

## **West Bragg Creek Emergency Access Route Determination Functional Planning Study**



PRESENTED TO  
**Rocky View County**

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## EXECUTIVE SUMMARY

Rocky View County has identified the need to determine an emergency access route for the West Bragg Creek area. Rocky View County (the County) has retained Tetra Tech Canada Inc. (Tetra Tech) to complete an emergency access route study for the community of West Bragg Creek. This study was undertaken in partnership between the County and Alberta Transportation

Currently, the only access to the West Bragg Creek area is via a crossing of the Elbow River at Balsam Avenue. Any disruption to the river crossing may strand the residents in West Bragg Creek without an emergency access across the river as well as hinder emergency services from responding adequately. During the 2013 flood event of Calgary and the surrounding areas, the river crossing at Balsam Avenue was temporarily closed leaving residents without the ability to access their homes or exit the area. A potential forest fire could also have similar consequences for the residents if there is only a single access to the community. It should be noted though, that there is a higher probability of a wildlife event occurring than a flood necessitating the need for emergency access into and out of this area.

In 2013, the Alberta Government and the Tsuut'ina Nation entered into an agreement for land transfer to construct the City of Calgary Southwest Ring Road, which included the transfer of lands north of Bragg Creek to be redesignated and incorporated into the Tsuut'ina Nation. This exchange of lands exacerbates the challenge of finding an emergency access route due to the potential for limited access directly north of the West Bragg Creek community.

The study area is located approximately 30 km southwest of Calgary in the southwest portion of Rocky View County, as shown on Figure 1. Within the study area, the Hamlet of Bragg Creek is located to the southeast and can be accessed by Highway 22 and Highway 758. The West Bragg Creek community is accessed through the hamlet via Balsam Avenue which crosses over the Elbow River. Within West Bragg Creek, the residences are predominantly located in the Wintergreen community in the northeast and within country residential subdivisions along Township Road 232 (West Bragg Creek Road).

Preliminary route options were developed on the premise of providing a connection from the existing roads within the West Bragg Creek area to the existing road/highway network outside of the study area, in all directions. Seven preliminary route options were developed as well as two sub-route options to minimize residential and land impacts, as shown on Figure 2.

Based on the preliminary benefits and drawbacks, the following three route options were considered to be unfavourable compared to other route options, predominantly in the provision of emergency response and evacuation services time. These three routes also traversed along the western boundary of the County where there is high to extreme wildfire behaviour potential as well as being closer to primary wildfire threat due to the predominant wind direction.

- Route Option 3 – north and east around the Tsuut'ina Nation lands before connecting with the existing municipal road towards Highway 22.
- Route Option 4 – north towards Highway 68.
- Route Option 6 – southeast towards the Kananaskis Ranger Station.

An internal connection was seen as an integral part of the emergency access road such that access is available to the west and to the north if the existing connection at Balsam Avenue is unavailable, regardless of the route option selected. A potential internal connection route was reviewed that would connect from Range Road 52 through

Township Road 234 to Mountain Lion Drive. Tetra Tech recommended implementation of this connector, or an alternative connector, to accompany any route recommendation. During subsequent discussions, the County indicated that any internal connection would be dealt with by the County's internal road planning exercises, separate from this study.

An initial stakeholder consultation component consisted of one-on-one and focus group meetings with directly impacted landowners and landowners adjacent to one of the potential emergency access road routes. This was followed by an open house, held on June 23, 2016, at the Snowbird Chalet in Bragg Creek, to gather input from the general public. Comments were addressed by inclusion of the factors into the evaluation criteria, adding more route options for review, and inclusion of other comments as potential risks to the routes. Ultimately, 11 routes were carried forward for further evaluation including routes that were initially screened out to assess queries and comments. These routes are shown on Figure 3.

The evaluation of the route options were completed in a workshop setting with representatives and subject experts from the County, Alberta Transportation and Tetra Tech. The evaluation criteria included emergency response service, emergency evacuation service, environmental constraints, geotechnical risks, historical resource areas, infrastructure, landowner impacts, operations/maintenance, topography, geometry, and utility impacts; and utilized construction costs to provide a score/cost ratio. With construction costs taken into consideration, Route Option 2 ranked the highest and was considered the technically preferred route. The results of the workshop evaluation are presented on Figure 4.

Route Option 2 extends north from Wintergreen Road along Range Road 50 (undeveloped road allowance) through Tsuut'ina Nation lands, east along Township Road 240 (undeveloped road allowance) then north along Range Road 45 (partially developed road allowance) to connect to the existing local road network. Option 2 then utilizes the existing portions of Range Road 45 and Township Road 242 to connect to Highway 22.

During the course of this study, the County has communicated with Tsuut'ina Nation to discuss the various preliminary route options including the technically preferred route option. Tsuut'ina Nation and the County are continuing to work together towards a mutually beneficial solution that follows closely to Option 2.

A second stakeholder consultation component was undertaken to present the results of the technical evaluation and the preferred route, including a focus group meeting and an open house on September 20, 2017, at the Snowbird Chalet in Bragg Creek. Comments from the public/stakeholder consultation program were taken into consideration for the functional planning of the preferred route option. The project and the preferred Route Option 2 were also presented to the Rocky View County Policy and Priorities Committee. The Policy and Priorities Committee subsequently carried a motion to recommend to Council that Route #2 be identified as the preferred emergency access route for West Bragg Creek and direct administration to continue working with Alberta Transportation and Tsuut'ina Nation on the project including finalizing the planning study and developing a funding strategy.

The plans and profile of the recommended alignment are shown in Appendix D. The study recommendations for Route Option 2 are as follows:

- Consult with Indigenous and Northern Affairs Canada, early on within the project, to determine if there are any environmental assessment requirements under the authority of a federal ministry.
- Conduct surveys to confirm the presence and potential of environmental impacts to soils, wetlands, rare plants and ecological communities, sensitive wildlife features and habitats, and fish and fish habitat.
- Conduct a historical resources impact assessment prior to the initiation of any land surface disturbance activities.

- Conduct a geotechnical investigation to verify the subsurface soil and groundwater conditions, with special attention directed to fluvial and organic deposits.
- The County continue the dialogue with the Tsuut'ina Nation and work together towards a mutually beneficial solution; and upon doing so, secure project funding for the construction of the emergency access road.
- The County advance the planning of an internal connection to ensure the integrity of the accesses into the West Bragg Creek area should one of these accesses be unavailable in the event an emergency situation occurs.
- Confirm the ownership of the presumed Township Road 240 road allowance.
- Continue discussions with impacted landowners regarding the land procurement process and a potential borrow source.
- As the intent is not to convert this emergency access road into a permanent access now or in the future, it is recommended that this study be used as the basis to determine the appropriate location for a second permanent access into the West Bragg Creek area should there be a desire from the County and/or area residents.
- Follow up with the community regarding any outstanding items raised during the course of this study.

The estimated construction cost for the new section of roadway, between Moose Drive and Range Road 45, as part of the Route Option 2 emergency access is **\$14.5M (2017 dollars)**. The estimated construction cost for an optional item of paving Township Road 242, from Range Road 45 to Highway 22 is \$3.6M.

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## **LIMITATIONS OF REPORT**

This report and its contents are intended for the sole use of Rocky View County and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Rocky View County, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech Canada Inc.'s Services Agreement.

## 1.0 INTRODUCTION

Rocky View County has identified the need to determine an emergency access route for the West Bragg Creek area. The emergency access will provide residents and emergency services with a route to access the West Bragg Creek area during an emergency such as flooding or fire should the main access into the area (Balsam Avenue Bridge) be compromised. Rocky View County (the County) has retained Tetra Tech Canada Inc. (Tetra Tech) to complete an emergency access route study for the community of West Bragg Creek. This study was undertaken in partnership between the County and Alberta Transportation.

### 1.1 Background

The Hamlet of Bragg Creek is situated approximately 30 km southwest of the City of Calgary in Rocky View County and lies at the foot of the eastern slope of the Rocky Mountains. The Elbow River runs through the hamlet in a southwest to northeast orientation, and the east and west portions are connected by a bridge crossing on Balsam Avenue. The West Bragg Creek community includes the portion of the hamlet situated west of the Elbow River and rural residential subdivisions outside of the hamlet boundary.

Currently, the only access to the West Bragg Creek area is via a crossing of the Elbow River at Balsam Avenue. Any disruption to the river crossing may strand the residents in West Bragg Creek without an emergency access across the river as well as hinder emergency services from responding adequately. During the 2013 flood event of Calgary and the surrounding areas, the river crossing at Balsam Avenue was temporarily closed leaving residents without the ability to access their homes or exit the area. A potential forest fire could also have similar consequences for the residents if there is only a single access to the community. The flooding in 2013 was extreme and at the time was noted to be the worst in the province's history; this event led to the commencement of this study due to the issues associated with access to the community. Moreover, the Greater Bragg Creek Area Structure Plan also includes a policy that an additional Municipal access/egress shall be constructed to lands in West and North Bragg Creek. It should be noted though, that there is a higher probability of a wildlife event occurring than a flood necessitating the need for emergency access into and out of this area.

In 2013, the Alberta Government and the Tsuut'ina Nation entered into an agreement for land transfer to construct the City of Calgary Southwest Ring Road. This transaction included the transfer of lands north of Bragg Creek which are to be redesignated as Reserve lands and will be incorporated into the Tsuut'ina Nation. In November 2014, the issue of a single access to West Bragg Creek was brought up by the public at a provincial open house regarding the land transfer deal. In May 2015, the Federal Government approved the land transfer deal. This exchange of lands north of Bragg Creek to Tsuut'ina Nation exacerbates the challenge of finding an emergency access route due to the potential for limited access, directly north of West Bragg Creek community as well as other surrounding constraints.

### 1.2 Study Area

The study area is located approximately 30 km southwest of Calgary in the southwest portion of Rocky View County. The study area includes the Greater Bragg Creek community and extends out to the County boundaries as well as to the surrounding local roads and provincial highways that could provide a suitable emergency access road connection out of West Bragg Creek. The study area is bounded by the M.D. of Foothills located to the south, Kananaskis Improvement District to the south and west, Township Road 242 to the north and Highway 22 to the east; and is defined by Highway 22, Highway 66, Jumping Pound Creek and the west boundary of Rocky View County. This area is generally shown on Figure 1.

Within the study area, the Hamlet of Bragg Creek is located to the southeast and can be accessed by Highway 22 and Highway 758. The West Bragg Creek community is accessed through the hamlet via Balsam Avenue. Within West Bragg Creek, the residences are predominantly located in the Wintergreen community in the northeast and within country residential subdivisions along Township Road 232 (West Bragg Creek Road). Tsuut'ina Nation's new transfer lands are located north of West Bragg Creek and extend from Wintergreen Road west to the County's west boundary. The Bragg Creek Provincial Park is located south of the hamlet along Highway 758. Redwood Meadows, and its' emergency services, are located approximately 6 km east of the hamlet along Highway 22.

## 1.3 Purpose and Objectives

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The purpose of the study is to determine an emergency access/egress route that serves the community in the West Bragg Creek area. This includes providing recommendations regarding the specific location of the access route as well as determining other infrastructure requirements associated with the route.

The objectives of the study are to:

- Develop plans for the recommended alignment;
- Identify right-of-way requirements for the emergency access road; and
- Identify capital improvement costs required to construct the recommended alignment.

The methodology followed during the course of this study to meet the objectives is described in the subsequent section.

## 1.4 Methodology

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The following steps were undertaken during this study to develop, evaluate and select a preferred emergency access route.

### 1.4.1 Compile and Review Available Information

Available information including roadway network plans, air photos, mapping and survey files; geometric information; utility information; studies and data from Rocky View County, Alberta Transportation and other sources were assembled and reviewed in an effort to identify preliminary routes and project constraints.

### 1.4.2 Develop a Communications Strategy

A communication strategy was developed by Tetra Tech and reviewed by the County for the purpose of guiding channels of correspondence between the study team, study committee and external interest groups. This strategy outlined the proposed methodology and systematic approach to be followed by Tetra Tech when addressing communication requirements for this study. The key components of the communication strategy included:

- Stakeholder identification and involvement;
- Meetings and discussions with individual property owner and other contacts;
- Collaboration with the project Technical Review Committee (TRC);
- Presentation to municipal partners;
- Delivery of two public open houses;

- Responses to requests for information; and
- Clarification of study roles and responsibilities.

### **1.4.3 Development of Preliminary Routes**

An initial site review was conducted on land by truck and foot to those access routes accessible to the public within the study area. Land reconnaissance was completed to confirm the existing road network; site constraints including topography, Elbow River and other water course crossings, environmental challenges, and residences; to orient the study team to the study area and to begin to identify possible routing options.

Based on the County's roadway design standards, horizontal and vertical criteria were defined and the typical roadway cross-section was confirmed in discussion with the County's Administration and Rocky View Emergency Services requirements. This information is used to determine future roadway characteristics and property impacts to adjacent landowners.

Preliminary route options were developed for initial consideration. These route options were based on maximizing the use of existing roadway infrastructure and County road allowances; minimizing impacts to adjacent landowners, potential Elbow River crossing locations, and environmental impacts; and to provide a variety of access options throughout the community. All options sought to connect as directly as possible to the surrounding highway network for ease of access.

### **1.4.4 Technical Review Committee Meeting No. 1**

The purpose of the first TRC meeting, comprised of representatives from Rocky View County, Alberta Transportation, and Tetra Tech, was to review the background information, assess the issues and existing conditions, confirm the design criteria to be applied, present and discuss some of the preliminary route options, and present an initial route evaluation framework. Minutes from this meeting, as well as subsequent TRC meetings, are included in Appendix A.

### **1.4.5 Environmental Overview**

This overview considered impacts to vegetation, wildlife, watercourses, and other environmental sensitive areas. It was based on available published resource. This was a desktop study only with no field investigation completed. Environmental constraints were identified to assist in the development and refinement of route options.

### **1.4.6 Geotechnical Overview**

A review of the study area was undertaken with respect to geotechnical considerations. This scope of this overview included a desktop review only with no field investigation or drilling completed. Geotechnical constraints were identified and avoided where possible during the development of route options.

### **1.4.7 Historical Resources Overview**

Existing historical resources constraints were mapped to assess the potential for archaeological, historical or palaeontological sites to occur on lands that could be impacted by the route options. This information was obtained from publicly available records and information.

#### **1.4.8 Utility Impacts**

A utility search was completed through a review of existing base plans, search of available databases, and observations in the field. Where possible, route options were developed to avoid or minimize impacts to known existing or future utilities.

#### **1.4.9 Technical Review Committee Meeting No. 2**

The purpose of this meeting was to confirm the route options that would be carried forward for further evaluation and to provide an update on the intended stakeholder and public consultation program.

#### **1.4.10 Stakeholder Consultation and Public Open House No. 1**

The purpose of the stakeholder consultation program was to disseminate project background and preliminary route options to identified stakeholders and the public to gather feedback on the project requirements as well as route options. The stakeholder consultation component included a series of focus group meetings with landowners adjacent to a common route option being considered for further evaluation as well as one-on-one meetings with landowners that could be directly impacted by a proposed route. Discussions with the County's area councillor were held to receive feedback and provide updates as required. A public open house was then conducted to provide the community with an opportunity to provide feedback on the study progress and findings to date. Comments from the public/stakeholder consultation program were utilized to refine the route options and the evaluation framework. A summary of the comments provided by stakeholders and the public is presented in Section 7.0.

#### **1.4.11 Evaluation of Route Options**

At the conclusion of the initial stakeholder consultation activities, 11 route options were taken forward as part of the detailed evaluation. The evaluation of the route options were completed in a workshop setting with representatives and subject experts from the County, Alberta Transportation and Tetra Tech. The purpose of this evaluation was to determine the technically preferred route option that met the intent of the County's vision for an emergency route option.

#### **1.4.12 Technical Review Committee Meeting No. 3**

The purpose of this meeting was to present the feedback from the initial stakeholder and public consultation program, present the findings of the route evaluation, and provide an update on the intended stakeholder and public consultation program for the technically preferred route.

#### **1.4.13 Stakeholder Consultation and Public Open House No. 2**

The County communicated with the Tsuut'ina Nation to gather feedback on their interest in the project, the preliminary route options and later, the technically preferred route option. Tsuut'ina Nation indicated support towards the study and the technically preferred route.

The stakeholder/public consultation program was to present the technically preferred route option to landowners that are adjacent to the route and to the community to gather feedback on the preferred route option. A focus group meeting was held with landowners adjacent to the preferred route. A public open house was then conducted to present the preferred route to the community. Comments from the public/stakeholder consultation program were taken into consideration for the functional planning of the technically preferred route option. A summary of the comments provided by stakeholders and the public is presented in Section 16.0.

#### 1.4.14 Presentation to Rocky View County – Policy and Priorities Committee

The project was presented to the Rocky View County Policy and Priorities Committee upon completion of Open House No. 2. Motions made by the Policy and Priorities Committee are presented in Section 17.0 and summarized below.

- Motion #1: That the presentation from Tetra Tech on the West Bragg Creek Emergency Access Study be received for information.
- Motion #2: That the Policy and Priorities Committee recommend to Council that Route #2 be identified as the preferred emergency access route for West Bragg Creek, and direct Administration to continue working with Alberta Transportation and Tsuut'ina Nation on the project including finalizing the planning study and developing a funding strategy.

#### 1.4.15 Report Preparation

The full study details were documented in this report.

## 2.0 PROPOSED DESIGN CRITERIA

The design criteria for a Municipal Grid Road – Regional Moderate Volume standard from the County's Servicing Standards were used for this study, as shown in Table 1. The design designation was provided by the County and confirmed through discussion with the TRC. The design speed was also provided by the County during latter discussions on the functional design. A typical cross section for this designation is provided in Appendix B.

**Table 1: Proposed Design Criteria**

Design Component	Criteria	Emergency Access Road	
<b>Classification</b>	Designation	Municipal Grid Road – Regional Moderate Volume	
	Design Speed	80 km/h <sup>1</sup>	
	Number of Lanes	2	
<b>Horizontal Alignment</b>	Minimum Curve Radius	250 m <sup>2</sup>	
	Maximum Superelevation	0.06 m/m	
<b>Vertical Alignment</b>	Minimum K	Crest	35 <sup>2</sup>
		Sag	35 <sup>2</sup>
	Gradient –Maximum	8%	
<b>Cross-section</b>	Lane Width	Through	4.0 m
	Shoulder Width	Inside	n/a m
		Outside	n/a m
	Finished Width	8.0m	
	Ditch Width	V-ditch	
	Sideslope	Maximum	3:1
	Backslope	Maximum	3:1
	Ditch Depth	Minimum	1.0 m
	Right-of-Way Width	Minimum	20.0 m
	Road Structure	Granular Base	100 mm
		Granular Subbase	250 mm

Notes: (1) Provided by Rocky View County.

(2) Based on Alberta Transportation's Highway Geometric Design Guide for an 80 km/h design speed.

## 3.0 EXISTING ROAD NETWORK

The land use surrounding the West Bragg Creek area is a mix of woodland to east, south and west; and agricultural lands (largely used for pasture) to the north. Much of the residential subdivisions within the West Bragg Creek area are surrounded by mature trees. The topography and Reserve to the north present challenges to establishing a road connection towards Highway 1, while the Elbow River valley can present significant challenges to establishing a road connection to the south and east. There are limited roadway connections to the west since much of Kananaskis Country is undeveloped and remote.

### 3.1 West Bragg Creek

The natural landscape of West Bragg Creek area consists of a transition between prairie grasslands extensive areas of rugged terrain, dense vegetation, and natural waterways. There are two regional collector roadways within West Bragg Creek, namely Township Road 232 (West Bragg Creek Road) and Wintergreen Road. There are other municipal roadways that serve moderate to lower traffic volumes connecting internal subdivision roads to the regional collector roadways.

#### 3.1.1 West Bragg Creek Road (Township Road 232)

West Bragg Creek Road is an east-west roadway that extends from the Balsam Avenue Bridge to the Kananaskis Country trailheads, west of the County's boundary. West Bragg Creek Road consists of a paved two-lane, two-way roadway approximately 8.0 m wide. It serves as the main access into and out of the West Bragg Creek area for rural residences and residential subdivisions located west of Balsam Avenue and towards Kananaskis Country recreational trailheads. It is the primary access for recreational pursuits in this area of the Kananaskis Country.

West Bragg Creek Road crosses the Bragg Creek watercourse in three locations. The two bridges, located approximately 1.2 km and 1.9 km west of the Balsam Avenue and Wintergreen Road intersection, were rebuilt in the autumn of 2012. These two bridges sustained the June 2013 flood event without incurring damage and the West Bragg Creek Road remained across these two bridge structures during the flood event. The third bridge, located approximately 4.0 km west of the Balsam Avenue and Wintergreen Road intersection, is tentatively scheduled for replacement in 2021. This bridge remained open during the 2013 flood event; however, the water level reached the underside of the girders without breaching the roadway.

#### 3.1.2 Wintergreen Road (Range Road 50)

Wintergreen Road is a north-south roadway that extends from the Balsam Avenue Bridge to the Wintergreen Area within West Bragg Creek. Wintergreen Road consists of a paved two-lane, two-way roadway approximately 7.0 m wide. It serves as the main access into and out of West Bragg Creek for rural residences and residential subdivisions located north of Balsam Avenue as well as the Wintergreen Golf and Country Club, and Our Lady Queen of Peace Ranch.

#### 3.1.3 Range Road 52 and Range Road 54

Range Road 52 is a low level roadway that runs north from West Bragg Creek Road to serve several rural residences and the Fawn Hills residential subdivision. Range Road 52 consists of a gravel surfaced two-lane, two-way roadway approximately 6.0 m wide. The road ends approximately 4 km north of West Bragg Creek Road.

Range Road 54 is also a municipal roadway that runs north and south from West Bragg Creek Road to serve rural residences and residential subdivisions. South of West Bragg Creek Road, Range Road 54 consists of a 7.0 m paved roadway that extends 2.7 km south to provide access to the Elk Willow, Elk Valley and Highlands

subdivisions. North of West Bragg Creek Road, Range Road 54 consists of an 8.0 m gravel surfaced roadway that extends 400 m north to provide access to the Hawk Eye subdivision.

### **3.1.4 Local Rural Subdivision Roads**

There are numerous other local roadways that provide access to rural residences and residential subdivisions. These roadways connect to either West Bragg Creek Road or Wintergreen Road.

## **3.2 Outside of West Bragg Creek**

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The roadway network outside of the West Bragg Creek area also forms an important component of establishing an emergency access route. The Hamlet of Bragg Creek and the West Bragg Creek area are served by a network of provincial highways with supporting municipal roadways connecting to these provincial highways. The following roadways are of importance to this planning study.

### **3.2.1 Highway 22**

Highway 22 is a north-south two lane, two-way paved road that runs on the east side of Bragg Creek, which connects to Highway 8 and Highway 1, both of which provide direct access to the City of Calgary. Highway 22 crosses the Elbow River north of Highway 8, to the northeast of the study area. A proposed dam located near the junction of Highway 22 and Elbow River, is to divert future flood waters from the Elbow River to minimize downstream flood impacts. As part of the dam's design considerations, Highway 22 would remain and operational.

### **3.2.2 Highway 66**

Highway 66 is an east-west two lane, two-way paved road that extends from Highway 22 immediately south of Bragg Creek and runs to the west into Kananaskis Country. Highway 66 primarily runs south of the Elbow River adjacent to the County's boundary; however, the highway crosses the Elbow River within the Kananaskis Country and continues west on the north side of the Elbow River where it provides access to many recreational areas. In 2013, the Elbow River crossing at Highway 66 was compromised by flood waters and the bridge crossing has since been replaced; however, at the same elevation.

### **3.2.3 Highway 758**

Highway 758 is primarily a north-south two lane, two-way paved highway that extends from Highway 66 into Bragg Creek. Highway 758 is located east of the Elbow River and provides access to Bragg Creek Provincial Park as well as a few rural residences. It is known as White Avenue within the hamlet.

### **3.2.4 Township Road 242**

Township Road 242 connects to Highway 22 and runs to the west for 5 km to Range Road 45. Township Road 242 consists of an approximately 8.5 m gravel surfaced municipal roadway. West of Range Road 45, Township Road 242 becomes a private roadway to serve aggregate production and other local developments. The proposed dam, mentioned previously, is also located in close proximity to Township Road 242 at Highway 22. As part of the dam's design considerations, Township Road 242 would remain intact and continue to serve the residences and developments to the west of Highway 22.

### **3.2.5 Range Road 45**

Range Road 45 connects to Township Road 242 and runs south to provide access to a rural residence and adjacent lands. Range Road 45 consists of an approximately 8.0 m gravel surfaced municipal roadway. Range Road 45 ends approximately 800 m south of Township Road 242.

## 4.0 DESIGN INPUT AND REFERENCES

### 4.1 Rocky View County Emergency Services

Rocky View County's Emergency Services (RVC-ES) was contacted to provide input into the study and design requirements. RVC-ES provided the following information and requirements for an emergency access road:

- Rocky View County has the Redwood Meadows fire station on an automatic aid agreement to be the first response station to Bragg Creek, backed up by other stations throughout the County. If additional support is required, RVC-ES could call upon neighbouring municipal resources.
- An emergency access road is to provide two-way traffic to allow emergency vehicles to access and residents to evacuate the community.
- A maximum 8% grade is acceptable for Rocky View County's emergency vehicles.

RVC-ES also indicated the following attributes as being desirable for an emergency access route from an emergency responder perspective:

- Shortest distance from emergency services and as direct a route as possible.
- Focus on serving a high population density within the shortest amount of time.
- Routes that can be used on a regular basis gain familiarity (of geometric conditions, connection points, etc.) and are maintained regularly. Routes that are remote and closed during non-emergency periods are prone to illegal activity when law enforcement is not regularly monitoring and available.

### 4.2 Alberta Agriculture and Forestry

Alberta Agriculture and Forestry – Wildfire Management (AAF) was contacted to provide input into the study. AAF indicated that they are responsible for wildfires within the Forest Protection Area (FPA), which lies to the west of the County's boundary. Assistance for fires outside of the defined FPA would be through a mutual aid request by the governing authority. As wildfires can occur anytime of the year throughout the FPAs of Alberta, location and timing of these occurrences cannot be determined ahead of time. Resources and access are determined at the time of the incident by the Incident Commander in conjunction with discussions with the Duty Officer in the Management Area (either by air/ground or a combination). AAF could not confirm permanent availability of resources at any of its facilities such as the Ranger Station located along Highway 66, west of the Elbow River bridge crossing.

In summary, AAF response cannot be a governing factor in determining an appropriate location for an emergency route for the West Bragg Creek area.

### 4.3 Greater Bragg Creek Wildfire Mitigation Strategy

The 2012 Greater Bragg Creek Wildfire Mitigation Strategy (GBC-WMS) was reviewed to determine the wildfire risk within the study area. The goal of the GBC-WMS was to develop/implement a plan to reduce the threat of wildfire to development and the threat of structure fires to the wildlands. The plan was developed under the guidance of the Bragg Creek FireSmart Committee comprised of representatives of the community, Rocky View County Council, Rocky View Fire Services and Alberta Forestry, and included input from several local stakeholder groups.

The development of the GBC-WMS included assessing wildland/urban interface site hazards, wildfire history, development plans, emergency fire response plans and interagency cooperation. The report indicated that the risk of wildfire in the planning area is significant and most frequently occurs in areas accessible to the recreational public and residents. A review of wildland fuel types and fire weather analysis indicated that the highest fire behavior potential occurs during the fall season (August 15 to October 31) and that the areas to the west and northwest of the County, in Kananaskis Country, are primarily rated as having a high to extreme wildfire behavior potential; and the areas within the West Bragg Creek area have moderate potential with isolated areas of extreme wildfire behavior potential. In addition, an analysis of the wind direction indicates that the primary wildfire threat will be from the west and southwest direction.

## 4.4 Bragg Creek Flood Mitigation – Preliminary Engineering Report

The 2015 Bragg Creek Flood Mitigation – Preliminary Engineering Report reviewed a previously developed concept for flood mitigation design. It also developed a preliminary design for local flood mitigation within the hamlet. The report presents the existing flood hazard mapping of the floodway and flood fringe and mitigative berming measures designed to a 1:100 flood event.

The updated flood mapping, which takes into account the flood mitigation measures, indicates that the Balsam Avenue Bridge, and the Balsam Avenue and Wintergreen Road intersection would not be compromised by a 1:100 year flood event. While the mitigative berms protect against the 1:100 flood event, a flood that exceeds the 1:100 would still not be expected to protect the lands within the flood fringe. It is worthwhile to note that the Balsam Avenue and Wintergreen Road intersection remained open during the June 2013 flood event.

Concurrently with the emergency access study, the County is in the process of completing the design of mitigative measures for Bragg Creek.

## 5.0 PRELIMINARY ROUTE OPTIONS

Preliminary route options were developed on the premise of providing a connection from the existing roads within the West Bragg Creek area to the existing road/highway network outside of the study area, in all directions. Seven preliminary route options were developed as well as two sub-route options to minimize residential and land impacts.

The preliminary route options are shown on Figure 2 and described in detail in the following sections.

### 5.1 Route Option 1

Route Option 1 utilizes West Bragg Creek Road, Range Road 54 and Elk Valley Drive, and to provide a new connection from Elk Valley Drive to Highway 66, by crossing the Elbow River near the County's southern boundary.

Preliminary benefits associated with this route includes:

- Favourable emergency response and evacuation service;
- Relatively direct route;
- Ease of connection to a provincial highway;
- Utilizes existing roadways; requires a short section of new road; and
- One landowner directly impacted.

Possible drawbacks to this route includes:

- Utilize an internal subdivision road;
- Requires a new bridge crossing of the Elbow River;
- Steep grades on west embankment;
- Crosses through a key wildlife/biodiversity zone associated with the Elbow River; and
- Route is located in a higher wildfire hazard area.

## 5.2 Route Option 2

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Route Option 2 provides a new connection that extends Wintergreen Road to the northeast through Tsuut'ina Nation lands that connects to Range Road 45. North of Tsuut'ina Nation lands, Option 2 would utilize the existing Range Road 45 and Township Road 242 alignments to connect to Highway 22.

Preliminary benefits associated with this route includes:

- No new Elbow River crossing;
- Feeds into existing County roads to the north;
- Relatively short length of new road required;
- Located in lower risk wildfire areas; and
- Minimal land requirements.

Possible drawbacks to this route includes:

- Requires agreement from Tsuut'ina;
- Moderate emergency response service;
- Potential impact to environmentally sensitive and historical resource areas; and
- Areas of steep terrain and grades.

## 5.3 Route Option 3

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Route Option 3 circumvents Tsuut'ina Nation lands by traversing north along the County's western boundary through a new roadway that extends from West Bragg Creek Road to Township 241. The route then proceeds east along the Township Road 241 road allowance to Range Road 45. The new roadway would then continue north on the Range Road 45 road allowance prior to utilizing the existing portions of Range Road 45 and Township Road 242 similarly to Option 2 before connecting with Highway 22.

Preliminary benefits associated with this route includes:

- No Elbow River crossing;
- No Elbow River crossing required;

- Relatively manageable terrain – rolling; and
- Circumvents Tsuut'ina lands.

Possible drawbacks to this route includes:

- Unfavourable emergency response and evacuation service;
- Requires a long section of new road;
- Longer exposure to higher wildfire risk areas;
- Crosses through various sensitive lands and historical resource area;
- Multiple landowners impacted;
- Will need focused maintenance to ensure its reliability in times of need; and
- Indirect route.

## 5.4 Route Option 4

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Route Option 4 also circumvents Tsuut'ina Nation lands by traversing along the County's western boundary through a new roadway that extends from West Bragg Creek Road to Highway 68. Route Option 4 then utilizes Highway 68 to connect to Highway 1.

An alternative to this is to utilize a portion of the forestry truck road within Kananaskis Country; however, this road tends to be very circuitous as it follows the natural topography of the land before connecting with Highway 68 approximately 6 km inside Kananaskis Country. This alternative was not pursued due to its length and indirect nature of the alignment, which is expected to require significant upgrading to meet the County's desirable standards.

Preliminary benefits associated with Option 4 includes:

- No Elbow River crossing required;
- Relatively manageable terrain – rolling; and
- Ease of use, i.e., head west then turn north.

Possible drawbacks to this route includes:

- Unfavourable emergency response and evacuation service;
- Requires a long section of new road;
- Longer exposure to higher wildfire hazard area;
- Crosses through various sensitive lands and historical resource area;
- Multiple landowners impacted; and
- Will need focused maintenance to ensure its reliability in times of need.

## 5.5 Route Option 5

Route Option 5 is a new road connection from Wintergreen Road to Redwood Meadows golf course parking lot to provide a relatively direct connection to Highway 22 and the Redwood Meadows emergency services. Route Option 5 crosses Tsuut'ina Nation lands and requires a new Elbow River bridge crossing.

Preliminary benefits associated with this route includes:

- Shortest emergency response;
- Favourable evacuation service;
- Direct; ease of connection;
- In a lower wildfire hazard area; and
- Requires a short section of new road.

Possible drawbacks to this route includes:

- Requires agreement from Tsuut'ina;
- Requires a new bridge crossing of the Elbow River;
- Steep grades on west embankment; and
- Crosses through a key wildlife/biodiversity zone – Elbow River and other sensitive lands.

## 5.6 Route Option 6

Route Option 6 provides a new road connection from the southwest portion of the West Bragg Creek area at the termination of Range Road 54, west through Kananaskis Country to connect to Highway 66 at the Kananaskis Ranger Station. Route Option 6 could be initiated at West Bragg Creek Road and continue south along the County's west boundary. Option 6A connects West Bragg Creek Road to the ranger station while Option 6B extends Range Road 54 south from Highland Boulevard to the ranger station.

Route Option 6 would then utilize Highway 66 to reach destination decision points to the east. This route would require an upgrade to the existing Highway 66 Elbow River bridge crossing, which was compromised in 2013 and returned to its' original design elevations, in order to provide a higher level of stormwater drainage protection.

Route Option 6 traverses through the Forest Protection Area, located within Kananaskis Country, which is known as having a high to extreme wildfire behavior potential, as indicated in the 2012 GBC-WMS study. In essence, this route option would send motorists into an area with a high forest fire potential.

Preliminary benefits associated with this route includes:

- Utilizes existing river crossing on Highway 66; and
- Utilizes existing roadways; relatively short section of new road required.

Possible drawbacks to this route includes:

- Unfavourable emergency response and moderate evacuation service;
- Requires upgrading of the existing Highway 66 bridge crossing
- Areas of steep terrain and grades;
- Longer exposure to higher wildfire risk areas;
- Crosses through various sensitive lands and a potential historical resource area;
- Multiple landowners impacted including Kananaskis Country;
- Isolated from road network options; and
- May present additional geotechnical challenges.

## 5.7 Route Option 7

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Route Option 7 provides a new road connection from West Bragg Creek Road south along the Range Road 52 road allowance, east of the Wild Rose subdivision, and either connect to Highway 66 (Option 7A) or to veer east to connect to Highway 758 (Option 7B) along the south provincial park boundary. Either sub-route would require a new Elbow River bridge crossing.

Preliminary benefits associated with this route includes:

- Favourable emergency response and evacuation service;
- Direct; ease of connection;
- Located in a lower wildfire hazard area; and
- Requires a relatively short section of new road.

Possible drawbacks to this route includes:

- Requires a new Elbow River crossing;
- Crosses through a key wildlife/biodiversity zone – Elbow River;
- Steep grades on both embankments;
- Multiple landowners impacted;
- May present additional geotechnical challenges; and
- Adjacent to Provincial Park boundary (Route Option 7B).

## 5.8 Internal Connection

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As indicated earlier, the existing local/residential road system within the West Bragg Creek area connects to either West Bragg Creek Road or Wintergreen Road, which intersect at the Balsam Avenue Bridge. In the event this

access point is unavailable, there is no internal circulation between the west and north areas of West Bragg Creek. An internal connection was seen as an integral part of the emergency access road such that access is available to the west and to the north if the existing connection at Balsam Avenue is unavailable, regardless of the route option selected.

To reduce land impacts and minimize new road construction, a potential internal connection route was reviewed that would connect from Range Road 52 through Township Road 234 to Mountain Lion Drive, to utilize existing roadways and road allowances. Tetra Tech recommends implementation of this connector, or an alternative connector, to accompany any route recommendation.

During subsequent discussions, the County indicated that any internal connection would be dealt with by the County's internal road planning exercises, separate from this study. The focus of the emergency access study is to determine an external route to/from the West Bragg Creek community as a whole, with any internal connection need addressed later by the County. As such, the following sections do not address the need for an internal connection unless otherwise noted.

## 6.0 PRELIMINARY SCREENING

Based on the preliminary benefits and drawbacks for each of the route options as described previously, it was determined that some of the route options could be eliminated at this stage in the study. Reducing the number of route options at this stage was preferable to take to the stakeholder/public consultation to focus the discussion on the more feasible route options.

The following route options were considered to be unfavourable compared to other route options, predominantly in the provision of emergency response and evacuation services time.

- Route Option 3 – north and east around the Tsuut'ina Nation lands before connecting with the existing municipal road towards Highway 22.
- Route Option 4 – north towards Highway 68.
- Route Option 6 – southeast towards the Kananaskis Ranger Station.

These three routes also traversed along the western boundary of the County where there is high to extreme wildfire behaviour potential as well as being closer to primary wildfire threat due to the predominant wind direction.

## 7.0 STAKEHOLDER AND PUBLIC CONSULTATION NO. 1

The initial stakeholder consultation component consisted of one-on-one and focus group meetings with directly impacted landowners and landowners adjacent to a potential future emergency access road. This was followed by an open house to gather input from the general public and others that could not attend other consultation activities. This purpose of the initial stakeholder consultation meetings was to outline the study objectives and to gather feedback on the study and preliminary route options being considered. At the onset of the project, the County provided direction that communications with the local Councillor would be completed by the County and that communications with Tsuut'ina Nations would be conducted by Alberta Transportation. At the request of the County, Tetra Tech attended a meeting with the local Councillor to inform them of the study objectives and alternative routes under review.

Tetra Tech held four focus group meetings, attended a Citizen Group meeting (at the request of the County) and attended four one-on-one landowner meetings. An open house was held on June 23, 2016. There were 123 attendees at the open house with 76 persons returning a completed questionnaire. In addition, emails and phone communications were held with landowners who could not attend the open house. Based on the meetings, questionnaire responses, and other communications, the feedback is summarized as follows.

The factors considered important for an emergency access routes are as follows:

- Easy access;
- Exit time (fast/distance);
- Cost;
- Account for fire, flood, sour gas;
- Timeliness of implementation; and
- Landowner impacts.

The routes that best addressed these factors included:

- Route Option 2 had the highest support;
- Route Option 7 had the second highest support;
- Route Option 3 and Option 4 were the least supported; and
- Route Option 1, Option 5, and Option 6 were mid-range.

Other comments for consideration included the following:

- Implications of crossing Tsuut'ina land;
- Implications of a new bridge;
- Implications of maintaining the access for emergency use only; and
- Multiple emergency accesses to serve different parts of the community.

These comments were addressed by inclusion of the factors into the evaluation criteria, adding more route option for review; and inclusion of other comments as potential risks to the routes. Ultimately, 11 routes were carried forward for further evaluation including routes that were initially screened out to assess stakeholder queries and comments.

## **7.1 Additional Routes Suggested by Stakeholder Input**

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During the first stakeholder engagement and public consultation program, the following additional routes were suggested for consideration:

### 7.1.1 Elkana Area to Highway 758, Crossing the Elbow River

An alternative route (Option 8) was suggested to connect Elkana Ranch (Bracken Road) to Highway 758. The route is located in the Elbow River flood plain/fringe and approximately 1.4 km south of the existing Balsam Avenue crossing. The crossing of Elbow River would require an extensive bridge length (~300 m) to span the river flood plain/fringe and is expected to be a relatively high crossing, which in turn would require realignment of Highway 758 to accommodate the vertical tie-in and potentially create direct impact to residences on the east side of the Elbow River. In addition, the proximity of Option 8 to the Balsam Avenue bridge does not provide a desirable separation between the two river crossings should an emergency event occur in close proximity to the area. This alternative route is considered to be inferior to other routes that provide an alternative emergency access away from the existing Balsam Avenue area and was not carried forward for further consideration.

### 7.1.2 Range Road 52 to Bragg Creek Provincial Park Crossing the Elbow River

An alternative route (Option 9A) was suggested to connect from Range Road 52 (similar initial alignment as the Option 7 routes) to Bragg Creek Provincial Park. Option 9A would cross the Elbow River and connect to the parking lot within the park. Some of the existing park would be lost to accommodate the crossing as well as to re-establish the same level of parking facility that current exists. In addition, property taking from a Provincial Park is not desirable when other options exist. The Provincial Park is also identified as a “Park and Protected Area” under the provincial environmental constraints map. This alternative route was not recommended to be carried forward due to potential environmental and social impacts.

Another alternative route (Option 9B) was suggested to connect from Bracken Road to the Bragg Creek Provincial Park. Option 9B would cross through the park in areas currently undeveloped and utilize a portion of the existing park access road. Given the same concerns with this option as noted with Option 9A, Option 9B was not carried forward for further consideration.

### 7.1.3 North on Range Road 52 to Connect to Route Option 3

An alternative route (Option 2A) was suggested that would extend Range Road 52 north from Township Road 234 to connect to Option 3 at the Township Road 241 road allowance. Option 2A would then follow the same alignment as Option 3 to reach Highway 22. This route is approximately 4.8 km longer than Option 2; however, Option 2A crosses a narrower section of Tsuut’ina lands. This option was carried forward for further evaluation.

### 7.1.4 South on Range Road 52 to Connect to Highway 66

A deviation from Option 7A and Option 7B was suggested that would extend Range Road 52 south along the undeveloped road allowance to connect directly to Highway 66. This is referred to as Option 7C. Option 7C would take advantage of the existing road allowance right-of-way and improved topography and reduce potential land impacts; however, this option would cross the Elbow River at a wider section potentially requiring a longer bridge span. This option is included for further evaluation.

## 8.0 DETAILED EVALUATION

A workshop forum with the TRC members was held between the two open houses for the purpose of reviewing stakeholder and public feedback, confirming the evaluation framework and methodology to be applied, evaluating route options and to determine initial study recommendations. This report section outlines the evaluation process and the rationale followed to select the recommended option.

The route options evaluated are shown on Figure 3. Through discussion with the TRC members, the three route options that were previously screened out (i.e., Option 3, Option 4, and Option 6) were also included in the evaluation process to provide a benchmark for the evaluation scoring and address stakeholder and public feedback.

## 8.1 Evaluation Workshop

### 8.1.1 Purpose of the Evaluation Workshop

The purpose of the evaluation workshop was to involve an evaluation team comprised of County, Alberta Transportation and Tetra Tech representatives to collaboratively evaluate the route options and select a preferred emergency access route. The workshop was facilitated by Tetra Tech.

### 8.1.2 Evaluation Methodology

The methodology used to evaluate the route options utilizes a matrix that considers certain criteria. This matrix allows weighting factors to be assigned to each criterion within the matrix. The weighting assigned determines which of the criterion are considered more important when determining a recommended route option. The weights assigned to each criterion consider its relative importance compared to all other criteria. Each option is then rated using a range of 0 to 5, with a high score indicating that the criterion is favourable for the option in question. The product of the rating and weighting factor produces a score for each criterion. The total scores for each option are normalized based on the total estimated construction cost for the option being evaluated. Using this process, the option with the highest criteria score/cost ratio is considered the preferred option.

Following discussion and review of the importance of each criterion during the workshop, weighting factors for each were determined. The weights of the criteria are factored to consider a total weighting out of 100.

### 8.1.3 Technical Evaluation Criteria and Evaluation Inputs

The evaluation criteria was developed jointly by Tetra Tech and the County before being vetted through the project TRC. The evaluation of the route options were based on the following criteria and supporting rationale:

- Emergency Response Service – estimated response time from the Redwood Meadows fire hall to the various subdivisions within the West Bragg Creek area and the expected coverage (proportion) within given time horizons; based on GIS analysis. Emergency response was categorized by the percentage of parcels within 8 km increments. The 8 km increments were utilized to match the County's Emergency Services criteria of serving 8 km within 18 minutes 80% of the time.
- Emergency Evacuation Service – estimated time for residents to reach a common muster point (Banded Peak School, Highway 22 and/or nearest highway decision point); based on GIS analysis. Emergency evacuation was categorized by the percentage of parcels that can reach the Banded Peaks School or the nearest highway decision point with scenarios of Balsam Avenue Bridge being open and closed. Evacuation services was measured in 10 km increments.
- Environmental Constraints – impacts to crown reserves, parks and protected areas, significant/sensitive areas, wetlands, watercourse crossings, etc., based on provincial environmental constraints databases. An environmental constraints mapping was completed to identify and quantify the environmental impacts along each route. Key wildlife and biodiversity zone is predominantly around the Elbow River and creeks as well as within the west and northwest portion of the study area. There is a potential range of limber pine towards the west and northwest study area. Wetland areas were identified predominantly around existing watercourses. Environmentally significant areas were identified throughout the study area. The environmental constraints mapping is included in Appendix C.

- **Geotechnical Risk** – challenges associated with unsuitable ground conditions, based on provincial geotechnical constraints databases. A surficial geological constraints mapping was completed to identify potential geotechnical conditions that may present challenges for the construction of the access road along each route. The unfavourable geotechnical areas are predominantly located within the floodplains of the Elbow River, heavily organic areas south of West Bragg Creek Road; and potentially unstable conditions between Range Road 52 and Range Road 51. The geotechnical constraints mapping is included in Appendix C
- **Historical Resource Areas** – impact to areas of known or having potential historical significance, based on provincial historical resource databases. A historical resources constraints mapping was completed to identify potential and previously recorded historical sites along each route. There is a potential for cultural historical resources along Tsuut'ina Nations transfer lands east to the north and east of Wintergreen Road. The areas surrounding the hamlet as well as north of Tsuut'ina Nation lands and east of Range Road 50 may have contain archaeological historic resources. There are also a few isolated locations where archaeological historical resources have been recorded within the study area. The historical resources constraints mapping is included in Appendix C
- **Infrastructure** – utilization of existing roads, new bridge and road construction.
- **Landowner Impacts** – parties involved, possible extent of impact. The land impacts associated with each route was measured according to the type of ownership and quantity. The right-of-way quantity was based on acquiring a 20 m right-of-way width along each route where County road allowances do not exist. No allowances were made for grading limits extending beyond the 20 m
- **Operations and Maintenance** – frequency, reliability, route directness and familiarity or route (wayfinding). The quantity was measured based on the quantity of new road construction and the links to access/egress the community for each route.
- **Topography and Geometry** – relative steepness of grade impacting response and evacuation effectiveness. The quantities were measure based on the general profile of the existing topography for each route option. The topography was classified into range of grade percentages for flat, rolling and steep terrain.
- **Utility Impacts** – number, type, commodity, outages, etc. A review of public accessible utility databases and on-site review indicated that there was a limited number of utility impacts to the preliminary route options, and the impacts were not considered significant to influence one route option from another; therefore, utility impacts had little bearing on the evaluation of the various route options.
- **Construction Cost Estimates** – total estimated cost for construction of new road and any bridgework. Cost estimates were based on quantity estimates for grading, granular base course, and granular sub-base; watercourse crossings; and right-of-way, utilizing provincial unit rate costs. Grading quantities were established through preliminary design profiles. Right-of-way costs were estimated based on current real estate listings for vacant lands. No costs were assigned to Tsuut'ina Nation lands due to ongoing discussions with the reciprocal benefits of access through their lands. Cost estimates for each option is included in Appendix C.
- **Risks Management** – defines the potential risk impacts associated with each route option and its significance and probability of occurrence; the mitigation and efforts to overcome the risk.

## 8.2 Results of Evaluation

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The results of the workshop evaluation are summarized as follows and presented on Figure 4:

- The three route options that were screened out initially (i.e., Option 3, Option 4, and Option 6) scored the lowest amongst the eleven options reviewed. The scoring confirms the validity of the conclusions from this initial screening.
- Option 1 scored the highest overall in terms of technical points with Option 5 second highest at 0.5% lower. The three Option 7 variations scored third, fourth, and fifth, at 7%, 10% and 11%, respectively, lower than Option 1.
- With construction costs taken into consideration through technical scoring/cost ratio, the high construction costs for Option 1, Option 5, and Option 7 (as these options involve an Elbow River Crossing) lower the value for these three options, while promoting Option 2 and Option 2A to be ranked first and second overall, respectively.
- With the evaluation based on a balanced multi-bottom-line approach, the option that has the highest technical points per construction dollar (i.e., greatest value for money spent) would be the most preferred option. It should be noted that Option 2 and Option 2A do not include Tsuut'ina land costs (undeterminable); however, the risk of such has been given consideration in the evaluation process.
- Environmental Factors: All options involve some traversing over lands of some form of environmental significance and/or river/creek crossings. Permitting (both federal and provincial) procedures must be met and in a timely fashion.
- Engineering and Construction/Topography: Some options involve traversing through challenging topography [i.e., significant earth movement or lengthy river/creek crossing(s)]. Risks are addressed through design and construction techniques and costs.
- If land negotiation with Tsuut'ina is not successful with the technically preferred option, an alternate plan would include either Option 7A or Option 7B which scored the next highest in terms of overall value for non-Tsuut'ina options and which were not screened out during the initial screening. Option 7A and Option 7B have received significant community opposition and the challenges associated with community and social impacts would be major obstacles to overcome. Furthermore, Option 7A and Option 7B involves building a new Elbow River bridge crossing, where the concept of building a multi-million dollar bridge that is not to be opened except during emergency events has not been well accepted, as mentioned from stakeholder consultations completed to date. Nonetheless, Option 7A and Option 7B can and should be assessed as part of the long term transportation network plan for the West Bragg Creek community, when a permanent second community access is provided with future development. At that time, other options may too be more favourable for long-term establishment, since determining the location of a permanent access will require options to be evaluated with different criteria.

The evaluation matrix are presented in Appendix C.

### 8.3 Technically Preferred Route and Associated Risk

Based on the evaluation, Option 2 is the technically preferred route option.

A major risk associated with Option 2 is that the route traverses through Tsuut'ina lands. Agreements to access Reserve lands may require timely discussion involving Tsuut'ina, the Federal government, Alberta Transportation, and Rocky View County. During the course of this study, the County has communicated with Tsuut'ina Nation to discuss the various preliminary route options including the technically preferred route option. Tsuut'ina Nation has agreed that the route has enough merit to continue a dialogue with the County. Tsuut'ina Nation and the County are continuing to work together towards a mutually beneficial solution that follows closely to Option 2.

Through the County's discussions with Tsuut'ina, Nations, Option 2 was revised to follow the north/south and east/west road allowances to reduce land impacts to the Reserve and adjacent properties, as shown on Figure 3.

## 9.0 FUNCTIONAL DESIGN

The recommended alignment follows existing undeveloped County road allowances and former road allowances through the Tsuut'ina Nation lands. Through discussions with the County, the route utilizes right-angle turns when transitioning from one direction to another, instead of introducing horizontal curves, to minimize impacts to adjacent lands.

### 9.1 Route Alignment

The following is a kilometre-by-kilometre description of the recommended alignment. The plan and profile mosaics for this alignment are presented in Appendix D. This description proceeds south to north from the departure at Wintergreen Road through the Tsuut'ina Nation lands before connecting to Highway 22.

- km 0.0 (Intersection with Mountain Lion Drive)
- km 0.2 (Intersection with Moose Drive – start of new road construction)
  - Currently, the north end of Wintergreen Road curves to the west and continues as Moose Drive to serve local residences. An existing residential driveway access is located on the east side of Wintergreen Road and intersects Wintergreen Road along the curve. The proposed Option 2 alignment is to extend Wintergreen Road to the north. Moose Drive and the residential access would need to be realigned to intersect Wintergreen Road at 90°.
- km 0.21 to km 1.00
  - Land titles indicate that the existing Wintergreen Road is on a 15.0 m road allowance, which extends to the north, between Moose Drive and the Tsuut'ina Nation new transfer lands. Through discussion with the County, it was noted that the right-of-way width shown may not be accurate. The County has provided direction to center the proposed Option 2 alignment within an assumed 20.0 m right-of-way width with the additional 5.0 m taken from the Tsuut'ina Nation (i.e., east) side, if required.
- km 1.00 to km 2.65
  - Within this section, Option 2 traverses south to north through the Tsuut'ina Nations new transfer lands. The roadway is centered along an assumed 20.0 m basic road allowance width that extends from the assumed road allowance along Wintergreen Road to the existing 20.0 m road allowance width north of the Tsuut'ina Nation lands.
- km 2.65 (Option 2 turns 90° from the south to the east)
- km 2.65 to km 4.30
  - Within this section, land titles indicate that the new Tsuut'ina Nation boundary extends to the north side of the presumed Township Road 240 road allowance. The County will review this internally and may bring this to Tsuut'ina Nation for further clarification. For the purpose of this study, the County has provided direction to assume a 20.0 m road allowance along Township Road 240 and center the road within the road allowance.
  - As an alternative to traversing through Tsuut'ina Nation lands within this west/east section, the adjacent landowner to the north has proposed that the emergency access road could run immediately north of the

presumed Township Road 240 road allowance, i.e., north of Tsuut'ina Nations lands, along their private land. In return, the landowner is willing to provide the land required for the emergency access road in exchange for Crown land that they currently lease within the Municipal District of Bighorn. The adjacent landowner will submit a written proposal to the County for consideration.

- km 4.30 (Option 2 turns 90° from the west to the north)
- km 4.30 to km 6.65
  - Within this section, Option 2 runs south to north and is centered on the existing Range Road 45 road allowance.
- km 6.65 (Option 2 ties into the existing Range Road 45 alignment and roadway)
- km 6.65 to km 12.40
  - Within this section, Option 2 utilizes the existing local municipal gravel roads of Range Road 45 and Township Road 242 to connect with Highway 22. The County has provided direction to include an optional item to base and pave Township Road 242 within the cost estimate.

## 9.2 Horizontal Alignment

As noted previously, the route utilizes right-angle turns when transitioning from one direction to another, instead of introducing horizontal curves, to minimize impacts to adjacent lands. Between these 90° turns, the alignment runs on a tangent section.

## 9.3 Vertical Alignment

As noted previously, the topography of the study area consists of rolling terrain with isolated sections of steeper terrain. The profile of the existing ground may reach grades as high as 25%. The vertical profile was designed to have a maximum grade of 8% to meet County design criteria for a municipal grid road with moderate traffic volumes and which would accommodate the operations of emergency response vehicles. The vertical crest and vertical sag curves were designed to achieve or exceed curve parameters for an 80 km/h design speed. The vertical design grades traversing over a substantial hill located 0.5 km to 2.5 km north of Wintergreen Road utilizes grades of 7.4% to 7.8% and minimum vertical crest parameter. The remaining sections of the route utilizes grades of 2.0% or flatter and higher curve design parameters.

## 9.4 Cross-section

A two-lane cross-section has been developed following the design criteria listed in Table 1. Two lanes with a width of 4.0 m have been considered in each direction for a total roadway width of 8.0 m. The cross-section utilizes 3:1 sideslope and backslope ratios with a 1.0 m v-ditch depth. In areas of significant cut and/or fill, there may be opportunities to steepen the sideslope and backslope, in conjunction with implementing roadside barriers, to reduce land impacts and right-of-way requirements.

## 9.5 Access Management

The intent of the study is that the emergency access road was to be used for emergency events only. The roadway is to be gated and locked at both ends. As the emergency access road traverses through Tsuut'ina Nation lands, the County and Tsuut'ina Nation will need to mutually determine the exact locations of the locked gates as well as the parties and individuals permitted to open/close the gate. In addition, Tsuut'ina Nation has indicated that they

would like to have some access points (approaches) along the route to gain access to their lands. The location of the access points have not been determined at this time. There is no other public access or road connection intended along the emergency access road, between the gated sections of the route.

## 9.6 Right-of-Way

In addition to the existing and assumed 20.0 m basic right-of-way, as noted above, approximately 13.3 hectares (32.9 acres) of private land, excluding Tsuut'ina Nation lands, are required to accommodate the grading limits.

In discussion with the County, it is assumed that Tsuut'ina Nation lands may be landscaped and fenced upon completion of the road construction at the assumed basic 20.0 m road allowance width without property acquisition. The quantity of Tsuut'ina Nation land required to accommodate the cut/fill grading limits, beyond the assumed 20 m road allowance is 14.1 hectares (34.9 acres). Right-of-way plans are included in Appendix E.

## 10.0 ENVIRONMENTAL OVERVIEW

An environmental overview (refer to Appendix F) was completed by Tetra Tech to identify existing environmental resources, evaluate potential impacts to the environment, and recommend measures to minimize or mitigate environmental impacts on the preferred route Option 2. No field survey or ground truthing was completed as part of this overview.

The new road construction limits of Option 2 intersects predominantly undeveloped land and areas that have been previously cleared and seeded for pasture use. The route is intersected by Harris Creek, a Class D waterbody with no restricted activity period, and its' tributaries. These watercourses are likely seasonal to small permanent watercourses which provide conveyance of surface water to Elbow River, 3 km downstream. Option 2 intersects numerous wetlands predominantly associated with the riparian areas surrounding Harris Creek but some are also isolated in higher relief areas.

Option 2 is located in close proximity to the known range of limber pine, a species protected under the Alberta Wildlife Act. Given the hummocky landforms and potential shallow depth to bedrock, limber pine has potential to be encountered. In addition, weeds and invasive non-native plant species are likely to occur.

Development of lands within a designated Reserve are subject to the authorization of Indigenous and Northern Affairs Canada (INAC). An environmental assessment may be required under the authority of a federal ministry. Early consultation with INAC is recommended.

Given the relatively intact context of lands intersected by route Option 2, it is recommended that surveys be conducted during the seasonally appropriate periods to confirm the presence and potential of environmental impacts to soils, wetlands, rare plants and ecological communities, sensitive wildlife features and habitats, and fish and fish habitat.

## 11.0 GEOTECHNICAL OVERVIEW

A geotechnical report (refer to Appendix G) was completed by Tetra Tech to provide an overview of the surficial geology and anticipated subgrade conditions that may be encountered and other geotechnical constraints for the preferred Option 2. The overview was based on a review of available data. No field confirmation, drilling, or sampling was conducted.

For most of the alignment, relatively thin organic blankets, less than 1 m thick, would have only minor construction issues. However, near the northern end of the alignment, isolated thicker organic deposits have been mapped which would impose construction constraints, such as deeper excavation and replacement with road fill.

It is recommended that prior to final design, a geotechnical investigation be conducted to verify the subsurface soil and groundwater conditions, with special attention directed to fluvial and organic deposits.

## 12.0 HISTORICAL RESOURCES OVERVIEW

A historical resources overview was completed by Tetra Tech (refer to Appendix H) to assess the potential for archaeological, historical or paleontological sites to occur on land within the study area. The mapping was based on a review of available published resources. No field investigation was conducted as part of this overview to identify new or confirm previously identified sites.

The project is situated within an area of the province that has a well-documented historical importance. A large portion of the project crosses land designated with a Historical Resource Value (HRV) of 5a. This is indicative of lands believed to contain an archaeological historic resource. Additionally, the project is in proximity of a portion of land designated with an HRV of 4a; this area corresponds to the location of a previously recorded site EgPp-21. This site consists of the remains of a historic homestead. No impacts to this site are anticipated as the Option 2 right-of-way is situated south of the site location, along the north boundary of Tsuut'ina lands. Several other historic structures are documented in land parcels located in close proximity to the study area; however, no impacts to these are anticipated through the construction of this project.

A Historical Resources application for the project was submitted to Alberta Culture and Tourism (ACT) on August 23, 2017. ACT's Historical Resources Act requirements indicate that a Historical Resources Impact Assessment (HRIA) for archaeological resources is to be conducted along the route, prior to the initiation of any land surface disturbance activities. The HRIA must address all areas of high archaeological potential within the project area and confirm the footprint of the route with the previously recorded archaeological site EgPp-21. There are no Historical Resources Act requirements associated with palaeontological resources, Aboriginal traditional use sites, historical structures, and provincially designated historical resources.

## 13.0 STORMWATER DRAINAGE REVIEW

A stormwater drainage plan (refer to Appendix I) was completed by Tetra Tech to identify impacts of Option 2 on existing drainage and any required mitigation strategies. This plan confirmed current stormwater drainage patterns through background review of available data.

There are four defined watercourses within the proposed new road section of Option 2. At approximately km 0.4, Option 2 crosses a stream which drains a basin area of approximately 7.49 km<sup>2</sup>. The crossing is immediately below (east of) the downstream face of a dam identified as the Robert Lyon Embankment regulated by Alberta Environment and Parks. To accommodate the 1:100 flow rate, it is anticipated that three 1.5 m (60 inches) culverts will be required, or an equivalent bridge crossing. Tetra Tech has assumed a 20 m long bridge at this location for the purpose of cost estimating. Further design details will need to be determined at the next stage upon completion of a preliminary survey of the watercourse channel. In addition, field investigation and review of available dam safety reviews will be required to determine the condition and capacity of what appears to be an outlet spillway at the north end of the dam embankment (at km 0.6) and its' flow path, which currently is not discernable in either having a separate Option 2 crossing or flow into the crossing at km 0.4. Overall, Option 2 will need to provide hydraulic capacity that is equivalent to the spillway capacity.

There are three other stream crossings at km 2.4, km 3.0, and km 3.6, which are all within the Harris Creek watershed. Upstream crossings at km 2.4 and km 3.0 are on a tributary that drains the western part of the catchment. The crossing at km 3.6 is located downstream on the main stem channel. The channel sections are contained within a broad floodplain typically about 50 m wide. To accommodate the 1:100 flow rate, it is anticipated that a 1.5 m (60 inches) and a 1.2 m (48 inches) diameter culverts are required at km 2.4; three 1.2 m diameter culverts at km 3.0; and three 1.5 m diameter culverts at km 3.6. Tetra Tech has assumed a 10 m long bridge for km 2.4, and 15 m long bridges at km 3.0 and km 3.6 for the purpose of cost estimating. Further design details can be determined at the next stage upon completion of a preliminary survey of the watercourse channel.

## 14.0 UTILITY IMPACTS

Within the new roadway section of Option 2, there is a Telus fibre optic line that runs parallel to and crosses Option 2 at various locations. The Telus easement is 5 m wide and depth of cable is 1.5 m (+/- 0.3 m). The Telus line crosses Option 2 at Moose Drive and at Range Road 45. The Telus line parallels Option 2 on the west side between Moose Drive and Tsuut'ina Nation's south boundary, as well as on the north side of the Township Road 240 road allowance, between Range Road 50 and Range Road 45. The cut/fill grading limits of Option 2 may extend beyond the basic 20 m road allowance width and impact the Telus line. Telus has provided an estimated cost to lower their lines at the crossing locations; however, they could not estimate a cost for impacts to the line in areas where the road parallels their facility (this is discussed further in Section 14.8).

At the north tie-in to the existing Range Road 45, there is a Fortis overhead powerline that runs along the west road allowance boundary. The cut/fill grading limits of Option 2 may extend beyond the 20 m road allowance width and impact the Fortis utility. Fortis has been contacted for more information and they have provided an estimate to relocate their facilities, which has been included as part of the detailed cost estimate.

There are no other known utilities either existing or proposed within the new roadway section of Option 2. Utility information has been included in Appendix J.

## 15.0 COST ESTIMATE

Construction cost for Option 2 have been estimated (refer to Appendix K) utilizing the 2017 Southern Region (Alberta Transportation) unit price average report and Tetra Tech estimated costs, unless stated in the subsection below.

### 15.1 Clearing

Quantity estimates for clearing included existing treed areas within the proposed right-of-way estimated through the 2015 aerial images.

### 15.2 Grading and Base

The costs for grading, granular sub-base and granular base for the new road section of Option 2, from Wintergreen Road to Range Road 45, were calculated based on the design criteria for the County's Regional Moderate Volume roadway classification, with a top width of 8.0 m including a granular base of 100 mm and granular sub-base of 250 mm. Grading quantities were determined through a balanced cut/fill vertical profile design utilizing Autodesk Civil 3D.

No upgrades of the existing Range Road 45 and Township Road 242 are included as these local roadways meet municipal standards for emergency access.

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## 15.3 Culverts

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The required centreline culverts were estimated to be 600 mm CSP and the length determined from cut/fill limits. The location of required centreline culverts were estimated by current stormwater drainage patterns as noted within the stormwater drainage report.

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## 15.4 Fencing

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The County has provided direction to include fencing along Option 2 that borders the Tsuut'ina Nation boundaries. Quantity estimates for fencing of this short section only have been included.

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## 15.5 Environmental – Wetland Impact Compensation

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Compensation for wetland impacts was estimated by the linear disturbance of 1,600 m at a 20 m wide right-of-way width, and a compensation ratio of 8:1 (worst case scenario). This equates to approximately 25.6 ha of compensation area. The estimated compensation rate is \$17,700/ha.

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## 15.6 Bridge Work

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The quantity for bridge work was estimated as indicated within the stormwater drainage section. The width of the bridge files are estimated at 9.0 m to account for an 8.0 roadway width additional 0.5 m for bridge rails.

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## 15.7 Utilities

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The lowering of the Telus line at two crossing locations is estimated at \$3,000/crossing location. An estimate for impacting approximately 2 km of Telus line at \$30/m by the grading cut/fill has also been included based on Tetra Tech estimates from previous projects.

Fortis has indicated that the cost to relocate two power poles at the south end of the existing Range Road 45 is estimated at \$15,000.

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## 15.8 Land Acquisition

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Land requirements beyond the 20 m basic and assumed road allowance right-of-way has been estimated based on cut/fill limits. Cost estimates for land acquisition were provided by the County and are based on the County's market survey and benchmark land value estimates.

Land costs associated with Tsuut'ina Nation lands have not been estimated within the overall cost estimate since there is interest from the community to benefit members of the Nation.

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## 15.9 Optional Work – Surfacing of Township Road 242

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The County provided direction to include an optional cost for the pavement surfacing of Township Road 242. Quantity estimates for the surfacing of Township Road 242, from Range Road 45 to Highway 22, (approximately 5.0 km in length) was estimated for subgrade preparation; granular base course and asphalt concrete pavement based on a cross-sectional width to achieve an 8.0 m paved finished surface consistent with the County's Regional Transitional Paved roadway standard. The surfacing includes 300 mm of granular sub-base, 100 mm of granular base, and 120 mm of asphalt concrete surfacing.

## 15.10 Mobilization

Mobilization was estimated at 10% of the total construction costs excluding wetland compensation, utilities and right-of-way purchases.

## 15.11 Contingency

A 20% contingency of the total construction cost is included in the cost estimate.

## 15.12 Engineering

Engineering was estimated at 10% of the total cost.

## 15.13 Summary of Cost Estimate

The total estimated cost for Option 2 is **\$14.5M**. The estimated cost for the optional pavement surfacing of Township Road 242 is \$3.6M. Details of the cost estimates are provided in Appendix K.

## 16.0 STAKEHOLDER AND PUBLIC CONSULTATION NO. 2

Upon completion of the route evaluation and determining a technically preferred route, a second stakeholder consultation component was undertaken to present the results of the technical evaluation and the preferred route.

Tetra Tech held a focus group meeting with landowners adjacent to the preferred route and attended a one-on-one landowner meeting. An open house was held on September 20, 2017 at the Snowbird Chalet in Bragg Creek. There were 140 attendees at the open house with 55 persons returning a completed questionnaire. In addition, emails and phone communications were held with landowners who could not attend the open house. Based on the meetings, questionnaire responses, and other communications, the feedback is summarized as follows:

- Concerns with congestion and bottleneck at Balsam Avenue intersection, and route being potentially unavailable (e.g., due to wildfire, landslide along Wintergreen Road).
- Need multiple access routes to serve different parts of the community; Route 2 does not serve the residents to the west end of West Bragg Creek.
- Implications of crossing Tsuut'ina Nation lands relating to project timeliness and cost.
- Preference of Route 2A over Route 2.
- Potential to increase development in the area.
- Potential trespassing concerns.
- Landowner impacts as well as impacts to environmental reserve.
- Upgrade connecting network roads (Wintergreen Road, Township Road 242, Highway 22).
- Upgrade Bragg Creek bridge crossing on Township Road 232 to accommodate 1:100 or higher flood event.
- Use as a permanent access road.

- Pave the access road.
- Study requires input from professional emergency management experts.
- Continue discussions with impacted landowners regarding the land procurement process, as well as a potential borrow source.
- Confirm landownership of the east/west road allowance along Township Road 240 (north side of Tsuut'ina land), and consider an option for land swap with adjacent landowner, should the Crown be willing to participate.
- Plans for a future fire hall in West Bragg Creek to reduce emergency services response times.

Stakeholder communications and questionnaire responses have been compiled into a supplemental document. Appropriate steps must be undertaken to meet the Freedom of Information and Privacy Act requirements if any part of the meeting notes is to be made accessible to the general public.

## 17.0 POLICY AND PRIORITIES COMMITTEE PRESENTATION

Tetra Tech presented the project and the preferred Route Option 2 to the Rocky View County Policy and Priorities Committee on October 3, 2017. The Policy and Priorities Committee made the following motions which were carried.

- Motion #1. That the presentation from Tetra Tech on the West Bragg Creek Emergency Access Study be received for information
- Motion #2. That the Policy and Priorities Committee recommends to Council that Route #2 be identified as the preferred emergency access route for West Bragg Creek and direct Administration to continue working with Alberta Transportation and Tsuut'ina Nation on the project including finalizing the planning study and developing a funding strategy.

Subsequently, On October 10, 2017, Council accepted Policy and Priorities Motion #2.

## 18.0 RECOMMENDATIONS

The West Bragg Creek Emergency Access Study has evaluated 11 potential route options for emergency access and egress from the community.

Route Option 2 is the preferred route for the emergency access based on the technical evaluation. From Wintergreen Road, Option 2 extends north along Range Road 50 (undeveloped road allowance), then east along Township Road 240 (undeveloped road allowance) then north along Range Road 45 (partially developed road allowance) to the existing local road network. Option 2 then utilizes the existing portions of Range Road 45 and Township Road 242 to connect to Highway 22.

The study recommendations for Route Option 2 are as follows:

- The County consult with INAC, early on within the project, to determine if there are any environmental assessment requirements under the authority of a federal ministry.
- Conduct surveys to confirm the presence and potential of environmental impacts to soils, wetlands, rare plants and ecological communities, sensitive wildlife features and habitats, and fish and fish habitat.

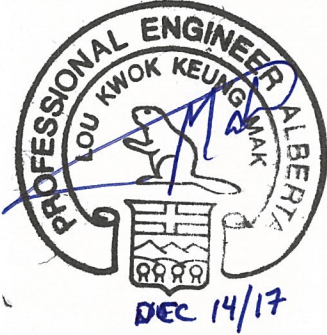
- Conduct a HRIA for archaeological resources prior to the initiation of any land surface disturbance activities.
- Conduct a geotechnical investigation to verify the subsurface soil and groundwater conditions, with special attention directed to fluvial and organic deposits.
- The County continue the dialogue with the Tsuut'ina Nation and work together towards a mutually beneficial solution; and upon doing so, secure project funding for the construction of the emergency access road.
- The County advance the planning of an internal connection to ensure the integrity of the accesses into the West Bragg Creek area should one of these accesses be unavailable in the event an emergency situation occurs.
- Confirm the ownership of the presumed Township Road 240 road allowance.
- Continue discussions with impacted landowners regarding the land procurement process, options for land swap, should the Crown be willing to participate, and a potential borrow source.
- As the intent is not to convert this emergency access road into a permanent access now or in the future, it is recommended that this study be used as the basis to determine the appropriate location for a second permanent access into the West Bragg Creek area should there be a desire from the County and/or area residents.
- Follow up with the community regarding any outstanding items raised during the course of this study, e.g., the intent to provide a fire hall in the West Bragg Creek area that might defer the need for this emergency access route.

The estimated construction cost for the new section of roadway, between Moose Drive and Range Road 45, as part of the Route Option 2 emergency access is \$14.5M (2017 dollars). The estimated construction cost for the optional paving of Township Road 242 is \$3.6M.

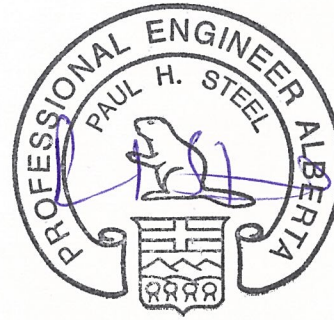
## 19.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,  
Tetra Tech Canada Inc.




Prepared by:  
Lou Mak P.Eng.  
Senior Transportation Engineer  
Direct Line: 403.723.3260  
lou.mak@tetrattech.com



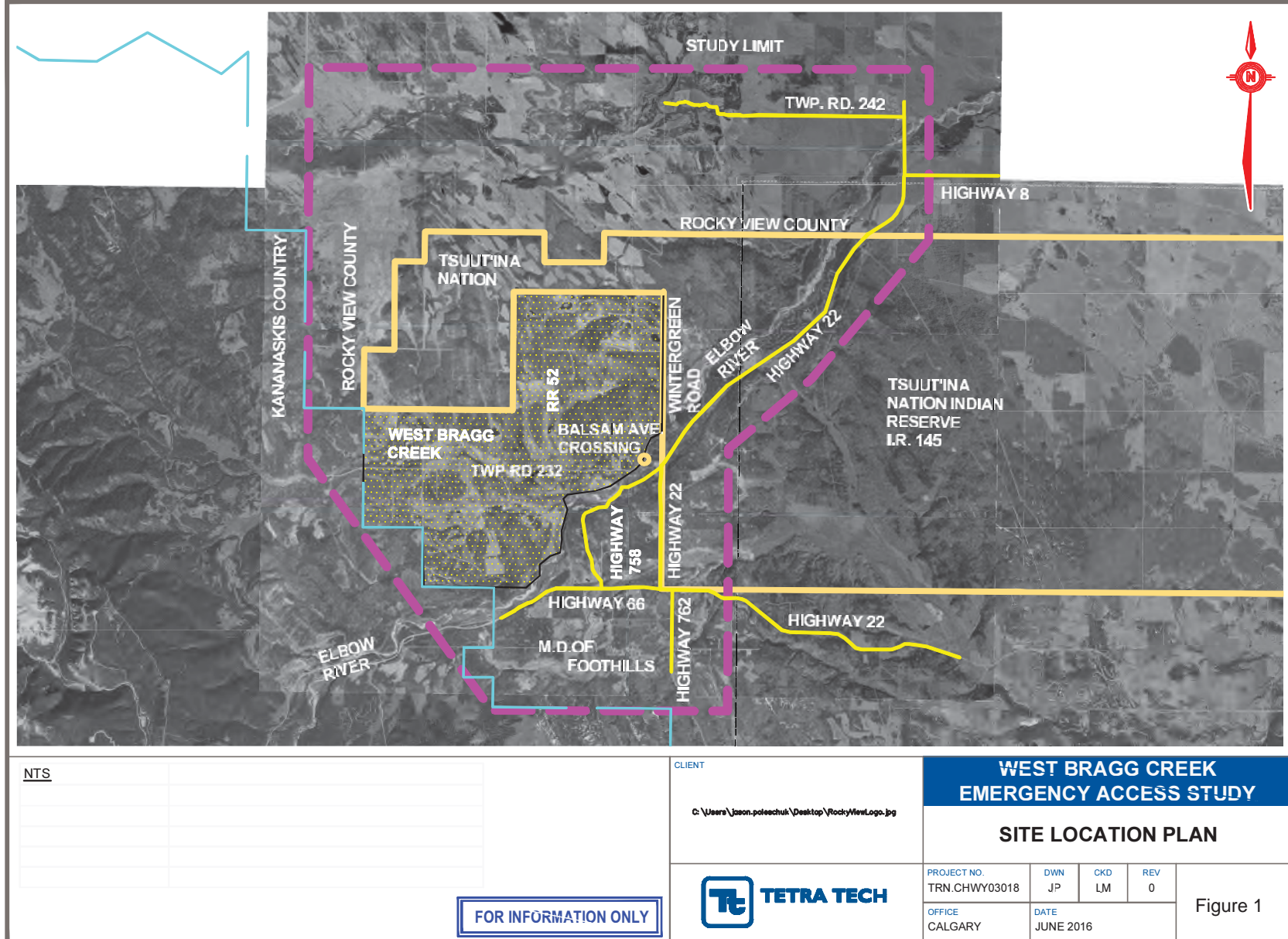
Reviewed by:  
Paul Steel, M.Eng., P.Eng.  
Transportation Planning Lead – Western Canada  
Direct Line: 403.723.6881  
paul.steel@tetrattech.com

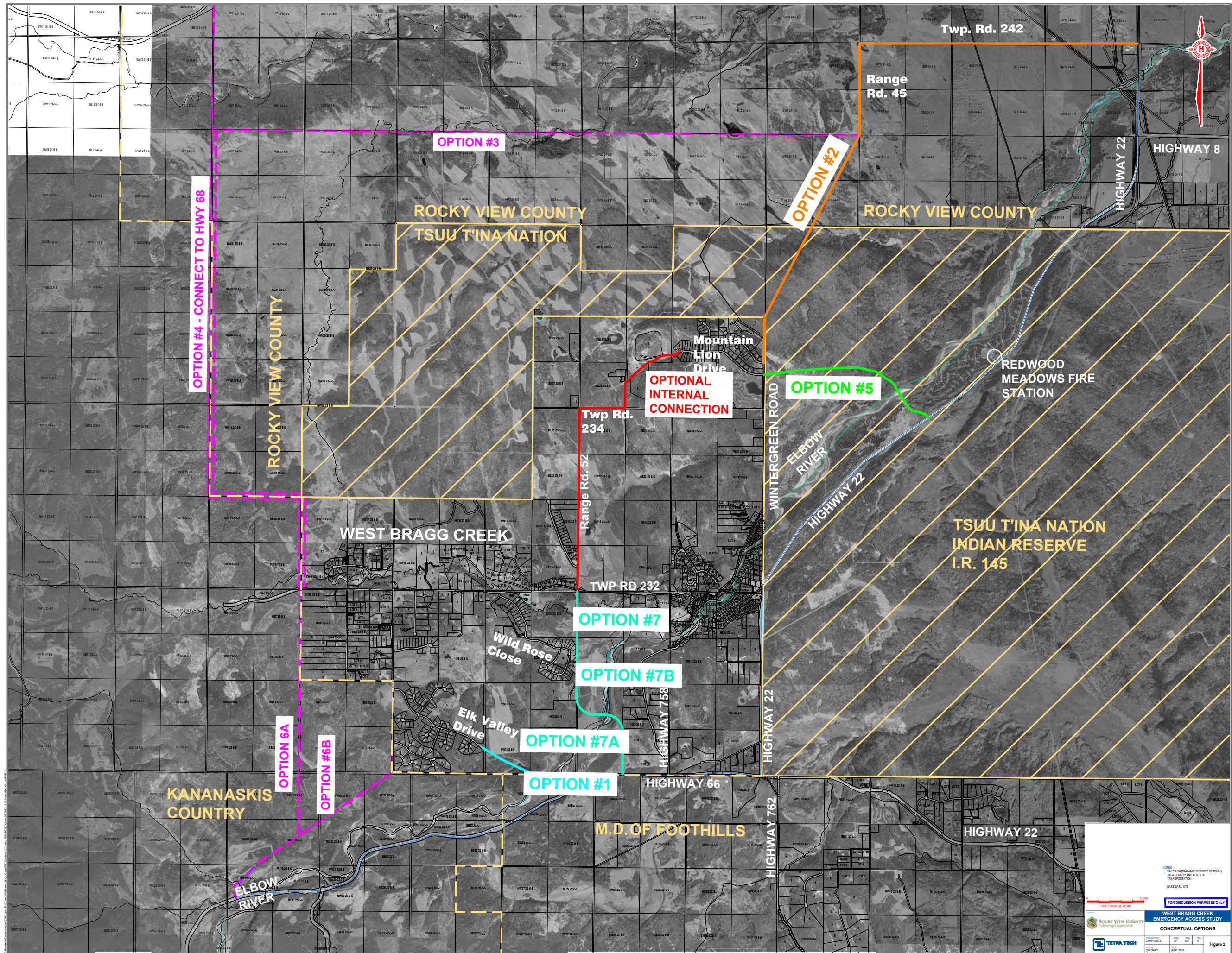
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<b>PERMIT TO PRACTICE TETRA TECH CANADA INC.</b>	
Signature	
Date	Dec 18, 2017
<b>PERMIT NUMBER: P13774</b>	
The Association of Professional Engineers and Geoscientists of Alberta	

## FIGURES

- |          |  |
|----------|--|
| Figure 1 | Study Area                             |
| Figure 2 | Preliminary Route Options Plan         |
| Figure 3 | Updated Preliminary Route Options Plan |
| Figure 4 | Results of the Technical Evaluation    |





NOTES  
BASED ON DRAWING PROVIDED BY ROCKY VIEW COUNTY AND ALBERTA TRANSPORTATION  
BASE DATA: NTS

FOR DISCUSSION PURPOSES ONLY

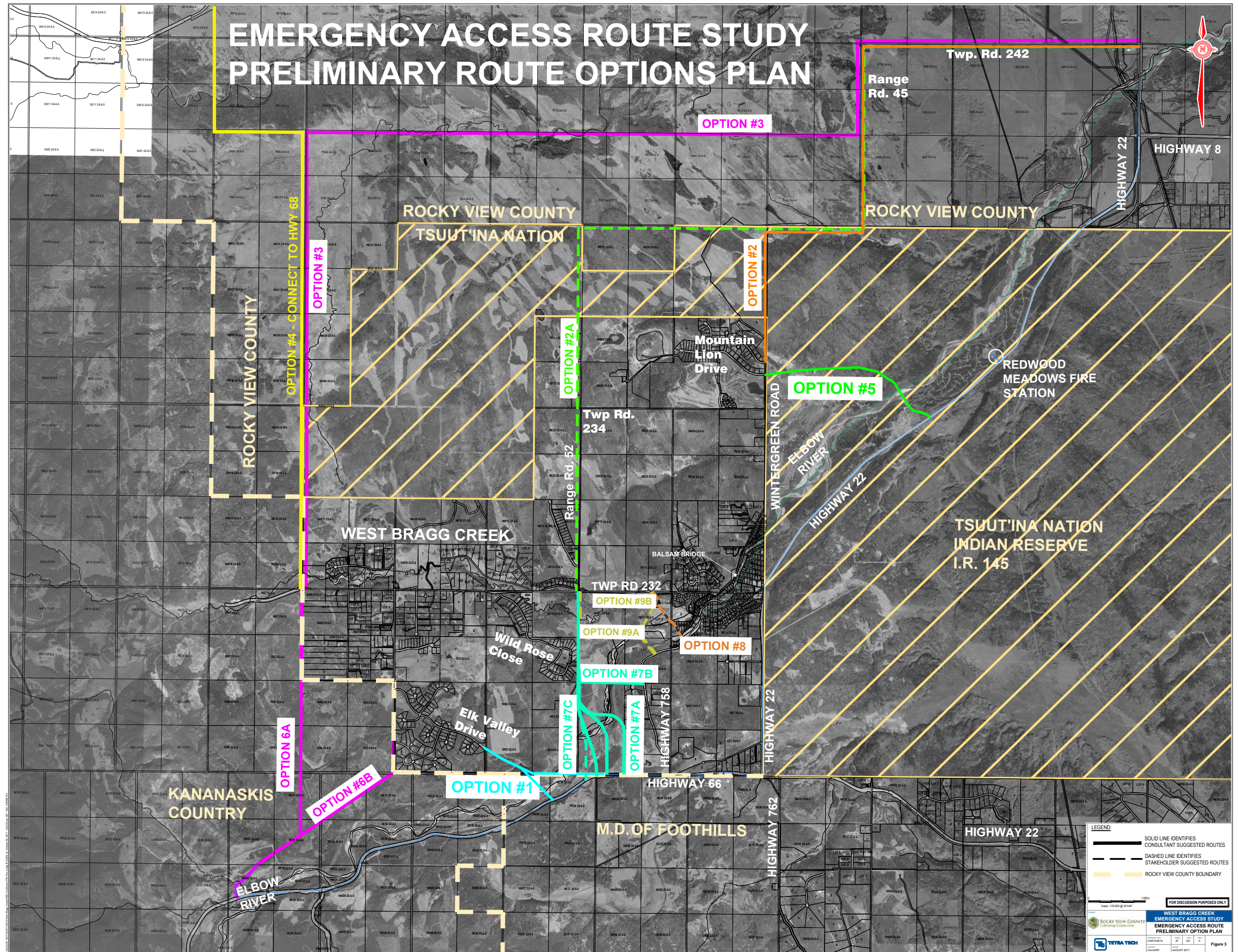
WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY

CONCEPTUAL OPTIONS

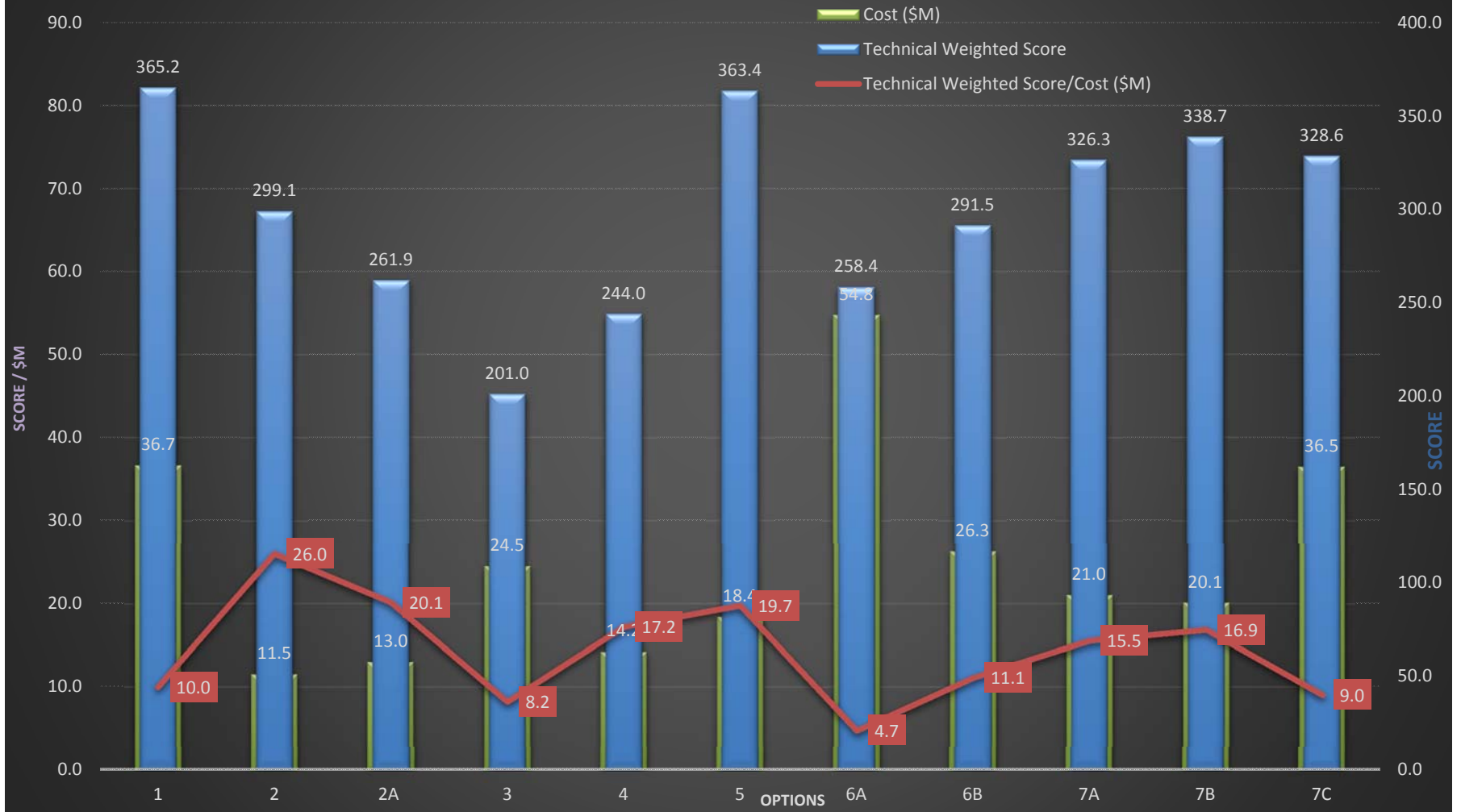
OPTION	DATE	STATUS
OPTION #1	JUNE 2016	IN PROGRESS
OPTION #2	JUNE 2016	IN PROGRESS
OPTION #3	JUNE 2016	IN PROGRESS
OPTION #4	JUNE 2016	IN PROGRESS
OPTION #5	JUNE 2016	IN PROGRESS
OPTION #6A	JUNE 2016	IN PROGRESS
OPTION #6B	JUNE 2016	IN PROGRESS
OPTION #7	JUNE 2016	IN PROGRESS
OPTION #7A	JUNE 2016	IN PROGRESS
OPTION #7B	JUNE 2016	IN PROGRESS

Figure 2

# EMERGENCY ACCESS ROUTE STUDY PRELIMINARY ROUTE OPTIONS PLAN



## West Bragg Creek Emergency Access - Options Comparison



### LEGEND

NOTES

STATUS

CLIENT



### WEST BRAGG CREEK EMERGENCY ACCESS STUDY

#### Results of Technical Evaluation

PROJECT NO.  
TRN.CHWY03018-01

DWN  
BV

CKD  
LM

APVD  
LM

REV

OFFICE  
CALGARY

DATE  
November 2017

Figure 4

## APPENDIX A

### TECHNICAL REVIEW COMMITTEE MEETING MINUTES

## TECHNICAL REVIEW COMMITTEE MEETING NO. 1 WEST BRAGG CREEK EMERGENCY ACCESS STUDY

<b>MEETING TIME:</b>	1:30 p.m. to 3:40 p.m.	<b>DATE:</b>	May 6, 2016
<b>LOCATION:</b>	Committee Room, RVC Office 911 32nd Avenue NE, Calgary	<b>FILE:</b>	TRN.CHWY03018-01
<b>ATTENDEES:</b>	<b>Rocky View County (RVC)</b> Dale Caines, Supervisor – Capital Infrastructure Projects Michele Habrylo, Municipal Engineer – Engineering Services Johnson Kwan, Planner – Development Services Angela Yurkowski, Municipal Engineer – Engineering Services <b>Alberta Transportation (AT)</b> Jerry Lau, Infrastructure Manager <b>Tetra Tech EBA Inc. (Tetra Tech)</b> Shane Duval, Manager – Project Director Lou Mak, Senior Transportation Engineer/Project Manager Paul Steel, Transportation Planning Lead		
<b>ABSENT:</b>	<b>Rocky View County (RVC)</b> Rick Wiljamaa, Manager – Engineering Services		

### Action

## 1.0 INTRODUCTIONS

- Roundtable introductions were made by all. Mr. Caines is representing Mr. Wiljamaa in his absence. Ms. Yurkowski will be on leave for a two week period starting the last week of May with Ms. Habrylo assuming Ms. Yurkowski's responsibilities during that period.

## 2.0 PROJECT STATUS TO DATE

- Mr. Mak provided an update as to the tasks completed to date as well as those tasks to be completed between now and the end of the project.
- RVC is in the process of confirming the details of the upcoming meeting to be held with the local Division Councillor (Councillor Liz Breakey), which may include a couple of prominent members of the West Bragg Creek community. This meeting will be scheduled in the near future. *A meeting was held on May 17 with one of these community members.*
- AT is currently leading the communication engagement for this project with the Tsuu T'ina First Nation. Tsuu T'ina has requested that the engagement commence with a formal letter from RVC Council to the band council advising of the study and the intent to engage in consultation. At this time, the initial invitation will proceed from RVC administration.

### 3.0 PRELIMINARY ROUTE OPTIONS

- There was some discussion regarding the mapping and contour data shown on the preliminary route options mapping. Tetra Tech advised that they are still in discussion with AT to confirm and obtain all remaining available data for use in this study. Of particular note is a small section adjacent to the south study limits (south County boundary) that may affect a portion of two or three of the options where coverage is not complete at this time. Tetra Tech will continue to work with AT to determine the availability of this data. Tetra Tech confirmed in the meeting that their project proposal did not consider generation of contours from the aerial imagery.  
**Tetra Tech and AT to confirm data availability**
- Tetra Tech provided a review of each of the options developed to date that seek to address the objectives of this study (i.e., identify an emergency access that will serve the West Bragg Creek area). These options are intended to be inclusive of all feasible options that connect to other regional roads to the north, south and east. The rationale for considering these options was presented as well as some of the high level details of the options such as the range of vertical grades and relative river crossing constraints. Where possible, these options seek to utilize as much existing road infrastructure as possible. Specific details of the options will be confirmed after the initial screening of the options and once all data gaps are addressed.
- One of the options (Option 7 and its subsets) propose to use an undeveloped road allowance; the extension of Range Road 52 to the south of Township Road 232. Some of the revisions made to introduce new options or to revise those from the proposal submission were discussed including the preference to use the undeveloped road allowance for Option 7 as opposed to using the Wild Rose subdivision roads due to route directness and other considerations made at this time.
- For future renditions of the mapping, it was suggested that the Kananaskis Country (K Country) and Tsuu T'ina lands be better delineated so their boundaries are more prevalent when reviewing the surrounding constraints and route options.  
**Tetra Tech to revise the mapping**
- Option 3 and Option 4 show a jog in the routes as they approach the Tsuu T'ina lands. RVC advised of presence of muskeg in this area and suggested that should these options be considered further, that the jog for Option 3 be removed and continue the alignment to the north before running in an east-west direction. For Option 4, the jog should be moved further north away from wet areas.
- It was noted that there are no options that follow a westerly direction into the K Country. This is largely to do with the limited connectivity to other regional routes since the road beyond RVC ends at a trail head approximately one to two miles to the west. Mr. Caines noted that an old logging route connected through this area in the past; however, the extent and feasibility of proceeding west is unknown. RVC has been working with trail advocates in the K Country and can approach contacts if this is to be reviewed further.  
**RVC to discuss feasibility to the west with K County contacts**
- Regardless of the option that will be recommended, a second connection between areas to the north and west within West Bragg Creek is essential. This secondary connection is itself recognized as an internal emergency route needed in the event that the primary access along Wintergreen Road is inaccessible during an emergency event. Tetra Tech has identified Range Road 52 between Township Road 232 and Mountain Lion Drive as this  
**RVC/Tetra Tech to follow up with emergency services**

secondary connection as there are no other developed or partially developed road allowances elsewhere within the West Bragg Creek area that appear to be feasible at this time. This connection, as well as several of the route options, may require grades as steep as 8% or higher given the surrounding terrain and constraints. As such, a follow up discussion with RVC emergency services was suggested to confirm operational restrictions from the emergency services equipment that will be required to negotiate such areas should they proceed. At this time, the intent is to provide a gravel surface road, but the question was raised as to whether emergency services equipment performs similarly on a gravel surface as it does on a paved surface. RVC advised that they would follow up with RVC emergency services to continue discussions and address these items.

## 4.0 CONSTRAINTS MAPPING

- Mapping of the study area showing environmental, geotechnical and historical resources constraints was reviewed. Each route has varying degrees of impact specific to one or more of these constraints.

## 5.0 RVC EMERGENCY SERVICES FINDINGS

- A summary of the meeting held with RVC emergency services was reviewed including items related to response times and route attributes that will be taken into considerations as part of the route evaluation.

## 6.0 EVALUATION CRITERIA

- Tetra Tech was asked to explain the approach to be taken when evaluating each of the route options. Specifically, the combination of multiple rationale or parameters within each of the criteria was the focus of much of the decision regarding the evaluation process. Each of the route options will be evaluated against the various criterion taking into consideration the relative impact or constraints of one option compared to another. Guidance will be sought from other disciplines within Tetra Tech's team including environmental, geotechnical, river crossing, historical resources, etc., when applying the evaluation process for those constraints.
- Some other considerations that could be included or should not be included within the evaluation criteria as mentioned by TRC members are:
  - Include: Amount of road right of way or value of land (capture in the 'land owners impacted' criterion).
  - Land acquisition costs should be captured as part of the total construction cost estimates for the applicable route options. (This differs from the previous criterion, which seeks to quantify the extent of impact without costs, whereas any cost items should be captured separately under total construction costs)
  - Exclude: First Nation lands should not be assigned a cost, where applicable, as there is no precedence for establishing cost estimates for Reserve lands.
  - Include: Wetland compensation.

**AT to confirm  
Crown land  
requirements**

- Include: Any federal land impacts may preclude a route option from proceeding any further.
- Crown land impacts would be managed through the Province; Mr. Lau noted that he would follow up internally to confirm the process required should Crown lands be impacted.

## 7.0 GIS ANALYSIS

- Outputs from the GIS analysis completed to review emergency response times and distances served by the several routes were reviewed. These outputs map the route from the nearest emergency services facility in Red Wood Meadows as well as the evacuation route to the Banded School site along Highway 22 south of Bragg Creek. These outputs will be used to assist in the evaluation of route options.

## 8.0 DESIGN CROSS-SECTION AND CRITERIA

- The initial direction for the emergency access road was to consider a regional low volume road and the associated design criteria for that classification. RVC has since advised that a moderate volume road with an 8.0 m gravel surface and a 20 m right-of-way should be considered.
- Since several of the route options seem to require a significant amount of capital expenditure, whether through bridge requirements or the length of the route in general, there was some discussion regarding the possibility of considering this route to be more than strictly for emergency events. In addition, the traffic volumes expected to use the route during an emergency event will likely exceed the design volume for which the road will be built or the intended volume for that classification of road. The question was raised as to whether the road access road should be designed for the peak hour during an evacuation. It was suggested that RVC confirm the desire to consider creating this access road as a permanent roadway, which in light of the recent Fort McMurray fires, may be forefront in the minds of the community and residents this route will seek to serve. Once confirmed, the intent of the access road, whether permanent or strictly for emergency events, should be communicated with the public.
- It may be that a staged plan is proposed for the emergency access road; however, considerations should be given to protecting for a wider right-of-way if the staging requires such as part of delivering the ultimate requirements for this road.

**RVC to review the intent of the road and confirm the appropriate designation to follow**

## 9.0 UNIT RATES

- The unit rate cost estimates for use in the technical evaluation of the route options were reviewed. RVC suggested that these estimates seem reasonable for the terrain being considered but would review further and confirm with Tetra Tech if any revisions should be considered.

**RVC to confirm unit rates**

## 10.0 NEXT STEPS

- As part of the future meeting with Councillor Breakey, the messaging to take to the public should be discussed since there is a relatively even split amongst the community regarding the intent of the access road (i.e., permanent versus emergency access only).
- Tetra Tech's schedule suggests that the stakeholder consultations will begin shortly after the next TRC meeting and prior to Open House No. 1. There is also some time set aside for the First Nation consultations being directed by AT. At the time that the open house is held, the public consultation should remain focused and succinct, to minimize the amount of detail being shared so that the key points are the focal points taken away by those in attendance.
- The date and time for the next TRC meeting were reviewed. Tetra Tech will forward a meeting invitation shortly to confirm these details.

**Tetra Tech /  
RVC to review  
messaging**

If there are any errors or omissions, please contact the undersigned.

Prepared by,  
Tetra Tech EBA Inc.

Paul H.A. Steel, M. Eng., P.Eng.  
Transportation Planning Lead – Western Canada  
Direct Line: 403.723.6881  
paul.steel@tetrattech.com

/bvb

## TECHNICAL REVIEW COMMITTEE MEETING NO. 2 WEST BRAGG CREEK EMERGENCY ACCESS STUDY

<b>MEETING TIME:</b>	10:0 a.m. to 12:00 p.m.	<b>DATE:</b>	May 30, 2016
<b>LOCATION:</b>	Committee Room, RVC Office 911 32nd Avenue NE, Calgary	<b>FILE:</b>	TRN.CHWY03018-01
<b>ATTENDEES:</b>	<b>Rocky View County (RVC)</b> Rick Wiljamaa, Manager – Engineering Services Michele Habrylo, Municipal Engineer – Engineering Services Johnson Kwan, Planner – Development Services <b>Alberta Transportation (AT)</b> Jerry Lau, Infrastructure Manager <b>Tetra Tech EBA Inc. (Tetra Tech)</b> Lou Mak, Senior Transportation Engineer/Project Manager Paul Steel, Transportation Planning Lead		
<b>ABSENT:</b>	<b>Rocky View County (RVC)</b> Angela Yurkowski, Municipal Engineer – Engineering Services		

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**Action**

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### 1.0 PREVIOUS ACTION ITEMS

Mr. Mak provided an update on the previous action items from Technical Review Committee (TRC) Meeting No. 1:

- Meeting with Division Councillor and/or representative member of West Bragg Creek community. RVC and Tetra Tech met with a representative member of West Bragg Creek. Details to follow in latter section of these meeting minutes.
- Mr. Lau indicated that RVC Council sent a letter to Tsuu T'ina Band Council advising of the study and the intent to engage in consultation last week. Mr. Lau will follow up with Tsuu T'ina on further engagement and interest in the study.
- Tetra Tech has obtained the missing mapping from AT to cover the routes, and delineated the boundaries of Kananaskis Country (K-Country), Tsuu T'ina, RVC, etc., on the plans. No further action required.
- RVC suggested rerouting Option 3 and Option 4 to avoid muskeg. Option 3 and Option 4 have since been eliminated as part of the discussions in TRC No. 2 from further study. No further action required.
- RVC suggested contacting K-Country if additional routes through K-Country are contemplated. Option 6 has since been eliminated for further study as part of the discussions in TRC No. 2, and no additional routes to the west are contemplated. No further action required.
- Tetra Tech and RVC confirmed with RVC Emergency Services that their firetrucks can operate on 8% grade. No further action required.

- AT/RVC suggested some considerations that could be included or excluded within the evaluation criteria. The suggestions will be taken into consideration at the route evaluation stage.
- Mr. Lau indicated that if the emergency access road impacts Crown lands, then RVC would be required to purchase the land from the Province. No further action required.
- There were discussions during TRC#1 that perhaps RVC should adopt a higher design cross-section depending upon future use of the roadway. Currently, the Regional Moderate Volume design is assumed. RVC to review the intent of the road to confirm the appropriate design designation. Outstanding action to be addressed. At this time, Tetra Tech will proceed with the Regional Moderate Volume design until further direction is provided.
- Unit rates of construction were presented at TRC No. 1. RVC to confirm unit rates. Outstanding action to be addressed.

## 2.0 SCREENING OF PRELIMINARY ROUTE OPTIONS

Mr. Steel provided an overview of the pros/cons of each route option. The following comments/conclusions were provided by the TRC members:

- Option 3 and Option 4 – the potential to assist forestry activities may not be seen as a pro from West Bragg Creek residents' viewpoint. This item will not be discussed outside the TRC membership unless it is raised by others.
- Option 1 wildfire risk may be better represented as 'yellow' instead of 'red' in the screening matrix, as the route is not within the high wildfire hazard area. Motorists accessing the route may need to travel towards the west to reach Option 1; however, these motorists will likely still be able to utilize the existing Balsam Avenue access point during any wildfire events.
- The results from the screening suggest elimination of Option 3, Option 4, and Option 6 from further study, predominantly due to their unfavourable emergency response and evacuation service compared to the other options. TRC members concurred with this conclusion. Option 3, Option 4, and Option 6 will be presented on future plans for stakeholders and Open House No. 1 as a dashed line indicating that these routes were considered.
- Given some of the feedback received from the proposed Springbank Reservoir (SR1) project, it was confirmed that the shortlisted options to be evaluated further (1, 2, 5 and 7) have been reviewed in relation to SR1 and the MacLean Creek alternate reservoir option. As such, any questions regarding the route options with respect to the reservoir options can be addressed with relative ease.

## 3.0 UPDATE ON STAKEHOLDER CONSULTATION

- Tetra Tech and RVC met with Mr. Gary Nikiforuk (representative member of West Bragg Creek) as requested by the Division Councillor, who could not attend. Mr. Nikiforuk provided suggestions and stakeholder consultation messaging, comments on the routes, guidance on engaging the community and some concerns from the community. Mr. Nikiforuk indicated that he would summarize his notes in an email to Councillor Breakey. No further action is

required from Tetra Tech and RVC at this time and no additional meetings have been planned.

- Mr. Mak provided the intended approach for upcoming stakeholder consultation efforts as follows:
  - Landowners with parcels adjacent to a route that will form a new road will be invited to a focus group meeting.
  - Landowners with parcels that are directly impacted (i.e., land may need to be acquired) will be invited for a one-on-one meeting.
  - All stakeholders will be invited to the study open houses.
- Focus group and one-on-one meetings are planned to be held at The CountryWood centre. Currently, Tetra Tech is gathering landowner contact information and preparing stakeholder consultation documents. The intent is to hold stakeholder meetings in the afternoon/evening between Monday, June 13 and Friday, June 17. Tetra Tech will work with RVC for any missing landowner contacts and send out invitation letters, after approval from RVC's communications review.
- The first open house is scheduled for June 23 at the Snowbird Seniors Fellowship centre in the hamlet of Bragg Creek. There was discussion on whether this date was still available and the potential to use other venues and dates. Subsequent to the meeting, the Snowbird's centre was booked for June 23.
- The Redwood Golf Course will be included as an invitee for one-on-one meetings.
- Mr. Lau will touch base with the Tsuu T'ina First Nation to determine if they would be interested in a one-on-one meeting.
- The landowners along Township Road 234 and the north connection to Wintergreen should be invited to one focus group meeting due to prior dealings with the group.

## 4.0 OPEN HOUSE NO. 1

- Open House No. 1 is scheduled for June 23 from 4:00 to 8:00 pm at the Snowbird's centre.
- Advertising for the open house will be completed by RVC and will include local postings, notification at the County office, on the County's website, email distribution to select stakeholders, sandwich boards deployed at select locations in West Bragg Creek, and newspaper ads.
- RVC advised of their Safe and Sound communication tool, which they will utilize to disseminate information regarding the upcoming open house.
- The intended format of the open house is to display presentation boards for viewing and discussion. There will be no formal presentation at the open house. There will be an information hand-out sheet and questionnaire/comment sheet for attendees to complete. All documents will be forwarded to RVC for review.
- There will be no reference to AT on any of the stakeholder consultation documents.

**RVC to place  
advertising in  
local  
newspaper as  
soon as  
possible**

**Tetra Tech to  
forward  
materials to  
RVC for  
review**

- Mr. Steel provided an overview of the open house boards. The TRC provided the following comments/suggestions:
  - RVC logo to be on all the boards.
  - Include that the purpose of the route is to prevent loss of life.
  - As part of sharing some of the initial input received from RVC Emergency Services, the use of the word reliability may need to be changed. The TRC will give this some thought as to the proper wording, with 'resiliency' offered as a possibility.
  - The study area plan should show up to Highway 1 since Option 4 extends northwards.
  - Ms. Habrylo/Ms. Yurkowski to check the figures (i.e., no. of residents, residences, value) for the Study Area Context board.
  - Include screening matrix and GIS output plans as part of the presentation boards.
  - Include a plan for the internal connection and the reasoning behind its need.
  - The plan of route options is to include Option 2 and Option 5 going through the Tsuu T'ina lands since these options have already been communicated to the First Nation.
  - The proposed road design information should not include the 80 km/h posted speed.
  - Evaluation Criteria title should include "for next stage". The slide should not include "Future Development Staging" as one the criteria being proposed.
- RVC noted that there is a development application for the Wintergreen area, which is still in the processing stage. This may be raised during the stakeholder consultations and as such, Tetra Tech should be aware of this.
- Mr. Steel provided an overview of the stakeholder letter. The TRC provided the following comments/suggestions:
  - The letter should include reasoning behind focus group meetings vs. one-on-one meetings, since it is expected that neighbours will talk to each other and may question the different communications received if not explained properly.

**Tetra Tech to  
update the  
open house  
boards  
accordingly**

**RVC to  
confirm the  
Study Area  
Context board  
content**

**Tetra Tech to  
revise  
stakeholder  
letter content**

If there are any errors or omissions, please contact the undersigned.

Prepared by,  
Tetra Tech EBA Inc.

Lou Mak, P.Eng.  
Sr. Transportation Engineer  
Direct Line: 403.723.3260  
Lou.mak@tetratech.com

/bvb



## TECHNICAL REVIEW COMMITTEE MEETING NO. 3 WEST BRAGG CREEK EMERGENCY ACCESS STUDY

<b>MEETING TIME:</b>	10:30 a.m. to 11:45 a.m.	<b>DATE:</b>	August 28, 2017
<b>LOCATION:</b>	Rocky View County Office 911 32 Avenue NE, Calgary	<b>FILE:</b>	TRN.CHWY03018
<b>ATTENDEES:</b>	<b>Rocky View County (RVC)</b> Rick Wiljamaa, Manager – Engineering Services Angela Yurkowski, Municipal Engineer – Engineering Services <b>Alberta Transportation (AT)</b> Jerry Lau, Infrastructure Manager <b>Tetra Tech Canada Inc. (Tetra Tech)</b> Shane Duval, Manager – Transportation Lou Mak, Senior Transportation Engineer/Project Manager Paul Steel, Transportation Planning Lead		
<b>ABSENT:</b>	<b>Rocky View County</b> Johnson Kwan, Planner – Development Services		

### Action

## 1.0 PROJECT STATUS UPDATE

- Tetra Tech outlined the tasks completed since the last TRC meeting and tasks ahead for project completion.
- RVC is to confirm that Tetra Tech is to present the project to Council rather than the Policy and Priorities Committee. The next RVC Council date is on October 10, 2017. **RVC – AY**

## 2.0 SUMMARY OF STAKEHOLDER/PUBLIC CONSULTATION

- Tetra Tech provided a summary of activities during the first round of stakeholder and public consultation, including one-on-one meetings, focus group meetings, open house, e-mail and phone communications; their feedback/comments; and how their comments were addressed.
- The feedback included not in my back yard (NIMBY) comments, concerns of gating and access; evacuation to the nearest highway, alternative route options; and comments related to the value of a bridge.
- Suggested alternative routes include Range Road 52 north; Range Road 52 south; through the Elkana area, across into Bragg Creek Provincial Park; and west into Kananaskis Country.
- The response to address these comments included:
  - Inclusion of “evacuation to nearest highway” metric in the evaluation matrix
  - Inclusion of two routes for further evaluation (RR 52 north and RR 52 south)

- Exclusion of three routes due to constraints/impacts
- Other comments were addressed through evaluation criterions

### 3.0 SUMMARY OF THE EVALUATION RESULTS

- Tetra Tech presented a summary of the evaluation results. This includes a revised cost estimate to reflect changes to route options 2 and 2A; removal of the internal connection, and latest RVC surfacing standards.
- Route option 2 has the highest benefit/cost ratio and is the technically preferred option.

### 4.0 UPDATE ON RVC'S DISCUSSION WITH TSUUT'INA NATION

- RVC and Tsuut'ina Nation agree that an emergency access route has mutual benefits and to continue dialogue on the revised route option 2 that follows closely to existing road allowances.
- RVC is to confirm that Tsuut'ina Nation has informed their residents of the preferred route and that the open house may proceed as planned for September 20. **RVC – AY**
- RVC's Inter-municipal Group is to send Tsuut'ina Nation an update and invitation to the Open House. **RVC – AY**

### 5.0 REVISED ROUTE 2 OPTION

- Tetra Tech presented the revised route 2 option. There was discussion amongst the group regarding the right-of-way boundaries and land ownership along the route.
- RVC directed Tetra Tech to center the alignment within a 20 m right-of-way. Along Wintergreen Road, where the existing right-of-way appears to be 15 m, Tetra Tech is to assume an additional 5 m exists on the east side. For the east/west portion of the route, Tetra Tech is to assume a 20 m right-of-way extending south of the existing Tsuut'ina north property line. **TT – LM/SD**

### 6.0 SUMMARY OF FOCUS GROUP MEETING FOR THE PREFERRED ROUTE

- Tetra Tech presented a summary of the topics that were discussed during the focus group meeting held with landowners adjacent to the preferred route on August 24, 2017.
- The feedback included concerns over gating; the route evaluation process and benefit/cost validity with Tsuut'ina Nation costs unknown; the potential opportunity to consider other routes; land ownership of the east/west portion along the Tsuut'ina Nation boundary; consideration of a future fire hall in the West Bragg Creek area; and implications of wildfire along Wintergreen Road.
- RVC to follow up internally regarding the potential firehall in the West Bragg Creek area to address the feedback presented. **RVC – AY**
- RVC to determine land ownership of east/west road allowance north of the Tsuut'ina Nation. **RVC – AY**

### 7.0 ROUTE OPTION 2 DESIGN CLARIFICATION

- Tetra Tech questioned whether the preferred route should incorporate curves or T-intersections. RVC directed that the route should utilize T-intersections to reduce land impacts.

- Tetra Tech questioned if additional analysis is required for a route option that proceeded straight north from Wintergreen Road utilizing Range Road 50 right-of-way. RVC indicated that there is no need to evaluate Range Road 50 at this time.

## 8.0 OPEN HOUSE #2

- Open House is tentatively planned for September 20, 2017 at the Snowbirds Chalet. This is contingent on a follow up with the Tsuut'ina Nation regarding their intent to inform community members of the study.
- RVC will complete the advertising for the open house. Advertising would include posting in the local newspaper, at the RVC office and on their website; roadside sign boards; and email to RVC contacts and select stakeholders. AT indicated that roadside boards within any highway right-of-way will require a permit. **RVC – AY**
- Tetra Tech indicated that the open house format includes presentation boards and a comments sheet. There will not be any handouts for attendees.
- Tetra Tech presented the anticipated story boards and content for the open house.
- RVC suggested removing the diagonal route from the preferred option plan as this appears to have confused the stakeholders during the focus group meeting. **TT – LM**
- Other suggestions were to include an indication of the weighting of the emergency evacuation and emergency response amongst all the evaluation criteria.

## 9.0 NEXT STEPS

- Tetra Tech presented a summary of tasks for completion of project.
- RVC indicated that a draft report is to be ready by September 16, in order to meet the review time for the TRC and include any report revisions into the Council agenda package.

## 10.0 OTHER BUSINESS

- AT questioned RVC on the contract completion date. RVC believes the contract completion date had been extended to the end of the calendar year.
- AT questioned the status of the scope change. Tetra Tech indicated that a scope change will be submitted later this week to RVC for review.

If there are any errors or omissions, please contact the undersigned.

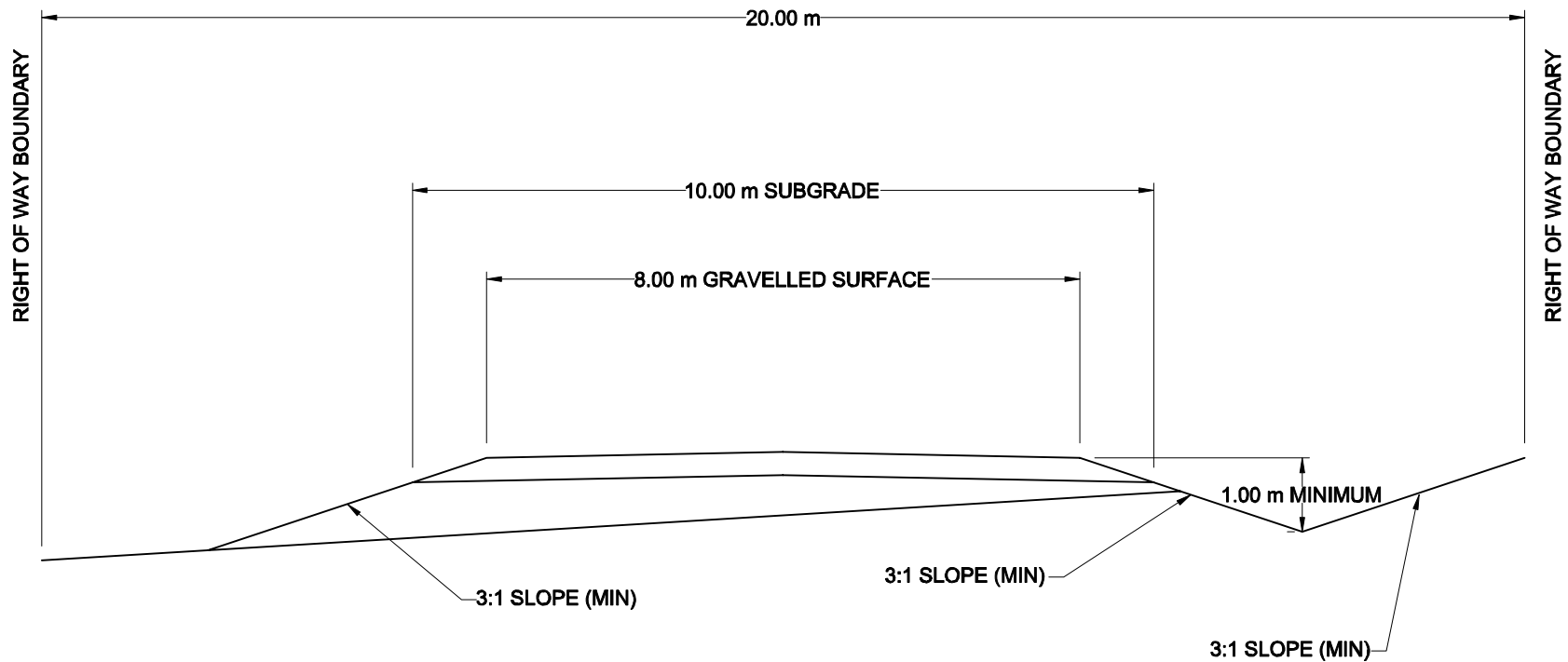
Prepared by,  
Tetra Tech Canada Inc.

Lou Mak, P.Eng.  
Senior Transportation Engineer  
Direct Line: 403.723.3260  
lou.mak@tetrattech.com

/tad

## APPENDIX B

### ROCKY VIEW COUNTY – CROSS-SECTION



#### Notes:

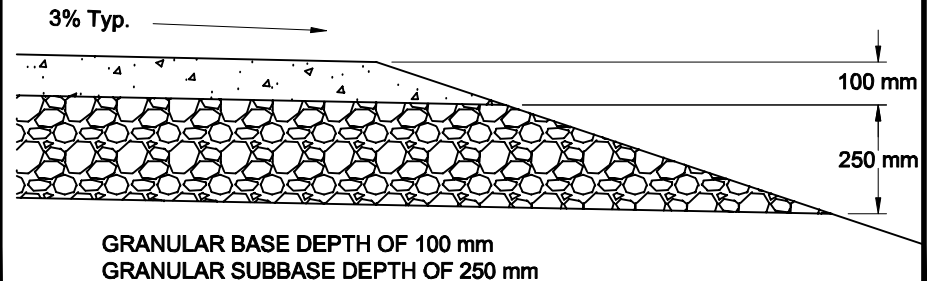
All roadway structure depths shall be certified by a Professional Engineer and be acceptable to the County based on soaked subgrade CBR values obtained from the actual subgrade road material, prior to entering the Development Agreement or Road Construction Agreement.

Backsloping agreement or extra ROW required must be obtained by the developer at their sole cost.

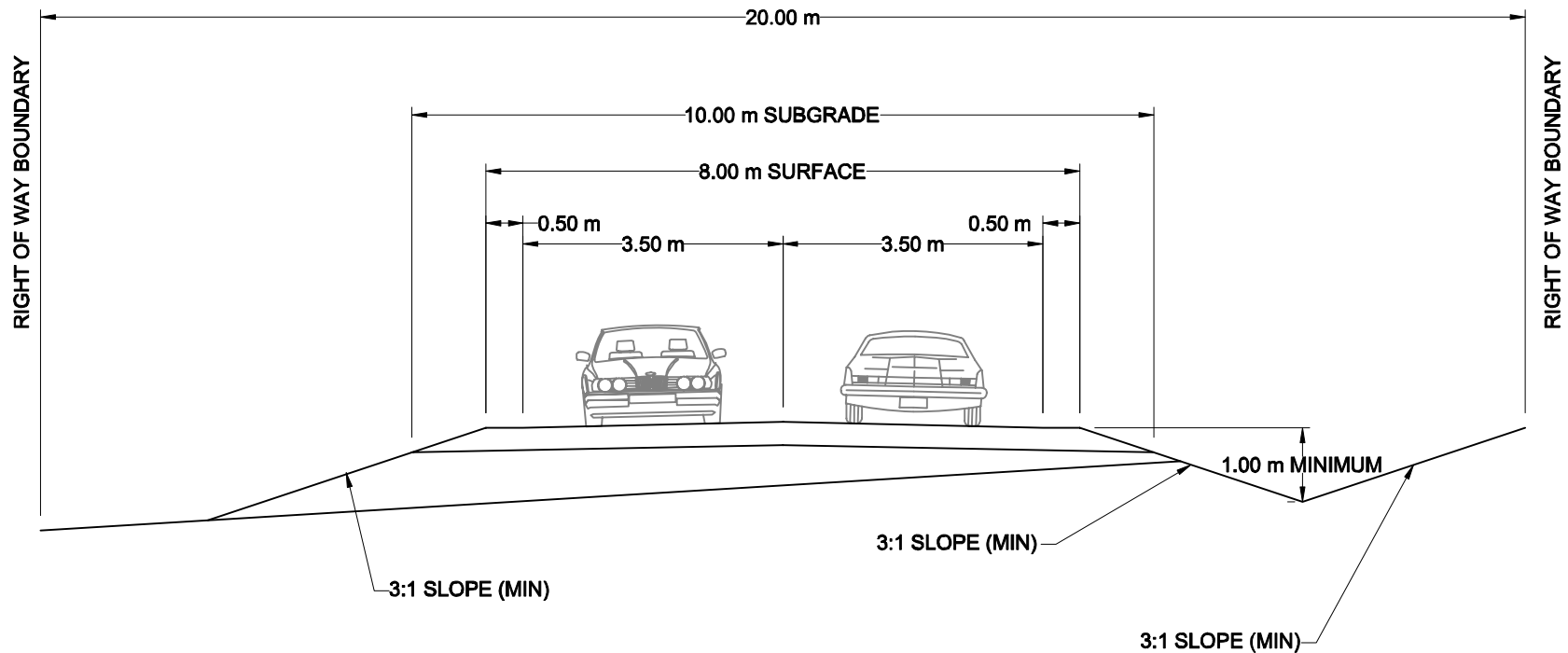
Slopes may be increased or decreased under exceptional circumstances if approved by the municipality in writing.

All ditch slopes and ditch bottoms require topsoil dressing and seed.

#### DETAIL



400.10	FIGURE NUMBER:	DESIGN BY:	ENGINEERING SERVICES		
		DRAWN BY: KW			
		CHECKED BY:			
		DATE: DEC 2010			
		SCALE: 1:100			
FIGURE NUMBER:		TITLE			
400.10		REGIONAL MODERATE VOLUME (RMV)			
		20.00 m R/W 8.00 m ROAD			
			No.	DATE	DESCRIPTION
					REVISIONS
			BY		



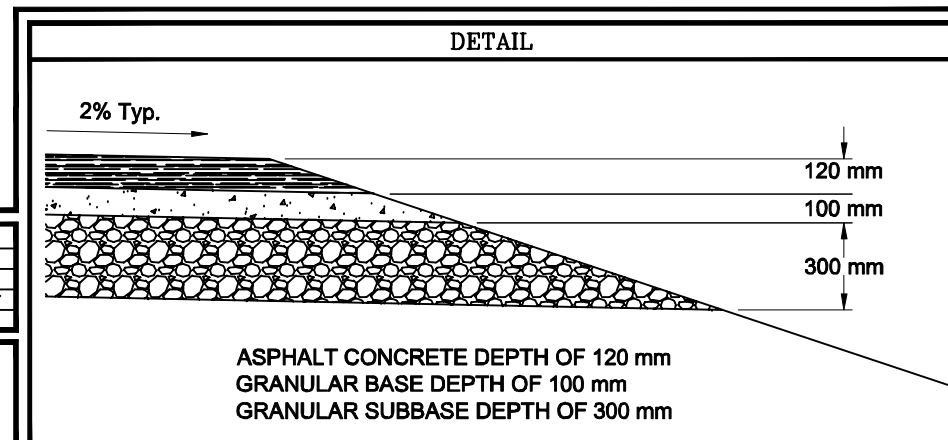
#### Notes:

All roadway structure depths shall be certified by a Professional Engineer and be acceptable to the County based on soaked subgrade CBR values obtained from the actual subgrade road material, prior to entering the Development Agreement or Road Construction Agreement. Table 400A identifies minimum asphalt depths.

Backsloping agreement or extra ROW required must be obtained by the developer at their sole cost.

Slopes may be increased or decreased under exceptional circumstances if approved by the municipality in writing.

All ditch slopes and ditch bottoms require topsoil dressing and seed.



400.11	FIGURE NUMBER:	DESIGN BY:
		DRAWN BY: KW
		CHECKED BY:
		DATE: DEC 2010
		SCALE: 1:100
		FIGURE NUMBER:
	400.11	

ENGINEERING SERVICES
TITLE
REGIONAL TRANSITIONAL PAVED (RMVP)
20.00 m R/W 8.00 m ROAD

3			
2			
1			
No.	DATE	DESCRIPTION	BY
		REVISIONS	

## APPENDIX C

### EVALUATION MATRIX AND SUPPORTING DOCUMENTS

West Bragg Creek, Emergency Access Study - Evaluation Matrix

Criterion	Rationale for Criteria:	Quantitative Measures Impacting Options	Units	Weightings (%)	Option 1			Option 2			Option 2A (RR 52 North)			Option 3			Option 4			Option 5								
					Elk Valley Dr to Hwy 66			Wintergreen Road to TR 242 thru Tsuu T'ina Lands			Range Road 52 North thru Tsuu T'ina Lands			North Route around Tsuu T'ina Lands to TR 242			North Route around Tsuu T'ina to Hwy 68			Wintergreen Rd to Redwood Meadows thru Tsuu T'ina Lands								
					Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures	Points Scoring (1-5)	Total Points (Weight x Point Scoring)						
Emergency Response Service	Emergency Response from Redwood Meadows (NBOUND)	% of total parcels within 8 km	%	17%	0	%	3.3	56.0	0	%	2.7	45.8	0	%	2.4	40.2	0	%	1.1	17.7	23	%	4.6	76.6				
		% of total parcels within 16 km	%		9	%			0	%			0	%			0	%			76	%						
		% of total parcels within 24 km	%		75	%			25	%			1	%			0	%			100	%						
		% of total parcels within 32 km	%		99	%			100	%			100	%			100	%			0	%						
Emergency Evacuation Service (Note: at 50 km/h, 10 km takes 12 min)	Evacuation to Banded Peaks Staging Area (with Balsam Avenue Closed)			21%																								
	Evacuation to Banded Peaks School	% of total parcels evacuated in 10 km	%		18	%	0	%	0	%	0	%	0	%	0	%	0	%	3	%								
		% of total parcels evacuated in 20 km	%		84	%	0	%	0	%	0	%	0	%	0	%	70	%										
		% of total parcels evacuated in 30 km	%		100	%	25	%	0	%	0	%	0	%	100	%												
		% of total parcels evacuated in 40 km	%			%	100	%	100	%	4% (100 with 50 km)	%	100% Outside 57 km															
	Evacuation to Nearest Highway Decision Point (with Balsam Avenue Closed)																											
	Nearest Highway Decision Point				Hwy. 22 and Hwy. 66 int.			Hwy 22 and TR 242 int.			Hwy 22 and TR 242 int.			Hwy 22 and TR 242 int.			Hwy 1 and Hwy 68 int.			Hwy. 22 and Redwood Meadows Golf Course Access								
		% of total parcels evacuated in 10 km	%		32	%	0	%	0	%	0	%	0	%	24	%												
		% of total parcels evacuated in 20 km	%		93	%	65	%	17	%	0	%	0	%	100	%												
		% of total parcels evacuated in 30 km	%		100	%	100	%	100	%	57	%	79	%														
		% of total parcels evacuated in 40 km	%			%		%	100	%	100	%	100	%														
	Evacuation to Nearest Highway Decision Point (with Balsam Avenue Opened)																											
	Nearest Highway Decision Points				Location 1: Hwy. 22 and Hwy. 66 intersection			Location 1: Hwy 22 and TR 242 int.			Location 1: Hwy 22 and TR 242 int.			Location 1: Hwy 22 and TR 242 int.			Location 1: Hwy 1 and Hwy. 68 int.			Location 1: Hwy 22 and Redwood Meadows GIC Access Int.								
	Neighbourhood Area and Closest Highway Decision Point		Wintergreen Area			Location 2			Location 2			Location 2			Location 2			Location 2			Location 2							
			Hamlet Area			Location 2			Location 2			Location 2			Location 2			Location 2										
			Wild Rose Area			Location 2			Location 2			Location 2			Location 2			Location 2										
			Hawk Eye Area			Location 2			Location 2			Location 2			Location 2			Location 2										
			Elk Valley / Highwood Area			Location 1			Location 2			Location 2			Location 2			Location 2										
			Range Road 55 Area			Location 2			Location 2			Location 2			Location 2			Location 2										
			% of total parcels evacuated in 10 km		%	100	%	100	%	100	%	100	%	100	%	100	%	100	%									
			% of total parcels evacuated in 20 km		%		%		%		%		%		%		%		%									
	Environmental Constraints	Federal / Provincial Crown Reserve	Length of impact		m	8%	0		4.0	33.0	0		3.0	24.8	0		3.0	24.8	400		1.1	9.2	400		2.0	16.5	0	
Federal and Provincial Parks and Protected Areas		Length of impact	m	0			0				0				0				0				0					
Environmentally significant Area		Length of impact	m	800			3,200				5,600				13,600				8,000				2,400					
Endangered and Threatened Plant Ranges (Lumber Pines)		Length of impact	m	0			0				2,400				13,600				12,000				0					
Sensitive Raptor Range & Sharp-tailed Grouse		Length of impact	m	0			4,800				4,800				0				0				0					
River/Stream Crossings		# of Crossings	#	1 - (Elbow River)			2 (Harris Creek + Unknown)				2 (Unknown)				8 - 3 (Muskeg Creek); 1 (Jumpingground Creek) 2 (Muskeg Creek); 1 (Harris Creek); 1 (West Bragg Creek) + tributaries				4 - 1 (Jumpingground Creek) 2 (Muskeg Creek) 1 (West Bragg Creek) + tributaries				2 - (Elbow River + Unknown)					
Impacted Wetlands		# of Crossings	Y/N	Yes 2 wetland crossings (~40 m & 70 m wide)			Yes; 1 wetland areas (~60)				Yes; 1 wetland areas (~200 m)				Yes ~ 2 - 2.5 km				Yes ~ 2 - 2.5 km				Yes, Approx. 500 m					
Gritzy Bear Zone		Length of impact	m	0			0				0				0				0				0					
Geotechnical Risks	Key Wildlife and Biodiversity Zone	Length of impact	m	8%	2,500		4.0	33.5	0		3.9	32.6	0		4.0	33.5	11,200		4.0	33.5	8,000		4.0	33.5	800		4.0	33.5
	Favorable	Zones: 4, 6b, 7, 9, 14a, 15, 21, 23	Zones		4,21	5, 4			7, 21	5, 4			7, 11, 21	5, 5, 4			4, 7, 11, 21	5, 5, 5, 4			4, 7, 11, 21	5, 5, 5, 4			7, 21	5, 4		
	Neutral	Zones: 2, 2b, 3a, 8, 10, 22, 26, 50	Zones		15	3			15, 22	3			15	3			2b, 15	3			2b	3			15	3		
	Unfavorable	Zones: 11, 17, 24, 27	Zones		none				24 (avoidable)	1			24	1			none				none				None			
Historical Resource Impacted	Municipal or Registered Historic Resource	Length of impact	m	5%	0		4.9	25.7	0		1.1	5.8	0		1.0	5.3	0		2.9	15.2	0		4.9	25.7	0		5.0	26.3
	Archaeological Historic Resource that may require avoidance	Length of impact	m		0				300				0				0				0							
	Cultural Historic Resource that may require avoidance	Length of impact	m		0				0				2,000				1,200				1,200				0			
	Believed to contain archaeological historic resource	Length of impact	m		0				3,200				3,200				3,200				0				0			
Infrastructure	New Elbow River bridge	Bridge required (assume 12 m wide)	Required?	11%	Required		2.8	31.6	Not Required		4.2	47.4	Not Required		3.9	44.9	Not Required		3.0	34.1	Not Required		3.1	35.4	Required		2.2	25.3
	New river/creek/stream crossings	# of Potential Large Diameter Pipe or Standard Bridge	#	1 - (Elbow River)		2 (Harris Creek + Unknown)		4.2	47.4	2 (Unknown)		3.9	44.9	2 (Unknown)		3.0	34.1	2 (Unknown)		3.1	35.4	2 - (Elbow River + Unknown)		2.2	25.3			
Land Owners Impacted	New Road	Length of New Road Construction	km	10%	1.85		3.5	33.7	6.0		2.3	22.5	10.8		2.1	19.8	19.4		2.4	23.0	12.0		3.4	32.6	2.4		2.1	20.3
	Private Land Owners	# of Parcels   Land Required	#   ha		0 parcel	0			2 parcels	3.2			3 parcels	10.4			15 parcels	21.6			4 parcels	5.6			0	0		
	Provincial / Federal Parks and Protected Areas (e.g. Bragg Creek Prov. Park, Kananaskis Prov. Park)	Length of Crossing   Land Required	m   ha		0	0			0	0			0	0			0	0			0	0			0	0		
	Provincial / Federal Crown Lands	Length of Crossing   Land Required	m   ha		1,100	2.2			0	0			400	0.8			400	0.8			400	0.8			0	0		
	Tsuu T'ina Lands	Length of Crossing   Land Required	m   ha		0	0			1,800	3.6			800	1.6			0	0			0	0			3,200	6.4		
	Total Land Area Required		ha		2.2				6.8				12				22.4				6.4				6.4			
Operations and Maintenance	Additional Annual Maintenance Requirement	Length of New Road and River Crossing (if applicable)	km	10%	2.2 (excl. Elk Valley Dr)		4.2	41.4	6 (excl. TR 242)		3.2	32.0	10.8 (excluding RR52 internal connection)		2.3	23.2	19.4 (excl. TR 242)		1.4	13.8	12.0 (excl. Hwy. 68)		2.2	21.5	3.2 (incl. golf course access)		3.7	36.4
	Simplicity and Familiarity of Route (Wayfinding)	municipal roads or internal subdivision roads to reach staging area	Road Links to Evacuate		From TR232, RR54, Elk Valley Drive (subdivision), Hwy 66, Hwy 22	From Wintergreen Rd North, TR 242 East, Hwy 22			From TR 234 North along RR 52 to TR 241 section line, to RR 45 to TR 242 to Hwy 22	From TR 232, RR 54 North, TR 241 East, RR45 North, TR 242 East			From TR 232, RR 54 North, TR 233 West, RR 55 North to Hwy. 68	From Wintergreen Rd, Redwood Meadows, Hwy 22														
Existing Topography & Geometry of Route	Flat	Length at +/- 2 %	m	9%	1,000		3.6	32.9	1,900		2.9	27.2	2,500		2.3	21.1	14,150		2.2	20.0	9,600		3.6	32.9	700		3.8	35.5
	Rolling	Length at +/- 3 - 8 %	m		200				3,200				6,200				7,150				2,150				1,600			
	Steep	Length at +/- > 8 %	m		650				900				2,100				2,900				200				100			
Utility Impacts	Surface Utilities Impacted	Utility Facilities Impacted	Type of Utility	0%	no major utilities identified		4.7	0.0	Fibre Optic		2.4	0.0	no major utilities identified		3.4	0.0	no major utilities identified		3.4	0.0	no major utilities identified		3.4	0.0	no major utilities identified		3.4	0.0
	Subsurface Utilities Impacted	Number of crossings	#		no major utilities identified	1 - on new road; 7 - Crossing TR 242 (already in place)			no major utilities identified	no major utilities identified			no major utilities identified	no major utilities identified														
Total Score				100%	365.2			299.1			261.9			201.0			244.0			363.4								
Estimated Roadway Capital Cost					\$ 791,000			\$ 5,600,000			\$ 5,950,000			\$ 8,860,000			\$ 5,035,000			\$ 1,260,000								
Estimated Bridge Costs					\$ 27,000,000			\$ 1,890,000			\$ 1,350,000			\$ 5,940,000			\$ 3,510,000			\$ 12,420,000								
Estimated Right-of-Way Costs (note: no costs assigned to Tsuu T'ina Lands)					\$ 55,000			\$ 119,000			\$ 198,000			\$ 554,000			\$ 159,000			\$ -								
Contingency (30%)					\$ 6,457,000			\$ 2,995,000			\$ 5,654,000			\$ 3,260,000			\$ 18,400,000			\$ 4,234,000								
Total Estimated Capital Cost					\$36,700,000			\$11,500,000			\$13,000,000			\$24,500,000			\$14,200,000			\$18,400,000								
Score / Cost Ratio					10.0			26.0			20.1			8.2			17.2			19.7								
Risks/Impacts & Significance/Probability/Mitigations & Efforts					- Environmental / River crossing & Medium / Certain / Permitting needed & Medium			- Property / Tsuu T'ina land & High risk / Certain / Agreement needed & High			- Property / Tsuu T'ina land & High risk / Certain / Agreement needed & High			- Environmental/River crossing & Medium/Certain/Permitting needed & Medium			- Property / Tsuu T'ina land & High risk / Certain / Agreement needed & High			- Engineering & construction / Topography & High / High / Engineering; route selection & High								
					- Community / EAR through nbhd & Medium / Certain / NA & Medium			- Community / Need for internal connection / Certain / NA* & High			- Community / Need for internal connection / Certain / NA* & High																	
								* Need for internal connection can be avoided if a 2nd EAR recommended to serve Mountain Lion Drive area			* Need for internal connection can be avoided if a 2nd EAR recommended to serve areas outside from Mountain Lion Drive																	

Option 6A				Option 6B				Option 7A				Option 7B				Option 7C									
South Route to Hwy 66 thru Kananaskis Park (from RR55)				South Route to Hwy 66 thru Kananaskis Park (from RR54)				RR 52 to Hwy 22				RR 52 to Hwy 758				RR 52 to Hwy 22 Straight South									
Measures		Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures		Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures		Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures		Points Scoring (1-5)	Total Points (Weight x Point Scoring)	Measures		Points Scoring (1-5)	Total Points (Weight x Point Scoring)						
0	%	2.2	36.4	0	%	2.4	40.2	0	%	3.8	63.5	0	%	3.8	63.5	0	%	3.8	63.5						
0	%			0	%			12	%			14	%			12	%								
0	%			4	%			94	%			94	%			94	%								
65	%			77	%			100	%			100	%			100	%								
100	%			100	%							100	%			100	%								
0	%	2.8	59.9	0	%	2.8	59.9	38	%	4.3	90.4	44	%	4.3	90.4	38	%	4.2	88.0						
27	%			33	%			100	%			100	%			100	%								
100	%			100	%																				
Hwy. 22 and Hwy. 66 Int.				Hwy. 22 and Hwy. 66 Int.				Hwy. 22 and Hwy. 66 Int.				Hwy. 22 and Hwy. 66 Int.													
0	%			57	%			57	%			57	%			57	%								
45	%			45	%			100	%			100	%			100	%								
100	%			100	%																				
Location 1: Hwy 22 and Hwy. 66 Int.				Location 1: Hwy 22 and Hwy. 66 Int.				Location 1: Hwy 22 and Hwy. 66 Int.				Location 1: Hwy 22 and Hwy. 66 Int.													
Location 2: Hwy 22 and Balsam Avenue Int.				Location 2: Hwy 22 and Balsam Avenue Int.				Location 2: Hwy 22 and Balsam Avenue Int.				Location 2: Hwy 22 and Balsam Avenue Int.													
Location 2				Location 2				Location 2				Location 2													
Location 2				Location 2				Location 1				Location 1													
Location 2				Location 2				Location 2				Location 2													
Location 2				Location 2				Location 2				Location 2													
Location 2				Location 2				Location 2				Location 2													
100	%			100	%			100	%			100	%			100	%								

Preliminary Cost Estimates for Comparison or Route Options

Unit Rates:

Bridge Construction (\$/m2):	\$4,500				
Right-of-Way					
Natural /Agricultural / acre	\$10,000				Realtor Listing Prices / acre:
Surfacing					812510377.3584933794.58795
Surfacing GBC \$/km	\$60,000	thickness (mm)		unit cost	
Surfacing SubBase \$/km	\$120,000	100	\$30	/tonne	
		250	\$20	/tonne	

<b>Option 1</b>					
Road Costs:					\$791,000
Surfacing GBC					\$114,000
Surfacing Sub-Base					\$228,000
RoW Costs:					\$55,000
Elbow River xing (m)	500	spanning river channel			
Bridge Costs:					\$27,000,000
Contingency (30%)					\$8,457,000
Total:					\$36,700,000
<b>Option 2 Revised (aka 2C)</b>					
New Road Costs:					\$5,600,000
Surfacing GBC					\$390,000
Surfacing Sub-Base					\$780,000
RoW Costs:					\$119,000
Watercourse Crossing Costs:	35 m				\$1,890,000
Contingency (30%)					\$2,634,000
Total:					\$11,500,000
<b>Option 2A Revised (TR240 Option)</b>					
New Road Costs:					\$5,950,000
Surfacing GBC					\$828,000
Surfacing Sub-Base					\$1,656,000
RoW Costs:					\$198,000
Watercourse Crossing Costs:	25 m				\$1,350,000
Contingency (30%)					\$2,995,000
Total:					\$13,000,000
<b>Option 3</b>					
New Road Costs:					\$8,860,000
Surfacing GBC					\$1,164,000
Surfacing Sub-Base					\$2,328,000
RoW Costs:					\$554,000
Non-Elbow Bridge Costs:	110 m				\$5,940,000
Contingency (30%)					\$5,654,000
Total:					\$24,500,000
<b>Option 4</b>					
New Road Costs:					\$5,035,000
Surfacing GBC					\$720,000
Surfacing Sub-Base					\$1,440,000
RoW Costs:					\$159,000
Non-Elbow Bridge Costs:	65 m				\$3,510,000
Contingency (30%)					\$3,260,000
Total:					\$14,200,000
<b>Option 5</b>					
New Road Costs:					\$1,260,000
Surfacing GBC					\$144,000
Surfacing Sub-Base					\$288,000
RoW Costs:					\$0
Elbow River xing (m)					\$11,880,000
Non-Elbow Bridge Costs:	10 m				\$540,000
Contingency (30%)					\$4,234,000
Total:					\$18,400,000

<b>Option 6A</b>			
New Road Costs:			<b>\$28,000,000</b> (estimated at 4,000,000 m3 of excavation x \$7)
Surfacing GBC			<b>\$804,000</b>
Surfacing Sub-Base			<b>\$1,608,000</b>
RoW Costs:			<b>\$331,000</b>
Elbow River xing (m)			<b>\$10,000,000</b> (estimated at BIS report x 2 for a 1:200 year flood)
Non-Elbow Bridge Costs:	25 m		<b>\$1,350,000</b>
Contingency (30%)			\$12,628,000
<b>Total:</b>			<b>\$54,800,000</b>

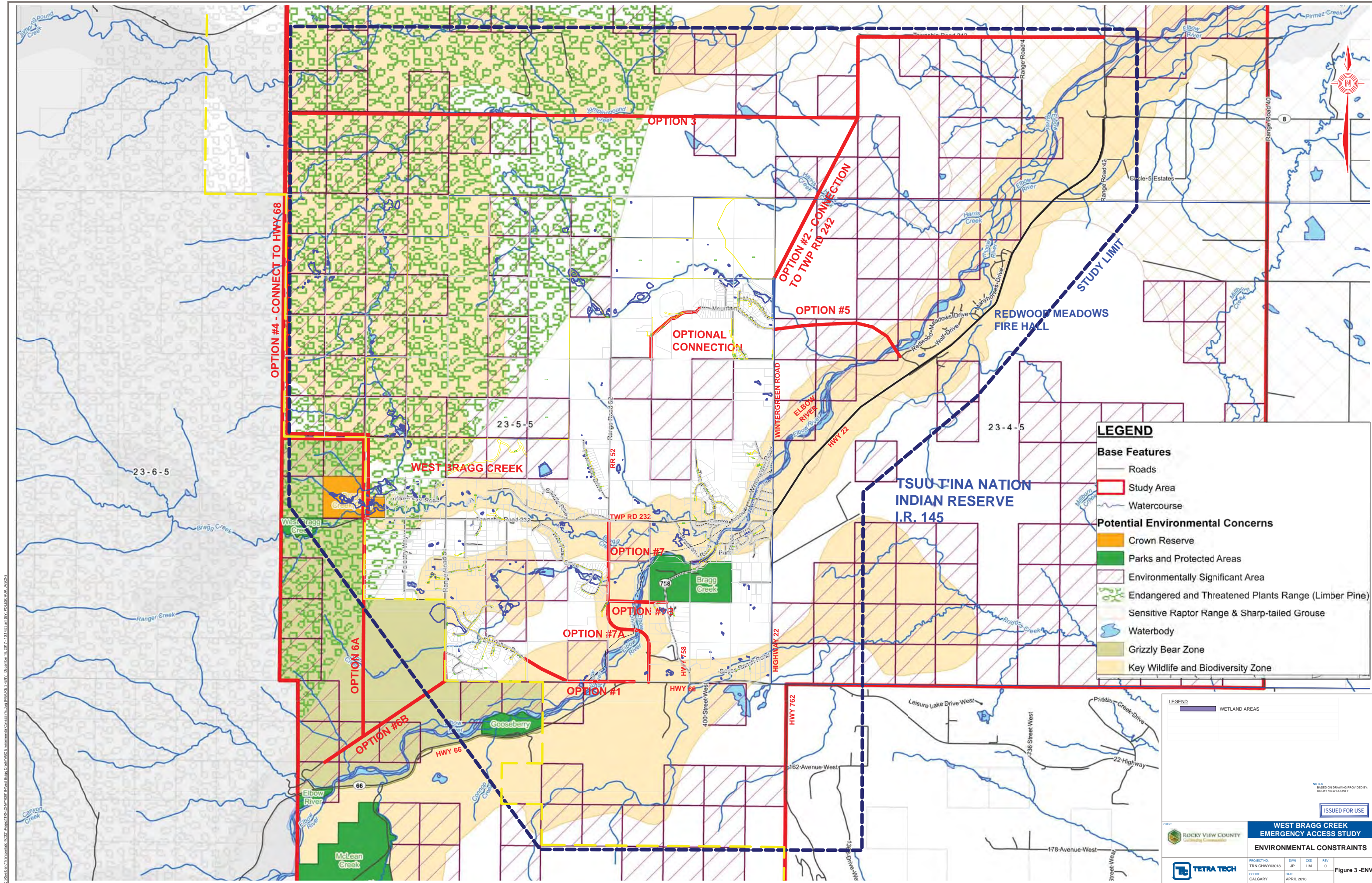
<b>Option 6B</b>			
New Road Costs:			<b>\$7,700,000</b> (estimated: 1.1M m3 x \$7)
Surfacing GBC			<b>\$564,000.00</b>
Surfacing Sub-Base			<b>\$1,128,000.00</b>
RoW Costs:			<b>\$233,000</b>
Elbow River xing (m)			<b>\$10,000,000</b> (estimated at BIS report x 2 for a 1:200 year flood)
Non-Elbow Bridge Costs:	10 m		<b>\$540,000</b>
Contingency (30%)			\$6,050,000
<b>Total:</b>			<b>\$26,300,000</b>

<b>Option 7A</b>			
New Road Costs:			<b>\$2,303,000</b> (estimated at 329,000 m3 of excavation x \$7)
Surfacing GBC			<b>\$252,000.00</b>
Surfacing Sub-Base			<b>\$504,000.00</b>
RoW Costs:			<b>\$104,000</b>
Elbow River xing (m) cost			<b>\$11,610,000</b>
Non-Elbow Bridge Costs:	25 m		<b>\$1,350,000</b>
Contingency (30%)			\$4,837,000
<b>Total:</b>			<b>\$21,000,000</b>

<b>Option 7B</b>			
New Road Costs:			<b>\$861,000</b> (estimated at 123,000 m3 of excavation x \$7)
Surfacing GBC			<b>\$144,000.00</b>
Surfacing Sub-Base			<b>\$288,000.00</b>
RoW Costs:			<b>\$60,000</b>
Elbow River xing (m) cost			<b>\$12,690,000</b>
Non-Elbow Bridge Costs:	25 m		<b>\$1,350,000</b>
Contingency (30%)			\$4,618,000
<b>Total:</b>			<b>\$20,100,000</b>

<b>Option 7C</b>			
New Road Costs:			<b>\$1,729,000</b> (est. 247,000 m3 x \$7)
Surfacing GBC			<b>\$192,000.00</b>
Surfacing Sub-Base			<b>\$384,000.00</b>
RoW Costs:			<b>\$60,000</b>
Elbow River xing (m) cost			<b>\$24,300,000</b>
Non-Elbow Bridge Costs:	25 m		<b>\$1,350,000</b>
Contingency (30%)			\$8,405,000
<b>Total:</b>			<b>\$36,500,000</b>

Infrastructure:	Route Options:										
	1	2	2A	3	4	5	6A	6B	7A	7B	7C
New Road Costs (incl. surfacing)	\$1,133,000	\$6,770,000	\$8,434,000	\$12,352,000	\$7,195,000	\$1,692,000	\$30,412,000	\$9,392,000	\$3,059,000	\$1,293,000	\$2,305,000
Bridge/Watercourse Crossing Costs:	\$27,000,000	\$1,890,000	\$1,350,000	\$5,940,000	\$3,510,000	\$12,420,000	\$11,350,000	\$10,540,000	\$12,960,000	\$14,040,000	\$25,650,000
Right-of-Way Costs	\$55,000	\$119,000	\$198,000	\$554,000	\$159,000	\$0	\$331,000	\$233,000	\$104,000	\$60,000	\$60,000
Contingency (30%)	\$8,457,000	\$2,634,000	\$2,995,000	\$5,654,000	\$3,260,000	\$4,234,000	\$12,628,000	\$6,050,000	\$4,837,000	\$4,618,000	\$8,405,000
Total (\$M):	\$36.7	\$11.5	\$13.0	\$24.5	\$14.2	\$18.4	\$54.8	\$26.3	\$21.0	\$20.1	\$36.5



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LEGEND

WETLAND AREAS

NOTES

BASED ON DRAWING PROVIDED BY:  
ROCKY VIEW COUNTY

ISSUED FOR USE

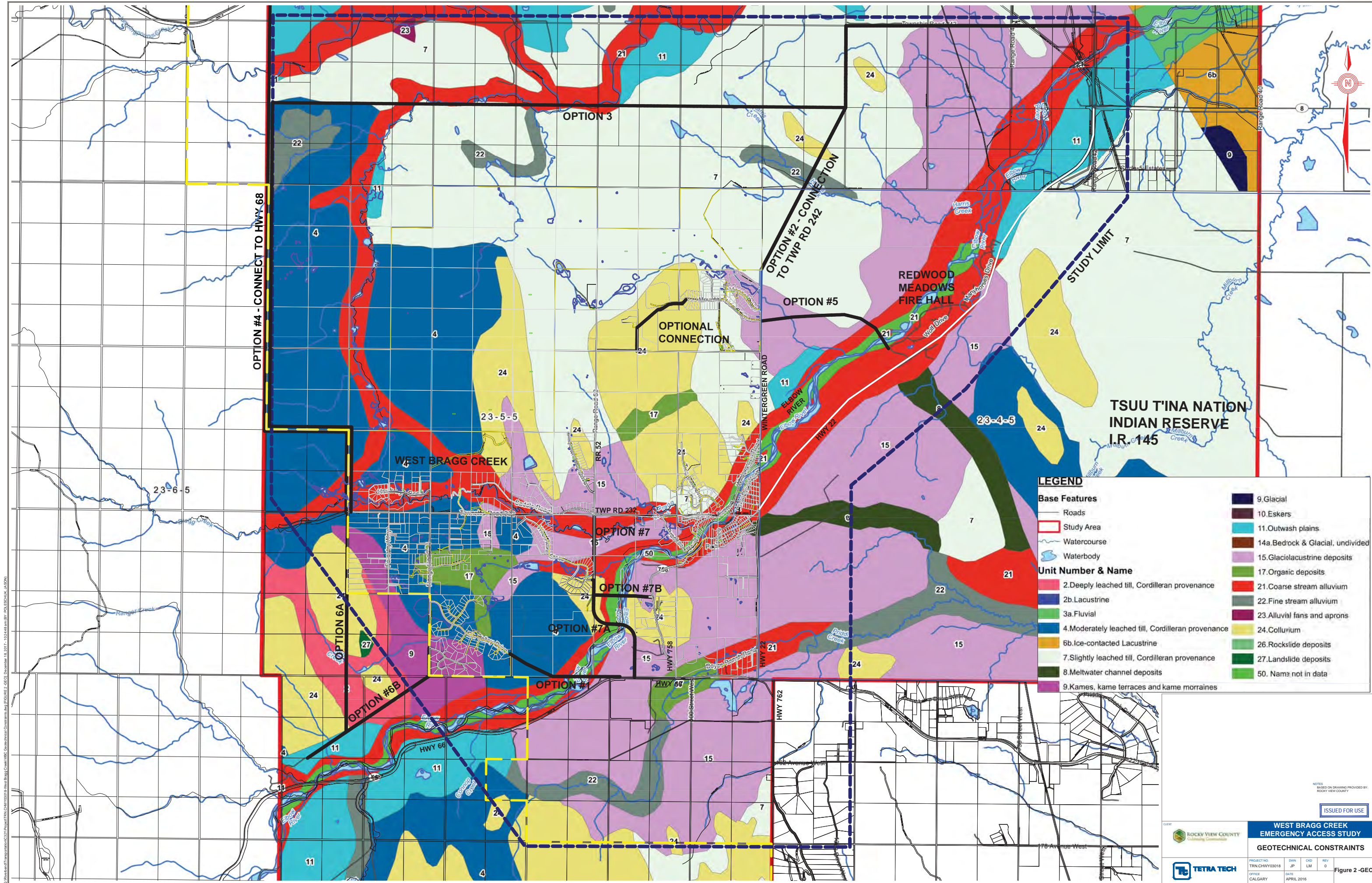
GUEST

ROCKY VIEW COUNTY  
Planning Commission

WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY  
ENVIRONMENTAL CONSTRAINTS

PROJECT NO.	DWN	CKD	REV
TRN.CHWY03018	JP	LM	0
OFFICE	DATE		
CALGARY	APRIL 2016		

Figure 3 -ENV



© Riverland Transportation Consultants Ltd. Project: TRN, CHWY03018 West Bragg Creek (WBC) Geotechnical Constraints Map (FIGURE 2 - GEO) December 18, 2017 - 10:24:44 am (BY: POL/ESCHUK, JASON)

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WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY

GEOTECHNICAL CONSTRAINTS

PROJECT NO.  
TRN.CHWY03018

OFFICE  
CALGARY

OWN  
JP

DATE  
APRIL 2016

CHK  
LM

REV  
0

Figure 2 - GEO

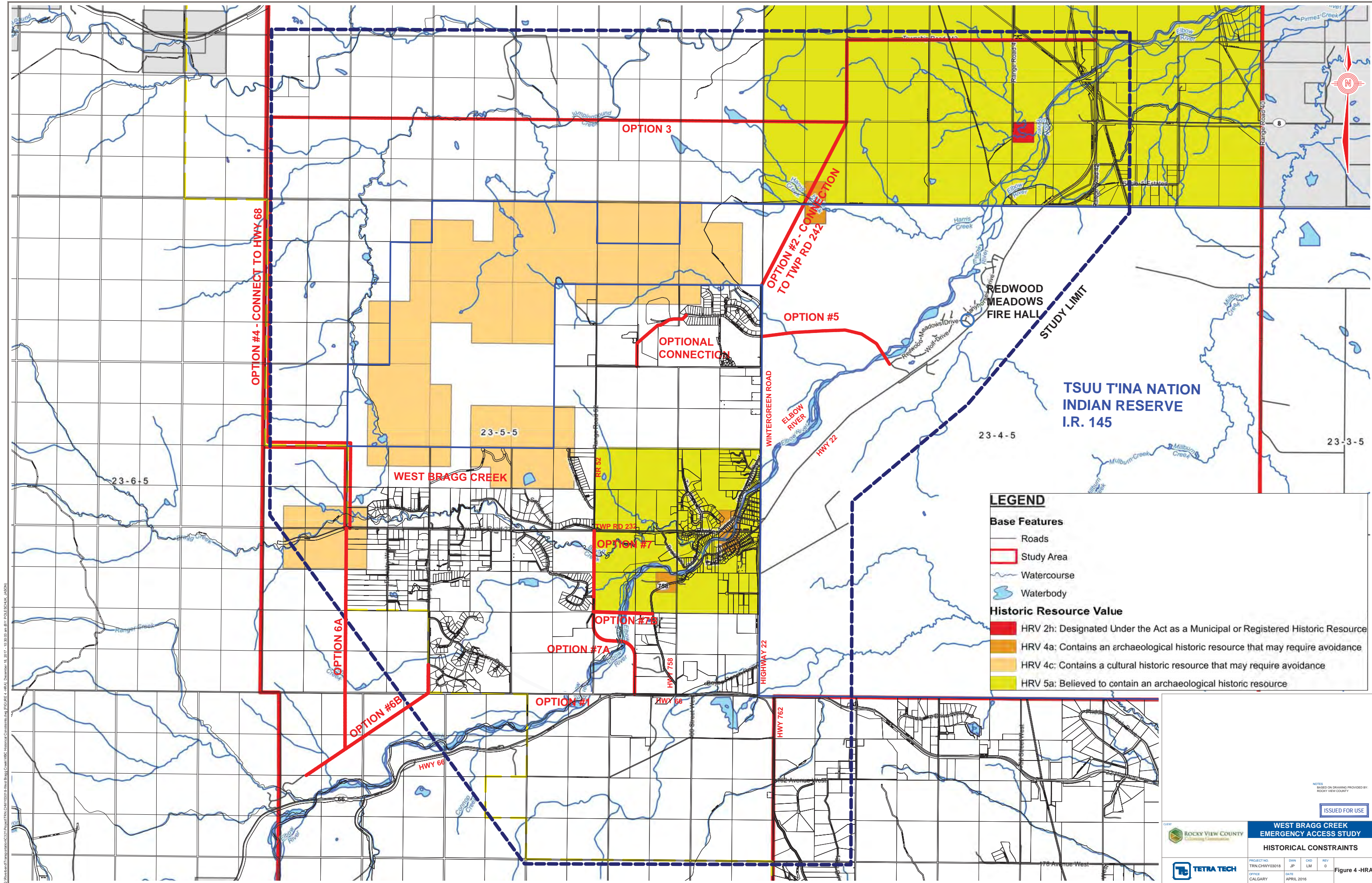
NOTES:  
BASED ON DRAWING PROVIDED BY:  
ROCKY VIEW COUNTY

CLIENT

ROCKY VIEW COUNTY  
Enhancing Communities

CONSULTANT

TETRA TECH



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WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY

HISTORICAL CONSTRAINTS

PROJECT NO.  
TRN.CHWY03018

OFFICE  
CALGARY

OWN  
JP

DATE  
APRIL 2016

CHK  
LM

REV  
0

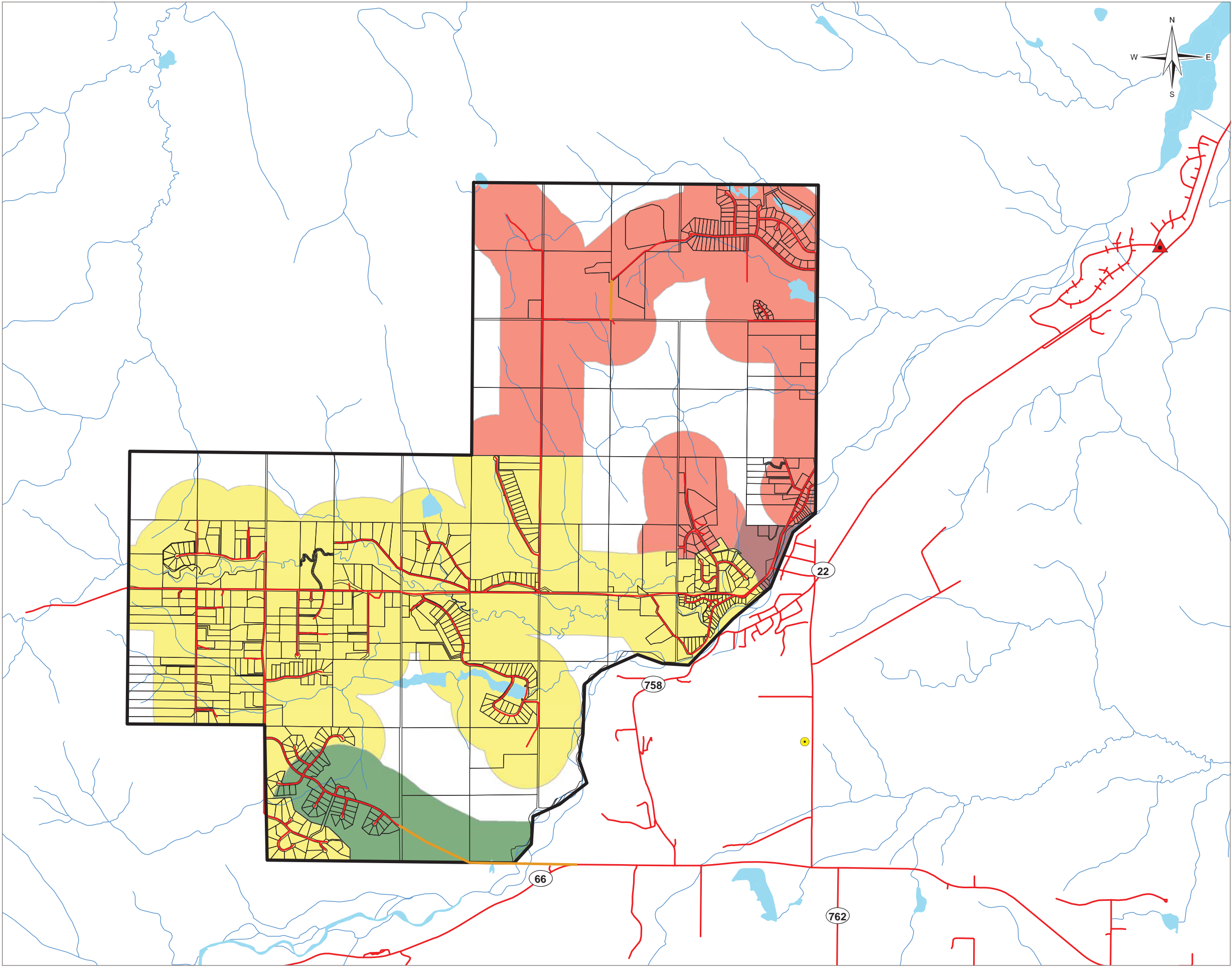
Figure 4 -HRA

CLIENT  
ROCKY VIEW COUNTY  
Sustaining Communities

TETRA TECH

Engineering & Construction

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
  - Emergency Staging Area
  - Existing Road
  - Potential Option 1 Road Segment
  - Watercourse
  - West Bragg Creek Parcel
  - ▬ West Bragg Creek Boundary
  - Waterbody
- Option 1 Fire Hall Service Area**
- 8-16 km
  - 16-24 km
  - 24-32 km
  - 32-40 km

**NOTES**  
Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 1 Emergency Response Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
0.5 0.25 0 0.5 1  
Kilometers



**TETRA TECH**

**FILE NO.**  
Figure1a\_Option1\_FireHall\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

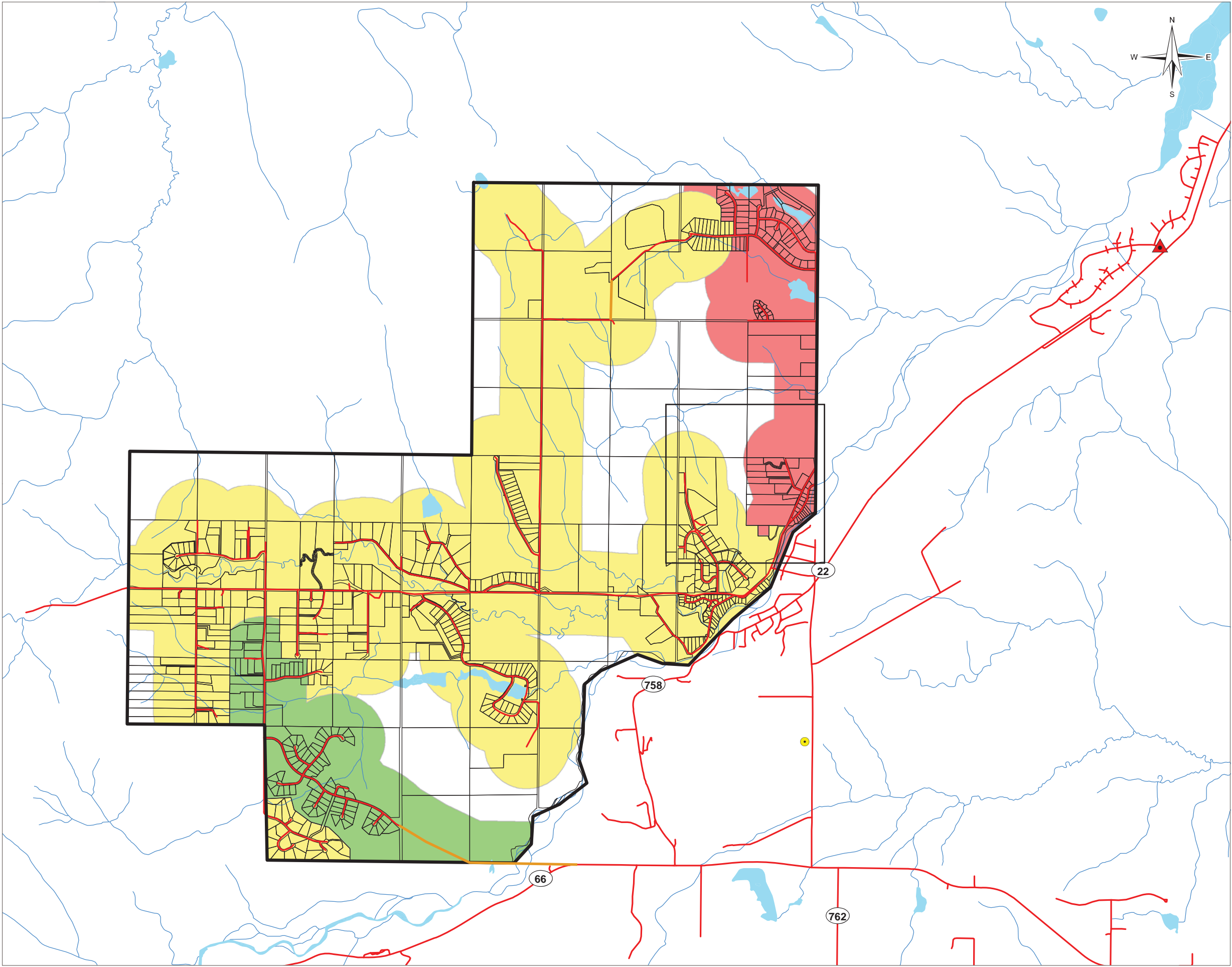
**REV**  
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 1a**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 1 Road Segment
- Watercourse
- West Bragg Creek Parcel
- ▬ West Bragg Creek Boundary
- Waterbody
- Option 1 Muster Point Service Area**
  - 0-10 km
  - 10-20 km
  - 20-30 km

## NOTES

Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 1 Evacuation Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
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Kilometers



**TETRA TECH**

## FILE NO.

Figure1b\_Option1\_MusterPoint\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

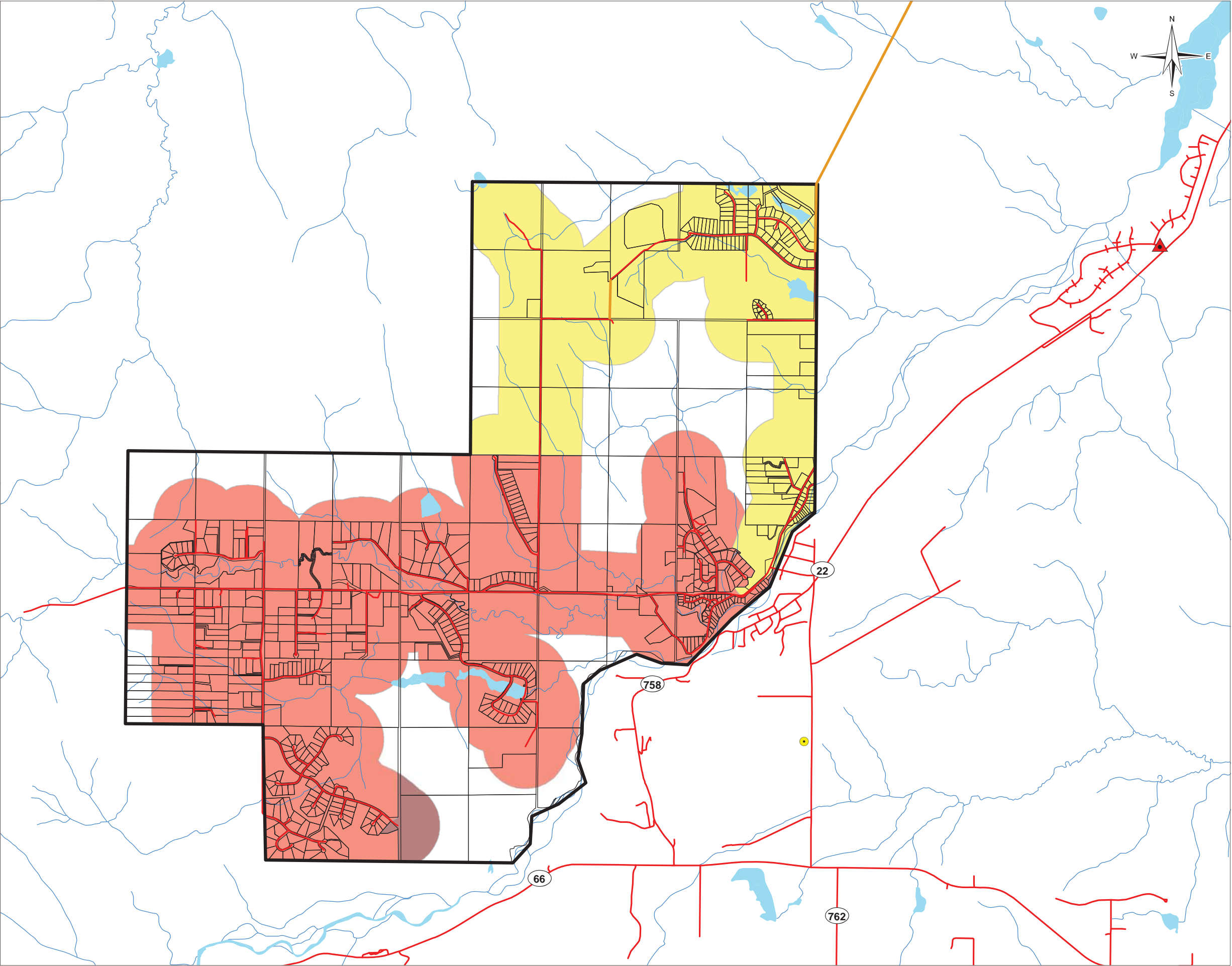
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 1b**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
  - Emergency Staging Area
  - Existing Road
  - Potential Option 2 Road Segments
  - Watercourse
  - West Bragg Creek Parcel
  - ▭ West Bragg Creek Boundary
  - Waterbody
- Option 2 Fire Hall Service Area**
- 16-24 km
  - 24-32 km
  - 32-40 km

## NOTES

Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 2 Emergency Response Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
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Kilometers



**TETRA TECH**

**FILE NO.**  
Figure2a\_Option2\_FireHall\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

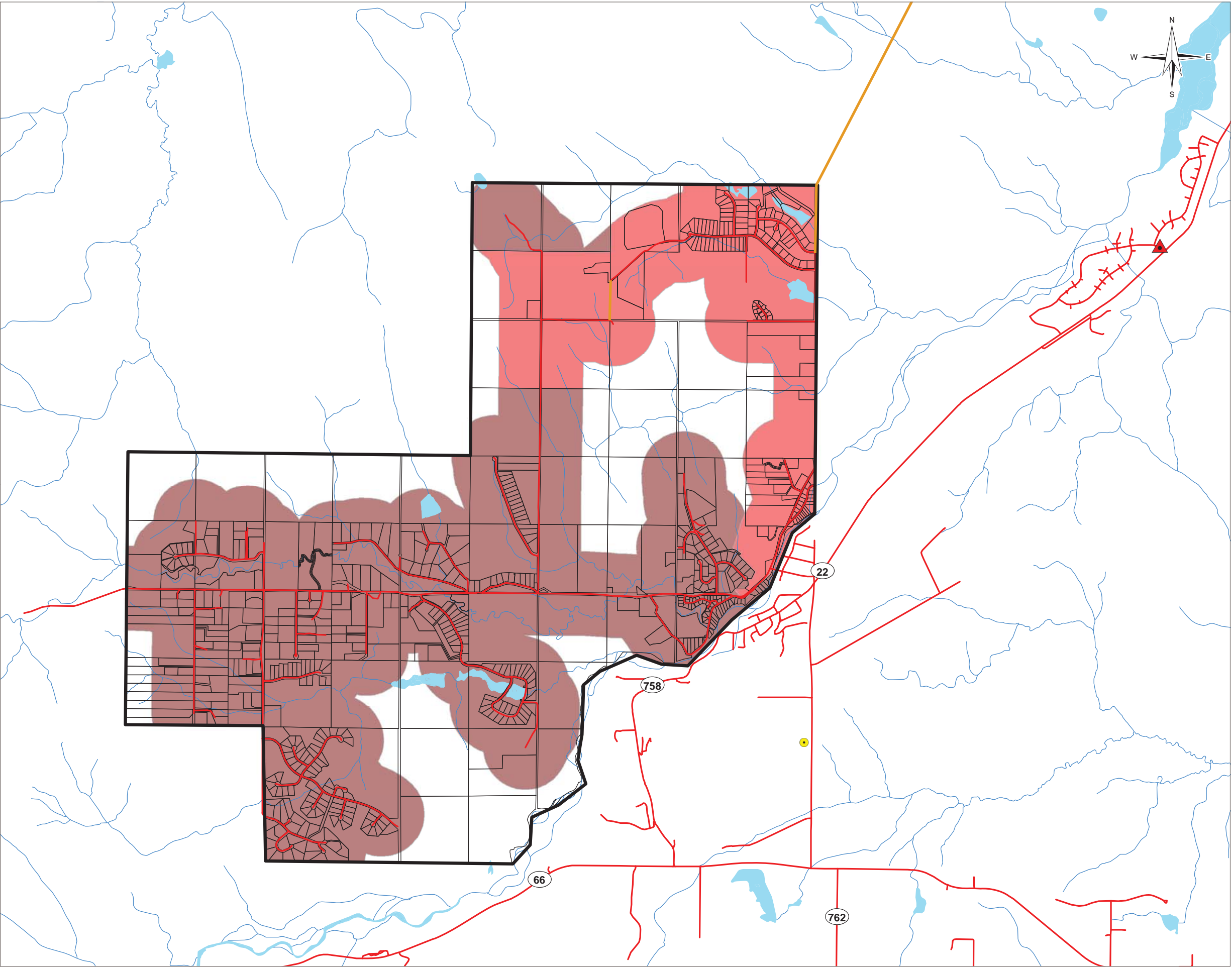
**REV**  
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 2a**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
  - Emergency Staging Area
  - Existing Road
  - Potential Option 2 Road Segments
  - Watercourse
  - West Bragg Creek Parcel
  - ▭ West Bragg Creek Boundary
  - Waterbody
- Option 2 Muster Point Service Area**
- 20-30 km
  - 30-40 km

**NOTES**  
Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 2 Evacuation Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
0.5 0.25 0 0.5 1  
Kilometers



**TETRA TECH**

**FILE NO.**  
Figure2b\_Option2\_MusterPoint\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

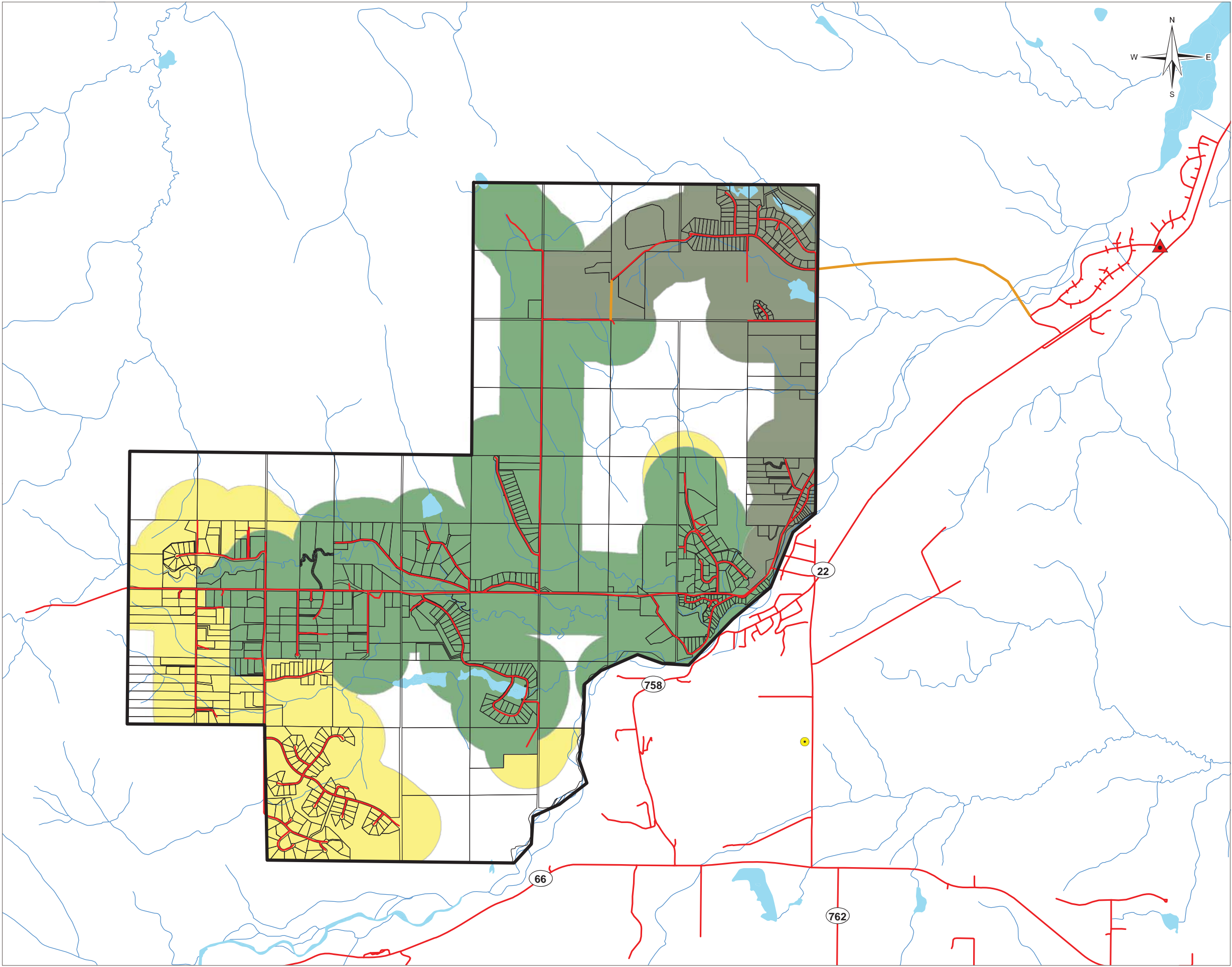
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 2b**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 5 Road Segments
- Watercourse
- West Bragg Creek Parcel
- ▭ West Bragg Creek Boundary
- Waterbody
- Option 5 Fire Hall Service Area**
  - 0-8 km
  - 8-16 km
  - 16-24 km

## NOTES

Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 5 Emergency Response Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
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Kilometers



**TETRA TECH**

## FILE NO.

Figure3a\_Option5\_FireHall\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

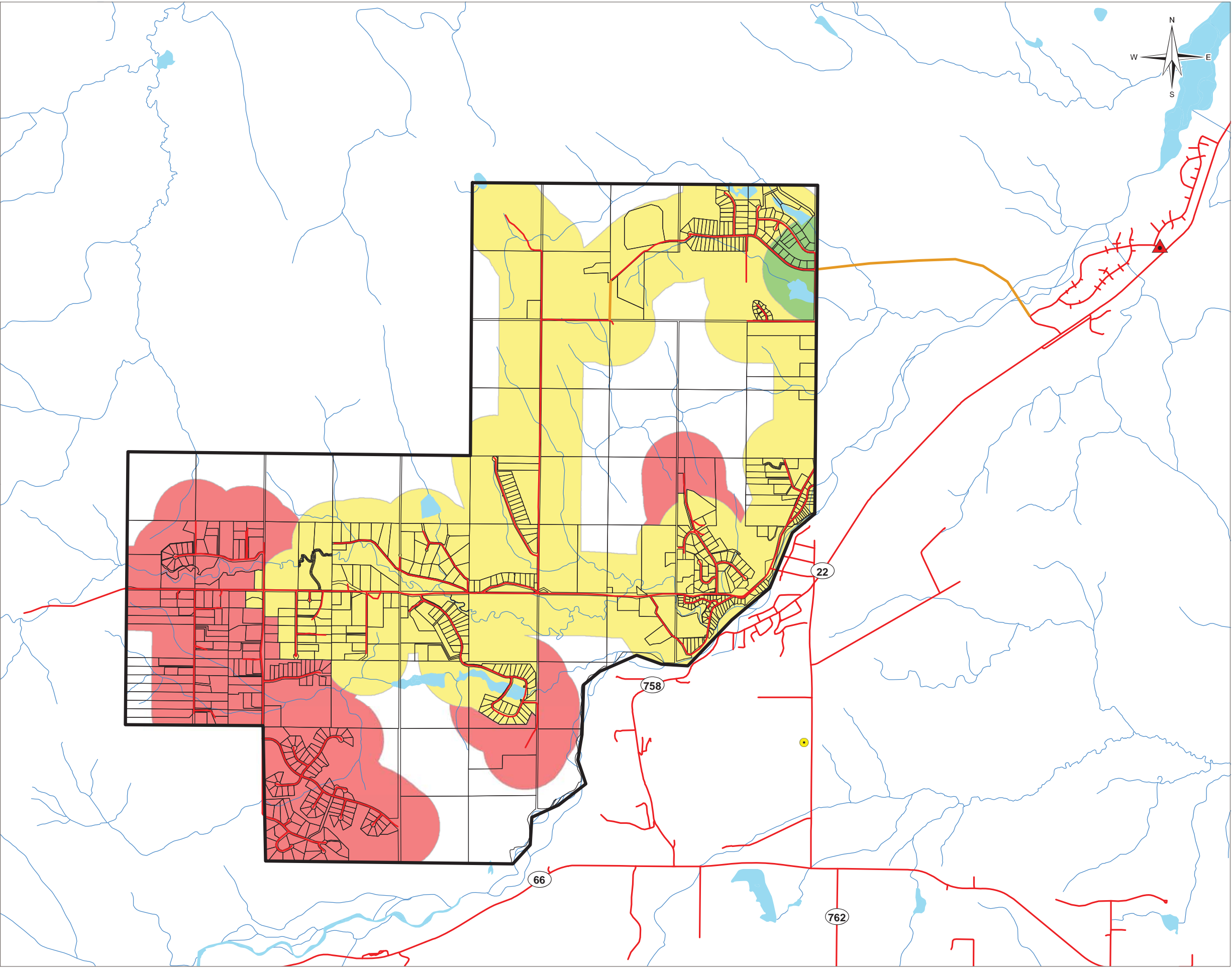
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 3a**

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LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 5 Road Segments
- Watercourse
- West Bragg Creek Parcel
- ▭ West Bragg Creek Boundary
- Waterbody
- Option 5 Muster Point Service Area**
  - 0-10 km
  - 10-20 km
  - 20-30 km

**NOTES**  
Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

**WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY**

**Option 5  
Evacuation Service**

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
0.5 0.25 0 0.5 1  
Kilometers



**TETRA TECH**

**FILE NO.**  
Figure3b\_Option5\_MusterPoint\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

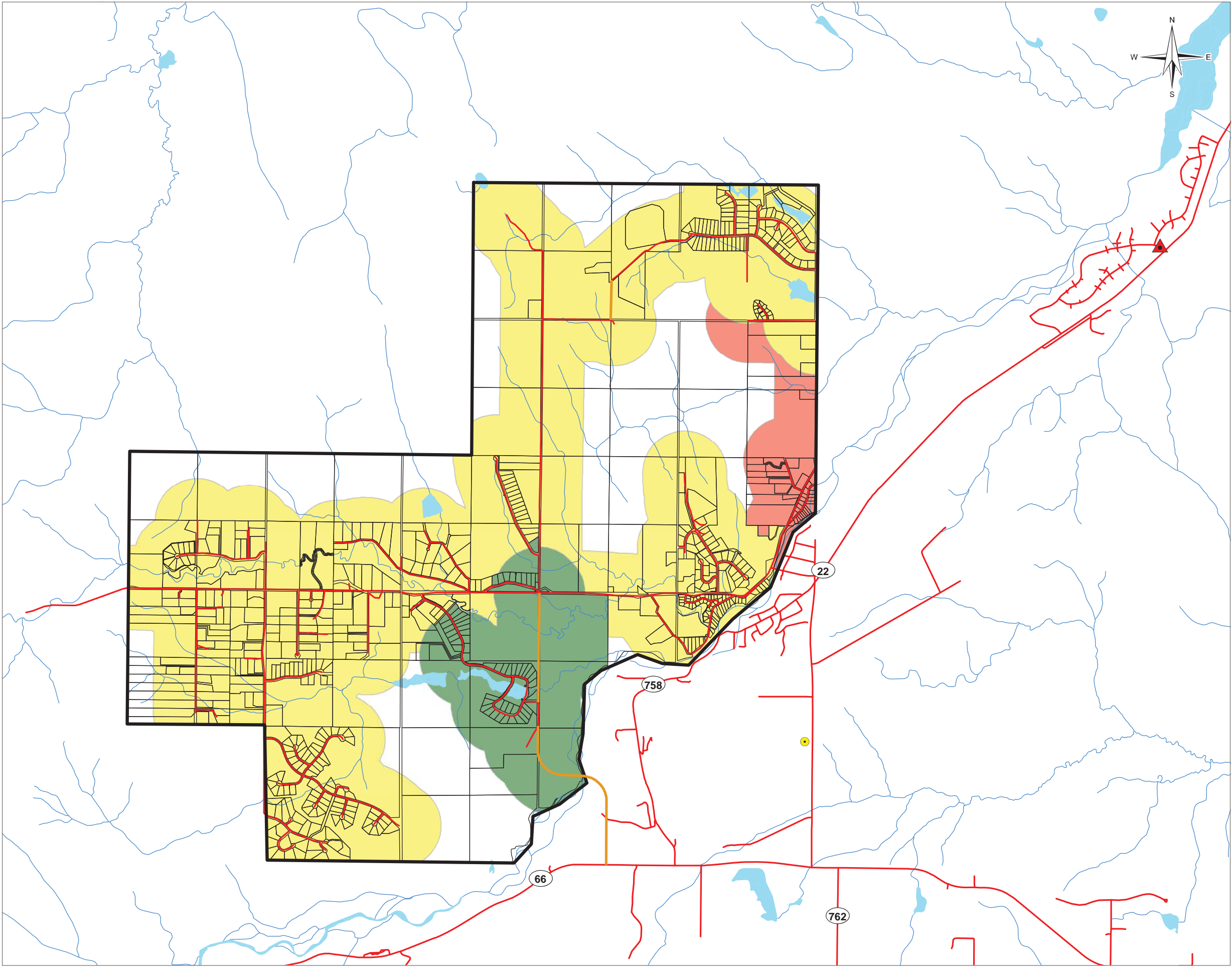
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**OFFICE**  
Tl EBA-CAL

**DATE**  
May 6, 2016

**Figure 3b**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 7A Road Segment
- Watercourse
- West Bragg Creek Parcel
- ▬ West Bragg Creek Boundary
- Waterbody
- Option 7A Fire Hall Service Area**
  - 8-16 km
  - 16-24 km
  - 24-32 km

**NOTES**  
Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 7A Emergency Response Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
0.5 0.25 0 0.5 1  
Kilometers



TETRA TECH

**FILE NO.**  
Figure4a\_Option7A\_FireHall\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
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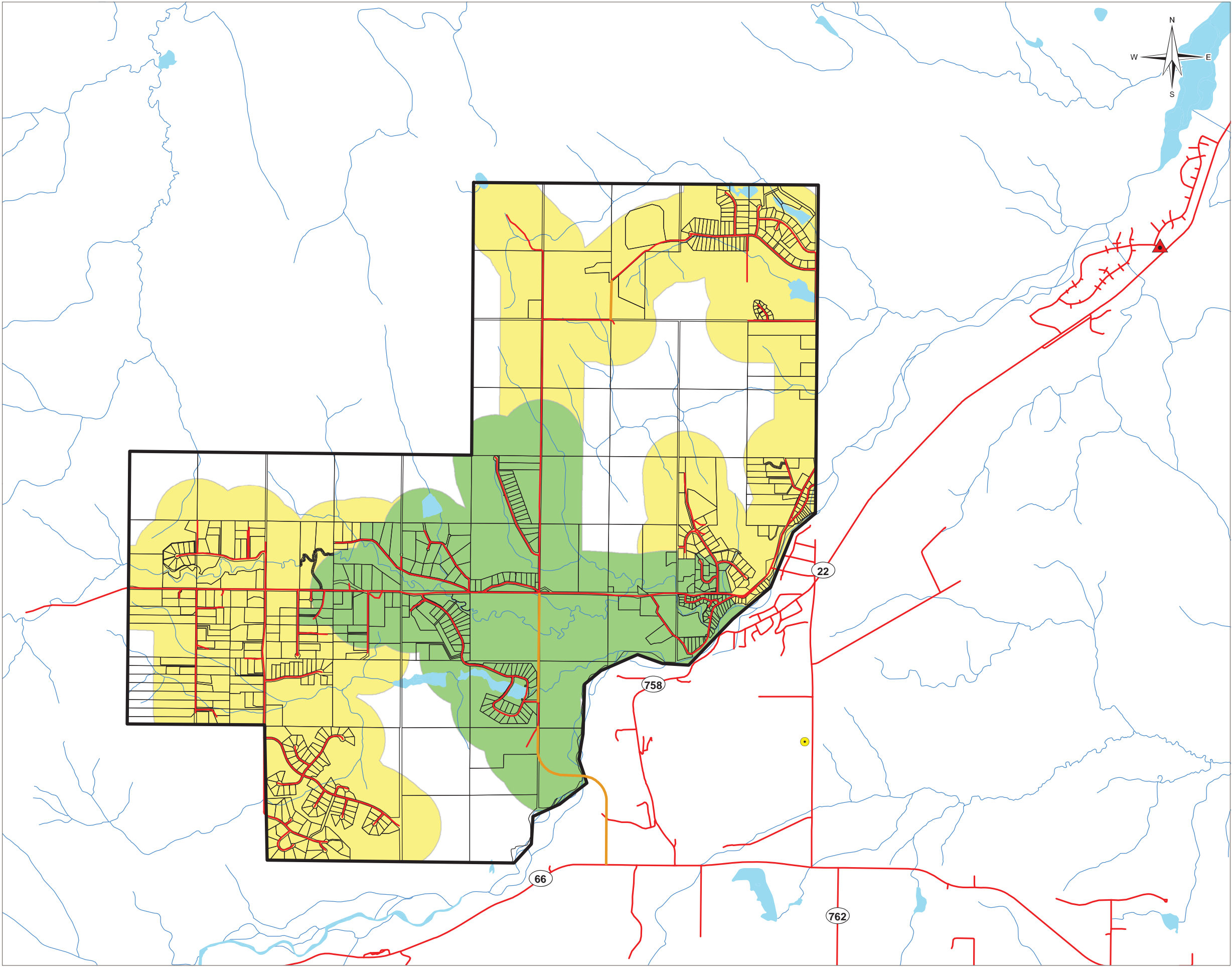
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 4a**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 7A Road Segment
- Watercourse
- West Bragg Creek Parcel
- ▬ West Bragg Creek Boundary
- Waterbody
- Option 7A Muster Point Service Area**
  - 0-10 km
  - 10-20 km

### NOTES

Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

### STATUS

ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 7A Evacuation Service

PROJECTION  
UTM Zone 12

DATUM  
NAD83

CLIENT



Scale: 1:45,000  
0.5 0.25 0 0.5 1  
Kilometers



TETRA TECH

### FILE NO.

Figure4b\_Option7A\_MusterPoint\_Alt.mxd

PROJECT NO.  
CHWY03018

DWN  
MS

CKD  
BB

APVD  
SD

REV  
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### OFFICE

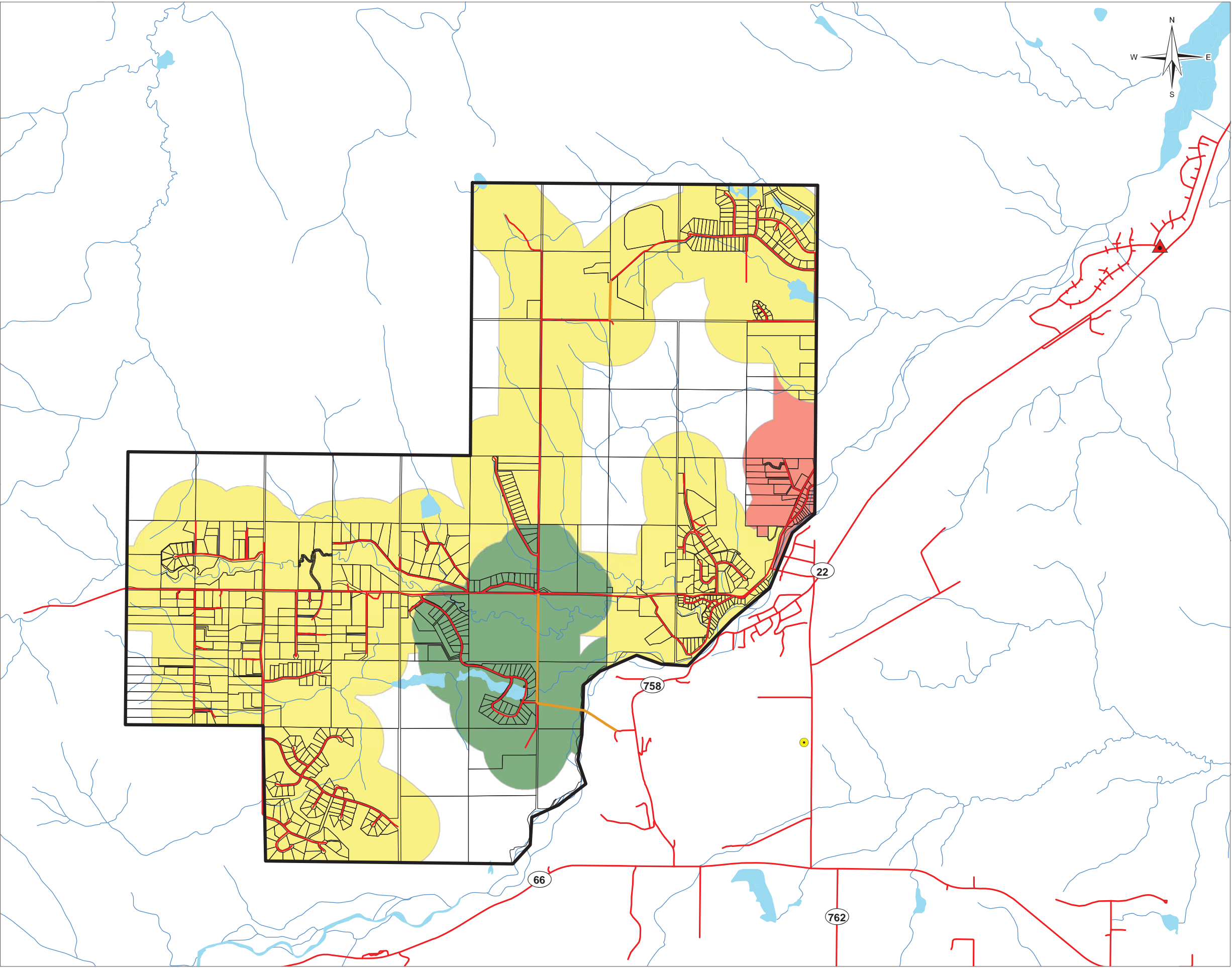
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### DATE

May 6, 2016

Figure 4b

M:\TRANSPORTATION\CHWY\CHWY03018 West Bragg Creek\Maps\Network\_Analysis\Results\_Figures\Figure5a\_Option7B\_FireHall\_Alt.mxd modified 5/6/2016 by matthewstephenson



## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 7B Road Segment
- Watercourse
- West Bragg Creek Parcel
- ▭ West Bragg Creek Boundary
- Waterbody
- Option 7B Fire Hall Service Area**
  - 8-16 km
  - 16-24 km
  - 24-32 km

**NOTES**  
Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

**STATUS**  
ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 7B Emergency Response Service

**PROJECTION**  
UTM Zone 12

**DATUM**  
NAD83

**CLIENT**



Scale: 1:45,000  
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Kilometers



TETRA TECH

**FILE NO.**  
Figure5a\_Option7B\_FireHall\_Alt.mxd

**PROJECT NO.**  
CHWY03018

**DWN**  
MS

**CKD**  
BB

**APVD**  
SD

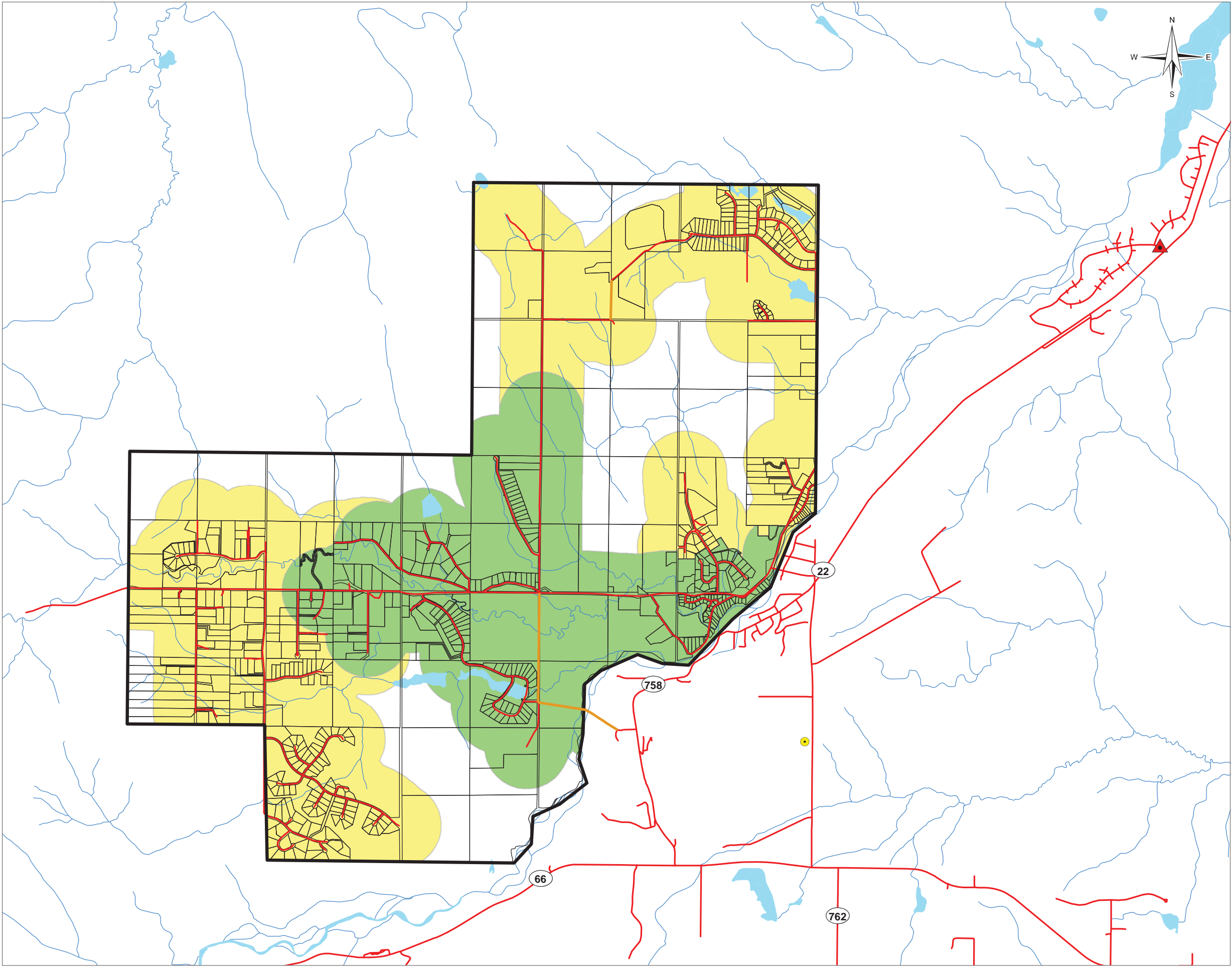
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**OFFICE**  
Tt EBA-CAL

**DATE**  
May 6, 2016

**Figure 5a**

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## LEGEND

- ▲ Fire Hall - Redwood Meadows
- Emergency Staging Area
- Existing Road
- Potential Option 7B Road Segment
- Watercourse
- West Bragg Creek Parcel
- ▬ West Bragg Creek Boundary
- Waterbody
- Option 7B Muster Point Service Area**
  - 0-10 km
  - 10-20 km

### NOTES

Base data source: AltaLIS (1:20,000),  
National Road Network - Alberta Portion (GeoBase)

### STATUS

ISSUED FOR USE

## WEST BRAGG CREEK EMERGENCY ACCESS STUDY

### Option 7B Evacuation Service

PROJECTION  
UTM Zone 12

DATUM  
NAD83

CLIENT



Scale: 1:45,000  
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Kilometers



TETRA TECH

FILE NO.  
Figure5b\_Option7B\_MusterPoint\_Alt.mxd

PROJECT NO.  
CHWY03018

DWN  
MS

CKD  
BB

APVD  
SD

REV  
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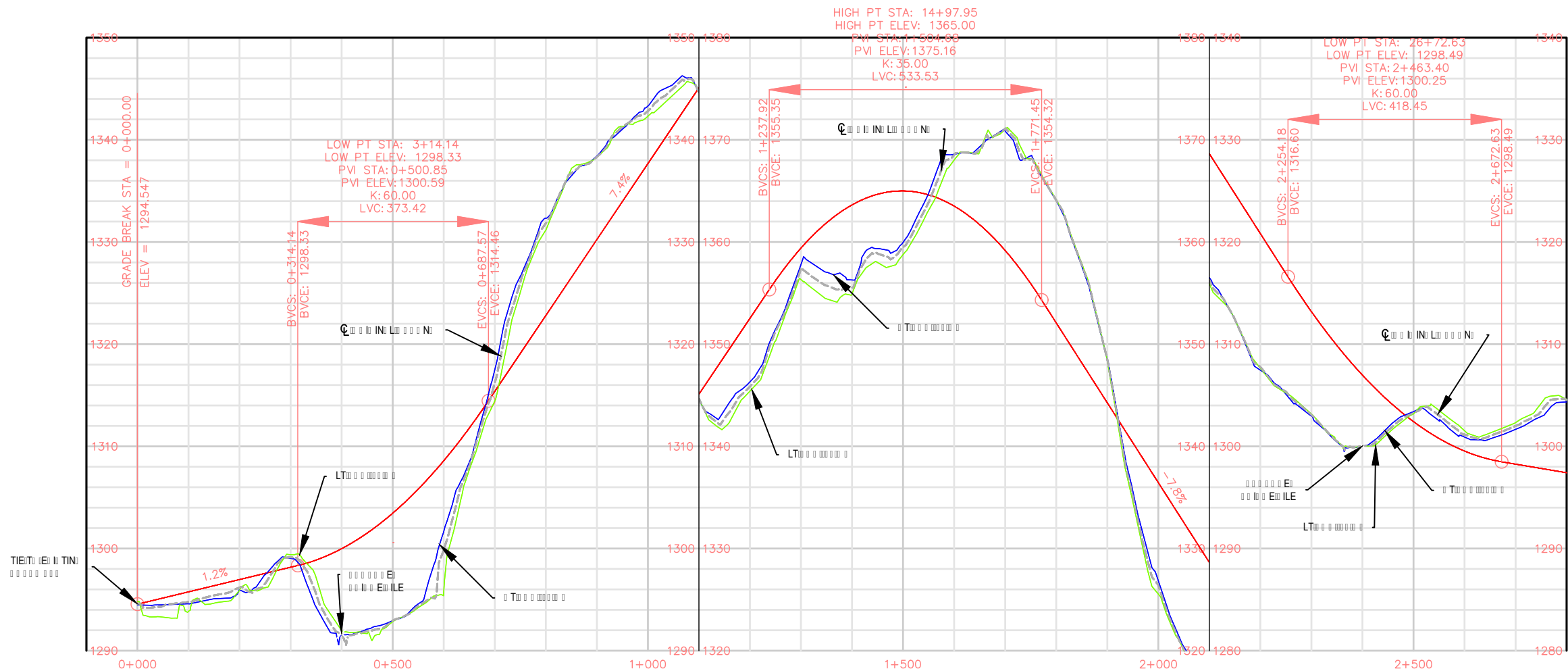
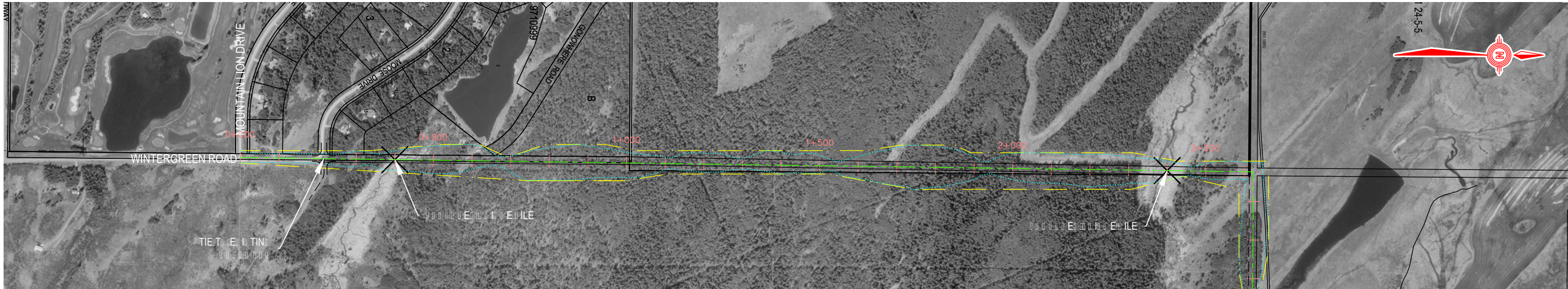
OFFICE  
Tt EBA-CAL

DATE  
May 6, 2016

Figure 5b

## APPENDIX D

### PLAN AND PROFILES – ROUTE 2



- LEGEND**
- CENTRE LINE OF ROAD
  - PROPOSED RIGHT-OF-WAY BOUNDARY
  - CONSTRUCTION LIMIT
  - LEGAL LINES
  - RIGHT SOD LINE
  - LEFT SOD LINE
  - DESIGN PROFILE



CLIENT

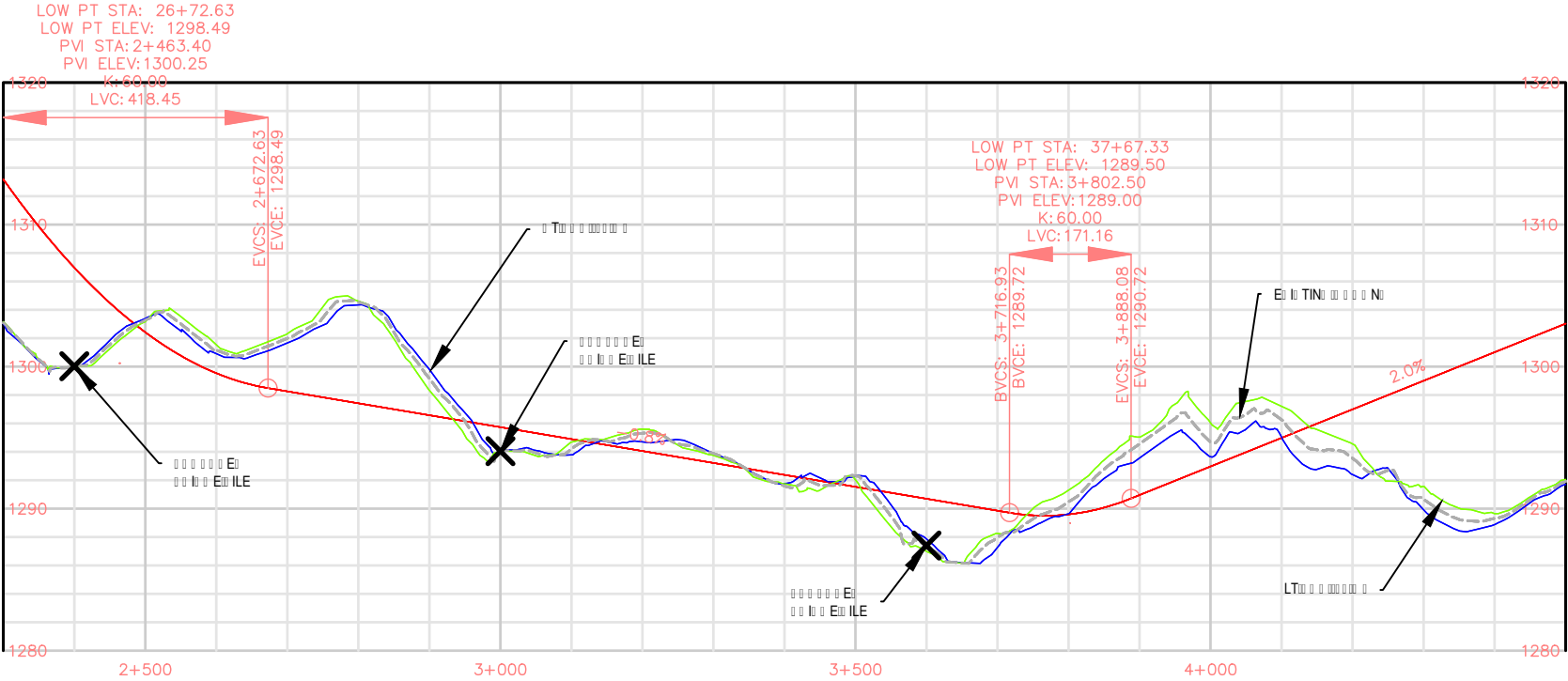


**WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY**

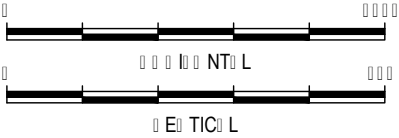
**ROUTE OPTION 2  
WINTERGREEN RD TO RR 45**

PROJECT NO. CHWY03018	DWN KY	CKD	REV 0	SHEET 1 OF 3
OFFICE CGY	DATE November 10, 2017			


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LEGEND	
	CENTRE LINE OF ROAD
	PROPOSED RIGHT-OF-WAY BOUNDARY
	CONSTRUCTION LIMIT
	LEGAL LINES
	RIGHT SOD LINE
	LEFT SOD LINE
	DESIGN PROFILE



CLIENT



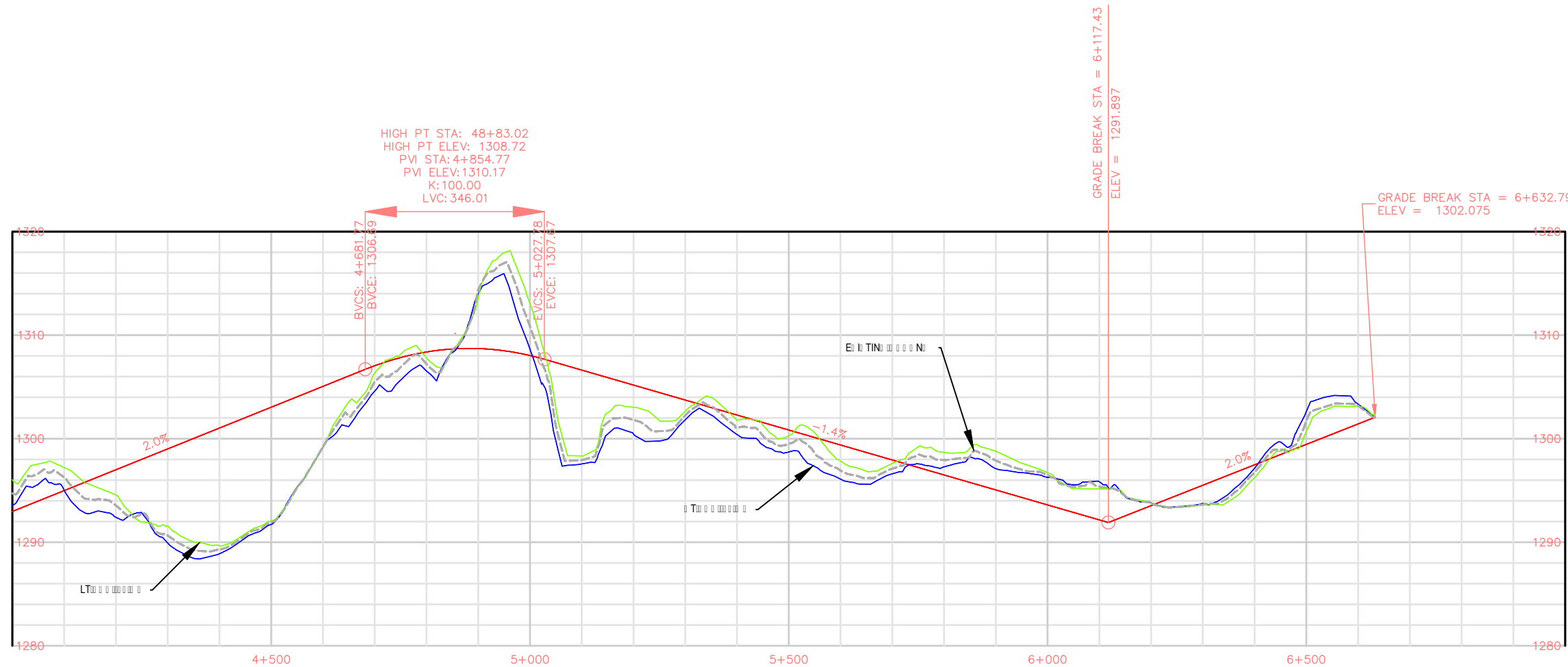
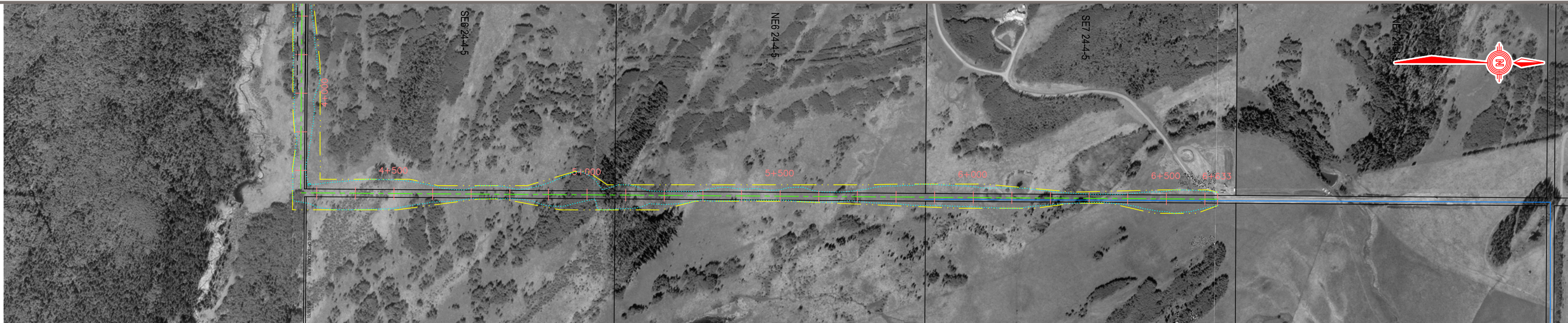
ROCKY VIEW COUNTY  
Cultivating Communities



TETRA TECH

WEST BRAGG CREEK EMERGENCY ACCESS STUDY			
ROUTE OPTION 2 WINTERGREEN RD TO RR 45			
PROJECT NO. CHWY03018	DWN KY	CKD	REV 0
OFFICE CGY	DATE November 10, 2017	SHEET 2 OF 3	

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LEGEND

- CENTRE LINE OF ROAD
- PROPOSED RIGHT-OF-WAY BOUNDARY
- CONSTRUCTION LIMIT
- LEGAL LINES
- RIGHT SOD LINE
- LEFT SOD LINE
- DESIGN PROFILE



CLIENT



WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY

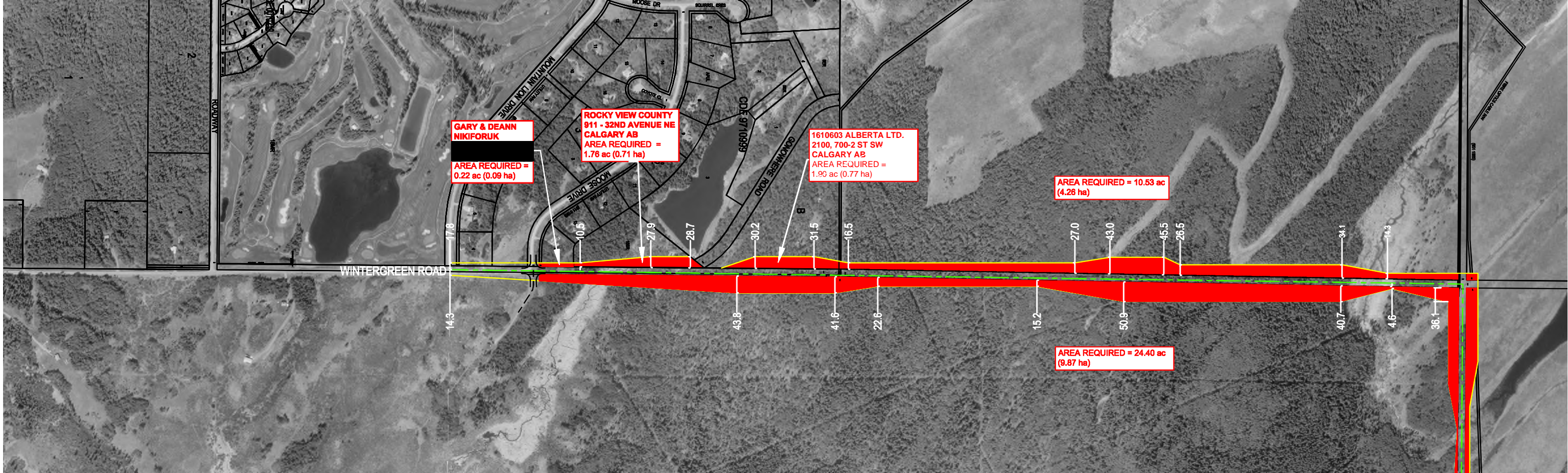
ROUTE OPTION 2  
WINTERGREEN RD TO RR 45

PROJECT NO. CHWY03018	DWN KY	CKD	REV 0
OFFICE CGY	DATE November 10, 2017		

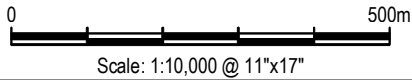
SHEET 3 OF 3

## APPENDIX E



### RIGHT-OF-WAY PLANS – ROUTE 2



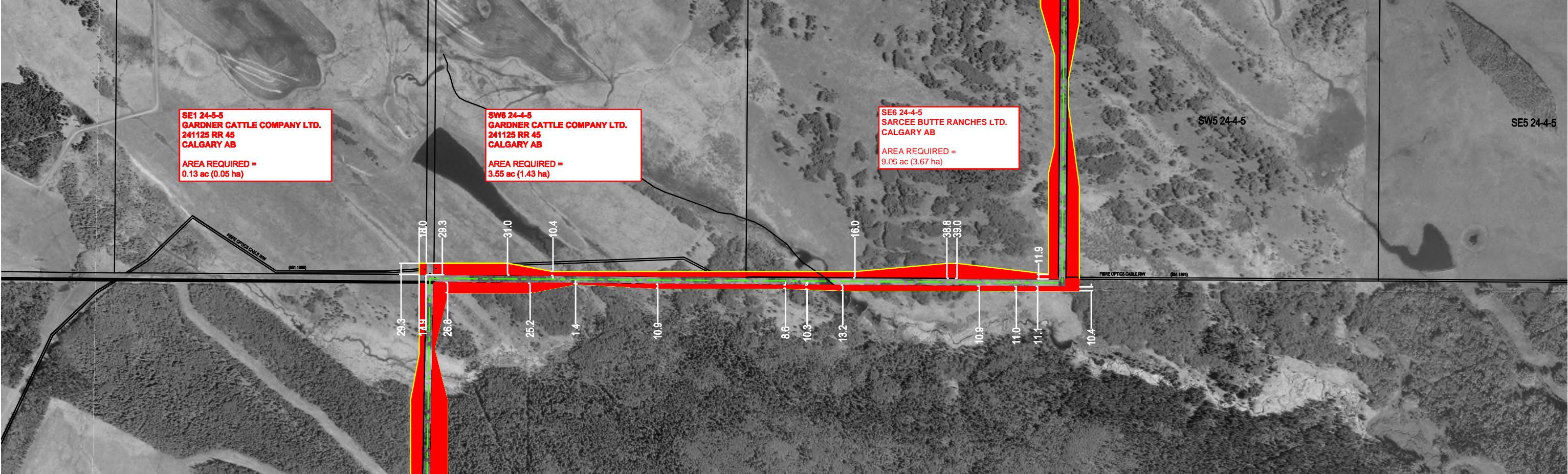
LEGEND



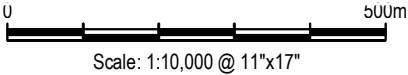
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- UNLESS NOTED OTHERWISE ALL  
DIMENSIONS ARE IN METERS.

<div>CLIENT</div> <div><div>ROCKY VIEW COUNTY</div><div>Cultivating Communities</div></div>		<div>WEST BRAGG CREEK</div> <div>EMERGENCY ACCESS STUDY</div>				
		<div>ROUTE OPTION 2</div> <div>RIGHT-OF-WAY PLAN</div>				
<div>TETRA TECH</div>		PROJECT NO. CHWY03018	DWN KY	CKD	REV 0	SHEET 1 OF 3
		OFFICE CGY	DATE November 10, 2017			

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NOTES:  
- UNLESS NOTED OTHERWISE ALL  
DIMENSIONS ARE IN METERS.

CLIENT

 **ROCKY VIEW COUNTY**  
Cultivating Communities

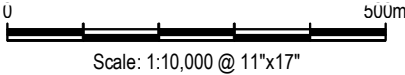
 **TETRA TECH**

WEST BRAGG CREEK EMERGENCY ACCESS STUDY				
ROUTE OPTION 2 RIGHT-OF-WAY PLAN				
PROJECT NO. CHWY03018	DWN KY	CKD	REV 0	SHEET 2 OF 3
OFFICE CGY	DATE November 10, 2017			

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LEGEND



NOTES:  
- UNLESS NOTED OTHERWISE ALL  
DIMENSIONS ARE IN METERS.



WEST BRAGG CREEK  
EMERGENCY ACCESS STUDY

ROUTE OPTION 2  
RIGHT-OF-WAY PLAN

PROJECT NO. CHWY03018	DWN KY	CKD	REV 0
OFFICE CGY	DATE November 10, 2017		

## APPENDIX F

### ENVIRONMENTAL OVERVIEW

<b>To:</b>	Lou Mak	<b>Date:</b>	November 20, 2017
<b>c:</b>		<b>Memo No.:</b>	001
<b>From:</b>	Bryan Hensel	<b>File:</b>	TRN.CHWY03018-01
<b>Subject:</b>	Rocky View County West Bragg Creek Emergency Access Road – Environmental Constraints Analysis		

## 1.0 INTRODUCTION

Rocky View County (RVC) is proposing to construct the West Bragg Creek Emergency Access Road (the project), providing access from Wintergreen Road to Township Road 24-2 via the undeveloped road allowances for Range Road 5-0, Township Road 24-0 and Range Road 4-5 (Figure 1). Although the project will be located within previously undeveloped Government Road Allowances, the site-specific spatial footprint has yet to be developed in consideration of environmental and regulatory constraints, stakeholder engagement and engineering requirements.

This technical memo provides the environmental constraints analysis for the project, identifying environmental features likely to be intersected by the proposed route, potential regulatory implications, and generalized recommendations addressing environmental constraints from a conceptual context.

## 2.0 METHODS

Tetra Tech Canada Inc. (Tetra Tech) conducted a desktop review of publicly accessible resources. Terrestrial and aquatic resources (i.e., soils and terrain, wetlands and watercourses and vegetation; designated/conservation areas) were evaluated to a distance of 300 m from the proposed route (Terrestrial Study Area); and wildlife resources were evaluated to a distance of 1,000 m from the proposed route (Wildlife Study Area).

The results and subsequent recommendations are based on the available data, and may be limited by the scale, accuracy and vintage available.

## 3.0 ENVIRONMENTAL CONSTRAINTS

### 3.1 Land Use, Soils and Terrain

The project intersects predominantly undeveloped land and areas that have been previously cleared and seeded for pasture use.

In upland areas, soils are likely Orthic Gray Luvisols situated on hummocky, high relief terrain. Parent material is dominated by glacial till with some areas of shallow till over bedrock due to historic glacial scour<sup>1</sup>. Lowlands associated with Harris Creek are likely Dark Gray Luvisols merging with Gleysols at the lowest points along the creek.

<sup>1</sup> Alberta Agriculture and Forestry. 2017. Alberta Soil Information Viewer. Available at: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag10372](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372) [accessed September 7, 2017].

The project overlaps with the Tsuut'ina First Nation (Figure 1).

## 3.2 Wetlands and Watercourses

---

The project is intersected by Harris Creek and its tributaries (Figure 2). Harris Creek is a mapped Class D waterbody with no Restricted Activity Period<sup>2</sup>. Based on its context within the landscape, Harris Creek and its tributaries are likely to be seasonal to small permanent watercourses, providing conveyance of surface water from the project to the Elbow River, approximately 3 km downstream to the east.

A review of aerial imagery and the Alberta Merged Wetland Inventory indicate that numerous wetlands are intersected by the project (Figure 2). These wetlands are predominantly associated with the riparian areas surrounding Harris Creek but some are also isolated in higher relief areas.

## 3.3 Vegetation

---

Vegetation communities encountered at the project consists of native shrublands, wetlands and forests; as well as modified cultivation and pasture (Figure 3).

There are no historic occurrences of rare plants or rare ecological communities located within the Terrestrial Study Area<sup>3</sup>; however, an absence of reported occurrences does not preclude the potential for rare plants or rare ecological communities to be encountered by the project. The project is located in close proximity to the known range of limber pine (*Pinus flexilis*) (i.e., approximately 9 km northwest from the project), a species protected under the Alberta *Wildlife Act*. Given the hummocky landforms and potential shallow depth to bedrock, limber pine has potential to be encountered at the project.

Given the agricultural context of some of the project lands, weeds and invasive non-native plant species are likely to occur at the project.

## 3.4 Wildlife

---

A search of the Fish and Wildlife Information Mapping Tool<sup>4</sup> identified the following wildlife resources located within the Wildlife Study Area:

- Historic occurrences of sensitive fish species, including: Brook Trout (*Salvelinus fontinalis*), Brown Trout (*Salmo trutta*), Bull Trout (*Salvelinus confluentus*), Rainbow Trout (*Oncorhynchus mykiss*) and White Sucker (*Catostomus commersonii*);
- Historic occurrences of sensitive wildlife species, including: Cougar (*Felis concolor*), Grizzly Bear (*Ursus arctos*) and Northern Pygmy Owl (*Glaucidium gnoma*);
- Sensitive wildlife range for Sharp-tailed Grouse (*Tympanuchus phasianellus*), Golden Eagle (*Aquila chrysaetos*), Bald Eagle (*Haliaeetus leucocephalus*) and Prairie Falcon (*Falco mexicanus*); and
- Key Wildlife Biodiversity Zone associated with the Elbow River.

---

<sup>2</sup> Province of Alberta. 2012. Alberta Water Act Code of Practice Map: Calgary. Available at: <http://aep.alberta.ca/water/legislation-guidelines/documents/Calgary-CodePracticeCross-Map-2012.pdf> [accessed September 7, 2017].

<sup>3</sup> Government of Alberta. 2015. Alberta Conservation Information Management System: Search ACIMS Data [online map viewer]. Available at: <http://www.albertaparks.ca/acims-data/> [accessed September 7, 2017].

<sup>4</sup> Government of Alberta. 2017. Fish and Wildlife Information Mapping Tool. Available at: [https://maps.alberta.ca/FWIMT\\_Pub/Viewer/?TermsOfUseRequired=true&Viewer=FWIMT\\_Pub](https://maps.alberta.ca/FWIMT_Pub/Viewer/?TermsOfUseRequired=true&Viewer=FWIMT_Pub) [accessed September 7, 2017].

Given the presence of intact native vegetation communities, the project is considered to intersect with wildlife habitat.

### 3.5 Designated/Conservation Areas

There are no parks or protected areas intersected by the project.

The project intersects through lands designated as Environmentally Significant Areas (ESAs)<sup>5</sup> (Figure 1). These areas have been designated primarily due to their ecological integrity (i.e., ESA Criterion 3.0) and their contribution to water quality and quantity (i.e., ESA Criterion 4.0). Although the specific reasons for the designations of these ESAs are not available, it is likely due to the presence of Harris Creek and its tributaries.

## 4.0 RECOMMENDATIONS

Tetra Tech understands that Rocky View County is reviewing opportunities to acquire the necessary land for the project via some form of agreement with the Tsuut'ina First Nation. Although the details surrounding this potential acquisition are not presently known, development of lands within a designated Indian Reserve are subject to the authorization of Indigenous and Northern Affairs Canada (INAC). In accordance with Section 67 of the Canadian Environmental Assessment Act, 2012, an environmental assessment may be required for such activities under the authority of a federal ministry. Tetra Tech recommends that early consultation be conducted with INAC as early as possible in the planning process, as additional environmental assessment may be required.

Given the relatively intact context of lands intersected by the project, it is recommended that pre-construction surveys be conducted during the seasonally appropriate periods to confirm the presence and potential project impacts on the following:

- Soils;
- Wetlands and watercourses;
- Rare plants and ecological communities;
- Sensitive wildlife features (e.g., nests, dens, roosts) and wildlife habitat; and
- Fish and fish habitat.

Assuming that the results of this environmental constraints analysis are correct, planning and development of the project should consider the following:

- Topsoil and subsoil should be salvaged and handled such that it is conserved and replaced wherever feasible.
- Occurrences of listed weeds may need to be controlled or eradicated during construction and over the operational life of the project.
- An Approval under the Alberta Water Act will be required for any permanent impacts to wetlands including preparation of a Wetland Assessment and Impact Report and Mitigation Plan.

<sup>5</sup> Fiera Biological Consulting Ltd. 2014. Environmentally Significant Areas in Alberta: 2014 Update. Available at: <https://www.albertaparks.ca/media/5425575/2014-esa-final-report-april-2014.pdf> [accessed September 8, 2017].

- A Notification under the Alberta Water Act Code of Practice for Watercourse Crossings must be submitted prior to construction of any crossings of Harris Creek or its tributaries, including the recommendations of a Qualified Aquatic Environment Specialist.
- An Erosion and Sediment Control Plan may be required for any ground disturbance activities occurring in close proximity to confirmed wetlands, Harris Creek or its tributaries.
- Site-specific mitigation measures may be required in the event that rare plants or ecological communities are encountered within the final project footprint.
- Construction activities should be scheduled to occur outside of the primary wildlife breeding season (i.e., April 15 to August 15, annually); however, some species may still be nesting/denning at, prior to, or following this period.
- In the event that an active nest, den or roost is detected within, or in close proximity (varies by species), construction activities may be delayed until after the associated breeding activity is complete and the wildlife feature is no longer occupied.
- In the event that construction is scheduled to occur within the primary wildlife breeding season, consultation with the local Alberta Environment and Parks Wildlife Biologist should be conducted to determine any surveys that may be required to detect any sensitive wildlife habitat features within the final project footprint.

The results of this environmental constraints analysis should be confirmed following completion of detailed design and engineering, including the final project footprint and any other enabling works (e.g., new borrow pits).

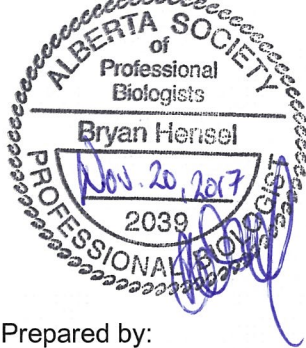
## 5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Rocky View County and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Rocky View county, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

## 6.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,  
Tetra Tech Canada Inc.



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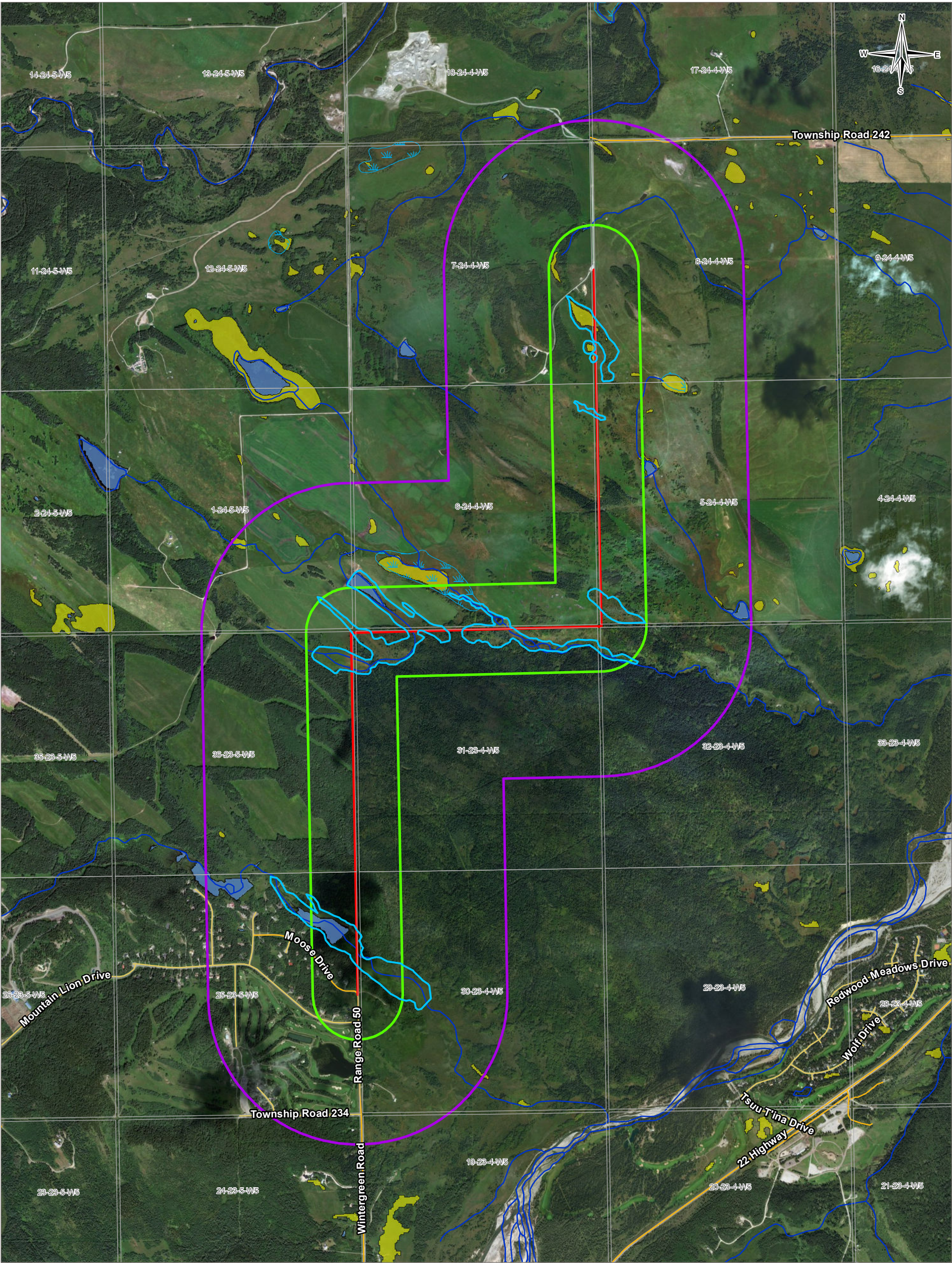
Attachments (4):  
Figure 1 – Site Location  
Figure 2 – Environmental Constraints  
Figure 3 – General Land Cover  
Tetra Tech's Limitations on the Use of this Document

	Option 2 Proposed Alignment		Main Road
	Environmentally Significant Area		Local Road
	Endangered and Threatened Plants Range (Limber Pine)		Resource/Recreational Road
	Sensitive Raptor Range / Sharp-tailed Grouse		Power Line
	Key Wildlife and Biodiversity Zone		Watercourse
	Bragg Creek Provincial Park		Waterbody
			Wetland
			First Nation

**STATUS**  
ISSUED FOR USE

<b>PROJECTION</b> UTM Zone 11		<b>DATUM</b> NAD83		<b>CLIENT</b>  Rocky View County		
<p>Scale: 1:50,000</p> <p>1      0.5      0      1</p>  <p>Kilometres</p>						 <b>TETRA TECH</b>
<b>FILE NO.</b> CHWY03018-01_Figure01_SiteLocation.mxd						
<b>OFFICE</b> Tt-VANC		<b>DWN</b> SL	<b>CKD</b> MEZ	<b>APVD</b> BH	<b>REV</b> 0	<b>Figure 1</b>
<b>DATE</b> November 16, 2017		<b>PROJECT NO.</b> TRN.CHWY03018-01				

### Figure 1





LEGEND

- Option 2 Proposed Alignment
- Terrestrial Study Area (300 m)
- Wildlife Study Area (1000 m)
- Delineated Wetland Boundary
- Alberta Merged Wetland**
- Marsh
- Open Water
- Main Road
- Local Road
- CanVec Watercourse
- CanVec Waterbody
- CanVec Wetland

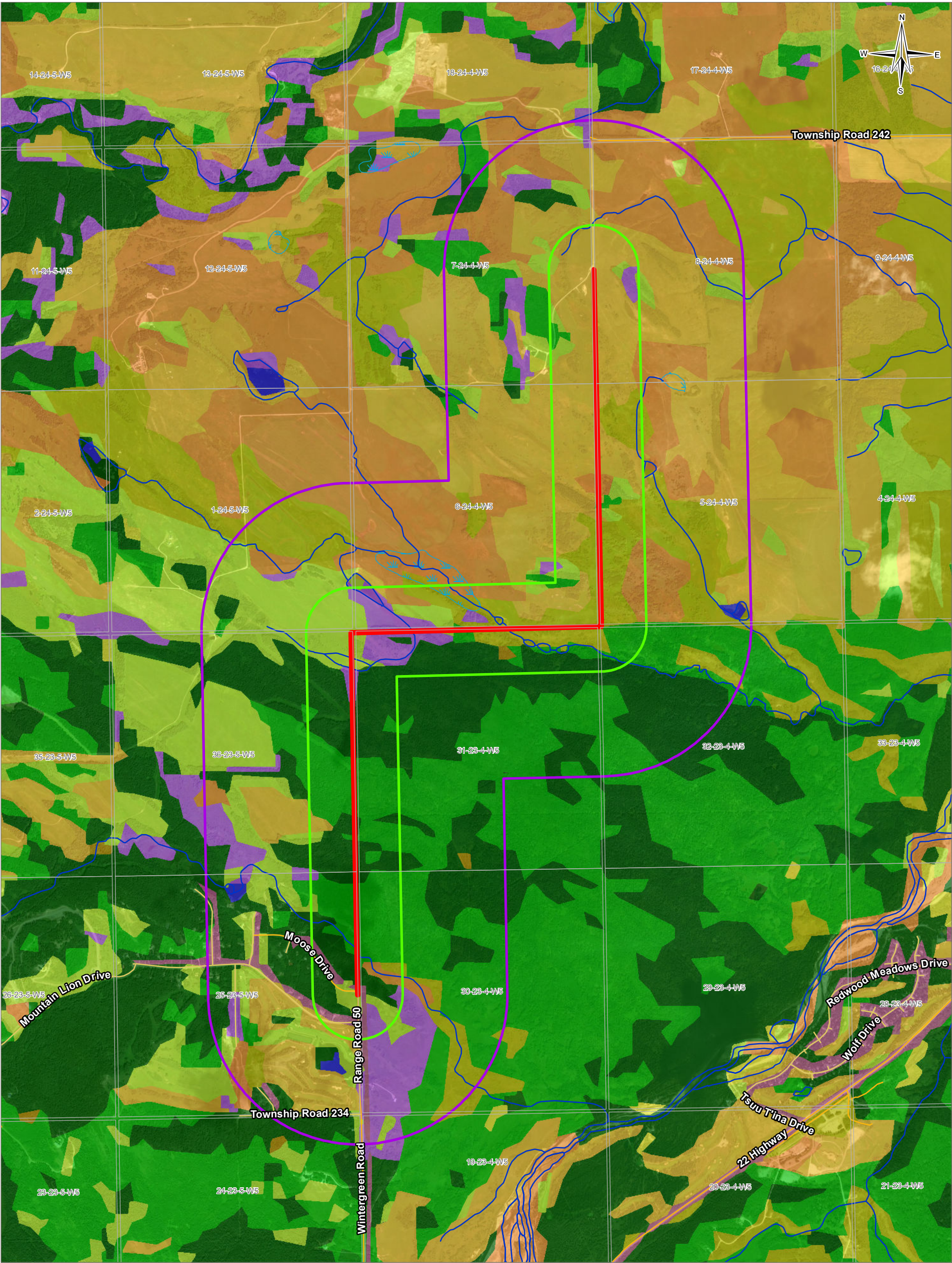
NOTES  
Base data source:  
CanVec 1:50,000  
Alberta Environment  
Imagery: ESRI; DigitalGlobe (2011/2016).

WEST BRAGG CREEK

Environmental Constraints

PROJECTION UTM Zone 11		DATUM NAD83		CLIENT  Rocky View County	
Scale: 1:25,000 500      250      0      500  Metres					
FILE NO. CHWY03018-01_Figure02_Constraints.mxd					
OFFICE Tl-VANC		DWN SL	CKD MEZ	APVD BH	REV 0
DATE November 16, 2017		PROJECT NO. TRN.CHWY03018-01			
Tetra Tech  TETRA TECH  Figure 2					

STATUS  
ISSUED FOR USE



LEGEND

- Option 2 Proposed Alignment

Terrestrial Study Area (300 m)

Wildlife Study Area (1000 m)

Main Road

Local Road

CanVec Watercourse

CanVec Waterbody

CanVec Wetland
- General Land Cover

Water

Developed

Shrub tall

Wetland - Shrub

Herb

Grassland

Annual Cropland

Perennial Cropland and Pasture

Coniferous Dense

Coniferous Open

Broadleaf Dense


Mixedwood Dense

NOTES

Base data source:  
CanVec 1:50,000  
Natural Resources Canada  
Imagery: ESRI; DigitalGlobe (2011/2016).

WEST BRAGG CREEK

General Land Cover

PROJECTION UTM Zone 11		DATUM NAD83		CLIENT  Rocky View County	
Scale: 1:25,000 500      250      0      500  Metres		FILE NO. CHWY03018-01_Figure03_LandCover.mxd			
OFFICE Tl-VANC	DWN SL	CKD MEZ	APVD BH	REV 0	Figure 3
DATE November 16, 2017	PROJECT NO. TRN.CHWY03018-01				

# LIMITATIONS ON USE OF THIS DOCUMENT

## GEOENVIRONMENTAL

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## APPENDIX G

### GEOTECHNICAL OVERVIEW

## **West Bragg Creek Emergency Access Study Option 2 Alignment Geotechnical Overview**



PRESENTED TO  
**Rocky View County**

SEPTEMBER 29, 2017  
ISSUED FOR USE  
FILE: TRN.CHWY03018-01

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Figure E1 Construction Constraints and Location of Thin Soils/Bedrock

### APPENDICES

Appendix A Tetra Tech's Limitations on the Use of this Document

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## 1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) undertook construction constraints mapping as part of the West Bragg Creek Emergency Access Study Geotechnical Overview. Constraints can be used to help guide construction practices along Option 2 of the road alignment. A second objective is to map thin soils and bedrock outcrop, also for construction purposes.

The following were undertaken as part of the scope of this work:

- Literature Review:
  - Bedrock Geology;
  - Surficial Geology; and
  - Aggregate Resources.
- Mapping:
  - Construction Constraints; and
  - Thin Soils/Bedrock.

## 2.0 LITERATURE REVIEW

### 2.1 Bedrock Geology

The following is summarized from Ollerenshaw (1976) and Hume and Beach (1942).

The project area is underlain by folded and thrustsedimentary rocks of the Brazeau and Wapiabi formations, which are both Upper Cretaceous in age. The various bedrock formations in the region are thrust over each other in a northeastward direction; the folds and faults trend northwestward.

The terrestrial Brazeau Formation has an upper and a lower member. The upper member comprises grey and greenish grey feldspathic sandstone, siltstone and rubbly mudstone, with minor bentonite and rare coal. The lower member is similar, but lacks the bentonite and coal and also contains minor pebbly sandstone and pebble conglomerate.

The marine Wapiabi Formation comprises dark grey silty, platy to rubbly shale and calcareous shale, containing some siltstone/sandstone laminations. It also includes concretionary shale/mudstone, minor argillaceous sandstone, pebble beds and bentonite seams.

### 2.2 Surficial Geology

Multiple glaciations are recorded in this region of the Rocky Mountain Foothills, but the surficial sediments mainly belong to the last glacial period, i.e., the Late Wisconsinan (Jackson et al. 2008). The Bragg Creek area was affected by montane ice only – ice sourced in the mountains that was deflected by the larger Laurentide continental ice sheet. As a result, the montane ice flowed south-southeastward across the area at the height of the last glaciation, then southeastward during the deglacial phase (Jackson et al. 2008).

The following is summarized from Shetsen (1987) and Jackson et al. (2008).

The project area is mainly covered with montane till up to 5 m thick. This till is slightly leached, poorly sorted and ranges from clay to boulders in size. The matrix is dominantly silty sand, clasts consist of local rock types and coarse glaciofluvial sediments are occasionally found within the deposits. The till forms flat to rolling topography, but becomes thin over bedrock uplands. It forms southeastward trending streamlined landforms (flutes, drumlins) in the vicinity of the project area.

The southernmost 500 m of the alignment is overlain by glaciolacustrine clayey silt with minor sand 3 to 6 m thick. It forms a flat, low relief landscape.

Colluvium is present on steeper slopes in the northern part of the region, but it does not appear to reach the project area except at its northern tip. The colluvium consists of local bedrock and may be layered parallel to the slope. It is about 1.5 m thick on slopes but more than 3 m thick at the base of slopes. Grain size ranges from clay to boulders, but the matrix is mainly sand.

Fine-grained fluvial sediments are found where Harris Creek crosses the alignment. These range from clay to sand but may contain minor gravel and/or organic material. Fluvial deposits are generally 2 - 7 m thick.

### 2.3 Aggregate Resources

A large deposit of glaciofluvial gravel to gravelly sand is located about 1.6 km northwest of the northern tip of the alignment (Shetsen, 1981).

## 3.0 METHODS

High-resolution digital stereo pair air photos were acquired from Alberta Environment and Parks in Edmonton and were georeferenced for PurVIEW.

Table 1 shows the air photos that were acquired for the project.

**Table 1: Aerial Photography Used for Constraints Mapping**

Year	Scale	AEP Roll Number	Photo/Imagery Numbers
2015	1:15,000	T15-239	87-91, 95-99

Constraints mapping and the mapping of thin soils and bedrock exposures was undertaken in PurVIEW, a software program that allows the mapper to zoom in and out of 3D imagery while working in the ArcGIS environment.

Constraints mapping should be considered reconnaissance level only as there has been no field checking to confirm the mapping. Results are preliminary and are not intended for use in development planning.

## 4.0 RESULTS

The constraints mapped for the Option 2 alignment are shown in Figure E1, along with areas of shallow soils.

Constraints are minor, consisting of organic deposits and fine-grained, wet creek sediments. Harris Creek is evident in the central portion of the Project Area as a flooding constraint. A few thicker wetlands are present (organic blanket and organic plain), but most organic units comprise thin peat deposits that pose only minor construction issues.

Shallow bedrock is present where till veneer has been mapped. Only one bedrock outcrop was identified on the air photos. It is located at the far northern end of the Project Area (Figure E1).

The rest of the area is mainly covered with till greater than 1 m thick.

## 5.0 RECOMMENDATIONS

For a geotechnical perspective, construction activities along the majority of the proposed alignment are considered to have relatively low constraints where the montane till deposits are present.

With respect to the existing ground gradient, at a location between km 5+000 and km 5+100 of the Option 2 alignment, the ground slopes at approximately 25 percent and would require attention for road gradient design.

With respect to the areas mapped as having flood hazards in Figure E1, mostly along the east-west alignment portion and a small stretch near the south end of the alignment, attention would be required to ensure the road grade design is acceptable for the design flood levels.

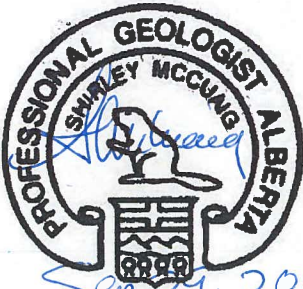
For most of the alignment, relatively thin organic blankets less than 1 m thick would have only minor construction issues. However, near the northern of the end of the alignment, isolated thicker organic deposits have been mapped which would impose construction constraints, such as deeper excavation and replacement with road fill.

It is recommended that prior to final design, a geotechnical investigation be conducted to verify the subsurface soil and groundwater conditions, with special attention directed to the area mapped as fluvial and organic deposits in Figure E1.

## 6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

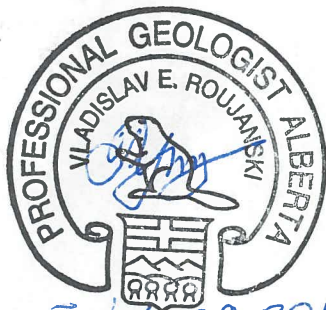
Tetra Tech Canada Inc.




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<b>PERMIT TO PRACTICE TETRA TECH CANADA INC.</b>	
Signature	
Date	<u>sep 29, 2017</u>
<b>PERMIT NUMBER: P13774</b>	
The Association of Professional Engineers and Geoscientists of Alberta	

/sm

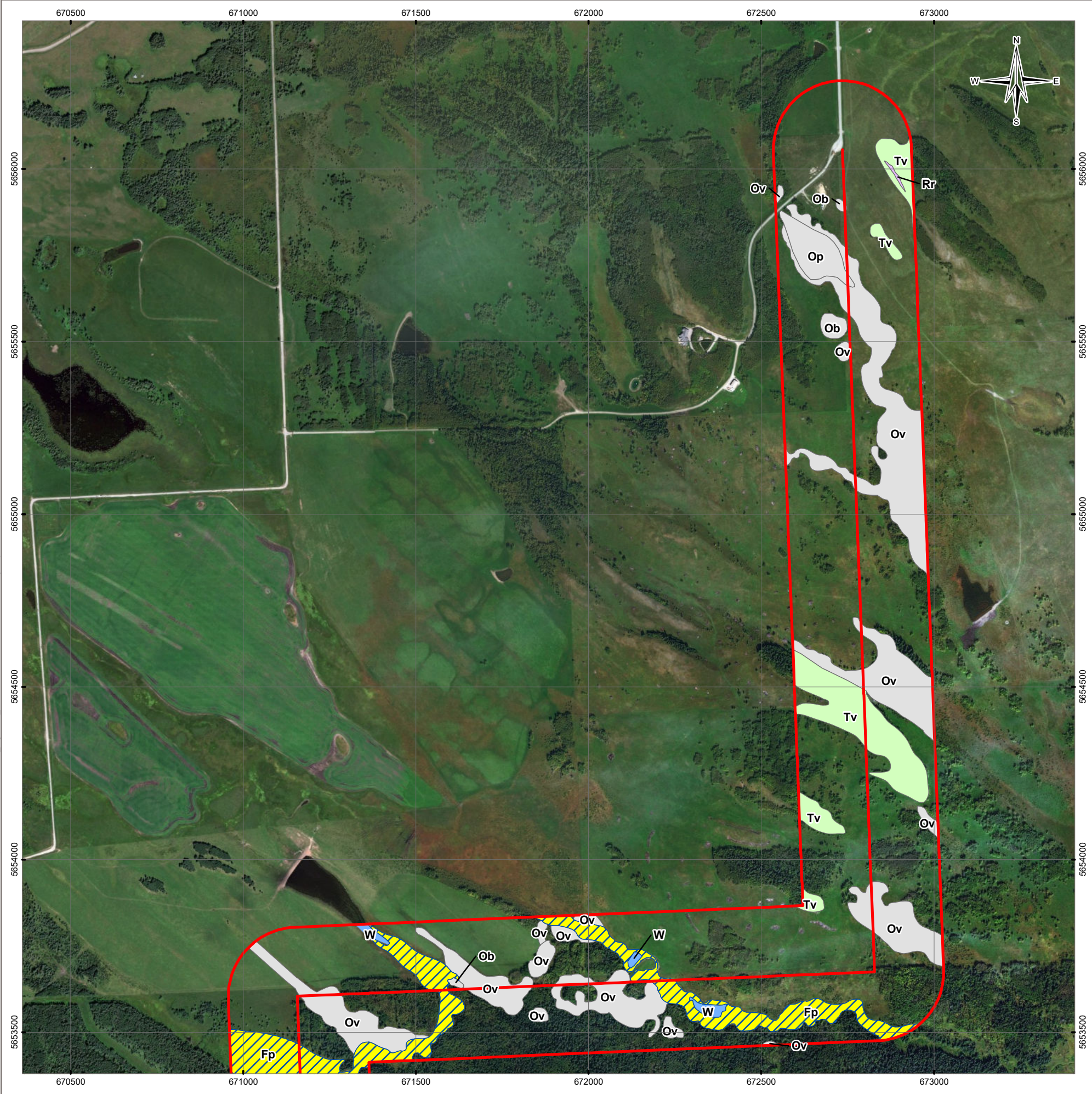
## REFERENCES

- Jackson, L.E., Jr., Leboe, E.R., Little, E.C., Holme, P.J., Hicock, S.R., Shimamura, K., and Nelson, F.E.N. 2008. Quaternary Stratigraphy and Geology of the Rocky Mountain Foothills, Southwestern Alberta. Geological Survey of Canada Bulletin 583.
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- Shetsen, I. (1981). Aggregate Resources, 82O/2 Jumpingpound Creek. Alberta Research Council, Natural Resources Division, Alberta Geological Survey Map, scale 1:50,000.
- Shetsen, I. 1987. Quaternary Geology, Southern Alberta. Alberta Research Council, Natural Resources Division, Terrain Sciences Department, Map 213, scale 1:500,000.

## FIGURES

Figure E1      Construction Constraints and Location of Thin Soils/Bedrock

Q:\Vancouver\GIS\TRANSPORTATION\CHWY03018-01\Maps\Geotech\CHWY03018-01\_FigureE1\_Constraints.mxd modified 9/12/2017 by stephanie leusink



LEGEND

- Option 2 Proposed Alignment
- Study Area (200 m)
- Constraints**
  - Flooding
  - Organic Deposits

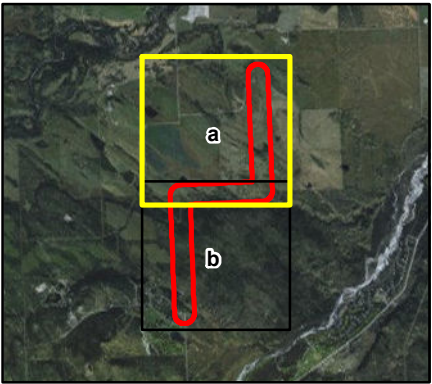
NOTES  
Imagery: ESRI; DigitalGlobe (2011/2016).

SURFICIAL MATERIAL

- T** **Till:** very poorly sorted sediment (diamicton) deposited directly by glacial ice by lodgment, melt out, or post-melt out gravity flow; generally matrix-supported and compact. Clasts comprise pebble, cobble and boulder gravel, with a clay to sand matrix. May contain lenses or beds of better sorted material deposited within subglacial channels.
- F** **Fluvial Deposit:** sediment deposited by streams (synonymous with alluvial). Moderately to well sorted, clay, silt, sand, minor gravel and organic matter.
- O** **Organic Deposit:** woody, fibrous peat, present in wetlands (bogs and fens) and organic mud; underlain by poorly drained sediment or bedrock.
- W** **Water:** waterbodies such as lakes and ponds.
- R** **Bedrock:** metasedimentary rocks of Upper Cretaceous age (Brazeau and Wapiabi formations).

SURFICIAL EXPRESSION

- b Blanket:** deposit greater than 1 m thick; minor irregularities of the underlying unit (generally bedrock) are masked but the topographic form is still evident.
- v Veneer:** deposit less than 1 m thick; minor irregularities of the underlying unit (generally bedrock) are masked but the topographic form is obvious.
- p Plain:** flat or relatively level landscape element; bedrock topography is masked.
- t Terrace:** level or gently inclined surface flanked by a steep slope or scarp; bedrock topography is masked.
- r Ridge:** narrow, elongate and commonly steep-sided feature that rises above surrounding landscape.



STATUS  
ISSUED FOR REVIEW

WEST BRAGG CREEK

Construction Constraints and Location of Thin Soils/Bedrock

PROJECTION  
UTM Zone 11

DATUM  
NAD83

CLIENT  
Rocky View County

Scale: 1:12,000

200 100 0 200

Metres

FILE NO.  
CHWY03018-01\_FigureE1\_Constraints.mxd

OFFICE  
TL-VANC

DWN  
SL

CKD  
MEZ

APVD  
SMC

REV  
0

DATE  
September 12, 2017

PROJECT NO.  
TRN.CHWY03018-01

TETRA TECH

Figure E1a



## LEGEND

- Option 2 Proposed Alignment
- Study Area (200 m)

### Constraints

- Flooding
- Organic Deposits

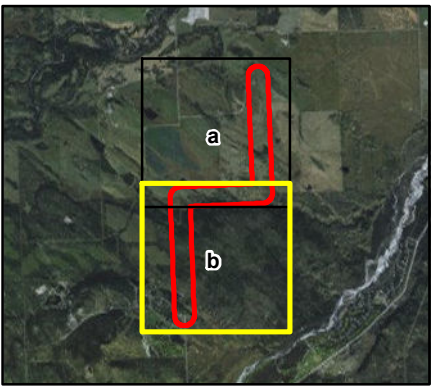
**NOTES**  
Imagery: ESRI; DigitalGlobe (2011/2016).

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**STATUS**  
ISSUED FOR REVIEW

## WEST BRAGG CREEK

### Construction Constraints and Location of Thin Soils/Bedrock

<b>PROJECTION</b> UTM Zone 11		<b>DATUM</b> NAD83		<b>CLIENT</b> Rocky View County	
Scale: 1:12,000 200 100 0 200 Metres		<b>FILE NO.</b> CHWY03018-01_FigureE1_Constraints.mxd		<b>TETRA TECH</b>	
<b>OFFICE</b> TL-VANC		<b>DWN</b> SL	<b>CKD</b> MEZ	<b>APVD</b> SMC	<b>REV</b> 0
<b>DATE</b> September 12, 2017		<b>PROJECT NO.</b> TRN.CHWY03018-01		<b>Figure E1b</b>	

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Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

### **1.3 STANDARD OF CARE**

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

### **1.4 DISCLOSURE OF INFORMATION BY CLIENT**

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

### **1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS**

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

### **1.6 GENERAL LIMITATIONS OF DOCUMENT**

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

---

## 1.7 ENVIRONMENTAL AND REGULATORY ISSUES

---

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

## 1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

---

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

## 1.9 LOGS OF TESTHOLES

---

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

## 1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

---

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

## 1.11 PROTECTION OF EXPOSED GROUND

---

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

## 1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

---

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

## 1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

---

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

## 1.14 OBSERVATIONS DURING CONSTRUCTION

---

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

## 1.15 DRAINAGE SYSTEMS

---

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

## 1.16 BEARING CAPACITY

---

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

## 1.17 SAMPLES

---

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

## APPENDIX H

### HISTORICAL RESOURCES OVERVIEW

## *Historical Resources Act Requirements*

---

Proponent: Rocky View County  
911 - 32 Avenue NE, Calgary, AB T2E 6X6

Contact: Ms. Angela Yurkowski

Agent: Soriak Consulting & Research Ltd. (on behalf of Tetra Tech Canada Inc.)

Contact: Charla Downey

**Project Name: West Bragg Creek Emergency Access Study**

Project Components: Access Road

Application Purpose: Requesting HRA Approval / Requirements

---

Pursuant to Section 37(2) of the *Historical Resources Act*, a Historic Resources Impact Assessment is required for all or portions of those activities described in this application and its attached plan(s)/sketch(es). The Historic Resources Impact Assessment is to be conducted in accordance with the instructions outlined in the following schedule.



---

David Link  
Assistant Deputy Minister

---

### **SCHEDULE OF REQUIREMENTS**

#### **ARCHAEOLOGICAL RESOURCES**

Pursuant to Section 37(2) of the *Historical Resources Act*, a Historic Resources Impact Assessment for archaeological resources is to be conducted on behalf of the proponent by an archaeologist qualified to hold an archaeological research permit within the Province of Alberta. A permit must be issued by Alberta Culture and Tourism prior to the initiation of any archaeological field investigations. Please allow ten working days for the permit application to be processed.

1. The Historic Resources Impact Assessment must address all areas of high archaeological potential within the project area.
2. The Historic Resources Impact Assessment is to be carried out prior to the initiation of any land surface disturbance activities under snow-free, unfrozen ground conditions. Should the project require field studies under winter conditions, directions in the [Archaeological Survey Information Bulletin: Winter Conditions](#) must be followed.
3. During the conduct of the Historic Resources Impact Assessment the proponent's consulting archaeologist is to confirm the relationship between the footprint of the proposed project and previously recorded archaeological site EgPp-21.

**SCHEDULE OF REQUIREMENTS (continued)**

<b>SITE</b>	<b>HRV</b>	<b>SITE DESCRIPTION</b>	<b>CONDITIONS/APPROVAL</b>
EgPp-21	4	homestead	The proponent's consulting archaeologist is to confirm the relationship between this site and the footprint of the proposed project.

**PALAEONTOLOGICAL RESOURCES**

There are no Historical Resources Act requirements associated with palaeontological resources; however, the proponent must comply with standard conditions under the Historical Resources Act, which are applicable to all land surface disturbance activities in the Province.

**ABORIGINAL TRADITIONAL USE SITES**

There are no *Historical Resources Act* requirements associated with Aboriginal traditional use sites of a historic resource nature; however, the proponent must comply with standard conditions under the *Historical Resources Act*, which are applicable to all land surface disturbance activities in the Province.

**HISTORIC STRUCTURES**

There are no Historical Resources Act requirements associated with historic structures; however, the proponent must comply with standard conditions under the Historical Resources Act, which are applicable to all land surface disturbance activities in the Province.

**PROVINCIALY DESIGNATED HISTORIC RESOURCES**

There are no Historical Resources Act requirements associated with Provincially Designated Historic Resources; however, the proponent must comply with standard conditions under the Historical Resources Act, which are applicable to all land surface disturbance activities in the Province.

**SPECIAL CONDITIONS**

1. In addition to any specific conditions detailed above, the proponent must abide by all [Standard Conditions under the \*Historical Resources Act\*](#).

Lands Affected: All New Lands

Proposed Development Area:

<b>MER</b>	<b>RGE</b>	<b>TWP</b>	<b>SEC</b>	<b>LSD List</b>
5	4	23	31	4,5,12,13-16
5	5	23	25	1,8,9,16
5	4	23	30	4,5,12,13
5	4	23	32	13
5	5	23	36	1,8,9,16
5	4	24	8	4,5

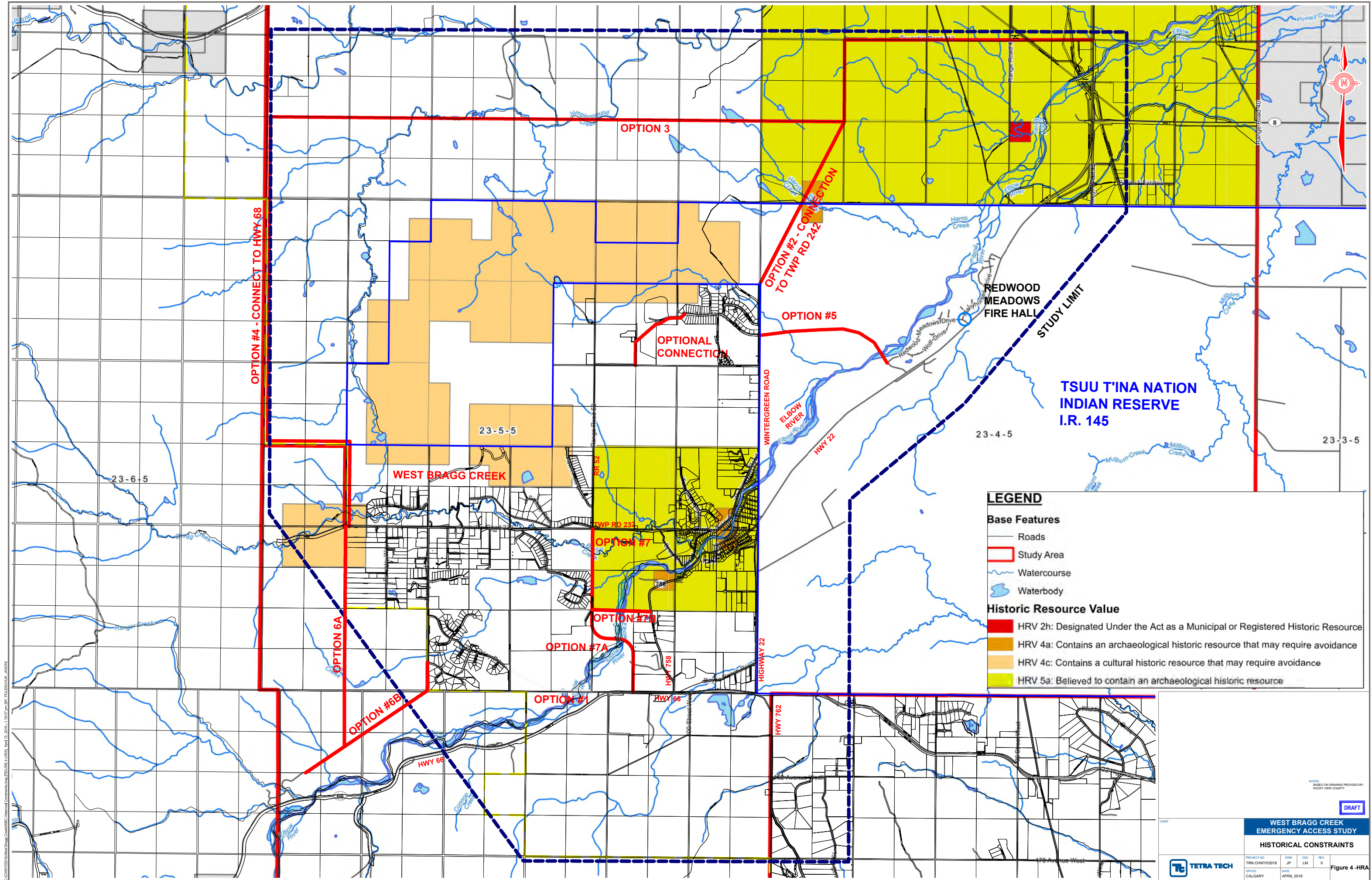
**SCHEDULE OF REQUIREMENTS (continued)**

5	4	24	6	1-4,8,9,16
5	5	24	1	1
5	4	24	5	4,5,12,13
5	4	24	7	1,8

## Documents Attached:

Document Name	Document Type
Project Study Area	Illustrative Material





C:\HWY030\Bragg Creek\WBC Historical Constraints.dwg [PLOT] 13:2016 - 1:10:07 pm [BY: POLSCHUL, JASON]

NOTES:  
BASED ON DRAWING PROVIDED BY:  
ROCKY VIEW COUNTY

DRAFT



WEST BRAGG CREEK EMERGENCY ACCESS STUDY				
HISTORICAL CONSTRAINTS				
PROJECT NO: TRN.CHWY03018	OWN JP	CKD LM	REV 0	Figure 4 -HRA
OFFICE CALGARY	DATE APRIL 2016			

## APPENDIX I

### STORMWATER DRAINAGE OVERVIEW

ISSUED FOR USE

**To:** Lou Mak  
Tetra Tech Southern Alberta Roads and Highways  
Prairie Region

**Date:** November 20, 2017

**Memo No.:** 001

**From:** Bill Rozeboom, P.Eng.

**File:** TRN.CHWY03018

**Subject:** Stormwater Overview – West Bragg Creek Emergency Access Road Option 2  
Rocky View County, Alberta

## 1.0 INTRODUCTION

A drainage overview analysis was performed to identify conditions to be accommodated as part of functional planning for a proposed emergency access road from West Bragg Creek.

The analysis was made for a single alignment identified as “Option 2” in planning work to date.

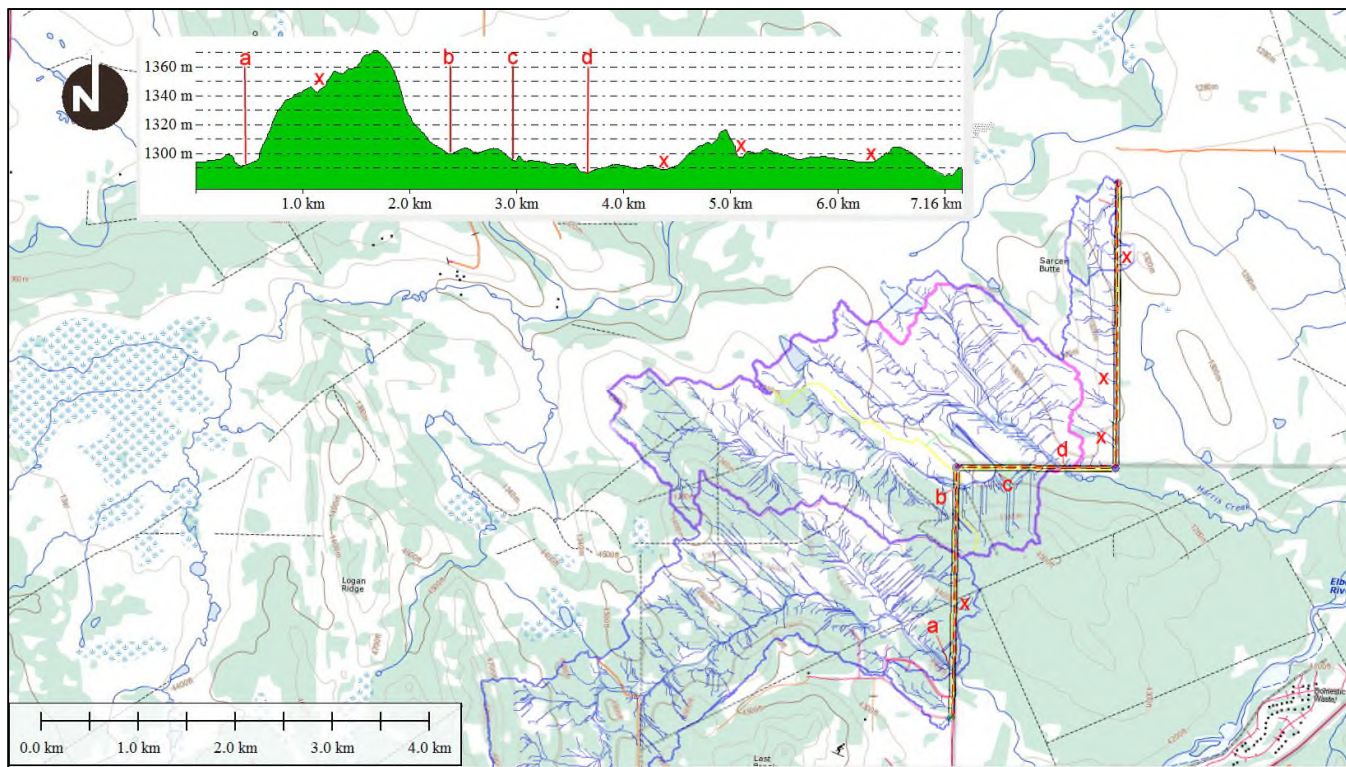
Drainage patterns and basin areas were determined from drainage features identified from 1:50,000 scale NTS mapping and a terrain surface derived from LiDAR elevation data. This information was processed and interpreted using Global Mapper software. Google Earth imagery was used to estimate channel widths.

Design flows for the crossings were estimated on the basis of basin areas and 100-year unit runoff amounts developed in previous studies by others. Preliminary sizing of culverts to pass the design flows were computed with inlet control conditions.

## 2.0 DRAINAGE PATTERNS

Figure 1 shows the watersheds areas that drain to the alignment of the proposed road, superimposed on a 1:50,000 scale NTS map. The total area draining to the road is approximately 17.65 km<sup>2</sup>. LiDAR-derived flow patterns are shown for the areas that drain to the alignment.

The figure is marked with labels “a” to “d” showing the location of five defined watercourses where the NTS mapping identifies a watercourse that intersects the alignment. The figure is also marked with “x” labels which indicate the location of low spots along the alignment, determined from the LiDAR elevation data, where culverts should be provided to allow for cross drainage. All of the labels are positioned to be on the upstream side of the crossing; the direction of flow is from the label to the road.



**Figure 1: Watershed Areas Draining to Road Alignment**

Stream “a” at the southern end of the alignment drains a basin area of approximately 7.49 km<sup>2</sup>. The normal channel width is approximately 0.8 m based on Google Earth imagery. The crossing is immediately below (east) of the downstream face of a dam identified as the Robert Lyon Embankment, regulated by Alberta Environment and Parks. A summary of dam features, obtained from <http://damsafetymap.alberta.ca/> is copied below:

#### Robert Lyon Embankment

- Latitude: 50.9905 Longitude: -114.5612; ATS: NE-25-23-5-W5th
- WSC Sub-Basin: 05BJ - ELBOW RIVER Tributary To: Elbow River
- Consequence Classification: Significant
- Dam Height: undefined; Capacity: 54.8 dam<sup>3</sup>
- Purpose: Habitat, Recreation; Regulated By: Alberta Environment and Parks

Figure 2 shows the crossing location relative to the dam. Field investigation, and review of available dam safety reviews, will be required to determine the condition and capacity of what appears to be an outlet spillway at the north end of the dam embankment and a flow path located north of crossing “a”. The flow paths for both the outlet spillway and also the main channel east of the road alignment, appear to flow in a southerly direction within or near the road footprint. Armouring of the road ditch and/or minor channel re-alignment work may be required to accommodate this flow.



**Figure 2: Stream Crossing “a” Below Regulated Dam**

Figure 3 shows Stream Crossings “b”, “c”, and “d” which are all within the Harris Creek watershed. Upstream crossings “b” and “c” are on a tributary that drains the western part of the catchment, with basin areas of 3.87 km<sup>2</sup> and 4.35 km<sup>2</sup>, respectively. Crossing “d” is located downstream on the main stem channel and drains a total basin area of 8.53 km<sup>2</sup>. The normal channel width based on Google Earth imagery is variable, but up to approximately 1.5 m at the downstream crossing. The channel sections are contained within a broad floodplain typically about 50 m wide.



**Figure 3: Stream Crossings “b”, “c”, and “d” all Draining to Harris Creek**

### 3.0 100-YEAR DESIGN FLOWS AND PRELIMINARY CULVERT SIZING

Design flows for the crossings were computed using pre-development Unit Area Flow Rate (UAFR) information summarized in the Rocky View County Bragg Creek Master Drainage Plan, October 2013. From that report, a 100-year UARF amount of 8.5 L/s/ha, previously developed for the Greater Bragg Creek ASP Sub-basin Study, MDRV 2004, was adopted because it most closely corresponds to the present study area. Also, the 8.5 L/s/ha amount may be conservative considering that UARF values developed in three other studies in the region yielded lower amounts ranging from 4.8 to 5.2 L/s/ha.

Culvert nominal capacities were determined from inlet control nomographs for corrugated culverts with non-projecting mitered inlets, and headwater depth equal to 80% of the culvert diameter. This approach yielded the nominal capacities listed in Table 1 below.

**Table 1: Nominal Capacities of Corrugated Culverts, Inlet Control**

Diameter		Discharge (HW/d = 0.8)	
inches	metres	ft <sup>3</sup> /s	m <sup>3</sup> /s
12.0	0.3	1.5	0.04
24.0	0.6	9.0	0.25
36.0	0.9	24	0.68
48.0	1.2	50	1.42
60.0	1.5	85	2.41

Table 2 presents the design 100-year discharges for each crossing and identifies a combination of culverts capable of passing the design flow.

**Table 2: Design Flows and Preliminary Culvert Sizing**

Crossing	Basin area	100-year Flow		Preliminary Culvert Design	
id	ha	L/s	m <sup>3</sup> /s	sizes	m <sup>3</sup> /s
a	749	6,367	6.37	3@ 60"	7.22
b	387	3,290	3.29	1@ 60" + 1 @ 48"	3.82
c	435	3,698	3.70	3@ 48"	4.25
d	853	7,251	7.25	3@ 60"	7.22

It is possible that bridge spans may be a preferred option for the two largest crossings, "a" and "d" above. The width of the existing defined channels will likely accommodate only a single 60" (1.5 m) diameter culvert and it is unknown at this time whether the road geometry over the overbank/floodplain areas will accommodate the additional required culverts.

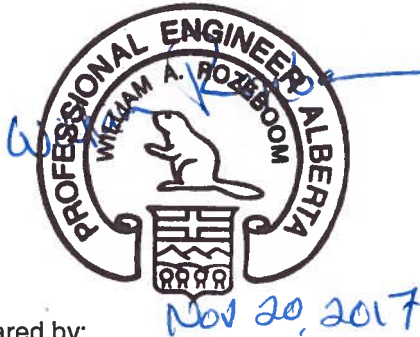
### 4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Rocky View County and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Rocky View County or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech's Services Agreement. Tetra Tech's General Conditions are attached to this memo.

## 5.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,  
Tetra Tech Canada Inc.




Prepared by:  
W.A. (Bill) Rozeboom, P.Eng.  
Principal Specialist, Water Resources  
Water and Marine Engineering  
Direct Line: 587.460.3611  
Bill.Rozeboom@tetrattech.com



Reviewed by:  
Brian C. Adeney, P.Eng  
Manager, Northern AB & NT/NU  
Environment & Water Practice  
Direct Line: 587.460.3445  
Brian.Adeney@tetrattech.com

/cee

<b>PERMIT TO PRACTICE</b> <b>TETRA TECH CANADA INC.</b> Signature  Date <u>November 20, 2017</u> <b>PERMIT NUMBER: P13774</b> The Association of Professional Engineers and Geoscientists of Alberta
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# GENERAL CONDITIONS

## GEOENVIRONMENTAL REPORT

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This report incorporates and is subject to these "General Conditions".

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### 1.1 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of TETRA TECH's client. TETRA TECH does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than TETRA TECH's Client unless otherwise authorized in writing by TETRA TECH. Any unauthorized use of the report is at the sole risk of the user.

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### 1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH's instruments of professional service); only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. The Client warrants that TETRA TECH's instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

### 1.1 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

### 1.2 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

## APPENDIX J

### UTILITIES

**Mak, Lou**

---

**From:** Stephens, Douglas <doug.stephens@Telecon.ca>  
**Sent:** Monday, September 11, 2017 1:24 PM  
**To:** Mak, Lou  
**Subject:** RE: West Bragg Creek - Emergency Access Study

I would say roughly \$3000.00 to lower the cable at the crossing depending on the lay of the land. It would be really difficult to estimate the parallel portion unless I had the cuts and exact location of the road in comparison with our cable. Keeping in mind it is a 5 meter easement and the depth of our cable should be 1.5 meters deep( give or take .3 meters). If there is any construction going on within our ROW, you would need to go through the Telus land department for an agreement. There is also quite a bit of rock in that area as well.

*Doug Stephens*

403 801-4171  
Field Construction Manager  
[Doug.stephens@telecon.ca](mailto:Doug.stephens@telecon.ca)

---

**From:** Mak, Lou [mailto:Lou.Mak@tetrattech.com]  
**Sent:** Monday, September 11, 2017 3:06 PM  
**To:** Stephens, Douglas  
**Subject:** RE: West Bragg Creek - Emergency Access Study

Stephen,

Could you provide a high-level estimate to lower the line at the crossing?  
And also a high level crossing to lower the line (per kilometre) if the line is in the backslope.

Thanks,

Lou

**Lou Mak, P. Eng.** | Sr. Transportation Engineer, Southern Alberta Roads and Highways – Prairie Region  
| Business +1 (403) 203-3355 ext 254 | Fax +1 (403) 203-3301 | Mobile +1 (403) 998-3412 | [lou.mak@tetrattech.com](mailto:lou.mak@tetrattech.com)

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**Transportation Practice** | Riverbend Atrium One, 115, 200 Rivercrest Drive SE, Calgary, AB T2C 2X5 | [tetrattech.com](http://tetrattech.com)

---

**From:** Stephens, Douglas [mailto:doug.stephens@Telecon.ca]  
**Sent:** Monday, September 11, 2017 1:03 PM  
**To:** Mak, Lou <[Lou.Mak@tetrattech.com](mailto:Lou.Mak@tetrattech.com)>  
**Subject:** RE: West Bragg Creek - Emergency Access Study

Lou  
Please see the attached. The thicker red line is our fiber optic cable. The pink line is your planned road. Depending on where the actual road will be going you will be paralleling our fiber for some distance. There will be one crossing for sure where the road turns North. The fiber cable could easily be lowered at that location. Our plans indicate no other Telus facilities on your planned route.

If you require any additional information please let me know.  
Thanks

*Doug Stephens*

403 801-4171  
Field Construction Manager  
[Doug.stephens@telecon.ca](mailto:Doug.stephens@telecon.ca)

---

**From:** Mak, Lou [<mailto:Lou.Mak@tetrattech.com>]  
**Sent:** Monday, September 11, 2017 10:50 AM  
**To:** Stephens, Douglas  
**Subject:** RE: West Bragg Creek - Emergency Access Study

Doug,

Start NE25-23-5-W5M  
End: NE7-24-4-W5M

Hope that helps.

Lou

**Lou Mak, P. Eng.** | Sr. Transportation Engineer, Southern Alberta Roads and Highways – Prairie Region  
| Business +1 (403) 203-3355 ext 254 | Fax +1 (403) 203-3301 | Mobile +1 (403) 998-3412 | [lou.mak@tetrattech.com](mailto:lou.mak@tetrattech.com)

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---

**From:** Stephens, Douglas [<mailto:doug.stephens@Telecon.ca>]  
**Sent:** Monday, September 11, 2017 8:29 AM  
**To:** Mak, Lou <[Lou.Mak@tetrattech.com](mailto:Lou.Mak@tetrattech.com)>  
**Cc:** Robinson,Carolynn <[carolynn.robinson@Telecon.ca](mailto:carolynn.robinson@Telecon.ca)>  
**Subject:** RE: West Bragg Creek - Emergency Access Study

Lou  
Do you have the legal land for the start and finish locations?

*Doug Stephens*

403 801-4171  
Field Construction Manager  
[Doug.stephens@telecon.ca](mailto:Doug.stephens@telecon.ca)

---

**From:** Mak, Lou [<mailto:Lou.Mak@tetrattech.com>]  
**Sent:** Monday, September 11, 2017 10:13 AM  
**To:** Stephens, Douglas  
**Cc:** Mak, Lou  
**Subject:** West Bragg Creek - Emergency Access Study

Doug,

It was a pleasure talking to you today.

As discussed, we are currently completing a study for an emergency access road for Rocky View County. The suggested route (see below) extends north from Wintergreen Road through Tsuut'ina Nation, then cuts east along Twp. 24.0 within the Tsuut'ina boundary, and then north on Rge. Rd. 45 and connects to the existing local road.

There is a Telus right-of-way to the north of Tsuut'ina's north boundary that runs east/west. Although the proposed road is to the south of Tsuut'ina's boundary, the backslope may impact the Telus line. We will also be crossing the line as the route turns north on RR45. Is there any where else where we may impact the line.

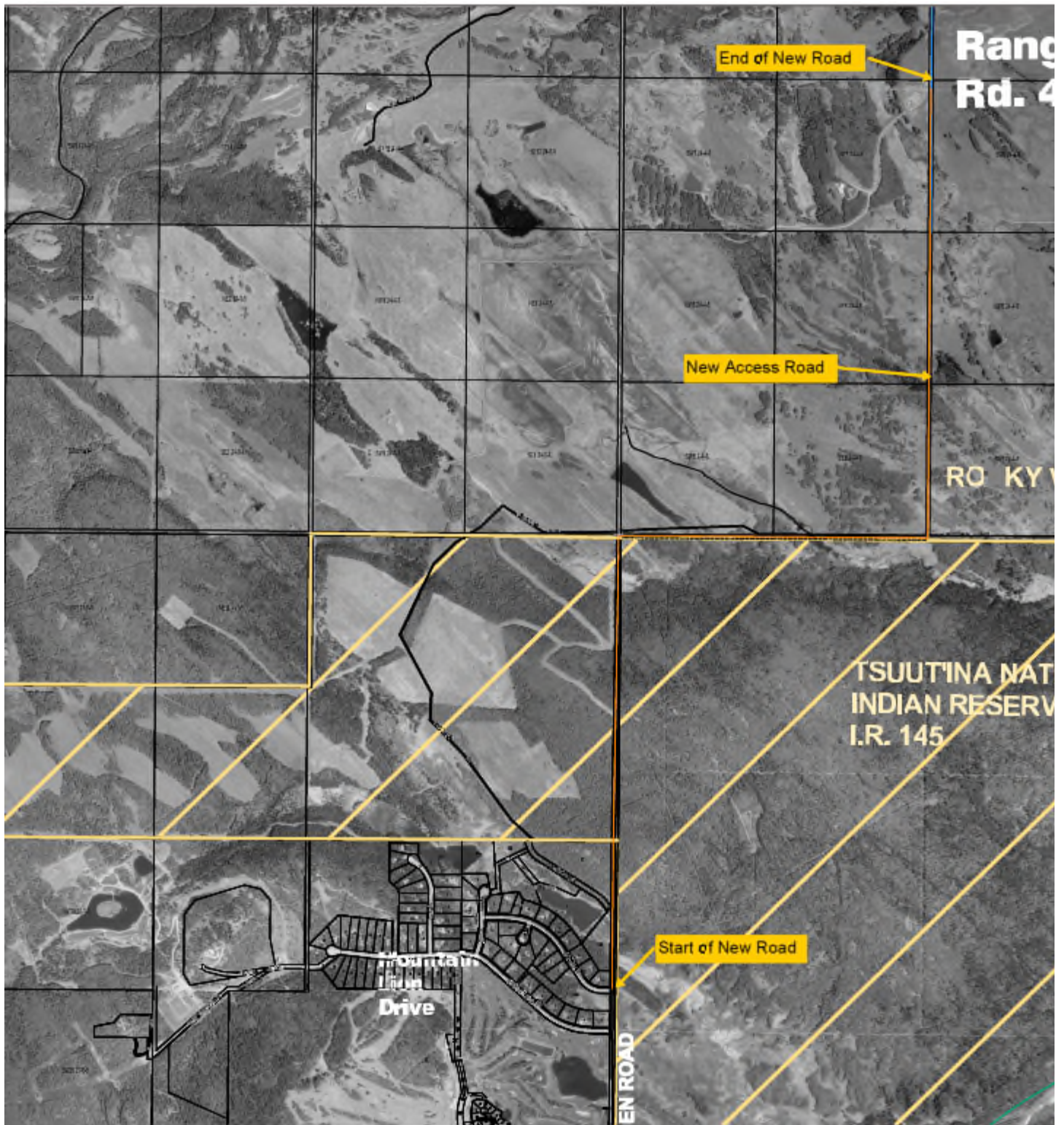
As noted previously, this is just a planning study. The timing of actual design/construction is not determined.

We are currently looking for information on your facility, impacts to your facility, and mitigations and estimated high-level costs.

Would you happen to know if there are any other utilities along the route?

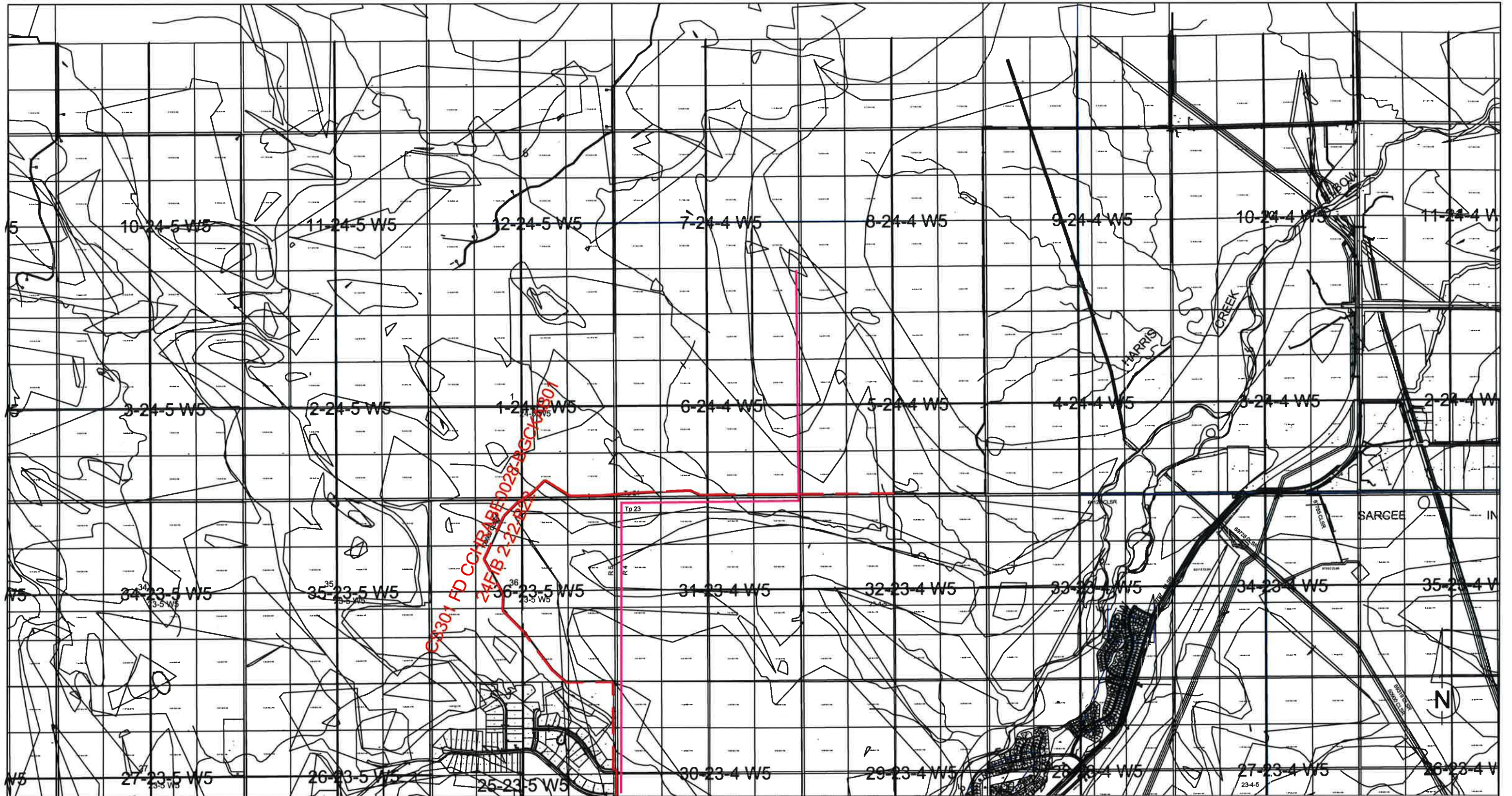
Thanks,

Lou



**Lou Mak, P. Eng.** | Sr. Transportation Engineer, Southern Alberta Roads and Highways – Prairie Region  
| Business +1 (403) 203-3355 ext 254 | Fax +1 (403) 203-3301 | Mobile +1 (403) 998-3412 | [lou.mak@tetrattech.com](mailto:lou.mak@tetrattech.com)

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Construction Notes:

TELECON DESIGN PROJECT # 14616	TELUS®	SCALE 1:500	ORIGINATOR DOUG STEPHENS
DESIGN BY: BRENDA ALWARD			PHONE: 403-801-4171
PHONE: 403-250-3860	WIRE CENTRE:	PROJECT:	NETWORK:
PREPARED BY:	BRAGG CREEK-BGCK		
telecon design	REISSUE	T01.dwg.	PLAN NO. T01
		Date: SEPT 11,2017	

**Mak, Lou**

---

**From:** Yau, Chris <chris.yau@fortisalberta.com>  
**Sent:** Thursday, September 21, 2017 9:10 AM  
**To:** Mak, Lou  
**Subject:** RE: [External Email] West Bragg Creek - emergency access study - Fortis Request 500061714 Sys Mail Num:0776117  
**Attachments:** 500061714-01 Facility Print.pdf; 500061714-01 Budgetary Print.pdf  
**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Good morning Lou,

Please see the attached print for details. The cost to perform the work indicated on the print is approximately \$14,000\*. There are no existing Fortis facility along the proposed emergency road.

Let me know if you have any questions or would like to discuss this in more details.

\*Budgetary Estimate. Cost cannot be accepted.

Regards,  
Chris Yau | Quotation Analyst

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**From:** Yau, Chris  
**Sent:** Thursday, September 14, 2017 10:38 AM  
**To:** 'Mak, Lou' <Lou.Mak@tetrattech.com>  
**Subject:** RE: [External Email] West Bragg Creek - emergency access study - Fortis Request 500061714 Sys Mail Num:0776117

Hi Lou,

I'll send you a print of our existing facilities and provide you with a budgetary estimate next week.

Please contact me if you have any questions or concerns.

Regards,  
Chris Yau | Quotation Analyst

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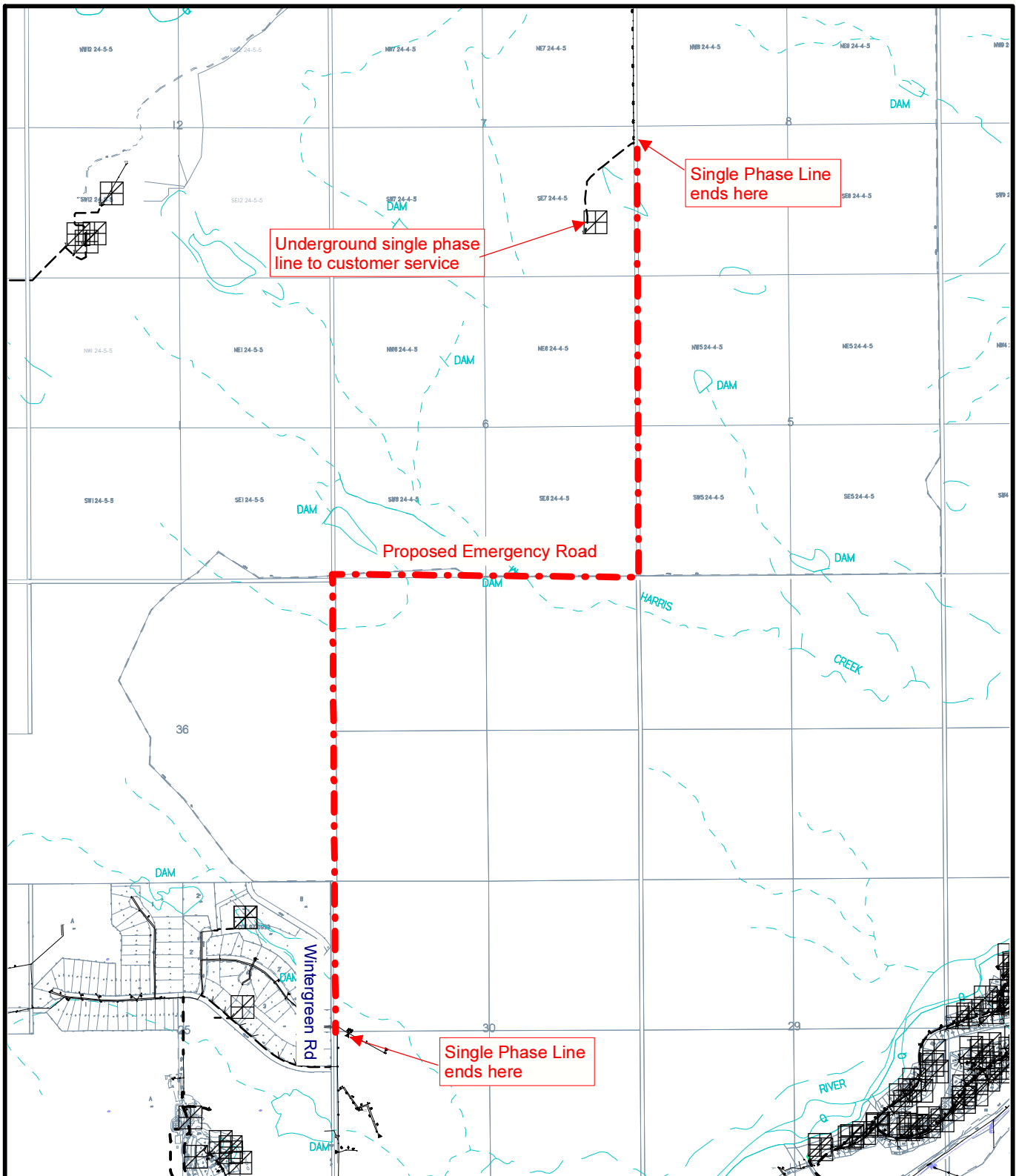
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---

**From:** Mak, Lou [<mailto:Lou.Mak@tetrattech.com>]  
**Sent:** Thursday, September 14, 2017 10:30 AM  
**To:** Yau, Chris <[chris.yau@fortisalberta.com](mailto:chris.yau@fortisalberta.com)>  
**Subject:** [External Email] West Bragg Creek - emergency access study

**Lou Mak, P. Eng.** | Sr. Transportation Engineer, Southern Alberta Roads and Highways – Prairie Region  
| Business +1 (403) 203-3355 ext 254 | Fax +1 (403) 203-3301 | Mobile +1 (403) 998-3412 | [lou.mak@tetrattech.com](mailto:lou.mak@tetrattech.com)

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NOTES:

Facility Print



LAND ONLY TO SCALE 1:30,000  
Print

**FORTIS  
ALBERTA**

LEGEND:  
 RED NEW PRIMARY  
 PURPLE NEW SECONDARY  
 BLUE SALVAGE  
 GREEN BRUSHING  
 BLACK EXISTING FACILITIES

Designer: Yau, Chris

Date: 9/21/2017

Customer: Tetra Tech

Location: SE07-24-04-W5

WO#/OI#: 500061714

**\*\*BUDGETARY ESTIMATE\*\***  
**Cost Cannot Be Accepted**

**FortisAlberta To:**

-Install 170m of new 1ph overhead line and re-connect existing service

-Salvage 170m of existing 1ph overhead line

**Note:**

Quote contingent to all outside approvals

Cost does not include brushing or easements

Final location of structures to be determined at time of design

NE07-24-04-W5

NW08-24-04-W5

Note: Budgetary estimate only. Quote cannot be accepted. Customer must re-apply for a firm quote at the Call Center: (403) 310-9473 (WIRE). Customer must provide final electrical requirements Site check might be required before a firm cost can be made.

SE07-24-04-W5

SW08-24-04-W5

Build ~170m  
of new line

Salvage ~170m of  
line and 2 poles

Connect customer to  
new riser pole

**NOTES:**

Budgetary Print



LAND ONLY TO SCALE 1:3,500  
Print



**LEGEND:**

RED	NEW PRIMARY
PURPLE	NEW SECONDARY
BLUE	SALVAGE
GREEN	BRUSHING
BLACK	EXISTING FACILITIES

Designer: Yau, Chris

Date: 9/21/2017

Customer: Tetra Tech

Location: SE07-24-04-W5

WO#/OI#: 500061714

## APPENDIX K

### COST ESTIMATE – PREFERRED ROUTE 2

**West Bragg Creek**

Emergency Access Study

- Cost estimate for new road section of Route 2

Moose Drive to Range Road 45 tie-in to existing road (6.6 km in length)

ITEM	UNIT	QUANTITY	UNIT PRICE	EST. COST
<b>NEW ROAD INFRASTRUCTURE</b>				
<b>New Road Section</b>				
Granular Sub-base (250 mm)	t	40,000	\$25	\$1,000,000
Granular Base Course (100 mm)	t	15,000	\$30	\$450,000
<b>GRADING</b>				
Common Excavation	m3	750,000	\$7	\$5,250,000
Clearing	ha	17	\$10,000	\$173,000
<b>BRIDGE CONSTRUCTION</b>				
km 0.400 assumed 20 m x 9 m	m2	180	\$3,500	\$630,000
km 2.4 assumed 10 m x 9 m	m2	90	\$3,500	\$315,000
km 3.0 assumed 15 m x 9 m	m2	135	\$3,500	\$472,500
km 0.200 assumed 20 m x 9 m	m2	180	\$3,500	\$630,000
<b>ANCILLARY</b>				
Culverts	m	200.0	\$350	\$70,000
Fencing	km	7.5	\$7,000	\$52,500
<b>WETLAND COMPENSATION</b>				
compensation for worst case scenario	ha	26.00	\$17,700	\$460,200
<b>RIGHT-OF-WAY</b>				
private lands	ac	35.0	\$13,700*	\$480,000
<b>UTILITY</b>				
Telus	L.S.	1	\$70,000	\$70,000
Fortis	L.S.	1	\$15,000	\$15,000
<b>MOBILIZATION</b>				
Mobilization	L.S.	1	10%	\$905,000
TOTAL ESTIMATED COST				\$10,973,200
CONTRACT COST				\$10,974,000

x 1.20 contingency factor =	\$13,168,800
10% Engineering	\$1,316,880

**TOTAL PROGRAM ESTIMATED COST**

(Rounded Up to Nearest \$100,000)

**\$14,500,000**

\*Right-of-way cost estimated by County, and excludes Tsuut'ina Nation lands

Prepared by:

Lou Mak

Date:

November 9, 2017

**West Bragg Creek**

Emergency Access Study

- Cost estimate for new road section of Route 2

Range Road 45 to Highway 22 (approx. 5.0 km in length)

ITEM	UNIT	QUANTITY	UNIT PRICE	EST. COST
<b>PAVEMENT SURFACING TOWNSHIP ROAD 242 (Surfacing Structure based on RVC Regional Transitional Paved road standard))</b>				
Subgrade Preparation	m2	50,000	\$1.25	\$62,500
Granular Sub-base (300 mm)	t	44,000	\$25.00	\$1,100,000
Granular Base Course (100 mm)	t	13,000	\$30.00	\$390,000
Asphalt Concrete Pavement (120 mm)	t	12,000	\$75.00	\$900,000
Line Painting, Signs etc.	L.S.	1	\$10,000.00	\$10,000
<b>MOBILIZATION</b>	L.S.		10%	\$247,000

TOTAL ESTIMATED COST

\$2,709,500

CONTRACT COST

\$2,710,000

x 1.20 contingency factor =

\$3,252,000

10% Engineering

\$325,200

**TOTAL PROGRAM ESTIMATED COST**
**\$3,600,000**

(Rounded Up to Nearest \$100,000)

Prepared by:

Lou Mak

Date:

November 9, 2017

West Bragg Creek  
Emergency Access Study

Preferred Route Option 2  
Cost Estimating Quantities

Common Excavation: Cut Quantity      733071 + 10%

Station: 6+620.000				
	Surface Gravel	0.83	16.66	5505.91
	Sub-Base Gravel	2.37	47.42	15671.51
	Subcut	7.37	147.43	48725.14
	Earthworks Cut	73.67	1905.18	733071.79
	Earthworks Fill	0.00	0.00	659885.43

Clearing:

from Moose Dr to Tsuut'ina S. Bndy

    basic 20 m row      4.8 ha

    additional private land      1.6 ha

    Tsuut'ina west      4.3 ha

Tsuut'ina east (estimated 2/3 of Tsuut'ina)      6.6 ha

Total est. (ha)      17.3

Culverts

km 1.050; est. length      30 m

km 4.500; est. length      70 m

km 5.100; est length      70 m

km 6.300; est length      30 m

Total:      200 m

Fencing (along Tsuut'ina Bndy):

N/S east side      2.4 km

N/S west side      1.6 km

E/W north side      1.6 km

E/W south side      1.6 km

Total      7.2 km

Right of Way

Lot/Legal #	Acres (ac)	Total
14		0.22 ac
15ER		1.76 ac
B		1.90 ac
SE1 24-5-5		0.13 ac
SW6 24-4-5		3.55 ac
SE6 24-4-5		9.06 ac
SW5 24-4-5		4.51 ac
NE6 24-4-5		3.92 ac
NW5 24-4-5		2.16 ac
SE7 24-4-5		2.83 ac
SW8 24-4-5		2.87 ac
Total Estimate		<b>32.91 ac</b>
Tsuut'ina (West)		10.53 ac
Tsuut'ina (East)		24.40 ac