

# HIGHWAY 947 EXTENSION PROJECT

## PROJECT DESCRIPTION

29 January 2014

## EXECUTIVE SUMMARY

Submitted To:

**ALBERTA TRANSPORTATION**  
**North Central Region**

Prepared For

ARA Engineering Ltd  
Suite 101, 110 Country Hills Landing NW  
Calgary, Alberta  
T3K 5P3

Prepared By

Ecofor Consulting Ltd  
9940 – 104th Ave  
Fort St. John, BC  
V1J 2K3  
(250) 787-6009

EPN: 2011-2136-155



## 1.0 Project's Name, Nature and Proposed Location

The name of the Project is *Alberta Highway 947 from Highway 16 to the Athabasca River Bridge*.

The Project is an extension of the existing Highway 47 north from the intersection of Highway 16, about 10 km west of Edson, Alberta. From Hwy 16 it runs north to tie into a bridge crossing over the Athabasca River, at the south end of an existing section of Highway 947, between Fox Creek and Whitecourt (Figure 1). Highway 947 will be constructed with a gravel roadway surface, with provision to pave at a later date.

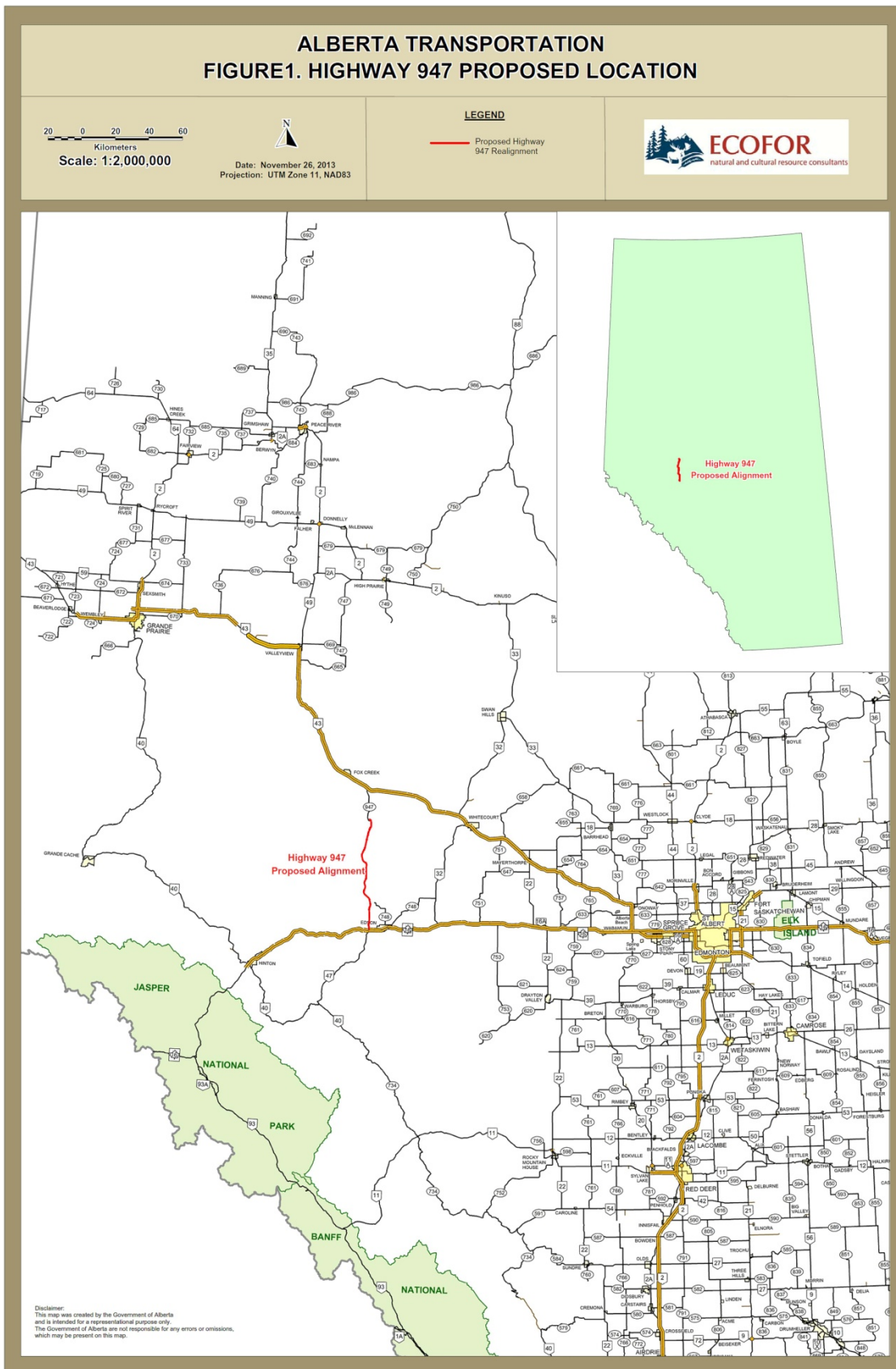
## 2.0 Proponent's Name and Contact Information

The Proponent is:

Alberta Transportation  
4999 - 98th Ave, 3rd Floor  
Edmonton, AB T6B 2X3  
Canada  
Phone: 780-643-1525  
Fax: 780-415-0475

The primary representative for the purpose of the description of the project is:

Stephen Legaree, PBIOL  
Environmental Coordinator, North Central Region  
Alberta Transportation  
Suite 310, 4999 - 98th Ave, 3rd Floor  
Edmonton, AB T6B 2X3  
Canada  
Phone: 780-643-1525  
Fax: 780-415-0475  
Email: [stephen.legaree@gov.ab.ca](mailto:stephen.legaree@gov.ab.ca)



### 3.0 Consultations with Aboriginal Peoples and the Public

Consultation with the public and other jurisdictions has not yet been completed.

Requests for consultation were made to the Alexander First Nation, Alexis Nakota Sioux Nation, Enoch Cree Nation, Louis Bull Tribe, Montana First Nation, Saddle Lake Cree Nation, Samson First Nation, and Sunchild First Nation. Discussions are on-going with the Enoch Cree Nation, Montana First Nation, Paul First Nation, Saddle Lake Cree Nation, Samson First Nation and Sunchild First Nation. Other aboriginal groups have not responded to date.

### 4.0 Other Relevant Information

The environmental assessment and regulatory requirements of other jurisdictions that are relevant to this project include

- Canadian Environmental Assessment Act (Canada)
- Fisheries Act (Canada)
- Navigable Waters Protection Act (Canada)
- Migratory Birds Convention Act (Canada)
- Species at Risk Act (Canada)
- Water Act (Alberta)
- Wildlife Act (Alberta)
- Historical Resources Act (Alberta)
- Environmental Protection and Enhancement Act (Alberta)

There are no Regional environmental studies or plans for the Project area.

### 5.0 Context and Objectives

The location of Highway 947 is an important north-south corridor from west of Edson on Hwy 16 north to an existing bridge across Athabasca River. Currently the general area of Highway 947 is served by a series of existing resource roads. The most northern section of Highway 947, from the Athabasca River north to Highway 43 was constructed in 1970-73. This section of the highway was constructed to service the Kaybob gas field and the resulting sulphur extraction plant just south of the Athabasca River.

The first report proposing Highway 947 south of the Athabasca River was produced in 1975. Hence the proposed route has a history of over 40 years. Yellowhead County would like to see this project complete as it would support and facilitate the economic activity (oil and gas, and increased log hauling, etc.) in the region, and will contribute some of the required funding and manage some of the construction. Local industry (oil/gas/forestry) are very supportive of this project as they see the benefits in terms of efficient transportation of people and products in the area, as well as increased safety for industry and the public by reducing heavy traffic on Hwy 32. It will be a forestry log haul route for logs moving from Edson/Hinton area to Whitecourt, avoiding the need to utilize local roads and causing

conflict with residences/school buses, etc. Recreational traffic mostly travels to the Silver Summit ski resort.

Some potential benefits of this initiative may include:

- create employment/economic spin-off;
- create a transportation corridor from Edson to the Fox Creek area on a provincial highway;
- and reduce industrial traffic volumes that currently use Hwy 32 going to Fox Creek area via Whitecourt.

The objective of the Project is to build and operate a modern roadway to connect Highway 16, about 10 km west of Edson, to an existing bridge across the Athabasca River. Highway 947 will provide a safe, rapid travel route from Highway 16 near Edson to Highway 43 between Fox Creek and Whitecourt. The new highway will be 69.2 km long, and will be designed as a 2-lane paved highway with a 10 m top width and a design speed of 110 km/hr. Stage 1 will be a gravel road with a posted speed of 80 km/hr, with paving (Stage 2) planned to occur at a later time.

Design and construction of the alignment will require a number of watercourse crossings, including two major bridges at Edson River and Pine Creek, standard bridges, and culverts. The project will also involve works at local roads to maintain existing road configurations. The Environmental Impact Statement will provide details on the alignment, stream crossing structures and proposed mitigation measures.

## 6.0 Regulations Designating Physical Activities

The new highway is 69.2 km long and will be predominantly located on a new right-of-way. Therefore the Canadian Environmental Assessment Act (CEAA) Regulations (2012) may apply to this Project under the *Regulations Designating Physical Activities*:

28. The construction, operation, decommissioning and abandonment of
  - (b) an all-season public highway that will be more than 50 km in length and either will be located on a new right-of-way or will lead to a community that lacks all-season public highway access

The capacity of the borrow pits, quarries and gravel pits required for the highway have not yet been determined. Therefore the following section of the *Regulations* may apply:

17. The construction, operation, decommissioning and abandonment, or an expansion that would result in an increase in production capacity of more than 35%, of
  - (i) a stone quarry or gravel or sand pit with a production capacity of 1 000 000 t/a or more

## 7.0 Physical Works

Highway construction will involve a survey for the clearance width, vegetation and surface soil clearance, bridge and culvert installation, and construction of the roadbed. The details of these works have not yet been determined; they will be part of the Environmental Impact Statement.

## 8.0 Capacity of the Project

Highway 947 will be 69.2 km of new highway, which may cause the Project to fall under the Canadian Environmental Assessment Act. There will be a number of sites developed for excavation of gravel and rock for use in construction of the highway. These sites have not yet been designed, but none are anticipated to individually reach 1,000,000 tons per annum production. However, the total capacity of all the sites may exceed that level. The Environmental Impact Statement will include the details of the gravel and rock extraction sites, including their anticipated production, required for the highway.

The traffic capacity of the new highway has not been calculated. However it is anticipated to considerably exceed the capacity of the existing network of industrial roads that presently carry traffic in the area. Highway 947 will be designed to carry all types of motor vehicle traffic, from passenger cars to heavy industrial trucks.

## 9.0 Activities to be Performed in Relation to the Project

The Project consists of several phases with various components, starting with the work required to develop the Environmental Impact Statement, followed by highway construction, and finally its operation. The Highway is anticipated to continue to exist, operate, and be maintained indefinitely into the future. Many of the activities will be performed simultaneously or during overlapping time frames.

### Highway Design

The route of the proposed highway was first determined in 1975, and minor revisions were done in 2001. The Environmental Impact Statement will include a proposed area to be surveyed and marked for clearance. The final area to be surveyed and cleared will depend on the results of the Environmental Impact Statement and the resulting Environmental Assessment; hence the field work will not be done until completion of those processes. The proposed survey and clearance locations that will be included in the Environmental Impact Statement are anticipated to be a close approximation of the final locations, subject only to changes resulting from the Environmental Assessment.

### Environmental Values Assessment

Field environmental assessment work will be done to provide information for the Environmental Impact Statement. The "environmental" work broadly includes studies of all *valued ecosystem components* (VECs). The VECs that have been identified to date include:

#### Biophysical Environment VECs

- fish
- wildlife
- species at risk
- plants
- amphibians
- migratory birds
- weeds
- wetlands
- streams
- ecosystems
- landforms
- soils
- surface hydrology
- groundwater
- noise
- air quality

### **Human Environment VECs**

- historical resources
- archaeological resources
- palaeontological resources
- aboriginal and community values
- socio-economic values

All the VECs will be addressed in the Environmental Impact Statement. Additional VECs may be identified through aboriginal and community consultation and socio-economic review, in which case they will also be addressed in the Environmental Impact Statement. Some of this work requires permits from the provincial and federal governments, and it may also require the involvement of local aboriginal and other communities, organizations and individuals.

### **Construction**

Field construction activities will commence with clearing vegetation from the width of the right-of-way. Top soils will be stripped and stockpiled for later use in reclamation of disturbed areas not used for roadbed or road surface. Borrow pits, gravel pits and rock quarries will be developed, and the materials used in the construction of the highway. The right-of-way will be levelled and graded, the roadbed constructed, and the highway will initially be surfaced with gravel and asphalt will be applied in the future. Bridges and culverts will be installed at stream crossings and other locations where drainage is required to carry fish and/or water from one side of the highway to the other. The right-of-way will be shaped to provide drainage away from the roadbed, including drainage ditches, and areas not to be used by traffic will be revegetated. A more detailed description of the construction process will be included in the Environmental Impact Statement.

### **Operation**

During the operational phase there will be a wide range of vehicles using the highway, primarily motorized (cars, trucks) but with some unmotorized (bicycles, primarily after paving). Foot traffic may occasionally use the sides of the highway, although this is anticipated to be rare because of the general lack of settlement along the route. A more detailed description of the operational phase will be included in the Environmental Impact Statement.

### **Maintenance**

Maintenance activities include ditch maintenance; snow clearing; general road maintenance such as grader work, sign maintenance, weed mowing, and, after paving, line painting and pavement patching; bridge maintenance; and culvert maintenance. A more detailed description of maintenance will be included in the Environmental Impact Statement.

### **Decommissioning and Closure**

The highway will be operational indefinitely into the future; therefore no decommissioning or closure activities are planned for the highway itself. Borrow pits, gravel pits, rock quarries, and laydown areas



that are closed after the completion of construction will have reclamation prescriptions specified in the Environmental Impact Statement. In many cases the reclamation prescription for such areas will be designed to be part of fish and wildlife habitat mitigation and compensation measures.

## 10.0 Wastes to be Generated During the Project

The existing air quality in the vicinity of the Project is influenced by traffic and nearby industrial activities. Local road traffic and oil/gas industry are the predominant existing sources of air contaminant emissions in the Project area, with forest harvesting sporadically producing emissions. In the vicinity of the Project area, existing contributors to air pollution include combustion emissions from vehicle traffic and machinery; forest harvest waste burning; generation of airborne dust by traffic; natural gas wells; gas flaring; gas processing plants; and other oil/gas industry plants. These emissions are anticipated to remain unchanged as a result of the construction of Highway 947.

The new highway length will be 69.2 km, including sections built over existing local roads. This is shorter than the existing winding route along existing resource roads. However, traffic volumes can be expected to increase, due to the higher quality and traffic speed of the new highway. Driving conditions on the new highway will be easier than the existing roads, and hence less fuel will be burned to travel each kilometer. It is unclear at this time whether there will be a net increase or decrease in emissions, including greenhouse gasses, from motorized traffic in the local area. There is unlikely to be a net change in total automobile traffic in this region of Alberta; hence here is unlikely to be a net regional change in gas emissions.

Greenhouse gas production is anticipated to temporarily increase during the construction phase, because the machinery will produce greenhouse gasses in addition to those produced by the existing traffic on the existing roads.

Liquid discharges from the highway will primarily be water. There will likely be small discharges of petroleum products due to spills and machinery malfunction during construction; these will be addressed as described in the Environmental Construction Operations Plan (ECOPlan) prepared by the construction contractor prior to construction. Measures to guide the contractor's ECOPlan will be included in the Environmental Impact Statement. There will be minor discharges of petroleum products such as oils from leaks from vehicle engines during the long term operation of the highway, and occasional larger spills due to accidents. Mitigation measures to minimize the environmental impact of such spills, such as highway design measures, will be included in the Environmental Impact Statement.

Waste disposal is a component of the Environmental Construction Operations Plan (ECOPlan), which will be prepared by the construction contractor prior to construction. The ECOPlan will detail the specific waste stream and hazardous management procedures applicable to the contractor's scope of work and work plan. Anticipated wastes include cement, concrete, wood products, oils, fluids, and asphalt. All waste materials will be retained in appropriate containment onsite and then transferred to appropriate recycling or disposal facilities at appropriate times during the project.



Maintenance work during the operational phase will also produce wastes. Road works and resurfacing will be conducted in accordance with Alberta Transportation standards and the contractor will be required to dispose of waste asphalt or other materials in appropriate locations, similarly to what was prescribed for the construction phases. Spills and other wastes associated with the road users will be handled according to applicable provincial and federal regulations.

## 11.0 Phases and Schedule of the Project

The environmental assessment work and historical resources assessment and mitigation work is expected to be completed by December 31, 2014. The highway right-of-way and clearance area will be surveyed and marked in 2015, with concurrent clearance of the alignment right-of-way followed by grade construction and watercourse crossings. Completion of Phase 1 of the highway construction (gravel surfaced roadway) is anticipated for 2016, at which time the operational phase will commence. Phase 2 construction (asphalt paving) has not been scheduled, and will depend on traffic use and funding availability. Staging areas for construction materials and equipment will be specified in the Environmental Impact Statement, and will be within the assessment area. Additional details of the scheduling and staging will depend on the outcomes of information resulting from aboriginal and community consultation, environmental assessments, and budget planning, and will be provided in the Environmental Impact Statement.

Road building and infrastructure construction works are not seasonally constrained, and may occur in any season. Timing constraints may be placed on select aspects of the project and will be stipulated by the environmental assessment and the associated authorizations or approvals. Proposed timing constraints will be stated in the Environmental Impact Statement.

The operation of the highway is anticipated to start in late 2016, and is intended to continue indefinitely. There will be no decommissioning and abandonment phases.

Construction activities will include vegetation clearance (trees, shrubs, herbs); excavating; grading; de-watering of wetlands, streams, ponds and saturated soils; drilling at bridge sites; piling installation; infilling of depressions and stream crossing structure approaches; and installing stream crossing and other structures. This work will utilize earthen materials from borrow excavations and quarries near the site. Gravel and riprap materials if required will come from an aggregate source; the locations have not yet been determined. Materials such as geotextile and geo-products, culverts, bridge and overpass components, cement, precast concrete products, asphalt, and fuel will come from suppliers selected by the contractor.

Reclamation works, if and where required, will occur in accordance with applicable Alberta Environment and Sustainable Resource Development guidelines.

Operation of the completed highway will include maintenance activities. Roadway runoff and ditch maintenance will involve use of labour and machinery. Snow clearing will involve use of snowplows, with sand and/or chemical compounds applied in accordance with Alberta Transportation standards and specifications. Road maintenance activities will be scheduled as required throughout the operational

stage of the project. Road maintenance could involve use of machinery and any of the associated materials identified for use in the construction phase.

The requirement for illumination will be determined through the detailed design process. If illumination is required for the project then there will be some energy needs, resulting in a requirement for construction of electrical infrastructure.

Toxic or hazardous materials may be used during the construction and would include the fuel and associated fluids to operate the construction and maintenance machinery, cement used for the construction, asphalt for the paving, and road de-icing chemicals used during the operation. All of these materials would be used in accordance with federal and provincial regulatory requirements.

Toxic, hazardous, or otherwise dangerous materials may be present during roadway operation, because it is a transportation corridor intended to transport goods. It is possible that vehicles using the highway could be hauling toxic substances. In Canada the transport of toxic substances is controlled by the Transportation of Dangerous Goods regulations. Transporters are in many cases required to have protection measures, including response plans and spill containment plans in place.

## 12.0 Project Location

The south end of the Project is located at the existing junction of Highway 16 and Highway 47, about 10 km west of Edson, Alberta. The south end of the Project is at 53° 34' 06" N 116° 34' 52.53" W; also UTM Zone 11u.527732.5935568. It is at the corners of SE 16 53 18 W5M, SW 15 53 18 W5M, NE 9 53 18 W5M, and NW 10 53 18 W5M.

The north end of the Project is at the north end of an existing bridge across the Athabasca River, west of Whitecourt, Alberta. The north end of the Project is at 54° 09' 12" N, 116° 35' 56" W; also UTM Zone 11u.526205.6000657. It is at NW 35 59 18 W5M.

The nearest urban area is the community of Edson, about 10 km east of the south end of the project. The community of Fox Creek is about 30 km northwest of the north end of the Project, and Whitecourt is about 55 km east of the north end. One residential property is directly impacted. The highway is generally located distant from residential and urban areas.

The Project is not in close proximity to any Federal Lands or Aboriginal Lands. The closest reserve is approximately 19 km to the northeast of the north end of the project, with another approximately 49 km to the east.

## 13.0 Federal Financial Support

There is no proposed or anticipated federal financial support that federal authorities are, or may be, providing to the designated project.

## 14.0 Federal Lands

There is no federal lands that may be used for the purpose of carrying out the designated project, including no granting of interest in federal land (i.e., easement, right of way, or transfer of ownership).

## 15.0 Federal Legislation or Regulatory Requirements

Highway 947 may be required to meet the requirements of the Canadian Environmental Assessment Act (CEAA), as specified in the *Regulations Designating Physical Activities*.

Fish and fish habitat, as defined under the Fisheries Act, will be impacted during construction of stream crossings. For some of the streams a *Notification* will be all that is required; for a few of the streams an *Authorization* may be required.

Watercourses will be assessed under the criteria of the Navigable Waters Protection Act to determine if they may be deemed navigable. If they are deemed navigable, Transport Canada approval may be required for stream crossing structures.

Highway 947 will pass through habitat used by birds that are protected under the *Migratory Birds Convention Act*. The requirements of the *Act* will be met.

## 16.0 Physical and Biological Setting

### 16.1 Air

The air quality is apparently generally good, with the predominant air flow moving eastward from the Rocky Mountains towards the prairies. There are no large urban areas or industrial centers to the west, from which large-scale pollution can be carried. The nearest large urban center is Edmonton, AB, about 200 km to the east; little influence on air quality in the Project area can be expected on the rare occasions when the winds are from the east. Gas production flaring likely produces some air pollution. Considerable amounts of dust are generated by traffic on local unpaved resource roads; the traffic includes a high proportion of heavy truck traffic.

### 16.2 Water

The Water Survey of Canada (WSC) operates or has compiled data from a network of hydrometric stations in the vicinity of the study area. The mean annual runoff increases from 117,000 m<sup>3</sup>/km<sup>2</sup>/yr in the south to 152,000 m<sup>3</sup>/km<sup>2</sup>/yr in the northern section of the alignment. These values correspond to average annual runoff depths of 117 to 152 mm which is approximately 20 to 30% of the average annual precipitation.

The seasonal variation in discharge indicates that the snowmelt freshet dominates the annual hydrograph in larger streams such as Sundance Creek or Athabasca River. Streamflow begins to increase in March or April, typically peaks in June or July and reaches winter base flow conditions by November or December. Precipitation events augment streamflow throughout the open water periods and can result in substantial flood flows during the height of the snowmelt in May, June or July.

The short term seasonal data from the four small (<24 km<sup>2</sup>) gauged watersheds in the vicinity of the proposed highway alignment suggest that the snowmelt freshet begins in late-March or early-April, peaks in mid-May and is more or less completed by mid-June. Subsequent open water flows are strongly influenced by rainfall activity with convective processes resulting in short-duration events which can exceed the snowmelt peak. Streamflows are substantially reduced by late-September.

The record of annual maximum daily and instantaneous data collected at the long term stations Athabasca River near Windfall and Sundance Creek indicate the timing of regional floods in these larger watersheds. These data suggest that sizeable flows occurred in 1965, 1972, 1980, 1982, 1997 and 2011. Data compiled by the Alberta Ministry of Environment and Sustainable Resource Development indicate that heavy precipitation associated with the June 2013 flood did not extend north into the project area. A review of how runoff values in the 30-years between 1971 and 2000 have compared to those recorded in the preceding time periods indicates that the mean annual discharge has been increasing in west-central Alberta.

Analysis of digital 1:20,000 scale topographic mapping, combined with field review during initial fisheries studies, indicates that the proposed highway alignment will cross 32 mapped watercourses. Five small mapped streams at the northern end of the alignment could not be located in the field. There are other sites where streams closely parallel the route of the highway.

The digital topographic data indicate that the basin areas upstream of the highway crossings range from <0.3 km<sup>2</sup> to 218 km<sup>2</sup>. The majority of the stream crossings have upstream basin areas of <5 km<sup>2</sup> and, with the exception of four crossings, all the crossings have upstream catchments of <15 km<sup>2</sup>. The three larger streams include the Edson River's mainstem crossing (basin area 218 km<sup>2</sup>), crossing of two unnamed tributaries to Edson River (basin areas 20 and 61.68 km<sup>2</sup>) and a crossing of Pine Creek (basin area 176.1 km<sup>2</sup>).

The majority of the small stream crossings on the alignment consist of narrow, single thread channels and appear laterally stable in areas where the bank vegetation has not been disturbed. These channels are unlikely to pose significant or unusual design challenges. The largest watershed with a stream crossing is Edson River. This consists of an irregular, single thread and likely incised channel. The proposed alignment crosses at the apex of a wide radius and apparently laterally stable meander bend. The northern Edson River tributary crossing is located near an existing road. The channel consists of a small irregular channel which has formed a narrow discontinuous valley flat incised within a higher plain. The channel appears to be laterally stable. None of these crossings appear to have unusual hydrotechnical issues. The second largest watershed with a stream crossing is Pine Creek. This irregularly meandering channel is flowing within a moderately wide valley flat. The channel contains unvegetated gravel bars indicating that the channel is laterally mobile and is periodically transporting a coarse-textured bed load. The proposed highway crossing is located within or near a previously cleared right-of-way. The crossing design will need to consider future channel instability and provide passage for water, coarse sediment and, potentially, debris.

## 16.3 Terrain and Vegetation

### 16.3.1 Terrain

The physiography of the Project area places it as part of the Southern Western Alberta Plains and the Alberta Uplands. Within that classification, the highway falls within the Edson Lowland, Edson Benchland, Mayberne Tableland and Athabasca Benchland physiographic subdivisions. Those are described as follows:

- The Edson lowland corresponds to an undulating to gently rolling topography smoothed out by glaciolacustrine sediments from the last glaciation. Its altitude varies from 900 à 1000 m and its upper limit occurs around Km 15.
- The Edson Benchland lies between the Edson Lowland and the toe of the Mayberne Tableland. The topography forms a plateau-benchland landscape varying from 1000 to 1100 meters of elevation. It is comprised between Km 15 and 30.
- The Mayberne Tableland lies between km 30 and 55. It consists of high plateaus of 1100 to 1250m overhung by flat top parallel ridges isolated by mostly steep-side valleys. Those summits reach an elevation of 1450 m.
- The Athabasca Benchland is the uppermost physiographic division and lies from km 55 to 69. As for the Edson Benchland, the topography forms a plateau-benchland landscape, generally ending at the foot of the Mayberne Tableland, but in addition steep-sided valleys are cut through the plateaus. The elevation varies from 800 m to 1100m.

The Mayberne Tableland draws the waterline between the Pine Creek watershed facing north and the Edson River area and other unnamed creeks watersheds flowing south-easterly. Pine creek connects directly to the Athabasca river while the Edson drainage area drains through the McLoad river, which also connects with the Athabasca further down. Except on the Mayberne Tableland and active alluvial plains, the area is covered by a dense forest boreal forest.

The study area is underlain by rocks belonging to the Paskapoo Formation of Pleistocene age. This formation is composed of weakly consolidated beds of sandstone, silt-stone, mudstone and shale with interbedded strata of shale, coal, chert and conglomerates consisting predominantly of metaquartzite, sandstone and chert. The sedimentological sequence and the subsequent natural processes left four main types of surficial material in the area: glacial (62.6%), alluvial (12.1%) glaciolacustrine (11.2%), colluvial (8.3%), glaciofluvial (5.6%) and a tiny area of Eolian ( 0.2%). Those units are described below according their distribution across the highway corridor and their sedimentological and morphological settings; and finally a brief summary was achieved.

Till is the most widespread material in the study area. It is overlaid by glaciolacustrine sediments in the Edson Lowland and Benchland, and is mainly reworked as alluvial and colluvial material in the Pine creek valley. Glaciofluvial, eolian and stagnant ice moraine deposits can also be found locally in this valley. Finally, pre-glacial valleys filled with glacial sediments would locally underlay the highway corridor.

The study area is composed of a majority of Luvisolic soils (56.6%). In order of importance the rest of the area is covered by Regosolic soils (15.5%), Brunisolic soils (8.7%), Organic soils (8.0%), Gleysolic soils (7.7%) and Nonsoils (3.5%). The Luvisolic soils are mainly found on the lower half of the highway corridor (< km 35) and in the Pine creek valley (km 55). The Regosolic soils found in the highway environment are located in the Pine Creek valley between km 42 and 61. Brunisolic Soils are located on the last ten kilometers of Pine Creek valley (Km 60 to 69). Organic soils form isolated patches found between km 0 and 25. Gleysolic soils are in the upper section of the Pine creek valley (km 35 to km 52). The Nonsoil category corresponds most of the time to very steep slope topography with heterometric coarse material highly disturbed by river erosion and mass wasting processes. They are found mainly on the steep sides of lower Pine Creek valley (km 58 to 68) and in contact with the Edson River (km 6).

The lower section of Pine Creek valley (km 55 to 69) is characterized by U shape profile typical of glaciated valleys. Those valleys are likely due to mass wasting processes mainly because of their high gradient, but also because streams may have modified or are still modifying the toe slope profile and initiating instabilities. According to the information available, the west side of Pine Creek valley between km 58 and 66 could have instability signs and possible predispositions for landsliding.

For its last 20 km Pine Creek shows a channel pattern varying from braided to anastomosed with some meandering sections with an estimated 0.0088 slope gradient. The 130 km<sup>2</sup> watershed is 35 km long by 2 to 18 km wide. Its upper half drains steep sided slopes surrounded by a flat summit of an average elevation of 1250 m. At its mid-point the river bed lies at an altitude of 1000 m, and at its mouth it sits at 800 m. This watershed morphology results in a highly reactive watershed likely to generate flash floods and thus river bank erosion. This, in fact, happened in summer 2012 and led to the washout of existing road sections in the lower section of the river.

### 16.3.2 Vegetation

The Project area is within the Foothills Natural Region, which includes the Lower and Upper Foothills Natural Subregions. The topography is highly variable, ranging from sharp, bedrock-controlled ridges near the mountains to rolling and undulating terrain in the north and east. Mixed forests of aspen, lodgepole pine, white spruce and balsam poplar with variable understories on Gray Luvisolic soils are dominant on average sites at lower elevations. Mixed forests of aspen, lodgepole pine, white spruce and balsam poplar with variable understories on Gray Luvisolic soils are dominant on average sites at lower elevations. Lodgepole pine forests with less diverse understories and well developed feathermoss layers on Brunisolic Gray Luvisols are typical of higher elevations (Natural Regions Committee 2006).

The Project area is mostly within the Lower Foothills Subregion, with the central, higher elevation part of the Project in the Upper Foothills Subregion. Within the Lower Foothills Subregion, forests on upland sites are typically deciduous or mixedwood with aspen, balsam poplar, white birch, lodgepole pine, white spruce and black spruce as common associates. Wetlands are mainly vegetated by stunted black spruce and tamarack or shrub-graminoid communities (Natural Regions Committee 2006).

The Upper Foothills Natural Subregion is dominated by forests that are typically even-aged fire origin lodgepole pine stands, often with an understory of black spruce. White spruce stands occur along river

valleys and on lower slopes. Deciduous and mixedwood stands are restricted to southerly and westerly slopes where conditions are similar to those found at lower elevations. Shrubby grasslands occur on the driest sites, and poor to rich fens dominated by black spruce, tamarack, shrubs and herbs occur on low, wet sites (Natural Regions Committee 2006).

The study area is dominated by natural and semi-natural ecosystems, with frequent gravel and dirt roads and trails. Clearings for power transmission lines and pipelines are the dominant land use within and adjacent to the study area.

All vascular and some non-vascular plant species present in the project area were recorded for at least one site within the Project area. The Project area within 150 m of the centreline was searched on foot for rare plants in 2012 and 2013. Voucher specimens were collected for identification as required, and a database of all records was compiled.

There were 302 species of plants recorded from the Project area in 2012 - 2013. Of these, a total of 5 plant species are *at risk* -- *Botrychium lanceolatum* (S2), *Botrychium pinnatum* (S3), *Chrysosplenium iowense* (S3), *Lactuca biennis* (S2), and *Pinguicula villosa* (S2) [S2 - provincially threatened; S3 - provincially special concern].

The relatively undisturbed nature of the Project area results in a limited distribution and relatively low abundance of noxious weeds. Three noxious weeds have been recorded from the Project area - Canada thistle, common tansy, and oxeye daisy. Roadsides, drill pads, powerline and pipeline right-of-ways, and other disturbed areas typically have these species throughout the study area. Some were also found in naturally disturbed areas such as beaver dams.

## 16.4 Wetlands

There are 38 wetlands within 150 m of the proposed centreline of the highway, which have been field verified and classified. Forested bogs and fens predominate, with a small amount of marsh, swamp, and shallow water pond areas.

Wetland Area Within 150 m of the Proposed Centerline:

Wetland Classes	Area within 150 m of centerline (ha)	% of Area within 150 m of centerline
<b>Bog</b>	34.5	1.65%
<b>Fen</b>	48.8	2.33%
<b>Marsh</b>	18.2	0.87%
<b>Shallow Water</b>	1.0	0.05%
<b>Swamp</b>	7.5	0.36%
<b>TOTAL</b>	<b>110.0</b>	<b>5.26%</b>

Peatlands, comprised of bogs and fens, made up 15 of the wetland areas and cover an area of 83.3 ha within the Project area (4.0 %). In some cases it can be difficult to distinguish between bogs and fens; vegetation cover provides some indication, but the underlying hydrology can be difficult to detect. Fens typically originate in areas with mineral rich water—the water contains minerals because it is constantly (if slowly) moving overland or subsurface. Water in bogs is mineral poor and generally acidic; it



originates mainly from rainfall. Fens can also be nutrient poor, resulting in a gradient of nutrient richness from bog to fen, for which it is sometimes difficult to delineate individual peatland areas. Nonetheless, many peatlands exhibit similar vegetation communities, and mitigation recommendations for peatlands are based not on the specific wetland class, but on the vegetation and wildlife resources identified within. Some peatlands are commonly referred to as "muskeg".

Non-peatland wetlands (marshes, swamps, and shallow water) comprise 26.7 ha within the Project area (1.3%). These wetlands tended to be small and isolated when compared to some of the extensive peatland areas; excluding several wetland complexes associated with stream areas altered by beavers.

Marshes and swamps were primarily distinguished by the abundance of trees over 6 m tall. Marshes and swamps can be quite similar in vegetation and other characteristics when tall shrubs are present. Shallow water wetlands require open water to cover greater than 75% of the wetland area. Most open water within the Project area is within streams or beaver ponds—which are also associated with the surrounding wet areas, and tended to be classified as marshes or swamps. Shallow water wetlands are rare in the Project area.

*Bogs:* Six wetlands within the Project area are classified as bogs. Most of the bogs are forested to some degree and have areas within the Project area that range from 0.3 ha to 17.1 ha. The larger bog areas tend to extend far beyond the boundaries of the Project area. Three CWCS bog subforms were identified: Flat Bog, Blanket Bog, and Basin Bog. Flat bogs are not confined within a well-defined basin and tend to cover extensive, flat, lowland areas. Blanket bogs also commonly cover extensive areas, however, they are found on gentle slopes. Basin bogs are confined to relatively discrete basins with no feeder streams and have a generally flat surface that is not raised above the surrounding area.

*Fens:* Ten wetlands were identified as fens within the Project area. Fens, also being peatlands, bear a strong resemblance to many of the described bogs. Fens differ in terms of vegetation, often with a large component of sedge in non-treed fens, or larch in treed fens. The dominance of these vegetation types is indicative of more nutrient rich water, which is a defining characteristic of fens. Because fens also tend to have moving water (overland or subsurface), the characteristics of local geography / hydrology also play a role in determining whether wetlands were fens or bogs (i.e. in areas where direction drainage was evident, especially in conjunction with identified drainages, a wetland is more likely a fen).

Three CWCS fen subforms were identified in the Project area: Horizontal fen, basin fen, and spring fen. Horizontal fens (similar to Flat Bogs) tend to occur in large poorly defined depressions, usually on gently sloped surfaces. Basin Fens are confined within basins in the local geography, but often have out-flowing streams. Spring fens occur in locations that have mineral rich springs providing the ground water.

*Swamps:* Within the Project area, four wetlands were classified as swamps. Two subforms of swamp were identified: Basin Swamp and Riverine Swamp. Basin Swamps usually occur in well-defined basins and may develop a layer of peat. Riverine Swamps occur along watercourses (permanent and intermittent).

*Marshes:* Fifteen wetlands were classified as marshes within the Project area. Four marsh subforms were identified, based largely on drainage characteristics: Linked Basin Marsh (n=2), Isolated Basin

Marsh (n=5), Discharge Basin Marsh (n=1) and Riparian Stream Marsh (n=7). Basin Marshes are found within well-defined basins or depressions, and receive water from precipitation, surface runoff, groundwater discharge, and stream inflows. Discharge Basin Marshes receive most of their water from groundwater discharge, and are found in low lying areas. Isolated Basin Marshes are usually in shallow depressions and lack surface inlets or outlets. Linked Basin Marshes have inlets and outlets but may only have water during times of high runoff. Riparian Stream Marshes are located along stream channels, embankments and riparian zones.

*Shallow Water:* Only one shallow water wetland was found within the Project area. The subform was identified as Linked Basin Water, which is defined as occupying a well-defined basin with in- and out-flowing streams.

## 16.5 Fish

The Project is located within the Edson River drainage to the south and the Pine Creek drainage to the north; both drainages are part of the Athabasca River watershed. The Project area has high potential for fisheries values, with native mountain whitefish, burbot and Athabasca rainbow trout. The Project area is within Fish Management Zone ES3.

The Edson River drainage supports *at-risk* and *sensitive* species that include Athabasca rainbow trout (at-risk), Arctic grayling (sensitive), northern redbelly dace (sensitive), and spoonhead sculpin (sensitive). Records of secure species include brook stickleback, burbot, finescale dace, lake chub, longnose dace, longnose sucker, mountain whitefish, trout perch and white sucker. The exotic species brook trout has also been historically found within this drainage.

The Pine Creek drainage supports *at-risk* and *sensitive* species that include Athabasca rainbow trout (at-risk), Arctic grayling (sensitive), bull trout (sensitive) and spoonhead sculpin (sensitive). Records of secure species include burbot, lake chub, longnose dace, longnose sucker, mountain whitefish and white sucker.

## 16.6 Birds

A total of 40 hours were spent in the field conducting nesting bird surveys in 2012, and 64 hours in 2013. There were 69 different bird species or groups of species recorded -- 52 in 2012 and 44 in 2013. Some birds were not able to be identified to species due to similarities in appearance and song to a closely related species (blackbirds) or because scat was used to identify species presence (grouse). One bird species (three-toed woodpecker) was recorded as an incidental observation during other work in February 2013, and then was recorded during the surveys in 2013. The nests of 4 species were found in the survey area. In 2012, two song sparrow nests were found (one had eggs and the other had chicks); cliff swallows were nesting under the bridge over the Athabasca River; and one American robin nest with chicks was found. In 2013 a grey jay nest was found and cliff swallow nests were again observed in a second location. Most of the other birds were likely breeding in the area. There were 23 species recorded in 2012 but not 2013, and 13 species recorded in 2013 but not 2012. This reflects a combination of habitat differences (especially elevation) and normal year-to-year variation in bird presence and abundance.

Thirteen species were common throughout the study area in one or both years: alder flycatcher, cliff swallow, gray jay, red-breasted nuthatch, American robin, ruby-crowned kinglet, Swainson's thrush, Tennessee warbler, yellow warbler, yellow-rumped warbler, chipping sparrow, dark-eyed junco and white-throated sparrow. Twelve species are fairly common in one or both years: ruffed grouse, grouse species, Wilson's snipe, northern flicker, gray jay, boreal chickadee, ruby-crowned kinglet, hermit thrush, warbling vireo, song sparrow, and brewers and/or rusty blackbirds (could not be distinguished).

The April 2013 survey detected six owls of four different species: northern saw-whet owl, boreal owl, long-eared owl, and great horned owl. A great gray owl was observed hunting prior to the commencement of the survey. Single individuals of long-eared and great gray owls were seen during the May 2013 nesting bird survey.

Eight species are bird *species at risk*. They are all listed as sensitive by Alberta ESRD, and are on the ACIMS watch list: osprey, American kestrel, sandhill crane, pileated woodpecker, least flycatcher, common yellowthroat, western tanager, and great gray owl. No rusty blackbirds were confirmed, because their song could not be distinguished from Brewer's blackbird, but they are likely present.

## 16.7 Amphibians

Amphibians breed in open-water such as ditches, ponds, lakes, ponded streams, and shallow-water wetlands. They migrate to the breeding sites in the spring, and migrate to upland living areas for the summer. Three species of amphibians have been found within the study area:

- Wood Frog, *Rana sylvatica*
- Boreal Chorus Frog, *Pseudacris maculata*
- Western Toad, *Anaxyrus boreas* (calling population)

It is unlikely that any other amphibian species occur within the Project area.

Amphibians recorded 2012 - 2013 included 2 sites with Western Toads, 45 sites with Wood Frogs, and 20 sites with Boreal Chorus Frogs. Fourteen sites had tadpoles too young reliably identify. In the Project area, Western Toads are rare, Boreal Chorus Frogs are uncommon, and Wood Frogs are common.

## 16.8 Mammals

Most mammals living in the Project area are of commercial and cultural importance for hunters and trappers. The surveys confirm the presence of 18 species or groups of species of mammals:

- American badger
- black bear
- moose
- red squirrel
- white-tail deer, mule deer
- snowshoe hare
- weasel species
- American marten
- fisher
- Canada lynx
- coyote
- shrew species
- vole species
- mouse species
- grey wolf
- wolverine
- northern river otter
- red fox

The greatest numbers of species found in winter were in the coniferous and mixed habitat types, with 14 species being found in each. The riparian habitat type had the next most at 13 species, while the deciduous habitat type had the least species with only 8 species found in total. The long-tailed weasel and wolverine are ranked 'may be at risk' by Alberta ESRD. The tracks of different weasel species could not be distinguished; hence it is unknown whether the tracks were made by a long-tailed weasel or another weasel species. Wolverine tracks were found in several places along the study area. American badger, fisher and Canada lynx are ranked as 'sensitive' by Alberta ESRD. Fisher and marten tracks could not be distinguished, but Canada lynx tracks were common throughout the study area. American badger was only seen once, crossing a road near the Project area, but is assumed to use the Project area.

## 16.9 Species at Risk

Athabasca rainbow trout are a genetically distinct population of rainbow trout that is unique to the Athabasca River watershed, and is presently ranked as *at risk* in Alberta. The trout occur throughout the Pine Creek watershed, including in many of the small headwaters tributaries, and locally in the Edson River watershed. Northern redbelly dace occur in some tributaries of the Edson River, but do not appear to occur in the Pine Creek watershed. They are ranked as 'sensitive' by Alberta ESRD. In contrast, bull trout occur in the main channel of Pine Creek, but do not appear to occur in the Edson River watershed. They are also ranked as 'sensitive' by Alberta ESRD.

Western Toads are listed as Sensitive by Alberta SRD and Special Concern under Schedule 1 of the federal Species at Risk Act. The "calling" population-type is present in the Highway 947 study area. Fair to good habitat for Western Toads exists within the study area, with breeding and overwintering habitat present in small wetlands and ponded water along streams.

Trumpeter swans are listed as 'at risk' by Alberta ESRD and designated as "Threatened" under the Alberta Wildlife Act. There is one identified Trumpeter Swan lake just to the east of the Project area, near the south end, which has the un gazetted name of "Lacy's Lake". The osprey is classified as 'sensitive' by Alberta ESRD. The species is uncommon but widespread, and is vulnerable to loss of nest sites. The osprey returns to the same nest year after year. One osprey has been observed in the project area. The great grey owl is classified as 'sensitive' by Alberta ESRD. Both observations of the owl were of it hunting along the current power transmission line right-of-way that parallels the proposed highway right-of-way. The pileated woodpecker is classified as 'sensitive' by Alberta ESRD. The species is uncommon but widespread, and is vulnerable to loss of large diameter trees used for nesting. One was observed in the project area. The rusty blackbird was classified as 'Special Concern' by COSEWIC in April of 2006 and is classified as 'Sensitive' by Alberta ESRD. The rusty blackbird could not be distinguished from the brewer's blackbird during the 2012 survey, but both these species may be nesting within the study area.

American badger is ranked as sensitive by Alberta ESRD and one was seen crossing a resource road near the Project area. Canada lynx are ranked as 'sensitive' by Alberta ESRD. Canada lynx were found throughout the study area during the winter track surveys in 2013. Fisher are ranked as 'sensitive' by Alberta ESRD. Many tracks classified as marten/fisher were found within the study area during the winter track surveys. One fisher was seen crossing a road just outside the project area, confirming the

presence of the species. Wolverine are classified as 'may be at risk' by Alberta ESRD and as 'special concern' by COSEWIC. Wolverine tracks were found in the study area during the winter track surveys.

## 17.0 Fisheries Act, Species at Risk Act, and Migratory Birds Convention Act

Fish may be impacted during construction and operation of the highway during dewatering of sections of streams during construction of stream crossing structures, or during maintenance during operation of the highway. Fish may also be impacted by downstream sedimentation during construction and maintenance. These impacts will be mitigated so as to result in few or no actual impacts to fish. Fish may also be impacted by increased fishing pressure as a result of increased access to the area resulting from construction of the highway.

Fish habitat may be impacted during construction and operation of the highway by construction of stream crossing structures, by removal of riparian vegetation in the clearance width, downstream sedimentation, alteration of channel morphology and dynamics, introduction of deleterious substances, and/or filling of stream channel area by roadbed or protective structures such as riprap. These impacts will be avoided where possible, and, where avoidance is not possible, mitigated or compensated as required by the *Fisheries Act*. There are no aquatic species at risk, as defined in the Species at Risk Act, known to occur in the Project area.

Migratory birds may be impacted during construction and operation of the highway through vegetation clearance, dust, noise and other disturbance, and vehicle collisions. Destruction of active nests will be mitigated as required by the Migratory Birds Convention Act. Some migratory birds may also be impacted by increased hunting pressure as a result of increased access to the area resulting from construction of the highway.

Migratory bird habitat may be impacted as a result of removal of vegetation from the clearance area, by noise and other disturbance, by dust and pollutants, and by light pollution (primarily vehicle lights). These impacts will be avoided where possible, and, where avoidance is not possible, mitigated or compensated as required by the *Migratory Birds Convention Act*.

## 18.0 Extra-territorial Changes to the Environment

There are no anticipated changes to the environment, as a result of carrying out the designated project, on federal lands, in a province other than the province in which the project is proposed to be carried out, or outside of Canada.

## 19.0 Effects on Aboriginal Peoples

The effects on the health and socio-economic conditions of aboriginal peoples of the construction of Highway 947 is being determined through consultation. There are no reserves or other settlements within or near the Project area. The physical and cultural heritage of the area has been assessed for any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

with few effects anticipated. The current use of lands and resources for traditional purposes will be determined through consultation.