Report Summary – Functional Plan for Whitehorse Corridor Alaska Highway

Prepared for

Government of Yukon, Highways and Public Works

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CH2MHILL®

Contents

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Acronyms and Abbreviations

km	kilometre
LOS	level of service
LT	left-turn
m	metre
No.	number
Rd	Road
SB	southbound
STA	Station
WB	westbound
YG	Government of Yukon
YHPW	Government of Yukon Department of Highways and Public Works

Report Summary – Functional Plan for Whitehorse Corridor Alaska Highway

Background

Whitehorse has grown by 24.3 percent over the past 9 years (Yukon Bureau of Statistics, 2013b), leading to increased concerns with traffic congestion and traffic safety on the section of the Alaska Highway within the city limits. The pressures on this part of the highway are anticipated to continue to grow. Therefore, the Government of Yukon Department of Highways and Public Works (YHPW) is considering options to upgrade the Whitehorse Corridor of the Alaska Highway from Gentian Lane to the northern municipal boundary, a distance of 39.7 kilometres (km).

In 2011, the Government of Yukon (YG) commissioned studies to assess road safety, environmental issues, and highway capacity within the corridor. Using these studies and recommendations as a basis, YG then prepared a conceptual plan that identifies and compares high-level development options that could be considered for the corridor. It is intended that this study, Functional Plan for Whitehorse Corridor Alaska Highway, will expand on the initial work undertaken by YG to deliver a plan that will be used to guide immediate- and long-term corridor improvements.

The overall scope of work of this functional planning study is to identify cost-effective solutions to transportation corridor management in the immediate-, medium-, and long-term, based on sound technical analysis and limited stakeholder engagement. For this project, the population planning horizons for the immediate-, medium-, and long-term were defined in 2011 by YG as 26,000, 35,000 and 46,800, respectively.

The objective of this Functional Plan is to develop a recommended long-term solution for development of the section of the Alaska Highway through Whitehorse, and staged implementation for the two shorter-term planning horizons. Ultimately, the options are to cost-effectively address safety and congestion issues experienced today and projected to increase over time as population expands in and around Whitehorse.

Following is a summary of the work done for this study and the resulting improvement recommendations.

Existing Conditions Analysis

The first step in the study was to gather and analyze data, information, and previous work done regarding the existing corridor. This included reviewing the existing site conditions; reviewing, refining, and supplementing existing survey data; and collecting and compiling existing mapping and legal survey data, and as-constructed information into a digital drawing base plan for the corridor.

Previous studies, including YG's 2011 traffic study and model, safety analysis, and environmental analysis, were reviewed and analyzed. The previous safety and environmental studies were found to be complete and accurate. While no fatal flaws were found in the traffic study, new traffic count information and a change in the planning timeframe for Pine Street Extension required revising and re-running the traffic model.

Limited stakeholder consultation was also undertaken to inform other government organizations and local utility companies of the study and gather feedback on their future plans along the corridor.

Basis of Functional Plan

The next step in the process was to establish project guidelines for developing conceptual designs and planning the long-term improvements.

Design criteria to be followed in developing conceptual designs of the recommended improvements to the corridor were established. The design criteria are based on recognized engineering design guidelines for highways, intersections, frontage roads, multi-use trails, and driveways, as well as for geotechnical design.

Guiding principles used in this study to determine recommended improvements to the corridor were also established. The guiding principles are based on recognized transportation engineering principles and are a function of:

- Level of service (LOS) on the highway segments between intersections (number of vehicles per lane and amount of time spent following other vehicles)
- LOS of intersections (delay time at intersections)
- Safety (predicted conflicts and collision rates) along the corridor and at intersections

Traffic and Safety Analysis

Updated traffic count information was used to model existing and forecasted traffic volumes along the corridor. Traffic, operational, and safety analyses were undertaken to determine long-, medium-, and immediate-term needs for recommended improvements on the Alaska Highway for population horizons of 46,800, 35,000, and 26,000, respectively. The assessment considered traffic volumes, delays, and the daily profile of traffic to determine when a particular intersection or highway segment exceeded the design criteria. As such, a combination of travel time and safety improvements for both intersections and segments was considered in this analysis.

The traffic and safety analysis established improvement requirements for intersections and the highway, based strictly on traffic operations and safety. These requirements were then used to develop conceptual design solutions, and the solutions were further analyzed, not only for traffic and safety, but also for cost and environmental impacts, to develop the recommended long-term functional plan. The further analysis is described in the following sections.

Long-term Plan Development

Numerous conceptual design options were prepared and analyzed in an effort to address the long-term needs of the corridor. Potential solutions explored included additional lanes on the highway (four-laning or two lanes with passing lane), access management, frontage roads, intersection improvements, and an overpass at Two Mile Hill Road (Rd). For solutions involving widening the highway to four lanes, the option of widening the existing highway equally on both sides with a flush, paved centre median, was compared to adding a second carriageway beside the existing two lanes, and separated by a depressed, grassed centre median. Equal widening on both sides with a paved center median was determined to be the preferred solution based on cost, potential right-of-way impacts and consistency within the corridor. Note that current traffic volumes do not warrant a traffic barrier in the centre paved median.

Ultimately, a preferred long-term improvement plan for the entire corridor was identified, plus three sub-options that required further analysis, as follows:

1. Northbound overpass at Two Mile Hill Rd
2. Additional lanes (three or four) through Rabbit's Foot Canyon
3. Median weigh scale facility

Planning-level cost estimates of the long-term design and sub-options were then prepared for budgeting purposes and for further evaluation of the improvement priorities and sub-options. An assessment of property impacts and costs was also undertaken at this time and incorporated into the planning-level cost estimates.

Segment and Option Evaluation

For further evaluation purposes, the corridor was divided into 10 segments, as shown in the attached Figures 1 to 3. A multiple account evaluation and high-level cost-benefit analysis was then completed to prioritize the segments. The multiple account evaluation included the following key accounts:

- Construction cost
- Travel time savings
- Accident savings
- Environmental impact

Cost-benefit analyses were also completed for the three sub-options to determine the recommended long-term plan.

The resulting recommended construction sequencing and costs to achieve all of the recommended improvements are summarized in the next section, Recommended Long-term Plan. More detailed Staged Implementation Plans for the recommended immediate- and medium-term improvements, as shown in the Recommended Implementation Plan section.

Recommended Long-term Plan

The recommended Long-term Plan for the Whitehorse Corridor of the Alaska Highway is provided in the full report titled *Functional Plan for Whitehorse Corridor, Alaska Highway* (CH2M HILL, 2015). The recommended improvements and most probably construction costs, broken down by segment, are summarized on the attached Figure 4. The Long-term Plan should be implemented in the stages described in Table 1 in order to maintain acceptable LOS along the corridor on an ongoing basis.

TABLE 1
Recommended Improvement Plan

Timing	Segment Improvement	Description	Estimated Cost
Immediate-term (population 26,000)	4, 5, 6	Four lanes, access consolidation, frontage roads, and intersection improvements from Robert Service Way to new intersection at Forestry-Bethany Tabernacle (north of Two Mile Hill Rd). Includes new EMS access on Hamilton Blvd.	$52 million[a]
Medium-term (population 35,000)	7, 8, 9	Four lanes (except in canyon), access consolidation, frontage roads, and intersection improvements from new intersection at Forestry-Bethany Tabernacle to Kathleen Rd	$50 million
Long-term (population 46,800)	1, 2, 3, 10	Intersection improvements, passing lanes, access consolation, and frontage roads from Gentian Lane to Robert Service Way, and from Kathleen Rd to the northern municipal boundary	$91 million
TOTAL			**$193 million**

Note:

[a] The estimated costs do not include the cost to move the Airport Maintenance Building in Segment 5.

Three sub-options were developed but not included in the Long-term Plan because they added low benefits to the highway operations and safety relative to cost. (From a financial perspective a benefit-cost ratio (b/c)

of greater than 1.0 is desired.) However, they are viable options that may be considered if funding is available. The three sub-options are:

- Northbound Overpass at Two Mile Hill Rd (Long-term):
  - The traffic analysis shows that a northbound overpass at Two Mile Hill Rd would be required just prior to population horizon 46,800 to achieve the recommended LOS at that intersection.
  - However, the cost-benefit analysis indicates that the cost to construct the overpass outweighs the monetized benefits (b/c = 0.66). Estimated cost is $33.4 million.
- Additional Lanes through Rabbit's Foot Canyon (Medium-term):
  - The Long-term Plan maintains only two lanes on the Alaska Highway through Rabbit's Foot Canyon due to the high cost of widening the highway through a 900-metre (m) section of high rock cuts (b/c = 0.86).
  - The traffic analysis shows that the LOS remains acceptable with only two lanes along this segment, as long as the other recommended highway improvements are implemented along the corridor. Estimated cost is $12.6 million.
- Median Weigh Scale Facility (Immediate-term):
  - The Long-term Plan was developed to allow the existing side-entrance weigh scale facility south of Robert Service Way to remain in operation.
  - Alternative concepts for a median weigh scale facility were developed as part of this report, but the implementation decision will involve bylaw enforcement and operations considerations in addition to highway operations. Estimated cost is $19.8 million.

Recommended Implementation Plan

The recommended immediate-term improvements represent the segments of the corridor currently not meeting the LOS design criteria. Based on a reasonable investment in upgrading the Whitehorse Corridor and consistent with the YG five-year capital program, it is recommended that these improvements be implemented in the next 5 years, commencing in 2016. A single contract to complete all of the recommended immediate-term improvements is feasible, but if smaller contracts are considered more desirable, the order of priority is described in Table 2.

TABLE 2
Immediate-term Improvements

Priority	Highway Segment	Approx. Start	Approx. End	Length (m)	No. of Highway Lanes	Estimated Cost ($ million)	Description
1	6	North of Sumanik Dr.	North of Two Mile Hill Rd	1,200	4	$12.1	Widen to four lanes, dual SB LT/dual WB LT at 2 Mile Hill Rd, new intersection at Forestry-Bethany Tabernacle. New EMS access on Hamilton Blvd.
2	5	Salvation Army North Access	North of Sumanik Dr.	1,300	4	$22.8	Widen to four lanes, upgrade Range/Sumanik, 2 Mile Rd/Range (by City), new intersection at Salvation Army North Access.
3	5	Radar Rd/ Lodestar Lane	Salvation Army North Access	1,800	4		Widen to four lanes, upgrade Norseman/Burns, Hillcrest,

TABLE 2
Immediate-term Improvements

Priority	Highway Segment	Approx. Start	Approx. End	Length (m)	No. of Highway Lanes	Estimated Cost ($ million)	Description
							Radar/Lodestar, and new frontage roads
4	4	S. of Hamilton Blvd./Robert Service Way	N. of Hamilton Blvd./Robert Service Way	700	4	$17.5	Widen to four lanes, upgrade Robert Service Way and rest area exit
5	4	N of Hamilton Blvd./Robert Service Way	Radar Rd/ Lodestar Lane	2,000	4		Widen to four lanes, upgrade entrance and exit to weigh scale

Notes:

LT – left-turn
SB – southbound
STA – station
WB – westbound

The recommended medium-term improvements should be in place prior to Whitehorse's population reaching 35,000. For the most likely population growth rate of 2 percent per year, forecast from 2011, this will be approximately year 2031. For a more aggressive population growth rate of 3.5 percent per year, forecast from 2011, this would be approximately year 2023. Construction of the medium-term improvements should be staged to meet population growth in the order of priority described in Table 3.

TABLE 3
Medium-term Improvements

Priority	Highway Segment	Approx. Start	Approx. End	Length (m)	No. of Highway Lanes	Estimated Cost ($ million)	Description
6	7	North of Two Mile Hill Rd	North of Prospector Rd	1,500	4	$12.1	Widen to four lanes, new intersection at Prospector/College access and new frontage roads
7	9	South of Centennial St.	North of Wann Road	1,900	4	$26.5	Widen to four lanes, upgrade Centennial, 15th, and Wann Rd, close 17th Ave., add new frontage roads
8	9	North of Wann Road	North of Kathleen Rd	2,100	4		Widen to four lanes, upgrade Laberge/MacDonald/Poplar intersection, Kathleen Rd, and new frontage roads
9	8	North of Prospector Rd	South of Centennial St.	2,200	2-4	$11.1	Upgrade with new intersection for War Eagle/Copper Belt, Fish Lake Rd, and the Waste Management Facility Access Rd

The traffic analysis of highway segment operations found that Segments 7, 8, and 9 are currently operating at less than an acceptable LOS during the afternoon peak hours. However, when intersection operations

were also considered, and when the segments were analyzed from a cost-benefit perspective, the required timeframe for constructing Segments 7, 8, and 9 dropped to the medium-term. If additional funding is available in the immediate-term, or if construction of Segments 4, 5, or 6 is delayed, the operation of the corridor would certainly benefit from advancing the medium-term priorities.

Conclusion

The analysis undertaken for this study concluded that the current infrastructure of the Whitehorse Corridor, Alaska Highway does not meet recommended transportation engineering guidelines and improvements are required in the immediate-, medium-, and long-term in order to achieve acceptable LOS and safety on the highway.

Recommendations

It is recommended that YG accept the principles presented in the March 2014 report *Functional Planning for Whitehorse Corridor, Alaska Highway* (CH2M HILL) to guide future corridor improvements.

It is also recommended that YG undertake the steps necessary to implement the recommended immediate-term improvements in the next 5 years with construction commencing in 2016 and plan for the implementation of the medium term priorities.

Planning for the implementation of the medium term priorities will be a function of population growth but for the most probable annual growth rate of 2%, construction of the medium term improvements should start no later than 5 years from now and could start sooner in order to spread out costs over a longer period. For a high annual growth rate of 3.5%, construction of the medium term improvements would need to start directly after the immediate term improvements are completed.

Next Steps

This report concludes Phase 1: Functional Planning for the project. The next phases of the project will be Phase 2: Public Consultation, Option Refinement, and Ranking, followed by Phase 3: Detailed Design. If detailed design is expected to proceed in 2015, pre-design activities that should be undertaken concurrent with Phase 2 include geotechnical investigations, survey data collection and environmental field investigations.

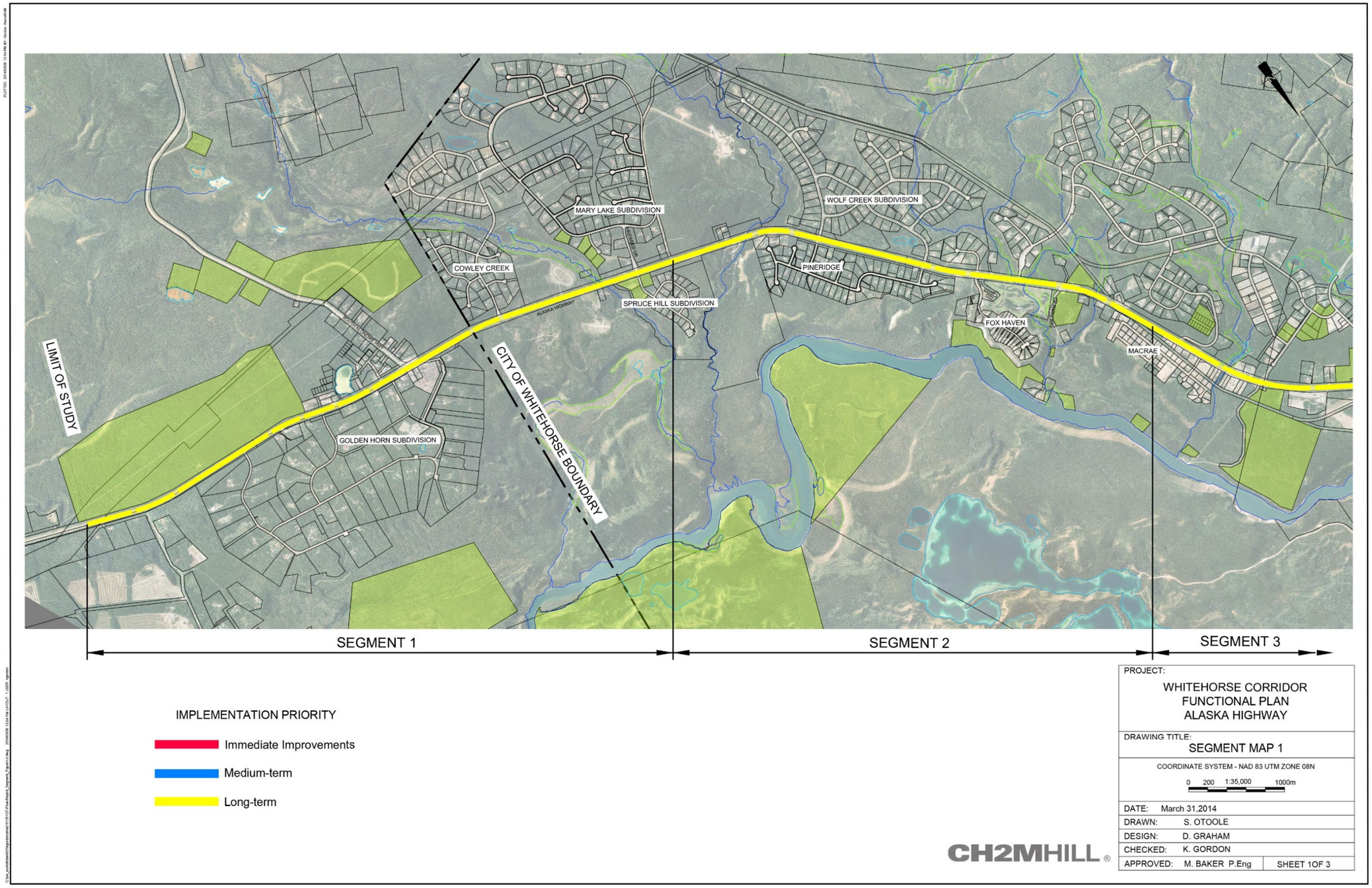
Works Cited

CH2M HILL Canada Limited (CH2M HILL). 2015. *Functional Planning for Whitehorse Corridor, Alaska Highway.* Prepared for Government of Yukon, Highways and Public Works. March.

Yukon Bureau of Statistics. 2013. *Population Report, March 2013.* Information sheet no. 58.44. Executive Council Office. October.

Figures

FIGURE 1
Segment Map 1



IMPLEMENTATION PRIORITY

- Immediate Improvements
- Medium-term
- Long-term

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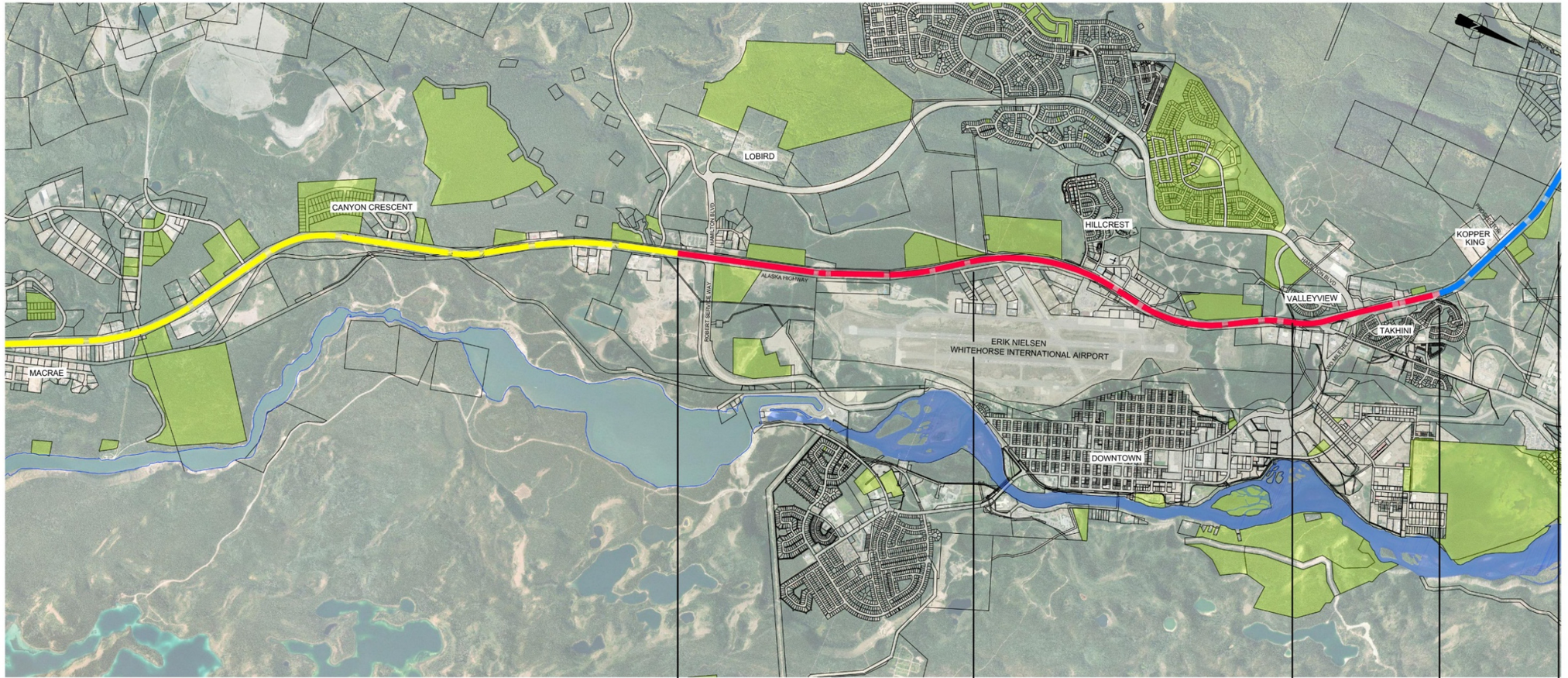
PROJECT: WHITEHORSE CORRIDOR FUNCTIONAL PLAN ALASKA HIGHWAY	
DRAWING TITLE: SEGMENT MAP 1	
COORDINATE SYSTEM - NAD 83 UTM ZONE 08N 0 200 1:35,000 1000m	
DATE: March 31,2014	
DRAWN: S. OTOOLE	
DESIGN: D. GRAHAM	
CHECKED: K. GORDON	
APPROVED: M. BAKER P.Eng	SHEET 1OF 3

FIGURE 2
Segment Map 2



IMPLEMENTATION PRIORITY

- Immediate Improvements
- Medium-term
- Long-term

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PROJECT: WHITEHORSE CORRIDOR FUNCTIONAL PLAN ALASKA HIGHWAY	
DRAWING TITLE: SEGMENT MAP 2	
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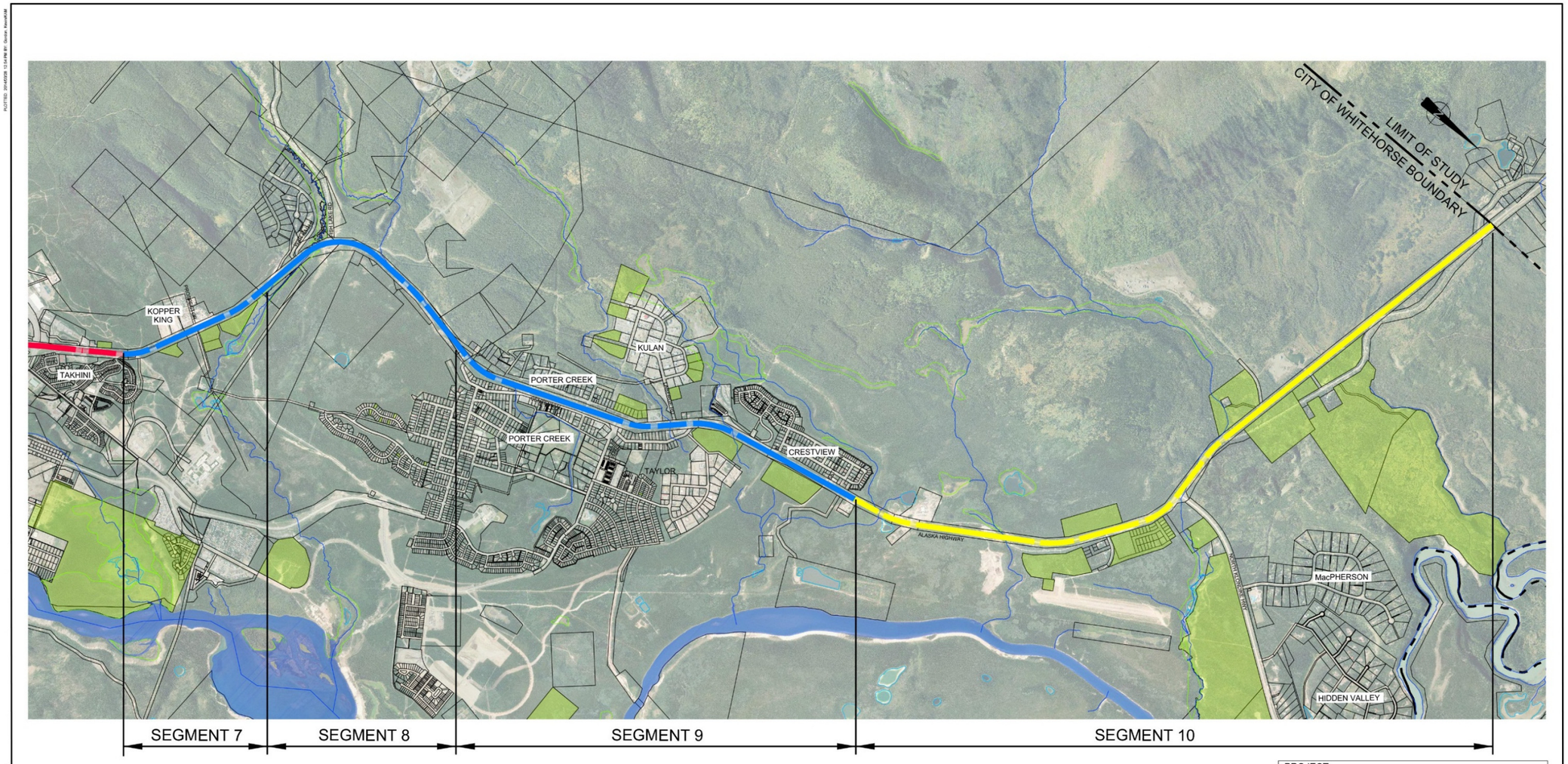
DATE: March 31,2014	
DRAWN: S. OTOOLE	
DESIGN: D. GRAHAM	
CHECKED: K. GORDON	
APPROVED: M. BAKER P.Eng	SHEET 2 OF 3

FIGURE 3
Segment Map 3



IMPLEMENTATION PRIORITY

- Immediate Improvements
- Medium-term
- Long-term

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PROJECT: WHITEHORSE CORRIDOR FUNCTIONAL PLAN ALASKA HIGHWAY	
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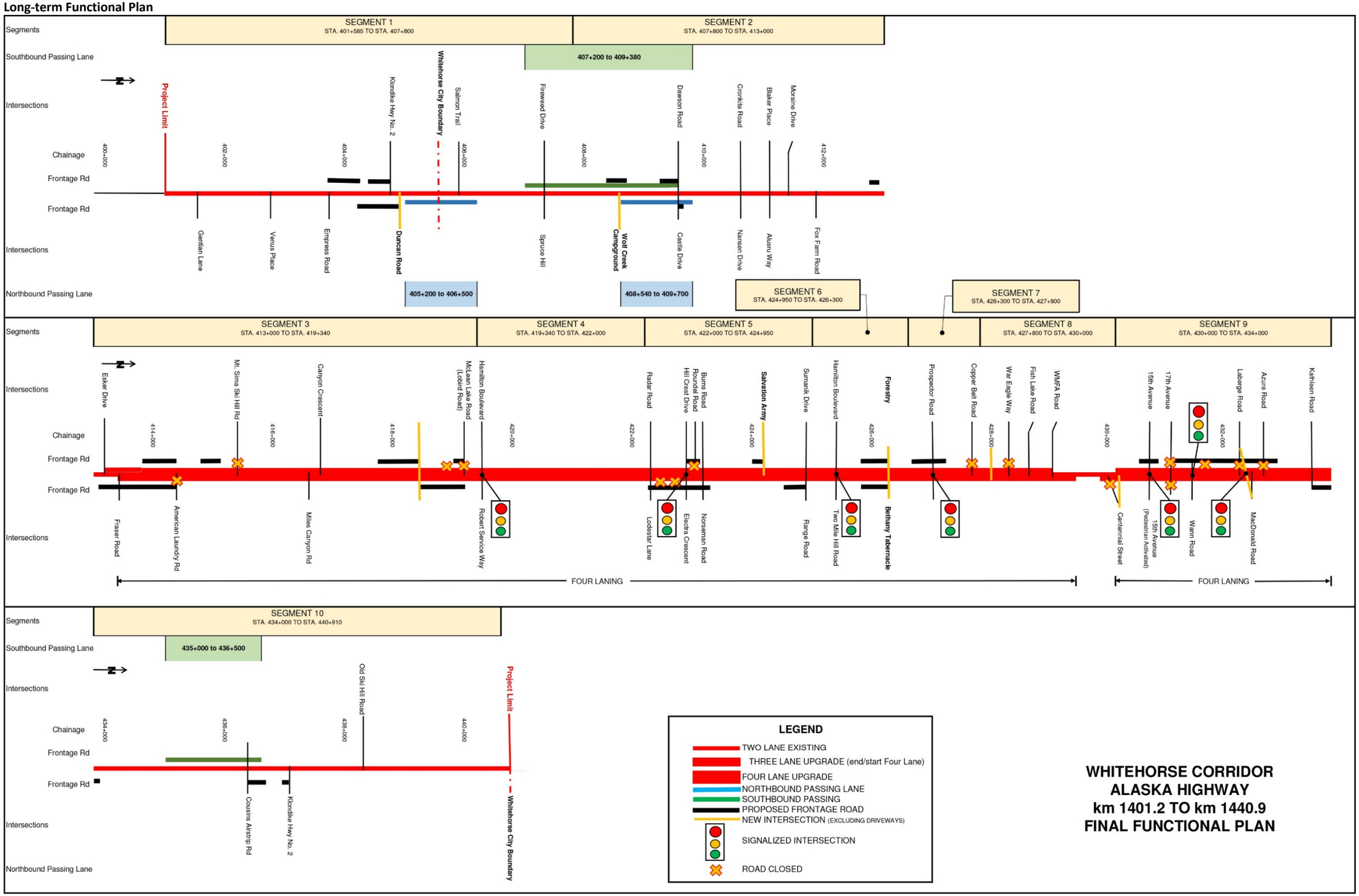
APPROVED: M. BAKER P.Eng	SHEET 3 OF 3

FIGURE 4

Long-term Functional Plan



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