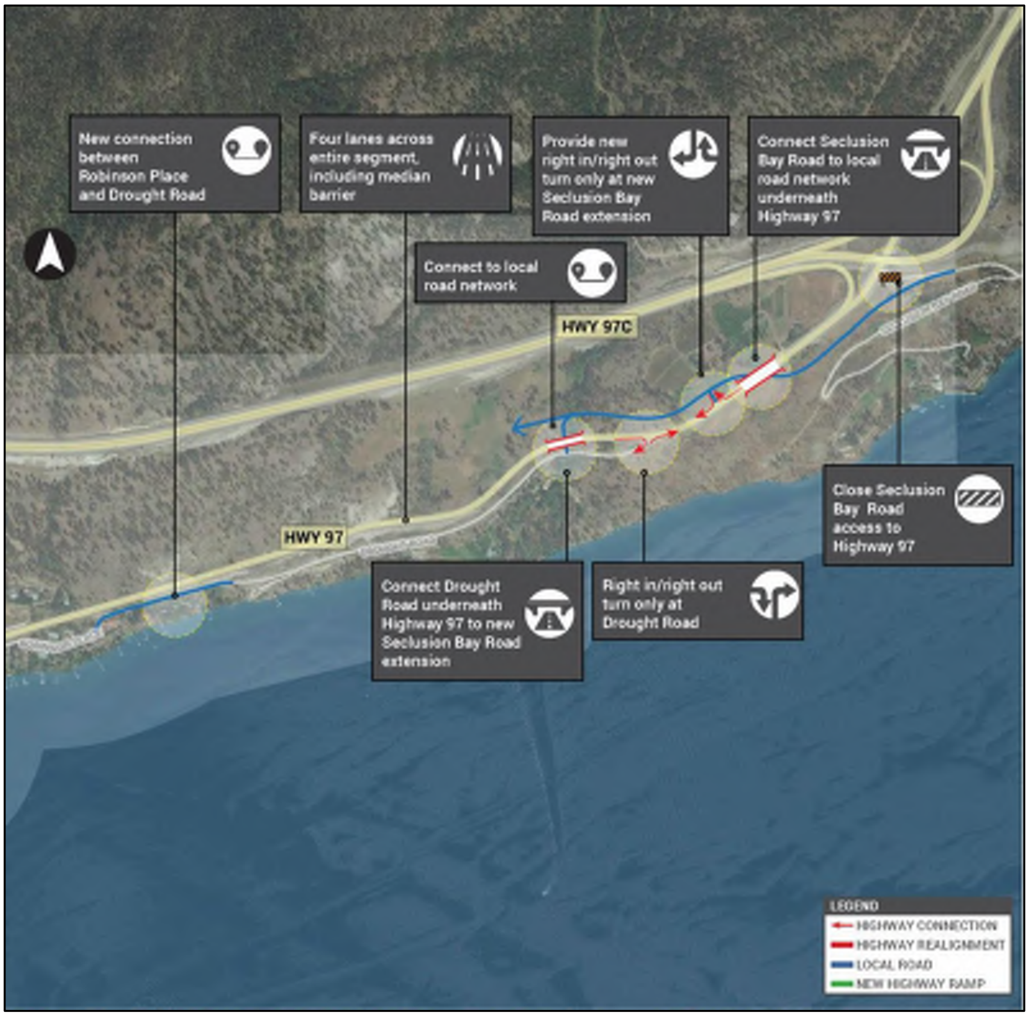


Figure 3.5: ER-1C Seclusion Bay Road and Drought Road Overpasses

Section 2: Huston Road / Buchanan Road to Trepanier Bench Road Options

In developing these options, key considerations acknowledged that the current two-lane highway would be at capacity and four-lane cross section is required by 2040. There are also delays in accessing the highway and delays on the highway due to higher traffic volumes.

Option ER-2A Overpass at Lang Road

This option provides right-in and right-out movements at Huston Road / Buchanan Road. An overpass connecting Lang Road across Highway 97 to Eyre Road provides a new local connection across the highway. The Buchanan Road South and Trepanier Bench Road access would be closed. Highway 97 would be widened to a four lane cross section. *Figure 3.6* illustrates Option ER-2A.

Figure 3.6: ER-2A Overpass at Lang Road

Option ER-2B Extension of Shaw Road and Huston Road

This option extends Shaw Road to connect with Buchanan Road passing under Huston Road and Highway 97. Right-in and right-out movements would be allowed at Huston Road / Buchanan Road. Buchanan Road South and Trepanier Bench Road access would be closed. Highway 97 would be widened to a four lane cross section. Option ER-2B is illustrated in ***Figure 3.7*** below.

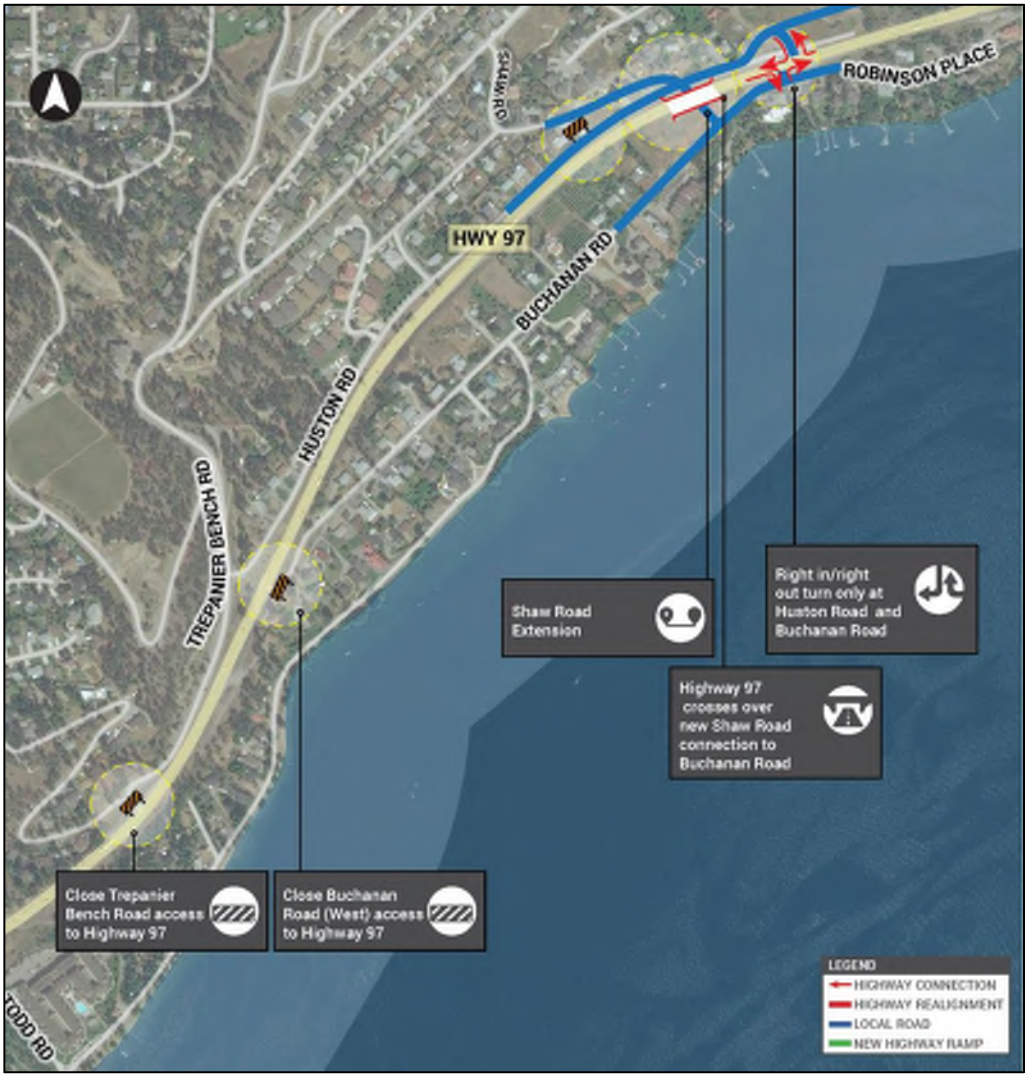


Figure 3.7: ER-2B Extension of Shaw Road and Huston Road

Option ER-2C Trepanier Road Over Highway 97

In this option, Trepanier Bench Road would cross over Highway 97 to connect with Buchanan Road. The existing Trepanier Bench Road and Buchanan Road South accesses would be closed. Right-in and right-out movements at Huston Road / Buchanan Road would be permitted. Highway 97 would be widened to a four lane cross section. Option ER-2C is illustrated in ***Figure 3.8*** below.

Figure 3.8: ER-2C Trepanier Road Over Highway 97

Option ER-2D Traffic Signal at Trepanier Bench Road

In this option, the Trepanier Bench Road intersection would be signalized and right-in and right-out movements would be permitted at Huston Road / Buchanan Road. Access to Buchanan Road South would be closed. Highway 97 would be widened to a four lane cross section. Option ER-2D is illustrated in ***Figure 3.9*** below.

Figure 3.9: ER-2D Signal at Trepanier Bench Road

Option ER-2E Signal at Huston Road / Buchanan Road

Consistent with all existing corridor options, Highway 97 would be widened for four lanes. The Huston Road / Buchanan Road intersection would be signalized and right-in and right-out access would be provided at Trepanier Bench Road. Access to Buchanan Road South would be closed. Option ER-2E is illustrated in ***Figure 3.10*** below.

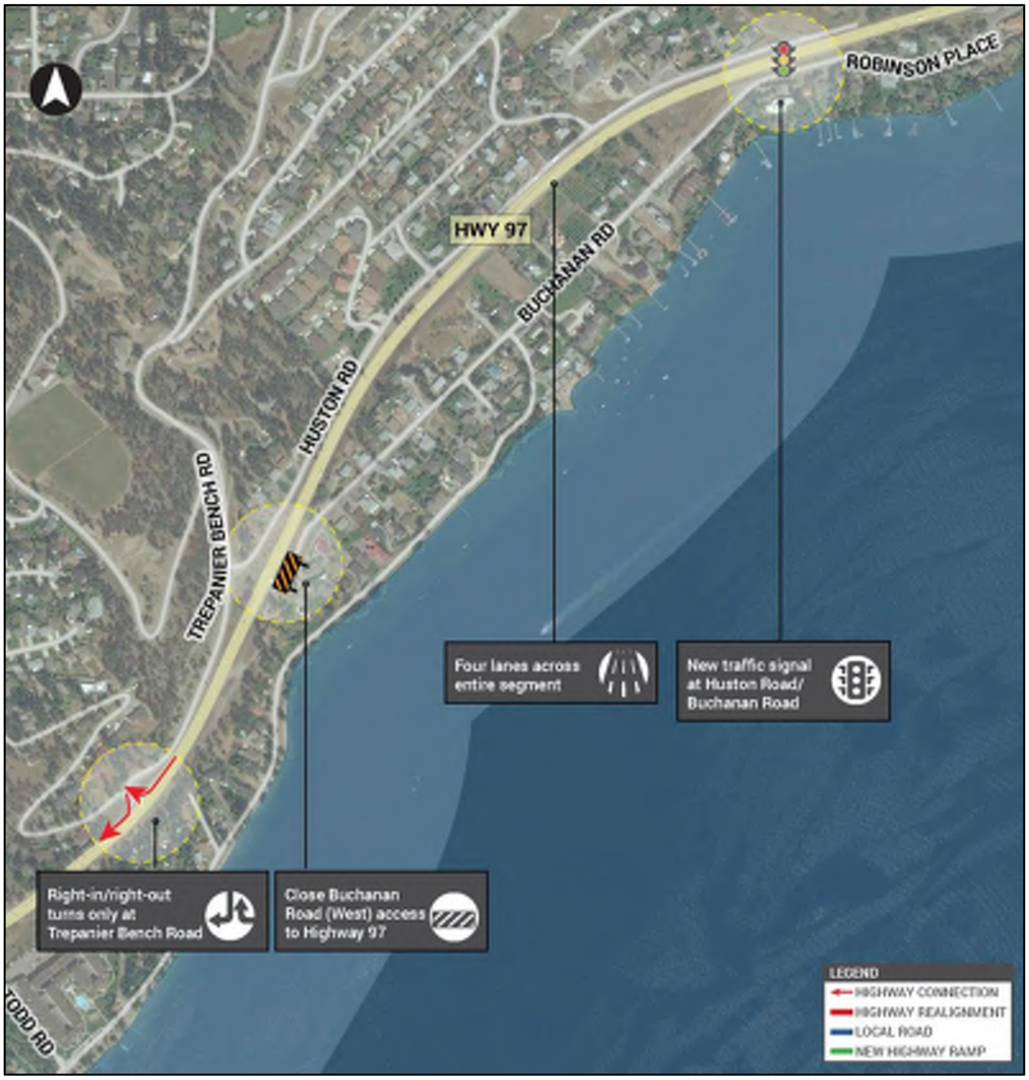


Figure 3.10: ER-2E Signal at Trepanier Bench Road

Section 3: Todd Road to Ponderosa Drive Options

By 2040, this area will need to address intersection safety, particularly at Ponderosa Drive / 13 Street and Clements Crescent. In addition to potential safety issues, there are also delays accessing the highway, and delays on the highway due to high traffic volumes.

Option ER-3A Todd Road and 13 Street Crossings

This option focuses on grade separating key intersections within this segment. A new northbound ramp would provide access to and from the highway at 13 Street. The realigned 13 Street route and Ponderosa Drive would cross over the highway, and a new local road would connect Ponderosa Drive to Clements Crescent. At Clements Crescent, right-in and right-out movements would be permitted from the highway. Chidley Road and Todd Road would connect under Highway 97, and a new northbound ramp would provide access to and from the highway. Highway 97 would be widened to a four lane cross section. Option ER-3A is illustrated in ***Figure 3.11*** below.

Figure 3.11: ER-3A Todd and 13 Street Crossings

Option ER-3B Retain Traffic Signals at Clement Crescent and Ponderosa Drive

This option maintains traffic signals at Ponderosa Drive / 13 Street and Clements Crescent. Right-in and right-out movements would be permitted at Todd Road, while access to Chidley Road would be closed from the highway. Local road improvements include a new connection from Childley Road to Clements Crescent to provide access to properties along Childley Road. Highway 97 would be widened to a four lane cross section. Option ER-3B is illustrated in ***Figure 3.12*** below.

Figure 3.12: ER-3B Retain Signals at Clement Crescent and Ponderosa Drive

Section 4: Princeton Avenue / Beach Avenue Options

When developing options for this highway section, key considerations acknowledge delays accessing the highway and delays on the highway due to higher traffic volumes.

Option ER-4A Interchange at Princeton Avenue

This option involves upgrading Princeton Avenue to connect to Beach Avenue through a grade separated crossing of Highway 97. At the south end, before the intersection at Princeton Avenue / Beach Avenue, a new northbound off-ramp and on-ramp would provide access to and from the highway. For southbound traffic, a new highway ramp from Princeton Avenue would provide right-in and right-out connections with the highway. Highway 97 would be widened to a four lane cross section. Option ER-4A is illustrated in ***Figure 3.13*** below.

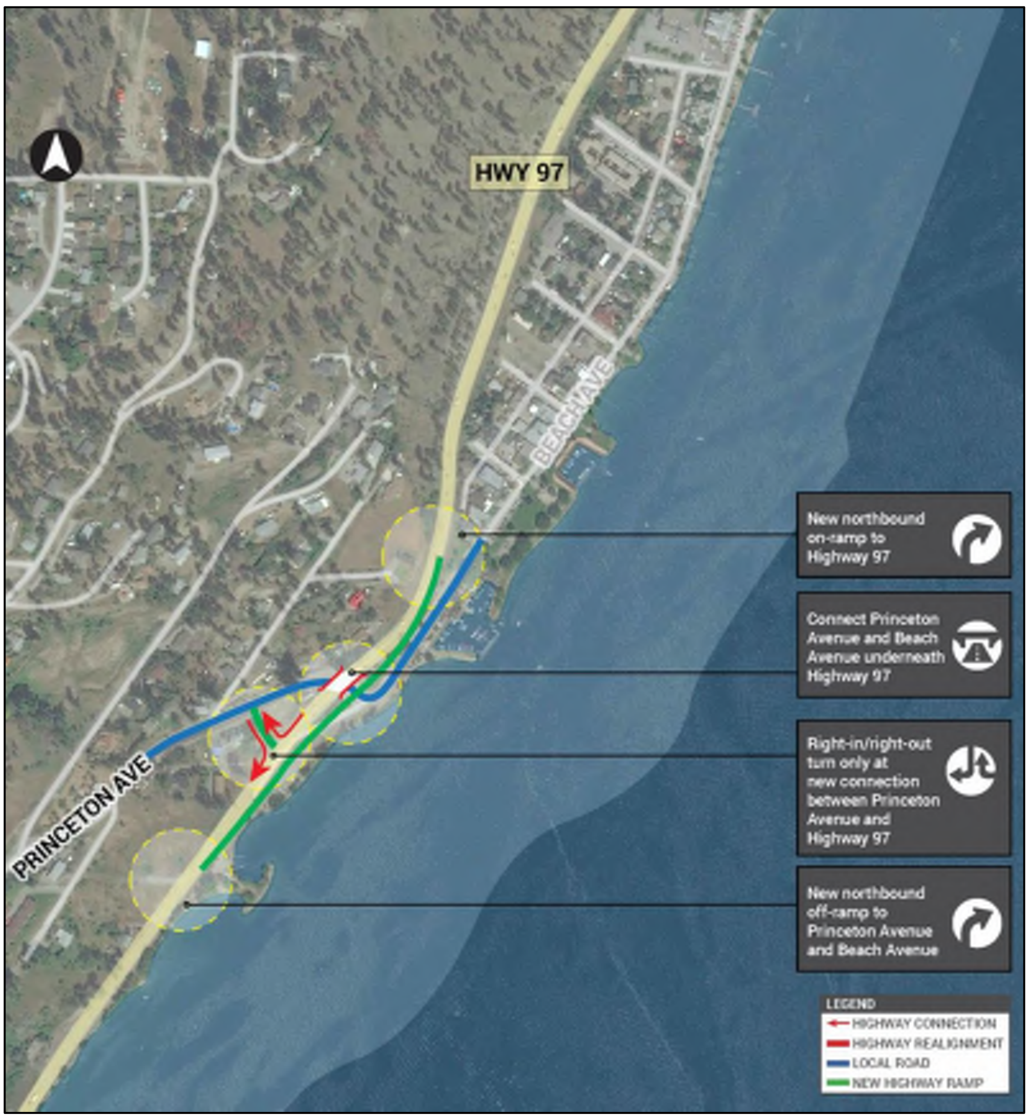


Figure 3.13: ER-4A Interchange at Princeton

Option ER-4B Retain Signal at Princeton Avenue

This option maintains the traffic signals at Princeton Avenue. Highway 97 would be widened to a four lane cross section. This option is illustrated in ***Figure 3.14*** below.

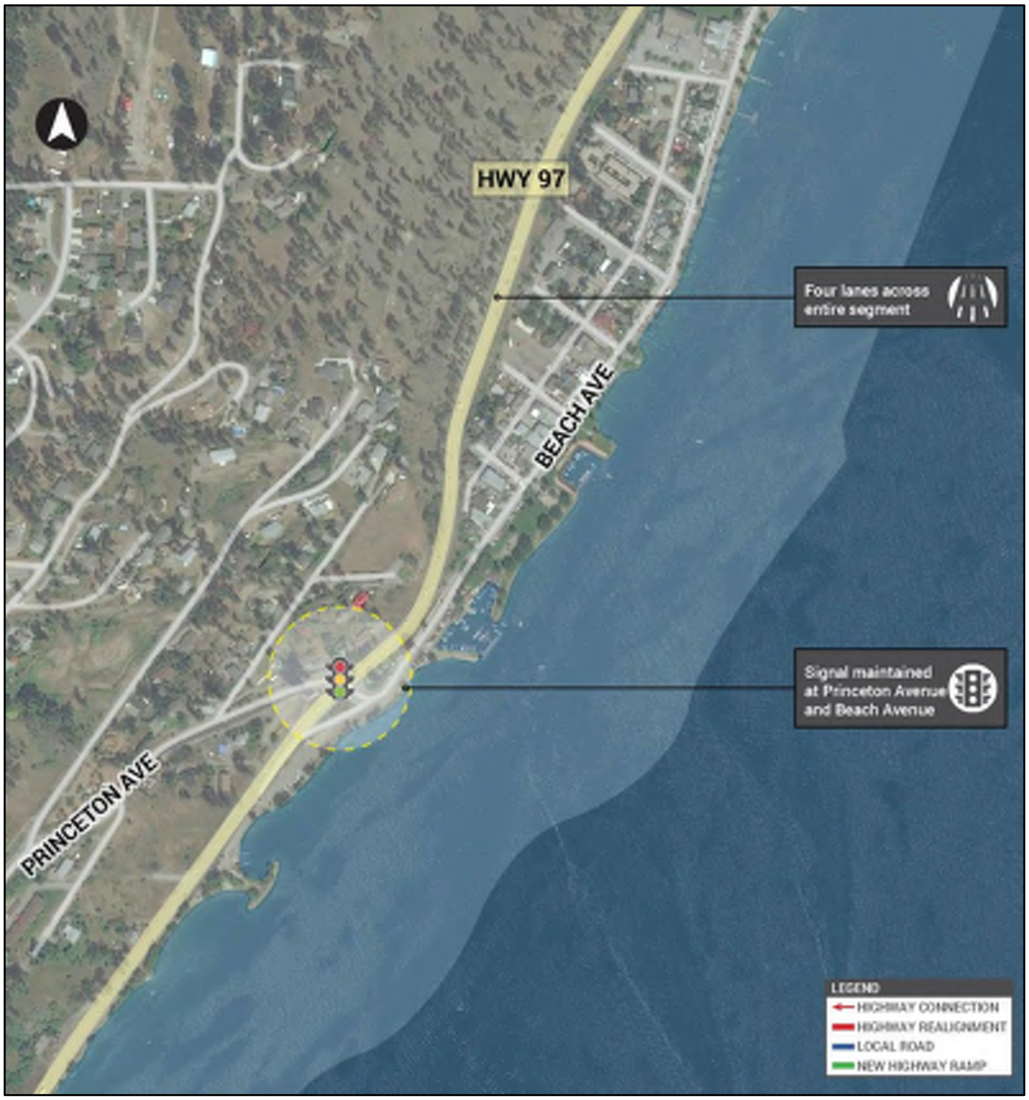


Figure 3.14: ER-4B Retain Signal at Princeton

Section 5: South of Princeton Avenue Options

In developing these options, key considerations acknowledge future delays accessing the highway.

Option ER-5A Realignment at Antlers Beach

In this option, Princess Street would be extended to Lipsett Avenue at the north end of the highway segment. At the south end of the highway segment, Renfrew Road would be upgraded and realigned to connect with Thorne Road. The extensions of both Princess Street and Renfrew Road would form a continuous local route running parallel to the existing Highway 97. At the south end of the highway segment, Highway 97 would be realigned at Antlers Beach. Access to or from the highway would be restricted to right-in and right-out movements at both Renfrew Road and Hardy Street. Highway 97 would be widened to a four lane cross section. Option ER-5A is illustrated in ***Figure 3.15*** below.

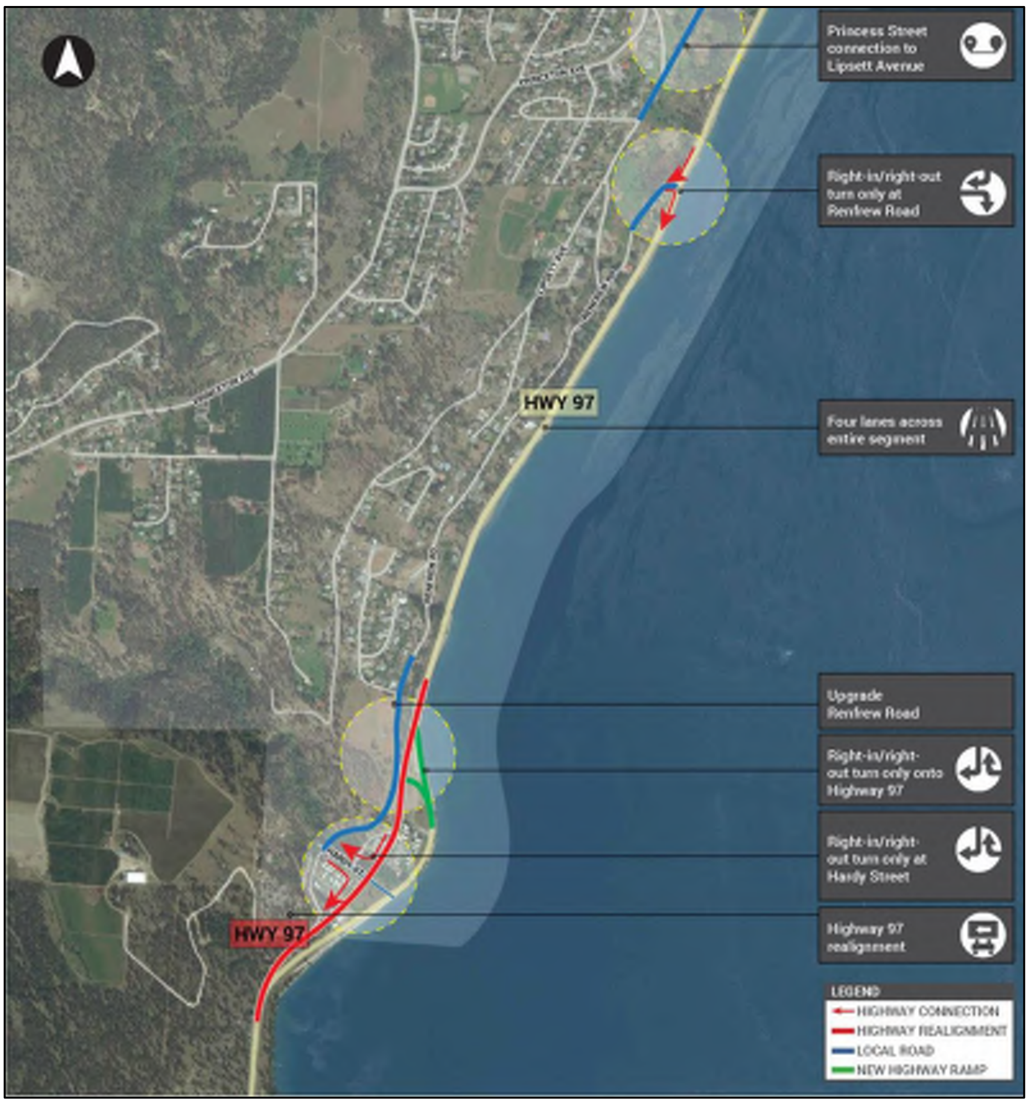


Figure 3.15: ER-5A Realignment at Antlers Beach

Option ER-5B Short Bypass

The short four lane bypass option connects to the existing highway inland near Hawkes Street. The new alignment would make a short climb, passing either over or under Lipsett Avenue and extend parallel to Bulyea Avenue. The short realignment would then return to meet the existing highway near Thorne Road. Highway 97 would be widened to a four lane cross section along the existing alignment segments. Option ER-5B is illustrated in ***Figure 3.16*** below.

Figure 3.16: ER-5B Short Bypass

3.2.2 Alternate Route Options

Five options were developed for the potential alternate route:

- Option AR-1: Far Most Westerly Route (Yellow Option)
- Option AR-2: Westerly and High Elevation Route (Blue Option)
- Option AR-3: Central and High Elevation Route (Pink Option)
- Option AR-4: Immediately West of Existing Development (Red Option)
- Option AR-5: Alignment Through Existing Development (Orange Option)

Figure 3.17 shows the five alternate route alignments.

Figure 3.17: Alternate Route Options

Descriptions of the five alternate route options are described below in terms of the approximate alignment, connections to the existing highway system, the overall length of the alternate route, and other key characteristics. As mentioned previously, all alternate route options would consist of a four lane divided cross section with a design speed of 100 km/hr.

Option AR-1: Far Most Westerly Route (Yellow Option)

Option AR-1 connects to Highway 97C approximately 2.5 kilometres northwest of the Trepanier Road underpass and continues south for approximately 6.5 kilometres along the valley west of Mount Coldham and turns east running along the hill side south of the Brenda Mines Road after crossing the Deep Creek valley. The vertical alignment reaches a maximum elevation of approximately 850 metres with grades exceeding 6% (6.2%). The approximate length of this route is 13.5 kilometres. This option represents the westernmost route, bypassing the most development of all other options. Apart from the section on the near south end, almost the entire alternate corridor alignment is located in undeveloped areas. This alternate route option will have one road crossing for Brenda Mines Road. Option AR-1 is shown graphically in ***Figure 3.18***.

Figure 3.18: AR-1 Far Most Westerly Bypass Route

*(This alternate route option was presented as Option 1B for the November 2016 Public Open House Event)

Option AR-2: Westerly and High Elevation Route (Blue Option)

The north end of this option is connected to Highway 97C approximately 2.5 kilometres northwest of the Trepanier Road underpass. The alignment continues south along the valley, then turns east and south climbing up and wrapping around Mount Coldham via the “saddle” between Pincushion Mountain and Mount Coldham, before continuing south to connect to Highway 97. The vertical alignment reaches a maximum elevation of approximately 850 metres with grades not exceeding 6%. With an approximate length of 15.0 kilometres, this route is the longest route of all the alternatives and passes through the highest elevation. Except for a short section near the south end, most of this alternate route option runs through undeveloped land and forest area. This option has several major cut sections and long stretches of steep grade (6% for four kilometres and six kilometres) along with one road crossing at Princeton Avenue. Option AR-2 is graphically shown in ***Figure 3.19***.

Figure 3.19: AR-2 Westerly and High Elevation Route

*(This alternate route option was presented as Option 1A for the November 2016 Public Open House Event)

Option AR-3: Central and High Elevation Route (Pink Option)

The north end of this options starts from Highway 97C approximately 850 metres northwest of the Trepanier Road underpass. The alignment continues southeast first, then towards the south climbing up along the sides of Pincushion Mountain to approximate elevation 750 metres, after which the alignment starts downwards following the existing topography to cross the valley south of Princeton Avenue and then continues alongside of the adjacent slope to connect to Highway 97 south of Hardy Street. Grades do not exceed 6%. The approximate total length of this route is 13.0 kilometres, of which a large section is likely to be constructed using a split-grade design for the north and southbound roadways to better match the alignment location which follows the steep slide slopes of Pincushion Mountain.

Large sections of this alternate route option are likely to have deep cuts in the range of >50 metres at centreline. The majority of this alternate route option traverses through undeveloped and forest land except for a short section near the south end. There would be one road crossing at Princeton Avenue, with potential impacts to some developments south of Princeton Avenue. Option AR-3 is graphically shown in ***Figure 3.20***.

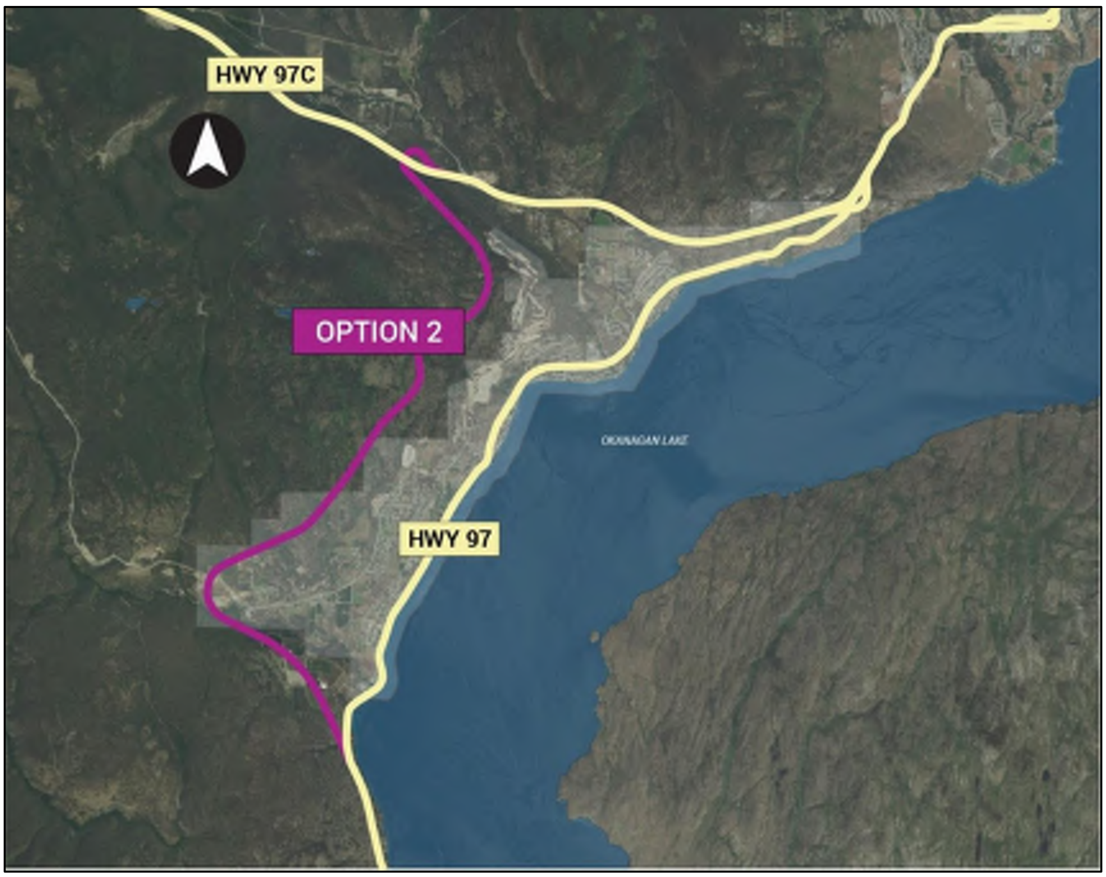


Figure 3.20: AR-3: Central and High Elevation Route
*(This alternate route option was presented as Option 2 for the November 2016 Public Open House Event)

Option AR-4: Immediately West of Existing Development (Red Option)

This option connects at the north-end with Highway 97C at the existing Trepanier underpass. The alignment continues southeast first and then towards the south climbing up alongside Pincushion Mountaintop to an elevation of approximately 675 metres with grades not exceeding 6%. The southern end, along a section approximately 3.5 kilometres in length, follows the Option AR-3 alignment once it crosses through the "saddle" between the peaks north of Law Street. The approximate length of this alternate route option is 12.6 kilometres, of which a significant portion is likely to be constructed using a split-grade design for the north and southbound roadways to better match the alignment location with follows several steep slide slopes.

Due to a maximum elevation in the vertical alignment of approximately 675 metres, this option allows for gentler grades in terms of steepness and length (grades of 6% for only four kilometres). Similar to Options AR-1 and AR-3, the majority of the alignment runs through undeveloped forest land. The last 3.5 kilometre section of this alternate route option follows the same alignment as Option AR-3, therefore, impact to property and road crossings are similar in these two options. Option AR-4 is shown in ***Figure 3.21***.

Figure 3.21: AR-4 Route Immediately West of Existing Development
*(This alternate route option was presented as Option 3A for the November 2016 Public Open House Event)

Option AR-5: Alignment Through Existing Development on South (Orange Option)

This option is another variation of Option AR-4, in which the route follows the same alignment of Option AR-4 for approximately 6.0 kilometres from the north end. This new option, Option AR-5, route then splits from Option AR-4 just north of Seymour Avenue and continues directly south cutting through some developments and crossing the creek near Hardy Street to connect back to Highway 97 at the same location as the other alternate corridor options. The vertical alignment in this option reaches a maximum elevation of approximately 600 metres with grades not exceeding 5.5% except for a short 6% section of less than one kilometre. The total length of this alternate route option is approximately 10.3 kilometres.

Due to a lower maximum elevation in the vertical alignment (compared to the other options), this option allows for gentler grades in terms of steepness and length. The majority of the 6.0 kilometre section from the north end runs along undeveloped land and forest while the rest of the route to the south will have a significant section running through private properties and developed lands. This route also crosses several existing roads including Princeton Avenue / Turner Avenue, Vernon Avenue and private access roads. Option AR-5 is graphically shown in ***Figure 3.22***.

Figure 3.22: AR-5 Route Lower Elevation Route

*(This alternate route option was presented as Option 3B for the November 2016 Public Open House Event)

4. Public Consultation and Engagement

Improvement options were developed and reviewed with the participation of Peachland residents, stakeholders, and Indigenous groups. Participation by key stakeholders and Indigenous groups included:

- District of Peachland Council.
- Technical Advisory Group – that includes staff-level expertise from the District of Peachland, the Regional District of Central Okanagan, and participating Indigenous groups.
- Community Liaison Committee – members who reflect a cross-section of Peachland citizens and stakeholder groups including BC Transit.
- General Public.

The public engagement events and a brief summary of the outcomes are presented in this section.

4.1 Public Engagement Events

Two Public Open Houses events were held at the Peachland Community Centre to present and obtain input at various development stages of the highway corridor improvement planning. The objectives of the two events are described below.

- Public Open House #1: Held on June 21, 2016 to provide citizens with a summary of the analysis conducted to date. The event presented information on the project team's understanding of the corridor. The project team also sought to identify feedback from participants regarding considerations that may have been overlooked in the technical data collection process. A total of 350 participants attended the open house. A project website was launched to coincide with the public open house.
- Public Open House #2: Held on November 21, 2016 was a key engagement and consultation milestone. The open house was designed to present several possible options for a bypass or existing corridor improvement, and gather public input on the issues, concerns, and opportunities associated with each option. The input received will be considered in the evaluation and refinement of the routes down to one or two preferred options for the existing corridor, and one or two preferred options for the bypass corridor. A total of 640 people attended the open house.

4.2 Stated Public Preferences

For the existing corridor, respondents had the opportunity to express their opinions on the different options presented for each section of the existing route by responding to a comment sheet. Each section of the corridor had as few as two proposed options and up to as many as five different options.

- Drought Hill (Seclusion Bay Road) Section – For the Drought Hill section of the existing route, respondents who noted a favoured option were more in favour of Options ER-1A and ER-1B when compared with Option ER-1C (which involves extending Drought Hill to Seclusion Bay and providing Right in / Right out access only.

- Trepanier Bench Road to Huston Road Section – Option ER-2A (which involves a Lang Road Overpass) was the most popular and Option ER-2E (which involves a traffic signal at the Huston Road / Buchanan Road intersection) was the second most popular with respondents who noted a favoured option for this section of the existing route.
- Ponderosa Drive to Todd Road Section – Of those respondents who noted a preference, Option ER-3B (which involves retaining traffic signals at Clement Crescent and at Ponderosa Drive) was slightly more popular than Option ER-3A (which involves connecting Todd Road with Chidley Road under Highway 97 and grade separating the 13 Street crossing) for this section of Highway 97.
- Princeton Avenue / Beach Avenue Section – Of those respondents who noted a preference, 75% were in favour of Option ER-4B (which involves retaining the traffic signal at Princeton Avenue) for the Princeton Avenue-Beach Avenue section of the highway.
- South of Princeton Avenue Section – Of the respondents who noted a favoured option most were in favour of Option ER-5A (which involves realignment of the highway at Antlers Beach) in the section south of Princeton Avenue of Highway 97.

When assessing the alternate route options, respondents seemed most concerned with how each option would affect residential areas. For this reason, Option AR-2 (Westerly and High Elevation Route) was considered the best option by the largest number of respondents. Respondents found Option AR-1 (Far Most Westerly Route) to be unacceptable due to the potential effects on residential areas, as well as the height and the length of the alignment. Some respondents saw Option AR-2 as an unacceptable option, while many more saw it as either acceptable or as the best option. Finally, respondents largely felt that Options AR-4 (Immediately West of Existing Development) and AR-5 (Alignment Through Existing Development) were situated too closely to residential areas to be considered acceptable.

5. Option Screening

Prior to submitting the existing route and alternate route options for more detailed evaluation, a screening process was conducted to reduce the set of options to a more manageable number which will focus the analysis requirements during the subsequent option evaluation process. By screening the options as this stage, only the most promising options are taken forward for detailed evaluation. This section describes the option screening process in terms of the screening criteria, screening assessment, and summary of retained or short-listed options.

5.1 Option Screening Criteria

The intent of the option screening process is to identify short comings that may exist in one or more options previously generated and presented at the last public consultation event in the fall of 2016. In identifying short comings in one or more options, some options can be eliminated from further consideration. Only the most feasible or practical short-listed options would be taken forward for a more detailed assessment using the multiple account evaluation (MAE) framework. The screening process would be applied separately to both the existing route options and alternate route options with the goal of short listing no more than three options for each existing route section and no more than three alternate route options.

The option screening is also the start of the option evaluation process, so some of the information generated in the screening assessment will be carried forward, where appropriate, in the more detailed option evaluation process. Noting the characteristics of the options being considered and the environment in which the options pass through, the following screening criteria are proposed:

- Environmental;
- Social / Community;
- Traffic and Travel Demand;
- Engineering; and
- Costs.

5.1.1 Environmental

The environmental screening assessment of each option includes consideration of an option's impacts to environmental features that support biodiversity and sustainable ecosystems including: wetlands, agricultural lands, forested areas, parks, conservation zones, and sensitive areas. The environmental screening will be based upon a high-level desk top investigation using available documentation including the *Penticton Indian Band Ecological and Cultural Heritage Assessment*. No field visits were conducted.

Considerations include potential impacts or improvements to:

- Sensitive lands;
- Aquatic resources;
- Wildlife corridors; and
- Species at risk.

5.1.2 Social and Community

The social and community screening assessment includes consideration of an option's impact on the community from a built form, planning, and land use. This assessment will be based on high level desk top investigations using local land use maps, previous studies, and feedback from stakeholders and residents.

Considerations include:

- Properties acquisition requirements
- Urban or agricultural lands – order of magnitude of area impacted;
- Impacts to access for residential, commercial, or industrial properties;
- Community severance (i.e. highway seen or acts as a barrier);
- Accessibility and connectivity for all modes across or along the highway at key activity centres / roads;
- Visual and noise impacts; and
- Consistency with community plans.

5.1.3 Traffic and Travel Demand / Traffic Functionally

Forecasted traffic demand (2040), volume-to-capacity (v/c) ratios, and travel times help assess if an option will be effective from a traffic engineering perspective, and, if an option will be sufficiently used or not. Reported results will be based on comparative outputs from the regional travel demand forecasting model and illustrated as appropriate for a screening level assessment only.

Considerations include:

- Traffic volumes / Usage – as measured at the segment with the highest peak period traffic volume;
- Volume / Capacity ratio – as an indication of level of service or congestion levels; and
- Travel Time – as measured across Peachland (between common points north and south of the community).

As the existing route has been segmented into sections, the above considerations may not be applicable due to impacts of upstream / downstream section uncertainty. Therefore, the ability of the section option to accommodate turning movements onto / off the highway and the convenience of access to lands, or overall traffic functionality will also be considerations for the existing route.

5.1.4 Engineering

The engineering criteria will assess each option for constructability, complexity and quality of the option conceptual design. Projects with less complex infrastructure and construction requirements will have lower risk and generally lower costs along with reduced construction impacts on road users and adjacent properties. Conversely, complex projects often have higher risks and generally higher costs along with potentially higher impacts to road users and adjacent properties. Quality of the achieved conceptual design will affect the user experience and required operating / maintenance efforts.

Engineering considerations relate to construction magnitude, complexity and risks, and include:

- Option overall length.
- Number / size of bridge structures, retaining walls, and rock cuts.
- Alignment coordination:
    - Abrupt changes in alignment;
    - Long tangents with short curves;
    - Consistent with existing topography; and
    - Roller coaster vertical profile.

5.1.5 Costs

The costs criteria will assess the order of magnitude costs for the implementation and operations / maintenance effort. Considerations include:

- Design, construction, and contingencies; and
- Maintenance and operations – added effort / costs for annual maintenance and operations.

5.2 Option Screening Assessment

The screening of options for the existing route and alternate route have been conducted separately by applying the criteria described above.

5.2.1 Existing Route

The assessment of each option along the existing route / section is summarized below with respect to each option screening criteria.

A. Environmental

Section 1: Drought Hill Options

ER-1A Drought Hill Expressway
ER-1B Drought Hill Expressway with Drought Road Overpass
ER-1C Seclusion Bay Road and Drought Road Overpasses

This group of options crosses through numerous vegetation polygons containing red-listed ecosystems (endangered or threatened) and blue-listed ecosystems (special concern). It also affects four areas containing sensitive ecosystems (woodlands, riparian, and sparsely vegetated). Based on review of ortho-imagery, the following additional sensitive habitat features (not field verified): large areas of rock outcrop that would potentially be lost / altered by the alignment – between Drought Road and Seclusion Bay Road.

All of these options have portions of the alignment within areas designated as “Very High” or “High” conservation ranking – primarily along the Drought Creek corridor. Relative biodiversity in the areas along these options is “Low” or “Very Low”. Among the online options, this set of options is predicted to have relatively high effects on areas of environmental concern, particularly around Seclusion Bay and Drought Creek corridor.

Section 2: Huston/Buchanan Road to Trepanier Bench Road Options

ER-2A Overpass at Lang Road
ER-2B Extension of Shaw Road and Huston Road
ER-2C Trepanier Road Over Highway 97
ER-2D Signal at Trepanier Bench Road
ER-2E Signal at Huston/Buchanan Road

This group of options crosses through two vegetation polygons containing red-listed ecosystems (endangered or threatened) and one containing blue-listed ecosystems (special concern). These options also affect a number of areas containing sensitive ecosystems (woodlands and sparsely vegetated). All of these options have a portion of the alignment within one area designated as “High” conservation ranking (relatively low proportion compared to other options).

Relative biodiversity in the areas along these options is “Low” or “Very Low”. Among the online options, this set of options is predicted to have relatively low effects on areas of environmental concern.

Section 3: Todd Road to Ponderosa Drive Options

ER-3A Todd and 13 Crossings
ER-3B Retain Signals at Clement Crescent and Ponderosa Drive

These options cross through one vegetation polygon containing red-listed ecosystems (endangered or threatened) and a few polygons with blue-listed ecosystems (special concern). These options also affect a number of areas containing sensitive ecosystems (woodlands, riparian, and sparsely vegetated). Both of these options have portions of the alignment within areas designated as “Very High” or “High” conservation ranking – primarily along the Trepanier Creek corridor.

Relative biodiversity in the areas along these options is primarily “Very Low”, with some areas of “Low” or “Moderate”, and one or two areas of “High” relative biodiversity. Among the online options, this set of options is predicted to have relatively high effects on areas of environmental concern, particularly around Trepanier Creek corridor.

Section 4: Princeton Avenue / Beach Avenue Options

ER-4A Interchange at Princeton
ER-4B Retain Signal at Princeton

Neither option affects red-listed (endangered or threatened), blue-listed (special concern) or sensitive ecosystems. ER-4A has a portion of the alignment within one area designated as “High” conservation ranking (relatively low proportion compared to other options).

Relative biodiversity in the areas along ER-4A is “Moderate” or “Very Low”. Among the online options, this set of options is predicted to have negligible effects on areas of environmental concern.

Section 5: South of Princeton Options

ER-5A Realignment at Antlers Beach
ER-5B Short Bypass

These options cross through seven vegetation polygons containing red-listed ecosystems (endangered or threatened) and 13 or 16 polygons with blue-listed ecosystems (special concern) – more than any other group of options. It also affects over 20 areas containing sensitive ecosystems (woodlands, riparian, grassland, and sparsely vegetated). This total is also higher than for any other group of options. Both of these options have portions of the alignment within areas designated as “Very High” or “High” conservation ranking – primarily along the Peachland Creek and Unnamed 9 stream corridors.

Relative biodiversity in the areas along these options is primarily “Very Low”, “Low”, or “Moderate”, and one or two areas of “High” relative biodiversity. Among the online options, this set of options is predicted to have the highest effects on areas of environmental concern, particularly around Peachland Creek corridor and all portions of bypass routes that are in currently undeveloped areas.

B. Social / Community

Section 1: Drought Hill Options

Option ER-1A Drought Hill Expressway

With the conversion of the Drought Road and Seclusion Bay intersections to right-in / right-out only permitted movements limits the ability to turn left to/from the highway and thus requires significant backtracking to access future developments such as New Monaco. This option does not exacerbate community severance effects since there is little to no existing development on the west side of the highway.

Option ER-1B Drought Hill Expressway with Drought Road Overpass

This option is identical to Option ER-1A with added southbound ramps to facilitate southbound connections to or from Drought Road. With access provided to both directions of Highway 97, this option does not exacerbate community severance effects.

Option ER-1C Seclusion Bay Road and Drought Road Overpasses

There is no substantial difference between Option ER-1B and Option ER-1C with the exception that the Drought Road extension is shifted from the lakeside of the highway to the west side of the highway. The passing of the local road under the highway adds turns and makes for a less straightforward route. However, shifting this local road to the west side of the highway allows for future development to more easily tie in to the network.

Section 2: Huston Road /Buchanan Road to Trepanier Bench Road Options

Unlike the Drought Hill section, adjacent land along this segment is more urban and predominantly residential. Most of the community impacts will be seen where local roads are extended, realigned, or connected.

Option ER-2A Overpass at Lang Road

This option provides increased local connectivity through the grade separation of Lang Road. A grade separated crossing of the highway benefits all modes, including cyclists and pedestrians and reduces community severance effects of the highway. Some property acquisition (estimated at 2-3 properties at this screening stage) may be required along the east side of the highway.

The overpass at Lang Road changes the role of Lang Road on the west and Greata Road on the east side of the highway. Due to the natural grade from the cut of the highway, the overpass structure will have no major visual impacts to adjacent residents. The new connection from Lang Road to Greata Road is at higher than recommended grades, at around 10% (the ideal grade is around 6%, but 10% to 12% is typically acceptable for local roads). The steepness could prove difficult for anyone with mobility impairments.

The realignment and extension of Huston Road at the Huston Road / Buchanan Road intersection would also have impacts to properties. Due to the restriction of left turns with this option, more circuitous routing is required and this longer routing may not be intuitive for travellers.

Option ER-2B Extension of Shaw Road and Huston Road

In this option, Shaw Road would pass under the highway. This would require a realignment of Shaw Road which would have residential property impacts, especially on the west side of the highway. In addition to the Shaw Road underpass, Huston Road would also be realigned and may require property acquisition. This configuration may be more of an intuitive connection for travellers; however, access from the highway to Trepanier Bench Road would be more circuitous and will tend to add traffic to Huston Road.

This option has minimal impacts to lands on the east side of the highway. The connection of Shaw Road across the highway reduces the community severance effects of the highway and provides a safe, grade separated crossing for all modes.

Option ER-2C Trepanier Road Over Highway 97

Like the other options, this option may require property acquisition at Huston Road. The structure itself may impact adjacent properties with the need to acquire additions right-of-way. Access from the highway to Trepanier Bench Road would be more circuitous. This option will increase traffic on Buchanan Road. Access from the highway to Buchanan Road is more circuitous as well.

The overpass at Trepanier Bench Road is large and imposing and follows steep grades. This would have some visual impacts on the adjacent community. Cyclists and pedestrians would be required to cross and climb uphill to reach the west side.

Option ER-2D Traffic Signal at Trepanier Bench Road

Signalization of Trepanier Bench Road will make left turns onto the highway much more comfortable at this location. Some traffic turning left onto Highway 97 would be attracted from Huston Road to Trepanier Bench Road. However, because of the amount of backtracking required, it is likely that many drivers would continue to turn left from Huston Road. The purpose of signalizing an intersection is to improve safety and operation on the corridor. If the left turn movement at Huston Road /Buchanan Road remains, there will be little benefit at that intersection. Therefore, it is recommended that if Trepanier Bench Road is signalized, the Huston Road / Buchanan Road intersection be converted to permit right-in / right-out movements plus the southbound left-in movement. The existing left turn movement at Buchanan Road (South) should also be removed. Closure of the left turn movement at both Buchanan Road intersections would require traffic to use Beach Avenue to travel south / west.

This option does little for cyclists and pedestrians as a connection across the highway is no facilitated by signalization, and additional pathway connections would be required to facilitate pedestrian and cycling movements to destinations on the lake side of the highway.

Based on the *Peachland Speed and Safety Study* (Parsons, 2017), this option is supported, by resolution, by Peachland Council.

Option ER-2E Traffic Signal at Huston Road / Buchanan Road

A traffic signal at this intersection would allow full movements to / from the highway. If this intersection is signalized, Buchanan Road (West) could be converted to permit only right-in / right-out movements. Similarly, the left turn movement from Trepanier Bench Road onto Highway 97 could be closed, with this turning movement being accommodated via the local network and the traffic signal at Huston Road / Buchanan Road. If this intersection were signalized, it is recommended that the 70 km/h zone start north of the Huston Road / Buchanan Road intersection.

In addition, an overhead "signal-ahead" warning should be considered for the southbound direction. While signalization of this intersection provides some benefits for travel patterns when compared with signalizing Trepanier Bench Road, the radii on the approaches to Highway 97 are very small and will not accommodate trucks. While the demand for truck movements would be very low, there is an occasional need to provide access for trucks such as moving or delivery vehicles.

Signalization of the Huston Road / Buchanan Road intersection would allow another opportunity for cyclists and pedestrians to more safely cross the highway.

Section 3: Todd Road to Ponderosa Drive Options

Option ER-3A Todd Road and 13 Street Crossings

This option improves the community severance effects of the highway by providing grade separated crossings at both Todd Road / Chidley Road and Ponderosa Drive / 13 Street. The overpasses at Todd Road and 13 Street would have some visual effects. Property access on the west side may be affected due to the structures.

This option provides good connectivity for all modes between the Peachland Centre and downtown; however, there would be circuitous left turn movements from Peachland Centre. This option would impact San Clemente Avenue and possibly access to properties depending upon the magnitude of impacts related to widening the highway.

Option ER-3B Retain Traffic Signals at Clement Crescent and Ponderosa Drive

This option maintains connectivity at-grade and since it is most similar to the existing corridor, the option would be familiar with locals. This option would require re-routing for Chidley Road traffic. Retaining the traffic signals would mean delays on the highway and delays on local roads at the intersections. Widening the highway to include additional turn lanes may impact the park area. The connection between Chidley Road and Clements Crescent may also have some minor agricultural land and residential property impacts.

This option has a lesser impact on San Clemente Avenue. Cycling and pedestrian connectivity remains at-grade across a wider highway but maintains all existing crossings. Noise and visual impacts will remain largely unchanged from today.

Section 4: Princeton Avenue / Beach Avenue Options

Option ER-4A Interchange at Princeton Avenue

An interchange at the Princeton Avenue / Beach Avenue junction would have visual impacts on the adjacent community. Some property acquisition may be required on the west side due to the ramp and highway widening. Ramps on the lake side of the highway may impact the boat launch area and parking lot. This parking lot may need to be relocated. This option also provides separation for pedestrians and cyclists to cross the highway.

During the August 2016 Community Workshop, concerns with this option included impacts to a dog beach, boat launch and access to parking. The community also identified this intersection as dangerous due to the steep grade, especially during winter conditions.

Option ER-4B Retain Traffic Signal at Princeton Avenue

Traffic signals would mean delays along the highway and delays along the intersecting streets. Pedestrians and cyclists are still required to cross the highway at grade.

Section 5: South of Princeton Avenue Options

Option ER-5A Realignment at Antlers Beach

This option impacts the mobile home park at Hardy Street. The benefits of the new local road network may result in new parcels becoming available for redevelopment around Hardy Street, but access will be challenging. This option increases traffic on Renfrew Road and this road will require upgrading to accommodate two-way traffic. Access from the highway to Renfrew Road would be circuitous. Highway widening at the north end of the section removes direct property access and shifts access to Princess Street. Some land acquisition may be required for the extension of Lipsett Avenue to Princess Street.

Option ER-5B Short Bypass

This option requires the most property acquisition including lands within the Agricultural Land Reserve. The extension of Lipsett Avenue to Princess Street would also impact properties and the overpass might have some visual impacts. Since the short bypass route cuts through existing developed areas, there would be some noise and visual impacts, and the new road may be close to existing homes. With a new highway alignment, it is anticipated that the existing highway would turn over for local use.

C. Traffic Functionality

Section 1: Drought Hill Options

Option ER-1A Drought Hill Expressway with Parallel Local Road

This option requires longer travel along the local road network to achieve left turn movements / access to and from the highway southbound. The added highway capacity improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour with some travel times savings, especially southbound during the PM Peak Hour.

Option ER-1B Drought Hill Expressway with Drought Road Overpass

This option requires longer travel along the local road network to achieve left turn movements / access to and from the highway. The added highway capacity improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour with some travel times savings, especially southbound during the PM Peak Hour.

Option ER-1C Seclusion Bay Road and Drought Road Overpasses

Compared to the other options, this option would required shorter distances to achieve a left turn movement / access to and from the highway along this section. The added highway capacity improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour with some travel times savings, especially southbound during the PM Peak Hour.

Section 2: Huston/Buchanan Road to Trepanier Bench Road Options

Option ER-2A Overpass at Lang Road

This option has circuitous routing for all turning movements onto and off Highway 97. Improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour. Minor travel timing savings in the southbound direction during the PM Peak Hour are anticipated along the highway.

Option ER-2B Extension of Shaw Road and Huston Road

This option has circuitous routing for all turning movements onto and off Highway 97. Improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour. Minor travel timing savings in the southbound direction during the PM Peak Hour are anticipated along the highway.

Option ER-2C Trepanier Road Over Highway 97

This option has very circuitous routing for all turning movements onto and off Highway 97, as the highway crossover is located far to the south. Improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour. Minor travel timing savings in the southbound direction during the PM Peak Hour are anticipated along the highway.

Option ER-2D Traffic Signal at Trepanier Bench Road

This option improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour. Minor travel timing savings in the southbound direction during the PM Peak Hour are anticipated along the highway. However, changing the intersection of Huston Road / Buchanan Road with Highway 97 to a right-in / right-out only intersection will result in very circuitous routing for access to and from the highway.

Option ER-2E Traffic Signal at Huston Road / Buchanan Road

This option improves performance in the AM Peak Hour but only minor improvements during the PM Peak Hour. Minor travel timing savings in the southbound direction during the PM Peak Hour are anticipated along the highway. This option includes closing the Buchanan Road intersection and converting the Trepanier Road intersection to only permit right-in / right-out movements, which in turn will redirect most access to and from Highway 97 to the new signalized intersection at the Huston Road.

Section 3: Todd Road to Ponderosa Drive Options

Option ER-3A Todd Road and 13 Street Crossings

This option provides circuitous routing from the Shopping Centre at Clement Crescent to access Highway 97 northbound. Improved performance during the AM and PM Peak Hours and improved travel time savings in the PM Peak Hour are anticipated along the highway. This option provides two grade separated opportunities for active transportation crossings of the highway.

Option ER-3B Retain Traffic Signals at Clement Crescent and Ponderosa Drive

With the full closure of Chidley Road at Highway 97, this option provides circuitous routing for local traffic destined to Chidley Road. Previous access to and from the highway at Todd Road will also be rerouted through local roads far to the south and north. Improved performance during the AM and PM Peak Hours and improved travel time savings in the PM Peak Hour are anticipated along the highway.

Section 4: Princeton Avenue / Beach Avenue Options

Option ER-4A Interchange at Princeton Avenue

This option improves performance during the AM and PM Peak Hours and improves travel time savings in the PM Peak Hour along the highway. This option also provides for all turning movements at the junction without the need for left turn movements onto or off Highway 97. This option also provides another grade separated opportunity for active transportation crossing of the highway.

Option ER-4B Retain Traffic Signal at Princeton Avenue

This option maintains the existing signalized intersection with no significant improvements in safety at the intersection. The added lanes on Highway 97 will slightly impacts crossing times for pedestrians and cyclists.

Section 5: South of Princeton Avenue Options

Option ER-5A Realignment at Antlers Beach

This option improves the performance of the highway during the AM and PM Peak Hours and improves travel time savings in the PM Peak Hour. This option also provides for all turning movements onto and off the highway with offset right-in / right-out connections. However, the “left turn” movements onto the highway for northbound traffic will be very circuitous.

Option ER-5B Short Bypass

This option realigns Highway 97 up the hill to the west. The existing highway route would be devolved to the District of Peachland as a municipal arterial road. Lipsett Avenue would have a grade separated crossing of the highway. Direct road connection to Highway 97 for the municipal land south of Princeton Avenue has yet to be determined for this option. This option improves performance and travel time savings along the highway during the AM and PM Peak Hours.

D. Engineering

Section 1: Drought Hill Options

Options ER-1A, ER-1B and ER-1C

All three options have geotechnical, cut, slope and other constructability concerns.

Section 2: Huston Road / Buchanan Road to Trepanier Bench Road Options

Option ER-2A Overpass at Lang Road

The overpass at Lang Road could make use of the existing cut for the highway for the overpass which would reduce the cost of this option. Steep slopes make it challenging to create a right-in and right-out junction at Huston Road / Buchanan Road, like all options. This option requires minimal disruption to highway traffic during construction but will be more difficult to stage.

Option ER-2B Extension of Shaw Road and Huston Road

Similar challenges to Option ER-2A with respect to the Huston Road / Buchanan Road intersection. Additional challenges due to Huston Road travelling over Shaw Road while Shaw Road needs to meet grade. This could result in a loss of driveways.

This option also requires some highway disruption during construction to build the new highway structure. This option could be easily staged if Huston Road is signalized in the short or medium term.

Option ER-2C Trepanier Road Over Highway 97

The Trepanier Bench overpass structure is a larger structure and travels along a steep slope and would require large cuts to connect to the existing roadways. The reduced geometry of the roadway alignment makes it difficult to tie into Trepanier Bench Road and Coldham Crescent, which may prove to be impractical. Same Huston Road / Buchanan Road right-in right-out issues as the previous two options. This option requires Trepanier Bench Road to pass under the structure. This option requires some highway disruption, but less than Option ER-2B and more than Option ER-2A.

Option ER-2D Traffic Signal at Trepanier Bench Road

This option has no major engineering issues.

Option ER-2E Traffic Signal at Huston Road / Buchanan Road

This option has no major engineering issues.

Section 3: Todd Road to Ponderosa Drive Options

Option ER-3A Todd Road and 13 Street Crossings

This option requires two new structures. The connection between Clement Crescent and Ponderosa Drive is challenging due to the steep slope. This option requires disruption to highway traffic, but also local traffic along Ponderosa Drive.

Option ER-3B Retain Traffic Signals at Clement Crescent and Ponderosa Drive

This option has no major engineering issues.

Section 4: Princeton Avenue / Beach Avenue Options

Option ER-4A Interchange at Princeton Avenue

This option would require disruption to highway traffic and to some local roads, requiring a detour during construction. The intersection of the northbound ramp on Princeton Avenue is along a steep section and may require reprofiling of Princeton Avenue.

Option ER-4B Retain Traffic Signal at Princeton Avenue

This option has no major engineering issues.

Section 5: South of Princeton Avenue Options

Option ER-5A Realignment at Antlers Beach

The widening of Renfrew Road and extension to Lipsett Avenue would be challenging due to terrain. This option would require little disruption during construction.

Option ER-5B Short Bypass

The creek crossing at the south end would likely require a structure. Noise walls are likely necessary. Also, to connect back to the existing highway, it may be difficult to provide all movements, at all intersections. The details of connections from the highway to the residential areas will be further developed through discussions with the District of Peachland should this option be advanced for further consideration.

E. Cost

A high-level cost estimate was generated based on conceptual single-line drawings. For the screening exercise, a cost index was applied, as shown in ***Table 5.1***, to provide a comparative analysis of costs for each segment. A more accurate cost-estimate based on further geotechnical and design work was subsequently developed for the evaluation stage.

Table 5.1: Cost Index for Existing Alignment Options

SEGMENT	OPTION	COST INDEX
DROUGHT HILL	ER-1A	1.0
	ER-1B	1.4
	ER-1C	1.6
HUSTON / BUCHANAN ROAD TO TREPANIER BENCH ROAD	ER-2A	1.6
	ER-2B	1.6
	ER-2C	1.9
	ER-2D	1.0
	ER-2E	1.3
TODD ROAD TO PONDEROSA DRIVE	ER-3A	1.3
	ER-3B	1.0
PRINCETON AVENUE TO BEACH AVENUE	ER-4A	2.3
	ER-4B	1.0
SOUTH OF PRINCETON AVENUE	ER-5A	1.0
	ER-5B	1.2

Key observations from the table above include:

- Higher costs are mostly associated with retaining walls and structures.
- For the Drought Hill Options, ER-1A is less than ER-1B and ER-1C, however, there is little difference between ER-1B and ER-1C.
- For the Huston Road / Buchanan Road to Trepanier Bench Road options, the signalization options are lower cost than the grade separated options.
- In the Todd Road to Ponderosa Drive options, the grade separated option is higher cost than the option to retain the existing traffic signals / at grade intersection.
- The Princeton Avenue to Beach Avenue options have the most significant difference, again, largely due to the structural requirements of ER-4A. South of Princeton, the options have only minor costs differences.

F. Existing Alignment Option Screening Summary

Table 5.2 summarizes the assessment of each option with respect to the social/community, environmental, engineering, traffic and travel demand, and cost screening criteria. The table also provides a screening recommendation based on the screening criteria and related assessment summarized in the previous sections.

Table 5.2: Existing Alignment Option Technical Screening Summary

SEC.	OPTION	ENVIRONMENTAL	SOCIAL/COMMUNITY	TRAFFIC AND TRAVEL DEMAND	ENGINEERING	COSTS	SCREENING RECOMMENDATION
Drought Hill	ER-1A Drought Hill Expressway	• High effects anticipated around Drought Creek corridor.	• This option does not exacerbate community. severance effects given the limited development on either side of the highway.	• Requires longer travel on local road network to achieve left turns.	• Significant geotechnical concerns regarding cuts and fill slopes.	• Lowest cost amongst options in this segment.	✓ Retain as no "show stoppers".
	ER-1B Drought Hill Expressway with Drought Road Overpass	• High effects anticipated around Drought Creek corridor.	• This option does not exacerbate community severance effects given the limited development on either side of the highway. • Compatible if the New Monaco development proceeds.	• Requires longer travel on local road network to achieve left turns. • Will improve performance along the highway and will attain some travel time savings – especially during the PM peak.	• Significant geotechnical concerns regarding cuts and fill slopes.	• Higher cost amongst options in the segment.	✓ Retain as no "show stoppers".
	ER-1C Seclusion Bay Road and Drought Road Overpasses	• High effects anticipated around Drought Creek corridor.	• This option does not exacerbate community severance effects given the limited development on either side of the highway. • Compatible if the New Monaco development proceeds.	• Shorter travel required on local road network to achieve left turns. • Will improve performance along the highway and will attain some travel time savings – especially during the PM peak.	• Significant geotechnical concerns regarding cuts and fill slopes.	• Higher cost amongst options in the segment.	✓ Retain as no "show stoppers".
Trepanier Bench Road to Huston/Buchanan Road	ER-2A Overpass at Lang Road	• Low effects anticipated.	• Will increase traffic on Huston Road. • May impact properties around Huston Road intersection. • Grade separated connection is central to community but has very steep grade between Lang Road and Greata Road.	• Circuitous routing for all movements to / from Highway 97. • Will improve performance along the highway and will attain some travel time savings during the PM peak.	• Option takes advantage of exiting cut slopes along highway. • Challenging to create right-in / right-out movement at Huston Road / Buchanan Road. • Potential difficulty to stage construction.	• Higher costs due to structural elements.	✓ Retain as no "show stoppers".
	ER-2B Extension of Shaw Road and Huston Road	• Low effects anticipated.	• Will increase traffic on Huston Road. • Grade separated connection will benefit peds / cyclists but is circuitous.	• Longer travel required on local road network to achieve left turn from highway. • Will improve performance along the highway and will attain some travel time savings during the PM peak.	• Challenging to create right-in / right-out movement at Huston Road / Buchanan Road. • Complexities related to grade separation of Shaw Road. • Some disruption to highway traffic anticipated during construction.	• Higher costs due to structural elements.	✓ Retain as no "show stoppers".
	ER-2C Trepanier Road Over Highway 97	• Low effects anticipated.	• May impact properties around Huston Road intersection. • Overpass structure may impact some properties. • Will increase traffic on Buchanan Road. • Grade separated connection will benefit peds / cyclists but has very steep grade.	• Very circuitous routing for all movements to / from Highway 97. • Will improve performance along the highway and will attain some travel time savings during the PM peak.	• Much larger and curved structure. • Difficult to tie into Trepanier Bench Road and requires Trepanier Bench Road to pass under structure. • Potentially less disruption during construction than other options.	• Higher costs due to structural elements.	X Design and constructability concerns associated with proposed overpass.
	ER-2D Signal at Trepanier Bench Road	• Low effects anticipated.	• Does not offer much improvement in connectivity across highway for pedestrians and cyclists. • Supported by District of Peachland Council.	• Will improve access to / from highway but will result in some disruption to through traffic.	• No major engineering considerations.	• Lower costs as there are no significant structural elements.	✓ Retain as no "show stoppers".
	ER-2E Signal at Huston/Buchanan Road	• Low effects anticipated.	• Offers improvement in connectivity across highway for pedestrians and cyclists.	• Will improve access to / from highway but will result in some disruption to through traffic.	• No major engineering considerations.	• Lower costs as there are no significant structural elements.	X This option is not consistent with District of Peachland objectives.

SEC.	OPTION	ENVIRONMENTAL	SOCIAL/COMMUNITY	TRAFFIC AND TRAVEL DEMAND	ENGINEERING	COSTS	SCREENING RECOMMENDATION
Ponderosa Drive to Todd Road	ER-3A Todd and 13 Crossings	• Anticipated to have high impacts, particularly around the Trepanier Creek corridor.	• New overpass will have visual effects. • Limited property impacts anticipated. • Improved connectivity across highway. • Impacts to San Clements Avenue access to 13 Street. • Grade separated pedestrian / cycling route.	• Circuitous travel to achieve left turn from 13 Street and from Shopping Centre – including use of Beach Avenue. • Will improve performance along the highway with the removal of two traffic signals.	• Requires new structure across the highway. • New structure on highway will require temporary detour during construction. • Connection between Clement Crescent and Ponderosa Drive is very challenging.	• High cost due to new overpass structure and new highway structure.	✓ Retain as no “show stoppers”.
	ER-3B Retain Signals at Clement Crescent and Ponderosa Drive	• Anticipated to have high impacts, particularly around the Trepanier Creek corridor.	• Requires re-routing of Chidley Road traffic. • Potential impact to adjacent park. • No significant improvement for pedestrian / cyclist crossing of highway.	• Will result in further travel for residents along Chidley Road. • Reduces access to / from the highway. • No significant change in traffic performance along highway.	• No major engineering considerations.	• Lower cost.	✓ Retain as no “show stoppers”.
Princeton Avenue/Beach Avenue	ER-4A Interchange at Princeton	• Anticipated to have negligible effects to the environment.	• New overpass will have visual effects. • Some property impacts anticipated. • Ramps may impact dog beach, parking lots, and boat launch. • Grade separated pedestrian / cycling route with highway elevated.	• Will improve performance along the highway with the removal of the traffic signal.	• New structure on highway will require temporary detour of traffic during construction. • Ramp connection to Princeton Avenue may be challenging due to steep grades.	• High cost due to new highway structure.	✓ Retain as no “show stoppers”.
	ER-4B Retain Signal at Princeton	• Anticipated to have negligible effects to the environment.	• No significant improvement for pedestrian / cyclist crossing of highway – still at-grade crossing.	• No significant change in traffic performance along highway.	• No major engineering considerations.	• Low cost option.	✓ Retain as no “show stoppers”.
South of Princeton Avenue	ER-5A Realignment at Antlers Beach	• Anticipated to have high impacts, particularly around the Peachland Creek corridor.	• Impacts to mobile home park on each side of Hardy Street. • Retains direct land access along highway within existing alignment. • Poor access to retained land parcels south of new highway alignment. • Poor access to Hardy Street and circuitous routing required to achieve left turns.	• Will improve performance along the highway with improved geometry.	• New bridge required across Deep Creek.	• High cost due to extent of new road construction and new structures.	✓ Retain as no “show stoppers”.
	ER-5B Short Bypass	• Anticipated to have high impacts, particularly around the Peachland Creek corridor.	• More extensive property impacts. • Some impacts to ALR lands. • Highway passes through existing development causing visual and noise impacts.	• Will improve performance along the highway with improved geometry. • Removes direct land access to majority of highway segment and therefore improves safety.	• Requires new structure at Lipsett Avenue. • New bridge required across Deep Creek may be significant in length.	• Higher cost due to extent of new road construction and new structures.	✓ Retain as no “show stoppers”.

5.2.2 Alternate Routes

The assessment of each alternate route option is summarized below with respect to each screening criteria outlined in Section 5.1.

A. Environmental

AR-1: Far Most Westerly Bypass Route (Yellow)

This option has the highest potential impact to endangered / threatened ecosystems among all the options. As with Options AR-3, AR-4 and AR-5, the impact on special concern ecosystems is also high. The area containing sensitive ecosystems, which includes riparian areas, wetlands, grassland, or sparsely vegetated areas, is moderate.

All alternate options are within the ungulate winter range for mule deer, and there is the potential for collision risk and loss of overwinter habitat. Like Option AR-2, this option would potentially impact moose winter range. This option also ranked as high or very high for conservation ranking at almost 60% of the total area. This option would also likely require alteration of the highly biodiverse Peachland Creek tributary corridor along much of the route.

Per the August 2016 Community Workshop, this option may impact the Spring Canyon Ecosystem and wildlife migration corridors. At the south end of the option, the workshop identified high value fish habitat. Per the *Penticton Indian Band (PIB) Ecological and Cultural Heritage Assessment* (2017), this option shares the ungulate impacts as in Option AR-2.

AR-2: Westerly and High Elevation Bypass Route (Blue)

The impact to endangered / threatened ecosystems and special concern ecosystems is low for this option. The potential impact to special concern ecosystems is relatively low compared to the other options. The impact on sensitive ecosystems, which includes riparian areas, wetlands, grassland, or sparsely vegetated areas, is moderate. There are also potential impacts to additional sensitive habitat features including Pigeon Creek wetlands / headwater lake and two rock outcrops.

All alternate options are within the ungulate winter range for mule deer, and there is the potential for collision risk and loss of overwinter habitat. In addition to potential impacts to mule deer winter range, this option might impact moose winter range as well. This option also ranked as high or very high for conservation ranking at almost 60% of the total area. The relative biodiversity is primarily low or moderate.

According to *Penticton Indian Band (PIB) Ecological and Cultural Heritage Assessment* Option AR-1 has the lowest ecological, cultural and archaeological impacts of all options; however, Options AR-1 and AR-2 may impact moose winter range, but do not cross the steep south slopes which are part of the mule deer winter range. For species at risk, Options AR-1 and AR-2 have the least impacts on snakes, bats and woodpeckers but may impact Western Screech-owl habitat due to riparian impacts.

AR-3: Central and High Elevation Bypass Route (Pink)

This option has moderate potential impacts to endangered / threatened ecosystems. The potential impacts to special ecosystems are high, but the potential impacts to sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) is the lowest among the alternate corridor options. There may be potential impacts to additional sensitive habitat features such as an additional wetland near the tributary of unnamed stream (10), a potential talus slope, and two rock outcrops.

All alternate options are within the ungulate winter range for mule deer, and there is the potential for collision risk and loss of overwinter habitat. Among the alternate corridor options, this option has a slightly higher proportion of route ranked as very high or high for conservation ranking (62%).

According to the *PIB Ecological and Cultural Heritage Assessment*, this option, along with Options AR-4 and AR-5, has little impact on moose, but the impacts to the steep south-facing slopes are critical to mule deer winter range. For species at risk, Options AR-3, AR-4, and AR-5 have the highest potential impacts to snakes and bats because of the impacts to steep rocky slopes.

AR-4: Immediately West of Existing Development (Red)

This option has moderate potential impacts to endangered / threatened ecosystems. The potential impacts to special concern ecosystems are high, but the potential impacts to sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) are moderate. There may be potential impacts to additional sensitive rock outcrop habitat features.

All alternate options are within the ungulate winter range for mule deer, and there is the potential for collision risk and loss of overwinter habitat. This option falls within the habitat for Lewis' Woodpeckers and Western Screech Owls. This option has slightly lower proportion of the route ranked as very high or high for conservation ranking (56%). The relative biodiversity if low among the bypass options.

The August 2016 Community Workshop identified potential impacts to Pincushion Goats habitat at the north end of the alignment. Per the *PIB Ecological and Cultural Heritage Assessment*, the lower options, AR-4 and Ar-5, have higher potential to impact species at risk such as bats, snakes and Lewis' woodpeckers.

AR-5: Through Existing Development on South (Orange)

This option has moderate potential impacts to endangered / threatened ecosystems. The potential impacts to special concern ecosystems are high, but the potential impacts to sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) is moderate. Much like AR-4, there may be potential impacts to additional sensitive rock outcrop habitat features. This option is also the closest to kokanee spawning grounds below Hardy Falls.

All alternate options are within the ungulate winter range for mule deer, and there is the potential for collision risk and loss of overwinter habitat. This option falls within the habitat for Lewis' Woodpeckers and Western Screech Owls. This option has slightly lower proportion of the route ranked as very high or high for conservation ranking (57%). The relative biodiversity is lowest among the bypass options.

The *Penticton Indian Band Ecological and Cultural Heritage Assessment* and August 2016 Community Workshop identified waterfalls and a deep creek at the south end of the alignment. The deep creek is connected to sensitive Kokanee spawning grounds below Hardy Falls.

B. Social and Community

Of all the offline options, Options AR-1 and AR-2 have the least amount of impact on populated areas. According to the August 2016 Community Workshop, at the south end of the options, there may be some areas of Indigenous groups historic and / or cultural significance.

AR-1: Far Most Westerly Route (Yellow)

Like AR-2, this option has the least amount of impact on populated areas. Per the August 2016 community workshop there may been some agricultural impacts along the south portion of the alignment, specifically to orchards and vineyards.

AR-2: Westerly and High Elevation Bypass Route (Blue)

This alignment crosses through an industrial subdivision at Pierce Place and residential subdivision at Law Street. This option has slightly more impacts to adjacent lands than AR-1, but overall impact is minimal since the alignment is through less populated and less developed areas.

AR-3: Central and High Elevation Route (Pink)

At the south end, this option follows the same alignment as Option AR-2 with similar impacts to Pierce and Law Street properties. This option may affect recreational trails along Pincushion Mountain, since Pincushion Trail follows the Pincushion Mountain ridge to the summit. The impacts of this option on the trail will depend on the exact location and elevation of the road, and potential grading impacts.

Due to the elevation, there may be visual impacts to the community. Unlike AR-1, portions of this alignment will be seen by the community.

AR-4: Bypass Route Immediately West of Existing Development (Red)

At the south end, this option follows the same alignment as Option AR-2. This option crosses recreational trails, including Pincushion Trail. Grading impacts may have substantial impacts to the trail. This option may also impact Trepanier Forest Trail. From the August 2017 Community Workshop, this option may also impact a golf course along the north-west section of the route.

Zoning along the Trepanier Forest Trail is both park and low density multi-family residential. In additional to visually impacting the community, this option, in closer proximity to the built-up area, may also have noise impacts. Since this alignment sits on the front face of the mountain, it will be seen and possibly heard by the community. The alignment comes very close to newer residential developments just off Ponderosa Drive.

At the northern end of this alignment the community identified potential impacts to Trepanier Regional Linear Park.

AR-5: Lower Elevation Route (Orange)

This option crosses Log Chute and Thorne Roads in the south, then crosses through ALR lands as well as residential and rural residential properties. This option has the most impact on residential properties and agricultural lands. The August 2016 Community Workshop identified the most residential impacts and visual/noise impacts of all options.

C. Traffic and Travel Demand

For this analysis, Options AR-1 and AR-2 were grouped together, and Options AR-3, AR-4 and AR-5 were grouped together given their similarities in overall length and thus presenting no real difference with respect to the regional travel demand model which was employed to assess the usage of the alternative corridors.

As shown in *Table 5.3*, there is limited diversion from the existing Highway 97 route to the alternate route options. At best, Options AR-3, AR-4 and AR-5 draw 300 vehicles per hour in the southbound afternoon peak. The volume-to-capacity ratios for these alternate route options are all well below 1.0, showing sufficient capacity for diverted traffic. As for travel time change, Options AR-1 and AR-2 show a slight increase compared to the Base Case / existing route, likely due to the added length of the alternate routes. For Options AR-3, AR-4 and AR-5 there is a slight reduction in travel times, with southbound trips saving around six minutes in the afternoon peak.

Table 5.3: Preliminary Demand, Performance and Travel Time Comparisons

MEASURE	PEAK HOUR	DIRECTION	BASE	OPTION				
				AR-1	AR-2	AR-3	AR-4	AR-5
DEMAND (VEH/HR)	AM	NB	1300	100	100	100	100	100
		SB	1050	100	100	100	100	100
	PM	NB	1500	50	50	100	100	100
		SB	1750	100	100	300	300	300
V/C RATIO	AM	NB	1.0	0.0	0.0	0.0	0.0	0.0
		SB	1.2	0.0	0.0	0.0	0.0	0.0
	PM	NB	1.2	0.0	0.0	0.0	0.0	0.0
		SB	1.3	0.0	0.0	0.1	0.1	0.1
TRAVEL TIME CHANGE (MIN)	AM	NB	0	3	3	0	0	0
		SB	0	1	1	-3	-3	-3
	PM	NB	0	1	1	-2	-2	-2
		SB	0	-2	-2	-6	-6	-6

D. Engineering

The engineering criteria was applied to the alternate alignment options to assess the constructability, complexity and quality of the option conceptual design.

AR-1: Far Most Westerly Route (Yellow)

This option has an overall length of 13.4 kilometres. The option includes three long span bridges and a total bridge length of approximately 2,200 metres along the alignment. About 75% of the alignment is in a cut section with an average depth of 30 metres and a maximum depth of 60 metres. About 10,600 metres or 80% of the alignment would have steep grades. The Alignment Coordination of the option's conceptual design achieves a rating of Good.

AR-2: Westerly and High Elevation Bypass Route (Blue)

This alignment option has an overall length of 15 kilometres. This includes four long span bridges (greater than 50 metre span) and a total bridge length of approximately 2,300 metres along the alignment. About 81% of the alignment would be in a cut section with an average cut depth of 35 metres and a maximum cut depth of 100 metres. About 8,900 metres or 59% of the alignment would have steep grades. The Alignment Coordination of the option's conceptual design achieves a rating of Fair.

AR-3: Central and High Elevation Route (Pink)

Option AR-3 has an overall length 13.4 kilometres. The option includes five long span bridges and a total bridge length of approximately 1,700 metres. About 80% of the alignment is in a cut section with an average cut depth of 33 metres and a maximum depth of 66 metres. About 6,700 metres or 50% of the alignment has steep grades. The Alignment Coordination of the option's conceptual design achieves a rating of Good.

AR-4: Bypass Route Immediately West of Existing Development (Red)

Option AR-4 has an overall length 12.6 kilometres. The option includes four long span bridges and a total bridge length of approximately 3,400 metres. About 63% of the alignment is in a cut section with an average cut depth of 22 metres and a maximum depth of 45 metres. About 5,100 metres or 40% of the alignment has steep grades. The Alignment Coordination of the option's conceptual design achieves a rating of Good.

AR-5: Lower Elevation Route (Orange)

This alignment option has an overall length of 10.3 kilometres. This includes six long span bridges (greater than 50 metre span) and a total bridge length of approximately 2,100 metres along the alignment. About 55% of the alignment would be in a cut section with an average cut depth of 20 metres and a maximum cut depth of 35 metres. About 3,500 metres or 34% of the alignment would have steep grades. The Alignment Coordination of the option's conceptual design achieves a rating of Good.

E. Cost

A high-level cost estimate was generated based on conceptual single-line drawings. For the screening exercise, a cost index was applied, as shown in ***Table 5.4***, to provide a comparative analysis of costs for each option. A more accurate cost estimate based on further geotechnical and detailed design work will be considered for the evaluation stage.

Table 5.4: Alternate Route Cost Index

OPTION	COST INDEX
AR-1 (YELLOW)	1.6
AR-2 (BLUE)	1.8
AR-3 (PINK)	1.6
AR-4 (RED)	1.2
AR-5 (ORANGE)	1.0

Options AR-1, AR-2 and AR-3 have much higher costs than Option AR-5, and higher costs than Option AR-4. It is likely that Options AR-1, AR-2 and AR-3 require a significant number of retaining walls and high cuts compared to Options AR-4 and AR-5.

F. Bypass Alignment Option Screening Summary

The screening process removes options for which issues have been identified that likely render the option infeasible, or those that have a low probability of being selected as a preferred option when compared to other competing options. ***Table 5.5*** summarizes the issues and screening recommendations.

Table 5.5: Alternate Routes Technical Screening Summary

OPTION	ENVIRONMENTAL	SOCIAL/COMMUNITY	TRAFFIC AND TRAVEL DEMAND	ENGINEERING	COSTS	SCREENING RECOMMENDATION
AR-1: Far Most Westerly Bypass Route (Yellow)	• Impacts to Peachland Creek tributary corridor. • May impact wildlife migration corridors and Spring Canyon Unique Ecosystem. • May impact moose winter range, mule deer habitat. • Moderate potential impact to species at risk.	• Low impact to developed areas. • Potential for moderate archeological impacts.	• Low demand for new route in either the AM or PM peak hours. • No travel time savings.	• Route length is approximately 13.4 km. • Over 10 km of steep grades. • Three longer span bridges anticipated.	• Mid range cost estimate (Rank 3).	X • Highest potential environmental (riparian) impacts and moderate impacts to species at risk. • Low traffic demand and travel time savings. • Remove from further consideration.
AR-2: Westerly and High Elevation Bypass Route (Blue)	• Potential impacts to sensitive habitat such as the Pigeon Creek wetlands. • May impact wildlife corridors. • May impact moose winter range. • Lower potential impact to species at risk.	• Low impact to developed areas. • Potential for moderate archeological impacts.	• Low demand for new route in either AM or PM peak hours. • No travel time savings.	• Route length is approximately 15 km. • Nearly 9 km of steep grades. • Four longer span bridges anticipated.	• Highest estimated cost (Rank 5).	✓ • High potential environmental (riparian) impacts, but less than AR-1. Lower species at risk impacts than AR-1. • Lowest impacts to developed areas. • Low traffic demand and travel time savings. • Retain for further consideration.
AR-3: Central and High Elevation Bypass Route (Pink)	• Higher proportion of route impacting conservation areas. • Potential impact to several sensitive habitat features. • Moderate potential impact to mule deer habitat. • High potential impact to species at risk.	• Mostly impacts to recreational areas. • Some visual and noise impacts anticipated. • Potential for moderate archeological impacts.	• Low demand for new route in AM peak hour but slightly higher in the PM peak hour. • Small travel time savings in the PM peak hour.	• Route length is approximately 13.4 km. • Nearly 7 km of steep grades. • Five longer span bridges anticipated.	• Mid range cost estimate (Rank 4).	✓ • Less impacts on developed areas and residential development than AR-4 and AR-5. • Some travel time savings and but demonstrates slightly higher demand in the PM peak hour compared to AM peak hour. • Retain for further consideration.
AR-4: Bypass Route Immediately West of Existing Development (Red)	• Relative biodiversity is low amongst options. • Potential impacts to several sensitive habitat features. • High potential impact to mule deer habitat. • High potential impact to species at risk.	• Some visual and noise impacts anticipated. • Potential for moderate archeological impacts.	• Low demand for new route in AM peak hour but slightly higher in the PM peak hour. • Small travel time savings in the PM peak.	• Route length is approximately 12.6 km. • Just over 5 km of steep grades. • Four longer span bridges anticipated.	• Mid range cost estimate (Rank 2).	X • High environmental impacts to south slopes. • Some travel time savings and but demonstrates slightly higher demand in the PM peak hour compared to AM peak hour. • Remove from further consideration as this option has higher environmental impacts and lower benefits compared to similar option AR-5.
AR-5: Lower Elevation Route (Orange)	• Relative biodiversity is lowest amongst options. • May have potential impacts to sensitive habitat features. • High potential impact to mule deer habitat. • High potential impact to species at risk. • Lowest riparian impacts amongst options.	• Some residential and / or agricultural property impacts. • Visual and noise impacts anticipated. • Low potential for archeological impacts.	• Low demand for new route in AM peak hour but slightly higher in the PM peak hour. • Small travel time savings in the PM peak.	• Route length is approximately 10.3 km. • Over 3.5 km of steep grades. • Six longer span bridges anticipated.	• Lowest estimated cost (Rank 1).	✓ • Lowest cost option, also shortest route. • Lowest environmental (riparian) impacts of all options. • Greatest travel time savings amongst options and demonstrates slightly higher demand in the PM peak hour as compared to the AM peak hour. • Retain for further consideration as the environmental impacts are the lowest and the benefits are the highest among all options.

5.3 Options and Option Packages

For the option screening, the outcome of the process resulted in an option being deemed possible, or due to issues, challenges or impacts, being deemed not preferred. The short-listed options which were deemed to be technically possible, are to be advanced for further detailed analysis and evaluation using a comprehensive multiple account evaluation process.

In the next step of evaluation, the entire route will need to be examined as a whole as many of the evaluation criterion are applicable on a corridor wide basis. This requirement for corridor wide analysis suggests that a further step is required to combine the various short-listed Existing Route section options into a set of improvements that cover the entire corridor. On the other hand, all of the Alternate Route options are continuous through the corridor and no other step is required to move forward to the multiple account evaluation process.

The packaging of route section options for the existing route is described herein and followed by a summary of the alternate route options.

5.3.1 Existing Route Option Packages

As indicated above, the short-listed options in each route section will need to be combined to form a package of improvements encompassing the entire existing route. However, it is noted that up to three options were shortlisted for each of the five route sections which could result in 72 possible option combinations. At the multiple account evaluation stage, no more than three options (option packages) are anticipated to be evaluated.

Therefore, the options packages were developed in a manner that allows alternative options to be isolated and potentially complementary options to be combined while reducing the overall combinations to just three. Based on this approach, three option packages for the existing route were assembled with the three short listed options in route section 1 forming the initial component in each option package and the short-listed options from the other route sections being added to these initial components in a complementary manner. The general themes of the three resulting option packages are:

- Option package ER-A is comprised of route section options that mostly include at-grade intersections.
- Option packages ER-B and ER-C are comprised of route section options that mostly include grade-separated junctions or crossings.

The selection rational for the option packages for the existing route is shown in ***Table 5.6***. As shown, the existing route option packages are assembled as follows:

- ER-A is comprised of route section options ER-1A, ER-2D, ER-3B, ER-4B and ER-5A.
- ER-B is comprised of route section options ER-1B, ER-2A, ER-3A, ER-4A and ER-5B.
- ER-C is comprised of route section options ER-1C, ER-2B, ER-3A, ER-4A and ER-5B.

Table 5.6: Existing Route Option Packages

AREA	OPTION	OPTION SCREEENING DISPOSITION	ADVANCED TO MAE	ALIGNMENT OPTION PACKAGE
Drought Hill	ER-1A Drought Hill Expressway	• Possible	✓	ER-A
	ER-1B Drought Hill Expressway with Drought Road Overpass	• Possible	✓	ER-B
	ER-1C Seclusion Bay Road and Drought Road Overpasses	• Possible	✓	ER-C
Trepanier Bench Road to Huston/Buchanan Road	ER-2A Overpass at Lang Road	• Possible	✓	ER-B
	ER-2B Extension of Shaw Road and Huston Road	• Possible	✓	ER-C
	ER-2C Trepanier Road Over Highway 97	• Not preferred • Design and constructability concerns with overpass structure	X	
	ER-2D Signal at Trepanier Bench Road	• Possible	✓	ER-A
	ER-2E Signal at Huston/Buchanan Road	• Not Preferred • District of Peachland Council does not support this option	X	
Ponderosa Drive to Todd Road	ER-3A Todd and 13 Crossings	• Possible	✓	ER-B & ER-C
	ER-3B Retain Signals at Clement Crescent and Ponderosa Drive	• Possible	✓	ER-A
Princeton Ave / Beach Ave	ER-4A Interchange at Princeton	• Possible	✓	ER-B & ER-C
	ER-4B Retain Signal at Princeton	• Possible	✓	ER-A
South of Princeton Avenue	ER-5A Realignment at Antlers Beach	• Possible	✓	ER-A
	ER-5B Short Bypass	• Possible	✓	ER-B & ER-C

5.3.2 Alternate Route Options

For the Alternate Route options, the short-listed options which were deemed to be technically possible are to be advanced for further detailed analysis and evaluation using a comprehensive multiple account evaluation process. The selection rational for the three short-listed alternate route options is summarized in *Table 5.7*.

Table 5.7: Alternate Route Options

OPTION	OPTION SCREENING DISPOSITION	ADVANCED TO MAE	ALTERNATE ROUTE OPTION
AR-1: Far Most Westerly Bypass Route (Yellow)	• Not preferred • Highest potential environmental (riparian) impacts and moderate impacts to species at risk. • Low traffic demand and travel time savings. • Remove from further consideration.	X	
AR-2: Westerly and High Elevation Bypass Route (Blue)	• Possible	✓	AR-A
AR-3: Central and High Elevation Bypass Route (Pink)	• Possible	✓	AR-B
AR-4: Bypass Route Immediately West of Existing Development (Red)	• Not preferred • High environmental impacts to south slopes. • Some travel time savings and but demonstrates slightly higher demand in the PM peak hour compared to AM peak hour. • Remove from further consideration as this option has higher environmental impacts and lower benefits compared to similar option AR-5.	X	
AR-5: Lower Elevation Route (Orange)	• Possible	✓	AR-C

For the purposes of simplifying route naming for the multiple account evaluation process such that the short-listed options remain sequential with no gaps between the identifiers, AR-2 (Westerly and High Elevation Route) is renamed AR-A, AR-3 (Central and High Elevation Route) is renamed AR-B, and AR-5 (Alignment Through Existing Development) is renamed AR-C.

The subsequent multiple account evaluation process will review existing route packages ER- A, ER-B, and ER-C, and alternate route options AR-A, AR-B, and AR-C.

6. Option Evaluation

The more detailed option evaluation process will involve the application of a comprehensive evaluation framework to the three existing route option packages and the three alternate route options. In this section, the proposed evaluation framework is introduced and then followed by a description of the option evaluation for the existing route option packages and then the alternate route options. A summary of the evaluation or the existing and alternate routes is provided at the end of the section.

6.1 Evaluation Framework

In order to compare and contrast the relative merits and impacts of each option, a set of high level evaluation criteria was developed based on the multiple account evaluation methodology typically used for BC MoTI planning studies. For this study, the following accounts are proposed:

- Customer Service;
- Socio Community;
- Environmental; and
- Financial.

Subsequent work as part of the Phase II study will involve more detailed analysis of the preferred existing route option and the preferred alternate route option. Given the high level nature of the Phase I study, the Economic Development Account was not considered; however, this account will be evaluated as part of the Phase II study.

The criteria under each account are a combination of quantitative and qualitative indicators that have been selected to provide sufficient comparative information to assist in determining a preferred option within the existing alignment or for an alternate alignment. For each criterion, the comparison of the option is against a Base Case. The qualitative evaluation is used when specific measurements cannot readily be made, but there are obvious benefits or impacts as compared to the Base Case. For the purposes of this study and the comparative evaluation, the Base Case represents the existing physical conditions with no improvements into the future planning horizon.

These qualitative evaluations are more prominent in the Customer Service, Socio-Community, and Environmental Accounts. To evaluate qualitative scoring consistently, a five-level rating system was applied as shown in ***Table 6.0***.

Table 6.0: Qualitative Scoring Format

SCORE	MEANING
○	Significantly Worse
◔	Somewhat Worse
◑	Similar to Base Case / Neutral
◕	Somewhat Better
●	Significantly Better

The descriptions below each proposed criterion include a summary of the criterion characteristics and rationale, as well as a range of evaluation output. For consistency with business case development, a 25-year analysis period has been assumed for the applicable quantitative related criteria. For those criteria that are reported in monetized values, the values have been brought back to Present Value (PV) 2018$ for comparison purposes using a 6% annual discount rate.

The level of detail that was considered within each criterion in the option evaluation framework is related to the level of development of the options being considered. Most options being considered have been developed to a single-line sketch level of detail. However, layout plans, vertical profiles, and typical cross-sections were only generated for selected options (e.g. alternate routes) where it was considered necessary to augment the basic information contained in the single-line sketches.

6.1.1 Customer Service Account

The Customer Service Account considers traffic mobility, safety, and network capacity for vehicular and cyclist movements. Where applicable, the regional travel demand model and other analytical tools will be applied to quantitatively assess each criterion. Documentation of the analysis methodology and related assumptions and other inputs will be included in the evaluation section.

Traffic Mobility

Using regional travel demand model outputs and proposed geometric and / or operational modifications to the road network, an assessment of the impact on level of mobility will be conducted.

Evaluation Output:

This quantitative assessment will take into consideration the following comparative performance statistics:

- *Volume to Capacity (v/c) ratios along key route links.*
- *Route Travel Time - end to end of corridor (minutes).*

Predicted Road Safety Performance

The predicted road safety performance for the options will be derived from the TAC Highway Safety Manual Part C predictive method to determine the predicted crash frequency for the highway corridor options. The predicted crash frequency is widely used in safety practices, especially when comparing different improvement alternatives. To predict the road safety performance, models will be prepared for the existing corridor and alterative routing options using the Interactive Highway Safety Design Model (IHSDM).

Evaluation Output:

This quantitative assessment will compare the present value of all collisions (Present Value over 25 years) using BC MoTI collision costs. The comparative collision estimates to be established based on exposure information available and will vary by area being assessed.

Vehicle Operating Costs

Using the regional travel demand model and proposed geometric and operational modifications to the road network, an assessment of the impact on vehicle operating costs will be conducted. The vehicle operating costs will largely be based on Vehicle Kilometres Travelled (VKT), a model output which would then be translated into monetary values based on expansion factors applicable to the vehicle composition found in, or around, Peachland.

Evaluation Output:

> *This quantitative assessment will compare vehicle operating costs for all traffic directly impacted by the option, compared with the Base Case, using BC MoTI values for vehicle operating costs for both autos and trucks. The results will represent Present Value dollars over 25 years.*

Network Travel Time – Travel Time Savings

Using the regional model to forecast traffic demand and overall network travel time, an assessment of the impact on network travel times will be conducted in comparison to the Base Case in the form of generalized cost savings.

Evaluation Output:

> *This quantitative assessment will compare the network travel time and vehicle operating cost for traffic directly impacted by the option, compared with the Base Case. The method will establish comparative travel time and cost estimates for each option package or alternate alignment. The results will be presented in vehicle hours travelled and monetized using BC MoTI value of travel time, combined with vehicle operating cost to form generalized cost savings. (Present Value over 25 years).*

Pedestrian and Cycling Accommodation

A qualitative assessment will be conducted on each option to evaluate the level of mobility provided to pedestrians and cyclists as well as the connectivity to key activity locations or other routes along the corridor.

Evaluation Output:

> *This qualitative assessment will compare the types of facilities being provided in each option for pedestrians and cyclists in terms of safety, terrain, and connectivity. An overall rating compared to the Base Case will be provided.*

6.1.2 Socio-Community Account

The Socio-Community Account considers property impacts, potential noise impacts, visual impacts, and community severance impacts. In addition, consistency with community plans will also be evaluated. Where possible, the impacts will be quantified, however, for some of these criteria, only a qualitative evaluation is practical.

Property Impacts

This criterion will consider the additional right-of-way required and quantify the number of individual properties impacted. Impacted properties will be identified as either residential, business / commercial, or institutional. Impacts to Agricultural Land Reserve (ALR) or parks will be identified separately as well.

Evaluation Output:

The number and type (land use) of properties impacted and the total area (sq. metres) of the impact. The number of impacted properties will be further identified as full impacts or partial impacts.

Noise Impacts

This qualitative criterion will consider the effects of noise on adjacent residents and businesses, measured by proximity to high volume traffic in comparison to the Base Case.

Evaluation Output:

- *Significantly Better – significant decrease in traffic volumes in proximity to adjacent properties.*
- *Somewhat Better – moderate decrease in traffic volumes in proximity to adjacent properties.*
- *Neutral / Similar to the Base Case – no change in traffic volumes in proximity to adjacent properties.*
- *Somewhat Worse – moderate increase in traffic volumes in proximity to adjacent properties.*
- *Significantly Worse – significant increase in traffic volumes in proximity to adjacent properties.*

Visual Impacts

This criterion will consider the visual intrusion / sight lines of the option in terms of its visual proximity to residents and businesses. The qualitative evaluation will determine whether each option would have visual impacts in comparison to the Base Case.

Evaluation Output:

- *Significantly Better – sight lines from adjacent properties are significantly improved.*
- *Somewhat Better – sight lines from adjacent properties are somewhat improved.*
- *Neutral / Similar to the Base Case – no change in sight lines from adjacent properties.*
- *Somewhat Worse – sight lines from adjacent properties are somewhat impacted.*
- *Significantly Worse – sight lines from adjacent properties are significantly impacted.*

Community Severance

This criterion will consider the barrier effect of a new higher speed or wider road on the existing community structure and linkages. Lack of connectivity and / or accessibility across the corridor can negatively affect pedestrian, cyclist and local vehicle movements. Severance may also create psychological barriers to trip planning.

Evaluation Output:

- *Significantly Better – connectivity and accessibility within the community significantly improved.*
- *Somewhat Better – connectivity and accessibility within the community somewhat improved.*
- *Neutral / Similar to the Base Case – no change in connectivity and accessibility.*
- *Somewhat Worse – connectivity and accessibility within the community somewhat impacted.*
- *Significantly Worse – connectivity and accessibility within the community significantly impacted.*

Consistency with Community Plans

This criterion will consider the community plans of the District of Peachland that have been developed to guide growth. The development community depends on them; municipal residents and business owners expect plans to be adhered to.

Evaluation Output:

- *Significantly Better – significantly conforms with District of Peachland planning documents.*
- *Somewhat Better – somewhat conforms with District of Peachland planning documents.*
- *Neutral / Similar to the Base Case – no change with respect to District of Peachland planning documents.*
- *Somewhat Worse – somewhat inconsistent with District of Peachland planning documents.*
- *Significantly Worse – significantly inconsistent with District of Peachland planning documents.*

6.1.3 Environmental Account

The Environmental Account considers potential impacts to terrestrial and aquatic resources, as well as archaeological / historic sites of significance. In addition, impacts related to changes in Greenhouse Gas (GHG) Emissions will also be considered.

Terrestrial Impacts

The relative severity of impacts to the terrestrial environment will be noted and ranked. The qualitative evaluation, based on high level desk top research, will determine whether each option would have good, fair or poor terrestrial impacts with respect to the Base Case.

Evaluation Output:

- *Significantly Better – significant improvement compared to existing conditions.*
- *Somewhat Better – moderate improvement compared to existing conditions.*
- *Neutral / Similar to the Base Case – no changes compared to Base Case.*
- *Somewhat Worse – moderate impacts due to direct effect, mitigate opportunities are possible.*
- *Significantly Worse – significant impacts due to direct effects, mitigation opportunities are limited.*

Aquatic Impacts

The relative severity of impacts to the aquatic environment will be noted and ranked. The qualitative evaluation, based on high level desk top research, will determine whether each option would have good, fair or poor aquatic impacts with respect to the Base Case.

Evaluation Output:

- *Significantly Better – significant improvement compared to existing conditions.*
- *Somewhat Better – moderate improvement compared to existing conditions.*
- *Neutral / Similar to the Base Case – no changes compared to Base Case.*
- *Somewhat Worse – moderate impacts due to direct effect, mitigate opportunities are possible.*
- *Significantly Worse – significant impacts due to direct effects, mitigation opportunities are limited.*

Archaeological / Historical Impacts

Any archaeologically or historically significant impacts will be noted and ranked in terms of the severity of impact. The qualitative evaluation, based on high level desk top research, will determine whether each option would have good, fair or poor impacts with respect to the Base Case.

Evaluation Output:

- *Significantly Better – significant improvement compared to existing conditions.*
- *Somewhat Better – moderate improvement compared to existing conditions.*
- *Neutral / Similar to the Base Case – no changes compared to Base Case.*
- *Somewhat Worse – moderate impacts due to direct effect, mitigate opportunities are possible.*
- *Significantly Worse – significant impacts due to direct effects, mitigation opportunities are limited.*

Greenhouse Gas Emissions

This criterion considered the impacts of greenhouse gas emissions (GHG), and the potential reductions or increases in GHGs that the option would enable. When quantifying these GHG in terms of dollar value (PV over 25 years), the Government of Canada's forecasted Social Cost of Carbon per emission year will be used.

Evaluation Output:

Quantified GHG emissions (kg and $).

6.1.4 Financial Account

The Financial Account considers the present value of capital, maintenance and rehabilitation costs, as well as project salvage value, and high level property costs. In comparison to any benefits generated in the customer service account, financial indicators such as Net Present Value and Benefit / Cost ratio can be calculated; however this assessment is deferred to Phase II of the Peachland Transportation Planning Study.

Capital Cost

The relative construction cost of each option will be assessed at a high level using a conceptual single line sketch and typical unit costs referenced from the BC MoTI's Construction and Rehabilitation Cost Guide and applied to the Wolski method. The cost is dependent on the extent of physical modifications and the complexity of the modifications (including geotechnical, utilities, drainage, and environmental compensation features).

Evaluation Output:

Total Construction Cost (Including Contingencies) represented in a simplified cost range ($ → $$$$$).

Property Cost

Property costs are based on a very high level estimate of the proposed number of properties impacted. This is an estimate only for the purposes of this study and in no way represents market value.

Evaluation Output:

Total Property Cost (Present Value) represented in a simplified cost range ($ → $$$$$).

Maintenance and Rehabilitation Cost

Consideration for annual maintenance and rehabilitation costs will be based on a 25-year service life, standard lane-kilometre costs and scheduled rehabilitation for major roadways.

Evaluation Output:

Maintenance and Rehabilitation Cost (Present Value) represented in a simplified cost range ($ → $$$$$).

Salvage Value

The salvage value of the proposed infrastructure for each option at the end of the 25-year analysis period will be reported.

Evaluation Output:

Salvage Value (Present Value) represented in a simplified cost range ($ → $$$$$).

Benefit Cost Ratio and Net Present Value

This calculation takes into consideration the present value of the monetarized benefits of each option (e.g. travel time savings benefits), capital costs, property costs, maintenance and rehabilitation costs, and salvage value. Due to the high level representation of costs, the B/C Ratio and NPV will not be calculated until Phase II of the Peachland Transportation Planning Study.

Evaluation Output:

B/C Ratio, NPV (25-Year Benefits – Costs).

6.2 Evaluation of Options – Existing Route

The three existing route option packages have been evaluated using the evaluation framework described in the previous section. Where applicable, the analysis methodology and any assumptions are described along with the analysis outcomes.

6.2.1 Customer Service Account

Under this account, the five criteria include traffic mobility, predicted road safety performance, vehicle operating costs, travel time savings, and pedestrian / cycling accommodation. Due to the option analysis methodology employed, the results for Network Travel Time and Vehicle Operating Costs have been combined.

Traffic Mobility

The RDCO regional travel demand model was applied, and 2040 AM and PM peak hour volume / capacity ratios were extracted for the five previously defined sections along the existing route for each option package. In addition, 2040 AM and PM peak hour travel times for the entire route were extracted from the model for each option package. For comparison purposes, values for the Base Case (2040 future) are provided in the tables.

Table 6.1 summarizes the volume / capacity values for the three existing route option packages as well as the end to end route travel times for the three existing route option packages. For the measure of travel times, the modelled travel times are reported from the common start and end points to allow the options to be compared directly. For comparison purposes, values reported are absolute travel times changes compared to the 2040 base.

Table 6.1: Existing Route Volume / Capacity and Route Travel Times

MEASURE		PEAK HR	DIR	BASE	ER-A	ER-B	ER-C
Performance (v/c)	Segment 1 & 2	AM	NB	0.8	0.4	0.4	0.4
			SB	0.6	0.4	0.4	0.4
		PM	NB	0.9	0.5	0.5	0.5
			SB	1.1	0.6	0.6	0.6
	Segment 3	AM	NB	1.0	0.6	0.3	0.3
			SB	1.2	0.6	0.3	0.3
		PM	NB	1.2	0.8	0.3	0.3
			SB	1.3	0.9	0.4	0.4
	Segment 4 & 5	AM	NB	0.6	0.3	0.3	0.3
			SB	0.9	0.5	0.2	0.2
		PM	NB	0.8	0.4	0.3	0.3
			SB	1.1	0.7	0.3	0.3
Travel Times (min)		AM	NB	0	-1	-2	-2
			SB	0	-3	-4	-4
		PM	NB	0	-3	-4	-4
			SB	0	-5	-7	-7

As can be seen in the table above, moderate benefits are observed for Option ER-A in terms of reduced volume / capacity ratios and travel times. However, Options ER-B and ER-C show significant benefits in terms of reduced volume / capacity ratios and travel times. These greater benefits in mobility performance are related to the lack of signalized intersections in Option ER-B and Option ER-C.

Predicted Road Safety Performance

Road safety performance was evaluated quantitatively using the TAC Highway Safety Manual predictive method. Models of the existing Highway 97 and all improvements options on both the existing and alternate route were developed in the Interactive Highway Safety Design Model (IHSDM) software. All alignments were imported into the software, and attributes of each option were coded based on the design criteria described in Section 3.1 of this report.

AADTs used in the crash prediction models for Highway 97 were estimated for all scenarios using the regional model (regional travel demand forecasting model). Traffic volume data for the intersecting roadways was only available in the AM and PM peak hours, based on turning movement counts. To estimate the AADT on intersecting streets, the ratio between AADT and peak hour volume was calculated for Highway 97 and then applied to each intersecting street. The IHSDM crash prediction model was then run to estimate the number of crashes along the corridor in each scenario using both year 2025 and 2043 volumes. The 2025 and 2043 volumes were extrapolated from the 2014 and 2040 volumes generated by the travel demand model.

The IHSDM outputs the number of fatal and injury collisions as an aggregate number. To estimate a value for each, historical crash data from 2004 to 2014 on the corridor were used, and it was assumed that the ratio of injury collisions to fatal collisions would remain constant in the future. The value of the collisions in the years 2025 and 2043 was then calculated using the 2018 BC MoTI collision costs, and the values of the collisions in the remaining years were linearly interpolated. Finally, the present value of the collisions over 25 years was calculated for each scenario in comparison to the Base Case. A social discount rate of 6% was applied to calculate the present values.

The results of the crash prediction analysis for the existing route are shown in ***Table 6.2*** and ***Table 6.3*** for the years 2025 and 2043.

Table 6.2: Crash Prediction Analysis Results (2025)

CRITERION	EXISTING ROUTE OPTIONS			
	BASE	ER-A	ER-B	ER-C
Evaluated Length (km)	12.1315	12.1315	12.0479	12.2002
Average Future Road AADT (vpd)	16,145	17,142	17,243	17,303
Total Crashes	69.1	61.42	46.9	48.85
Fatal Crashes	1.091	1.248	1.048	1.083
Injury Crashes	23.12	26.45	22.22	22.97
Property-Damage-Only Crashes	44.88	33.72	23.62	24.8
Crash Value (PV)	**$16.4 Million**	**$18.5 Million**	**$15.5 Million**	**$16.1 Million**

Table 6.3: Crash Prediction Analysis Results (2043)

CRITERION	EXISTING ROUTE OPTIONS			
	BASE	ER-A	ER-B	ER-C
Evaluated Length (km)	12.1315	12.1315	12.0479	12.2002
Average Future Road AADT (vpd)	21190	23282	23458	23551
Total Crashes	90.98	84.81	67.76	70.88
Fatal Crashes	1.443	1.678	1.488	1.547
Injury Crashes	30.59	35.57	31.55	32.79
Property-Damage-Only Crashes	58.94	47.56	34.72	36.53
Crash Value	**$21.2 Million**	**$21.9 Million**	**$21.9 Million**	**$21.7 Million**

The total crash savings (PV 2018$), shown in ***Table 6.4***, have been estimated by summing the annual benefits over the 25 year analysis period. The benefits for the interim years have been linearly interpolated between the values derived for the assessed years of 2025 and 2043.

Table 6.4: Existing Route Crash Prediction Analysis Results (Total Benefits)

	EXISTING ROUTE OPTIONS		
	ER-A	ER-B	ER-C
Total Safety Benefits (PV)	-$20.3 Million	$3.2 Million	-$2.1 Million

As can be seen in the table above, Option ER-A has negative benefits as does Option ER-C. Only Option ER-B results in any positive safety benefits.

Network Travel Time and Vehicle Operating Costs

The latest RDCO regional travel demand model was used in estimating the benefits related to network travel time and vehicle operating costs. The model was developed as part of the Central Okanagan Planning Study (COPS). Documentation on model structure, procedures, components, assumptions, methodology, calibration, and validation can be found in *COPS Regional Transportation Model – User Guide (Parsons 2015).*

To assist in the evaluation of the existing route options, the following scenarios were modelled in the horizon years of 2014 and 2040:

- 2014:
    - Base Case
    - Existing Route ER-1A
    - Existing Route ER-1B
    - Existing Route ER-1C

- 2040:
    - Base Case + Committed (see below)
    - Existing Route ER-1A
    - Existing Route ER-1B
    - Existing Route ER-1C

The future transportation network changes that are assumed to form part of the 2040 base network were established through an extensive review of previous reports, transportation plans, official community plans, and discussions with BC MoTI and municipal representatives within the Central Okanagan Region. A list of committed projects, defined as those with a very high likelihood of being implemented in 2040, were assumed as part of the 2040 base network which encompasses the entire Central Okanagan Region. For more information, please refer to *COPS – Future Base Transportation Networks (Parsons 2015).*

To estimate the user benefits that each scenario may generate, the modelling results from the regional travel demand analysis were used. Specifically, for each of the scenarios developed and run within the regional traffic model, conditions were assessed for the AM and PM peak hours.

A total of four vehicle classes were included in the regional model analysis:

- SOV (Single Occupancy Vehicle)
- HOV (High Occupancy Vehicle)
- LGV (Light Goods Vehicle)
- HGV (Heavy Goods Vehicle)

One transit mode was also included in the regional model analysis:

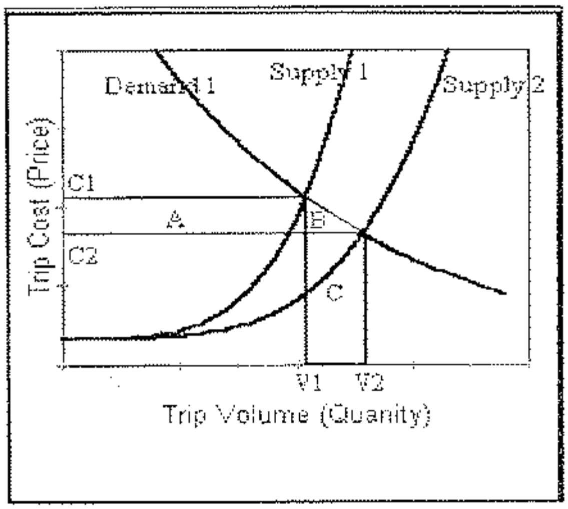
- Bus

Using a special procedure in the model, the user benefits combining travel time savings and vehicle operating cost savings were generated for each vehicle class. The model produces hourly user benefits in generalized cost terms valued in time units. The term "generalized cost" refers specifically to the concept of combined monetary and non-monetary costs in one single unit. As a result, the user benefits derived from the model are the combination of travel time savings and vehicle operating cost savings. The hourly savings were expanded to annual savings using the methodology documented in *the TransLink Transportation Evaluation Guidelines (T Partridge & Associates, October 2000).*

To estimate the benefits, a description is provided for the four key areas, namely cost parameters, expansion factors, and user benefits. Specifically, the cost parameters section describes the assumptions and methodology used to estimate the cost parameters. The expansion factors section describes the methodology used to expand hourly benefits to annual benefits. The user benefits section presents and compares the 25-year benefits of each scenario in present value (PV).

Cost Parameters

The document *TransLink Transportation Evaluation Guidelines (T Partridge & Associates, October 2000)* guided the method used to calculate user benefits.



The diagram illustrates the appropriate method for calculating transportation user benefits due to capacity improvement from Supply 1 to Supply 2. The existing base trips represented by the volumes V1 each receive a benefit of C1-C2 units of cost reduction. Since these trips are made with or without the improvement, there is a reduction in costs equal to V1*(C1-C2), represented by the area A. The newly induced trips V2-V1, which are encouraged by the lower unit cost C2, receive a net benefit represented by the triangular area B. The total user benefit can be expressed by the formula below:

User Benefit = ½(V1-V2)(C1-C2)*

The calculation is executed with a special procedure within the regional model. This procedure calculates for each vehicle class the user benefits using, as shown in the equation, base volumes V1, scenario volumes V2, base cost C1, and scenario costs C2 for all trips.

Each model scenario returns for each vehicle class the user benefits in generalized cost savings (veh-hr) that combine travel time savings and vehicle operating cost savings. For each vehicle class, generalized cost savings (veh-hr) were subsequently monetized by multiplying by the values of time ($/veh-hr). Also, each model scenario returns for each transit mode the travel time savings (person-hr). For each transit mode, travel time savings (person-hr) were monetized by multiplying by the values of time ($/person-hr).

The generalized cost savings for each vehicle class (veh-hr) were multiplied by the corresponding value of time ($/veh-hr), to obtain the values of generalized cost savings ($). The values of time by vehicle class, documented in the BC MoTI Default Values for Benefit Cost Analysis 2018 were used, as presented in ***Table 6.5*** below.

Table 6.5: Default Values of Time ($2018)

	2018
Auto	$/person-hr
Total	**$18.49**
Straight Truck	$/Truck-hr
Driver	$31.25
Truck Time	$6.86
Total	**$38.11**
Combination Truck	$/Truck-hr
Driver	$31.25
Truck Time	$15.85
Total	**$47.10**

The resulting values of time applied to each vehicle class and transit mode are as follows:

- SOV - $18.49/veh-hr
- HOV- $18.49/veh-hr
- LGV- $38.11/veh-hr
- HGV- $47.10/veh-hr
- Bus- $18.49/person-hr

Expansion Factors

The development of the expansion factors involved a review of available daily count data in the study area (or adjacent to the study area).

Count Data and Review

Base year William R. Bennett Bridge count data collected by BCMoTI was used in the expansion. Other locations, some even closer to Peachland, were considered but did not get used because continuous data was not available for the entire year. It is important that a whole year of count data is used to develop these expansion factors such that seasonal variations are captured.

Count data was collected 24/7 by vehicle detectors at the south end of the William R. Bennett Bridge. The data were summarized by vehicle class in 15-minute intervals and those in 2014 were used. The typical October weekday daily profile over the William R. Bennett Bridge is shown in ***Figure 6.1.***

Figure 6.1: Typical October weekday daily profile over the William R. Bennett

The regional model is based on fall season weekday travel. The base year model was calibrated to October 2014 counts. The purpose of employing an October weekday daily profile was to be consistent with the regional model.

Hourly to Daily Expansion

The document *TransLink Transportation Evaluation Guidelines (T Partridge & Associates, October 2000)* guided the method used to develop the peak hour to daily expansion factors. The method was expanded to cover the application of all model scenarios.

Particularly, when an off-peak model does not exist, the Evaluation Guidelines document describes that a project such as road widening has benefits only in the five (5) peak hours, and no benefits in the off-peak when volumes are low enough not to benefit from the extra lanes, while a new project such as a river crossing saves time all day long due to a more direct route regardless of capacity considerations. However, considering the various proposed improvement options, none of them are solely capacity improvements that only benefit the peak periods. For the purposes of the benefit estimates herein, the results from the modelled AM hour will apply to 12 AM peak hours, while the modelled PM hour will apply to the rest.

The percentages of daily traffic for each time period used are illustrated in ***Table 6.6***. The resulting expansion factors to be used for each model scenario are summarized in ***Table 6.7***.

Table 6.6: Percentages of William R. Bennett Bridge Daily Traffic

DATA TYPE	TIME PERIOD	AUTO	LGV	HGV
Model Volumes	Modelled AM Hour (730-830)	7.7%	8.7%	7.0%
	Modelled PM Hour (1630-1730)	8.7%	7.2%	5.0%
2014 Oct TWTh Avg Counts	12 AM Peak Hours (0000-1200)	38.8%	47.3%	51.4%
	12 PM Peak Hours (1200-2400)	61.2%	52.7%	48.6%

Table 6.7: Expansion Factors

TIME PERIOD	AUTO	LGV	HGV
AM Hour (0730-0830)	5.1	5.4	7.4
PM Hour (1630-1730)	7.0	7.3	9.4

Daily to Annual Expansion

Table 6.8 presents a summary of the count data in different day-of-week count periods and the annual average daily traffic (AADT).

Table 6.8: William R. Bennett Bridge October Daily Average and AADT

COUNT PERIOD	AUTO	LGV	HGV
2014 Oct TWTh	51600	4900	1700
2014 Oct MF	50200	4700	1500
2014 Oct SS	42500	2600	700
2014 AADT	47800	4000	1300

The relationships between an October weekday and the AADT would be the daily to annual expansion factors, shown in ***Table 6.9.***

Table 6.9: Daily to Annual Expansion Factors

COUNT PERIOD	AUTO	LGV	HGV
2014 Oct TWTh	338	299	269

User Benefits

The user benefits of generalized cost savings, combining travel time savings and vehicle operating cost savings, were calculated by travel mode for all model scenarios for all time frames. Annual user benefits were calculated by applying the same expansion factors to the 2014 and 2040 model horizon years. Annual user benefits for the intermediate years were estimated by linear interpolation. All years between 2014 and 2040 were interpolated using 2014 and 2040 annual benefits. All years after 2040 were extrapolated using 2014 and 2040 annual benefits. Since all cost components used were in 2018 dollars as previously described, the annual user benefits were first calculated in 2018 dollars as shown in ***Figure 6.2***.

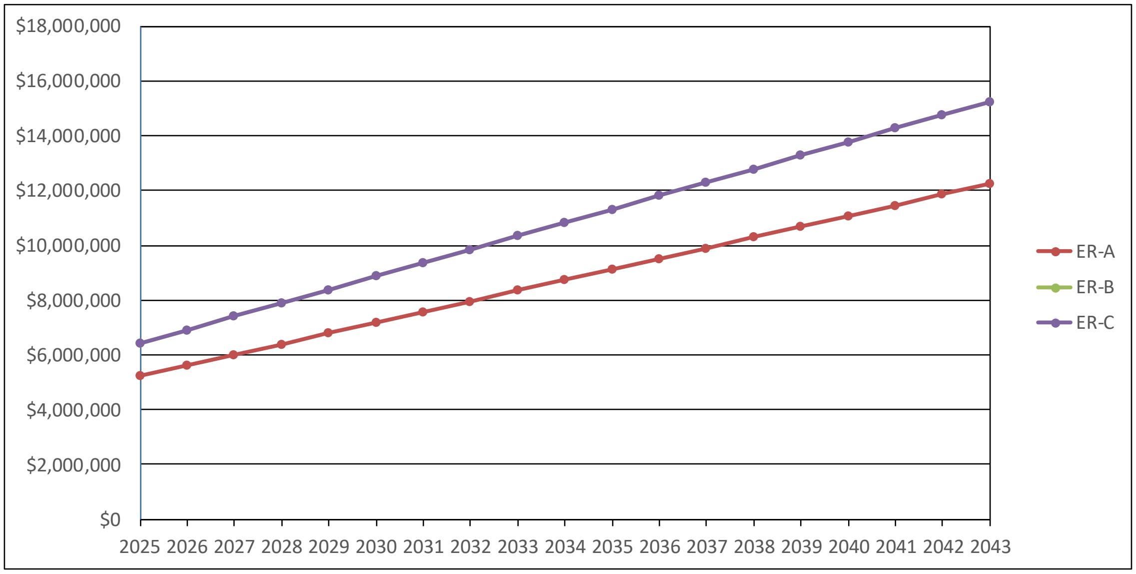


Figure 6.2: Annual User Benefits (in 2018 Dollars)

For a 25-year user benefit analysis covering the years between 2018 and 2043, and assuming design and construction will continue until 2024, the opening and any existing route option was assumed to occur in 2025. Therefore, annual user benefits from 2025 to 2043 were discounted back to the current year 2018 using an industry standard annual social discount rate of 6%. The resulting 25-year user benefits in 2018 dollars are illustrated in ***Figure 6.3*** and summarized in ***Table 6.10***.

Table 6.10: Discounted 25 Year User Benefits (in 2018 Dollars)

	EXISTING ROUTE OPTION		
	ER-A	ER-B	ER-C
Total User Benefits ($M)	$64	$79	$79

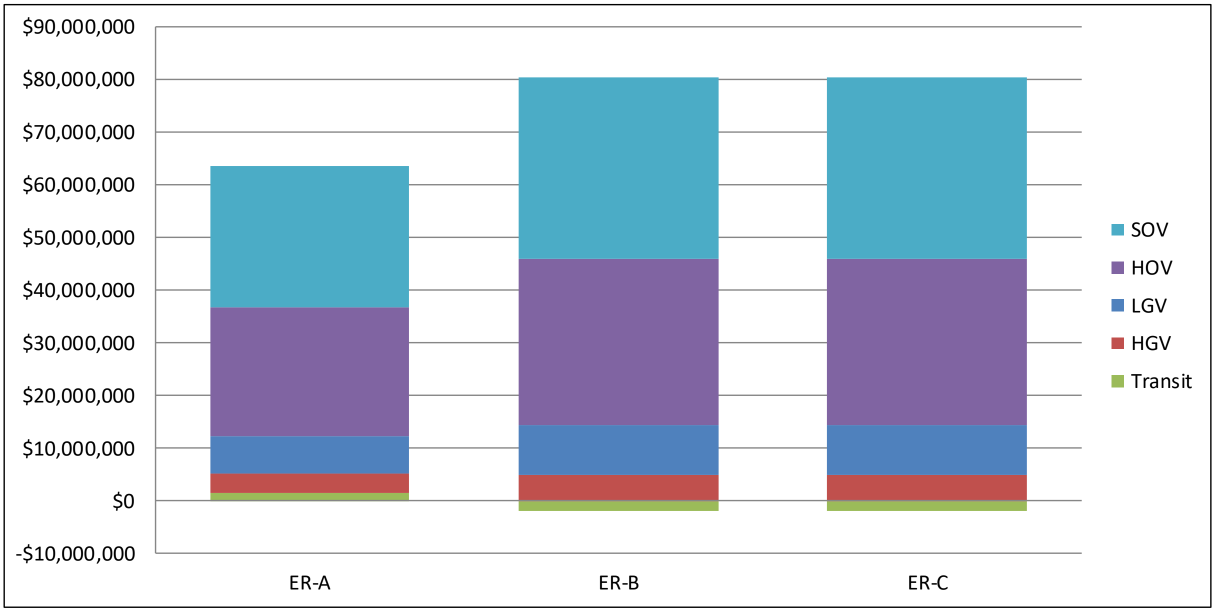


Figure 6.3: Discounted 25 Year User Benefits (in 2018 Dollars)

Pedestrian and Cycling Accommodation

A qualitative assessment was conducted on each of the existing route options to evaluate the level of mobility provided to pedestrians and cyclists as well as the connectivity to key activity locations or other routes along the corridor. The findings of the assessment are discussed in the following subsections.

Existing Route Option ER-A

Relative to the Base Case, a shoulder is constructed along the length of Highway 97 through Peachland for use by cyclists and pedestrians, giving them the opportunity to use the highway without sharing the lane with motorists. However, the additional through lanes will increase traffic volumes and speeds, which will reduce the quality of the user experience for pedestrians and cyclists on the highway. The shoulders along the highway will support cycle tourism in the area but would not likely be a first-choice route for local cyclists, who would favour local roads over the highway where available.

The new signal at the intersection of Highway 97 and Trepanier Bench Road will make it easier for cyclists to complete turning movements. The existing traffic signals along the highway could include enhancements of road markings, detection and phasing to support cyclists crossing of, or tuning onto, the highway as appropriate.

Evaluation Output:

Somewhat better

Existing Route Option ER-B

Relative to the Base Case, a shoulder is constructed along the length of Highway 97 through Peachland for use by cyclists and pedestrians, giving them the opportunity to use the highway without sharing the lane with motorists. However, the additional through lanes will increase traffic volumes and speeds, which will reduce the quality of the user experience for pedestrians and cyclists on the highway. The shoulders along the highway will support cycle tourism in the area but would not likely be a first-choice route for local cyclists, who would favour local roads over the highway where available.

New grade separations at Drought Road, Lang Road, Ponderosa Drive, Chidley Road, and Princeton Avenue create five new opportunities for pedestrians and cyclists to cross Highway 97 without interacting with traffic on the highway. The new grade separations will include sidewalks and bike lanes or cycle tracks. Multi-use paths may also be considered at one or more of these grade separation locations.

The conversion of the traffic signal at Clement Crescent to a right-in, right-out intersection may increase speeds on the highway and make it more difficult for cyclists to complete turning movements.

Evaluation Output:

Somewhat better

Existing Route Option ER-C

Relative to the Base Case, a shoulder is constructed along the length of Highway 97 through Peachland for use by cyclists and pedestrians, giving them the opportunity to use the highway without sharing the lane with motorists. However, the additional through lanes will increase traffic volumes and speeds, which will reduce the quality of the user experience for pedestrians and cyclists on the highway. The shoulders along the highway will support cycle tourism in the area but would not likely be a first-choice route for local cyclists, who would favour local roads over the highway where available.

New grade separations at Drought Road, Seclusion Bay Road, Shaw Road, Ponderosa Drive, Chidley Road, and Princeton Avenue create six new opportunities for pedestrians and cyclists to cross Highway 97 without interacting with traffic on the highway. The new grade separations will include sidewalks and bike lanes or cycle tracks. Multi-use paths may also be considered at one or more of these grade separation locations.

The conversion of the traffic signal at Clement Crescent to a right-in, right-out intersection may increase speeds on the highway and make it more difficult for cyclists to complete turning movements.

Evaluation Output:

Somewhat better

6.2.2 Socio-Community Account

Under this account, the seven criteria include property impacts, noise impacts, visual impacts, community severance, and consistency with community plans.

Property Impacts

This criterion considered the additional right-of-way required and the number of individual properties impacted. The number of affected properties has been categorized by those properties likely to be fully impacted and those that are likely to only be partially impacted.

Due to the limited information available with respect to the horizontal and vertical geometry for each existing route option, the affected areas have not been estimated as this parameter is highly dependent upon the horizontal and vertical geometry of the various improvement measures as well as the terrain.

The estimated property impacts for each existing route option is summarized in ***Table 6.11***.

Table 6.11: Estimated Property Impacts – Existing Route Options

PROPERTY TYPE		AREA (M2)	ROUTE OPTION		
			ER-A	ER-B	ER-C
Residential	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Business / Commercial	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Industrial	Partial	n/a	0	0	0
	Full	n/a	0	0	0
ALR	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Vacant	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Total Partial			92	83	88
Total Full			18	30	36
Total (impacted properties			**110**	**113**	**124**

As can be seen in the table above, a significant amount of properties are impacted by each existing route option with Option ER-C having the most property impacts in terms of number of properties affected.

Noise Impacts

Impacts related to noise where based primarily upon the magnitude of traffic demand and the proximity of the roadways to adjacent developments.

Option ER-A

This option follows the existing highway alignment except for a small realignment around Antlers Beach. The traffic volumes are forecast to increase slightly into the future. This option widens the existing two-lane highway to four lanes which will result in the travel lanes being closer to adjacent properties along the highway. Also, converting some intersections to right-in / right-out along the highway and the building of new local road connections to support accessibility for this option, will add traffic and impact traffic noise for some properties along municipal roads in the following areas:

- Drought Road between Robinson Road and Seclusion Bay Road;
- Buchanan Road and Robinson Place;
- Chidley Road, Clements Road and Todd Road; and
- Renfrew Road and Hardy Avenue.

Therefore, noise impacts for this option are anticipated to increase somewhat compared to the Base Case.

Evaluation Output:

Somewhat Worse

Option ER-B

This option follows the existing highway alignment except for a short bypass between Hawkes Street and Thorne Road. The traffic volumes are forecast to increase slightly into the future. This option widens the existing two-lane highway to four lanes which will result in the travel lanes being closer to the adjacent properties along the highway. Also, converting some intersections to right-in / right-out along the highway and the building of new local road connections to support accessibility for this option, will add traffic and impact traffic noise for some properties along municipal roads in the following areas:

- Drought Road between Robinson Road and Seclusion Bay Road;
- Buchanan Road, Robinson Place, Huston Road, Lang Road, H and Eyre Road;
- Chidley Road, Clements Road, Todd Road, Ponderosa Drive and 13 Street;
- Princeton Avenue; and
- Lands adjacent the short bypass of Highway 97 between Hawkes Street and Thorne Road.

Therefore, noise impacts for this option are anticipated to increase somewhat compared to the Base Case.

Evaluation Output:

Somewhat Worse

Option ER-C

This option follows the existing highway alignment except for a short bypass between Hawkes Street and Thorne Road. The traffic volumes are forecast to increase slightly into the future. This option widens the existing two-lane highway to four lanes which will result in the travel lanes being closer to the adjacent properties along the highway. Also, converting some intersections to right-in / right-out along the highway and the building of new local road connections to support accessibility for this option, will add traffic and impact traffic noise for some properties along municipal roads in the following areas:

- Drought Road between Robinson Road and Seclusion Bay Road;

- Buchanan Road, Robinson Place, and Huston Road;
- Chidley Road, Clements Road, Todd Road, Ponderosa Drive and 13 Street;
- Princeton Avenue; and
- Lands adjacent the short bypass of Highway 97 between Hawkes Street and Thorne Road.

Therefore, noise impacts for this option are anticipated to increase somewhat compared to the Base Case.

Evaluation Output:

Somewhat Worse

Visual Impacts

This criterion considered the potential visual intrusion of the existing route options in terms of the impact to sight lines from adjacent residents and businesses. The qualitative evaluation of the alternate options was conducted in comparison to the Base Case.

Option ER-A

This existing route option involves widening of the highway from two lanes to four lanes which may result in some locations where rock cuts or slope fills are required. If these rock cuts and / or slope fills are of a significant height (>3 metres), then there may be some visual impacts to residents both adjacent to the corridor as well as closure to the lake shore.

More specifically, the realignment of the intersection at Huston Road / Buchanan Road may have some minor visual impacts as would the extension of Clements Avenue to Chidley Road. The widening of the intersection at Princeton Avenue may also have some localized visual impacts. Significant visual impacts are anticipated in the Antlers Beach area due to the realignment of the highway and impacts to the adjacent residents.

Evaluation Output:

Somewhat worse – local visual impacts at two areas (at least) along the highway

Option ER-B

This existing route option involves widening of the highway from two lanes to four lanes which may result in some locations where rock cuts or slope fills are required. If these rock cuts and / or slope fills are of a significant height (>3 metres), then there may be some visual impacts to residents both adjacent to the corridor as well as closure to the lake shore. The short bypass at the southern end of the route will also create visual impacts to various residents along the new route.

More specifically, the realignment of Lang Road and the new overpass structure will have some visual impacts to the adjacent residents in this area – on both sides of the highway. Similarly, the new overpass structure connecting Chidley Road with Todd Road will have visual impacts for several residents on either side of the highway. The new overpass structure connecting Ponderosa Drive with 13 Street will create visual impacts to many residents in the adjacent area. Finally, the widening of the highway at Princeton Avenue and development of an interchange will also have some significant localized visual impacts.

Evaluation Output:

Significantly Worse – local visual impacts at four areas (at least) along the highway

Option ER-C

This existing route option involves widening of the highway from two lanes to four lanes which may result in some locations where rock cuts or slope fills are required. If these rock cuts and / or slope fills are of a significant height (>3 metres), then there may be some visual impacts to residents both adjacent to the corridor as well as closure to the lake shore. The short bypass at the southern end of the route will also create visual impacts to various residents along the new route.

More specifically, the realignment of the Huston Road intersection coupled with the new overpass structure connecting Shaw Road with Buchanan Road will have significant visual impacts to the adjacent residents in this area – on both sides of the highway. Similarly, the new overpass structure connecting Chidley Road with Todd Road will have visual impacts for several residents on either side of the highway. The new overpass structure connecting Ponderosa Drive with 13 Street will create visual impacts to many residents in the adjacent area. Finally, the widening of the highway at Princeton Avenue and development of an interchange will also have some significant localized visual impacts.

Evaluation Output:

Significantly Worse – local visual impacts at four areas (at least) along the highway

Community Severance

This criterion will consider the barrier effect of a new higher speed or wider road on the existing community structure and linkages. Lack of connectivity and / or accessibility across the corridor can negatively affect pedestrian, cyclist and local vehicle movements. Severance may also create psychological barriers to trip planning.

Existing Route Option ER-A

Additional through lanes on Highway 97 will widen the pavement and will increase vehicle volumes and possibly speeds, making it more difficult to cross the corridor for all travel modes. In addition, the widening will contribute to the existing “barrier effect” of the highway between origins and destinations on opposite sides of the highway.

The modification of the existing intersections at Drought Road, Seclusion Bay Road, Huston Road/Buchanan Road, Todd Road, Renfrew Road, and Hardy Street to right-in, right-out configurations will create six new locations where crossing the highway is more circuitous which in turn increases the level of community severance. Changing these intersections to right-in, right-out configurations will also increase route complexity and travel time for road users that currently rely on these accesses.

Closing access to Highway 97 at Buchanan Road (West) and Chidley Road reduces connectivity and accessibility in two areas.

However, new local road connections between Seclusion Bay Road and Drought Road, Chidley Road and Clements Crescent, and Princess Street and Lipsett Avenue increases local connectivity in three areas for all road users. Although, access to / from the highway is reduced for these same areas as mentioned above, especially in the Antlers Beach area due to the realignment of the highway.

The new traffic signal at Trepanier Bench Road makes turning movements across the highway easier and should reduce the severance effects in this area.

Evaluation Output:

Somewhat Worse

Existing Route Option ER-B

Additional through lanes on Highway 97 will widen the pavement and will increase vehicle volumes and possibly speeds, making it more difficult to cross the corridor for all travel modes. In addition, the widening will contribute to the existing "barrier effect" of the highway between origins and destinations on opposite sides of the highway.

The new grade separations at Drought Road, Lang Road, Ponderosa Drive, Chidley Road, and Princeton Avenue create five new opportunities for all road users to cross Highway 97 unimpeded.

The modification of the existing intersections at Drought Road, Huston Road/Buchanan Road, and Clements Crescent to right-in, right-out configurations will create three new locations where community severance is increased. Changing these intersections to right-in, right-out configurations will also increase route complexity and travel time for road users that currently rely on these accesses.

Closing access to Highway 97 at Seclusion Bay Road, Buchanan Road (West), Trepanier Bench Road, and 13 Street will also reduce connectivity and accessibility in four areas. However, new local road connections between Seclusion Bay Road and Drought Road, and between Ponderosa Drive and Clements Crescent will increase local connectivity in two areas for all road users.

Evaluation Output:

Neutral compared to the Base Case

Existing Route Option ER-C

Additional through lanes on Highway 97 will widen the pavement and will increase vehicle volumes and possibly speeds, making it more difficult to cross the corridor for all travel modes. In addition, the widening will contribute to the existing "barrier effect" of the highway between origins and destinations on opposite sides of the highway.

The new grade separations at Drought Road, Seclusion Bay Road, Shaw Road, Ponderosa Drive, Chidley Road, and Princeton Avenue create six new opportunities for all road users to cross Highway 97 unimpeded.

The modification of the existing intersections at Drought Road, Huston Road/Buchanan Road, and Clements Crescent to right-in, right-out configurations will create three new locations where crossing the highway is more circuitous which in turn increases the level of community severance. Changing these intersections to right-in, right-out configurations will also increase route complexity and travel time for road users that rely on these accesses.

Closing access to Highway 97 at Buchanan Road (West), Trepanier Bench Road, and 13 Street reduces connectivity in three areas. However, new local road connections between Seclusion Bay Road and Drought Road, and between Ponderosa Drive and Clements Crescent will increase local connectivity in two areas for all road users.

Evaluation Output:

Neutral compared to the Base Case

Consistency with Community Plans

This criterion considered the community plans of the District of Peachland that have been developed to guide growth within the community. The primary resource was the Official Community Plan (OCP) for Peachland, however, information gathered through the various stakeholder meetings was also considered in evaluating the options.

Existing Route Option ER-A

Focus groups for the OCP identified the need for traffic signals and grade separations at Highway 97 for vehicles, pedestrians, and cyclists, in addition to additional local road connectivity parallel to the highway. This option includes many of these items, however no grade separations are included.

The OCP identifies a need for improvements to Highway 97 but does not specify whether a new alternate route or widening the existing route is preferred.

Evaluation Output:

Somewhat Better, as this option somewhat conforms with the District of Peachland planning documents.

Existing Route Option ER-B

Focus groups for the OCP identified the need for grade separations at Highway 97 for vehicles, pedestrians, and cyclists, in addition to additional local road connectivity parallel to the highway. This option includes these items.

The connection between Ponderosa Drive and Clements Crescent is a proposed future road in the OCP Major Street Network.

The OCP identifies a need for improvements to Highway 97 but does not specify whether a new bypass route or widening the existing route is preferred.

Evaluation Output:

Somewhat Better, as this option somewhat conforms with the District of Peachland planning documents

Existing Route Option ER-C

Focus groups for the OCP identified the need for grade separations at Highway 97 for vehicles, pedestrians, and cyclists, in addition to additional local road connectivity parallel to the highway. This option includes these items.

The connection between Ponderosa Drive and Clements Crescent is a proposed future road in the OCP Major Street Network.

The OCP identifies a need for improvements to Highway 97, but does not specify whether a new bypass route or widening the existing route is preferred.

Evaluation Output:

Somewhat Better, as this option somewhat conforms with the District of Peachland planning documents

6.2.3 Environmental Account

Under this account, the four criteria include terrestrial impacts, aquatic impacts, archeology / historical impacts, and greenhouse gas emissions.

Terrestrial Impacts

The terrestrial impacts of each existing route option were qualitatively assessed based on a high level desktop review of available information within the study area using online government resources such as:

- The BC Ministry of Forests, Lands, and Natural Resource Operations online mapping application (iMapBC);
- The BC Conservation Data Centre Species and Ecosystem Explorer database (BC CDC);
- The Wildlife Tree Stewardship Atlas (WiTS);
- The British Columbia Blue Herons Atlas (GBHMT);
- The Ministry of Environment and Climate Change Strategy (MECCS) HabitatWizard; and,
- Various municipal mapping applications.

Along with Indigenous knowledge and input as well as pertinent regulatory acts such as the Species at Risk Act (SARA), such resources allowed for the estimation of the presence of at-risk species, the amount and severity of impacted vegetation, and what environmental reviews are expected to be necessary. For at risk species, the specific SARA status and BC list status are given.

The existing route options, for the most part, follow the existing Highway 97 corridor. Although the existing route options may travel through environmentally sensitive areas or create barriers for wildlife migration, these impacts are already occurring due to the presence of the existing highway. As all existing route options propose to widen the existing highway, this may increase the negative terrestrial impacts, but not to the same degree as building a new highway. With this understanding, the terrestrial impacts of the existing route options are highlighted for the five route sections - from the north to the south.

Existing Route – Drought Hill Segment

All the existing route options follow a common alignment and cross through numerous vegetation polygons containing red-listed ecosystems (endangered or threatened) and blue-listed ecosystems (special concern). The routes also affect four areas containing sensitive ecosystems (woods, riparian, and sparsely vegetated). In addition:

- The route options travel through large areas of rock outcrop that would potentially be lost or altered by the alignment.
- Portions of the route alignment is within areas designated as “Very High” or “High” conservation ranking, primarily along the Drought Creek area.
- Relative biodiversity in the areas along these routes is “Low” or “Very Low”.

In general, the existing route options are predicted to have relatively high effects on areas of environmental concern, particularly around Seclusion Bay and Drought Creek.

Existing Route – Buchanan to Trepanier Segment

All the existing route options travel through two vegetation polygons containing red-listed ecosystems (endangered or threatened) and one containing blue-listed ecosystems (special concern). In addition:

- The routes also affect several areas containing sensitive ecosystems (woodlands and Sparsely vegetated).
- A portion of the route alignment is within one area designated as “High” conservation ranking.
- Relative biodiversity in the areas along these route options is “Low” or “Very “Low”.

The existing route options through this segment of the alignment are predicted to have relatively low effects on areas of environmental concern.

Existing Route – Trepanier to Ponderosa Segment

All the existing route options cross through one vegetation polygon containing red-listed ecosystems (endangered or threatened) and a few polygons with blue-listed ecosystems (special concern). In addition:

- Portions of the route option alignment is within areas designated as “Very High” or “High” conservation ranking, primarily along the Trepanier Creek corridor.
- Relative biodiversity in the areas along the route options is primarily “Very Low”, with some areas of “Low” or “Moderate”, and one or two areas of “High” relative biodiversity.

The existing route options are predicted to have relatively high effects on areas of environmental concern, particularly around Trepanier Creek corridor.

Existing Route – Princeton Segment

The existing route options do not affect red-listed blue-listed or sensitive ecosystems along this segment. Options ER-B and ER-C have a portion of their alignment within one area designated as “High” conservation ranking (however relatively low proportion compared to other options).

The route options are predicted to have negligible effects on areas of environmental concern within this segment.

Existing Route – Princeton to Antlers Beach Segment

The route options cross through seven vegetation polygons containing red-listed ecosystems (endangered or threatened) and 13 or 16 polygons with blue-listed ecosystems (special concern). In addition:

- The routes affect over 20 areas containing sensitive ecosystems (woodlands, riparian, grassland, and sparsely vegetated).
- The route options have portions of the alignment within areas designated as “Very High” or “High” conservation ranking – primarily along the Peachland Creek and Unnamed 9 stream corridors.
- Relative biodiversity in the areas along these existing route options are primarily “Very Low”, “Low”, or “Moderate”, and one or two areas of “High” relative biodiversity.

The existing route options are predicted to have the highest effects on areas of environmental concern, particularly around Peachland Creek corridor.

Evaluation Output:

Overall the existing route options, in terms of terrestrial impacts, are qualitatively rated in comparison to the Base Case as follows:

- *Route Option ER-A – Somewhat Worse*
- *Route Option ER-B – Somewhat Worse*
- *Route Option ER-C – Somewhat Worse*

Aquatic Impacts

The aquatic impacts of each existing route option were qualitatively assessed based on a high level desktop review of available information within the study area using online government resource such as:

- iMapBC;
- BC CDC;
- MECCS Fisheries Information Data Queries (FIDQ);
- MECCS HabitatWizard; and,
- Various municipal mapping applications.

Along with Indigenous knowledge and input as well as pertinent regulatory acts such as the Fisheries Act and the Species at Risk Act, such resources allowed for the estimation of the presence of aquatic species, the amount and severity of impacted water bodies, and what environmental reviews are expected to be necessary.

The existing route options, for the most part, follow the existing Highway 97 corridor. As all existing route options propose to widen the existing highway, this may increase the negative aquatic impacts, but not to the same degree as building a new highway. With this understanding, the aquatic impacts of the existing route options are highlighted for the five route sections - from the north to the south.

Existing Route – Drought Hill Segment

There are two new and / or upgraded watercourse crossings required for the existing route options within this segment of the corridor (excluding required crossing upgrades along existing Highway 97 corridor that apply to all options):

- Unnamed 12;
- Drought Creek (1, 2, or 3 crossing locations).

These two stream corridors are affected by upgraded (or replacement) stream crossings – potential effects on fisheries and wildlife corridors.

- Watercourse ID “Unnamed 12” (310-747400) – potential for effects from crossing upgrades requires confirmation of flowing stream channel presence / alignment from field confirmation (orthophotography review finds this has likely already been diverted to a culvert and there is currently no visible channel). Potential for water quality impairment issues if a feature that does collect and drain water. May also provide juvenile salmonid or other fish habitat within the mouth of the stream, which is approximately 50 metres downstream of the stream crossing location. It is noted that there is a wildlife collision record on Highway 97 (wildlife species not confirmed) at this stream crossing location indicating its use as a wildlife corridor that is currently interrupted by the existing highway corridor.
- Drought Creek (310-751500) - fish observation records are not available for Drought Creek, but the mouth of Drought Creek along the Okanagan Lake shoreline is a “yellow zone” for Kokanee (*Oncorhynchus nerka*) salmon shoreline spawning, meaning it provides moderate or possibly some high value shore spawning habitat. Depending how far upstream from the mouth of Drought Creek is passable to fish – construction of new crossings for the Drought Road overpass may directly affect fish habitat, and potentially Kokanee salmon.
    - Option ER-A has 1 crossing of Drought Creek
    - Option ER-B has 2 crossings of Drought Creek
    - Option ER-3 has 3 crossings of Drought Creek, each with worsening effects.

The alignment through the Drought Creek riparian corridor is undesirable considering potential effects on aquatic resources, wildlife corridors and creation of water pollution. Among the existing route options, this alignment has relatively high potential effects because the existing conditions are undisturbed, with the exception of the other Highway 97 / 97C crossings.

Existing Route – Buchanan to Trepanier Segment

There are two new and / or upgraded watercourse crossings required for the existing route options (excluding required crossing upgrades along existing Highway 97 corridor that apply to all options):

- Unnamed 11 (1 or 2 crossing locations);
- Unnamed 12.

These two unconfirmed stream corridors are affected by upgraded (or replacement) stream crossings – potential effects on fisheries and wildlife corridors.

- Watercourse ID "Unnamed 11" (300-432687-748521) – Potential for effects from crossing upgrades requires confirmation of flowing stream channel presence / alignment from previous EAs for highway development and/or field confirmation. From orthophotographic image review – it appears the lowest section of this stream, somewhere north of the existing Highway 97 crossing, has been diverted into a culvert; no stream channel is visible downstream of the highway. This limits the potential for future water quality and habitat effects on this stream channel as it has likely already been impacted by development through diversion into a culvert.
- Effects on Unnamed 12 stream similar to all existing route options in this segment.

Both stream corridors require field confirmation of their existence in the location of the new stream crossings – based on a review of orthophotography, neither appear to have open stream channels with functioning riparian corridors at these crossing locations. If both have previously been diverted into culverts, the potential for effects on aquatic resources, wildlife corridors and water pollution is low. Based on the ultimate design of new crossing structures – there is the potential for stream channel daylighting by use of clear-span bridges. This could potentially serve to improve existing conditions for aquatic resources and wildlife corridors.

Existing Route – Trepanier to Ponderosa Segment

There is one new watercourse crossing required for the existing route options in this segment (excluding required crossing upgrades along existing Highway 97 corridor that apply to all options). At Trepanier Creek, one road crossing of the creek and one segment of new road adjacent to the stream centerline, are proposed.

Trepanier Creek (310-742200) is an important fish bearing stream containing multiple species including rainbow trout (*Oncorhynchus mykiss*) and Kokanee salmon. This creek has a stated Management Objective of "preservation." Summer low flows are considered a constraint for increasing rainbow trout fisheries production (BC MOE 2015b). Kokanee salmon habitat is considered a sensitive habitat feature (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing crossing is located near the mouth where Kokanee salmon spawning occurs.

Potential for similar effects from new road construction and operation, as well as direct fish habitat losses from new crossing connection construction between Chidley Road and Clements Crescent. Both options also include a new road segment connecting Chidley Road and Todd Road that is parallel to the stream at Todd Road, which should be avoided.

The mouth of Trepanier Creek is a “red zone” for Kokanee salmon shoreline spawning, meaning it provides high to very high value habitat for the long-term maintenance of productivity (>50 spawning fish observed). Depending on risk rating of activity, the Okanagan Large Lakes Protocol recommends avoidance of development in this zone or movement to lower risk area. Surrounding the “red zone” at the mouth of Trepanier Creek, there is an additional 500 metres on the east and west shoreline of “yellow zone” for Kokanee salmon shoreline spawning. This indicates moderate or possibly some high value shore spawning habitat (typically, there are yellow zones added as protection buffers along the shoreline at red zone creek mouths – for additional Kokanee salmon habitat protection). There is an important Kokanee salmon spawning location upstream of the new proposed crossing location.

It is noted that there are numerous wildlife collision records on Highway 97 (wildlife species not confirmed) at this stream crossing location – indicating its use as a wildlife corridor that is currently interrupted by the existing highway corridor.

Existing route alignments through Trepanier Creek riparian corridor are undesirable considering potential effects on aquatic resources, wildlife corridors and creation of water pollution. Among existing route options, this route segment has relatively high potential effects because the existing conditions are undisturbed, with the exception of the existing Highway 97 crossing.

Existing Route – Princeton Segment

Negligible to minimal potential for effects on aquatic resources, wildlife corridors and water pollution anticipated from Option ER-A – only signalization involved with this option and widening of Highway 97.

Options ER-B and ER-C would potentially require modification to the existing shoreline of Okanagan Lake to accommodate the new on and off ramps and connection of Princeton Avenue to Beach Avenue underneath Highway 97. This is within Foreshore Inventory Mapping (FIM) segment number 281 (Ecoscape 2011), which was rated as having “moderate” current habitat index rating and “High” juvenile salmonid rearing capability. There is the potential for habitat improvement as part of highway construction, as the current shoreline is currently highly modified by highway fill and rip rap armouring with the current alignment being immediately adjacent to the shoreline.

Existing Route – Princeton to Antlers Beach Segment

There are several new and / or upgraded watercourse crossings required for the existing route options in this segment (excluding required crossing upgrades along existing Highway 97 corridor that apply to all options):

- McCall Creek (1 or 2 new crossings);
- Peachland Creek (2 or 3 new crossings, different locations);
- Unnamed 8;
- Unnamed 9 (ER-B and ER-C only).

Four stream corridors are affected by upgraded (or replacement), or new stream crossings – potential effects on fisheries and wildlife corridors.

- McCall Creek (310-731400) is a first order tributary of Okanagan Lake. McCall Lake (at the headwaters) is stocked with eastern brook trout (*Salvelinus fontinalis*) and rainbow trout, and there are recorded observations of bull trout (*Salvelinus confluentus*). No data are available to determine if fish bearing at proposed crossing locations. Potential for water quality impairment effects on stream providing food and nutrient value to downstream fish bearing habitat (Okanagan Lake shoreline at mouth of McCall Creek) from new crossing construction. The mouth of McCall Creek along Okanagan Lake shoreline is a “yellow zone” for Kokanee salmon shoreline spawning, meaning it provides moderate or possibly some high value shore spawning habitat. Depending how far up from the mouth of McCall Creek is passable to fish – the new crossings may directly affect fish habitat, and potentially Kokanee salmon spawning habitat.
- Peachland Creek (310-725700) is fish bearing (rainbow trout, eastern brook trout, and Kokanee salmon). This creek is an important rainbow trout habitat; 12,000 of 90,000 total stream spawning rainbow trout for Okanagan Lake spawn in this stream (BC MOE 2015b). This creek is also considered an important Kokanee salmon spawning channel (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing bridge crossing is located at the mouth where salmonid spawning occurs. There is an important Kokanee salmon spawning location upstream of the new proposed crossing location, within Hardy Falls Regional Park. The mouth of Peachland Creek is a “red zone” for Kokanee salmon shoreline spawning, meaning it provides high to very high value habitat for the long-term maintenance of productivity (>50 spawning fish observed). Depending on risk rating of activity, the Okanagan Large Lakes Protocol recommends avoidance of development in this zone or movement to lower risk area. Surrounding the “red zone” at the mouth of Peachland Creek, there is an additional 500 m on the east and west shoreline of “yellow zone” for Kokanee salmon shoreline spawning. This indicates moderate or possibly some high value shore spawning habitat (typically there are yellow zones added as protection buffers along the shoreline at red zone creek mouths – for additional Kokanee salmon habitat protection).
- Watercourse ID “Unnamed 8” (310-724484) – Potential for impairment from crossing upgrades requires confirmation of flowing stream channel presence / alignment from previous EAs for highway development and/or field confirmation. Potential for water quality impairment issues if a feature that does collect and drain water. From orthophotographic image review – it is not possible to discern a visible stream channel or outlet to Okanagan Lake. Despite this, the mouth of this creek is mapped as a “yellow zone” for Kokanee salmon shoreline spawning, meaning it provides moderate or possibly some high value shore spawning habitat. Depending how far up from the mouth is passable to fish – this may directly affect fish habitat, and potentially Kokanee salmon.
- Watercourse ID “Unnamed 9” (310-727661) – Potential for impairment from new crossing requires confirmation of flowing stream channel presence / alignment from previous EAs for highway development and/or field confirmation. Potential for water quality impairment issues if a feature that does collect and drain water. From orthophotographic image review – it is not possible to discern a visible stream channel or outlet to Okanagan Lake.

Alignment through Peachland Creek riparian corridor is highly undesirable considering potential for effects on aquatic resources, wildlife corridors, and creation of water pollution. Among options, this alignment has the highest potential effects because the existing conditions upstream of the existing highway crossing are undisturbed and protected within Hardy Falls Regional park, with high wildlife value.

Option ER-A would create two new disturbances on Peachland Creek from an upgraded crossing at Renfrew Road and a new, substantial disturbance from the realigned highway crossing. If a clear-span bridge, the aquatic habitat effects would be minimized; however, there would still be associated losses of riparian habitats associated with these new and upgraded crossings. Existing issues at the existing Highway 97 crossing would continue (as the road alignment would not change, just be downgraded to a municipal road).

Option ER-A would also potentially require modification to the existing shoreline of Okanagan Lake to accommodate the new right in / right out turn onto the newly realigned Highway 97. This is within Foreshore Inventory Mapping (FIM) segment number 281 (Ecoscape 2011), which was rated as having “moderate” current habitat index rating and “High” juvenile salmonid rearing capability. There is the potential for habitat improvement as part of highway construction, as the current shoreline is currently highly modified by highway fill and rip rap armouring with the current alignment being immediately adjacent to the shoreline.

Option ER-B and ER-C would create a new, substantial disturbance of Peachland Creek from the realigned highway crossing. If a clear-span bridge, the aquatic habitat effects would be minimized; however, there would still be associated losses of riparian habitats associated with new crossing. Existing issues at the existing Highway 97 crossing would continue (as the road alignment would not change, just be downgraded to a municipal road).

Evaluation Output:

Overall the existing route options, in terms of aquatic impacts, are qualitatively rated in comparison to the Base Case as follows:

- *Option ER-A – Somewhat Worse*
- *Option ER-B – Somewhat Worse*
- *Option ER-C – Somewhat Worse*

Archaeological / Historical Impacts

The archaeological / historical impacts of each existing route option were qualitatively assessed based on a high level desktop review of available information within the study area. Any archaeologically or historically significant impacts will be noted and ranked in terms of the severity of impact. The qualitative evaluation will determine whether each option would have good, fair or poor impacts with respect to the Base Case.

The existing route options, for the most part, follow the existing Highway 97 corridor. As all existing route options propose to widen the existing highway, this may increase the negative archaeological and historic impacts. The archaeological and historic impacts of the existing route options are highlighted for the five route segments - from the north to the south.

Existing Route – Drought Hill Segment

There is one recorded archaeological site (DkQv-42) adjacent to this section of the existing route options.

All the existing route options in this segment have similar potential for affecting archaeological sites; among the various route segments, the potential for this segment to affect archaeological sites is high– as there is already a recorded site immediately adjacent to the alignment. A review of the type of site present at this location is required to make further recommendations regarding the need for avoidance.

Existing Route – Buchanan to Trepanier Segment

There are no recorded archaeological sites are within this route segment. However, there is potential for the existing route options to affect archaeological sites as there is a high proportion of the new alignments that cross through areas mapped as having “high” archaeological potential.

Existing Route – Trepanier to Ponderosa Segment

There is one recorded archaeological site along Trepanier Creek (DkQw-45) that is within this segment of the existing route options.

All the existing route options within this segment have similar potential for affecting archaeological sites; among the various route segments, the potential for this segment to affect archaeological sites is high– as there is already a recorded site within the alignment. Review of the type of site present at this location is required to make further recommendations regarding the need for avoidance. If avoidance of the registered archaeological site is not possible, the completion of archaeological permitting and assessment will be necessary.

Existing Route – Princeton Segment

There is negligible to minimal potential for effects on archaeological sites anticipated from Option ER-A – only signalization involved with this option and widening of Highway 97.

Options ER-B and ER-C would potentially require modification to the existing shoreline of Okanagan Lake to accommodate the new on and off ramps and connection of Princeton Avenue to Beach Avenue underneath Highway 97. One recorded historic site (DkQw385) is within this segment of the corridor.

Existing Route – Princeton to Antlers Beach Segment

There is one recorded archaeological site along Peachland Creek (DkQw-21) that is within this route segment. Another site (DkQw-5) is adjacent to this segment.

All the existing route options within this route segment have similar potential for affecting archaeological sites; among the various route segments, the potential for this segment to affect archaeological sites is high – as there is already a recorded site within the alignment for this segment. A review of the type of site present at this location is required to make further recommendations regarding the need for avoidance. If avoidance of the registered archaeological site is not possible, the completion of archaeological permitting and assessment will be necessary.

Evaluation Output:

Overall the existing route options, in terms of archaeological and historic impacts, are qualitatively rated in comparison to the Base Case as follows:

- *Option ER-A – Somewhat Worse*
- *Option ER-B – Somewhat Worse*
- *Option ER-C – Somewhat Worse*

Greenhouse Gas Emissions

This criterion considered the impacts of greenhouse gas emissions (GHG), and the potential reductions or increases in GHGs that the project would enable. When quantifying these GHG in terms of dollar value (PV over 25 years), the Government of Canada's forecasted Social Cost of Carbon per emission year will be used.

Vehicle operations-related greenhouse gas emission impacts were estimated based on the fuel consumption associated with vehicle use in the Base Case and for each option. Fuel consumption was then converted into CO_2 equivalent emissions using the factors provided in ***Table 6.12,*** and then monetized using an increasing yearly rate beginning at $47.28 (in 2018$) per tonne of emitted CO_2 equivalent. Greenhouse gas emissions associated with construction of the options are not included in this assessment.

Table 6.12: Quantitative Analysis Inputs for Greenhouse Gas Emission Savings

VARIABLE NAME	VALUE	SOURCE	COMMENTS
Emitted CO_2 Equivalent for Gasoline	2.363 kilograms of CO_2 equivalent / litre of gasoline	*2016 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, BC Ministry of Environment, May 2016	Based on average of Light-duty Vehicle and Light-duty Truck (includes SUV and Minivan) in Table 7 of source document.
Emitted CO_2 Equivalent for Diesel	2.630 kilograms of CO_2 equivalent / litre of diesel	*2016 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, BC Ministry of Environment, May 2016	Based on Heavy-duty Transport Mode in Table 7 of source document.
Value of CO_2 Equivalent Damages	Variable by year (i.e. increasing value per tonne over time in constant dollars)	*Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates*, Environment and Climate Change Canada, March 2016.	Inflated from 2012$ to 2018$ using Statistics Canada Consumer Price Index.

Results of the analysis are provided in ***Table 6.13*** below.

Table 6.13: Greenhouse Gas Emission Savings

	EXISTING ROUTE OPTION		
	ER-A	ER-B	ER-C
Greenhouse Gas Emission Reductions (kg)	20 M	20 M	20 M
Greenhouse Gas Emission Reductions ($M)	$0.5	$0.5	$0.5

6.2.4 Financial Account

Under this account, the four primary criteria include capital costs, property costs, salvage value, and maintenance and operations costs. For each criterion, results have been presented in Present Value (PV 2018$) as estimated over a 25 year analysis period and discounted at an annual rate of 6%. Other key assumptions, required to estimate the present value of each option, for the purpose of equivalent comparisons, include:

- Further Planning and detailed design efforts to be completed by 2021;
- Construction of any option to begin in 2022 with a duration of three years;
- Benefits to accrue in 2025.

Capital Cost

The relative construction cost of each option has been developed at a high level using single line sketch representations of the improvement options and composite linear costs based on a typical road cross section. Separate costs for roadways, deck areas for bridges, and general lengths of retaining walls were separated in the overall cost estimates. This information provided input to the Wolski method spreadsheets. Given the high level nature of the cost estimates at this time, a 40% contingency has been applied.

The total construction costs (2018$) for the options are presented in ***Table 6.14*** using a range of cost values as follows: $ (<$100 Million) → $$$$$ ($500 Million). These costs were also estimated in Present Value (PV 2018$) but have been presented in the table using the same range of cost values.

Table 6.14: Existing Route Options - Total Construction Costs

	EXISTING ROUTE OPTION		
	ER-A	ER-B	ER-C
Construction Costs (2018$)	$$$	$$$$	$$$$
Construction Costs (PV)	$	$$	$$

Property Costs

Due to the high level nature of the option development in terms of the defining the vertical and horizontal geometry for each existing route option, property impacts and related costs have only be estimated at a similar high level. Property costs are therefore based on a very high level estimate of the proposed number of properties impacted. This is an estimate only for the purposes of this report and in no way represents market value. The property costs are presented in ***Table 6.15*** using a range of cost values as follows: $ (<$20 Million) → $$$$$ ($100 Million).

Table 6.15: Property Costs

	EXISTING ROUTE OPTIONS		
	ER-A	ER-B	ER-C
Property Costs (Aggregate)	$$	$$$	$$$

More accurate costs will be prepared for the preferred option in the subsequent Phase II study.

Maintenance and Rehabilitation Cost

Roadway maintenance and resurfacing costs were estimated based on lane-kilometers of roadway in the Base Case and for each existing route option. Bridge maintenance and resurfacing costs were estimated based on total bridge deck surface area in the Base Case and for each existing route option. The net differences of each existing route option compared to the Base Case are summarized in ***Table 6.16***.

Table 6.16: Summary of Roadway and Bridge Deck Surface

MEASURE		EXISTING ROUTE OPTIONS		
		ER-A	ER-B	ER-C
Road Length (km)	Highway	13.0	13.2	13.2
	Crossing	3.4	5.6	5.8
	Ramp	0.4	2.0	1.2
	Total	16.8	20.9	20.2
Net Road Length (Ln-km)		**32.0**	**49.0**	**50.8**
Number of Overpasses	Segment 1	0	1	2
	Segment 2	0	1	1
	Segment 3	0	2	2
	Segment 4	0	1	1
	Segment 5	0	1	1
	Total	0	6	7
Net Total Bridge Surface Area (m^2)		**0**	**4,500**	**5,500**

Annual maintenance costs and schedule rehabilitation costs were then monetized using the factors provided in ***Table 6.17***.

Table 6.17: Assumptions for Maintenance and Resurfacing Costs

VARIABLE NAME	VALUE	SOURCE
Annual Road Lane Maintenance	(2012\$) \$3839/ln-km per year (2018\$) \$4236/ln-km per year	*Default Values for Benefit Cost Analysis in BC 2012*, BC MoTI
Annual Bridge Maintenance	(2012\$) \$19.9/m^2 per year (2018\$) \$21.9/m^2 per year	*Default Values for Benefit Cost Analysis in BC 2012*, BC MoTI
Road Lane Resurfacing	(2018\$) \$100,000/ln-km every 15 years	*Default Values for Benefit Cost Analysis in BC 2018*, BC MoTI
Bridge Deck Resurfacing	(2018\$) \$1,500/m^2 every 30 years	*Default Values for Benefit Cost Analysis in BC 2018*, BC MoTI

The estimated maintenance and operating costs for the existing route options are presented in ***Table 6.18*** below. Consideration for annual maintenance and rehabilitation costs have been based on a 25-year analysis period, therefore, these costs were calculated in Present Value (PV 2018$) but are presented in a range of cost values as follows: **$** (<$1 Million) → **$$$$$** ($5 Million).

Table 6.18: Existing Route Options - Maintenance and Operating Costs

	EXISTING ROUTE OPTION		
	ER-A	ER-B	ER-C
Maintenance and Operating Costs (PV)	$$	$$$$	$$$$

Salvage Value

The salvage value of the proposed infrastructure for each option at the end of the 25-year analysis period has been estimated as per the table below. The salvage value is based on the average life of the various road network improvements including roadways, structures, and acquired properties for additional right-of-way. The following service life values have been used:

- Property 100% (not included at this time)
- Roads – 25 years
- Structures – 50 years

The estimated salvage values the existing route options are presented in ***Table 6.19*** below. These costs have been based on a 25-year analysis period, therefore, these costs were calculated in Present Value (PV 2018$) but are presented in a range of cost values as follows: $ (<$20 Million) → $$$$$ ($100 Million). Property costs are not included.

Table 6.19: Existing Route Options - Salvage Values

	EXISTING ROUTE OPTION		
	ER-A	ER-B	ER-C
Salvage Value (PV)	$$	$$$	$$$

6.2.5 Summary

The results of the multiple account evaluation of the existing route options are summarized in ***Table 6.20***:

Table 6.20: Multiple Account Evaluation Summary – Existing Route

CRITERIA	UNITS	OPTION ER-A	OPTION ER-B	OPTION ER-C
CUSTOMER SERVICE ACCOUNT				
Traffic Mobility	v/c Ratio Travel Time (Min)	v/c ratio AM 0.4 to 0.6; v/c ratio PM 0.4 to 0.9 Route Average Travel Time Savings per trip: AM 1 to 3 min., PM 3 to 5 min.	v/c ratio AM 0.2 to 0.4; v/c ratio PM 0.3 to 0.6 Route Average Travel Time Savings per trip: AM 2 to 4 min., PM 4 to 7 min.	v/c ratio AM 0.2 to 0.4, PM 0.3 to 0.6 Route Average Travel Time Savings per trip: AM 2 to 4 min., PM 4 to 7 min.
Predicted Road Safety Performance	Crashes $(PV)	2025: 61.42 predicted crashes, $18.5M total crash costs 2043: 84.81 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$20.3 Million	2025: 46.9 predicted crashes, $15.5M total crash costs 2043: 67.76 predicted crashes, $21.9M total crash costs Total Safety Benefits: $3.2 Million	2025: 48.85 predicted crashes, $16.1M total crash costs 2043: 70.88 predicted crashes, $21.7M total crash costs Total Safety Benefits: -$2.1 Million
Network Travel Time & Vehicle Operation Cost Savings	$M (PV)	$64M	$79M	$79M
Pedestrian and Cycling Accommodation	Qualitative	New shoulder, but higher speeds and volumes. One new traffic signal. Somewhat better ◕	New shoulder, but higher speeds and volumes. Five new grade separations from Highway 97. One less traffic signal. Somewhat better ◕	New shoulder, but higher speeds and volumes. Six new grade separations from Highway 97. One less traffic signal. Somewhat better ◕
SOCIO COMMUNITY ACCOUNT				
Property Impacts	# of Properties	Partial Property Takes > 90; Full Property Takes > 15	Partial Property Takes > 80; Full Property Takes > 30	Partial Property Takes > 85; Full Property Takes > 35
Noise Impacts	Qualitative	Somewhat worse ◔	Somewhat worse ◔	Somewhat worse ◔
Visual Impacts	Qualitative	Visual impacts from any significant cut / fill. Minor impacts at least two intersection realignments along the corridor. Significant impacts anticipated at Antlers Beach. Somewhat worse ◔	Visual impacts from any significant cut / fill. Potential for significant impacts from three intersection realignments and overpass structures along the corridor. Impacts from bypass at south end of corridor. Significantly worse ○	Visual impacts from any significant cut / fill. Potential for significant impacts from three intersection realignments and overpass structures along the corridor. Impacts from bypass at south end of corridor. Significantly worse ○
Community Severance	Qualitative	Higher volumes and speeds and wider pavement. Six new right-in, right out intersections. Two closed Highway 97 accesses. Three new local road connections. One new traffic signal. Somewhat worse ◔	Higher volumes and speeds and wider pavement. Three new right-in, right out intersections. Four closed Highway 97 accesses. Two new local road connections. Three new grade separated crossings. Neutral ◑	Higher volumes and speeds and wider pavement. Three new right-in, right out intersections. Two closed Highway 97 accesses. Two new local road connections. Six new grade separated crossings. Neutral ◑
Consistency with Community Plans	Qualitative	Little or no impact on OCP. Neutral ◑	New road between Ponderosa Dr and Clements Cr is proposed in OCP. Neutral ◑	New road between Ponderosa Dr and Clements Cr is proposed in OCP. Neutral ◑
ENVIRONMENTAL ACCOUNT				
Terrestrial Impacts	Qualitative	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔	Several areas along the route, such as near Drought Creek and Trepanier Creek, are ranked high or very high for conservation. Somewhat Worse ◔
Aquatic Impacts	Qualitative	Potential impacts to eight watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. Somewhat Worse ◔	Potential impacts to nine watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. May also require modification to lake shoreline near the Princeton segment. Somewhat Worse ◔	Potential impacts to nine watercourses, including Trepanier Creek which provides hey value habitat to Kokanee salmon. May also require modification to lake shoreline near the Princeton segment. Somewhat Worse ◔
Archaeological / Historical Impacts	Qualitative	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔	Three known archaeological sites along the corridor. Some areas of the route rank high for archaeological potential. Somewhat Worse ◔
Greenhouse Gas Emission Benefits	$M (PV)	$0.5M	$0.5M	$0.5M
FINANCIAL ACCOUNT				
Capital Cost	Range	$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)
Property Costs	Range	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)
Maintenance and Rehabilitation Cost	Range	$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)
Salvage Value (not including property)	Range	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)

6.3 Evaluation of Options – Alternate Route

The three alternate route options have been evaluated using the evaluation framework described in the previous section. Where applicable, the analysis methodology and any assumptions are described along with the analysis outcomes.

6.3.1 Customer Service

Under this account, the five criteria include traffic mobility, predicted road safety performance, vehicle operating costs, travel time savings, and pedestrian / cycling accommodation. Due to the option analysis methodology employed, the results for Network Travel Time and Vehicle Operating Costs have been combined.

Traffic Mobility

The same methodology and assumptions as described under the evaluation of the existing route options was used to evaluate the alternate route options. *Table 6.21* summarizes the volume / capacity values for the three alternate route options for both the alternate routes and the existing route. The end to end route travel times for the three alternate route options are also shown for both the alternate routes and the existing route. For the measure of travel times, the modelled travel times are reported from the common start and end points to allow the options to be compared directly (i.e. between the Highway 97C interchange and approximately Greata Ranch Road). For comparison purposes, values reported are absolute travel times changes compared to the 2040 base.

Table 6.21: Alternate Route Volume / Capacity and Route Travel Times

MEASURE			PEAK HR	DIR	BASE	AR-A	AR-B	AR-C
Existing Route	Performance (v/c)	Segment 1 & 2	AM	NB	0.8	0.8	0.8	0.8
				SB	0.6	0.6	0.6	0.6
			PM	NB	0.9	0.9	0.9	0.9
				SB	1.1	1.1	1.1	1.0
		Segment 3	AM	NB	1.0	1.0	1.0	1.0
				SB	1.2	1.1	1.1	1.1
			PM	NB	1.2	1.2	1.2	1.2
				SB	1.3	1.3	1.3	1.2
		Segment 4 & 5	AM	NB	0.6	0.5	0.5	0.5
				SB	0.9	0.8	0.8	0.8
			PM	NB	0.8	0.8	0.8	0.7
				SB	1.1	1.1	1.1	1
	Travel Times (min)		AM	NB	0	0	0	0
				SB	0	-1	-1	-1
			PM	NB	0	0	0	-1
				SB	0	0	0	-2
Alternate Route	Performance (v/c)		AM	NB		0.0	0.0	0.0
				SB		0.0	0.0	0.0
			PM	NB		0.0	0.0	0.0
				SB		0.0	0.0	0.1
	Travel Times (min)		AM	NB	0	4	3	0
				SB	0	2	1	-2
			PM	NB	0	1	1	-3
				SB	0	-2	-2	-6

Peak hour volume-to-capacity ratios (v/c) are anticipated to improve only slightly along the existing route with any of the alternate route options. The alternate route is not anticipated to divert much traffic away from the existing route.

With any of the alternate route options, travel times are anticipated to reduce only slightly for shorter distance trips travelling on the existing route. The alternate route option that is closest to the existing Highway 97 facility (AR-C) could reduce travel times by several minutes in the southbound direction for longer distance trips.

Predicted Road Safety Performance

The same methodology and assumptions as described under the evaluation of the existing route options was used to evaluate the alternate route options. The results of the crash prediction analysis for the alternate route options is shown in ***Table 6.22*** and ***Table 6.23*** for the years 2025 and 2043.

Table 6.22: Crash Prediction Analysis Results (2025)

CRITERION	ALTERNATE ROUTE OPTIONS (2025)			
	BASE	AR-A	AR-B	AR-C
Evaluated Length (km)	12.1315	27.1563	25.5374	22.4172
Average Future Road AADT (vpd)	16,145	15,278/1,111	15,350/1,111	15,063/1,788
Total Crashes	69.1	67.68	67.77	67.13
Fatal Crashes	1.091	1.092	1.091	1.084
Injury Crashes	23.12	23.15	23.13	22.99
Property-Damage-Only Crashes	44.88	43.43	43.55	43.05
Crash Value (PV)	**$21.7 Million**	**$25.0 Million**	**$22.1 Million**	**$22.9 Million**

Table 6.23: Crash Prediction Analysis Results (2043)

CRITERION	ALTERNATE ROUTE OPTIONS (2043)			
	BASE	AR-A	AR-B	AR-C
Evaluated Length (km)	12.1315	27.1563	25.5374	22.4172
Average Future Road AADT (vpd)	21,190	2,0267/1,400	20,436/1,400	19,648/3,000
Total Crashes	90.98	89.87	90.31	88.83
Fatal Crashes	1.443	1.454	1.459	1.446
Injury Crashes	30.59	30.83	30.92	30.66
Property-Damage-Only Crashes	58.94	57.58	57.94	56.71
Crash Value (PV)	**$21.7 Million**	**$21.9 Million**	**$21.9 Million**	**$21.7 Million**

The total crash savings (PV 2018$), shown in ***Table 6.24***, have been estimated by summing the annual benefits over the 25 year analysis period. The benefits for the interim years have been linearly interpolated between the values derived for the assessed years of 2025 and 2043.

Table 6.24: Alternate Route Crash Prediction Analysis Results (Total Benefits)

	ALTERNATE ROUTE OPTIONS		
	AR-A	AR-B	AR-C
Total Safety Benefits (PV)	-$ 0.5 Million	-$ 0.6 Million	$ 0.5 Million

As can be seen in the table above, none of the alternate route options result in positive safety benefits.

Network Travel Time and Vehicle Operating Costs

The latest regional travel demand model was used in estimating the benefits related to network travel time and vehicle operating costs. The model was developed as part of the Central Okanagan Planning Study (COPS). Documentation on model structure, procedures, components, assumptions, methodology, calibration, and validation can be found in *COPS Regional Transportation Model – User Guide (Parsons 2015).*

To assist in the evaluation of the alternate route options, the following scenarios were modelled in the horizon years of 2014 and 2040:

- 2014:
  - Base Case
  - Alternate Route AR-A
  - Alternate Route AR-B
  - Alternate Route AR-C
- 2040:
  - Base Case + Committed
  - Alternate Route AR-A
  - Alternate Route AR-B
  - Alternate Route AR-C

The future transportation network changes that are assumed to form part of the 2040 base network were established through an extensive review of previous reports, transportation plans, official community plans, and discussions with BC MoTI and municipal representatives within the Central Okanagan Region. Committed projects, defined as those with a very high likelihood of being implemented in 2040, were assumed as part of the 2040 base network which encompasses the entire Central Okanagan Region.

The same methodology and assumptions as described under the evaluation of the existing route options was used to evaluate the alternate route options.

The user benefits of generalized cost savings, combining travel time savings and vehicle operating cost savings, were calculated by travel mode for all model scenarios for all time frames. Annual user benefits were calculated by applying the same expansion factors to the 2014 and 2040 model horizon years. Annual user benefits for the intermediate years were estimated by linear interpolation. All years between 2014 and 2040 were interpolated using 2014 and 2040 annual benefits. All years after 2040 were extrapolated using 2014 and 2040 annual benefits. Since all cost components used were in 2018 dollars as previously described, the annual user benefits were first calculated in 2018 dollars as shown in ***Figure 6.4***.

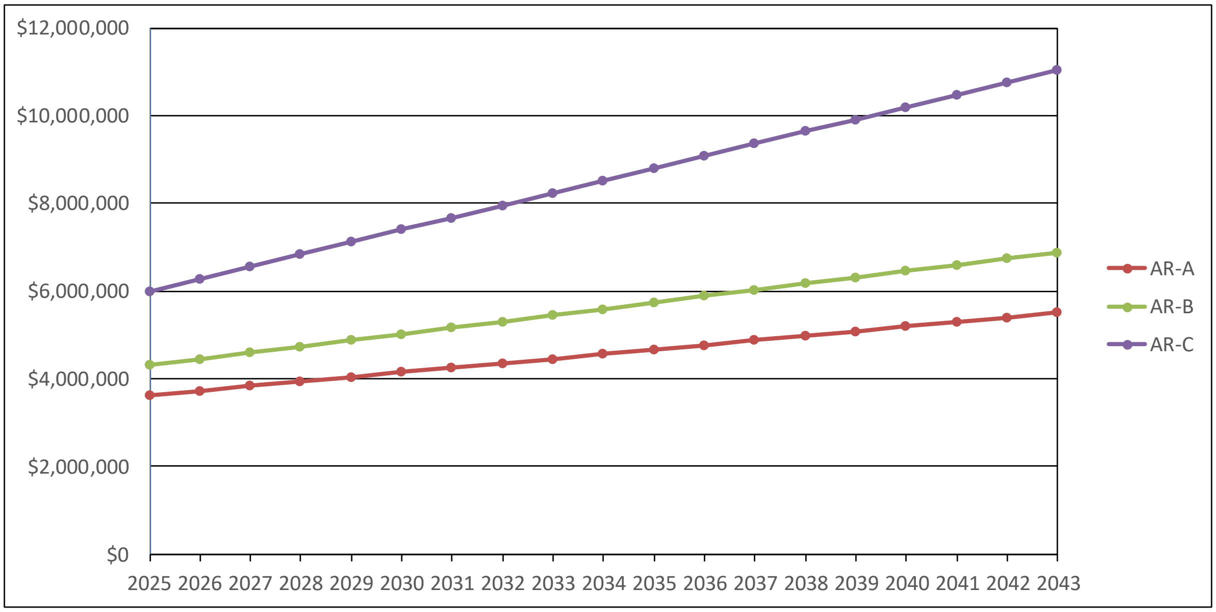


Figure 6.4: Annual User Benefits (in 2018 Dollars)

For a 25-year user benefit analysis covering the years between 2018 and 2043, and assuming design and construction will continue until 2024, the opening of any alternate route option was assumed to occur in 2025. Therefore, annual user benefits from 2025 to 2043 were discounted back to the current year 2018 using an industry standard annual social discount rate of 6%. The resulting 25-year user benefits in 2018 dollars are illustrated in ***Figure 6.5*** and summarized in ***Table 6.25***.

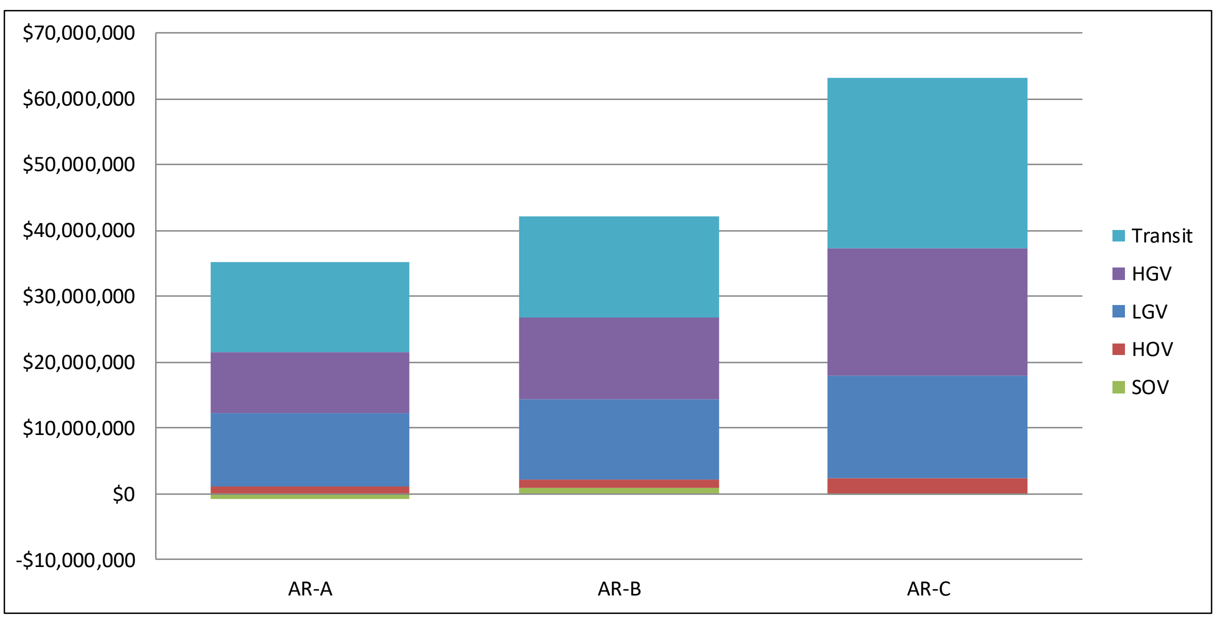


Figure 6.5: Discounted 25 Year User Benefits (in 2018 Dollars)

Table 6.25: Discounted 25 Year User Benefits (in 2018 Dollars)

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Total User Benefits ($M)	$34	$42	$63

For the alternate route options, the alignment closer to the existing Highway 97 corridor yield greater user benefits.

Pedestrian and Cycling Accommodation

A qualitative assessment was conducted on each of the alternate route options to evaluate the level of mobility provided to pedestrians and cyclists as well as the connectivity to key activity locations or other routes along the corridor. The findings of the assessment are discussed in the following subsections.

Alternate Route Option AR-A

This option creates a new route for cyclists and pedestrians between Highway 97 and Highway 97C on the shoulder of the alternate alignment but is unlikely to be used because of the steep grades, high speeds, and lack of facilities or amenities along the route. Accommodation for pedestrians and cyclists along the existing Highway 97 corridor remains unchanged.

Evaluation Output:

Neutral

Alternate Route Option AR-B

This option creates a new route for cyclists and pedestrians between Highway 97 and Highway 97C on the shoulder of the alternate alignment but is unlikely to be used because of the steep grades, high speeds, and lack of facilities or amenities along the route. Accommodation for pedestrians and cyclists along the existing Highway 97 corridor remains unchanged.

Evaluation Output:

Neutral

Alternate Route Option AR-C

This option creates a new route for cyclists and pedestrians between Highway 97 and Highway 97C on the shoulder of the alternate alignment which may be a viable alternative to the existing route because of the somewhat gentle grades and proximity to the developed area. Accommodation for pedestrians and cyclists along the existing Highway 97 corridor remains unchanged.

Evaluation Output:

Somewhat better

6.3.2 Socio-Community Account

Under this account, the seven criteria include property impacts, noise impacts, visual impacts, community severance, and consistency with community plans.

Property Impacts

This criterion considered the additional right-of-way required and the number of individual properties impacted. The number of affected properties has been categorized by those properties likely to be fully impacted and those that are likely to only be partially impacted.

Due to the limited information available with respect to the horizontal and vertical geometry for each alternate route option, the affected areas have not been estimated as this parameter is highly dependent upon the horizontal and vertical geometry of the various improvement measures as well as the terrain. The impacted properties have also not been identified by property type at this time. The estimated property impacts for each alternate route option are summarized in ***Table 6.26***.

Table 6.26: Estimated Property Impacts – Alternate Route Options

PROPERTY TYPE		AREA (M2)	ROUTE OPTION		
			AR-A	AR-B	AR-C
Residential	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Business / Commercial	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Industrial	Partial	n/a	0	0	0
	Full	n/a	0	0	0
ALR	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Vacant	Partial	n/a	0	0	0
	Full	n/a	0	0	0
Total Partial			14	15	24
Total Full			4	4	6
Total Impacted Properties			**18**	**19**	**30**

Noise Impacts

Impacts related to noise is based primarily upon the magnitude of traffic demand and the proximity of the roadways to adjacent developments.

Option AR-A

The alignment of this route is primarily through undeveloped and forested areas except for the short segment near Princeton Avenue. The route will have long stretches of steep grades for about 70% of the alignment. Only a very small amount of the daily traffic on the exiting corridor is forecast to divert from the existing highway to this route option. Therefore, although the noise levels along the alternate route would be significant compared to the Base Case, there is no land development along most of the route to be negatively impacted by the noise. The existing route, which would still service the vast majority of the daily traffic, would experience the same noise impacts as before. Therefore, compared to the Base Case, this option should have about the same noise impacts.

Evaluation Output:

Neutral

Option AR-B

The alignment of this route is similar to Option AR-A and primarily travels through undeveloped and forested areas except for the short segment near Princeton Avenue. The route will have long stretches of steep grades for about 50% of the alignment. Only a very small amount of the daily traffic on the exiting corridor is forecast to divert from the existing highway to this route option. Therefore, although the noise levels along the alternate route would be significant compared to the Base Case, there is no land development along most of the route to be negatively impacted by the noise. The existing route, which would still service the vast majority of the daily traffic, would experience the same noise impacts as before. Therefore, compared to the Base Case, this option should have about the same noise impacts.

Evaluation Output:

Neutral

Option AR-C

The alignment of this route is primarily through undeveloped and forested areas. However the route does enter the developed lands just north of Seymour Avenue and continues directly south cutting through existing developments and crossing the creek near Hardy Street to connect back to Highway 97. The route will have long stretches of steep grades for about 35% of the alignment. About 10% of daily traffic is forecast to divert from the existing highway to this route option. For the portion of the alternate route north of Seymour Avenue there would be no significant noise impacts. For the portion to the route south of Seymour Avenue, there could be significant noise impacts to the adjacent land developments. The existing route, which would still service about 90% of the daily traffic, would experience the same noise impacts as before. Therefore, compared to the Base Case, this option should have somewhat worse noise impacts.

Evaluation Output:

Somewhat Worse

Visual Impacts

This criterion considered the potential visual intrusion of the alternate route options in terms of the impact to sight lines from adjacent residents and businesses. The qualitative evaluation of the alternative options was conducted in comparison to the Base Case.

Option AR-A

The alignment of this alternate route option is away from most developments and would therefore have minimal affects on adjacent residents. However, this alternate route will likely have more “global” visual impacts from points closer to the lake shore as the potentially large rock cuts and slope fills associated with the new roadway will be noticeable along the mountain sides.

Evaluation Output:

Somewhat worse

Option AR-B

The alignment of this alternate route option is away from most developments and would therefore have minimal affects on adjacent residents. However, this alternate route will likely have more “global” visual impacts from points closer to the lake shore as the potentially large rock cuts and slope fills associated with the new roadway will be noticeable along the mountain sides.

Evaluation Output:

Somewhat worse

Option AR-C

The alignment of this alternate route option is away from most developments, but does pass close to several residential lots near to the limits of the Peachland community. As such, there could be some visual impacts to nearby residents due to the presence of a new highway with potentially large rock cuts and slope fills.

This alternate route will also likely have more “global” visual impacts from points closer to the lake shore as the potentially large rock cuts and slope fills associated with the new roadway will be noticeable along the mountain sides.

Evaluation Output:

Somewhat Worse

Community Severance

This criterion will consider the barrier effect of a new higher speed route on the existing community structure and linkages. Lack of connectivity and / or accessibility across the corridor can negatively affect pedestrian, cyclist and local vehicle movements. Severance may also create psychological barriers to trip planning.

Option AR-A

The alignment of this alternate route option is within undeveloped or rural areas and will have little to no effect on community severance. The alternate route option does not include any connections to the developed area within Peachland other than the two termini, therefore no additional accessibility is provided.

Community severance and accessibility along the existing Highway 97 corridor will remain unaffected relative to the Base Case.

Evaluation Output:

Neural compared to the Base Case

Option AR-B

The alignment of this alternate route option is within undeveloped or rural areas and will have little to no effect on community severance. The alternate route option does not include any connections to the developed area within Peachland other than the two termini, therefore no additional accessibility is provided.

Community severance and accessibility along the existing Highway 97 corridor will remain unaffected relative to the Base Case.

Evaluation Output:

Neutral compared to the Base Case

Option AR-C

The alignment of this alternate route option passes through or nearby residential properties and developed land and may create new community barriers. The alternate route option does not include any connections to the developed area within Peachland other than the two termini, therefore no additional accessibility is provided.

Community severance and accessibility along the existing Highway 97 corridor will remain unaffected relative to the Base Case.

Evaluation Output:

Somewhat Worse

Consistency with Community Plans

This criterion considered the community plans of the District of Peachland that have been developed to guide growth within the community. The primary resource was the Official Community Plan (OCP) for Peachland, however, information gathered through the various stakeholder meetings was also considered in evaluating the options.

Alternate Route Option AR-A

A short section of this alternate route option traverses through land designated as rural or industrial land use, however the majority of the route alignment runs through undeveloped land and forest area.

The OCP identifies a need for improvements to Highway 97 but does not specify whether a new alternate route or widening the existing route is preferred. The District of Peachland has formed a task force to examine a Highway 97 bypass of the Peachland urban area option and the possible need to amend the OCP.

Evaluation Output:

Neutral

Alternate Route Option AR-B

A significant section of this alternate route option traverses through land designated as rural or industrial land use with potential impacts to some developments south of Princeton Avenue. However, the majority of this route traverses through undeveloped land and forest area.

The OCP identifies a need for improvements to Highway 97 but does not specify whether a new alternate route or widening the existing route is preferred. The District of Peachland has formed a task force to examine a Highway 97 bypass of the Peachland urban area option and the possible need to amend the OCP.

Evaluation Output:

Neutral

Alternate Route Option AR-C

This alternate route option will have significant impacts on existing developments and private property, and passes through land designated in the OCP as park, residential, rural, agriculture, and tourist commercial.

The OCP identifies a need for improvements to Highway 97 but does not specify whether a new bypass route or widening the existing route is preferred. The District of Peachland has formed a task force to examine a Highway 97 bypass of the Peachland urban area option and the possible need to amend the OCP.

Evaluation Output:

Somewhat Worse – the option is somewhat inconsistent with the OCP along the southern segment of the option and significantly impacts existing developed land areas.

6.3.3 Environmental Account

Under this account, the four criteria include terrestrial impacts, aquatic impacts, archeology / historical impacts, and greenhouse gas emissions.

Under this account, the four criteria include terrestrial impacts, aquatic impacts, archeology / historical impacts, and greenhouse gas emissions.

Terrestrial Impacts

The terrestrial impacts of each alternate route option were qualitatively assessed based on a high level desktop review of available information within the study area using online government resources such as:

- The BC Ministry of Forests, Lands, and Natural Resource Operations online mapping application (iMapBC);
- The BC Conservation Data Centre Species and Ecosystem Explorer database (BC CDC);
- The Wildlife Tree Stewardship Atlas (WiTS);
- The British Columbia Blue Herons Atlas (GBHMT);
- The Ministry of Environment and Climate Change Strategy (MECCS) HabitatWizard; and
- Various municipal mapping applications.

Along with Indigenous knowledge and input as well as pertinent regulatory acts such as the Species at Risk Act (SARA), such resources allowed for the estimation of the presence of at-risk species, the amount and severity of impacted vegetation, and what environmental reviews are expected to be necessary. For at risk species, the specific SARA status and BC list status are given.

The terrestrial impacts of the three alternate route options are highlighted in the following discussion.

Option AR-A

This route option has the highest impact, by total area of the route (65.6%), of any of the alternate route options, in terms of impact to conservation status and sensitivity of terrestrial ecosystems among the alignment options, the coverage of vegetation polygons within the area to be affected containing red-listed ecosystems (endangered or threatened). In addition:

- As with the other alternate route options, the area containing blue-listed ecosystems (special concern) is a large proportion of the total alignment area and at a similarly high level (76.6%) compared to the other alternate route options. The area containing sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) is moderate among other alternate route options (15.4%).
- Based on review of ortho-imagery, there were no additional sensitive habitat features identified.
- All the alternate route options are within the Ungulate Winter Range #U-8-001 of the Okanagan TSA established for mule deer (limitations on tree harvest and other forestry practices, minimum tree retention levels, relates to amount of habitat that is to be retained for protection of mule deer winter foraging) – potential for collision risk and loss of overwintering habitat.

- Among the alternate route options – similar proportion of Option AR-A is ranked as “Very High” or “High” conservation ranking (59.2% of total area).
- Relative biodiversity is primarily “Low” or “Moderate” (62.0% of total area), but among options has largest proportion as “High” (34.1%), through the Peachland Creek tributary corridor.
- No species at risk occurrence records within this option route.

All the alternate route options will have effects on areas of environmental concern. However, among the alternate route options, this option has relatively high effects. This alternate route option would likely require alteration of the Peachland Creek tributary corridor along much of the route, which alone makes this option unjustified from an environmental perspective.

This alternate route option would create a large connectivity barrier in an otherwise largely undeveloped and forested area. This option is the most remote and is the farthest distance away from Peachland, therefore a new highway here would create the biggest fragmentation of natural open space. This alternate route option is undesirable from that perspective.

Evaluation Output:

> *In terms of terrestrial impacts, when compared to the Base Case, the qualitatively rating for Option AR-A is Significantly Worse.*

Option AR-B

Considering the conservation status and sensitivity of terrestrial ecosystems among the alternate route options, the coverage of vegetation polygons within the area to be affected and containing red-listed ecosystems (endangered or threatened) is moderate for Option AR-B compared to the other alternate route options (49.8% of total area). As with the other alternate route options, the area containing blue-listed ecosystems (special concern) is a large proportion of the total alignment area and at a similarly high level (76.6%) compared to the other options. In addition:

- The area containing sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) is lowest among other alternate route options (10.7%).
- Based on review of ortho-imagery, the following additional sensitive habitat features are impacted by this option (not field verified):
    - An additional wetland near the tributary of unnamed stream 10.
    - A potential talus slope.
    - Two rock outcrops that would potentially be lost / altered by the alignment.
- All alternate route options are within the Ungulate Winter Range #U-8-001 of the Okanagan TSA established for mule deer (limitations on tree harvest and other forestry practices, minimum tree retention levels, relates to amount of habitat that is to be retained for protection of mule deer winter foraging) – potential for collision risk and loss of overwintering habitat.
- Among the alternate route options, this option has the highest proportion of route ranked as “Very High” or “High” conservation ranking (65.0% of total area).

- Relative biodiversity is low among the alternate route options; primarily "Moderate" or "Low" (90.9% of total area), and only 2.8% "High".
- No species at risk occurrence records within this option route.

Although all the alternate route options will have effects on areas of environmental concern; among these options, Option AR-B has relatively moderate effects. However, this option would create a large connectivity barrier in an otherwise largely undeveloped and forested area.

Evaluation Output:

> *In terms of terrestrial impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-B is Significantly Worse.*

Option AR-C

Considering the conservation status and sensitivity of terrestrial ecosystems among the alternate route options, the coverage of vegetation polygons within the area to be affected and containing red-listed ecosystems (endangered or threatened) is moderate, when compared to the other options (38.0% of total area). As with the other alternate route options, the area containing blue-listed ecosystems (special concern) is a large proportion of the total alignment area and at a similarly high level (69.4%) compared to the other alternate route options. In addition:

- The area containing sensitive ecosystems (riparian, wetland, grassland, or sparsely vegetated) is moderate among other options (43.2%).
- Based on review of ortho-imagery, the following additional sensitive habitat features (not field verified), an additional rock outcrop that would potentially be lost / altered by this option.
- All options are within the Ungulate Winter Range #U-8-001 of the Okanagan TSA established for mule deer (limitations on tree harvest and other forestry practices, minimum tree retention levels, relates to amount of habitat that is to be retained for protection of mule deer winter foraging) – potential for collision risk and loss of overwintering habitat.
- Among the alternate route options – this option has a similar proportion of route ranked as "Very High" or "High" conservation ranking (57.1% of total area).
- Relative biodiversity is lowest among bypass options; primarily "Low" or "Moderate" (93.3% of total area), and only 1.9% "High".
- Lewis's Woodpecker – this route option impacts two areas with occurrence records for Lewis's woodpecker (Melanerpes lewis) at known nesting locations (Province of BC 2013). This species is red-listed in BC and federally listed on Schedule 1 of the federal Species at Risk Act as Threatened (BC CDC 2015a). They nest in cavities in large dead and decaying trees, often in black cottonwood or Ponderosa pine (Vierling et al. 2013. Surveys would be required to confirm continued occupancy of these nests. If occupied, the nest locations must be avoided by the highway alignment as Lewis's woodpeckers are protected under the federal Species at Risk Act. and active nests and eggs are protected under the federal Migratory Birds Convention Act and provincial Wildlife Act.

All the alternate route options will have effects on areas of environmental concern; among these options, Option AR-C has relatively moderate effects. The alignment of this option crosses areas currently considered to have "High" habitat connectivity (51.5%) and a low proportion (1.5%) is currently a connectivity barrier. However, among the alternate route options, this option is preferable as it has the largest proportion of the route within previously developed areas.

Evaluation Output:

> *In terms of terrestrial impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-C, is Significantly Worse.*

Aquatic Impacts

The aquatic impacts of each alternate route option were qualitatively assessed based on a high level desktop review of available information within the study area using online government resource such as:

- iMapBC;
- BC CDC;
- MECCS Fisheries Information Data Queries (FIDQ);
- MECCS HabitatWizard; and,
- Various municipal mapping applications.

Along with Indigenous knowledge and input as well as pertinent regulatory acts such as the Fisheries Act and the Species at Risk Act, such resources allowed for the estimation of the presence of aquatic species, the amount and severity of impacted water bodies, and what environmental reviews are expected to be necessary.

The aquatic impacts of the three alternate route options are highlighted in the following discussion.

Option AR-A

Option AR-A will have seven watercourse crossings:

- Unnamed 8;
- Peachland Creek tributary 2;
- Peachland Creek mainstem;
- Peachland Creek tributary 3 (alignment follows stream corridor for ~ 4.7 km), plus mouth of 2 additional tributaries;
- Pigeon Creek mainstem (3 crossings);
- Pigeon Creek tributary 2; and
- Pigeon Creek tributary 1.

These stream corridors will be affected by new highway crossings. A significant section of this route option (~ 4.7 km) would result in direct loss of aquatic habitat (Peachland Creek tributary) – effects on downstream fisheries. This could be a "show stopper" for this option unless the stream can be avoided.

The Peachland Creek mainstem is fish bearing (rainbow trout, eastern brook trout, kokanee). This creek is an important rainbow trout habitat; 12,000 of 90,000 total stream spawning rainbow trout for Okanagan Lake spawn in this stream (BC MOE 2015b). This stream is also considered an important kokanee spawning channel (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing crossing is located at the mouth where salmonid spawning occurs. Potential for same effects from new highway construction and operation, as well as direct fish habitat losses from new crossing construction.

The Pigeon Creek mainstem is fish bearing (rainbow trout, eastern brook trout) and a second order tributary of Trepanier Creek. There is potential for effects on fish bearing stream habitat, and downstream fish bearing habitat (Okanagan Lake shoreline at mouth of Trepanier Creek) from new crossing construction.

All the alternate route options have similarly high potential for effects on aquatic resources and wildlife corridors and water pollution; among the alternate route options, Option AR-A has the highest potential effects and should be excluded unless the alignment can be re-routed out of the Peachland Creek tributary stream corridor.

Evaluation Output:

> *In terms to aquatic impacts as compared to the Base Case, the qualitative rating for Option AR-A is Significantly Worse.*

Option AR-B

Route AR-B will have eight watercourse crossings:

- Unnamed 8;
- Peachland Creek mainstem (2 crossing locations);
- Peachland Creek tributary 1;
- Unnamed 9;
- McCall Creek;
- McCall Creek tributary;
- Unnamed 10; and
- Trepanier Creek tributary.

Eight stream corridors affected by new crossings - effects on fisheries.

The Peachland Creek mainstem is fish bearing (rainbow trout, eastern brook trout, kokanee). This stream is an important rainbow trout habitat; 12,000 of 90,000 total stream spawning rainbow trout for Okanagan Lake spawn in this stream (BC MOE 2015b). This stream is also considered an important kokanee spawning channel (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing crossing is located at the mouth where salmonid spawning occurs. There is potential for the same effects from new highway construction and operation, as well as direct fish habitat losses from new crossing construction. Clear span bridge required.

McCall Creek is a first order tributary of Okanagan Lake. McCall Lake (headwaters) is stocked with eastern brook trout and rainbow trout, and there are recorded observations of bull trout. There is no data to determine if the creek is fish bearing at the proposed crossing location. Potential for water quality impairment effects on the stream providing food and nutrient value to downstream fish bearing habitat (Okanagan Lake shoreline at mouth of McCall Creek) from new crossing construction.

All alternate route options have similarly high potential for effects on aquatic resources and wildlife corridors and water pollution; among the alternate route options, this option has relatively moderate potential effects.

Evaluation Output:

> *In terms of aquatic impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-C is Significantly Worse.*

Option AR-C

Option AR-C will have nine watercourse crossings:

- Unnamed 8;
- Peachland Creek mainstem (2 crossing locations);
- Peachland Creek tributary 1;
- Unnamed 9;
- McCall Creek;
- McCall Creek tributary (3 crossing locations), plus mouth of 1 additional tributary;
- Unnamed 10;
- Trepanier Creek tributary;
- Trepanier Creek mainstem (2 crossing locations).

Nine stream corridors affected by new crossings - effects on fisheries.

The Peachland Creek mainstem is fish bearing (rainbow trout, eastern brook trout, kokanee). This stream is an important rainbow trout habitat; 12,000 of 90,000 total stream spawning rainbow trout for Okanagan Lake spawn in this stream (BC MOE 2015b). This stream is also considered an important kokanee spawning channel (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing crossing is located at the mouth where salmonid spawning occurs. There is potential for similar effects from new highway construction and operation, as well as direct fish habitat losses from new crossing construction.

McCall Creek is a first order tributary of Okanagan Lake. McCall Lake (headwaters) stocked with eastern brook trout and rainbow trout, and there are recorded observations of bull trout. No data to determine if fish bearing at proposed crossing location. Potential for water quality impairment effects on stream providing food and nutrient value to downstream fish bearing habitat (Okanagan Lake shoreline at mouth of McCall Creek) from new crossing construction.

The Trepanier Creek mainstem is fish bearing (rainbow trout, kokanee, prickly sculpin, sucker (general), burbot). This "Fifth order stream", has a stated Management Objective of "preservation." Summer low flows are considered a constraint for increasing rainbow trout fisheries production (BC MOE 2015b). Kokanee habitat is considered a sensitive habitat feature (BC MOE 2015b). Water quality impairment or sedimentation from existing highway operations and maintenance is a known issue, especially as the existing crossing is located near the mouth where kokanee spawning occurs. There is potential for similar effects from new highway construction and operation, as well as direct fish habitat losses from new crossing construction at intersection with Highway 97C. Route Option AR-C appears to parallel the stream, which must be avoided.

All the alternate route options have similarly high potential for effects on aquatic resources and wildlife corridors and water pollution; among options, this alignment has relatively moderate potential effects.

Evaluation Output:

> *In terms of aquatic impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-C is Significantly Worse.*

Archaeological / Historical Impacts

The archaeological / historical impacts of each alternate route option were qualitatively assessed based on a high level desktop review of available information within the study area. Any archaeologically or historically significant impacts will be noted and ranked in terms of the severity of impact. The qualitative evaluation will determine whether each option would have good, fair or poor impacts with respect to the Base Case.

The archaeological and historic impacts of the three alternate route options are highlighted in the following discussion.

Option AR-A

For this alternate route option, a moderate proportion of the alignment crosses areas considered to have "High" archaeological potential (26.1%) and a moderate proportion (34.6%) crosses areas considered to have "Moderate" archaeological potential. There is one recorded archaeological site (DkQw-2) located within the alignment.

All the alternate route options have similar potential for affecting archaeological sites; among options, the potential for this option to affect archaeological sites is highest – as there is already a recorded site within the alignment. This site should be avoided by the alignment.

Evaluation Output:

> *In terms of archaeological and historic impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-A is Significantly Worse.*

Option AR-B

For this alternate route option, a moderate proportion of the alignment crosses areas considered to have "High" archaeological potential (27.3%) and a moderate proportion (30.1%) crosses areas considered to have "Moderate" archaeological potential. There are no recorded archaeological sites are within the alignment.

All the alternate route options have similar potential for affecting archaeological sites; among these options, the potential for this option to affect archaeological sites is relatively moderate.

Evaluation Output:

In terms of archaeological and historic impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-B is Significantly Worse.

Option AR-C

This alternate route option has largest proportion of alignment crossing areas considered to have “High” archaeological potential (34.7%) and a relatively low proportion (18.0%) crosses areas considered to have “Moderate” archaeological potential, among the alternate route options. There are no recorded archaeological sites are within the alignment.

All the alternate route options have similar potential for affecting archaeological sites; among these options, the potential for this option to affect archaeological sites is relatively moderate.

Evaluation Output:

In terms of archaeological and historic impacts as compared to the Base Case (Existing Conditions), the qualitative rating for Option AR-C is Significantly Worse.

Greenhouse Gas Emissions

This criterion considered the impacts of greenhouse gas emissions (GHG), and the potential reductions or increases in GHGs that the project would enable. When quantifying these GHG in terms of dollar value (PV over 25 years), the Government of Canada’s forecasted Social Cost of Carbon per emission year will be used.

Vehicle operations-related greenhouse gas emission impacts were estimated based on the fuel consumption associated with vehicle use in the Base Case and for each option. Fuel consumption was then converted into CO_2 equivalent emissions using the factors provided in ***Table 6.27,*** and then monetized using an increasing yearly rate beginning at $47.28 (in 2018$) per tonne of emitted CO_2 equivalent. Greenhouse gas emissions associated with construction of the options are not included in this assessment.

Table 6.27: Quantitative Analysis Inputs for Greenhouse Gas Emission Savings

VARIABLE NAME	VALUE	SOURCE	COMMENTS
Emitted CO_2 Equivalent for Gasoline	2.363 kilograms of CO_2 equivalent / litre of gasoline	*2016 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, BC Ministry of Environment, May 2016	Based on average of Light-duty Vehicle and Light-duty Truck (includes SUV and Minivan) in Table 7 of source document.
Emitted CO_2 Equivalent for Diesel	2.630 kilograms of CO_2 equivalent / litre of diesel	*2016 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, BC Ministry of Environment, May 2016	Based on Heavy-duty Transport Mode in Table 7 of source document.
Value of CO_2 Equivalent Damages	Variable by year (i.e. increasing value per tonne over time in constant dollars)	*Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates*, Environment and Climate Change Canada, March 2016.	Inflated from 2012$ to 2018$ using Statistics Canada Consumer Price Index.

Results of the analysis are provided in ***Table 6.28*** below.

Table 6.28: Greenhouse Gas Emission Savings

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Greenhouse Gas Emission Reductions (kg)	16 M	14 M	3 M
Greenhouse Gas Emission Reductions ($M)	$0.4	$0.4	$0.1

6.3.4 Financial Account

Under this account, the four primary criteria include capital costs, property costs, salvage value, and maintenance and operations costs. For each criterion, results have been presented in Present Value (PV 2018$) as estimated over a 25 year analysis period and discounted at an annual rate of 6%. Other key assumptions required to estimate the present value of each option include:

- Further Planning and detailed design efforts to be completed by 2021;
- Construction of any option to begin in 2022 with a duration of three years;
- Benefits to accrue in 2025.

Capital Cost

The relative construction cost of each option has been developed at a high level using single line sketch representations of the improvement options and composite linear costs based on a typical road cross section. Separate costs for roadways, deck areas for bridges, and general lengths of retaining walls were separated in the overall cost estimates. This information provided input to the Wolski method spreadsheets. Given the high level nature of the cost estimates at this time, a 40% contingency has been applied.

The total construction costs (2018$) for the options are presented in ***Table 6.29*** using a range of cost values as follows: **$** (<$100 Million) → **$$$$$** ($500 Million). These costs were also estimated in Present Value (PV 2018$) but have been presented in the table using the same range of cost values.

Table 6.29: Alternate Route Options - Total Construction Costs

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Construction Costs (2018$)	$$$$$	$$$$$	$$$
Construction Costs (PV)	$$$	$$$	$$

Property Costs

Due to the high level nature of the option development in terms of the defining the vertical and horizontal geometry for each alternate route option, property impacts and related costs have only be estimated at a similar high level. This is an estimate only for the purposes of this report and in no way represents market value. Property costs are presented in ***Table 6.30*** using a range of cost values as follows: **$** (<$20 Million) → **$$$$$** ($100 Million).

Table 6.30: Property Costs

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Property Costs (Aggregate)	$	$	$

More accurate costs will be prepared for the preferred option in the subsequent Phase II study.

Maintenance and Rehabilitation Cost

Roadway maintenance and resurfacing costs were estimated based on lane-kilometers of roadway in the Base Case and for each option. Bridge maintenance and resurfacing costs were estimated based on total bridge deck surface area in the Base Case and for each option. The net differences of each option compared to the Base Case are summarized in ***Table 6.31***.

Table 6.31: Summary of Roadway and Bridge Deck Surface

MEASURE		ALTERNATE ROUTE OPTIONS		
		AR-A	AR-B	AR-C
Road Length (km)	Highway	15.0	13.4	10.3
	Crossings	3.1	1.8	2.7
	Ramps	0.0	0.0	0.0
	Total	18.1	15.2	13.0
Net Road Length (Ln-km)		**72.4**	**60.7**	**52.1**
Number of Bridges		4	5	6
Total Bridge Surface Area (m^2)		**52,300**	**38,600**	**48,200**

Annual maintenance costs and scheduled rehabilitation costs were then monetized using the factors provided in ***Table 6.32***.

Table 6.32: Assumptions for Maintenance and Resurfacing Costs

VARIABLE NAME	VALUE	SOURCE
Annual Road Lane Maintenance	(2012$) $3839/ln-km per year (2018$) $4236/ln-km per year	*Default Values for Benefit Cost Analysis in BC 2012*, BC MoTI
Annual Bridge Maintenance	(2012$) $19.9/m² per year (2018$) $21.9/m² per year	*Default Values for Benefit Cost Analysis in BC 2012*, BC MoTI
Road Lane Resurfacing	(2018$) $100,000/ln-km every 15 years	*Default Values for Benefit Cost Analysis in BC 2018*, BC MoTI
Bridge Deck Resurfacing	(2018$) $1,500/m² every 30 years	*Default Values for Benefit Cost Analysis in BC 2018*, BC MoTI

The estimated maintenance and operating costs for the existing route options are presented in ***Table 6.33*** below. Consideration for annual maintenance and rehabilitation costs have been based on a 25-year analysis period, therefore, these costs were calculated in Present Value (PV 2018$) but are presented in a range of cost values as follows: $ (<$1 Million) → $$$$$ ($5 Million).

Table 6.33: Alternate Route Options - Maintenance and Operating Costs

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Maintenance and Operating Costs (PV)	$$$$$	$$$$	$$$$

Salvage Value

The salvage value of the proposed infrastructure for each option at the end of the 25-year analysis period has been estimated as per the table below. The salvage value is based on the average life of the various road network improvements including roadways, structures, and acquired properties for additional right-of-way. The following service life values have been used:

- Property 100% (not included at this time)
- Roads – 25 years
- Structures – 50 years

The estimated salvage values the existing route options are presented in ***Table 6.34*** below. These costs have been based on a 25-year analysis period, therefore, these costs were calculated in Present Value (PV 2018$) but are presented in a range of cost values as follows: $ (<$20 Million) → $$$$$ ($100 Million).

Table 6.34: Alternate Route Options - Salvage Values

	ALTERNATE ROUTE OPTION		
	AR-A	AR-B	AR-C
Salvage Value (PV)	$$$$	$$$$	$$

6.3.5 Summary

The results of the multiple account evaluation of the alternate route options are summarized in ***Table 6.35***:

Table 6.35: Multiple Account Evaluation Summary – Alternate Route

CRITERIA	UNITS	OPTION AR-A	OPTION AR-B	OPTION AR-C
CUSTOMER SERVICE ACCOUNT				
Traffic Mobility	v/c Ratio Travel Time (Min)	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.8 to 1.3 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.0 Route Average Travel Time Savings per trip: Alternate Route: AM -2 to -4 min.: PM -1 to 2 min	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.9 to 1.3 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.0 Route Average Travel Time Savings per trip: Alternate Route: AM -1 to -3 min.; PM -1 to 2 min.	Existing Route: v/c ratio AM 0.5 to 1.1; v/c ratio PM 0.9 to 1.2 Alternate Route: v/c ratio AM 0.0; v/c ratio PM 0.1 Route Average Travel Time Savings per trip: Alternate Route: AM 0 to 2 min.; PM 3 to 6 min.
Predicted Road Safety Performance	Crashes $(PV)	2025 – 67.68 predicted crashes, $25.0M total crash costs 2043 – 89.87 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$0.5 Million	2025 – 67.77 predicted crashes, $22.1M total crash costs 2043 – 90.31 predicted crashes, $21.9M total crash costs Total Safety Benefits: -$0.6 Million	2025 – 67.13 predicted crashes, $22.9M total crash costs 2043 – 88.83 predicted crashes, $21.7M total crash costs Total Safety Benefits: -$0.5 Million
Network Travel Time & Vehicle Operation Costs	$M (PV)	$34M	$42M	$63M
Pedestrian and Cycling Accommodation	Qualitative	New route with shoulder but prohibitive grades and lack of amenities Neutral ◑	New route with shoulder but prohibitive grades and lack of amenities Neutral ◑	New route with shoulder which may be viable alternative Somewhat better ◕
SOCIO COMMUNITY ACCOUNT				
Property Impacts	# of Properties	Partial Property Takes > 10; Full Property Takes < 5	Partial Property Takes > 15; Full Property Takes < 5	Partial Property Takes > 20; Full Property Takes > 5
Noise Impacts	Qualitative	Neutral ◑	Neutral ◑	Somewhat worse ◔
Visual Impacts	Qualitative	Option is set back from most developments and therefore minimal affect on adjacent residents, however large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔	Option is set back from most developments and therefore minimal effect on adjacent residents, however large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔	Option is set back from most developments, although does pass closer to the limits of Peachland, and therefore is anticipated to have some effect on adjacent residents. Large rock cuts and fills would potentially be visible from the lakeshore. Somewhat worse ◔
Community Severance	Qualitative	Little to no impact. Neutral ◑	Little to no impact. Neutral ◑	Creates additional severance in developed areas. Somewhat worse ◔
Consistency with Community Plans	Qualitative	Little to no impact. Neutral ◑	Some impacts on existing developments and rural land uses. Neutral ◑	Impact on existing developments and future land use. Somewhat worse ◔
ENVIRONMENTAL ACCOUNT				
Terrestrial Impacts	Qualitative	Highest level of impact to conservation status and sensitivity of terrestrial ecosystems. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○	High level of impact to conservation status and sensitivity of terrestrial ecosystems, although less impact than AR-A. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○	High level of impact to conservation status and sensitivity of terrestrial ecosystems, although less impact than AR-A or AR-B. Creates a connectivity barrier in a large undeveloped forested area. Significantly Worse ○
Aquatic Impacts	Qualitative	Crosses seven watercourses, and parallels a watercourse for almost five kilometers in a manner that could create a direct loss of habitat. Several watercourses are fish bearing. Significantly Worse ○	Crosses eight watercourses; several of which are fish bearing. Significantly Worse ○	Crosses nine watercourses; several of which are fish bearing. Significantly Worse ○
Archaeological / Historical Impacts	Qualitative	Slightly over half the alignment considered to have high or moderate archaeological potential. One recorded archaeological site within the alignment. Significantly Worse ○	Slightly over half the alignment considered to have high or moderate archaeological potential. Significantly Worse ○	Slightly over half the alignment considered to have high or moderate archaeological potential. Significantly Worse ○
Greenhouse Gas Emission	$M (PV)	$0.4	$0.4	$0.1
FINANCIAL ACCOUNT				
Capital Cost	Range	$$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)	$$$ Range: $ (<$100 Million) → $$$$$ ($500 Million)
Property Costs	Range	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$ Range: $ (<$20 Million) → $$$$$ ($100 Million)
Maintenance and Rehabilitation Cost	Range	$$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)	$$$$ Range: ($ (<$1 Million) → $$$$$ ($5 Million))	$$$$ Range: $ (<$1 Million) → $$$$$ ($5 Million)
Salvage Value (not including property)	Range	$$$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)	$$$$ Range: ($ (<$20 Million) → $$$$$ ($100 Million))	$$ Range: $ (<$20 Million) → $$$$$ ($100 Million)

7. Technical Findings

Key findings from the evaluation of the existing route options and the alternate route options are presented in this section. Based on these initial findings, recommendations have been made to identify a preferred existing route option and an alternate route option. These preferred route options were then reviewed with the key study stakeholders and Indigenous groups to confirm the findings and to identify the need for any refinements prior to proceeding to the next study phase (Phase II).

7.1 Existing Route

From the multiple account evaluation, the following key findings can be derived:

- Option ER-A:
    - Is the least expensive of the three existing route options.
    - Provides the least amount of benefits in terms of travel time savings and mobility, however, these are only moderately less than the other two existing route options.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Creates some highway access and intra-community connectivity issues in the northern portion of the corridor due to the changes in the permitted movements of several intersections.
    - Creates some highway access issues in the southern portion of the corridor (Antlers Beach area) due to the short realignment of the highway.
    - Has the least amount of property impacts in terms of the number of properties impacted.
- Option ER-B:
    - Has slightly greater travel time and mobility benefits than Option ER-A.
    - Has more property impacts as compared to Option ER-A.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Has significant property impacts at the Princeton Avenue Interchange and potentially some environmental issues due to the proximity to the lakeshore.
- Option ER-C:
    - Has the highest construction costs of the three existing route options.
    - Generates slightly greater travel time and mobility benefits than Option ER-A, and similar benefits to Option ER-B.
    - Decreases road safety as compared to the Base Case, likely due to the increased speeds and widened highway at the retained intersections.
    - Has the most property impacts in terms of the number of properties impacted.

Recommendation

Based on the outcome of the multiple account evaluation and the key findings above, it is recommended that Option ER-A be taken forward for further consideration as part of Phase II of the Highway 97 Peachland Transportation Planning Study. However, it is also acknowledged that the evaluation process identified the need for refinements to Option ER-A in order to improve connectivity and accessibility as the conversion of many intersections to right in, right out configurations has reduced access to, from and across the highway in many areas. Therefore, prior to Option ER-A being advanced to Phase II, the option package was updated with some additional refinements, to address the weaknesses of the option highlighted in the evaluation process, as well as the refinements resulting from engagement with the key study stakeholders and Indigenous groups, as described in Section 8.

7.2 Alternate Route

From the multiple account evaluation, the following key findings can be derived:

- Option AR-A and Option AR-B:
    - Are the more costly options.
    - Have environmental impacts.
    - Have low trip attraction from the existing Highway 97 corridor during the peak.
    - Have the fewest impacts to developed properties within Peachland.
- Option AR-C:
    - Significantly less costly than the other two options.
    - Highest volume attraction away from the c volumes of the three alternate route options. Due to the slightly shorter travel length, Option AR-C does actually attract some traffic from Highway 97 with origins / destinations to the north of Peachland. Options AR-A and AR-B only divert traffic from Highway 97C.
    - Some environmental impacts, but fewest impacts of the three alternate route options.
    - Impacts some developed properties within Peachland whereas the other two alternate route options are largely located in undisturbed forested areas.

Recommendation

All alternate route options provide marginal benefits, which are largely accrued on the existing route due to a slight diversion in traffic to the alternate route. Of the three alternate route options, AR-C has the least impacts and greatest benefits. It is therefore recommended that Option AR-C be taken forward for further consideration in the Phase II study. However, it should be noted that due to the lack of diversion of traffic from the existing route to this alternate route, many of the underlying traffic safety and operations issues along the existing Highway 97 corridor remain. As such, further consideration of this alternate route option is required to encourage use of the alternate route. Therefore, prior to Option AR-C being advanced to Phase II, the option was subjected to further refinements. These refinements are described in Section 8 and encompass both technically-driven refinements to further confirm the scope of the design concept as well as the refinements resulting from engagement with the key study stakeholders and Indigenous groups, as described in Section 8.

It is acknowledged that without an increase in anticipated traffic diversion away from the existing route and towards the alternate route, there may also be a need to expand the scope of the alternate route option(s) to include focused improvements along the exiting highway corridor to address the remaining identified deficiencies. These potential focused improvements to the existing route will be identified in Phase II.

8. Refinements to Recommended Options

As noted in the previous section, although Option ER-A was recommended as the preferred option from among the existing route option packages, the option evaluation processes identified a number of negative impacts associated with this option. Similarly, as noted in Section 7.2, opportunities were noted for further technically-driven refinements to further confirm the scope of the design concept for the preferred alternate route option, AR-C.

Subsequent to the development of these refinements, a series of engagement workshops to review the existing and alternate route concepts were held with the following groups:

- Internal BC MoTI stakeholders;
- The Technical Advisory Committee (TAC);
- The Community Liaison Committee (CLC);
- The Peachland District Council; and,
- The Penticton Indian Band.

These workshops yielded further feedback and suggestions for refinements to both the existing route and alternate route options. Further documentation of the engagement process can be found in the *Phase I - Preferred Route Options What We Heard Report*.

The refinements to the recommended existing route option (ER-A) based on both the outcomes of the evaluation process as well as the subsequent stakeholder engagement process are described below in Section 8.1. Similarly, Section 8.2 describes the refinements to the recommended alternate route option (AR-C) based on both further technical design development as well as the subsequent stakeholder engagement process.

8.1 Existing Route Refinements

As a first step in refining ER-A, opportunities to refine the option were taken to address some of the weaknesses of the option with respect to highway access and intra-community connectivity that were identified during the option evaluation process. These refinements are discussed in Section 8.1.1. Subsequently, the refined option was presented to stakeholders and Indigenous groups, and feedback from this engagement process was used to further refine the concept; these ancillary refinements are described in Section 8.1.2. The resultant refined option package ER-A is provided in Appendix A.

8.1.1 Refinements Based on Evaluation Outcomes and Further Design Development

In the option generation, screening and evaluation components of the analysis of the existing route options, the Highway 97 corridor was split into five sections, with multiple options developed for each section:

- Section 1: Drought Hill;
- Section 2: Huston Road / Buchanan Road to Trepanier Bench Road;
- Section 3: Todd Road to Ponderosa Drive;

- Section 4: Princeton Avenue / Beach Avenue; and,
- Section 5: South of Princeton Avenue.

As described in Section 3.2.1, between two and five separate options were generated for each of these five sections. Subsequently, in Section 5.2.1, an option screening process was undertaken for each of these five sections, which in turn identified the options for each section that warranted further consideration. As described in Section 5.3.1, these screened-in options for each section were then combined into a total of three options packages (known as ER-A, ER-B and ER-C) that provided an overall series of upgrades for the entire existing Highway 97 corridor through Peachland. Option ER-A is comprised of section options that mostly included access control and retention of signalized at-grade intersections, while option packages ER-B and ER-C are comprised of section options that mostly included grade-separated junctions or crossings.

As described in Section 7.1, the evaluation of the existing route options resulted in Option ER-A being identified as the recommended option package along the existing alignment. However, while Option ER-A was the overall strongest-performing option, the evaluation process identified several negative impacts caused by this summation of the section options within the option package. These impacts related primarily to the cumulative effects of the access management strategy elements of the option, and specifically with respect to a lack of connectivity from the community to and from Highway 97 as well as intra-community connectivity across the highway corridor. Therefore, a series of refinements to mitigate these issues without fundamentally changing the overall premise of option package ER-A (i.e. primarily consisting of access control measures and signalized at-grade intersections) were identified.

In order to provide a relatively high level of highway corridor mobility without the need for grade-separations, the section options selected at each of the five sections to comprise the ER-A option package involved the implementation of access control such as closure of existing intersections or conversion of intersections to right-in / right-out movements only as well as consolidating movements that conflict with highway through-traffic to a few full-movement signalized intersections. Although these access control measures can create community severance impacts at the section level, these impacts were considered to be a reasonable trade-off relative to the benefits they provide to overall highway mobility and safety. However, when such measures along each of the five sections were combined into an overall option package, the option evaluation identified that the cumulative effects of all such measures would be a significant impact to community severance.

Therefore, the section-level options that comprise option package ER-A were reviewed with a focus on developing potential alternative concepts to mitigate some of the community severance impacts without significantly deviating from the overall design philosophy of the ER-A option package (i.e. access control and retention of signalized intersections). Each of the five option sections is reviewed below, and in some cases, alternative section options are identified for consideration of incorporation into a "refined" ER-A option package. In some cases, these alternative section-level options consist of previously-developed options that were incorporated into the ER-B and / or ER-C option packages, while in other cases, the concepts have been newly-developed (or refined) as part of this review.

Section 1: Drought Hill

Option ER-1A (Drought Hill Expressway) was incorporated into the ER-A option package. This option, shown previously in ***Figure 3.3***, extends the Drought Road connection with Seclusion Bay Road and Robinson Place. This extension forms a parallel local network. Right-in and right-out movements would be permitted between Seclusion Bay Road and Highway 97. Right-in and right-out movements would also be permitted between Drought Road and Highway 97. Highway 97 would be widened to a four lane cross section.

The primary challenge with this option is that, when considered in conjunction with Option ER-2D in Section 2, this option creates very circuitous movements for some trips in and out of properties located along Seclusion Bay Road. Specifically:

- For trips to the north from Seclusion Bay Road: Use the right-out movement at Seclusion Bay Road and Highway 97; no change from present.
- For trips to the south from Seclusion Bay Road: Travel along local roads for a distance of 5.8 km and connect to Highway 97 at the Ponderosa Drive / 13 Street signalized intersection, rather than turning left from Seclusion Bay Road onto Highway 97 and travelling 5.4 km at highway speeds. As the local roads are “on the way” towards a destination to the south, the net increase in travel distances and travel times is limited.
- For trips to Seclusion Bay Road from the north: Bypass the intersection of Highway 97 and Seclusion Bay Road (since a left turn movement is no longer possible) and travel 5.4 km south on Highway 97 to the Ponderosa Drive / 13 Street signalized intersection, turn left to exit the highway, and travel 5.8 km north along local roads. This results in a total detour of 11.6 km.
- For trips to Seclusion Bay Road from the south: Use the right-in access at Seclusion Bay Road and Highway 97; no change from present.

To reduce the circuitousness of access to and from Seclusion Bay Road, Option ER-1B (Drought Hill Expressway with Drought Road Overpass) was incorporated into the refined option package instead of Option ER-1A. Option ER-1B, shown previously in ***Figure 3.4***, creates a parallel local road network by extending Drought Road to Seclusion Bay Road and also to Robinson Place. The existing intersection of Seclusion Bay Road and Highway 97 would be restricted to right-in / right-out movements. Right-in and right-out movements would be permitted between Highway 97 and Drought Road. Southbound on / off connections to / from the highway are provided by on and off ramps on the west side of the highway. Highway 97 would be widened to a four lane cross section. For trips to the south from Seclusion Bay Road, this option would require only travel along local roads for a distance of 1.4 kilometres before accessing the highway, and would also reduce the detour length for trips to Seclusion Bay Road from the north from a total of 11.6 km to a total of 2.4 km.

The option was refined to incorporate retaining walls adjacent to the highway in order to reduce the footprint of fill slopes on the east side of the highway alignment.

Section 2: Huston Road / Buchanan Road to Trepanier Bench Road

Option ER-2D (Traffic Signal at Trepanier Bench Road) was incorporated the ER-A option package. In this option, shown previously in ***Figure 3.9***, the Trepanier Bench Road intersection would be signalized and right-in and right-out movements would be permitted at Huston Road / Buchanan Road. Access to Buchanan Road South would be closed. Highway 97 would be widened to a four lane cross section.

The primary challenge with this option is that with the elimination of full movements at the intersection of Highway 97 with Huston Road / Buchanan Road and the closure of the T-intersection of Highway 97 and Buchanan

Road (west), circuitous trips are created to and from the areas on both the hillside and lakeside of the highway, and especially when travelling across the highway. Specifically:

- For trips to the north from Huston Road: Travel 2.4 km south on Highway 97 to the Ponderosa Drive / 13 Street signalized intersection, exit the highway, U-turn and travel 2.4 km north along the highway past the right-in / right-out intersection. This results in a total detour length of 4.8 km.
- For trips to the south from the Huston Road: Use the right-out access at Huston Road and Highway 97; no change from present.
- For trips to Huston Road from the north: Use the right-in access at Huston Road and Highway 97; no change from present.
- For trips to Huston Road from the south: Continue northbound past Huston Road for 4.8 km to the Glenrosa Road Interchange, exit the highway, U-turn, enter the highway in the southbound direction, travel 4.8 km south to Huston Road. This results in a total detour length of 9.6 km. Note that the intersection of Highway 97 and Brent Road would likely need to be upgraded to safely accommodate this movement.
- For trips to the north from Buchanan Road: Use the right-out movement at the Buchanan Road and Highway 97 intersection; no change from present.
- For trips to the south from Buchanan Road: Travel along local roads for a distance of 2.9 km and connect to Highway 97 at the Ponderosa Drive / 13 Street signalized intersection, rather than turning left from Buchanan Road onto Highway 97 and travelling 2.4 km at highway speeds. As the local roads are “on the way” towards a destination to the south, the net increase in travel distances and travel times is negligible.
- For trips to Buchanan Road from the north: Bypass the intersection of Highway 97 and Buchanan Road (since a left-in movement is no longer possible) and travel 2.4 km south on Highway 97 to the Ponderosa Drive / 13 Street signalized intersection, turn left to exit the highway, and travel 2.9 km north along local roads. This results in a total detour length of 5.3 km.
- For trips to Buchanan Road from the south: Use the right-in access at the Buchanan Road and Highway 97 intersection; no change from present.
- For trips to the north from Buchanan Road (west): Travel along local roads for a distance of 1.0 km and connect to Highway 97 at the Buchanan Road intersection, rather than turning left from Buchanan Road onto Highway 97 and travelling 1.1 km at highway speeds. As the local roads are “on the way” towards a destination to the south, the net increase in travel distances and travel times is negligible.
- For trips to the south from Buchanan Road (west): Travel along local roads for a distance of 2.8 km and connect to Highway 97 at the Ponderosa Drive / 13 Street signalized intersection, rather than turning left from Buchanan Road (west) onto Highway 97 and travelling 1.4 km at highway speeds. As the local roads are “on the way” towards a destination to the south, the net increase in travel distances and travel times is somewhat mitigated.
- For trips to Buchanan Road (west) from the south: Exit Highway 97 at the Ponderosa Drive / 13 Street signalized intersection and travel along local roads for a distance of 2.8 km, rather than travelling approximately 1.4 km at highway speeds and turning right from Highway 97 onto Buchanan Road (west). As the local roads are “on the way” from an origin to the south, the net increase in travel distances and travel times is somewhat mitigated.

- For trips to Buchanan Road (west) from the north: Bypass the intersection of Highway 97 and Buchanan Road (west) (since a left-in movement is no longer possible) and travel 1.4 km south on Highway 97 to the Ponderosa Drive / 13 Street signalized intersection, turn left to exit the highway, and travel 2.8 km north along local roads. This results in a total detour length of 4.2 km.
- For trips across Highway 97 at Huston Road / Buchanan Road: Trips towards the lakeside from the hillside would need to make a 2.4 km detour in each direction to / from Ponderosa Drive / 13 Street. Trips towards the hillside from the lakeside would need to make a 4.8 km detour in each direction to / from the Glenrosa Road Interchange. This would result in a total detour length of 14.4 kilometres for a round trip across Highway 97.

In the refined option, the intersection of Highway 97 with Huston Road / Buchanan Road would still be fully closed. However, in response to these increases in community severance for some movements, a new option was developed to provide a new right-in / right-out intersection in Section 2 at Highway 97 at Shaw Road on the hillside and a new road connecting to Buchanan Road (effectively an extension of Shaw Road) on the lakeside. To facilitate the implementation of this intersection, Huston Road would be disconnected from Shaw Road by creating a cul-de-sac on Huston Road on either side of the new intersection. To maintain connectivity to properties on Huston Road to the north of Shaw Road, as well as Walker Road, a new connection from Walker Road to Clarence Road would be implemented. The Buchanan Road (west) crossing would still be fully closed. Although some rerouting would still be required, the provision of a full-movement Drought Road interchange as well as the Drought Road – Robinson Place connector would allow rerouting to destinations along Buchanan Road to be “on the way”, and eliminate the need to double-back via the Ponderosa Drive / 13 Street signalized intersection. However, additional travel distance would still be incurred to destinations along Huston Road.

Design refinements to add retaining walls adjacent to the Robinson Place extension in order to reduce fill slopes were also incorporated into the option.

Section 3: Todd Road to Ponderosa Drive

Option ER-3B (Retain Traffic Signals at Clement Crescent and Ponderosa Drive) was incorporated into the ER-A option package. This option, shown previously in ***Figure 3.12***, maintains traffic signals at Ponderosa Drive / 13 Street and Clements Crescent. Right-in and right-out movements would be permitted at Todd Road, while access to Chidley Road would be closed from the highway. Local road improvements include a new connection from Chidley Road to Clements Crescent to provide access to properties along Chidley Road. Highway 97 would be widened to a four lane cross section.

The signalization of the full-movement intersection of Highway 97 with Ponderosa Drive / 13 Street and the T-intersection of Highway 97 with Clements Crescent do not restrict any existing vehicle movements that are currently possible. Therefore, no impacts in terms of community severance were identified from these measures, and hence no refinements to the option package as it relates to these two intersections were contemplated.

The closure of direct highway access from Chidley Road would add a 0.8 km detour in each direction for people travelling to / from the north to double-back to / from the Clements Crescent signalized intersection, but no increase in travel distances for people travelling to / from the south. The community severance impacts of detouring were felt to be sufficiently limited that no refinements to the option package for access to / from Chidley Road were contemplated.

The conversion of the highway access at Todd Road to right-in / right-out movements will create additional travel distance for some trips. Specifically:

- For trips to the north from Todd Road: Use the right-out movement at Todd Road and Highway 97; no change from present.
- For trips to the south from Todd Road: Travel along local roads for a distance of 1.2 km and connect to Highway 97 at the Ponderosa Drive / 13 Street signalized intersection, rather than turning left from Todd Road onto Highway 97 and travelling 0.8 km at highway speeds. As the local roads are “on the way” towards a destination to the south, the net increase in travel distances and travel times is limited.
- For trips to Todd Road from the north: Continue southbound past Todd Avenue to the signalized intersection at Highway 97 with Ponderosa Drive / 13 Street, turn left onto 13 Street, turn left onto Beach Avenue and then turn left onto Todd Avenue. This detour results in a net increase in travel distance of 1.9 km.
- For trips to Todd Road from the south: Use the right-in access at Todd Road and Highway 97; no change from present.

The greatest impacts relating to the closure of the Todd Road access to Highway 97 are for trips to Todd Road from the north, where 1.9 km of additional travel is necessary. However, this detouring would be eliminated if the refinement under consideration for Section 1 were to be implemented; although trips to Todd Road would still need to reroute to local roads, the rerouting would be “on the way”, and could reduce the incremental travel distance and time.

Design refinements to add retaining walls adjacent to the highway near Trepanier Bench Road and between Clements Crescent and Ponderosa Drive to reduce fill and cut slopes, respectively, were also incorporated into the concept.

Section 4: Princeton Avenue / Beach Avenue

Option ER-4B (Retain Traffic Signal at Princeton Avenue) was incorporated into the ER-A option package. This option, shown previously in ***Figure 3.14***, maintains the traffic signals at Princeton Avenue. Highway 97 would be widened to a four lane cross section.

The signalization of the full-movement intersection of Highway 97 with Princeton Avenue / Beach Avenue does not restrict any existing vehicle movements that are currently possible. Therefore, no impacts in terms of community severance were identified, and hence no refinements to the option package were contemplated.

Design refinements to add retaining walls along the highway north of the intersection of Highway 97 with Princeton Avenue and Beach Avenue in order to reduce cut slopes were also incorporated into the concept.

Section 5: South of Princeton Avenue

Option ER-5A (Realignment at Antlers Beach) was incorporated into the ER-A option package. In this option, shown previously in ***Figure 3.15***, Princess Street would be extended to Lipsett Avenue at the north end of the highway section. At the south end of the highway section, Renfrew Road would be upgraded and realigned to connect with Thorne Road. The extensions of both Princess Street and Renfrew Road would form a continuous local route running parallel to the existing alignment of Highway 97. At the south end of the highway section, Highway 97 would be realigned at Antlers Beach. Access to or from the highway would be restricted to right-in and right-out movements at both Renfrew Road and Hardy Street. Highway 97 would be widened to a four lane cross section

The primary challenge with this option is that the option creates very circuitous movements for trips in and out of sites located along the lakeshore side of the realigned highway, including a portion of the mobile home park, as well as the Antlers Beach Regional Park. Specifically:

- For trips to the north from the Antlers Beach area: Use the right-out movement where the existing Highway 97 alignment (which would be a local road) merges onto the realigned Highway 97 northbound alignment.
- For trips to the south from Antlers Beach area: Use the right-out movement where the existing Highway 97 alignment (which would be a local road) merges onto the realigned Highway 97 northbound alignment, and travel north for 3.7 km to the Princeton Avenue signalized intersection, exit the highway, U-turn, enter the highway in the southbound direction, travel 3.7 km south to the Antlers Beach area, and then continue further south along the highway. This results in a total detour length of 7.4 km.
- For trips to Antlers Beach area from the north: Continue southbound past Hardy Street for 2.1 km to Brent Road, exit the highway, U-turn, enter the highway in the southbound direction, travel 2.1 km north to the Antlers Beach area, and access the right-in movement where the existing Highway 97 alignment (which would be a local road) diverges from the realigned Highway 97 northbound alignment. This results in a total detour length of 2.1 km. Note that the intersection of Highway 97 and Brent Road would likely need to be upgraded to safely accommodate this movement.
- For trips to Antlers Beach area from the south: Use the right-in access where the existing Highway 97 alignment (which would be a local road) diverges from the realigned Highway 97 northbound alignment.
- For trips across Highway 97 at Hardy Street: Trips towards the lakeside from the hillside would need to make a 2.1 km detour in each direction to / from Brent Road. Trips towards the hillside from the lakeside would need to make a 3.7 km detour in each direction to / from Princeton Avenue. This would result in a total detour length of 11.6 kilometres for a round trip across Highway 97.

In response, a refinement to this section option was developed wherein the intersection of the realigned Highway 97 with Hardy Street would be signalized, thereby allowing full movements in and out of the area. This new option package would eliminate the need for any significant detouring. Access would be fully closed where the existing Highway 97 alignment diverges and merges with the realigned Highway 97, and the existing highway alignment would be converted to a local road to provide access to destinations such as the mobile home park and the beach.

8.1.2 Refinements Based on Stakeholder and Indigenous Group Feedback

Similar to the refinements described in Section 8.1.1, refinements resulting from stakeholder and Indigenous group feedback is organized into the five sections. In addition to these section-level refinements, a “global” change was incorporated into all five sections, wherein cut and fill slopes would be refined from 1.5:1 to 2:1, unless known to be an area with rock cuts (in which case cut slopes would remain at 0.5:1). This change reflects current design practices for BC MoTI in areas with similar terrain, and is intended to address slope stability issues and ensure resiliency to climate change-related events that can trigger slides. In some cases, minor adjustments were made to the scope of the retaining walls that were previously incorporated into the option package as described in Section 8.1.1.

Section 1: Drought Hill

Stakeholder feedback noted safety concerns with the horizontal curvature on the existing highway alignment in the vicinity of Drought Hill. Due to the steep topography on either side of the highway corridor, introducing more relaxed horizontal curvatures would be challenging; however, it is anticipated that the widening of the cross-section to four lanes with a median barrier and wider shoulders will address the safety concerns. It was further confirmed that the provided horizontal curve radius is also appropriate for an 80 km/h design speed. Therefore, no additional refinements were incorporated into this section.

Section 2: Huston Road / Buchanan Road to Trepanier Bench Road

Several refinements were undertaken to this section, primarily to address stakeholder feedback regarding walking, transit and emergency service accessibility.

With respect to pedestrian connectivity, stakeholders noted the need for the provision of walking connections as outlined in the District of Peachland *Parks and Recreation Master Plan (2018 – 2018)*. To provide consistency with this plan, a pedestrian overpass crossing Highway 97 from Lang Road to McKay Lane was incorporated into the preferred route option.

Currently, within this section of the highway corridor the BC Transit Route 22: Peachland service runs as a couplet along Huston Road and Buchanan Road. As direct access from the highway to these local roads would be eliminates, the bus service would need to be rerouted to run along the highway. Therefore, it is anticipated that bus stops (including bus bays) would be required along the highway roughly in the same vicinity of where the bus service currently stops on Huston Road and Buchanan Road. Additionally, pedestrian connectivity across the highway in the vicinity of the bus stops is important to ensure that transit patrons can easily use one stop on their outbound journey and use the reciprocal stop on their return journey. Given that a pedestrian overpass was already incorporated into the preferred route option from Lang Road to McKay Lane, bus stops would be provided in the vicinity of this overpass, and would replace stops 103672 (southbound direction) and 103671 (northbound direction). The need for transit pullouts at these locations has been noted on the preferred route option.

Additionally, it is suggested that bus stops also be placed along the highway near the intersection of Walker Road and Huston Road. These bus stops would replace stops 103665 and 103669 (southbound direction) and 103667 (northbound direction), and the need for transit pullouts as these locations has been noted on the preferred route option drawings. An additional pedestrian connection across the highway would therefore be required at this location; such a connection was incorporated into the refined preferred route option.

Considerations were also raised regarding the effects of access control measures on emergency vehicle response times, and in particular whether some local streets such as Trepanier Bench Road were suited for use as an emergency response route. An emergency vehicle-only gap in median barrier at the Shaw Road right-in-right-out intersection was also incorporated.

Section 3: Todd Road to Ponderosa Drive

Several refinements were undertaken to this section, primarily to address stakeholder feedback regarding walking (including safe routes to school), transit, multi-modal road safety, and impacts to parks and open spaces.

Similar to the changes to bus service routing in Section 2, provision of on-highway transit stops are also required along the north-most part of this section. Therefore, the option was refined to note the need for transit pullouts to be incorporated into the highway in the vicinity of the Highway 97 and Trepanier Bench Road intersection, which is planned to be signalized, thus providing an opportunity for pedestrians to cross the highway to travel to / from the stops. These bus stops would replace existing stops 103682 (southbound direction) and 103675 (northbound direction).

Although not incorporated into the refined concept at this stage, the opportunity to realign the Todd Road right-in / right-out access to instead provide a consolidated full-movement signalized intersection at the Highway 97 and Trepanier Bench Road intersection was also highlighted. Further study of this connector will be conducted in Phase II.

Several stakeholders noted that the widened highway alignment would impact Lambly Park, including the tennis courts and the row of mature trees adjacent to the highway that act as a visual and sound barrier. In response, the need to shift the highway alignment away from the park and into the open space located between the highway and the Peachland Centre shopping plaza has been noted. This area currently contains extra-wide gravel shoulders that are used by trucks to pull over and stop, which has been noted by stakeholders to create safety concerns. These extra-wide gravel shoulders would be eliminated as part of the highway widening to four lanes.

It was noted that children living in the Ponderosa Drive area that attend Peachland Elementary School must walk along the highway, as the highway provides the only connection between the residential area and the school. Therefore, a sidewalk separated from the vehicle traffic lanes by a concrete roadside barrier along the highway alignment between Ponderosa Drive and Clements Crescent was incorporated into the refined option in order to provide a safe route to school.

To further respond to the need for pedestrian crossing opportunities, crosswalks were also added at the Highway 97 / Clements Crescent signalized intersection. Opportunities for “smart channelization” of right-turns at this intersection will also be investigated as part of further design refinements in Phase II.

The existing highway bridge crossing of Trepanier Creek was noted to be within an alluvial fan, and therefore considerations should be given to potential climate change-related increases in flood risk. As part of further design development in Phase II, it is anticipated that opportunities to raise the road profile, and by extension the height of the bridges above the creek, will be investigated. The need to maintain (and enhance) the pedestrian crossing underneath the bridge will also be considered.

Section 4: Princeton Avenue / Beach Avenue

A number of minor refinements were identified for this section, primarily to address stakeholder feedback regarding access and road network connectivity. In order to maintain continuity along Princeton Avenue, the Princeton Avenue / Princess Street T-intersection was reconfigured such that Princess Street tees-in to Princeton Avenue instead.

Additionally, it was noted that access would need to be maintained to the boat launch adjacent to Pentowna Park. The configuration of this access will be confirmed as part of Phase II.

Section 5: South of Princeton Avenue

A number of minor refinements were identified for this section, primarily to address stakeholder feedback regarding local road alignments, connectivity and environmental considerations.

Stakeholders noted that with highway access management and new local road connections, there could be additional volumes on local roads. In some cases the cross-section of these local roads are not suitable to handle additional traffic volumes and therefore additional improvements would be required. The potential need or such refinements will be investigated in further detail as part of Phase II.

The option was refined to note the opportunity to shift the intersection of Highway 97 and Hardy Street slightly south to move the intersection away from Deep Creek in order to reduce potential for additional environmental impacts. Similar to Trepanier Creek, the terrain in the vicinity of Deep Creek is an alluvial fan. Relocation of this intersection would therefore provide increased flexibility to raise the road elevation in order to provide a higher bridge crossing to mitigate any increased risks of flooding events caused by climate change. A local road connection was also added to the south of the Hardy Street intersection to provide alternative access to properties that currently have private accesses onto the highway.

Finally, stakeholders also noted that this area is a popular crossing location for wildlife. The opportunity to provide a wildlife crossing in this area was noted, although the exact location of such a crossing would need to be determined through a more detailed assessment of wildlife movements in the area.

8.2 Alternate Route Refinements

As a first step in refining the preferred alternate route option, AR-C, opportunities to further develop the design concept to improve definition of the scope of work (particularly with respect to cuts, fills and structure locations) was undertaken; these refinements are discussed in Section 8.2.1. Subsequently, these refined options were presented to stakeholders and Indigenous groups, and feedback from this engagement process was used to further refine the option; these refinements are described in Section 8.2.2. The resultant refined option package AR-C is provided in Appendix B.

The alternate route alignments were not split into sections in the same manner as the existing route options. The lack is sectioning is because, unlike the existing route options, the alternate route options are not design variations on the same corridor, but rather different corridors from one another altogether. However, for the purposes of categorizing refinements, the recommended alternate route option, AR-C, has been split into five sections as follows:

- Section 1: North-End Tie-In;
- Section 2: Vicinity of Ponderosa Drive;
- Section 3: Vicinity of Gerrie Road;
- Section 4: Vicinity of Princeton Avenue; and,
- Section 5: South End Tie-In.

8.2.1 Refinements Based on Evaluation Outcomes and Further Design Development

Several unknowns with respect to alignment definition and constructability were identified in the option generation, screening and evaluation components of the analysis of the alternate route options. Therefore, further design development was undertaken to optimize the horizontal and vertical alignment geometry with respect to cost and constructability.

Section 1: North-End Tie-In

During the preceding components of the study, a specific interchange layout at the north end of the alternate route (where the highway would connect to Highway 97C at/near the Trepanier Road Interchange) was not fully defined; creating a need to develop a specific interchange concept. Per the origin-destination patterns provided in ***Figure 2.11***, the vast majority of traffic travelling along Highway 97 through Peachland is travelling to / from Highway 97 north of the Drought Hill Interchange (i.e. to West Kelowna or beyond) rather than Highway 97C (i.e. towards Aspen Grove). This finding, combined with the need for the alternate route to provide travel times that are competitive with the existing route, resulted in a decision to focus on interchange concepts that provided east-facing ramps on Highway 97C with free-flow connectivity to the alternate route. However, given the adjacent recreational and environmental considerations, the specific interchange concept was not developed at this point in time, but rather was developed subsequent to the engagement process when stakeholder and Indigenous group input was available regarding other considerations in this area. The resultant interchange concept is therefore described below in Section 8.2.2.

The option was refined to incorporate retaining walls adjacent to the highway in order to reduce the footprint of fill slopes on the east side of the highway alignment; this change also reduced the risk of impacts to Trepanier Creek.

Section 2: Vicinity of Ponderosa Drive

Just north of the end of Ponderosa Drive, the highway alignment passes between two hills and travels over a low point in the terrain at roughly 20 to 30 metres above the existing grade. The opportunity to replace these high fills and / or retaining walls with a bridge structure is noted. The opportunity to add a vertical sag within the vertical alignment in order to reduce the height of the fills will also be investigated as part of Phase II.

Slightly further south, the alternate route option was also refined to incorporate retaining walls adjacent to the highway in order to reduce the footprint of fill slopes on the east side of the highway alignment.

Section 3: Vicinity of Gerrie Road

Throughout much of this section, the option was refined to incorporate retaining walls adjacent to the highway in order to reduce the footprint of fill slopes on the east side of the highway alignment.

Section 4: Vicinity of Princeton Avenue

The highway alignment conflicts with several local roads in this area, including Princeton Avenue, Vernon Avenue and Elliot Avenue. The need for refinements across the highway corridor to address these conflicts was noted. An opportunity was identified to raise the highway over Princeton Avenue and Vernon Avenue, and provide an alternative access to Elliot Avenue from Princeton Avenue. This configuration was not initially incorporated into the information presented to stakeholders in order to solicit feedback on other considerations in this area prior to incorporating this opportunity into the refined alternate route option.

The need for further refinements to the horizontal and vertical geometry in this area to reduce agricultural land impacts and provide a crossing of Deep Creek that reduces the extent of bridge structure(s) was also noted.

Section 5: South End Tie-In

In order to tie-in to the existing Highway 97 alignment, an interchange with south-facing directional ramps was incorporated into the option, with the alternate route acting as the Highway 97 mainline and the existing route becoming a local route for travel within Peachland. The south-facing ramps enable travel between Peachland and points to the south (e.g. Penticton). North-facing ramps were not included in the concept as the intention of the alternate route is to provide a bypass of Peachland, and therefore no provision was made for vehicles travelling between Peachland and points to the north.

8.2.2 Refinements Based on Stakeholder and Indigenous Group Feedback

Similar to the refinements described in Section 8.1.1, refinements due to stakeholder and Indigenous group feedback is organized into the five alternate route sections. In addition to these section-level refinements, a “global” change was incorporated into all five sections, wherein cut and fill slopes would be refined from 1.5:1 to 2:1, unless known to be an area with rock cuts (in which case cut slopes would remain at 0.5:1). This change reflects current design practices for BC MoTI in areas with similar terrain, and is intended to address slope stability issues and ensure resiliency to climate change-related events that can trigger slides. In some cases, minor adjustments were made to the scope of the retaining walls that were previously incorporated into the concept described in Section 8.1.1.

Although not specifically shown in the design concept, two broader considerations were identified through the stakeholder engagement process Based on feedback from the engagement process:

- The alternate route falls within the Penticton Indian Band South Okanagan Commonage land claim.
- Consideration should be given to lowering the posted speed limit on the existing highway corridor to 60 km/h.

Section 1: North-End Tie-In

Feedback from the engagement process noted that the area in the vicinity of the tie-in between the alternate route and Highway 97C features a regional park (including trailhead and associated parking lot), the Trepanier Creek watercourse, and numerous other destinations accessed via Trepanier Creek Road. Opportunities to modify the existing Trepanier Road Interchange to provide an interchange that both maintains all existing movements while also providing free-flow movements between the alternate route and Highway 97C were investigated, but found to be challenging. Therefore, a decision was made to retain the existing Trepanier Road Interchange as-is, so that this interchange can continue fulfilling its function of providing access to destinations along Trepanier Road. In turn, a new independent “trumpet” interchange configuration would be implemented to the west of the existing Trepanier Road Interchange, thereby providing free-flow movements in all directions, avoiding conflicts with local movements to and from Trepanier Road, and minimizing impacts to the Trepanier Creek watercourse.

Stakeholder feedback also noted that the Trepanier Creek watercourse is a key source of water for area wildlife, and that the highway should avoid severing this access. In response, a wildlife underpass was incorporated into the option to the west of the new interchange connection to Highway 97C. The exact location of such a crossing would need to be further refined through a more detailed assessment of wildlife movements in the area.

Section 2: Vicinity of Ponderosa Drive

Stakeholders noted that the highway could sever access from Peachland to nearby hiking trails such as the Pincushion Mountain Trail. If, as noted previously in Section 8.2.1, the design concept was refined to include a bridge structure in this area, then hiking trail access could be maintained underneath the bridge. Alternatively, if fills are used, then a small pedestrian underpass structure near the final switchback on Ponderosa Drive would be provided in order to maintain access to the hiking trails. Given stakeholder concerns about motorized access to trails, it is anticipated that the underpass structure would be restricted to hiking-only.

Feedback from the engagement process noted that the highway alignment runs through a stalled golf course development. However, due to uncertainty regarding the status of the development, the alignment was not shifted at this point in time, but could potentially be shifted in the future if needed.

Section 3: Vicinity of Gerrie Road

Stakeholders noted that the new highway could sever access from Peachland to nearby hiking trails such as the Gladstone Trail. In response, a pedestrian underpass structure was incorporated into the design concept due north of Gerrie Road in order to maintain trail continuity. Given stakeholder concerns about motorized access to trails, it is anticipated that the underpass structure would be restricted to hiking-only.

Section 4: Vicinity of Princeton Avenue

Several refinements were undertaken to this section, primarily to address stakeholder feedback regarding impacts to community connectivity, impacts to parks and impacts to agricultural lands.

Stakeholders noted that there is a municipal park just west of Seymour Avenue which would be bisected by the new highway alignment. In response, investigation will be undertaken to assess the feasibility of shifting the highway alignment further to the west, to minimize impacts to the park.

As touched on previously in Section 8.2.1, it was recognized that the alternative route would several access along Princeton Avenue, Vernon Avenue and Elliot Avenue. The previously-noted configuration to raise the highway over Princeton Avenue and Vernon Avenue, and provide an alternative access to Elliot Avenue from Princeton Avenue was therefore incorporated into the alternate route design. Stakeholder feedback also noted that the highway alignment through this area creates significant impacts to agricultural lands. Opportunities to refine the option in this area such that the new highway would run along the edge of the existing fields, thereby retaining a single contiguous (albeit smaller) field, will be investigated as part of Phase II.

At a broader level, several stakeholders expressed concerns regarding the overall choice of the preferred alternate route in this area, and advocated for an alternative corridor further up the hillside and away from the community to be considered instead. Therefore, alternate route AR-4, which was previously screened-out as part of the option screening assessment in Section 5.2.2, was reintroduced for more detailed consideration as part of Phase II. Alternate route AR-4 broadly follows the same alignment as the recommended option, other than in the vicinity of Princeton Avenue and across Deep Creek, where it diverts further inland. Opportunities for a connection between the alternate route highway and Princeton Avenue will also be investigated. A drawing package of the segment of AR-4 where the alignment diverges from AR-C is provided in Appendix C.

Section 5: South End Tie-In

The engagement process did not generate any significant feedback in this section that was not already previously addressed as part of the initial alternate route option development process.

Appendix A

Refined Design Concept for Existing Corridor Recommended Option (ER-A)

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NOT FOR CONSTRUCTION

Highway 97 Online Laning
Exhibit 1

EXHIBIT
1 - Draft

PARSONS

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Highway 97 Online Laning
Exhibit 2

EXHIBIT
2 - Draft

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Highway 97 Online Laning
Exhibit 3

EXHIBIT
3 - Draft

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Highway 97 Online Laning
Exhibit 4

EXHIBIT
4 - Draft

PARSONS

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Highway 97 Online Laning
Exhibit 5

EXHIBIT
5 - Draft

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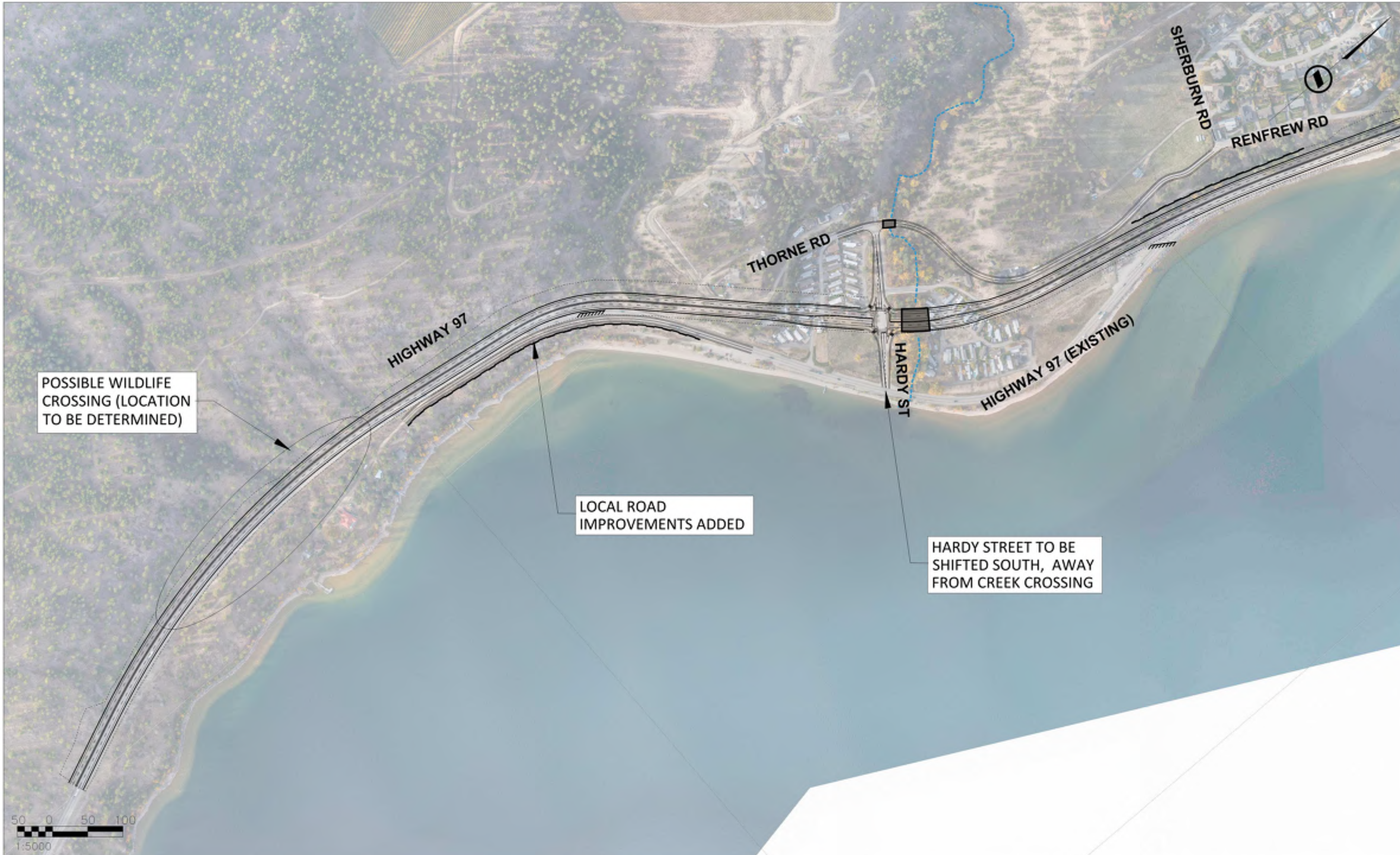

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Highway 97 Online Laning
Exhibit 6

EXHIBIT
6 - Draft

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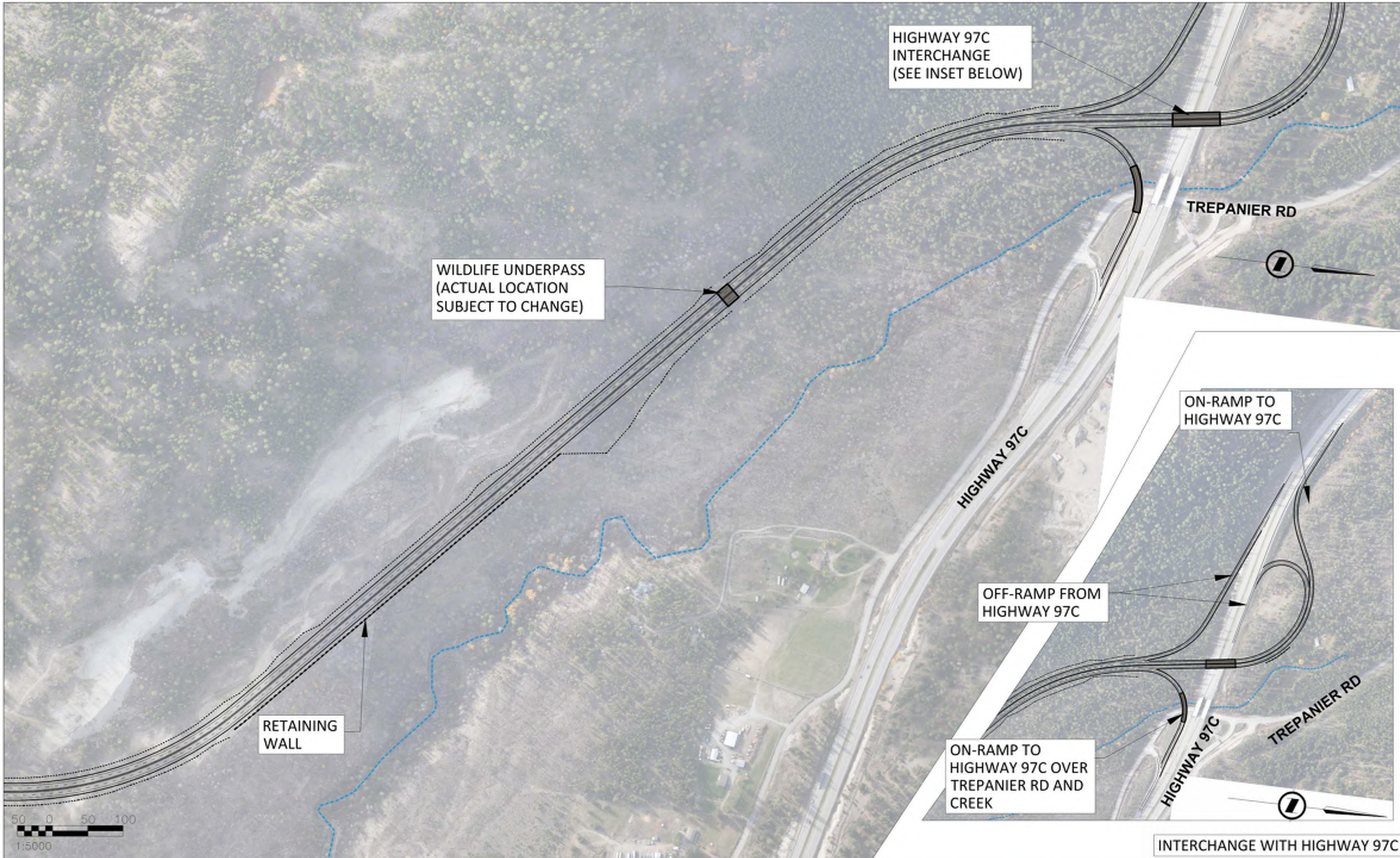
Appendix B

Refined Design Concept for Alternate Corridor Recommended Option (AR-C)



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Alternate Route Option 5
Exhibit 1

EXHIBIT
1 - Draft

PARSONS

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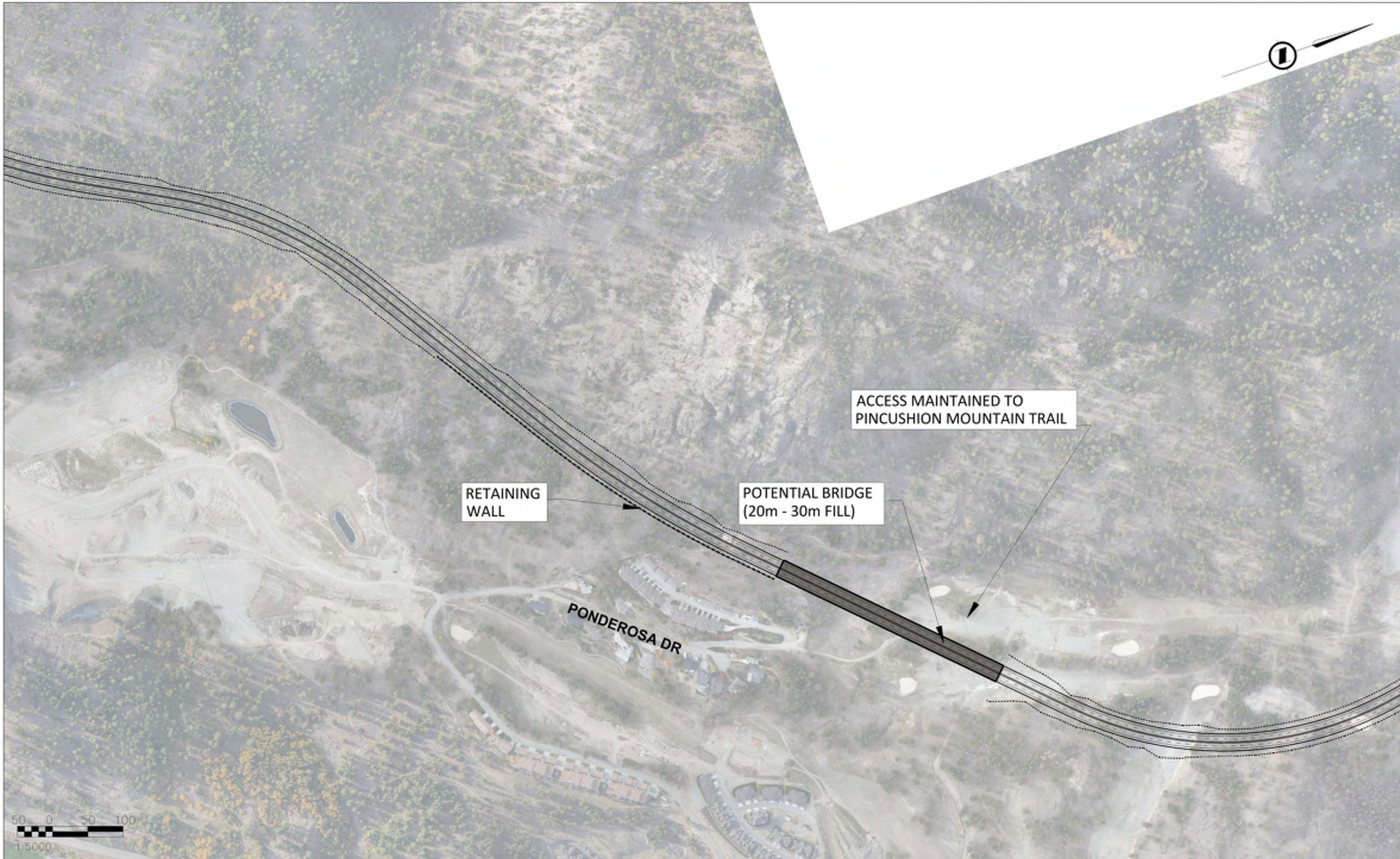

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Alternate Route Option 5
Exhibit 2

EXHIBIT
2 - Draft

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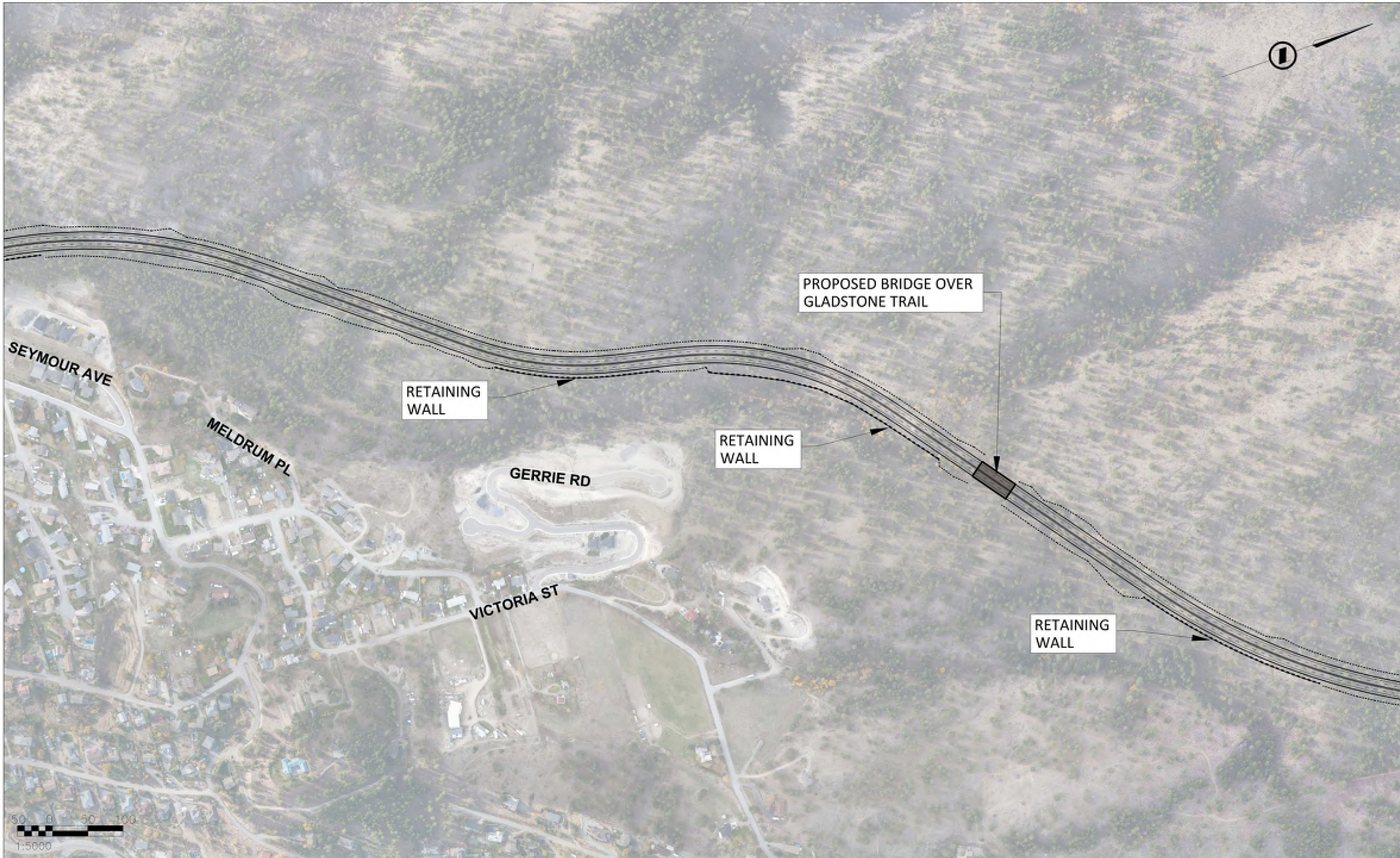

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Alternate Route Option 5
Exhibit 3

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3 - Draft

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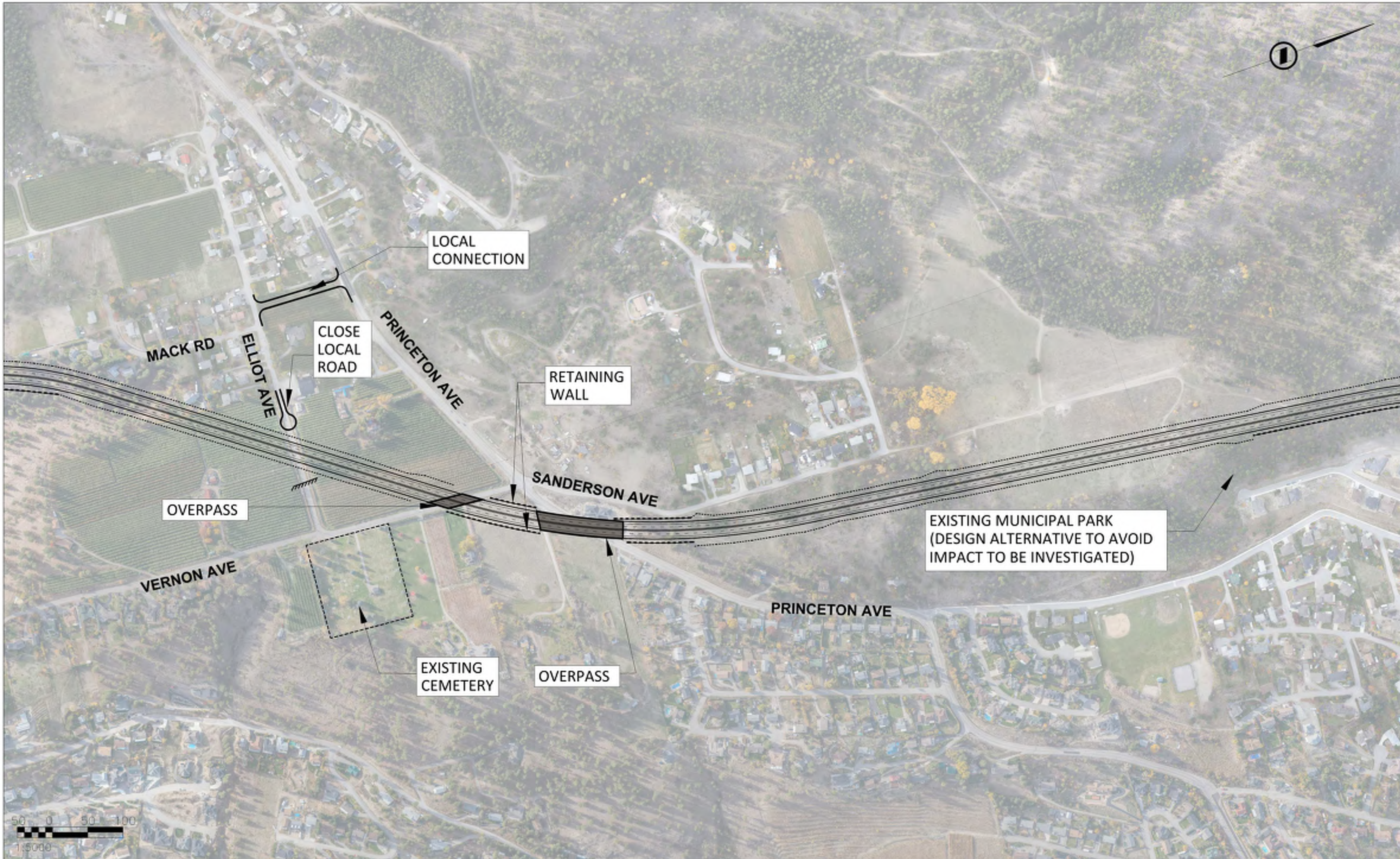

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Alternate Route Option 5
Exhibit 4

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Alternate Route Option 5
Exhibit 5

EXHIBIT
5 - Draft

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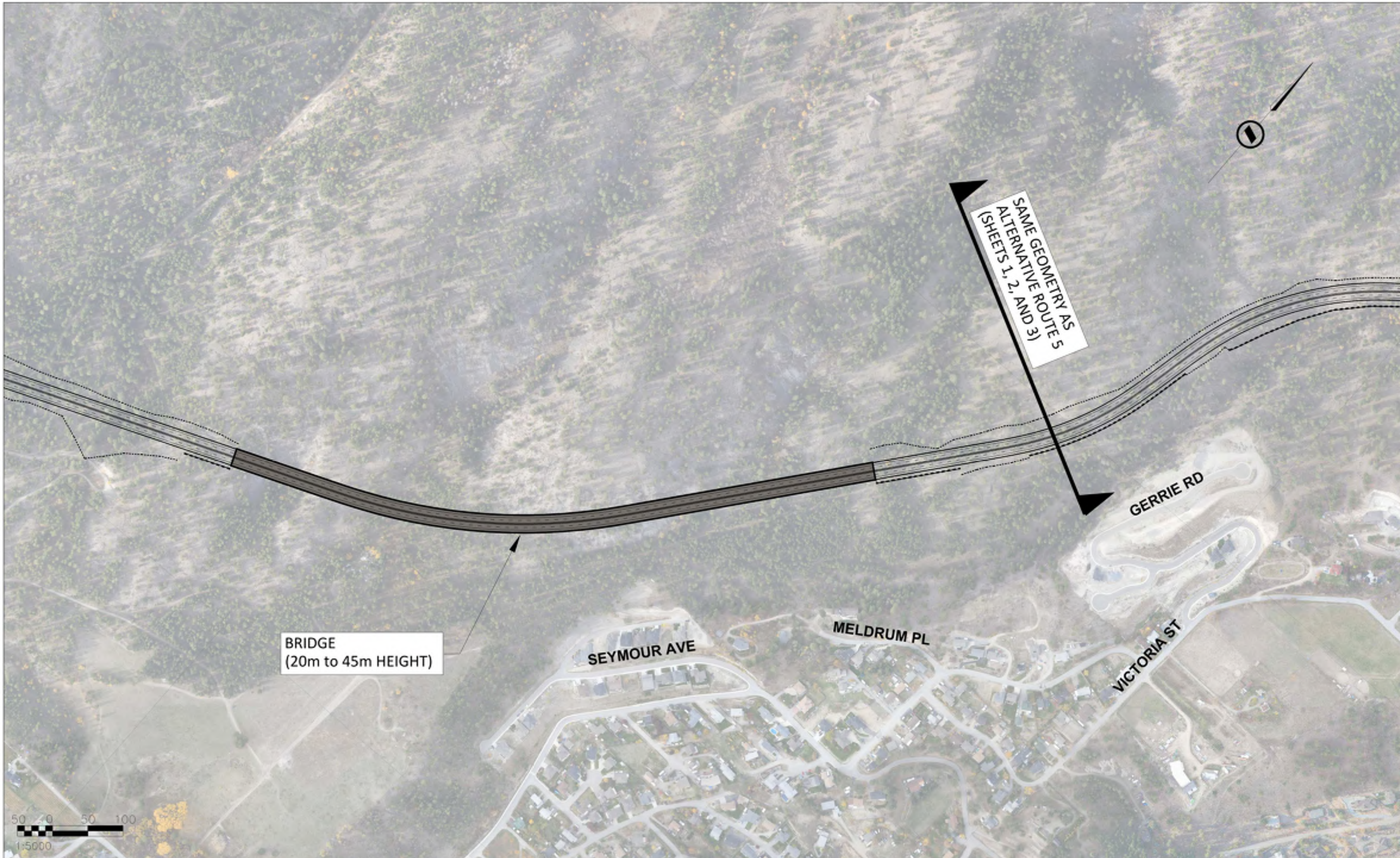
Appendix C

Refined Design Concept For Alternate Corridor

Additional Option (AR-4)



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Alternate Route Option 4
Exhibit 1

EXHIBIT
1 - Draft

PARSONS

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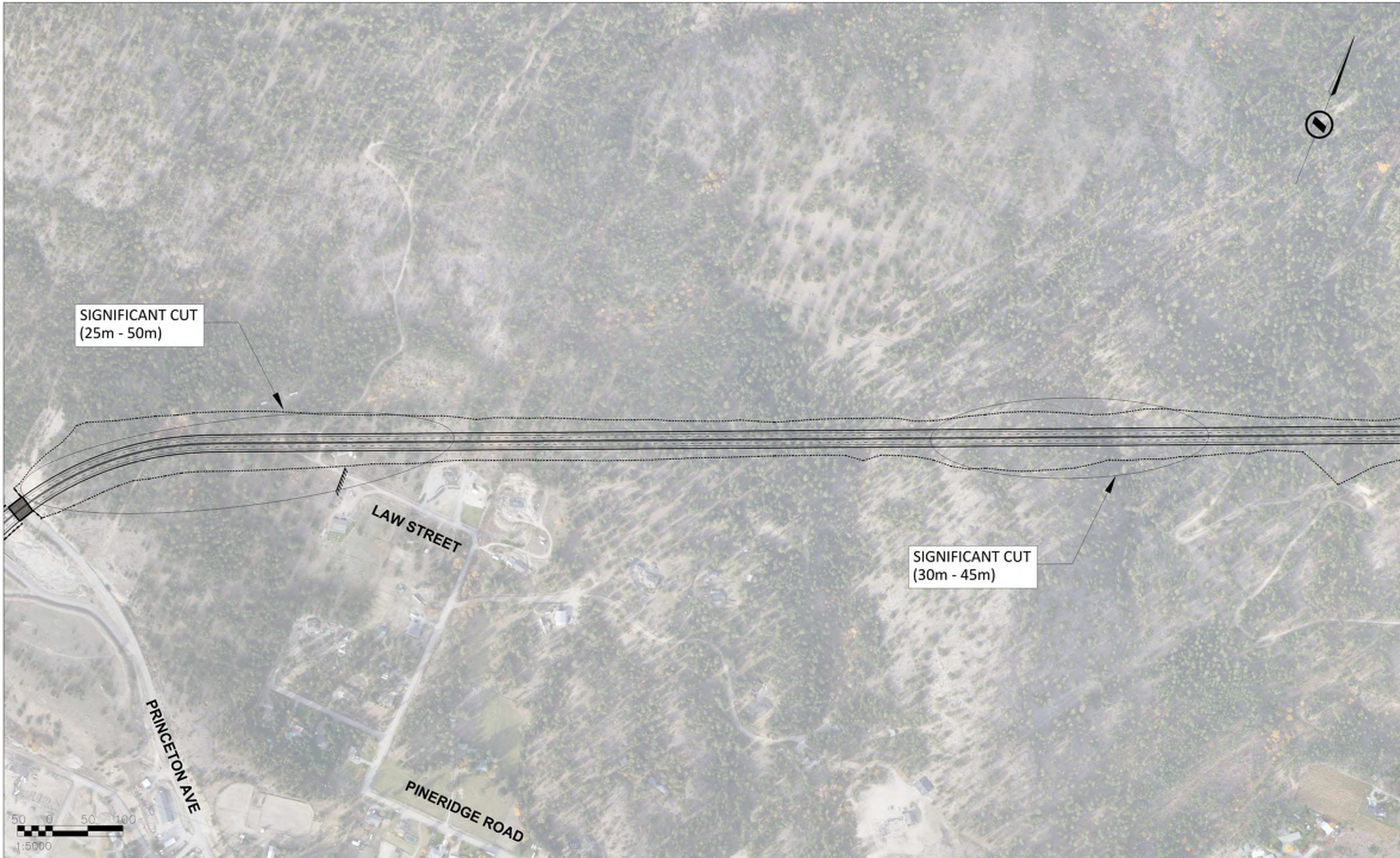

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Alternate Route Option 4
Exhibit 2

EXHIBIT
2 - Draft

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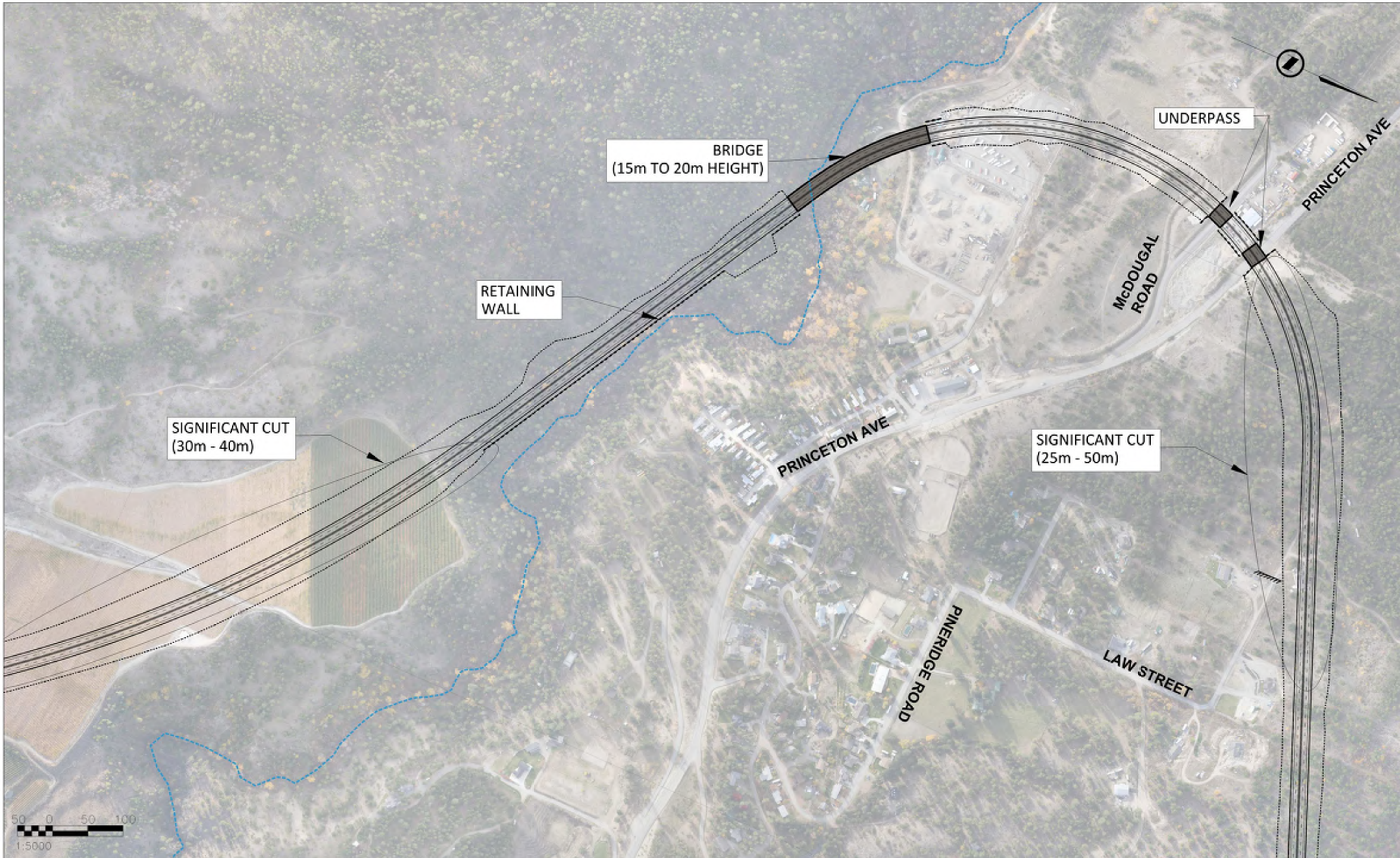

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Alternate Route Option 4
Exhibit 3

EXHIBIT
3 - Draft

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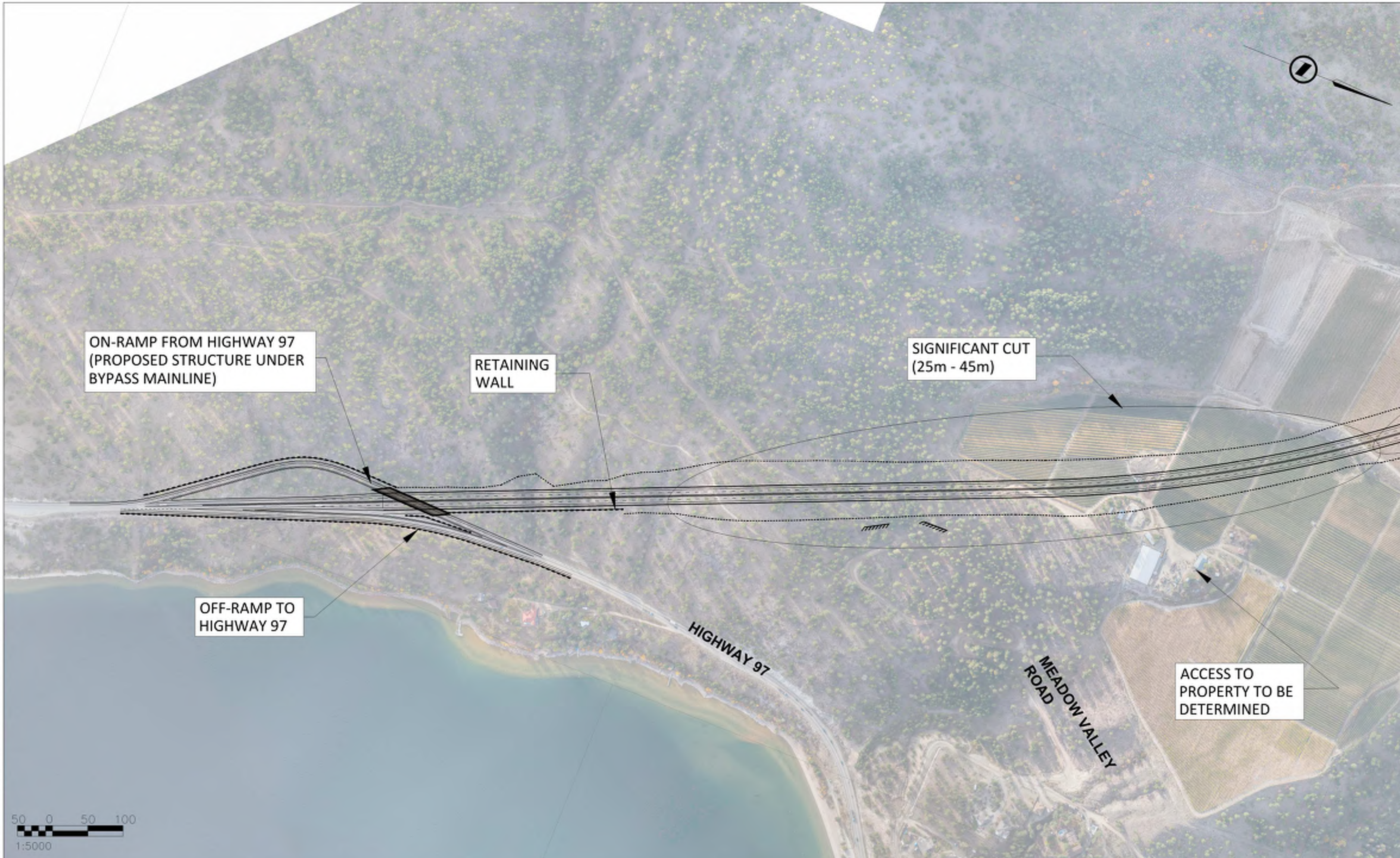

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