Appendix H. Historical Resources Reports

HISTORICAL RESOURCES IMPACT ASSESSMENT
SOUTHEAST LRT ALIGNMENT
IN LSD 15-33-52-24-W4M
IN THE CITY OF EDMONTON

FINAL REPORT ARCHAEOLOGY PERMIT 2011-249

Prepared for

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REPORT ABSTRACT

At the request of Art Washuta of AECOM, on behalf of the City of Edmonton, an Historical Resources Impact Assessment (HRIA) was conducted for a proposed preliminary design project for a proposed Southeast LRT alignment in LSD 15-33-52-24-W4M, in the City of Edmonton, Alberta. The fieldwork for this project was undertaken between October 5 and 25, 2011.

The HRIA survey area consists of a strip of land approximately 100 metres long by 25 metres wide extending from the sidewalk at the south end of the footbridge over the North Saskatchewan River across a gully up to the edge of 98 Avenue.

In-field investigations consisted of foot surveys and shovel testing within select parts of the gully within the proposed project area. A total of 17 shovel tests were excavated during the survey in the gully but no shovel tests were excavated on the general level beside the gully because of previous disturbances caused by paving, landscaping, or previous infrastructure emplacements.

Modern cultural items were found in the gully, but none of these was considered to be significant historic cultural items and all appear to be from the last part of the 20th century. No prehistoric cultural items or palaeontological materials, stratified layers, or buried soils were found in the shovel tests, on the ground surface, or in existing exposures. The lack of significant historic cultural materials, stratified layers, buried soils, or palaeontological artifacts in the study area suggests that no further concern for historical resources is warranted for this project area along the proposed Southeast LRT alignment in LSD 15-33-52-24-W4M.

One historic site (FjPi-166) was recorded on the north side of the North Saskatchewan River in LSD 15-33-52-24-W4M but outside the HRIA survey area by a Hydro-vac team working for Thurber Engineering Ltd. doing a geo-tech survey of the river valley for the Southeast LRT project. Cultural materials were found in a hydro-vac hole down to a depth of 8.5 feet (2.59 metres) and the artifacts were sent to Archaeology Group to determine their significance.

The cultural items appear to be from the first half of the 20th century and archival documents suggest that the hydro-vac findspot was within the old Grierson nuisance grounds/dump. The dump was used for approximately 50 years and extended for hundreds of metres along the North Saskatchewan River. It is concluded that any disturbances caused by construction of support structures for the Southeast LRT line within the dump area would be relatively small and insignificant in terms of the trash volume and large size of the old dump that could possibly be disturbed or destroyed by the LRT line project. It is concluded that no further concern for historical resources is warranted for this Grierson Dump (FjPi-166) area.

In this regard, this report recommends that further historical resource investigations are not warranted for the proposed Southeast LRT in LSD 15-33-52-24-W4M, in Edmonton, Alberta, and the project should proceed as planned. However, should any fossils be discovered during development, staff at the Royal Tyrrell Museum should be contacted immediately. This recommendation is subject to approval by the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit.*

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1.0 INTRODUCTION

1.1 Scope and Objectives

At the request of Art Washuta of AECOM, on behalf of the City of Edmonton, an Historical Resources Impact Assessment (HRIA) was conducted for a proposed preliminary design project for a proposed Southeast LRT alignment in LSD 15-33-52-24-W4M, in the City of Edmonton, Alberta (Figures 1 and 2).

Figure 1. Map showing the general location of the HRIA survey area in LSD 15-33-52-24-W4M for the Southeast LRT alignment, in the City of Edmonton (after 1:50,000 NTS Maps 83 H/6 – Cooking Lake and 83 H/11 – Edmonton).

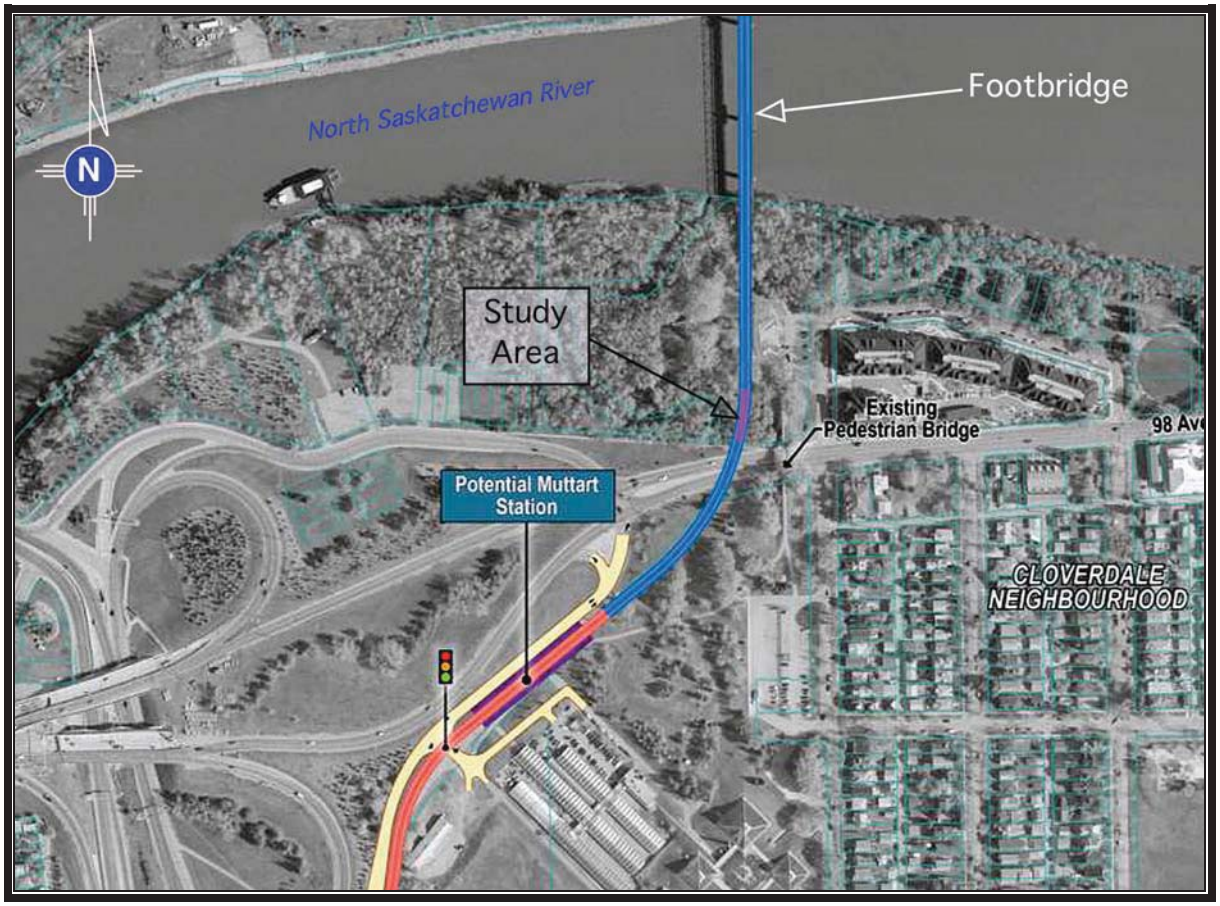


Figure 2. Photomosaic showing the location of the study area along the proposed Southeast LRT line which is highlighted in blue and coral.

The fieldwork for this project was undertaken between October 5 and 25, 2011. In-field investigations consisted of foot surveys and shovel testing within select parts of the proposed project area. A total of 17 shovel tests were excavated during the survey.

The current HRIA was undertaken because the Historical Resources Management Branch issued a Historical Resources Requirement letter on December 6, 2010 (see Appendix I) in response to an Historical Resources Overview (HRO/SOJ) conducted for CH2M Hill for the Southeast LRT Planning Study in PT. Sections 2, 11, 14, 15, 22, 23, 27, 33, and 34-52-24-W4M and Section 3-53-24-W4M in the City of Edmonton.

The HRO/SOJ recommended further assessment for only one small area on the south side of the North Saskatchewan River in LSD 15-33-52-24-W4M and that no further assessment work be done for the rest of the Planning Study area, and the Historical Resources Management Branch agreed with this recommendation. The Historical Resources Management Branch requirement letter stated that: "The HRIA is required only for the area on the south side of the North Saskatchewan River, between the river and 87th Street. More specifically on the north side of the small gully and within the gully as outlined in the SOJ."

Further, the requirement letter also indicated that a palaeontological HRIA assessment be done for two parts of the planning study area. "The HRIA shall consist of the conduct of a pre-construction impact assessment. The HRIA is required only for the area where the LRT will go underground on the Davies Road optional alignment and in the gully on the south side of the North Saskatchewan River as outlined in the SOJ." Michael Riley of Aeon Paleontological Consulting Ltd. was contacted and agreed to do the palaeontological assessment of these two parts of the planning study area, and his report will be filed separately and will not be part of the archaeological HRIA report.

The proposed Southeast LRT line will cross the North Saskatchewan River in the vicinity of an existing footbridge and will then pass over 98 Avenue. It is expected that crossing over the avenue will require support structures to be installed on both sides of 98 Avenue. On the north side of 98 Avenue there is a small gully wherein one support structure or more may need to be constructed. The gully is approximately 70 metres across (north-south) at the point where the LRT line is proposed, and is approximately 3 metres deep at its deepest point when measured from the avenue level. On the north side of the gully there is a small section of lawn approximately 6 metres wide (north-south between the gully and a paved sidewalk that extends to the footbridge). On the south side of the gully there is only a few metres of land between the gully and the side walk that runs along 98 Avenue.

It is expected that the construction of the LRT line could result in disturbance to the lands within or beside the gully, and any Historical Resources sites within any previously undisturbed areas within this new alignment area could be impacted or destroyed. Historical Resources are recognized in the Province of Alberta as non-renewable resources, subject to protective measures and defined under the Historical Resources Act (Province of Alberta 2000)[1].

This is the final report of the HRIA carried out for the proposed project in accordance with the HISTORICAL RESOURCES ACT (2000) and its respective regulations; and the Guidelines for Archaeological Permit Holders in Alberta (Archaeological Survey of Alberta 1989). This report provides relevant background material for the project and the HRIA. It describes the methods and results of the study and provides recommendations regarding further Historical Resource concerns in regard to the development proposal.

Historical resource sites are fragile and precious and easily suffer damage or destruction from such activities as road and pipeline construction, route realignments, construction activities, landscaping, soil and gravel removal, recreational activities, and landfill development. Once the context is disturbed or destroyed, the informational and interpretive value of historical resources are seriously affected and in some cases lost forever. The purpose of a Historical Resources Impact Assessment is to locate and evaluate the significance of all historical resource sites within a defined development area and to formulate

1 The Province of Alberta Historical Resources Act defines "historical resource" as ". . . any work of nature or of man that is primarily of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest including but not limited to, a palaeontological, archaeological, prehistoric, historic, or natural site, structure or object . . . ".

recommendations regarding the importance of sites discovered and the necessity for mitigative action. Mitigation may involve avoidance or further study.

Management and protection of Historical Resources is the responsibility of the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit.* While all observations, conclusions and recommendations made in this report are the result of research undertaken by the permit holder, this work is subject to the review and acceptance or modification by *Alberta Culture and Community Spirit.* All recommendations regarding either the need for further work or that no further work is necessary must be ratified, in writing, by *Alberta Culture and Community Spirit* before they can be considered acceptable in terms of the requirements of the development.

2.0 BACKGROUND

2.1 PREDICTING HISTORICAL RESOURCE POTENTIAL

The assessment of Historical Resources potential involves the evaluation of previously recorded sites, coupled with information from models of settlement patterns (ethnography and history), local topography and biogeoclimatic features of the region. From these studies, a set of prediction variables can be selected which together are used to characterize a defined area of interest.

Predicting the occurrence of historic period sites, by comparison, is an exercise not usually undertaken because the distribution of historic sites is usually known. Historic period sites are, for the most part, visible features such as buildings, farms or cabins. In areas that have been settled for many years, sites of this type are well known, mapped and documented, and in some cases recorded as provincially designated sites.

The prediction of palaeontological resources is also different from that of archaeological sites. Palaeontological resources are associated with fossil bearing geological formations. The distributions of these formations are for the most part known. Therefore, predicting the occurrence of palaeontological resources can at times be achieved by knowing beforehand the existence of fossil bearing strata.

Another important consideration is the fact that development usually occurs on the land surface, thereby missing the fossil bearing formations found below the surface of the earth. In such cases, concern for palaeontological resources is unnecessary since no impact of potentially sensitive areas will occur. In general, any development activity that affects bedrock formations, especially in the valley breaks of any major waterway, will require a Palaeontological consultant to evaluate the area. Otherwise, developments that will not disturb the surficial geological strata that contain the fossil bearing formations are not of concern.

2.2 Archaeological Prediction Criteria

Archaeological site prediction is based upon a defined set of descriptive variables. For each development area the occurrence of these variables determines archaeological potential. These variables commonly include: cultural and biogeoclimatic zones, distinct geographic or topographic features, slope, aspect, proximity to water sources, sedimentation/drainage, elevation, proximity to open meadows, proximity to known archaeological sites, proximity to historic settlements. This section lists the prediction criteria used in this study.

As a result of the review of the known sites located in the greater study area along with information from the ethnographic and historic record, we can propose a set of variables or criteria that tend to be associated with previously located archaeological sites. With this knowledge in hand, a predictive model for the location of undiscovered archaeological sites is presented.

The environmental and ethnographic data are used to predict the type and frequency of historical resources sites for the ecozone of the project area.

While the archaeological information currently available is insufficient to accurately predict site densities in any particular environmental zone, water availability is the one overwhelming environmental predictor of archaeological site potential. Most sites have been found to be located near existing or extinct sources of water.

2.2.1 ENVIRONMENTAL SETTING

The prediction of historical resource locations, and in particular archaeological sites, is in part based on environmental descriptions of known site locations. Site locations in different regions display different environmental variables. Such environmental variables are thus important to predictive studies and for these reasons are presented herein.

2.2.2 GEOGRAPHIC VARIABLES

The geographical variables that appear to be most commonly associated with the occurrence of archaeological sites in the general region are:

1) areas immediately surrounding present-day lakes, especially flat, well-drained and South-facing terraces;
2) elevated beach ridges, strand lines and spillway channels associated with ancient glacial and post glacial lakes;
3) major river valley terraces, especially flat and well-drained landforms;
4) major river valley rims, especially high promontories along the valleys and flat, well-drained sections along the Eastern rims which hold the potential for containing stratified cliff-top dune deposits;
5) confluences of major and minor streams and rivers, especially flat and well-drained landforms in the immediate vicinity;
6) creek and stream terraces, especially flat, well-drained and South-facing sections;
7) prominences or elevated areas located away from modern water sources, especially ancient beach ridges and strand lines associated with these features, Western-facing aspects which hold the potential for containing stratified cliff-top dune deposits, and areas with quartzite pebble and cobble concentrations often used as quarries by local indigenous groups.
8) postglacial dune fields, especially flat, well-drained and South-facing sections and topographical features possibly used as natural drive lanes and animal traps;
9) known historic trails that often followed prehistoric transportation routes.

It should be noted that the pattern suggested in the above characteristics, and the limited number of sites recorded away from waterways, is prejudiced by the fact that traditional archaeological survey often focused on the examination of lakes, streams, their associated features, and easily accessible areas. This practice is particularly common in the boreal forest where access is difficult and site visibility is greatly reduced by heavily wooded areas.

Locations that exist adjacent to the specific development areas of this study that display the same biogeoclimatic character or environmental features may be considered to hold a similar level of archaeological potential.

2.2.3 PREVIOUSLY RECORDED RESOURCES

Historical Resource sites occur on the landscape in a normally predictable fashion. Cultural sites are found in areas of known settlement or resource use and, in the case of historic sites, these areas are mostly documented.

In the case of archaeological sites, the knowledge of prehistoric settlement patterns is largely based on ethnographic accounts of native settlement within a region and characteristics of previously recorded sites in the area.

Expectations of palaeontological site occurrence are based on known distributions of fossil bearing landforms.

As of November 2011, there are over 25,000 archaeological sites, over 2,000 palaeontological sites, and over 70,000 historic sites recorded within the Province of Alberta. The majority of the historic sites are standing structures found within existing settlements and are not commonly of concern to land developments that occur outside of recently or historically settled areas. Of the three historical resource site types, archaeological sites are of primary concern to land developers.

2.3 ARCHAEOLOGICAL SITE POTENTIAL

The assessment of archaeological site potential within a defined development area involves two main objectives. The first is the characterization of the development area within the context of relevant past research. The second is the evaluation of the development zone in terms of the existence of specific characteristics of site prediction.

The purpose of the first objective is to identify specific characteristics of site location. With respect to the first objective, the following questions may be asked:

1) What is known about patterns of native settlement from ethnographic research?
2) What is known about prehistoric settlement patterns from archaeological research?
3) What characteristics of the development area may be considered good indicators of past and historic cultural settlement?

The aim of the second objective is to identify the existence of these site location predictors within the proposed development area. Within a project area, there are several distinct geographical situations that can be linked to specifics of settlement pattern and resource use to determine archaeological potential (Table 1). The most commonly applied variables used to determine archaeological site potential in Alberta are listed below (Table 2).

Table 1. List of distinct geographic features used in the assessment of archaeological potential.

Feature	Potential
Stream Valley	Moderate
Stream Terrace	High
Lake Margin	High
Upland Grasslands	Low
Upland Forest	High
Glacial Terrace	Moderate
Remnant Dune	High
Prominent Hill	High
Disintegration Moraine	Moderate

Table 2. List of site prediction variables used in the assessment of archaeological potential.

Variable	Potential
Slope	None
Elevated	Moderate to High
Proximity to resources	Moderate to High
Proximity to water	Moderate to High
Proximity to known archaeological site(s)	High
Well-drained sediments	Moderate to High
Poorly -drained sediments	None
Aspect - South Facing	High
Aspect - North facing	Low
No distinct geographic or topographic features	None
Proximity to historic settlement	High
Previous/Existing disturbance	Low

Based on the sets of variables listed above, the determination of the potential of archaeological sites in a project area can result in one of two possible recommendations being selected. Either no further work is required, or the need to conduct a Historical Resources Impact Assessment is identified.

2.4 Environmental Setting

The physical environment, including geomorphological features, and resource availability, plays a role in the selection of areas that are used by animals and humans. The distribution of the remnants of the cultural and natural past follow relatively specific patterning. As environmental settings changed through time, the cultural, floral and faunal landscape also changed. An understanding of the environmental settings and changes through time allow us to predict in part where archaeological, historic and palaeontological sites are most likely to be found.

Certain landforms and geomorphological features are commonly found in association with prehistoric, historic and palaeontological sites. For example, archaeological sites are frequently found along streams and near lakes. During prehistoric times these locations provided fresh water and transportation, were focal points for wildlife, and were the source of other food resources. The beneficial attributes of these areas would be just as attractive in the past as they are today. In the same manner, flat well-drained terrain, and sunny, warm southern exposures would also be considered important criteria for the location of camping or habitation sites.

Alberta displays a wide variety of geography and one of the ways that such diversity can be described is through the use of a Land Classification system. Such systems are designed to organize and simplify the landscape so that the resulting units of description can be used for planning and management purposes. In Alberta there are two ecologically-based land classification systems that are commonly used by government and private industry: the Natural

Regions and Subregions classification (Achuff 1994) and the Ecoregions of Alberta classification (Strong and Leggat 1981; Strong 1992). There are many similarities between the two systems however, the primary difference lies in the emphasis given to climate in the latter. The Natural Regions classification " . . . emphasizes overall landscape pattern which, in some cases, reflects climate but in others, reflects the predominance of geological or soil factors" (Achuff 1994:5). Achuff goes on to note that the differences are largely a reflection of purpose. The former is used primarily in studies of agriculture, forestry and wildlife production whereas the Natural Region system is utilized more in ecosystem and biodiversity modeling. The land classification system used here to describe the physical landscape is entitled 'Natural Regions, Subregions and Natural History Themes of Alberta: a Classification For Protected Areas Management' prepared for Park Services, Alberta Environmental Protection by Peter Achuff in 1992 and updated and revised in 1994.

> Natural Regions are recognized on the basis of broad differences in landscape patterns, especially the broad vegetational, soil and physiographic features, for example grassland vs. parkland vs. forest, Chernozemic soils vs. Luvisolic soils, or mountains vs. foothills vs. plains. These features also reflect broad patterns of climate and geology. To a lesser extent, wildlife features are used, although wildlife occurrence patterns are usually not as distinctive or useful as soil, physiographic and vegetation patterns (Achuff 1994:5).

In Alberta, six Natural Regions are currently recognized (Downing and Pettapiece 2006): Grassland, Parkland, Foothills, Rocky Mountain, Boreal Forest, and Canadian Shield/Kazan Upland. The six Natural Regions are divided into Subregions based on recurring landscape patterns relative to other parts of the Natural Region. The present study area is in the Central Parkland Natural Subregion of the Parkland Natural Region (Figure 3) (Downing and Pettapiece 2006). The following description of the Central Parkland Subregion is from Downing and Pettapiece (2006).

2.4.1 CENTRAL PARKLAND SUBREGION

2.4.1.1 Theme

The Central Parkland Natural Subregion occupies a broad, intensively cultivated and heavily populated fertile crescent in central Alberta. It lies between the cold, snowy northern forests and the warm, dry southern prairies, sharing the climatic and vegetation characteristics of both.

2.4.1.2 Key Features

- Mostly cultivated with mosaic of aspen and prairie vegetation on remnant native parkland areas, usually associated with hummocky till or eolian materials.
- Temperature, precipitation and growing season characteristics are intermediate between the dry, warm grasslands to the south and the cooler, moister boreal forests to the west and north.
- Black Chernozems, some Dark Gray Chernozems, significant occurrences of Solonetzic soils.

2.4.1.3 General Description

The Central Parkland Natural Subregion includes over 50,000 km^2, much of it under cultivation. It includes all or parts of Alberta's three largest cities, and arches north from Calgary through Edmonton and east to the Alberta–Saskatchewan border. It meets the Dry Mixedwood Natural Subregion to the west and north, and the Foothills Fescue, Foothills Parkland and Northern Fescue Natural Subregions to the south.

Elevations range from 500 m near the Alberta–Saskatchewan border to 1250 m near Calgary. Undulating till plains and hummocky uplands are the dominant landforms. Lacustrine and fluvial deposits are locally common in the northern and eastern parts of the Natural Subregion, and there are some significant eolian deposits. Almost all the area is cultivated, but a mosaic of aspen and prairie vegetation occupies remnant native parkland areas.

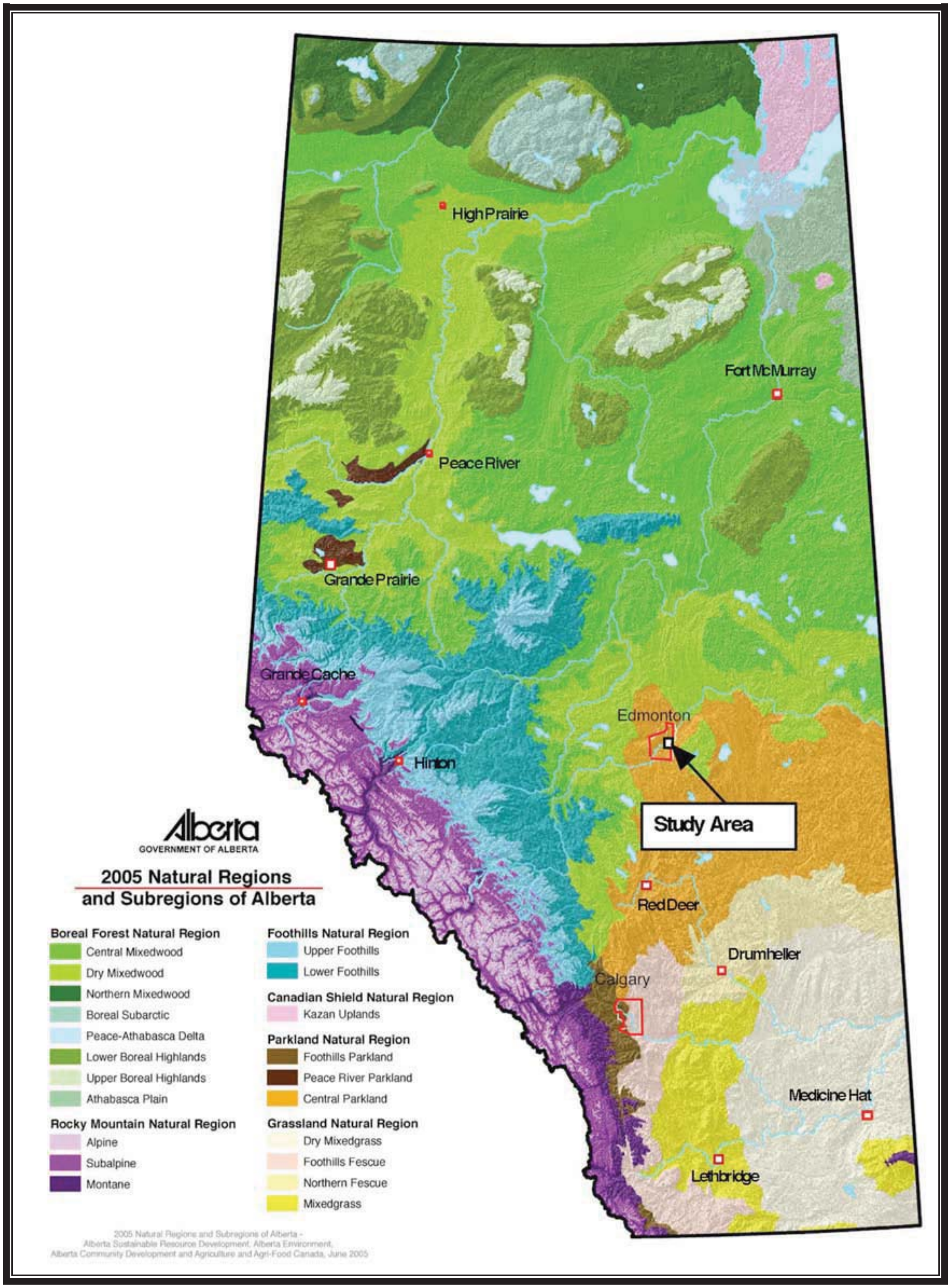


Figure 3. Map showing the location of the study area within the Central Parkland Subregion of the Parkland Natural Region in the Province of Alberta (after Downing and Pettapiece 2006).

In the southern and eastern parts of the Natural Subregion, plains rough fescue prairie is the dominant vegetation, with clumps of aspen present but restricted to moist sites. In the northern and western parts, aspen forest is dominant and grasslands are restricted to drier areas. Black Chernozems usually occur under grasslands, and Dark Gray Chernozems and Luvisols usually occur under aspen forests.

2.4.1.4 Climate

The Central Parkland Natural Subregion has a climate intermediate between the Dry Mixedwood Natural Subregion to the north and west and the Northern Fescue Natural Subregion to the south.

Monthly temperature variations are most similar to those of the Northern Fescue Natural Subregion, with slightly warmer winters and summers than the Dry Mixedwood Natural Subregion.

Monthly precipitation patterns are most similar to those of the Dry Mixedwood Natural Subregion, with a marked peak in July and significant rainfalls in June and August. The western third of the Central Parkland Natural Subregion receives more annual precipitation on average than the remainder of the area, possibly due to higher elevations and more intense summer rainfalls.

The Central Parkland Natural Subregion is highly productive for annual crops because summer precipitation is adequate, the growing season is sufficiently warm and long, and soils are suitable.

2.4.1.5 Vegetation

Estimates vary, but current information suggests that only about 5 percent of the Central Parkland Natural Subregion remains in native vegetation. The area has been intensively cultivated for over a century, and the few remaining contiguous areas of parkland vegetation occur on sites that are unsuitable for agriculture because of topography or soil constraints.

Much of the native vegetation occurring on extensive till plains within the Natural Subregion was replaced by croplands before it could be surveyed and catalogued. Consequently, the delineation of Central Parkland Natural Subregion boundaries depends heavily on soil maps.

The primary vegetation differences between the Central Parkland and Foothills Parkland Natural Subregions are the dominance of plains rough fescue in the Central Parkland and mountain rough fescue in the Foothills Parkland, and other diagnostic species. For example, beaked hazelnut, bunchberry, wild lily-of-the-valley and wild sarsaparilla commonly occur in the Central Parkland Natural Subregion, but are absent from the Foothills Parkland Natural Subregion.

The remaining native communities indicate a marked change in vegetation from southeast to northwest in response to increasing moisture. Fescue prairies dotted with aspen groves occur in the driest areas to the south and east.

Increased moisture in the central portions allows the development of true parkland, where roughly equal proportions of aspen forest and plains rough fescue grasslands occur. Higher precipitation to the north and west promotes closed aspen forests within which small grassland patches may occur.

Strong and Leggat (1992) suggest the Central Parkland Natural Subregion be subdivided into a southern grassland-dominated portion and a northern aspen-dominated portion in recognition of these climate-related changes.

Grassland communities described for the Central Parkland Natural Subregion are similar to those in the adjacent Northern Fescue Natural Subregion. Western porcupine grass, June grass, needle-and-thread, blue grama, dryland sedges and pasture sagewort occur in sparsely vegetated communities on dry, rapidly drained sandy Black and Dark Brown Chernozems or Regosols. Plains rough fescue, slender wheat grass and forb cover increase with better soil moisture conditions. Smooth brome invasion on moist, loamy soils is currently a threat to plains rough fescue communities.

Reference sites for the grassland-dominated southern portion, which are now very uncommon, occur on loamy, well drained Black Chernozems. On undisturbed sites, plains rough fescue strongly dominates in stands with few other species.

More commonly, on light to moderately grazed sites, plains rough fescue shares dominance with western porcupine grass, northern wheat grass, Hooker's oatgrass and a variety of perennial herbs (e.g., prairie crocus, prairie sagewort, wild blue flax, northern bedstraw, three-flowered avens). Dry sites in the northern part of the Natural Subregion may also be vegetated by jack pine–bearberry communities on sandy, rapidly drained Regosols and Brunisols; however, these are uncommon.

Moderately well drained sites in somewhat moister locations often support shrub communities (buckbrush, silverberry, prickly rose, chokecherry and saskatoon) on Black Chernozems. Silverberry communities are often found adjacent to saline wetlands in the southern Central Parkland Natural Subregion.

In the southeastern parts of the Central Parkland Natural Subregion, aspen communities are restricted to imperfectly drained depressions on medium to fine textured Gleysolic soils, where moisture is sufficient to support tree growth throughout the growing season. Precipitation increases to the north and west; aspen communities on Dark Gray Chernozems and Dark Gray Luvisols become dominant and are considered the reference community type for the aspen-dominated portion of the Central Parkland Natural Region.

Aspen understories throughout the Natural Subregion can be quite variable depending on parent material and moisture, but typically include saskatoon, prickly rose, beaked hazelnut, and a variety of forbs and grasses. Species such as hay sedge and creeping juniper make up the understory of aspen stands on sandy, rapidly drained sites. Balsam poplar is often present with aspen and white spruce on moist, rich sites with lush, diverse understories throughout the Natural Subregion. White spruce can occur in pure stands on moist sites where fire occurrence is infrequent, and are most commonly found on protected locations on coulee slopes.

Common cattail, sedge or bulrush marshes and willow shrublands are common on wet, poorly drained Gleysolic soils across the Central Parkland Natural Subregion. Treed fens with black and white spruce, common Labrador tea and feathermosses occur on poorly drained Gleysols or Organic soils in the aspen-dominated portion of the Natural Subregion, and particularly in the northwest section.

2.4.1.6 Geology and Geomorphology

The Central Parkland Natural Subregion lies mainly within the Eastern Alberta Plains. At higher elevations to the southwest, it also includes a small part of the Western Alberta Plains. Non-marine Upper Cretaceous sandstone and mudstone formations with minor occurrences of marine shales underlie the eastern portion. Tertiary sandstones and mudstones underlie the western portion. The dominant landform is undulating glacial till plains, with about 30 percent as hummocky, rolling and undulating uplands.

Surficial materials are dominantly medium to moderately fine textured, moderately calcareous glacial till that may be a thin (less than 2 m) blanket over bedrock in some of the low-relief plains. In the eastern part of the Natural Subregion, about 15 percent of the area is covered by glaciolacustrine and glaciofluvial sediments occurring as inclusions within the till plains.

2.4.1.7 Water and Wetlands

Many small waterbodies are scattered throughout the Central Parkland Natural Subregion, and account for about 2 percent of the area. The largest of these are Beaverhill, Gull, Buffalo and Sounding Lakes. Major watercourses include the Red Deer, Battle and North Saskatchewan Rivers.

Wetlands cover about 10 percent of the Central Parkland Natural Subregion, and are more common than in the Northern Fescue Natural Subregion because of the somewhat cooler and moister climate. Marshes, willow shrublands and seasonal ponds are typical wetland types in the southern part of the Natural Subregion, but treed fens with shallow organic soils also occur in the northwest.

2.4.1.8 Soils

Orthic Black Chernozems are typically associated with grasslands and open woodlands in the Central Parkland Natural Subregion. Solonetzic soils (Solodized Solonetz and Solod) occupy significant areas (about 15 percent) of the central low-relief plain, with a further 20 to 30 percent of soils having Solonetzic properties. Thickness of the dark surface humus layers ranges from 15 cm at the southern limits of the Natural Subregion, to about 30 cm along its northern limits.

Forested areas commonly have Orthic Dark Gray Chernozemic and Dark Gray Luvisolic soils. These soils are uncommon in the southern part of the Natural Subregion, but become increasingly common to the north and occur on about 30 percent of landscapes along the northern boundary.

Humic and Orthic Gleysols are the most common soil types associated with wetlands. Peaty subgroups are common along the Central Parkland–Dry Mixedwood Natural Subregion boundary.

2.4.1.9 Land Uses

The Central Parkland Natural Subregion is the most densely populated region in Alberta; Edmonton, Red Deer and Calgary all lie wholly or partly within it. This Natural Subregion is also the most productive agricultural region in Alberta. Cropland covers about 80 percent of the plains and about 65 percent of hummocky uplands; the remaining area is grazing land. Wheat, barley and canola are the dominant crops in the central and eastern portions with some specialty crops such as pulses and flax. At higher elevations in the southwestern part of the Natural Subregion, a shorter frost-free period limits crop production to cool-season barley and forages.

Conventional petroleum exploration and development activities occur throughout. Heavy oil, strip coal mining and gravel extraction activities occur locally.

One of the greatest threats to plains rough fescue appears to be the invasion of smooth brome. This is occurring primarily on moist sites with loamy soils. The degree of infestation varies depending on a number of factors including proximity to seed source, grazing regime, and any activity that creates bare soil.

2.5 Cultural Setting

The earliest evidence for human occupation in Alberta dates to the end of the last glaciation (approximately 12,000 years BP). The Prehistoric Period spans the time from the earliest occupations up to the arrival of the first Europeans. The Prehistoric Period includes the period of time before direct contact occurred between Europeans and native peoples. That is, the time period when European culture modified native culture through trade and the introduction of new ideas, well before the first Europeans even set foot in the region.

Site classification, the general chronology of the prehistoric period, and the distribution of known archaeological sites are described below. This prehistorical overview will be used to establish a chronology and distribution pattern for archaeological sites.

Prehistoric sites in the province of Alberta are divided into various categories that reflect site function. The categories include:

1. isolated finds (generally a single artifact not found in association with any other archaeological materials or features);
2. scatters (usually small assemblages of lithic material from which it is difficult to draw conclusions about the site's original function);
3. campsites (which contain a variety of materials and possibly features);
4. stone features (without artifacts);
5. workstations (where a specific task such as butchering, plant processing, or stone tool manufacture took place);
6. kill sites;
7. quarries (where lithic material for stone tool manufacture was mined);
8. rock art;
9. human burials; and
10. ceremonial sites.

These typological classifications are commonly used by archaeologists to develop chronological understandings and sometimes even movements of ideas, materials, and peoples in prehistoric times. In addition to the small size of many of the archaeological assemblages, artifact collections are often poorly preserved, or are from poorly understood contexts which further limit the information that can be gleaned from these collections. Research to date has produced some useful information about the distribution of archaeological sites on the landscape, but there remains much to be learned about the prehistory of northwestern Alberta.

2.5.1 CLASSIFICATION OF PREHISTORIC CULTURES

In order to provide a chronological framework for the interpretation of the prehistory of a region, prehistoric time is commonly divided into a sequence of periods. This is referred to as the culture history of an area. In Alberta, culture history is generally divided into four major time periods (Figure 4).

Each of these periods displays a relatively different archaeological landscape. The periods are, for the most part, defined on the basis of environmental change, resource use, settlement patterns and artifact styles. In general, this sequence may be applied to the province as a whole, since similar artifact styles have been found in almost all areas of Alberta.

Regional differences and the clarity of the definitions remains somewhat cloudy largely due to a lack of consistent research in all areas. The theory is that each of these periods can be further divided into ever decreasing subsets of more specific groups or cultural manifestations. These cultural manifestations or theoretical archaeological constructs are known as Traditions and Complexes. Depending upon the evidence at hand these may be further divided into subsets of more specific archaeological culture types, such as “Phases”.

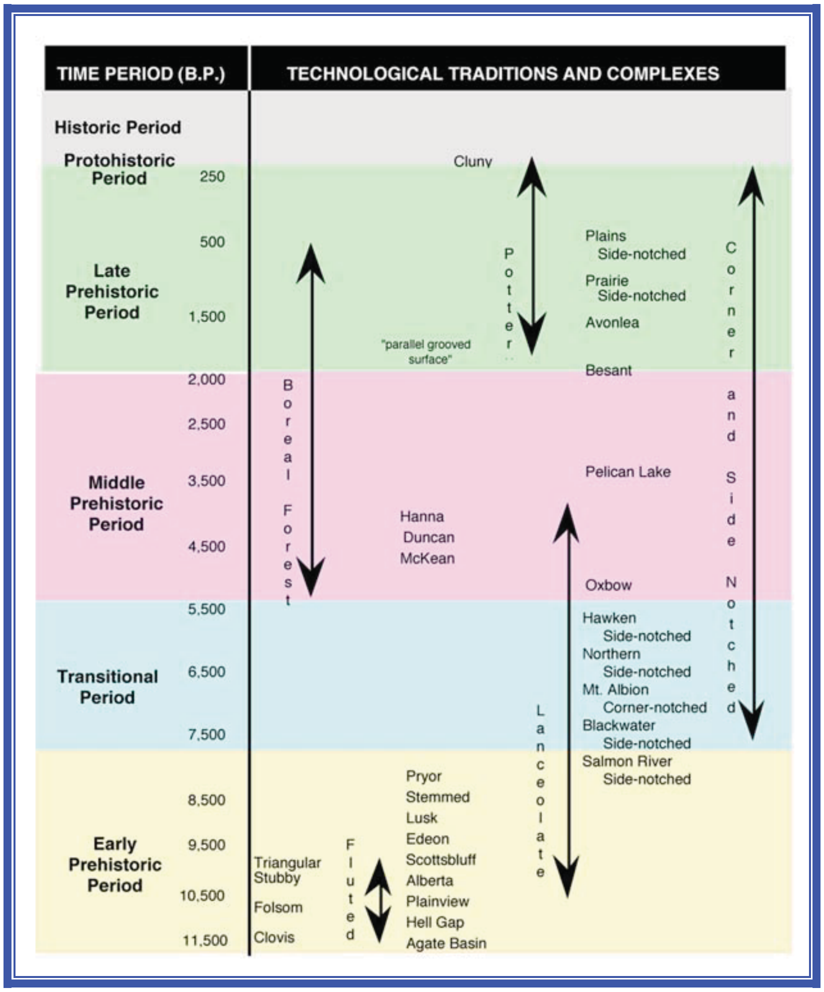


Figure 4. Culture History sequence for Alberta.

2.6 Previously Recorded Historical Resources

Archaeological sites in the Province of Alberta are recorded in the Archaeological Site Inventory Data files of the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit.* Site location information is maintained using a geographical system known as the Borden System[2]. All previously identified archaeological sites are geographically

[2]The Borden System relies on existing zones of longitude and latitude. Each longitude and latitudinal zone is divided into smaller areas each of which is identified by a number, called a Borden Block (e.g. GbQh). The capital letters refer to units which are two degrees of latitude by four degrees of longitude in size. These units are further divided into units which are ten minutes on a side, identified by the lower case letters. Sites found within these Block areas are given sequential numbers, such as GbQh-1, GbQh-2 and so on.

recorded using a numbered alphabetical system called the Borden System.

Each site found within an area keyed to longitude and latitudinal zones is given an identification number, called a Borden number. All sites of historic significance are also inventoried by the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit.* Prior to the field inspection site file searches were made of the Archaeological Site Inventory Data files and the Historic Sites Service files maintained by the *Cultural Facilities and Historical Resources Division*.

The Borden Blocks pertinent to this project are FjPi and FjPj. Of these previously located sites, 29 are located within 3 kilometres of the current project area (Figure 5). These sites consist of FiPi-03, FiPi-05, FiPi-06, FiPi-08, FiPi-12, FiPi-17, FiPi-20-23, FiPi-39, FiPi-42, FiPi-109; FjPi-33, FjPi-44, FjPi-45, FjPi-48, FjPi-72, FjPi-73, FjPi-75, FjPi-94, FjPi-98, FjPi-109; FjPj-04, FjPj-06, FjPj-26, FjPj-35, FjPj-63, FjPj-64, FjPj-125.

Of these sites, the five nearest ones (FjPi-44, FjPi-45, FjPi-48, FjPi-72, and FjPi-73) are along the North Saskatchewan River and consist of 4 historic sites and 1 archaeological site. FjPi-44 is a series of wooden pilings directly below the Low Level Bridge and has an Historic Resources Value = 0 (HRV=0). FjPi-45 is an historic cellar depression, a section of hedge and assorted modern cultural debris and has an HRV=0. FjPi-48 is a campsite consisting of a possible piece of Fire-Broken-Rock, a bison phalanx and 6 unidentified bone fragments and has an HRV=0. FjPi-72 is a grade section of old Dowlers Hill Road and has an HRV=0. FjPi-73 consist of wooden pilings related to an old ferry landing and has an HRV=4. Besides being by the North Saskatchewan River, none of these sites has a similar environmental situation as that found at the current study area location.

Previous archaeological investigation in the immediate vicinity of the proposed

Southeast LRT project area has not been comprehensive, but the fact that the proposed new alignment is by the North Saskatchewan River in a possibly undisturbed setting (an environmental situation considered to have high archaeological potential) suggested that there was potential for undisturbed Historical Resources sites to be located within the project lands.

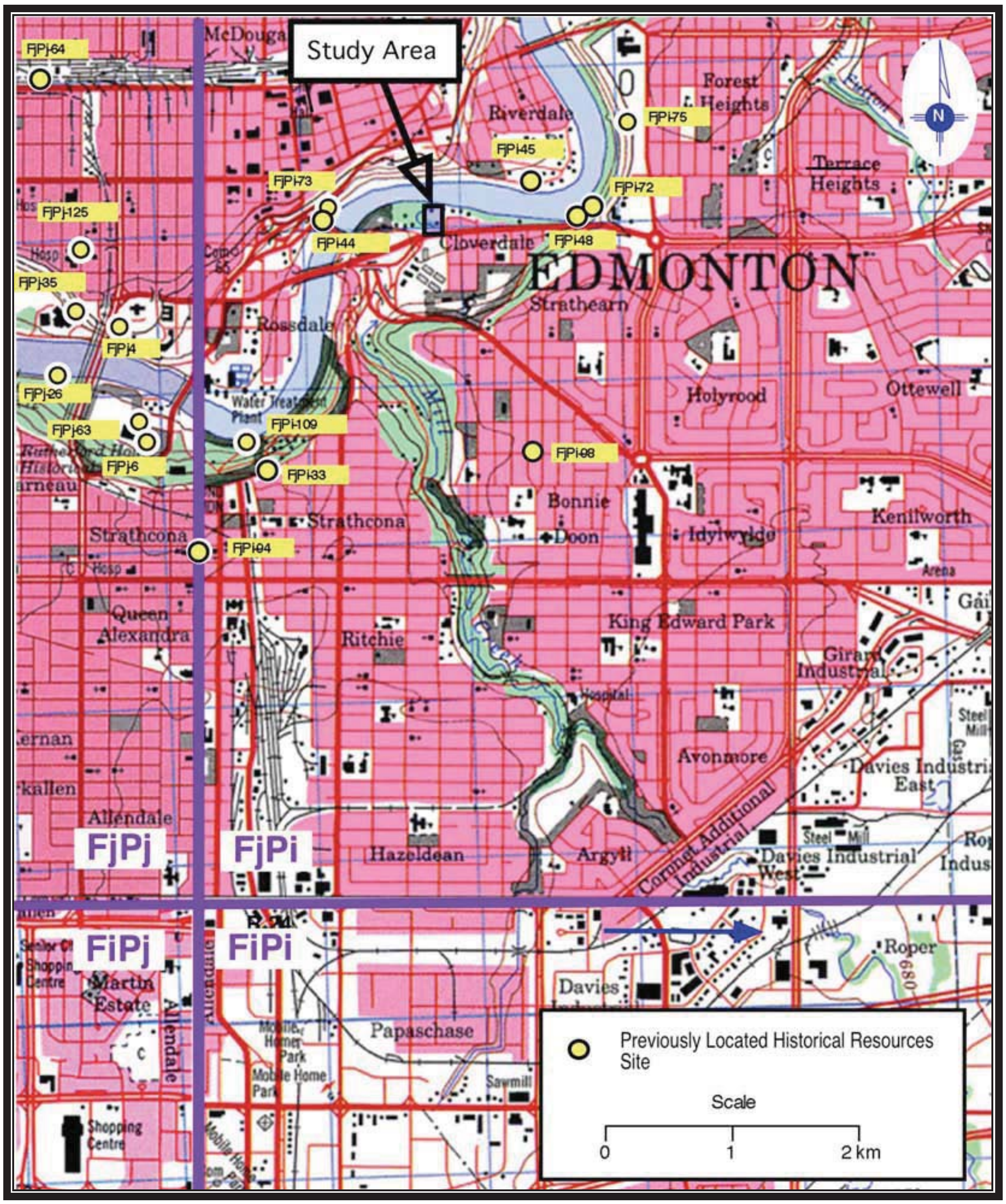


Figure 5. Map showing the location of sites in the general vicinity of the project area (after 1:50,000 NTS Maps 83 H/6 – Cooking Lake and 83 H/11 – Edmonton).

3.0 METHODOLOGY

3.1 HISTORICAL RESOURCES POTENTIAL

Searches of the Palaeontological Resources Sensitivity Zones map (Tyrrell Museum of Palaeontology 1984), the Archaeological Site Inventory Data files, and the Historic Sites Service files maintained by the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit,* were undertaken to determine the potential for historical resources in the Project area.

3.2 SURVEY METHODS

In-field investigations consisted of foot survey of all parts of the development area within the target area, and shovel testing of select parts of this part of the project area.

Areas for shovel testing were selected judgmentally. Subsurface examinations consisted of shovel tests ranging in size from 30 cm x 30 cm to 50 cm x 50 cm excavated to a depth of 30 - 75 cm below surface.

4.0 RESULTS

The area surveyed consists of a strip of land approximately 100 metres long by 25 metres wide extending from the sidewalk at the south end of the footbridge over the North Saskatchewan River across a gully up to the edge of 98 Avenue (Photographs 1, 2, 3 and 4). The area at the northern end of the study area (south of the end of the sidewalk up to the gully) appeared a likely candidate for deep testing using a backhoe (Photographs 5, 6, and 7). Alberta One-Call identified a buried pipeline running along the edge of the gully (Photographs 7 and 8) and it was noted that a water line and an electric line run from the metal boxes seen in Photograph 4 to a park building to the west (Photograph 7). It appears that all or almost all of the 6 or so metre wide area on the top of the north bank of the gully was disturbed by the excavations for these infrastructure installations, so no deep testing or shovel testing was undertaken between the north edge of the gully and the paved sidewalk to the north.

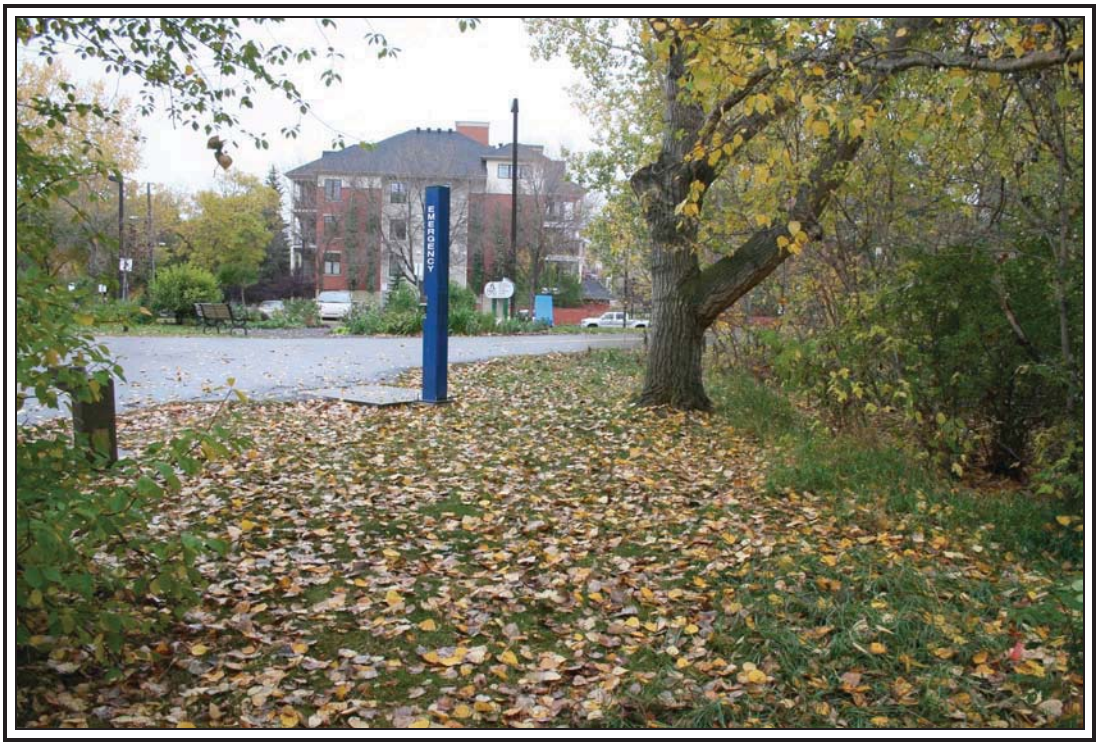
Photograph 1. View to the north across a paved area leading to the footbridge over the North Saskatchewan River.

Photograph 2. View to the south showing the location of a small gully immediately beyond the large tree and the small flat area between the paved area and the edge of the gully.

Photograph 3. View to the south-southeast across the gully bottom towards 98 Avenue.

Photograph 4. View to the south showing the side-slope up to the sidewalk which runs along 98 Avenue.

Photograph 5. View to the south-southeast showing a blue emergency post that has a disabled call button and a water fountain which lied between the edge of the paved area and the gully to the south.



Photograph 6. View to the east showing the emergency post and water fountain between the edge of the paved area and the gully to the south.

Photograph 7. View to the west showing the park building that the water line and electrical lines run towards from the emergency post and the water fountain. The intermittent orange line on the grass marks the buried pipeline identified by Alberta One-Call.

Photograph 8. View to the east showing the location of the buried pipeline that was flagged by Alberta One-Call along the edge of the gully.

Since there was only a small one or two metre area between the south edge of the gully and the sidewalk along 98 Avenue, no shovel testing was done on the top of the south bank of the gully. All shovel tests undertaken during the survey were within the gully itself.

On the northern downslope into the gully just below the buried pipeline that Alberta One-Call had flagged were a number of cultural items extending half way down the slope. These items included a wire cable, a plastic (PVC) pipe, a metal gas line pipe, concrete, and a piece of sheet metal that may have been a stove part (Photographs 9 and 10). The cable, the plastic pipe, and the gas line pipe were embedded in the side of the gully and when pulled upon they did not budge, which suggested that they were deeply embedded.

Photograph 9. View to the northeast showing the gully's northern downslope. A metal gasline pipe is visible at the bottom centre of the photograph.

Photograph 10. View to the north showing the modern cultural materials on the gully's northern downslope, some of which were embedded in the side of the gully.

The surface on the bottom of the gully was found to contain modern cultural debris that includes, concrete fragments, plastic sheeting, bricks, aluminum beer cans, plastic candy wrappers, wooden planks, a small pillow, a small backpack, pieces of paper, a piece of sheet metal, and the metal runners of an old sleigh (Photographs 11, 12, and 13).

There were a number of flat benches within the gully that extend from the bottom of the sideslope of the fill used to elevate a footbridge over 98th Avenue on the north edge of the study area. Fourteen shovel tests were placed on all of these flat benches and three shovel tests were placed on the bottom of the gully (Photographs 14 and 15). The shovel tests revealed a medium gray silt to depth (Photograph 16). No rocks, buried soils, stratigraphic layers, or cultural items were found in any of the shovel tests.

Photograph 11. Photograph showing some of the modern cultural materials found on the gully floor which include a beer can, two fragments, a plastic candy wrapper, and a large plank.

Photograph 12. Photograph showing some of the modern cultural materials found on the gully floor which include a black backpack, a pillow, and pieces of plastic packaging.

Photograph 13. Photograph showing the metal runners of an old sleigh on top of a piece of galvanized sheet metal.

Photograph 14. Photograph showing one of the shovel test locations on one of the flat benches within the gully.

Photograph 15. Photograph showing one of the shovel test locations on a flat bench near the southern side of the gully.

Photograph 16. Photograph showing the silty matrix found in the shovel tests within the gully.

Besides the modern cultural items found in the study area no significant historic cultural items and no palaeontological materials, stratified layers, or buried soils were found in the shovel tests, on the ground surface, or in existing exposures. The lack of significant historic cultural materials, stratified layers, buried soils, or palaeontological artifacts in the study area suggests that no further concern for historical resources is warranted for this project area.

4.1 Historic Site FjPi-166

While the Southeast LRT HRIA survey was confined to the small gully area on the south side of the North Saskatchewan River, other disciplinary surveys associated with the Southeast LRT project were being conducted for the whole project route. One of these studies was a Geotech Survey of the river valley that was conducted by Thurber Engineering Ltd, and one of their hydro-vac teams working by the north end of the footbridge over the north side of the North Saskatchewan River found sawn bone and other cultural items just east of the north end of the footbridge (hydro-vac hole location is at TH11-17 on Figure 6). The hydro-vac team abandoned the hole after wood was encountered at approximately 12 feet (3.66 metres) below surface that they could not get through.

The cultural items and bone plus a log of their depths of occurrence were sent to The Archaeology Group to determine their possible significance and to determine if there were any Historical Resources concerns. The recovered items (Table 3) consist of a white ironstone bowl fragment, a complete milk bottle, a complete red brick, a complete ink bottle with cork, and a patent medicine bottle with its cork, two butchered bone fragments (cow (Bos Taurus)), and an unidentified large mammal rib fragment (see Figures 7 to 14). None of the cultural items have any maker's marks and the bottles all are made using two piece molds, and the white bowl fragment is very generic and has no decoration, and none of these items could be dated to earlier than the beginning of the 20th century. The butchered bone was sawn and had no other butchering marks. The rib fragment was broken and had no butchering marks on it.

Table 3. Ten cultural items recovered from the hydro-vac hole at the northeast end of the footbridge over the North Saskatchewan River.

Artifact	Catalogue No.	Depth Below Surface
Cow Leg bone (radius)	FjPi-166:1	3 feet/0.91 metres
Large mammal rib fragment	FjPi-166:2	4 feet/1.22 metres
Bowl fragment	FjPi-166:3	4 feet/1.22 metres
Milk bottle	FjPi-166:4	4.5 feet/1.37 metres
Cow pelvic bone (ischium fragment)	FjPi-166:5	4.5 feet/1.37 metres
Brick	FjPi-166:6	7.5 feet/2.29 metres
Ink bottle	FjPi-166:7	8.5 feet/2.59 metres
Ink bottle cork	FjPi-166:8	8.5 feet/2.59 metres
Patent medicine bottle	FjPi-166:9	8.5 feet/2.59 metres
Patent medicine bottle cork	FjPi-166:10	8.5 feet/2.59 metres

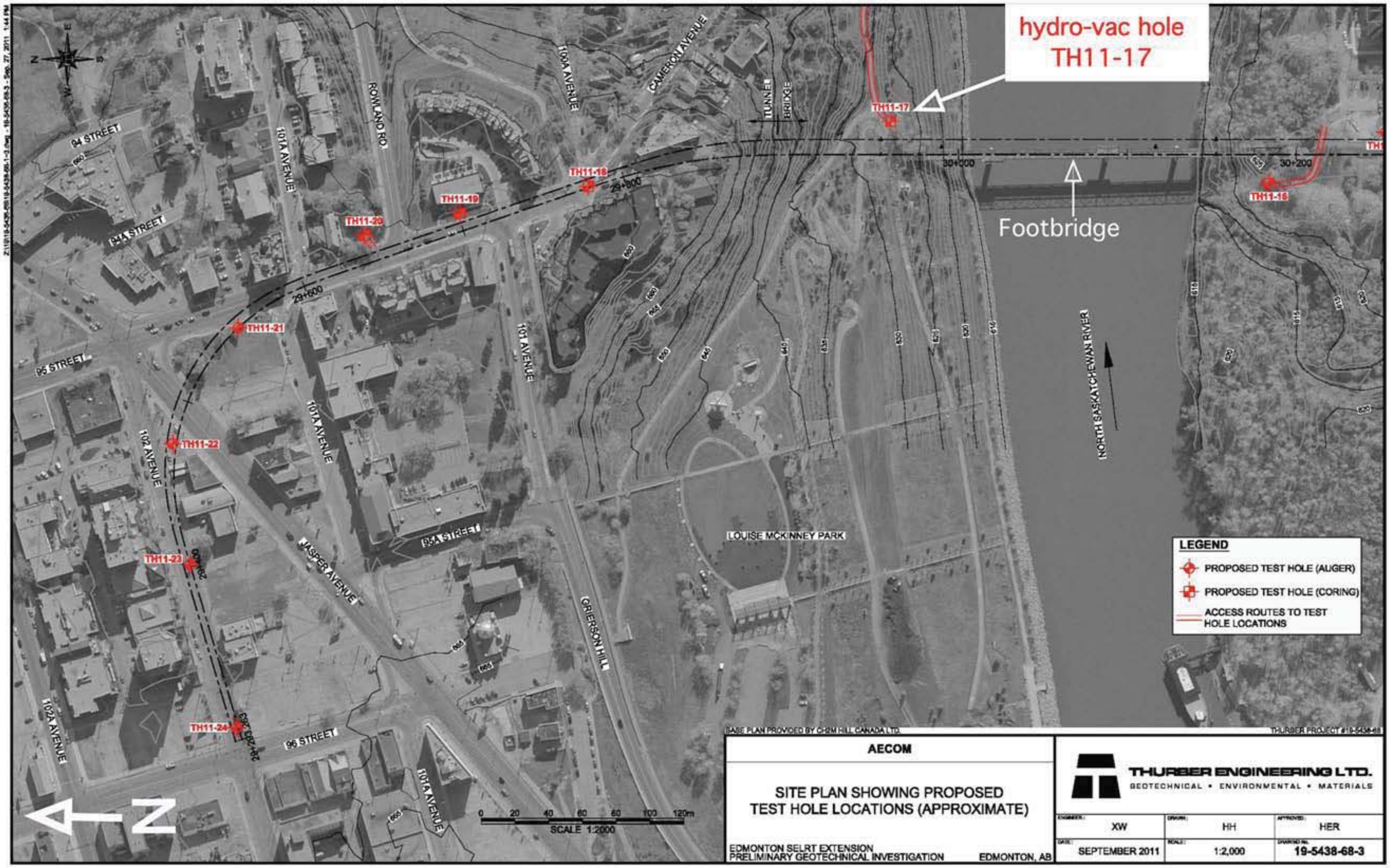


Figure 6. Photomosaic showing the location of Hydro-vac hole TH11-17 at the northeast end of the footbridge over the North Saskatchewan River.

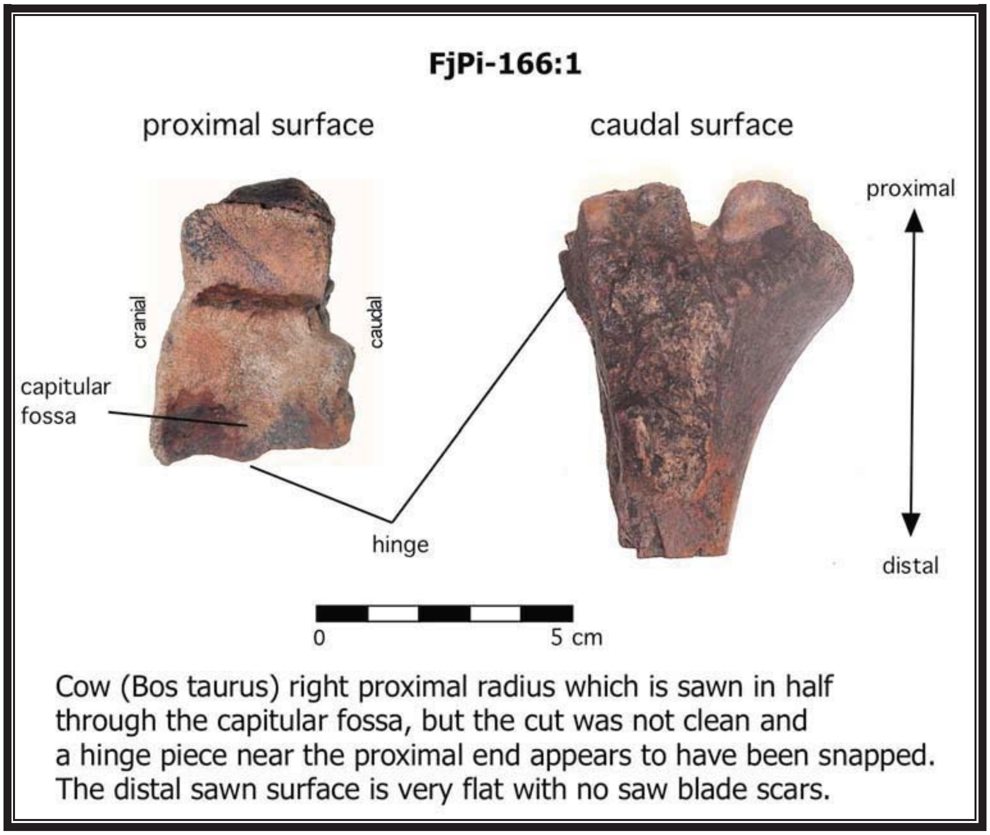


Figure 7. Butchered immature cow (Bos taurus) proximal right radius fragment found in Hydro-vac hole TH11-17.

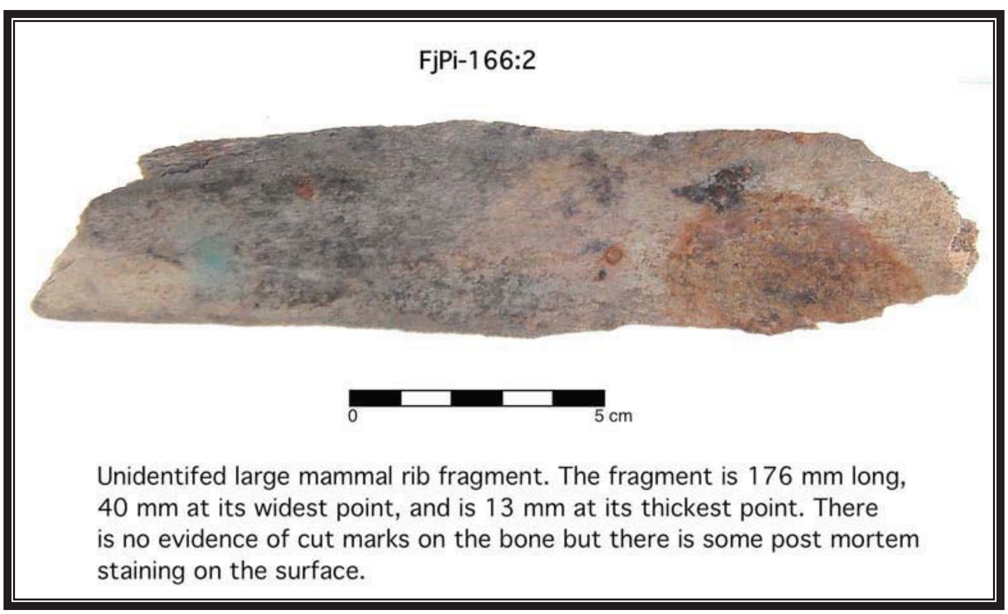


Figure 8. Unidentified large mammal rib fragment found in Hydro-vac hole TH11-17.

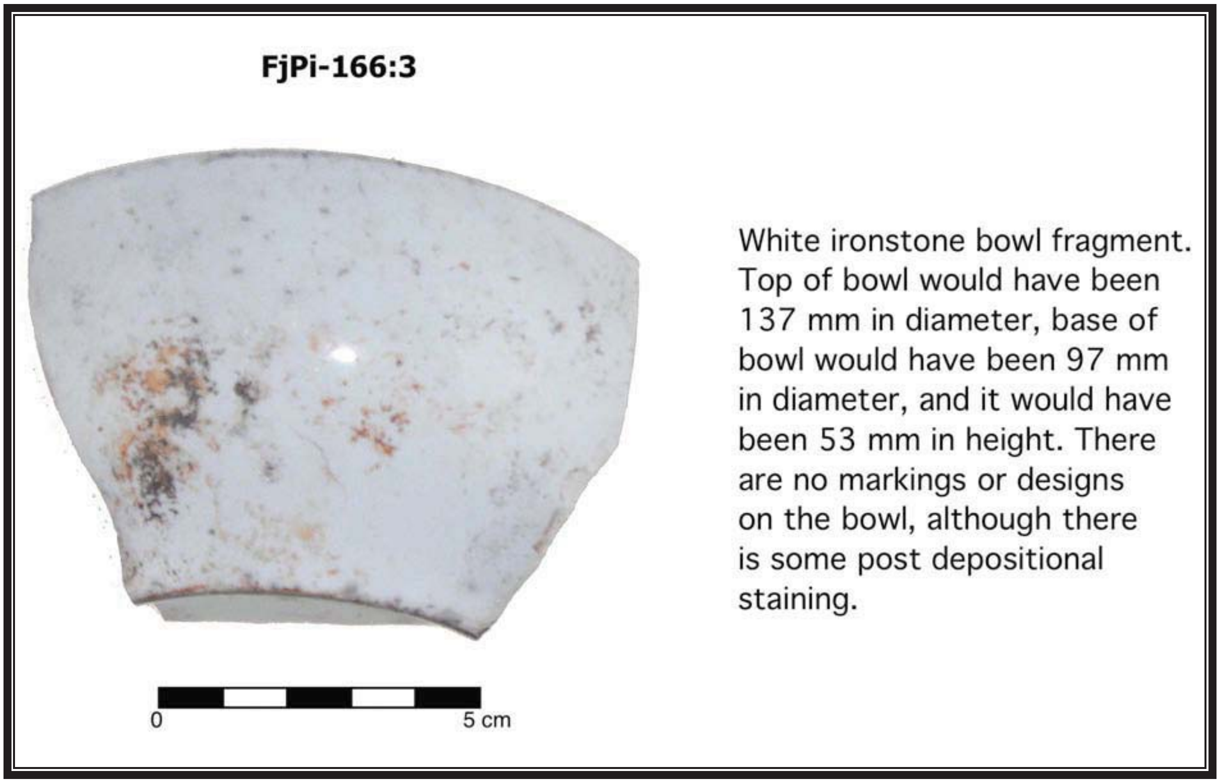


Figure 9. White ironstone bowl fragment found in Hydro-vac hole TH11-17.

FjPi-166:4

Clear glass milk bottle with a purple hue. The bottle is 200 mm tall, the top is 47 mm in diameter, the neck is 43.5 mm in diameter, while the body and base are 75 mm in diameter. The body and neck of the bottle were made using a two piece mold which has left strong side seams and the top rings and the base were fused to the main part of the bottle. The top consists of two rings separated by a thin indented line. While the bottom ring has fusion lines indicating that it was made in two pieces, the topmost ring has no fusion lines. The base has a circular post mold scar in the center that is slightly raised above the central part of the base, and so is the lateral edge which allows the bottle to sit flat, which it could not do otherwise since the post mold scar is not flat. There are no markings on the bottle.

Figure 10. Milk bottle found in Hydro-vac hole TH11-17.

Figure 11. Butchered immature cow (Bos taurus) right proximal ischium fragment found in Hydro-vac hole TH11-17.

FjPi-166:6

Complete red brick with mortar attached. While the sides and top of the brick are flat, the bottom of the brick is pitted and slightly irregular. This suggests that the brick was made in a mold sitting on sand. The central part of the top of the brick is concave with sloped sides and there raised linear bumps near the four corners of the bottom of the concavity. The brick is 210 mm long, 95 mm wide, and 63 mm thick. The concavity on the top of the brick is 19 mm deep, 142 mm long at the top and 120 mm long at the bottom of the concavity, and it is 52 mm wide at the top and 30 mm wide at the bottom of the concavity. There is no maker's mark on the brick.

Figure 12. Red brick found in Hydro-vac hole TH11-17.

FjPi-166-7 is a clear glass ink bottle. The bottle is 69 mm tall, the base is 51.5 mm in diameter, the body is 50 mm in diameter, the neck is 26 mm in diameter, and the top is 29.5 mm in diameter. The bottle was made using a two piece mold and the side seam extends from the base to the top. The top has a rounded ring which sits on a neck 10 mm in length. The neck sits on a small ring that sits on the rounded shoulder which extends to a raised ring at the top of the body. The body is 30 mm tall and it rests on a basal ring. The bottom of the bottle is depressed so that the bottle can sit on the basal ring. In the center of the base is an embossed triangle with the letter C in the center.

FjPi-166:8 is the cork for the ink bottle.
The cork has shrunk through drying so that it loosely fits in the top of the bottle, and the top of the cork has been broken off. The cork is 17 mm in diameter at its base and the body of the cork is 14 mm l ong, while the remaining part of the top of the cork is 20 mm in diameter.

Figure 13. Ink bottle with its cork found in Hydro-vac hole TH11-17.

FjPi-166:9 is a clear glass rectangular graduated patent medicine bottle. The bottle is 186 mm tall, the top is 29 mm in diameter, the neck is 23 mm in diameter, while the body and base are 63 mm wide and 40 mm thick. The bottle was made using a two piece mold which has left strong side seams that are tranversely positioned on the sides of the bottle and are not centered on the sides. The bottle is sligtly concave on the front and slightly convex on the back. The front has embossed graduated scales on either side. The left side scale is numbered 1 to 7 while the right side has 50, 100, and 200 cc. In the center of the top of the body just below the start of the shoulder is an embossed 3 VIII. The shoulder and neck are fluted or scalloped. The top ring is rounded and sits on a parallel sided part of the neck that is separated from the fluted part of the neck with an incised line. The base is slightly indented and a circular post mold scar extends to the edges of the front and back parts of the base. There is not maker's mark on the bottle.

FjPi-166:10 is a cork that was found in the top of the bottle. The cork is dry and it may have shrunk in size, but it still fits snuggly in the top. The cork is 23 mm high, and is approximately 16 mm in diameter at the top. The bottom portion of the cork is approximately 9 mm in diameter.

Figure 14. Patent medicine bottle with its cork found in Hydro-vac hole TH11-17.

Dr. Heinz Pyszczyk of Alberta Culture and Community Spirit was contacted and informed of the artifact discovery and the depths at which the items were found. He concluded that shovel testing or deep testing would be impractical given the depth of the deepest items, so he asked that we do an historic archival and library search to see if there were any records that could shed light on the possible origin of the deeply buried materials.

The archival search revealed that the Hydro-vac hole TH11-17 was within the bounds of the old Grierson nuisance grounds or dump (assigned site number FjPi-166, see Site Form in Appendix II). Garbage dumping at the Grierson nuisance grounds began around 1894 and it continued until the mid-1940's. One letter to the editor (Edmonton Bulletin March 1, 1912) indicates that by 1912 the dump was well-used, and residents in the immediate vicinity of the dump were referring to this as the City Dump, and that some if not all of these residents were not happy with the dump's location due to strong odors emanating from the dump and the fact that flies attracted to the dump were plaguing the residences in the summer time. Significant slumping occurred between McDougall Hill and what is now 95 Street during the last part of the second decade of the century, and around 1922 stabilization of the bank began in earnest. Part of the stabilization plan was to use garbage to help in-fill above the toe and foot of the slump. In this regard controlled or directed dumping under City control was used to build up the lower terrace. Approximately 30,000 cubic yards of rubbish were being dumped at the dump by 1932 which consisted of house and trade refuse including paper, scrap wood, broken glass, grass cuttings from city lawns, manure from stables, plaster and concrete from new or old buildings, vehicles and vehicle parts, and clothing (Edmonton Civic Town Planning newsletter July 15, 1932).

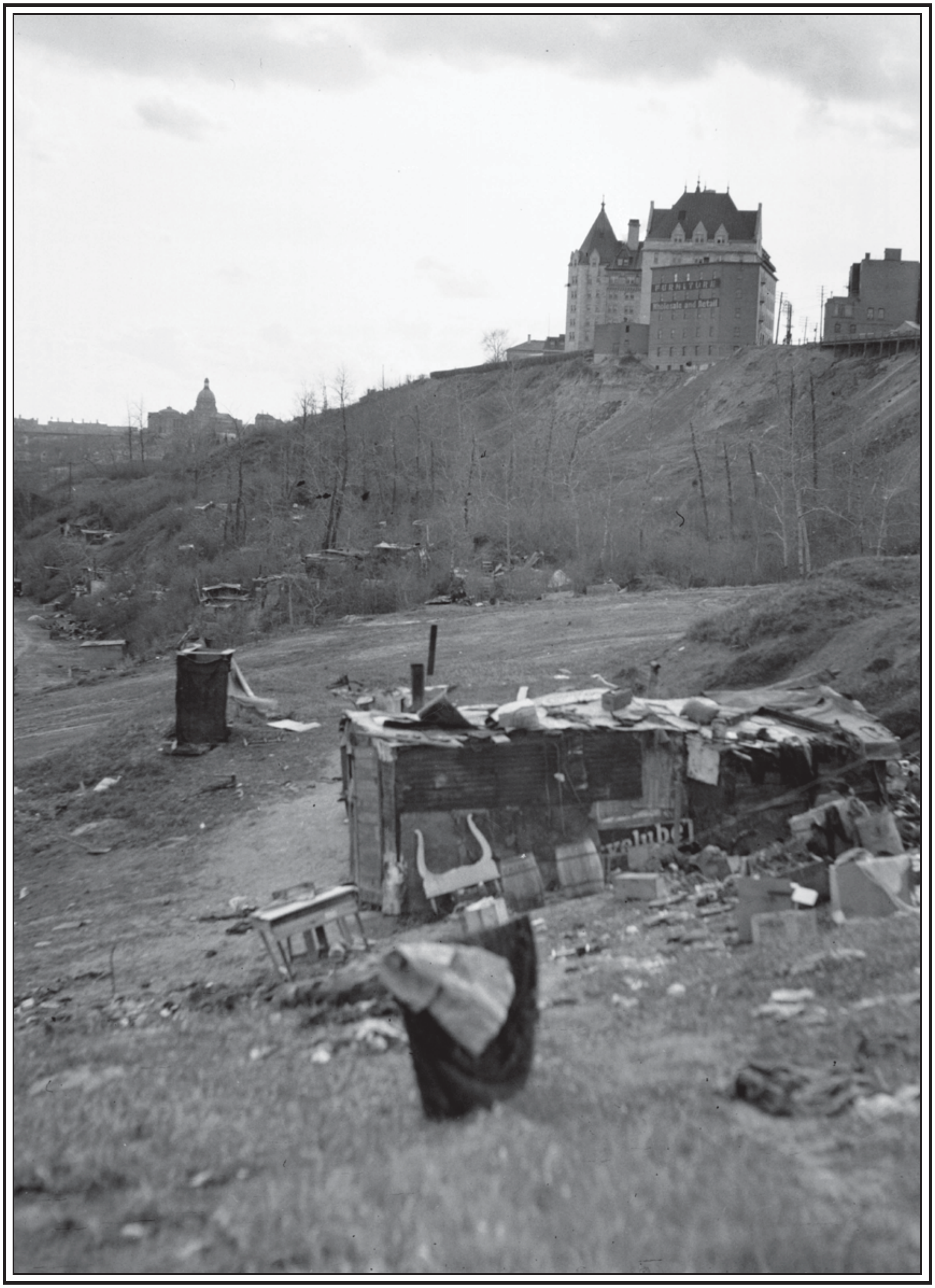
During the Great Depression squatters began setting up shacks on or by the dump. These squatters were able to build their shacks from dumped material, but they also sorted through and collected salvageable items which they sold. A letter to R. B. Jenkins of the City Health Department (April 2, 1937) indicates that the City tried to have these people moved from the dump, and over time several of the shacks were covered up. The letter offers some insight about the land reclamation progress at the dump wherein it states “as our dump progresses along the toe of the bank we have covered up the shacks and several have been removed in this way” (Haddow 1937). This statement suggests that the in-filling at the dump was being done in a deliberate manner. By the late 1940’s it appears that dumping at the Grierson dump was discontinued and the Rundle Park area on the eastern City limits became the main City of Edmonton dumping grounds. The Grierson dumpsite was covered with soil matrix, was landscaped, and now sits under Louise McKinney Park.

Since no archaeological excavations were undertaken at the dumpsite area, the exact limits and depths of the Grierson Dump were not established, but photographs of the dump area (Photographs 17 to 19) suggest that the bulk of the Grierson Dump lies between the North Saskatchewan River and the mid-slope up to the top of the northern river valley edge (Figure 15). The historic photographs of the dump show that the Grierson Dump extended for approximately 700 metres along the river and approximately 100 metres or more from the river’s edge. The road shown in Photograph 17 appears to be at the approximate location of the modern Grierson Hill road and if this is the case, Hydro-vac hole TH11-17 appears to be near the eastern end of the Grierson Dump (Figure 15). Although hole TH11-17 was only taken down to around 12 feet below surface, the actual depth of the garbage may be significantly deeper at this location.

The fact that the dump area was very large (possibly more than 50 hectares) suggests that any disturbance that will be caused by the Southeast LRT project will only impact an extremely tiny fraction of the whole dump area and therefore these impacts should not be considered significant since the vast majority of the dumpsite will not be impacted and will remain buried.

Photograph 17. View to the east showing the extent of the Grierson Dump in 1931 (Photograph # EA-217-3 courtesy of the City of Edmonton Archives).

Photograph 18. View to the west showing men working at the Grierson Dump site on May 8, 1931 (Photograph # EA-217-2 courtesy of the City of Edmonton Archives).



Photograph 19. View to the west showing some of the squatter's cabins on the Grierson Dump site in 1938 (Photograph # EA-160-325 courtesy of the City of Edmonton Archives).

Figure 15. Satellite photo showing the estimated extent of the Grierson Dump based on the approximate dumping area as existed in Photographs 17 and 18, though the continued dumping at the site after this date could mean that the actual dump site is much larger.

While all of the cultural materials recovered from the hydro-vac hole could date to the period from 1900 to 1940, none can definitely be attributed to the period before 1900, but materials buried below 12 feet may be from the earlier historic period. But, given the huge volume of material dumped at the site, the disturbance or destruction of a tiny fraction of the cultural materials at the dump from the late 19th or early to mid 20th century should not be considered significant since more than 99.9% of the dump will remain undisturbed. It is recommended that the proposed Southeast LRT construction through this site area should be allowed to proceed.

5.0 RECOMMENDATIONS

The HRIA survey area consists of a strip of land approximately 100 metres long by 25 metres wide extending from the sidewalk at the south end of the footbridge over the North Saskatchewan River across a gully up to the edge of 98 Avenue.

In-field investigations consisted of foot surveys and shovel testing within select parts of the gully within the proposed project area. A total of 17 shovel tests were excavated during the survey in the gully but no shovel tests were excavated on the general level beside the gully because of previous disturbances caused by paving, landscaping, or previous infrastructure emplacements.

Modern cultural items were found in the gully, but none of these was considered to be significant historic cultural items and all appear to be from the last part of the 20th century. No prehistoric cultural items or palaeontological materials, stratified layers, or buried soils were found in the shovel tests, on the ground surface, or in existing exposures. The lack of significant historic cultural materials, stratified layers, buried soils, or palaeontological artifacts in the study area suggests that no further concern for historical resources is warranted for this project area along the proposed Southeast LRT alignment in LSD 15-33-52-24-W4M.

One historic site (FjPi-166) was recorded on the north side of the North Saskatchewan River in LSD 15-33-52-24-W4M but outside the HRIA survey area by a Hydro-vac team working for Thurber Engineering Ltd. doing a geo-tech survey of the river valley for the Southeast LRT project. Cultural materials were found in a hydro-vac hole down to a depth of 8.5 feet (2.59 metres) and the artifacts were sent to Archaeology Group to determine their significance.

The cultural items appear to be from the first half of the 20th century and archival documents suggest that the hydro-vac findspot was within the old Grierson nuisance grounds/dump. The dump was used for approximately 50 years and extended for hundreds of metres along the North Saskatchewan River. It is concluded that any disturbances caused by construction of support structures for the Southeast LRT line within the dump area would be relatively small and insignificant in terms of the trash volume and large size of the old dump that could possibly be disturbed or destroyed by the LRT line project. It is concluded that no further concern for historical resources is warranted for this Grierson Dump (FjPi-166) area.

In this regard, this report recommends that further historical resource investigations are not warranted for the proposed Southeast LRT in LSD 15-33-52-24-W4M, in Edmonton, Alberta, and the project should proceed as planned. However, should any fossils be discovered during development, staff at the Royal Tyrrell Museum should be contacted immediately. This recommendation is subject to approval by the *Archaeological Survey, Historical Resources Management Branch, Alberta Culture and Community Spirit.*

6.0 REFERENCES

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Province of Alberta

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Strong, W.L.

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Tyrrell Museum of Paleontology

1984 Palaeontological Resources Sensitivity Zones Map. Alberta Bureau of Survey and Mapping, Edmonton.

APPENDIX I: REQUIREMENT LETTER FROM ALBERTA CULTURE AND COMMUNITY SPIRIT

Government of Alberta
Culture and Community Spirit

Historic Resources Managemer
Old St. Stephen's College
8820 – 112 Street
Edmonton, Alberta T6G 2P8
Canada
Telephone: 780-431-2300
www.culture.alberta.ca/hrm

December 6, 2010

Project File: 4715-10-042

Mr. James Hnatiuk
CH2M Hill
Suite 800, Highfield Place
10010 – 106th Street
Edmonton, Alberta
T5J 3L8

Dear Mr. Hnatiuk:

SUBJECT: CITY OF EDMONTON
SOUTHEAST LRT PLANNING STUDY
PART SECTIONS 2, 11, 14, 15, 22, 23, 27, 33 & 34-52-24-W4M; 3-53-24-W4M
HISTORIC RESOURCES STATEMENT OF JUSTIFICATION

The Archaeology Group has provided the Historic Resources Management Branch (HRMB) of Alberta Culture and Community Spirit with an Historic Resources Statement of Justification (SOJ) package for the captioned project. Staff of the HRMB have reviewed the potential for the proposed development to impact historic resources and have concluded that an Historic Resources Impact Assessment (HRIA) is required. Staff of the Royal Tyrrell Museum of Palaeontology have also reviewed this information and have indicated that an HRIA for palaeontological resources is also required.

HISTORIC RESOURCES IMPACT ASSESSMENT

Pursuant to Section 37(2) of the *Historical Resources Act*, an HRIA report is required for both archaeology and palaeontology for the proposed project. The HRIAs are to be prepared in accordance with the instructions outlined in the attached Schedule "A". In addition, if it is determined that historic structures will be affected by this project, staff of the HRMB are to be notified, additional studies may be required prior to development proceeding.

Should you require additional information or have any questions concerning the above, please contact Barry Newton at (780) 431-2330 or by e-mail at barry.newton@gov.ab.ca.

…cont.

Alberta
Freedom To Create. Spirit To Achieve.

Mr. James Hnatiuk
December 6, 2010
Page 2

On behalf of Alberta Culture and Community Spirit, I would like to thank you and officials of the City of Edmonton for your cooperation in our endeavour to conserve Alberta's past.

Sincerely,

David Link, PhD
Assistant Deputy Minister

Attachment

cc: Walt Kowal, The Archaeology Group
Dan Spivak, RTMP (3948-83H-6)

SCHEDULE "A"
***HISTORICAL RESOURCES ACT* REQUIREMENTS**
CITY OF EDMONTON
SOUTHEAST LRT PLANNING STUDY
PART SECTIONS 2, 11, 14, 15, 22, 23, 27, 33 & 34-52-24-W4M; 3-53-24-W4M
(PROJECT FILE: 4715-10-042)

1. HISTORIC RESOURCES IMPACT ASSESSMENT - ARCHAEOLOGICAL RESOURCES

Pursuant to Section 37(2) of the *Historical Resources Act*, an Historic Resources Impact Assessment (HRIA) and any work resulting from this assessment is to be conducted on behalf of the City of Edmonton by an archaeologist qualified to hold an Archaeological Research Permit within the Province of Alberta. In order to conduct the HRIA, the archaeological consultant must submit "An Application for an Archaeological Research Permit - Mitigative Research Project" to the Historic Resources Management Branch. Please allow up to ten working days for the permit to be processed.

Timing: The HRIA shall consist of the conduct of a pre-construction impact assessment carried out under snow-free, unfrozen ground conditions. The HRIA is required only for the area on the south side of the North Saskatchewan River, between the river and 87th Street. More specifically on the north side of the small gully and within the gully as outlined in the SOJ.

Deep Testing: A deep testing program may be required in areas of significant sedimentation, at the discretion of the consulting archaeologist.

Additional measures: Depending upon the results of the HRIA, additional salvage, protection or preservative measures may be required

2. FINAL REPORT

A copy of the HRIA final report for archaeological resources and any Interim reports are to be sent to the Historic Resources Management Branch, 8820 - 112 Street, Edmonton, Alberta, T6G 2P8.

3. HISTORIC RESOURCES IMPACT ASSESSMENT - PALAEONTOLOGICAL RESOURCES

Pursuant to Section 37(2) of the *Historical Resources Act*, an Historic Resources Impact Assessment (HRIA) and any work resulting from this assessment is to be conducted on behalf of the City of Edmonton by a palaeontological consultant qualified to hold a Permit to Excavate Palaeontological Resources (Mitigative) within the Province of Alberta.

…cont.

SCHEDULE "A" – PAGE 2

Timing: The HRIA shall consist of the conduct of a pre-construction impact assessment. The HRIA is required only for the area where the LRT will go underground on the Davies Road optional alignment and in the gully on the south side of the North Saskatchewan River as outlined in the SOJ.

Additional measures: Depending upon the results of the HRIA, additional salvage, protection or preservative measures may be required.

4. FINAL REPORT

A copy of the final report for palaeontological resources and any Interim reports are to be submitted directly to Dan Spivak, Royal Tyrrell Museum of Palaeontology Box 7500, Drumheller, Alberta, T0J 0Y0.

APPENDIX II: ARCHAEOLOGICAL SITE INVENTORY DATA FORM

Culture and Community Spirit

ARCHAEOLOGICAL SITE INVENTORY DATA

Borden No. FjPi-166
Permit No. 11-249

Return to: Historic Resources Management, Archaeological Survey
8820 - 112 Street, Edmonton, Alberta T6G 2P8

Revisit Date:

1. Site Name: Grierson Dump
2. Field No.: Grierson Dump
3. Elevation (m): 610
4. N.T.S. 1:50,000 Map No.: 83 H/11
5. Legal Description: LSD 14,15;2,3 Section 33;4 Township 52;53 Range 24 W of 4 M
6. UTM NAD83 Zone 12 Easting Centre 335692 Northing Centre 5935331
7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☒ Municipal Government ☐ Freehold

Land Owner Name/Address: City of Edmonton

8. Access (refer to highway, road number, trail, cardinal directions, landmarks, nearest settlement, distances)

From the west end of the Low Level Bridge in the City of Edmonton go northeast up Grierson Hill road 375 metres to the access road and parking lot on the southeast side of Grierson Hill road. Proceed southeast 120 metres into Louise McKinney Park. The site occupies the first terrace above the river and extends approximately 700 metres to the northeast along the North Saskatchewan River.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

The site area has been totally landscaped and there are numerous trails throughout the old dump site area.

10. Site Class
- ☐ prehistoric
- ☐ indigenous historic
- ☒ historic
- ☐ contemporary
- ☐ undetermined

11. Site Context
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

12. Component
- ☒ single
- ☐ multi
- ☐ undetermined

1 # components

13. Site Type

☐ isolated find	☐ quarry	☐ ranch	☐ school
☐ scatter <10	☐ rock art	☐ dwelling	☐ urban
☐ scatter >10	☐ burial	☐ trading post	☐ ceremonial/religious
☐ campsite	☐ palaeoenvironmental	☐ police post	☐ industrial
☐ stone feature	☐ settlement	☐ mine	☐ transportation
☐ killsite	☐ homestead	☐ trail	
☐ workshop	☐ farm	☐ mission	

other, specify: historic feature

14. Features (frequencies if possible)

___ stone circle	___ medicine wheel	___ pit	___ structure	other, specify
___ cairn	___ effigy	___ mound	___ foundation	1 dump
___ stone arc	___ pictograph	___ depression	___ cellar	___
___ stone line	___ petroglyph	___ cabin	___ dump	
___ drive lane	___ hearth	___ house	___ fence	

Borden No. FjPi-166

Permit No. 11-249

15. Description (spatial extent, patterning, density and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

10 historic items were recovered from one hydro-vac hole near the northeast end of the estimated limits of the old Grierson Dump. The 10 items are a white ironstone bowl fragment, a complete milk bottle, a complete red brick, a complete ink bottle with cork, and a patent medicine bottle with its cork, two butchered bone fragments (cow (Bos Taurus)), and an unidentified large mammal rib fragment.

16. Materials Observed ☒ yes ☐ no   Materials Collected ☒ yes ☐ no

Materials observed/collected (frequencies if possible).

observed	collected		observed	collected		observed	collected	
		projectile points	3	3	faunal remains			wood
		lithic tools			human remains			shell
		lithic cores			metal points			metal
		lithic debitage			floral remains	3	3	glass
		bone tools			tephra			beads
		pottery			soil samples	1	1	ceramics (historic)
		fire cracked rock			macrofossils	3	3	other, specify 2 corks, 1 red brick
		charcoal						

17. Collection Remarks (formed tools, raw materials, etc. that were collected)

The 10 items collected are a white ironstone bowl fragment, a complete milk bottle, a complete red brick, a complete ink bottle with cork, and a patent medicine bottle with its cork, two butchered bone fragments (cow (Bos Taurus)), and an unidentified large mammal rib fragment. All of the cultural items appear to be from the first half of the 20th century.

18. Collection Repository ☒ Royal Alberta Museum ☐ Private collection ☐ Other…

19. Photo/Images ☒ yes ☐ no   Repository Archaeology Group Inc.

20. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☒ Historic other, specify
☐ Middle Prehistoric ☐ Fur Trade/Contact ☐ undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnographic & ethnic groups)

Culture Remarks

21. Calendar Date (A.D./B.C.) 1894-mid 1940's

22. Radiocarbon Dates

Borden No. FjPi-166

Permit No. 11-249

23. Dimensions Length (m) 700 Width (m) 100 Orientation E/W Depth Below Surface (m) >4 metres

24. Estimated Portion Intact (%) 0

25. Assessment Methods

☐ surface inspection ☐ backhoe tests ☐ mapping
☐ erosion exposure ☐ excavation ☐ monitor
☐ shovel tests ☐ auger tests

other, specify hydro-vac hole

shovel tests ______ # positive shovel tests ______

backhoe tests ______ # positive backhoe tests ______

auger tests ______ # positive auger tests ______

excavation units ______ length (m) ______ width (m) ______ # excavated square meters ______

26. Disturbance Factors (natural, human, current, potential)

Type of Disturbance

☐ agriculture ☐ road/highway ☐ coal mine ☐ transmission line ☐ industrial area
☐ pipeline ☐ gravel/sand pit ☐ oil sands ☐ reservoir ☐ vandalism
☐ wellsite ☐ residential area ☐ forestry ☐ recreation area ☐ erosion

other, specify LRT line

Will current development impact site? ☒ yes ☐ no ☐ unknown

Disturbance Factors Remarks

The site area has been covered with sediment and has been landscaped.

27. Permit Holder/Researcher Walt Kowal

28. Observed by Thurber Engineering Ltd. Date (YYYYMMDD) November 8, 2011

29. Collected by Thurber Engineering Ltd. Date (YYYYMMDD) November 8, 2011

30. Tested by ______ Date (YYYYMMDD) ______

31. Excavated by ______ Date (YYYYMMDD) ______

32. Form completed by Walt Kowal Date (YYYYMMDD) January 4, 2012

33. Report Title/Project Name Southeast LRT Alignment in LSD 15-33-52-24-W4M, in the City of edmonton

34. Site Significance/Recommendations Remarks

The site is considered to be significant since it contains millions of pieces of cultural material from the first half of the 20th Century and these items may be of historic interest in the future. The possible impact on this huge dump area by the proposed Southeast LRT project is considered to be insignificant and no further work is recommended for this dump site in regards to the Southeast LRT project, but further investigation should be undertaken if wholesale disturbance of the buried materials is to take place in the future.

35. Additional Remarks

The site was not tested or visited and the dump dimensions are estimates based on 1931 photographs like the one below, and it may in fact be larger than estimated.

Borden No. FjPi-166

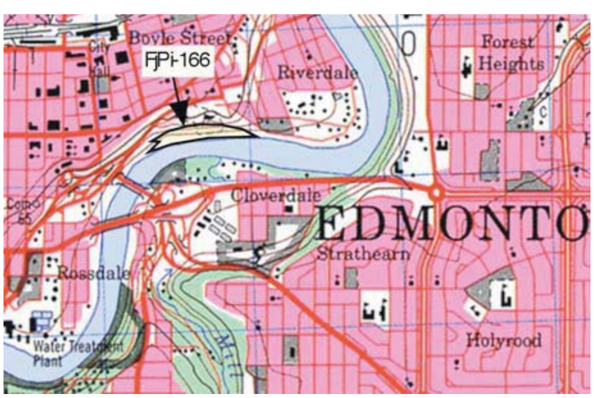
Permit No. 11-249

36. Site Map

Photograph courtesy of the City of Edmonton Archives

N.T.S. 1:50,000 Map Inset

Map No.: 83 H/11



Legend

Extent of Site	———	Fence	××××
Positive Shovel Test	■	Railway	++++++
Negative Shovel Test	□	River	
Road	═══	Steep Rise	
Trail	———		

Additional Legend

N

Scale : ___ cm = ___ m

HISTORIC RESOURCES IMPACT ASSESSMENT (PALEONTOLOGICAL REPORT)

Southeast LRT Planning Study Route

Prepared for
City of Edmonton
by
Michael G. Riley, M.Sc.
of
AEON Paleontological Consulting Ltd

ACCS Project File: 4715-10-042; RTMP Permit No.: 11-022

This document contains sensitive information regarding Historic Resources that are protected under provisions of the Alberta Historical Resources Act. This information is to be used to assist in planning for the proposed project only. It is not to be disseminated, and no copies of this document are to be made without written permission of Historic Resources Management Branch, Alberta Culture and Community Services.

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Paleontological Historic Resources Impact Assessment

PROJECT NAME	Southeast LRT Planning Study

Introduction

In response to a request by The Archaeology Group Inc. on behalf of the City of Edmonton - LRT Design and Construction, Aeon Paleontological Consulting Ltd. (Aeon) was retained to complete a paleontological Historic Resources Impact Assessment of the proposed southeast extension of the City of Edmonton's Light Rapid Transit (LRT) line and associated facilities (ACCS File: 4715-10-042 - Schedule "A" requirements for paleontology have been issued).

The proposed SE LRT line extension project will connect the potential Grey Nuns LRT station at 66 Street and 31 Avenue in Mill Woods to the potential Quarter LRT station at 96 Street and 102 Avenue in downtown Edmonton. Along the proposed LRT route alignment, two areas of paleontological interest were noted: the slopes of the North Saskatchewan River Valley and the Wagner Park ravine (Mill Creek Ravine system). These two drainage systems were of paleontological interest as they are associated with incised watercourse crossings that have downcut and may have exposed fossil resources and/or bedrock from the underlying Empress and Horseshoe Canyon formations. Fossil resources have been recorded along the slopes and floodplains of both the North Saskatchewan and Mill Creek drainage systems.

A pre-construction Historic Resources Impact Assessment for paleontology was completed in October 2011, according to the Schedule A requirements issued for paleontology. Based on background research and the author's past work in the Edmonton area, the two high potential crossings along the proposed route (North Saskatchewan River Valley and Wagner Park) were surveyed using pedestrian reconnaissance.

After review of the field survey data, geotechnical reports, and proposed design/construction plans, it is suggested that bedrock from the Horseshoe Canyon Formation is likely to be disturbed during development of the SE LRT expansion. The disturbance will likely occur during specific phases of construction at three areas along of the north and south slopes of the North Saskatchewan River Valley (River Valley). The three areas included the underground LRT tunnel excavation (sequential excavation), the north slope development around the tunnel portal, and the south slope (mid-slope) roadway/railway development along Conners Road.

Note: Due to the paleontological sensitivity of the North Saskatchewan River Valley slopes, any changes to the current plan (e.g. project boundaries, routing, bridge construction techniques, etc.) may require a reevaluation of the paleontological program and scope of work required.

[illegible]

The objective of this report is to:

- provide a brief review of the known paleontological resources, geologic formations and areas of high paleontological potential within and around the proposed SE LRT Expansion project;
- document any paleontological sites, resources and/or high potential zones within and around the proposed SE LRT project noted during the impact assessment;
- assess the proposed project's potential during development activities to disturb any documented or known paleontological sites, resources, high paleontological potential zones and/or bedrock (e.g. Horseshoe Canyon Formation and Empress Formation);
- and, if appropriate, suggest areas within the proposed project area that may require a paleontological post-impact assessment (monitoring program), once the final route alignments are completed.

Key Contacts

Report Prepared by	Aeon Paleontological Consulting Ltd.			
Address:	169, 51042 Range Road 204			
	Sherwood Park, AB T8G 1E5			
Contact Person:	Michael G. Riley, M.Sc.		**Title:**	Principal Paleontologist
	Tel:	780.662.3277	**email:**	mriley@paleoconsulting.com
	Fax:	780.662.3282	**File:**	Aeon-11-0162

Proponent	City of Edmonton - LRT Design and Construction			
Address:	14th Floor, Century Place, 9803 102A Avenue			
	Edmonton, AB T5J 3A3			
Contact Person:	Jeff Ward, P. Eng.		**Title:**	Senior Engineer
	Tel:	780.495.9976	**email:**	jeff.ward@edmonton.ca
	Fax:	780.496.2803	**File:**	Not available

Contracting Client	The Archaeology Group Inc.			
Address:	2526 Bell Court S.W.			
	Edmonton, AB T6W 1J8			
Contact Person:	Walt Kowal		**Title:**	Principal Archaeologist
	Tel:	780.438.4262	**email:**	w.kowal@shaw.ca
	Fax:	780.439.4285	**File:**	Not available

Heritage Contact	Heritage Resources Branch, Land Use Planning Section			
Address:	Old St Stephen's College, 8820-112 St			
	Edmonton, AB T6G 2P8			
Contact Person:	Rebecca Traquair		**Title:**	Administrative Coordinator
	Tel:	780.431.2300	**Email:**	rebecca.traquair@gov.ab.ca
	Fax:	780.431.2301	**File #:**	4715-10-042

Museum Contact	Royal Tyrrell Museum, Resource Management Program (RMP)			
Address:	Box 7500			
	Drumheller, AB T0J 0Y0			
Contact Person:	Dan Spivak		**Title:**	Head, RMP
	Tel:	403.823.7707	**Email:**	dan.spivak@gov.ab.ca
	Fax:	403.823.7131	**File #:**	3948-83H-6

Project Details

Table 1							
Nature of Project	Rail system, bridge construction (foundations, abutments, piles, new single span bridge), construction/realignment of roadways, intersections and pedestrian pathways.						
Legal Description:	LSD*	Sec	Twp	Rge	Mer	HRV	Category
	6,11,14	2	52	24	4	---	---
	3,4,5,12,13	11	52	24	4	---	---
	4,5,12,13	14	52	24	4	---	---
	1,8,9,16	15	52	24	4	---	---
	1,2,7,8,10,11,14,15	22	52	24	4	---	---
	4,5	23	52	24	4	---	---
	2,3,6,7,10,11,14,15	27	52	24	4	---	---
	6-8,10,11,15	33	52	24	4	**5**	**p**
	3,5,6	34	52	24	4	---	---
	2,3,5, 6,7	4	53	24	4	**5**	**p**
* - if LSD is **RED** then it has been notated in the *Listing of Historic Resources* with a Historic Resource Value (HRV) of 5p = High Palaeontological Resource Sensitivity Zone							
Project Size:	~10 hectares (13 km long railway)			Nearest Town:	Edmonton		
NTS Map Sheet:	83 H/6 Cooking Lk. & H/11 Edm.			Area/County:	City of Edmonton		

Natural Region	Central Parkland
Surficial Covering*:	Forested valley slope and terraces, landscaped parkland with grasses and trees, roadways and industrial/commercial sites.
Depth of Cover:**:	Up to ~10 m - test holes indicate floodplain deposits are up to 10 m thick on the lower alluvial terrace; slopes unknown but variable.
Outcrop***:	Visible along cutbanks and slopes of North Saskatchewan River.
Relation to Slope:	Floodplain, terraces and valley slope

* **Surficial Covering** = any vegetation, sediments, or water bodies/channels that overlie the bedrock in the proposed project area (e.g. forest, creek, pasture, glacial sands).

** **Depth of Cover** = the estimated depth of the sediments (e.g. soil, glacial drift, fill) overlying the bedrock deposits on average, throughout the proposed project lands.

*** **Outcrop/Exposure** = any bedrock outcropped or exposed in and around the proposed project area ROW.

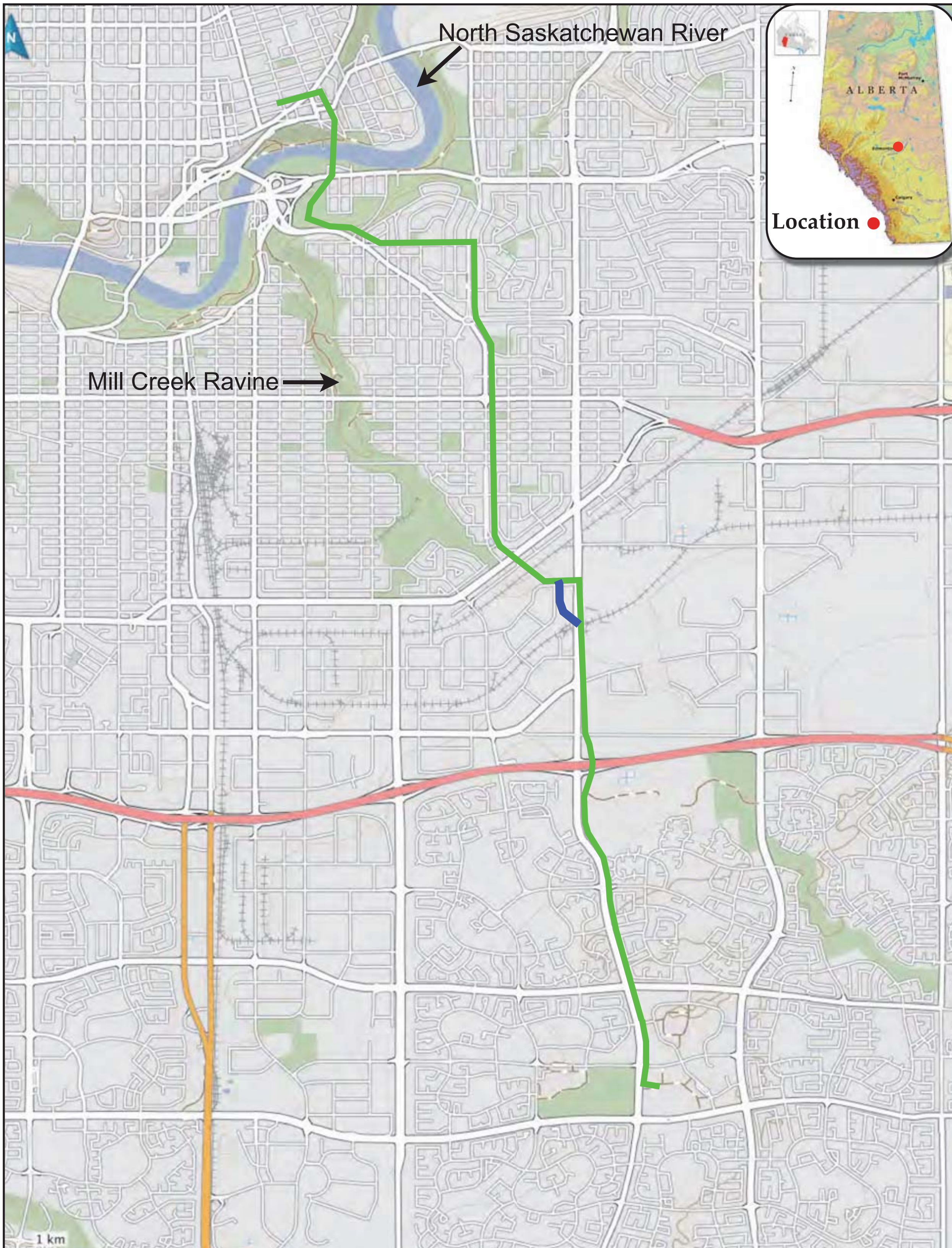

Figure 1. Topographical map with roadway overlay showing proposed Southeast LRT route (and optional Davies Road alignment ( ) from downtown to Mill Woods.

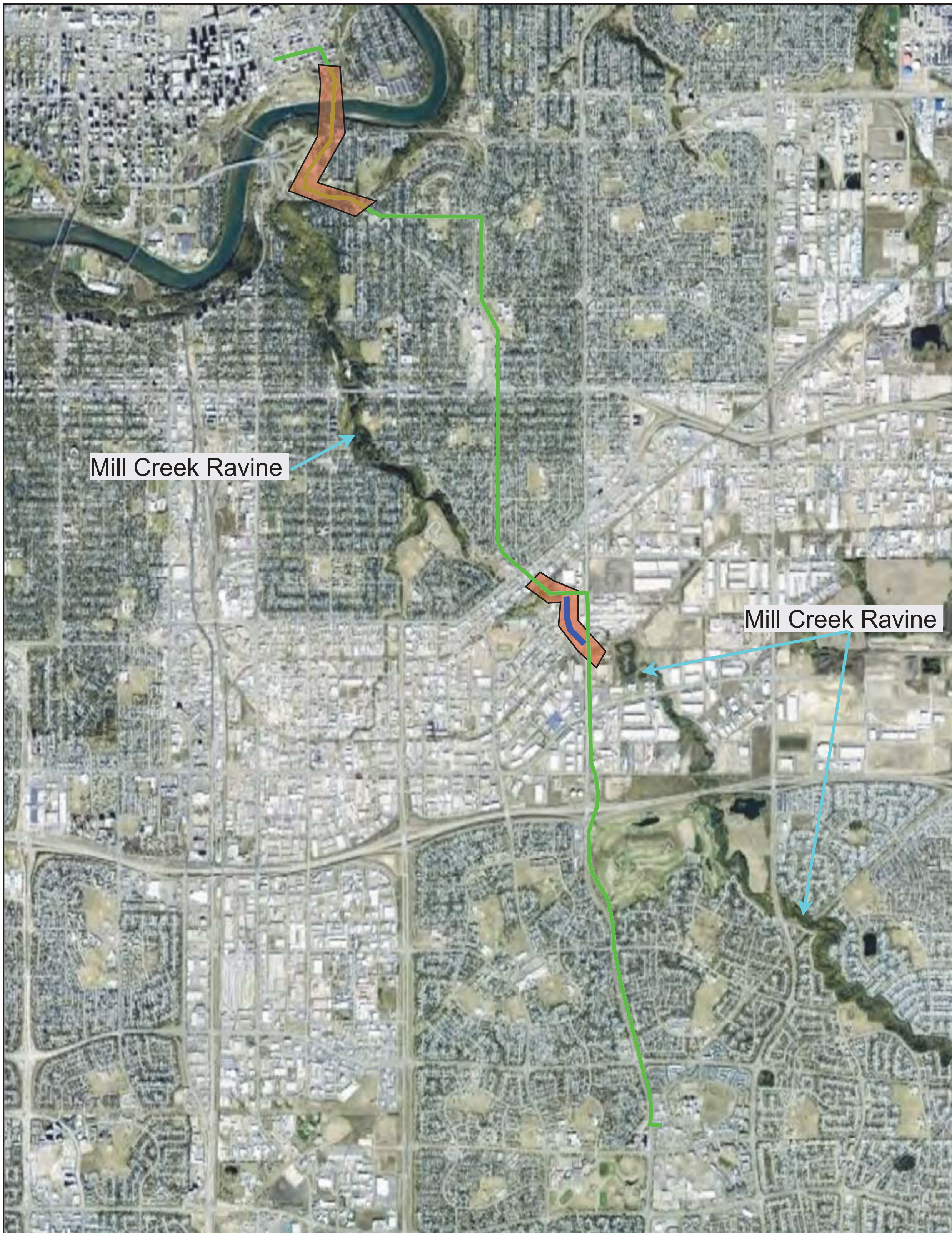

Figure 2. Satellite image showing proposed Southeast LRT route (and Davies Road optional alignment (from downtown core to Mill Woods.
Red areas (■) are assessed as areas of paleontological interest. Google 2010.

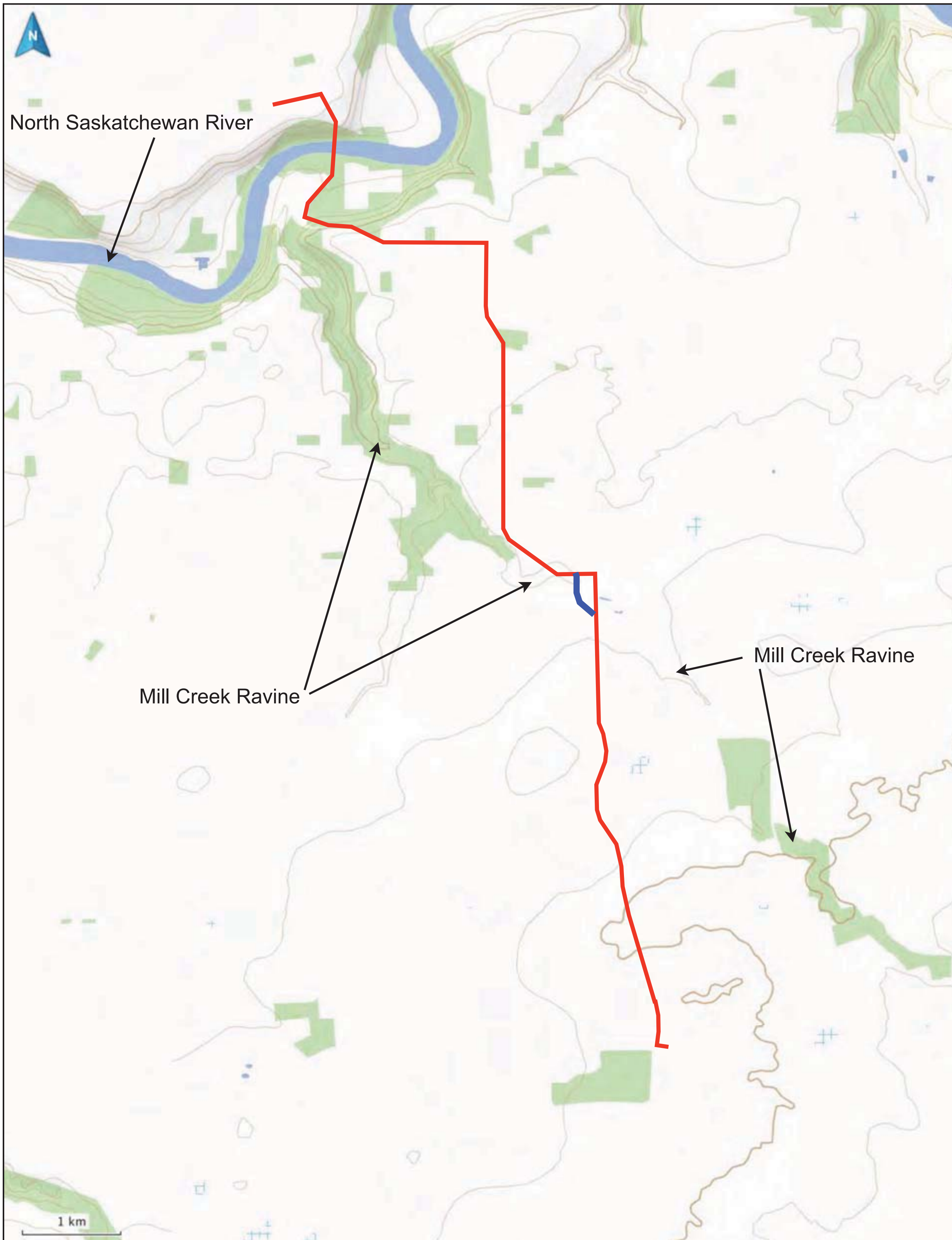

Figure 3. Shaded topographical map showing proposed Southeast LRT route (and Davies Road optional alignment (from downtown to Mill Woods. Contour = 10 m.

Paleontological Resources and Stratigraphic Information

Table 2			
In *Listing of Historic Resources* :	**Yes**	**HRV Value:**	**5p**
Designated Lands:	6-8,10,11,15 33-52-24 & 2,3,7-4-53-24 W4M March 1, 2011 *Listing*		
Site Name:	High Palaeontological Resource Sensitivity Zone		
Comments:	The project will impact the valley slope, terraces and floodplain of the North Saskatchewan River (NSR). Outcrop from the Horseshoe Canyon Fm. is present along river cut-banks, valley slopes and tributary walls near the project. Significant paleontological resources (vertebrate remains - dinosaur) have been recovered along the valley slopes and tributaries of the NSR up and downstream of the project.		
Stratigraphic Information			
Group:	Edmonton		
Formation:	Horseshoe Canyon		
Member:	Unknown		
Epoch:	Upper Cretaceous		
Age:	late Campanian to early Maastrichtian (69-72 Ma)		
Comments:	Based upon past studies by the author in the area, the strata underlying the project are likely associated with the informally named Unit 1 complex of the Horseshoe Canyon Formation. It is considered to be an aggradational, coastal to alluvial system. The age of the sediments is considered to be late Campanian (~69-72 Ma) and the unit is composed primarily of grey to brown siltstone/mudstone, sandstone, and thick black coal seams with minor isolated channel deposits.		

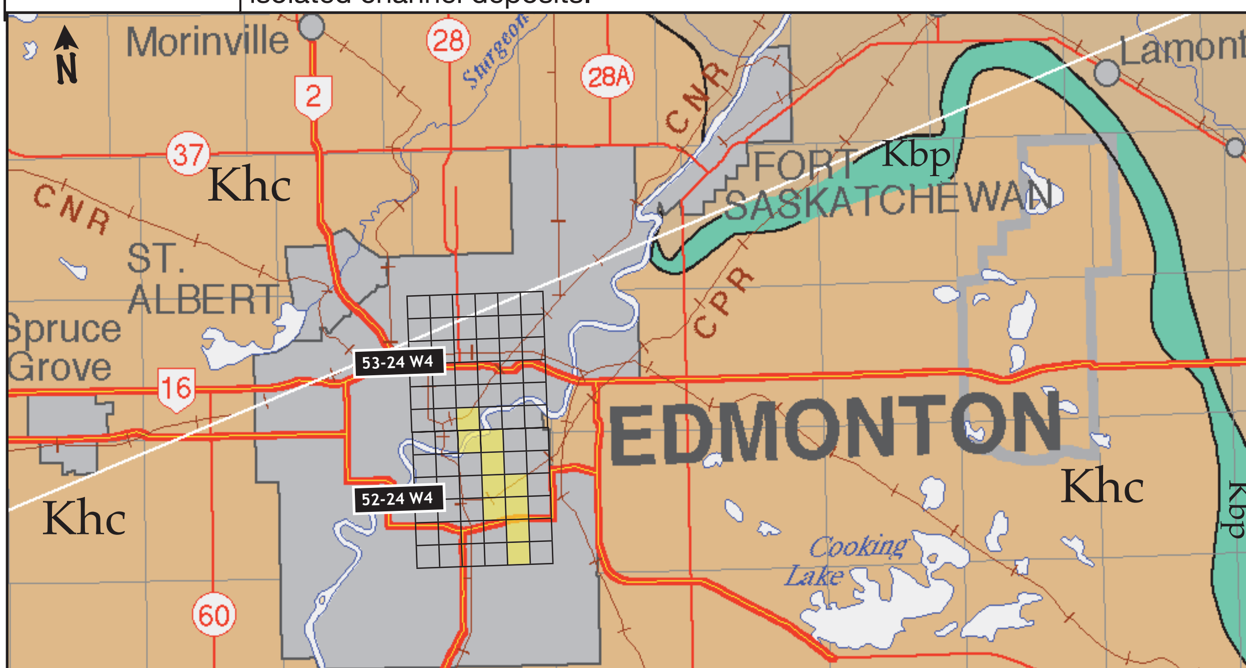

Figure 4. Portion of Geological Map of Alberta showing surficial bedrock. Proposed SE LRT located within Alberta Township Grid sections highlighted in yellow ( ). Khc = Horseshoe Canyon Formation; Kbp = Bearpaw Formation. AB Geologic Survey 1999.

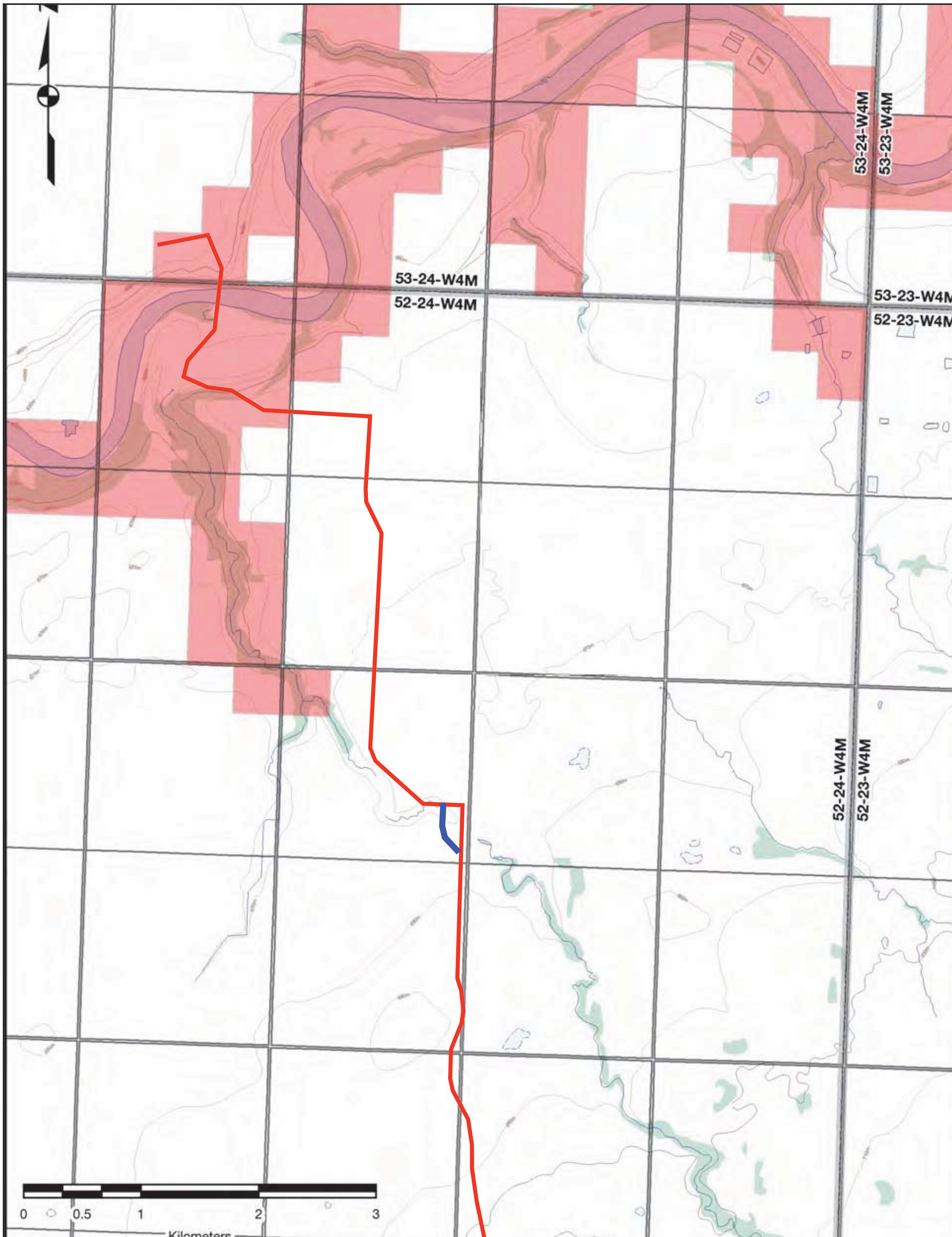

Figure 5. Topographical map showing lands with HRV 5P designation (■) along proposed Southeast LRT route (—) and Davies Road optional alignment (—).

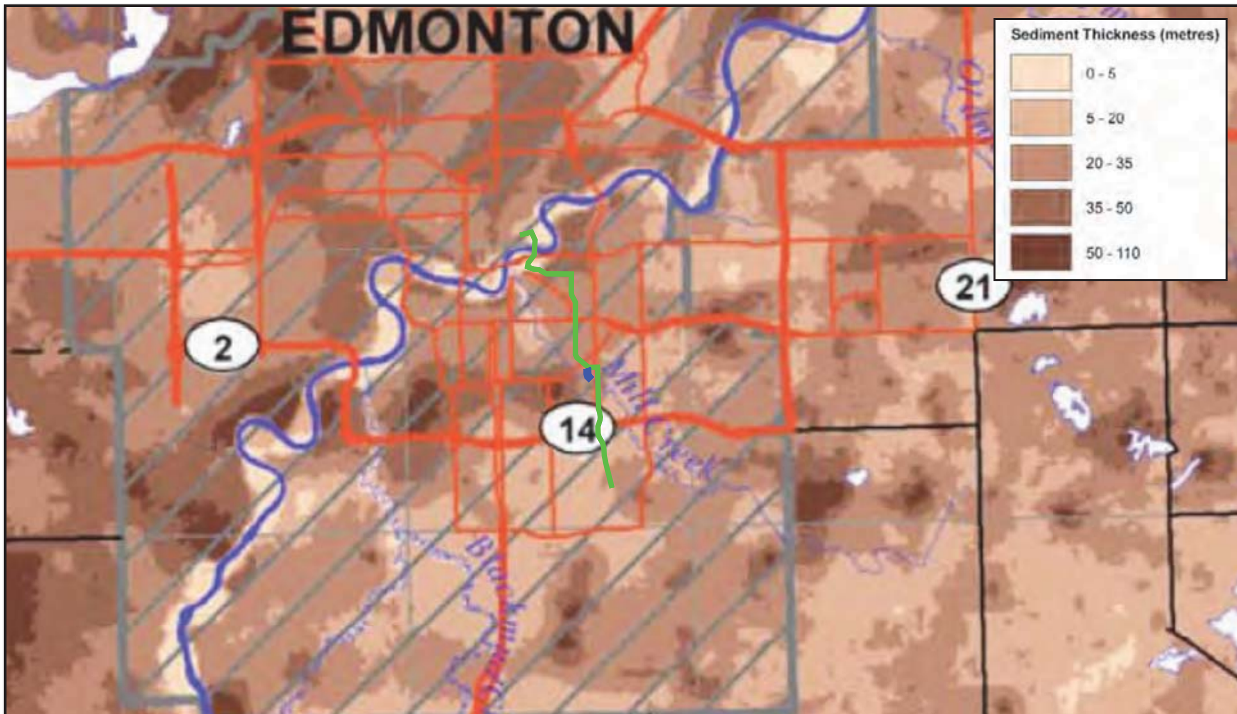

Figure 6. Drift thickness map showing proposed Southeast LRT route (—) and Davies Road optional alignment (—). Scale 1:500,000. Slattery & Barker 2010.

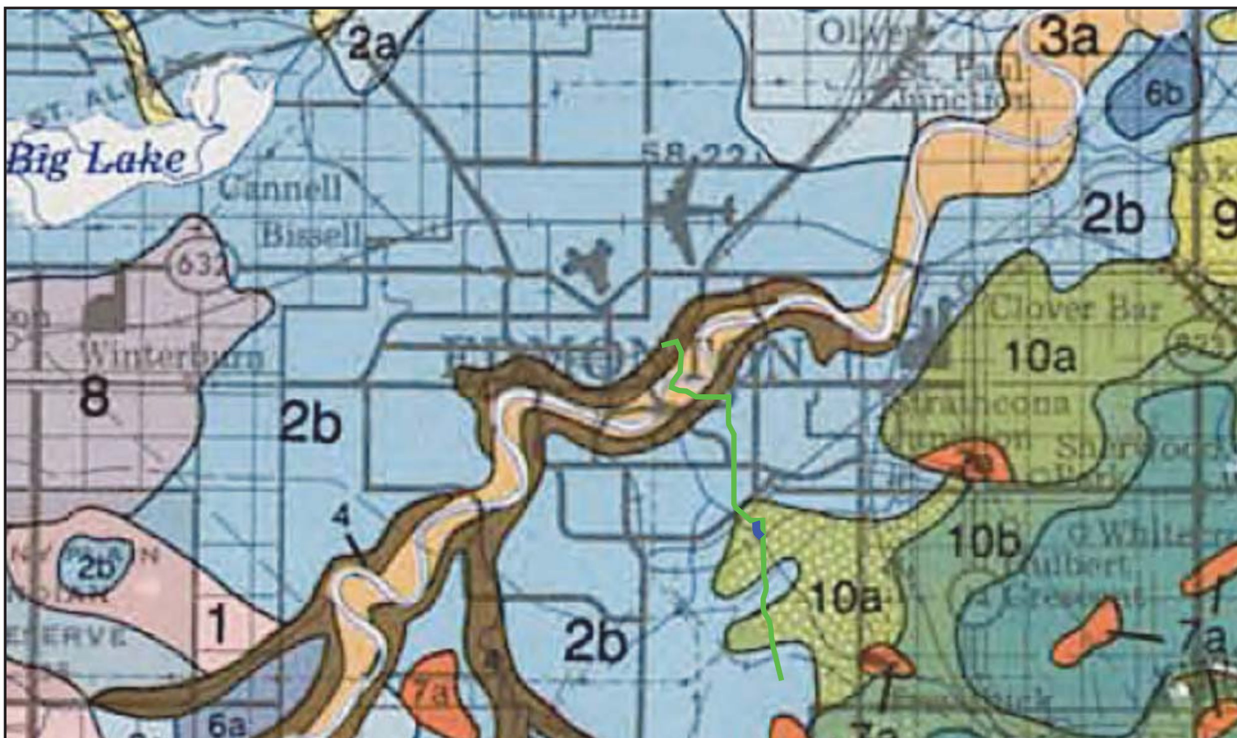

Figure 7. Quaternary geology map. Map legend: Lacustrine Deposit (2) - 2b = fine sediment (silt & clay); Fluvial Deposit (3) - 3a = coarse sediment (gravel, sand, & minor silt); Stream and Slopewash Eroded Deposit - 4 = exposed till and bedrock; Stagnation Moraine (10) - 10a = undulating topography with local relief generally less than 3 m. Shetson 1990.

Evaluation

North Saskatchewan River Valley

Churchhill Station to LRT Tunnel /North Slope

The City of Edmonton proposes the expansion of the LRT system from the downtown core into the southeast section of the City (Figs. 2, 8).

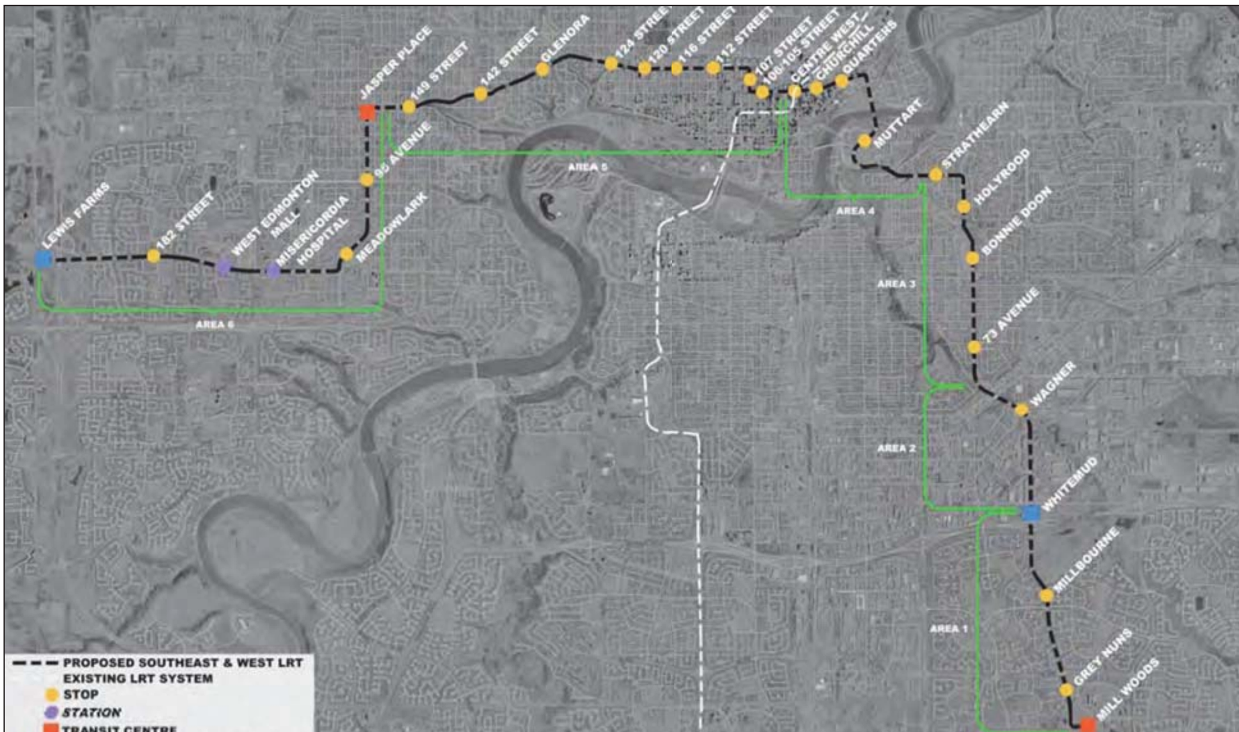

Figure 8. Approved corridor for the West and SE LRT expansion projects. SE LRT corridor (Areas 1 to 4) is the proposed line assessed in this report. City of Edmonton 2012.

Beginning at the proposed ground-level Churchill station, an at-grade track system will be developed, running east-west down 102 Avenue. The LRT line will be excavated below-grade east of 96 Street and continue to slope downward along 102 Avenue until it enters the proposed LRT tunnel. The tunnel will run below 102 Avenue then turn south at 95 Street. The tunnel will continue south, below the existing city infrastructure, until the tunnel portal emerges, approximately midway down the bank of the north slope of the River Valley below 95 Street (Figs. 9-12). The proposed alignment of the tunnel below ground level suggests that a portion of the tunnel will be excavated through bedrock from the Horseshoe Canyon Formation (Figs. 4, 10).

The LRT tunnel will likely be developed using the sequential excavation method (New Austrian Tunnelling method - NATM). It is likely that a backhoe-like excavator will excavate and advance small sections of the tunnel. The excavated material (spoil) will be loaded onto muck-trucks (hopper cars?) for removal. Shotcrete (concrete/mortar sprayed on at high pressure) will be applied (as the tunnel advances) to support and stabilize the newly excavated section of the tunnel.

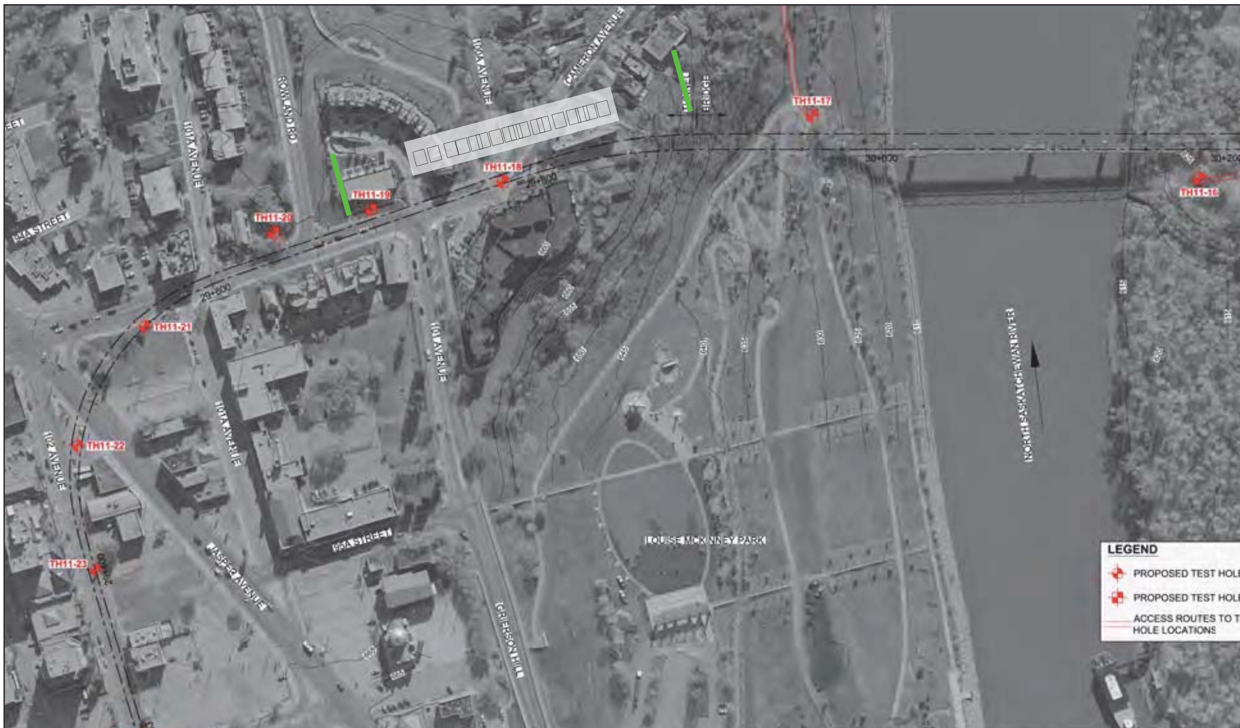

Figure 9. Geotechnical Test Hole Drilling Program. Green lines (—) bound section of proposed tunnel that will likely impact bedrock. Courtesy AECOM. Modified by Aeon.

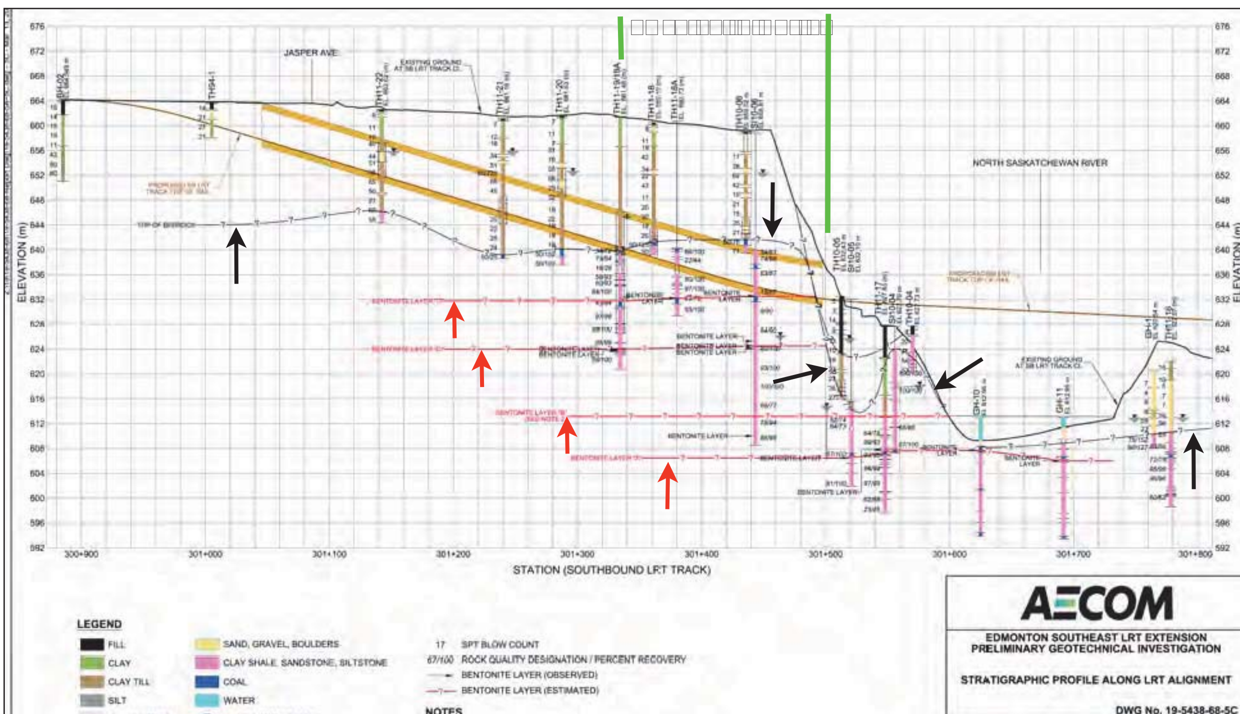

Figure 10. Stratigraphic profile along section of proposed LRT alignment. Drill/bore hole locations TH-11-16 to -22 shown. Note estimated top of bedrock (—?—)(→) and bentonite layers (—?—)(→). Green lines (—) bound section of proposed tunnel that will impact bedrock. Courtesy AECOM. Modified by Aeon.

Figure 11. View facing north from pedestrian walkway on north bank of North Saskatchewan River Valley showing approximate LRT tunnel portal (●) placement.

Figure 12. View facing north from south bank of North Saskatchewan River showing existing footbridge and approximate location of proposed LRT tunnel portal (●) on north valley slope. Note: bedrock likely near surface below thin vegetative/colluvial or lanscaped cover (areas bounded by — lines). 1= reference point (see house in Fig. 13)

Based upon the stratigraphic profile provided by AECOM (Fig. 10; Appendix A) along the proposed LRT alignment, it is likely the tunnel will be excavated through bedrock from the Horseshoe Canyon Formation (Figs. 4, 10). If the sequential type of excavation is utilized, then the exposed bedrock face and spoil/excavated sediments could expose (and leave intact/recoverable) significant fossil vertebrate resources from the Horseshoe Canyon Formation.

Figure 13. View facing northeast from footbridge of exposed bedrock face (bounded within — lines) along northside cutbank of North Saskatchewan River. 1= reference point (see house in Fig. 12) proposed LRT alignment .

The survey noted that bedrock from the Horseshoe Canyon Formation outcrops immediately to the east (downstream) of the proposed LRT alignment (Figs. 12, 13). The light-grey coloured bedrock deposits are exposed at an active cut-bank on the north side of the river (Fig. 13). Observations of the exposed bedrock face indicate the deposits are primarily comprised of interbedded mudstone/siltstone layers. Silty sandstone layers and thin ironstone layers were also noted, but were a minor component of the exposures in this area (Figs. 14, 15). This exposed bedrock is *in situ* and does not appear to be an isolated slump block associated with the Grierson Hill landslide in 1901. Several, small poorly preserved fragments of fossil plant material were observed in the slope debris/talus. No fossil vertebrate material was noted.

Historical note: the landslide was likely caused by a combination of coal mining operations targeting the coal seams within the Horseshoe Canyon Formation at Grierson Hill and extremely heavy rainfall. The mining operation likely caused fracturing and subsidence while the rainfall resulted in extreme bank erosion and ground saturation eventually leading to slippage along one or more of the bentonite layers (montmorillonite - mineral clay) (Godfrey, 1993).

Figure 14. View looking east along north valley wall of North Saskatchewan River showing exposed bedrock from the Horseshoe Canyon Formation. Slide scar (→).

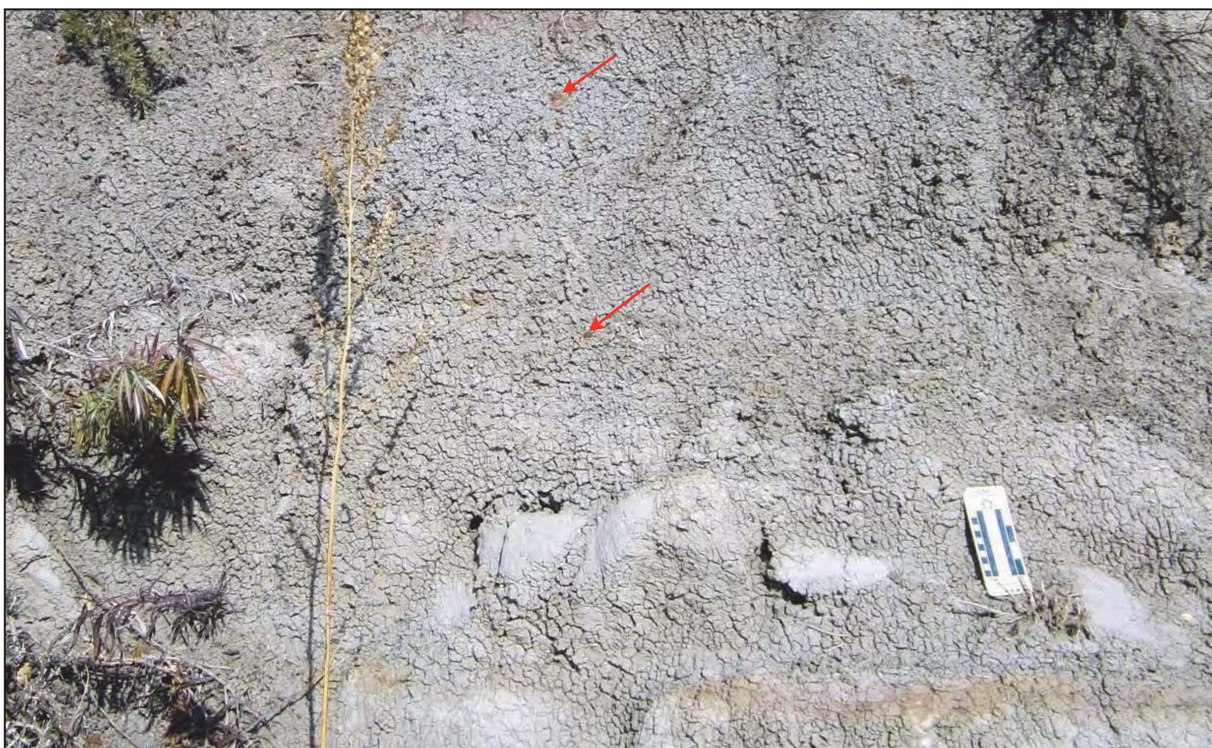

Figure 15. Close-up of weathered bedrock face in Fig. 14 showing interbedded layers of siltstone/mudstone, silty sandstone and ironstone fragments (→) in slopewash .

North Saskatchewan River Valley

LRT Bridge [illegible]

The proposed LRT bridge-elevated trackway will span the North Saskatchewan River from the tunnel portal on the north valley slope to the proposed Muttart Station on the south side floodplain. The tracks will remain elevated across 98 Avenue then drop to grade before the proposed Muttart Station (Fig. 16). The line will continue south and ascend Connors Road to the north of the existing road, utilizing the existing disturbed and landscaped road right-of-way. Just beyond the top of the south valley slope, the line will head east at grade level down 95 Avenue to 85 Street. At 85 Street, the line turns south and heads south toward Bonnie Doon Shopping Centre.

Figure 16. Satellite image of North Saskatchewan River Valley showing section of proposed SE LRT alignment (—) from existing footbridge to 85 Street. Inset shows photomosaic of proposed alignment from 2010 workshop sessions (City of Edmonton).

The vertical clearance of the LRT bridge over the North Saskatchewan River has not been determined. The vertical clearance, however, will be set to meet the federal *Navigable Waters Protection Act* (Figs. 10, 19). On the south side of the North Saskatchewan River channel, the bridge-trackway will remain elevated across the pedestrian path and 98 Avenue, then continue to descend in elevation to near grade level at the proposed Muttart Station (Figs. 17, 19).

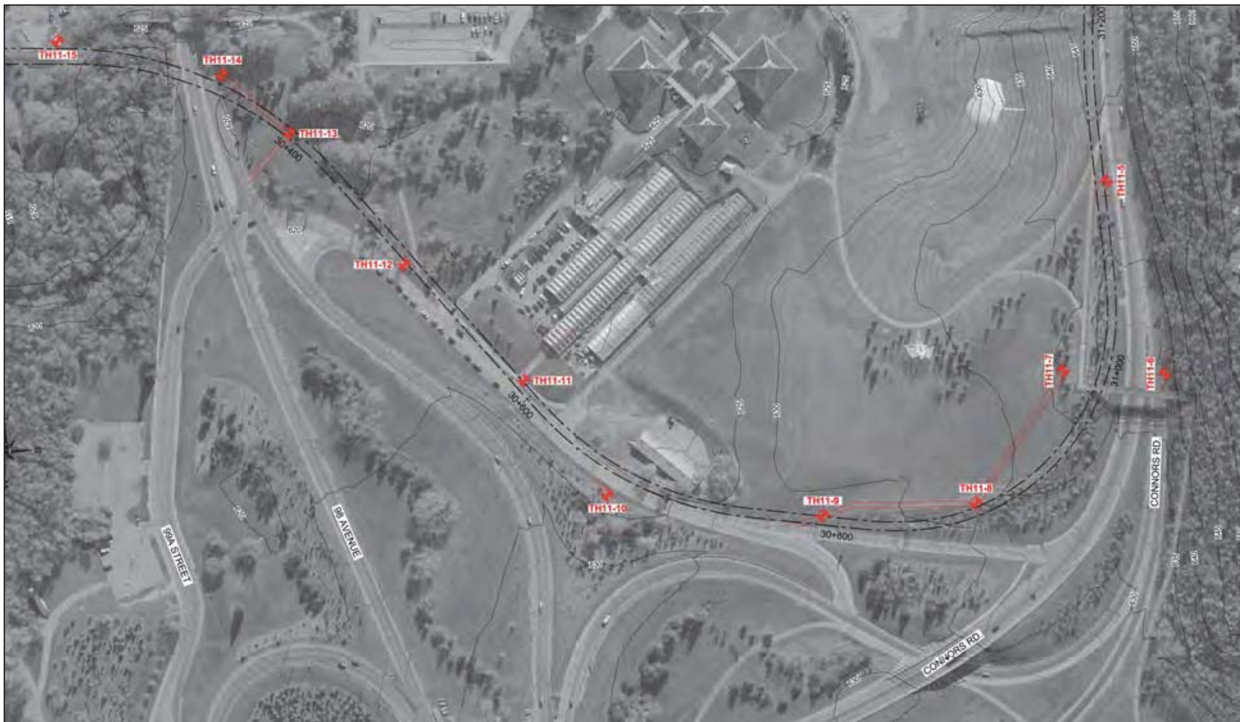

Figure 17. Geotechnical test hole drilling program locations showing south floodplain around Muttart Conservatory and topography of south valley slope along Connors Road. Courtesy AECOM.

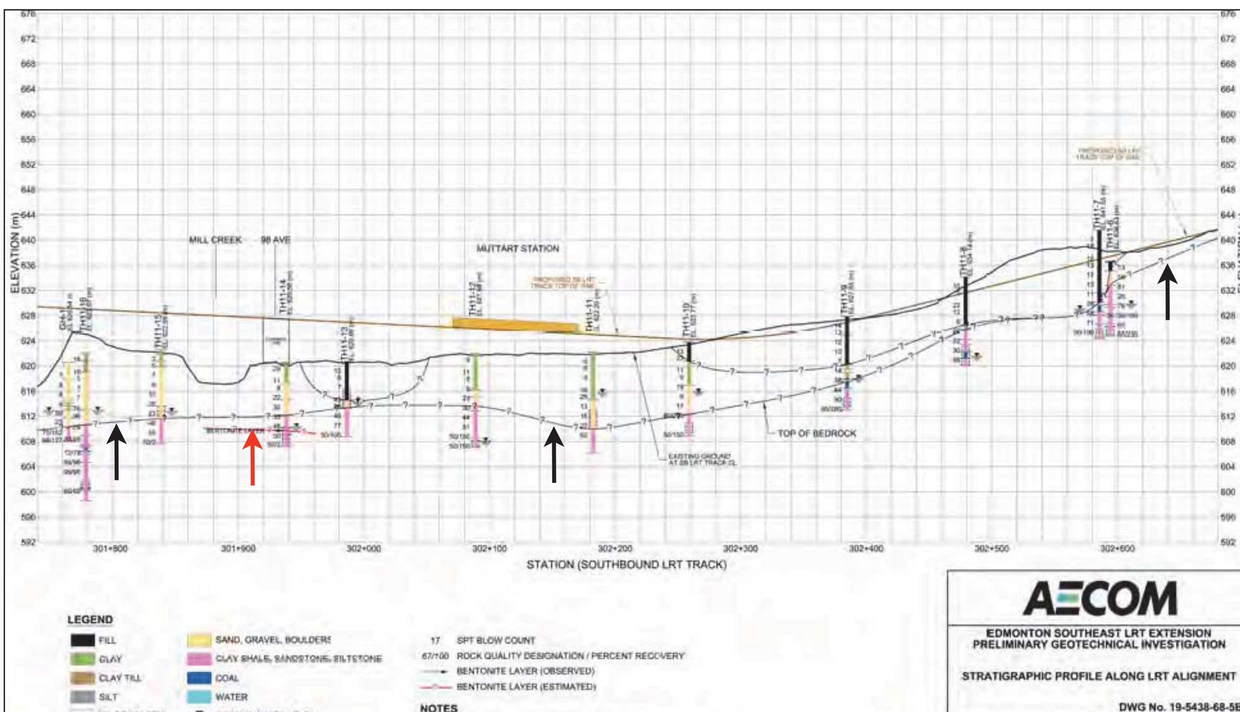

Figure 18. Stratigraphic profile along North Saskatchewan River and base of Connors Hill section of proposed LRT alignment. Drill hole locations TH11-7 to -16 shown. Note estimated top of bedrock (—?—)(→) and bentonite layers (—?—) (→). Courtesy AECOM.

Figure 19. View facing south along proposed alignment (—) near tunnel portal on upper north slope of North Saskatchewan River Valley. View shows footbridge, gulley on south bank (→), Muttart Conservatory pyramids (→) and Connors Road (→) in background.

Figure 20. View looking southeast from footbridge observation deck showing exposed right (south) bank of North Saskatchewan River. Note thick floodplain deposits along bank (→) and reworked coal (inset) and bedrock fragments (→) along exposed river bed.

Figure 21. View facing southwest from footbridge showing gulley (→) incised into thick floodplain deposits on the right bank (south side bank) of the river.

Figure 22. View of right bank from river level showing thick floodplain deposits of silt and sand next to mouth of gulley (→) in Figure 21. White scale bar sheet = 15 cm high.

The field survey noted that the north bank had previously been landscaped and the slope stabilized. The bank development appears to have included grading, rip-rap emplacement, and replacement of vegetative cover. Consequently, if bridge development is minimal along the bank, then there is a low potential to impact bedrock along the bank. However, if excavation work for temporary access roads and bridge support structures on this lower slope/bank is required, it will likely disturb bedrock (Fig. 10). Therefore, due to the uncertain nature of the bridge construction plans (piers, bank development) and the amount of bedrock that will likely be disturbed, there is a low or high potential that significant paleontological resources will be disturbed - a high potential if development activities require excavation on the north bank.

Note: Along the north slope, bedrock is close to the surface at two areas likely slated for development during bridge construction: the tunnel portal and the north river bank (Figs. 10, 12). Paleontological monitoring has been previously suggested for the tunnel and tunnel portal development.

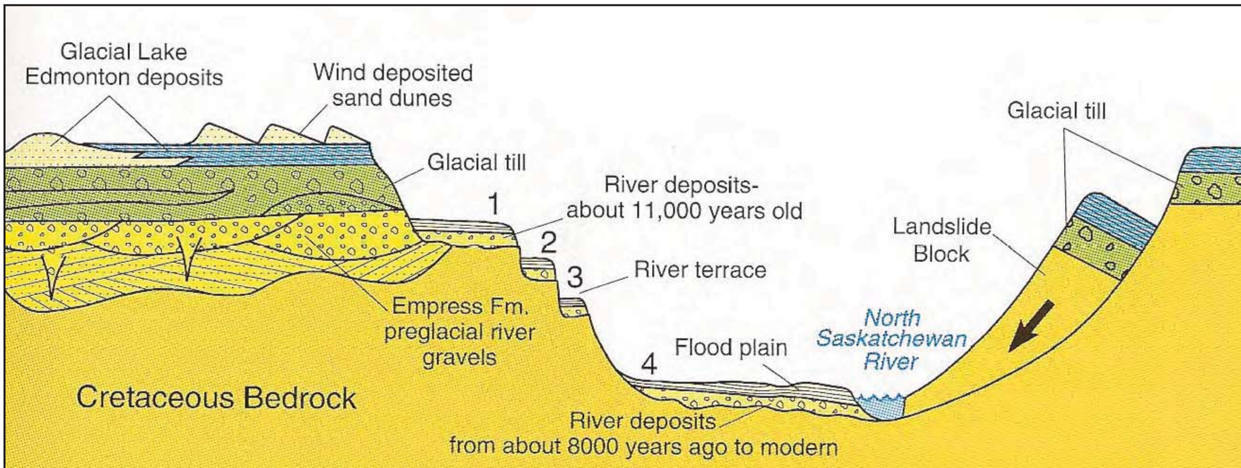

Figure 23. Idealized geological cross section of the North Saskatchewan River Valley. Edmonton Geological Society 1993.

The pedestrian survey (at low water levels in the fall season) of the right (south) bank of the river, noted thick floodplain deposits of silt and fine-grained sands (Figs. 20-22). Due to low water levels in the fall, the river bed and gravel bar were also exposed and accessible. Numerous coal and reworked bedrock fragments from the Horseshoe Canyon Formation were noted among the coarse gravel deposits of the exposed river bed (Fig. 20). The stratigraphic cross sections provided indicate that the underlying bedrock lies close to the ground surface - anywhere from 0.5 to 2 m below the river bed (Fig. 10). Therefore, any pit excavations (open caisson - retaining, water-tight structures) in the river channel will have a potential to impact bedrock.

The author has no direct experience with open caissons, however, it is suggested that there is a moderate to high potential to impact fossil resources if open pit excavation work will impact bedrock. However, due to water table penetration and saturation of the uppermost layers of bedrock beneath the river bed, the upper 0.5 m of bedrock is often ‘weathered’, reducing the potential to recover fossil resources. If pit excavation is to impact bedrock to a depth greater than 0.5 m below the bedrock contact, then monitoring of the open pit excavation (if accessible) and spoil material is suggested.

Bridge construction also requires deep foundations to support the abutment(s) and bridge piers that cross the river channel and the piers that support the elevated trackway. The bridge piers will likely use drilled, belled cast-in-place concrete piles socketed into the bedrock (Fig. 24C) and pre-drilled and/or driven piles (Figs. 24A, 24B). Open caissons (retaining, water-tight structures), if used to develop the channel crossing piers, will likely encounter bedrock during excavation. This is due to the shallow depth of bedrock below the river bed (Fig. 10). Deep foundations (likely cast-in-place concrete piles socketed into the bedrock) will also be required to support the piers of the bridge-elevated trackway leading to the proposed Muttart Station.

Typically, there is no potential of recovering paleontological resources from driven piles. However, there is a low to moderate potential of recovering intact paleontological resources from borehole drillings/spoil material. Generally, the larger the bore hole auger, the higher the potential to recover fossil resources. This conclusion is based upon the author’s previous experience with large-diameter bore hole projects (including the Quesnell Bridge Widening Project (RTMP File: 3948-83H-5)). During paleontological monitoring of the north bank bore hole drills

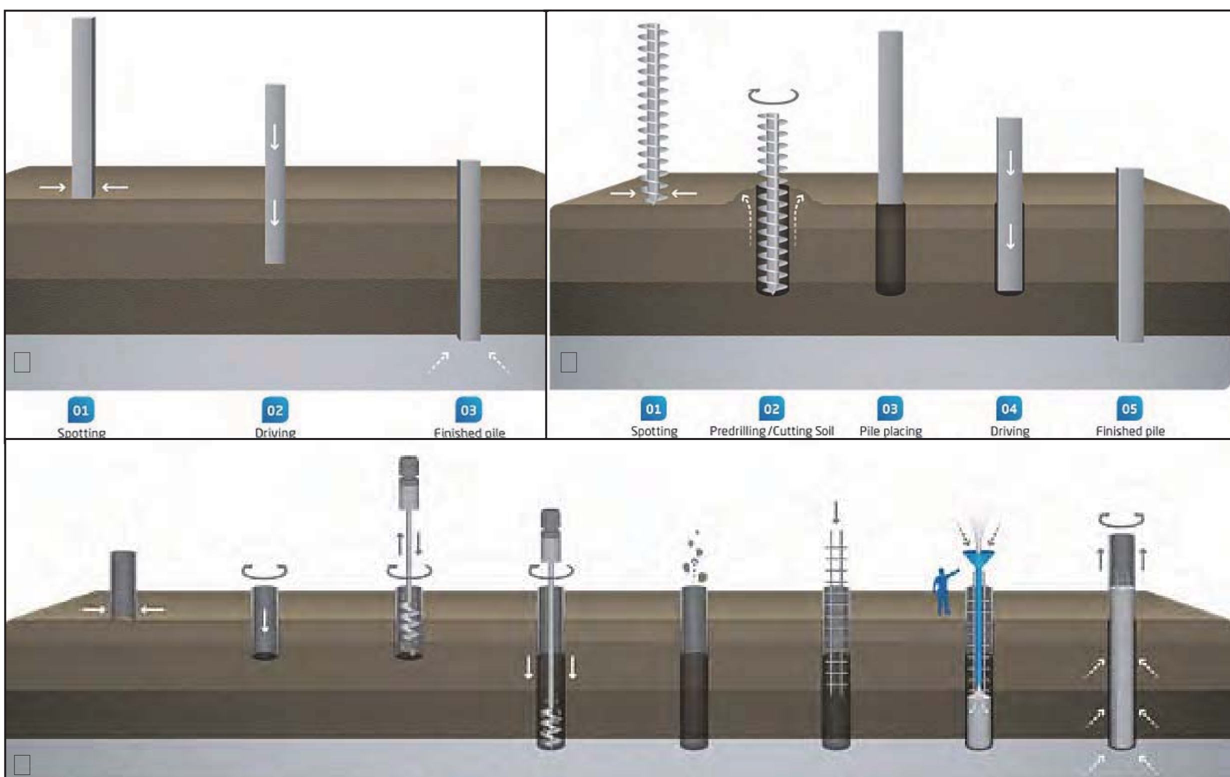

Figure 24. Diagrams of typical construction of three types of piles that may be used in bridge and trackway construction. A) Pre-fabricated driven pile. B) Pre-drilled driven pile. C) Large-diameter bore, cast-in-place, concrete pile into bedrock. Junttan 2011.

during the Quesnell Bridge project, fossil resources were recovered from the auger spoil piles.

As the proposed elevated trackway continues south from the right river bank and associated levee to the proposed Muttart Station, it crosses the alluvial terrace (active floodplain/river-built terrace) (Fig. 23). The unconsolidated deposits on the alluvial terraces average 10 m in thickness, with the deposits thinning to approximately 5 m along the dry stream bed of the gully (gully = original Mill Creek Ravine outlet channel) that has incised into the floodplain (Figs. 18, 19). Based upon the site survey and utilizing information from a 2008 Thurber geotechnical report (North Western Utilities project), the alluvial deposits are comprised of clay-silt, sand and gravel deposits (in descending order) (Figs. 21, 22).

Based upon the overall thickness of alluvial sediments and the likely use of pre-drilled or driven piles for structural supports, there is a low potential that construction activities will expose bedrock or provide recoverable fossil material from the south bank to the proposed Muttart Station.

North Saskatchewan River Valley

Proposed Muttart Station to top of the South Valley Slope (along Connors Road)

South of the proposed Muttart Station, the line begins to ascend the south valley slope, remaining north of the existing paved roadway (Connors Road). The alluvial sediments and fill remain relatively thick along the lower valley slope - approximately 5-10 m thick (Figs. 25, 26). At the midpoint of the slope (for approximately a 300 m stretch) the bedrock lies close to the surface - 0.5-2 m below the ground surface (Figs. 25-28). The upper part of the valley slope sees a thickening of alluvial deposits and fill to greater than 8 m in depth (Figs. 25, 26).

Foundation support structures for the trackway along the south valley slope will likely be pre-drilled and/or driven piles. Therefore, there is a low potential that grading, ground surface preparation and construction of foundation supports will impact bedrock along the lower or upper portions of the valley slope. There is a moderate potential that grading and ground surface preparation and construction of foundation supports will expose bedrock or provide recoverable fossil material along the middle portion of the valley slope.

However, there is also the possibility that the roadway may be relocated to the south, further into the valley slope, allowing the trackway to utilize the existing road bed. This would require a realignment of Connors Road and likely require the development of retaining walls. Roadway realignment and slope grading along the middle to upper slopes and terraces could require substantial excavation into the valley slope and upper terraces. It is suggested that if a realignment of the roadway is required, that there is a high potential to impact bedrock during construction of the roadway.

Figure 25. Geotechnical test hole drilling program locations showing topography of south valley slope along Connors Road. Courtesy AECOM.

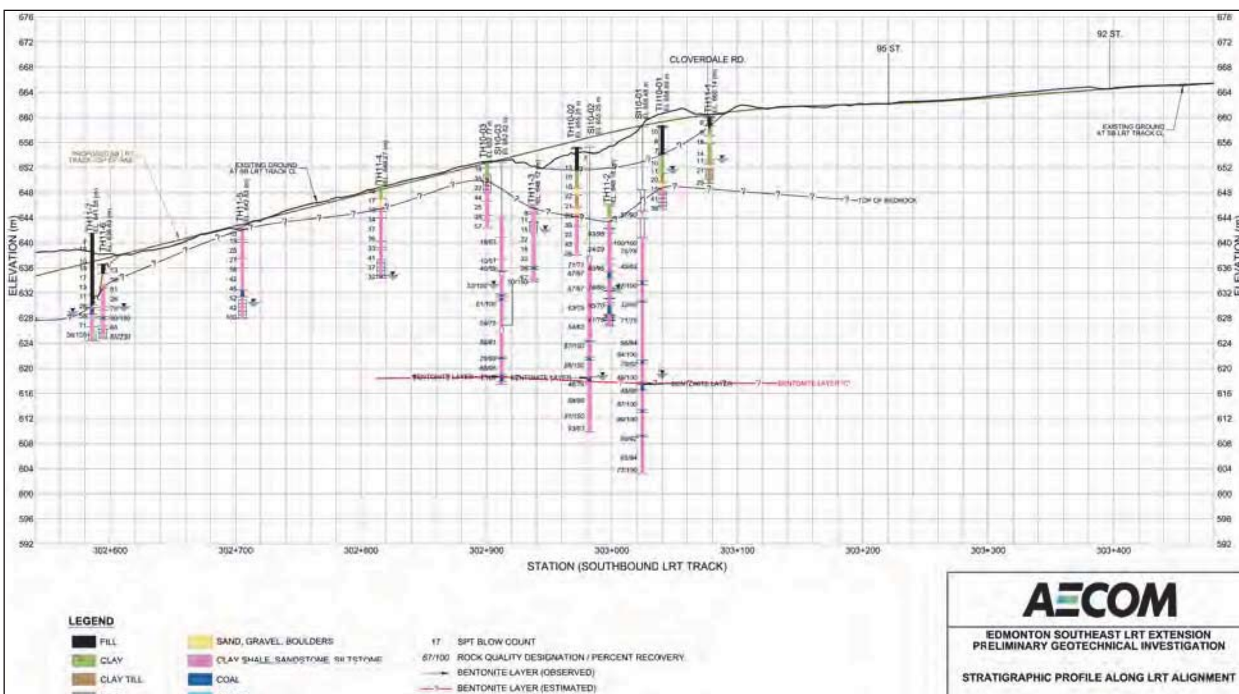

Figure 26. Stratigraphic profile along Connors Hill section of proposed LRT alignment. Drill hole locations TH11-1 to -7 shown. Note estimated top of bedrock (—?—)(→) and bentonite layers (—?—) (→). Courtesy AECOM.

Figure 27. View looking south from top of north valley slope showing Muttart Conservatory pyramids (→), Connors Road (→) and proposed LRT alignment (—). Area between orange arrows (→) is area that bedrock is close to the surface.

Figure 28. View looking southeast below Connors Road showing moderate to steep landscaped slopes along the middle valley slope. Area of thin cover over bedrock.

Wagner Road Alignment

The author noted that the proposed SE LRT alignment called for an elevated trackway across Argyll Road, Wagner Park and along Wagner Road. The optional Davies Road alignment along with the below ground tunnel have been removed as a potential option (Figs. 29-31). Although there were no HRV notations for paleontology assigned to the area (Fig. 5), a brief pedestrian survey of the dry creek bed and banks within Wagner Park was undertaken. The survey was undertaken as the creek in Wagner Park is part of the original Mill Creek Ravine drainage system (Figs. 2, 3).

Today, the isolated section of Mill Creek in Wagner Park is bounded by city infrastructure (roads and commercial development) (Fig. 30). The park has been landscaped along the proposed ROW except at the crossing. The creek channel and a small riparian buffer around the channel remains intact and is vegetated with shrubs and trees (Fig. 34).

A pedestrian survey followed the dry creek bed through the park to assess if any bedrock or fossil resources may have been exposed along the creek bed and banks (Fig. 35). The creek channel appears to have downcut 6-8 m into the surrounding terrain. Underlying the thin soil and organic debris layer, the banks and creek bed appear to be comprised of glaciolacustrine deposits of silts and very fine-grained sands. No bedrock or fossil resources were observed.

A review of drift thickness and surficial Quaternary geology maps for the region (Figs. 6, 7) and the drill test hole logs provided by AECOM/Thurber (Figs. 32, 33), indicate that bedrock from the Horseshoe Canyon Formation (referred to as ‘clay shale’ in the logs) is present in this area, but is a significant distance below the ground surface. In the drill hole logs provided, 13 m at the creek crossing, is the closest to the ground surface that bedrock is first encountered (Fig. 32). The depth of bedrock impact varies, put appears to range from 19-22 m north of the creek to greater than 25 m or more south of the creek along 75 Street. Several logs south of the creek along Wagner Road were terminated at 15 m and no bedrock was impacted at this point.

The logs suggest that the Quaternary deposits are primarily comprised of clay tills (clay, silts, sands, and minor gravels). Some silty, fine-grained sand and thin ‘coal’ layers were noted. It is likely these sediments represent glacial tills and Glacial Lake Edmonton-derived deposits. It does not appear that any preglacial Empress Formation gravels are present in this area of the the proposed LRT line.

The proposed trackway will be elevated over Argyll Road and Wagner Park and return to grade near the intersection of Wagner Road and Davies Road (Fig. 29). Foundation support structures for the elevated trackway along this corridor will likely be pre-drilled and/or driven piles. The possible maximum pile length will be 26 m. Typically, there is no potential of recovering paleontological resources from driven piles. However, there is a low to moderate potential of recovering intact paleontological resources from borehole drillings/spoil material (see page 21). Overall, there is a low potential that grading, ground surface preparation and construction of foundation supports will disturb bedrock due to the depth that bedrock lies below ground surface (greater than 13 m).

Figure 29. Photomosaic of proposed Argyll Road-Wagner Road alignment showing elevated trackway crossing Argyll Road, CN railway, and Wagner Park. City of Edmonton.

Figure 30. Satellite image of Wagner Park showing drill hole locations. Courtesy AECOM.

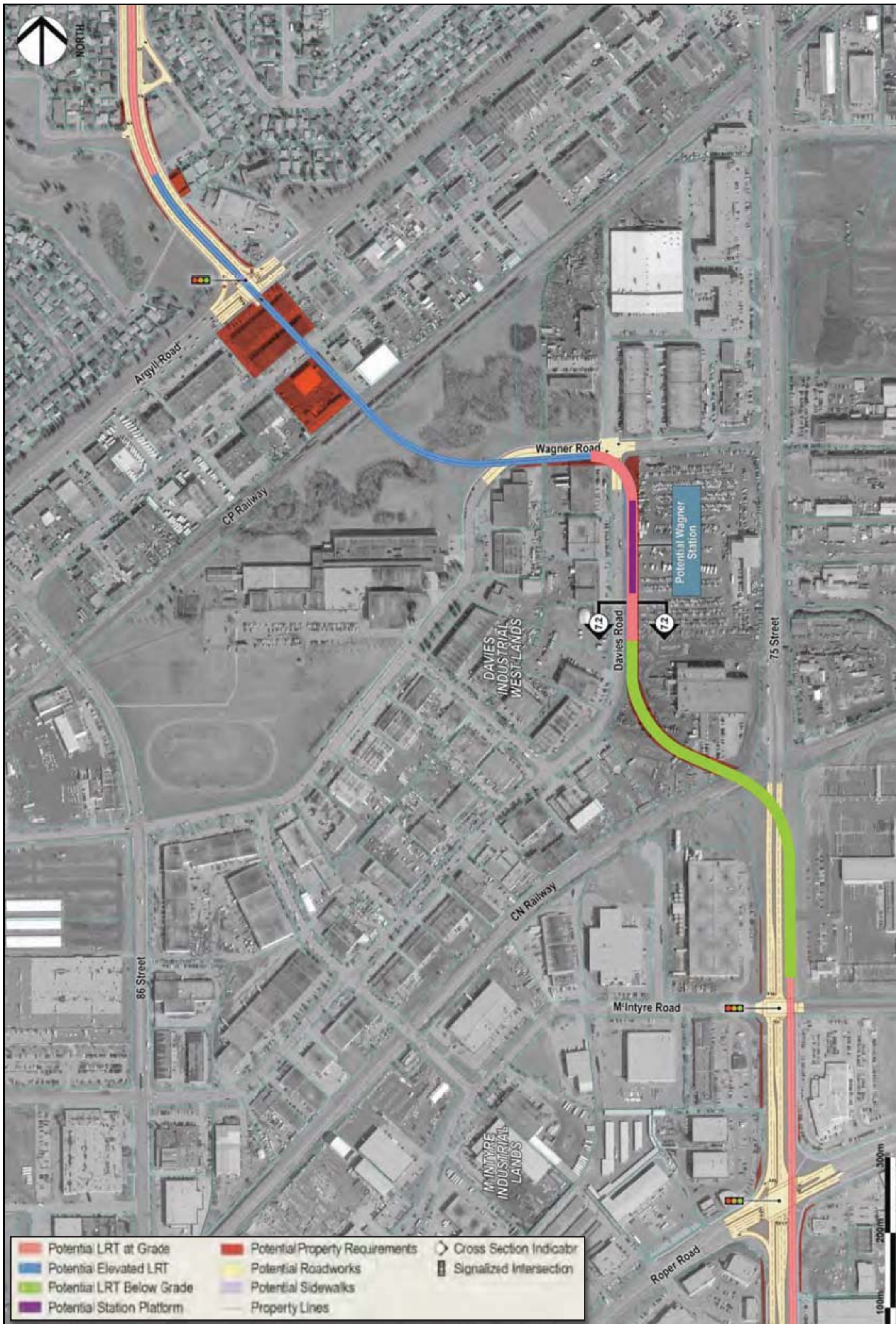

Figure 31. Photomosaic of proposed Argyll Road-Wagner Road alignment showing optional Davies Road alignment and associated tunnel under CN railway and 75 Street.

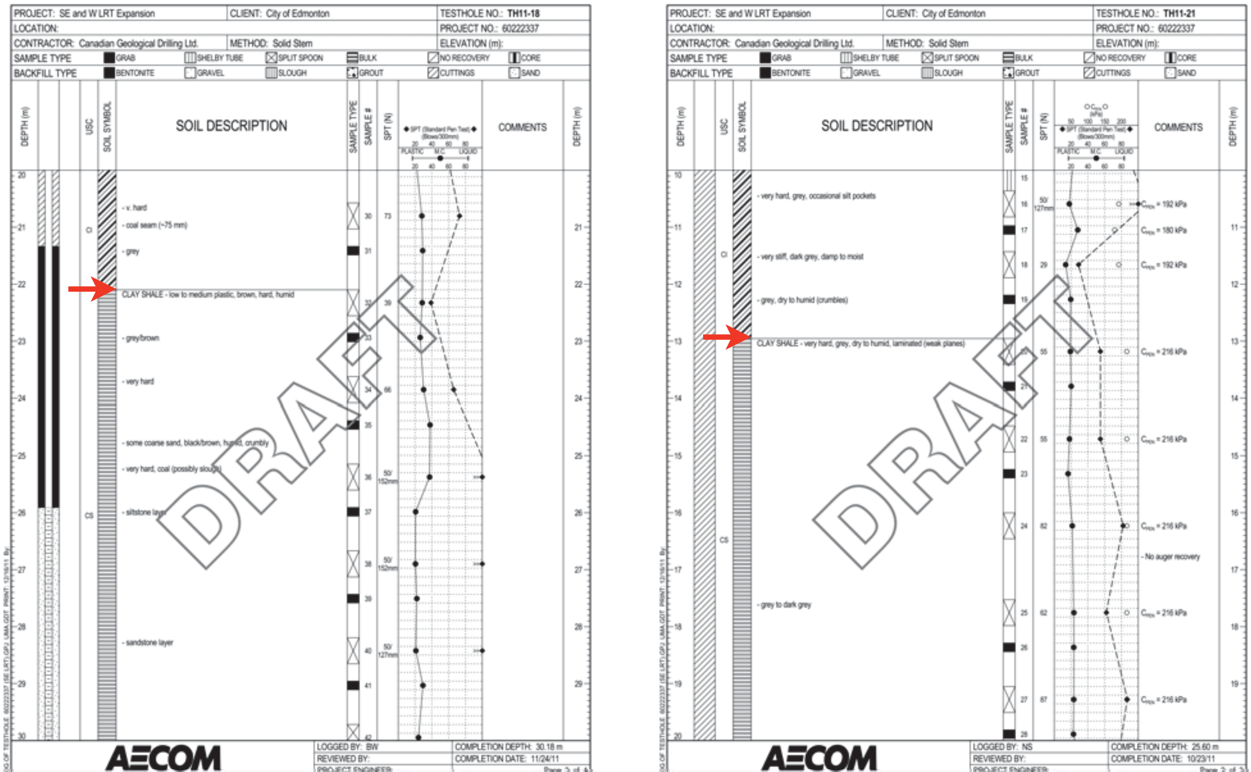

Figure 32. Portion of drill test hole logs from TH11-18 and 21 (see Fig. 30) showing bedrock contact (→ = start of clay shales from Horseshoe Canyon Fm.). Courtesy AECOM.

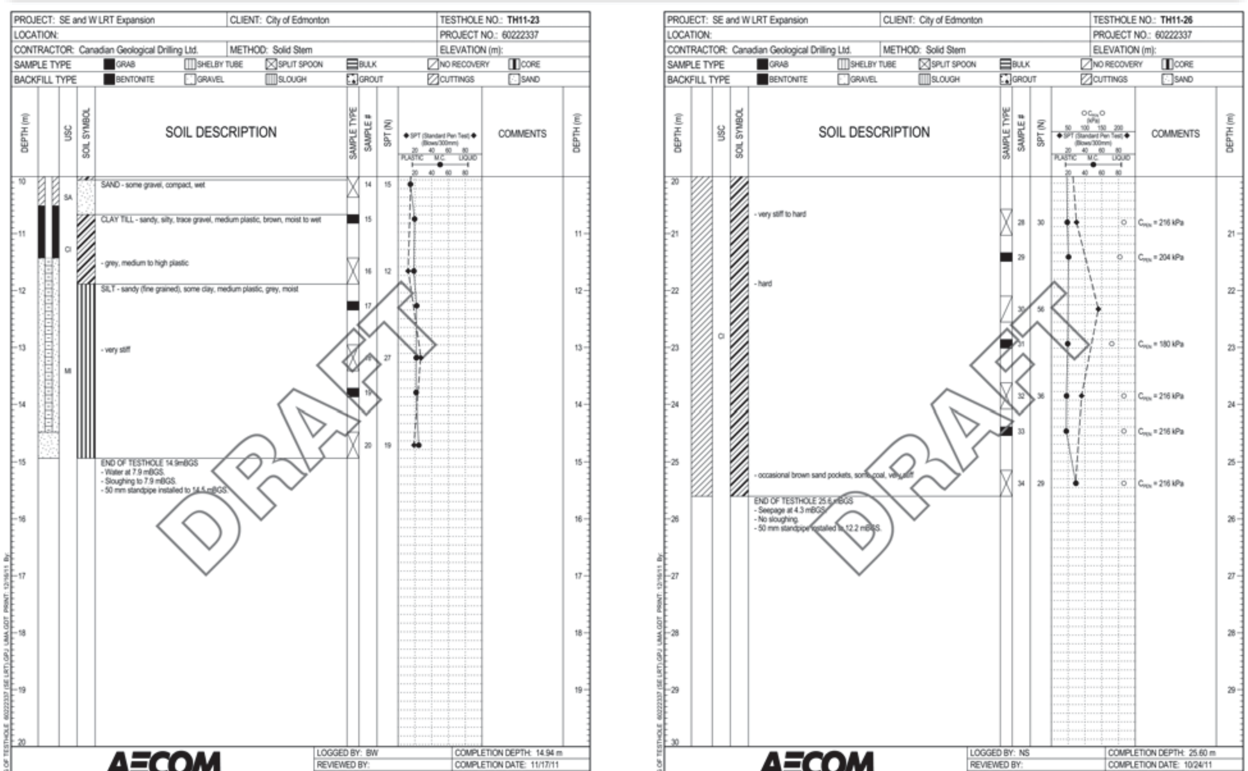

Figure 33. Portion of drill test hole logs from TH11-23 and 26 showing (see Fig. 30) end of test hole in 'Quaternary' deposits. No bedrock contact logged. Courtesy AECOM.

Figure 34. View facing northwest from south side of Wagner Park along proposed alignment showing thick vegetation surrounding dry drainage. The drainage is an isolated section of the original Mill Creek drainage system maintained within the park.

Figure 35. View facing north from dry creek bed in Wagner Park. Inset shows thick deposits of clay till (silt and silty sand) along banks of dry creek bed (aka Mill Creek).

Recommendations

The Historic Resources Management Branch of Alberta Culture and Community Spirit issued a Schedule A requirement for paleontology for the Southeast LRT Planning Study (ACCS File: 4715-10-042). After completing the pre-construction Historic Resources Impact Assessment for paleontology, background research, discussions with staff at AECOM and Thurber Engineering, and a review of the drill hole logs and stratigraphic cross sections, three areas of high paleontological potential were noted for the currently proposed SE LRT alignment (**Fig. 36**).

Figure 36. Areas that have a high paleontological potential to impact bedrock during development activities of the proposed Southeast LRT development.

Based primarily upon the bedrock geology, stratigraphic cross sections and construction techniques likely to be utilized during development, it is suggested that these three areas (Fig. 36) require a paleontological monitoring program (Table 3), as there is a high potential to disturb significant fossil resources from the Horseshoe Canyon Formation. Horseshoe Canyon Formation deposits in this area are known to contain the well-preserved fossil remains of large vertebrates (primarily dinosaurs) - both dinosaur bone beds and isolated remains have been recovered from the slopes and the floodplains of the North Saskatchewan River Valley and its major tributaries within the City of Edmonton. This includes dinosaur bone fragments from Mill Creek Ravine and the valley slope at the Quesnell Bridge. Therefore, any significant amount of disturbance of these bedrock sediments is considered to have a high potential to disturb fossil resources.

Table 3 - Areas of High Paleontological Potential Along SE LRT Alignment	
Areas of High Paleontological Potential	Monitoring Program Suggested*
Area A - southern portion of LRT tunnel to be excavated through bedrock and associated development of tunnel portal/ north valley slope around tunnel portal.	**Yes** - monitor spoil during bedrock excavation portion of LRT tunnel development and associated slope/ bridge abutment development around tunnel portal.
Area B - North Saskatchewan River LRT bridge abutments and piers. If construction technique utilizes open caissons, this may allow inspection of exposed bedrock or survey of excavated sediments.	**Yes** - monitor excavation pits **only if** open cassions/pier pits used and accessible for monitoring and if excavation will impact in situ bedrock to a depth greater than 0.5 m (so, monitoring contingent on accessibility and construction techniques).
Area C - middle slope of Connors Road. If existing roadway requires realignment, then grading and retaining wall development may require development of south valley slope.	**Yes** - monitor **only if** existing roadway requires realignment, requiring excavation and grading of valley slope (e.g. to install retaining walls).
* As design and construction plans are finalized, then impact to fossil resources/bedrock in the three suggested monitoring areas above may need to be re-assessed. If construction techniques or design plans suggest that impact to bedrock will be minimal or monitoring is unlikely to recover fossil resources, then the Royal Tyrrell Museum and Heritage Resources Management Branch can be advised and the suggested monitoring program adjusted accordingly.	

It is suggested that all remaining areas of the the proposed SE LRT alignment have a low potential to impact bedrock and/or recover significant fossil resources. This includes the Wagner Park elevated trackway and water course crossing. This recommendation is primarily based upon the thickness of the overlying drift cover and the construction techniques employed to develop the proposed support structure for the trackway.

Therefore, it is suggested that if the proposed SE LRT alignment plan reviewed in this report is adopted, that a **paleontological post-impact assessment (monitoring program) be required** for three areas (Fig. 36: Areas A-C) within the North Saskatchewan River Valley. Due to the low potential to impact paleontological resources during construction activities throughout the remainder of the proposed alignment and optional alignments, it is suggested that no further paleontological assessment/action is required for these areas if the applicant complies with Section 31 of the *Historical Resources Act* – " a person who discovers an historic resource in the course of making an excavation for a purpose other than for the purpose of seeking historic resources shall forthwith notify the Minister of the discovery."

Notes

Note 1: Due to the paleontological sensitivity of the North Saskatchewan River Valley slopes, any changes to the current alignment plan, (e.g. project boundaries, trackway routing, bridge construction techniques, etc.) may require a re-evaluation of the paleontological potential and scope of work required.

Note 2: There is a high potential for recovery of significant Pleistocene (ice-age) fossil vertebrate remains from the Empress Formation gravels, but drill hole logs suggest the gravels are not present along the proposed SE LRT alignment.)

Acknowledgements

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Report Authorization

Please contact the report author if you have any further questions in regards to the paleontological component and evaluation of this project.

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Aeon Paleontological Consulting Ltd.

*Disclaimer required by Alberta Culture and Community Spirit:
"Any recommendations made in this report are not necessarily consistent with the requirements of the *Historical Resources Act.*"

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Appendix A

Select Pages of Geotechnical Report Referenced for Test Hole Locations and Stratigraphic Cross Section

THURBER ENGINEERING LTD.

Table 1 Tentative Test Hole Depths and Approximate Drilling Time Required

Test Hole No.	Approximate Station	Location	Drilling (Coring) Depth (m)	Standpipe Depth (m)	Drilling Time (hours)	Traffic Lane Closure
TH11-1	31+480	Cloverdale Hill Rd.	10	10	3	One lane on Cloverdale Hill Rd.
TH11-2	-	Edmonton Ski Club	15 (10)	15	6	-
TH11-3	-	Edmonton Ski Club	15	15	4	-
TH11-4	31+260	Edmonton Ski Club	15	15	4	-
TH11-5	31+100	Muttart Conservatory	10	10	3	-
TH11-6	31+000	Pedestrian bridge over Connors Rd.	20	20	8	One lane on Connors Rd.
TH11-7	31+000	Pedestrian bridge over Connors Rd.	20	20	8	-
TH11-8	30+880	Muttart Conservatory	10	10	3	-
TH11-9	30+800	Muttart Conservatory	10	10	3	-
TH11-10	30+670	Muttart Conservatory	15	15	4	-
TH11-11	30+600	Muttart Conservatory	15	15	4	-
TH11-12	30+500	Muttart Conservatory	15	15	4	-

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A1. Locations of geotechnical test holes for proposed SE LRT Extension at the North Saskatchewan River Valley crossing. Table shows locations and tentative depths for test holes TH11-1 to TH11-12 (see locations Figs. 9, 17, 25). Courtesy AECOM, Sept 27, 2011.

THURBER ENGINEERING LTD.

Table 1 Tentative Test Hole Depths and Approximate Drilling Time Required (Continued)

Test Hole No.	Approximate Station	Location	Drilling (Coring) Depth (m)	Standpipe Depth (m)	Drilling Time (hours)	Traffic Lane Closure
TH11-13	30+400	Muttart Conservatory	15	15	4	-
TH11-14	30+350	Pedestrian bridge over 98 Ave.	20	20	8	-
TH11-15	30+230	Pedestrian bridge over 98 Ave.	20	20	8	-
TH11-16	30+180	Bridge over N. Sask. River	20 (15)	15	10	-
TH11-17 (1)	29+960	Louise McKinney Park	25 (20)	15	12	-
TH11-18	30+000	95 Str. & Cameron Ave.	30 (10)	20	16	One lane on 95 Str.
TH11-19 (2)	29+780	Condominium Building at 95 Str.	30 (10)	16	16	-
TH11-20 (2)	29+700	Vacant land area at 95 Str. & Rolland Rd.	25(5)	16	12	-
TH11-21	29+560	Parking lot	20	20	7	-
TH11-22	29+470	Parking lot	18	10	6	-
TH11-23	29+400	102 Ave.	18	10	6	One lane on 102 Ave.
TH11-24	29+300	102 Ave.	10	10	3	One lane on 102 Ave.

(1) Slope indicator will be installed in test hole TH11-17.
(2) Test holes TH11-19 and TH11-20 are located on private properties.

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e-file: 08\19\5438-68 let

Date: September 27, 2011
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A2. Locations of geotechnical test holes for proposed SE LRT Extension at the North Saskatchewan River Valley crossing. Table shows locations and tentative depths for test holes TH11-13 to TH11-24 (see locations Figs. 9, 17, 25). Courtesy AECOM, Sept 27, 2011.

Appendix B

Paleontological Permit

Government of Alberta
Culture and Community Spirit

Royal Tyrrell Museum of Palaeontology
P.O. Box 7500
Drumheller, Alberta T0J 0Y0
Telephone 403/823-7707 Fax 403/823-7131

PERMIT TO EXCAVATE PALAEONTOLOGICAL RESOURCES 11-022

NAME:	Riley, Michael
ADDRESS:	#169, 51042 Range Road 204, Sherwood Park, AB T8G1E5
AFFILIATION:	Aeon Paleontological Consulting Ltd.

Is hereby authorized to conduct the palaeontological investigations described on the applicant's Application dated Oct 13, 2011 subject to the conditions of the *Historical Resources Act* and the Regulations passed pursuant to that Act, the *Occupational Health and Safety Act* and Regulations passed pursuant to that Act and any other relevant Provincial legislation. It is the permit holder's responsibility to ensure that all necessary permits and permissions are in place prior to the commencement of fieldwork.

PERMIT SUMMARY AND SCHEDULE

1.	Purpose of investigations:	Mitigative, Historical Resources Impact Assessment
2.	Location of investigations:	City of Edmonton, LRT Expansion Branch, Capital Construction Dept. Southeast LRT Planning Study West LRT Planning Study Edmonton City of Edmonton W4 R24 T53 S3 L2,5-7 W4 R24 T52 S2 L6,11,14 W4 R24 T52 S15 L1,8,9,16 W4 R24 T52 S11,14 L4,5,12,13 W4 R24 T52 S23 L4,5 W4 R24 T52 S27 L2,3,10,11,14,1 W4 R24 T52 S22 L1,7,8,10,11,14 W4 R24 T52 S33 L6-8,10,11,15 W4 R24 T52 S34 L2,3,5,6 W4 R25 T52 S35 L4,5,12,13,14 W4 R25 T52 S26 L13 W4 R25 T52 S28 L8-12 W4 R24 T53 S6 L5-8 W4 R25 T53 S1 L3,4,6-8 W4 R25 T53 S2 L1-4 W4 R25 T52 S30 L9,10,15,16 W4 R25 T52 S34 L1,8,9,16 W4 R25 T52 S27 L5-12,16 W4 R24 T53 S5 L5,6 W4 R25 T52 S29 L9-12
3.	Types of palaeontological resources sought:	Cretaceous vertebrate, invertebrate & fossil plants. Pleistocene fauna
4.	Geological Ages:	Cretaceous, Quaternary
5.	Formations:	Horseshoe Canyon
6.	Date two paper copies of final report and digital data are due:	Jun 08, 2012
7.	Institution in which palaeontological specimens and records are to be deposited:	Royal Tyrrell Museum of Palaeontology - P.O. Box 7500, Drumheller, Alberta, T0J 0Y0

PERMIT NO. 11-022 Page 1 of 2

8. Date palaeontological specimens and records are to be deposited: Dec 10, 2012
9. Permit is valid from date of issue to: Dec 11, 2011

APPROVED

Andrew Neuman Acting Assistant Deputy Minister	Oct 13, 2011 Date

PERMIT NO. 11-022 Page 2 of 2