MYSTIC BEACH OUTLINE PLAN

Submitted for

Mystic Beach, legally described as SE¼ 16-68-13-4, SW¼ 16-68-13-4, NW¼ 16-68-13-4, NE¼ 16-68-13-4, a portion of NE¼ 9-68-13-4, Plan 3952TR Block A, Plan 3952TR Lot R1 (reserve), and a portion of Lot 79 of the Lac La Biche Settlement, Lakeland County

Submitted to

LAKELAND COUNTY

Prepared for

1015314 Alberta Ltd.

by

ARMIN A. PREIKSAITIS & ASSOCIATES LTD.

in association with

Associated Engineering

ENVIRO MAK Inc. Environmental Management Consultants

THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

Altamira Consulting Ltd
Archaeological & Historical Resource Consulting

AGP Geomatics Inc.

January 2005

MYSTIC BEACH OUTLINE PLAN

Submitted to

Prepared for

1015314 Alberta Ltd.
by

ARMIN A. PREIKSAITIS
& ASSOCIATES LTD.

January 2005

Mystic Beach Outline Plan

(Mystic Beach, legally described as SE¼ 16-68-13-4, SW¼ 16-68-13-4, NW¼ 16-68-13-4, NE¼ 16-68-13-4, a portion of NE¼ 9-68-13-4, Plan 3952TR Block A, Plan 3952TR Lot R1 (reserve), and a portion of Lot 79 of the Lac La Biche Settlement, Lakeland County)

Submitted to

LAKELAND COUNTY

Prepared for

1015314 Alberta Ltd.
by

ARMIN A. PREIKSAITIS
& ASSOCIATES LTD.
#408 The Boardwalk, 10310 – 102nd Avenue
Edmonton, Alberta T5J 2X6
Phone: (780) 423-6824 Fax: (780) 423-6840
Email: arminap@compusmart.ab.ca
Web: http://www.compusmart.ab.ca/arminap/

in association with

ASSOCIATED ENGINEERING

ENVIRO MAK Inc.
Environmental Management Consultants

THURBER

Altamira Consulting Ltd
Archaeological & Historical Resource Consulting

AGP Geomatics Inc.

January 2005

TABLE OF CONTENTS

MAPS **AFTER PAGE**

FIGURES **AFTER PAGE**

APPENDICES

1.0 INTRODUCTION

1.1 Purpose

Consistent with Lakeland County's Outline Plan Requirements for Multi-lot Subdivisions, the purpose of this outline plan is to provide a planning framework for consideration of a tentative plan of subdivision by describing how planning, transportation, servicing, environmental and design issues have been addressed.

The subject site is included within the Lac La Biche Lake Management Plan Area Structure Plan.

"Site Specific Plan *3.5 Each application for a multi-lot country residential subdivision shall complete a site specific Area Structure Plan or outline plan which, among other factors, provides information in regard to:*

(i) the number and size of parcels being created;

(ii) internal vehicle and pedestrian circulation;

(iii) environmental sensitivity and constraints;

(iv) provision of servicing, including the impact of the subdivision on external roads;

(v) the provision of and impact on local community services;

(vi) identify and deal with any legitimate concerns of adjacent landowners; and,

(vii) the provision of municipal and/or environmental reserve."

1.2 Planning History

The Lac La Biche Lake Management Plan Area Structure Plan (ASP), prepared by the Planning Branch, Alberta Municipal Affairs for Improvement Districts, was adopted by the Minister of Municipal Affairs, as Council for Improvement District #18 (South), under Ministerial Order #551/90 on August 16, 1990.

The ASP was based upon the Lac La Biche Lake Management Plan: Background Study completed in June 1982.

On August 25, 2004, Lakeland County Council gave Second and Third Reading to amend the Lac La Biche Lake Management Plan Area Structure Plan (ASP) to allow the lands legally described as SE¼ 16-68-13-4, SW¼ 16-68-13-4, NW¼ 16-68-13-4, NE¼ 16-68-13-4, a portion of NE¼ 9-68-13-4, Plan 3952TR Block A, Plan 3952TR Lot R1 (reserve), and a portion of Lot 79 of the Lac La Biche Settlement, Lakeland to be redistricted from a Recreation Area and Rural Conservation Area to Residential Area. An additional amendment was made to the Lac La Biche Lake Management Plan ASP to change the

text of *Policy 2.3(b) – Residential Area* revising the minimum parcel size from 0.4 ha to 0.2 ha.

Subsequently, an amendment to the Land Use Bylaw was approved to rezone the plan area from Agricultural District - A to Country Residential – CR.

This Outline Plan and the proposed Tentative Plan of Subdivision conforms to the ASP as amended.

1.3 Plan Area

The Plan Area, shown on Map 1, encompasses 155.9 ha (385.2 ac) legally described as SE¼ 16-68-13-4, SW¼ 16-68-13-4, NW¼ 16-68-13-4, NE¼ 16-68-13-4, a portion of NE¼ 9-68-13-4, Plan 3952TR Block A, Plan 3952TR Lot R1 (reserve), and a portion of Lot 79 of the Lac La Biche Settlement, Lakeland County.

The lands subject to this outline plan are owned by Michael and Kathy Maccagno. Dr. Richard Birkill (1015314 Alberta Ltd.) has an option to purchase the lands.

1.4 Report Organization

Chapter 1.0 – Introduction: Provides an overview of the Outline Plan by documenting the purpose, background, and a description of the plan area.

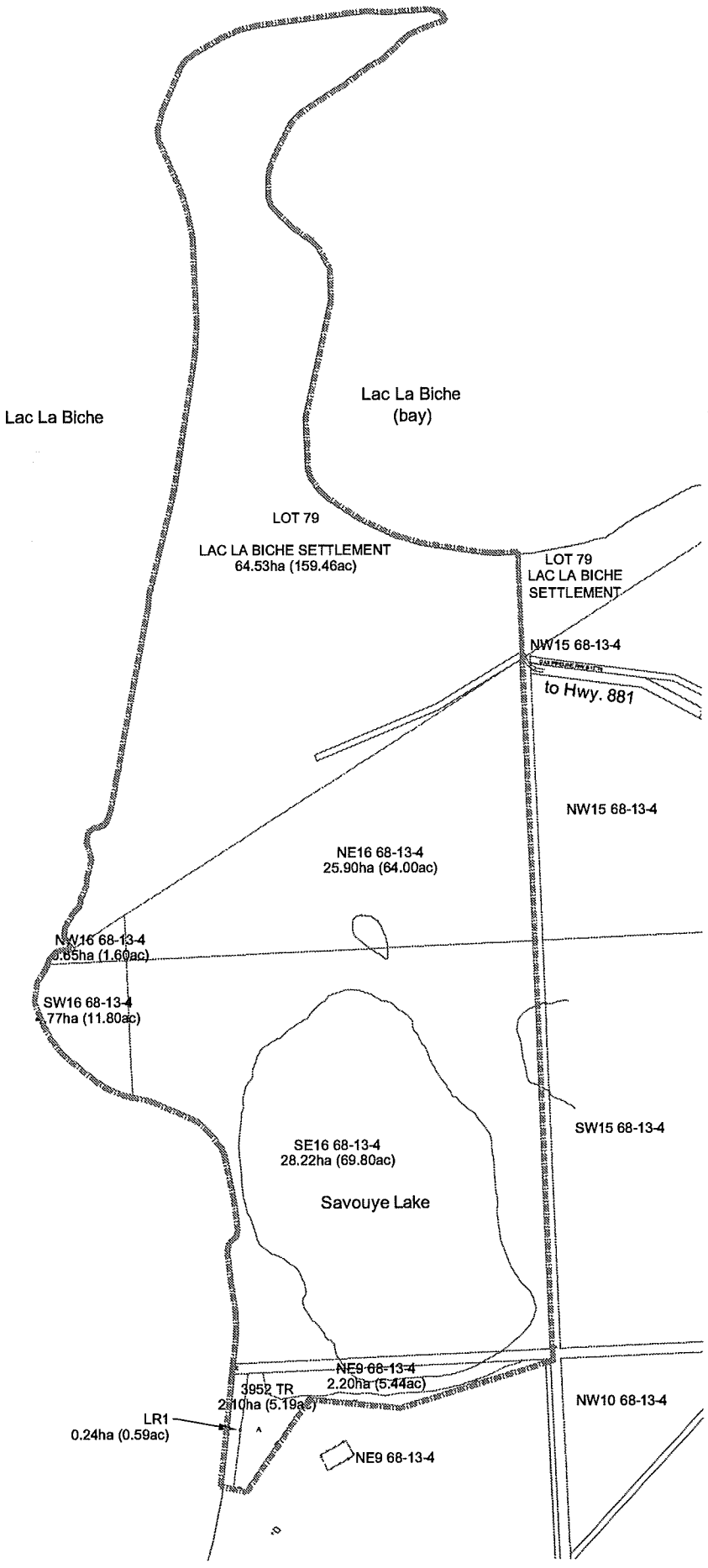
Chapter 2.0 – Site Context and Development Considerations: Profiles soils, topography and vegetation, existing land uses, the results of the environmental screening and the biophysical site assessment, the results of the historical impact assessment, transportation and access, potential impact of development on schools, fire, police and emergency services, and parks and recreation development opportunities.

Chapter 3.0 – Development Concept: Presents the overall development concept and the planning principles behind it, elaborates on opportunities and constraints to development, lot sizes, environmental and municipal reserve, and trail development.

Chapter 4.0 – Municipal Services: Summarizes the Site Servicing Concept Report produced by Associated Engineering and discusses roadways, potable water supply, sewage treatment and disposal, stormwater management, and franchise utilities.

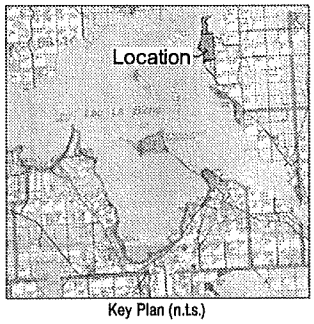
Chapter 5.0 – Community Consultation: Presents the results from the Public Open House, the concerns expressed at the Public Hearing and how they were addressed.

Chapter 6.0 – Implementation: Summarizes the implementation actions necessary, including the plan of subdivision, staging, and design guidelines.



Legend

Plan Boundary



Key Plan (n.t.s.)

N

0 100 200 300 m

Map 1
Plan Area

ARMIN A. PREIKSAITIS
& ASSOCIATES LTD.

MYSTIC BEACH
Subdivision

Project No.: 04-020

Date: January 2005

File: F:\AAP Project Files\Real Estate\04-020 Dr. Birkill Subdivision - Lakeland County \Map\AAP\Outline Plan\Map 1 - Plan Area.dwg

2.0 SITE CONTEXT AND DEVELOPMENT CONSIDERATIONS

2.1 Topography, Soils, Vegetation

Map 2 – Aerial Photograph identifies areas cleared for agriculture on the subject site. Large expanses of sand beach make the plan area well suited for a lakefront multi-lot subdivision. Refer to Appendix A – Geotechnical Report by Thurber Engineering Ltd.

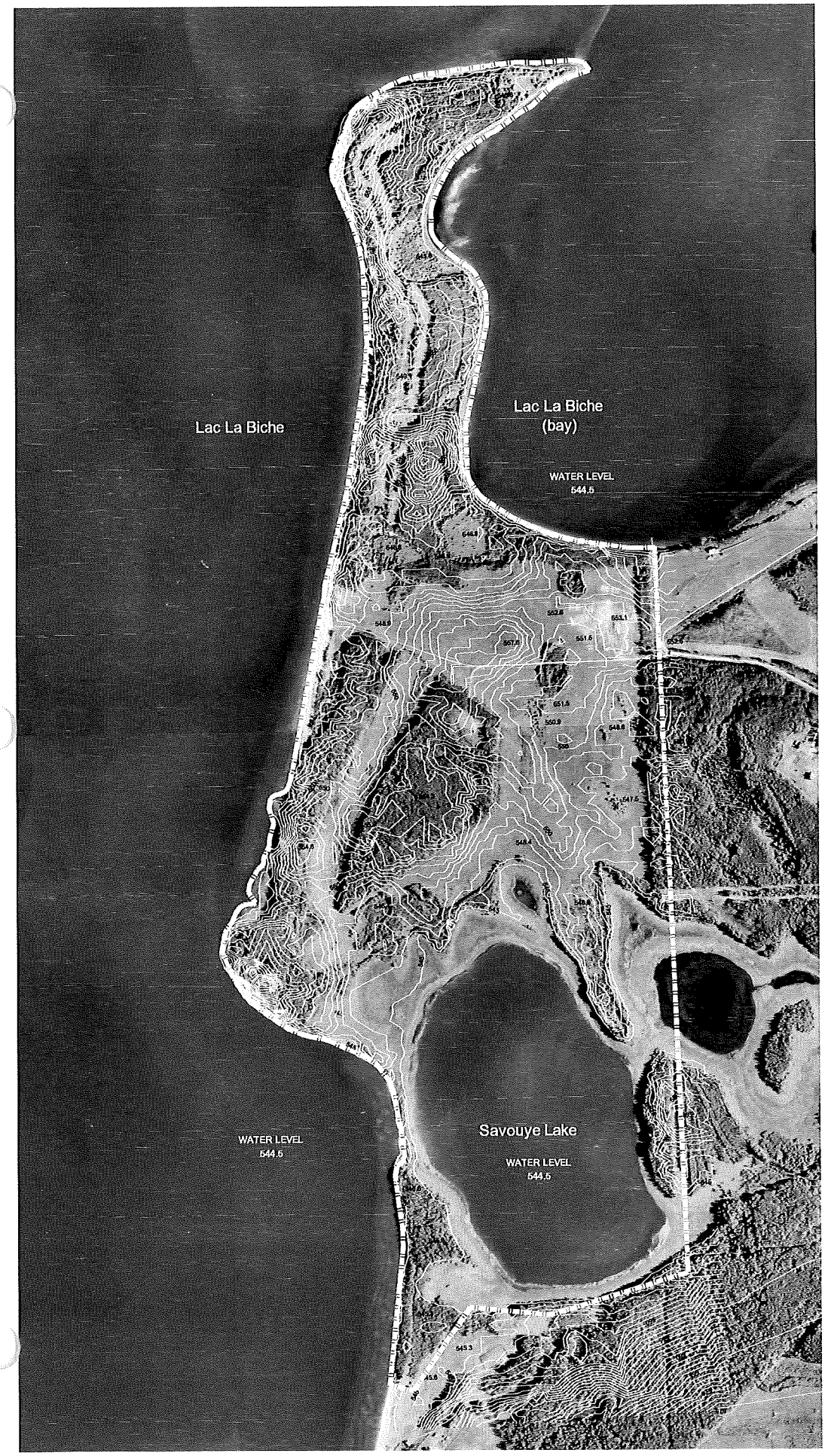
The topography of the area is characterized by undulating to rolling hills interspersed with low-lying muskeg area, predominantly of the lucustrine / morainal landforms. The east shore of Lac La Biche is covered primarily by ground moraine. Large knobs and ridges are found in the hummocky morainal areas of the backshore and dominate the peninsular area of the site. From approximately half way along the north shore to the Owl River Delta, Aeolian fluvioglacial deposits containing sand and gravel are found.

The slope of the terrain ranges between 0-5% and 9-15%. Elevations range from a low of 545 meters along the water front areas to a high of 557.6 meters near the entrance to the site. A steep ridge runs parallel to the lake along much of the shoreline of the site. An area of lower elevation typically backs this ridge on the shoreward side. Separating this ridge from the lake is a wide strip of flat sandy beach. Steep ridges and hills dominate the peninsular area of the site. Most of the land area located south of the bay and north of Savouye Lake is characterized by gently rolling terrain.

Other prominent features include; a depressed area running east and west between the southern tip of the bay and Lac La Biche, which contains two wet areas; a high ridge running parallel to this depression and directly to its north; rapidly varying high and low areas in the peninsular area, with a prominent high point at its north western extreme; two additional low-lying wet areas located south of the bay in the agricultural area; a high point located on the lake shore northwest of Savouye Lake; areas of steep terrain located within the wooded zone in the center of the agricultural area of the site; and wide, gently sloping areas subject to flooding north of Savouye Lake.

The area is characterized primarily by Luvisolic soils with Orthic and Dark Gray Luvisols. Soil complexes in this region include Mesisol (organic), Tucker, Newbrook, Grandin, Athabask and Tolman. These soils are predominantly suited for all types of development. Land capability for agriculture is classified as 4 or 5 with severe limitations or very severe limitations due to undesirable soil structure and/or low permeability or adverse topography.

Lac La Biche is part of the Mixed Wood portion of the Boreal Forest. Paper birch, balsam poplar, white spruce and, in low-lying areas, black spruce and tamarack are the most common tree stands. Common shrubs in the area include red osier, dogwood, Saskatoon, chokecherry, wildrose, willow, cranberry, labrador tea, mountain elder and pincherry. Other land cover forms include agricultural hay and riparian/wetland.



Legend

- Plan Boundary
- Contour Line (1m Interval)

N

0 100 200 300 m

Map 2
Aerial Photograph

ARMIN A. PREIKSAITIS & ASSOCIATES LTD.

MYSTIC BEACH
Subdivision

Project No.: 04-020

Date: June 28, 2004

File: F:\AAP Project Files\Real Estate\04-020 Dr. Birkill Subdivision - Lakeland County \Map\AAP\Outline Plan\Map 2 - Aerial Photograph.dwg

Existing agricultural land.

Savouye Lake.

2.2 Existing Land Use

As can be seen on the aerial photograph, less than half the site has been cleared for agricultural purposes. There are some low-lying areas surrounding Savouye Lake. Agricultural uses are located on cleared land, generally coinciding with the more gently rolling areas of the property, primarily between the southern tip of the bay of Lac La Biche and north of Savouye Lake. In the western portion of the agricultural area a large, north - south oriented, area of woodland separates a narrow strip of agricultural use from the main area.

Surrounding land uses are primarily agricultural with a focus on cultivated hay production. No livestock grazing was observed in the surrounding area.

Located in a clearing within this woodland and accessed via a trail from the eastern entrance of the site is a natural gas well. Servicing this well is a pipeline right of way running northeast from the well, underground, and continues off site in an eastward direction.

2.3 Environmental Screening and Biophysical Site Assessment

An Environmental Screening and a Biophysical Site Assessment, prepared by EnviroMak Inc., was conducted in order to determine whether there are any environmental features that would affect the subdivision of the lands under consideration. *(See Appendix B).*

- The study concludes that the majority of the natural landscape has not been altered.
- The riparian/wetland complex (marsh wetland, lakeshore, and two small riparian areas) of vegetation types does not provide considerable biological diversity for wildlife.
- The current water level (June 2004) was 1.288m lower than the 1997 water level. The high water mark could create increased water in all of the riparian areas, thereby influencing the land available for subdivision.
- Fisheries values are significant, with a lengthy shoreline and some specific spawning and rearing areas in the adjacent marsh wetlands.
- Fish habitats are particularly of concern as they relate to the possible increases in eutrophication.

- No forestry, environmentally sensitive areas (i.e. ecological reserves, special natural projects) and/or endangered or threatened species were noted.
- The proposed development will not influence on the riparian habitats that presently exist.
- The environmental screening indicates that no major issues arise that cannot be addressed by an Environmental Protection Plan. *(Environmental Protection Plan Concepts are included as Appendix 15.3 in EnviroMak's Environmental Screening and Biophysical Site Assessment).*

Sphagnum bog.

2.4 Historical Resources Impact Assessment

Altamira Consulting Ltd. conducted a Historical Resources Impact Assessment (HRIA) on the plan area. The Final Report was circulated to Alberta Community Development, who reviewed the findings and subsequently approved Altamira's recommendations. *(See Appendices C and D).*

The Report concluded the only historically significant site on the plan area is a burial area located on the western shore of the peninsula that is currently surrounded by a barbed-wire fence. To ensure that this historic cemetery site is not inadvertently disrupted, permanent fencing is required.

Burial area currently surrounded by barbed-wire fence.

2.5 Potential Impact on Schools

Northern Lights School Division #69 has been contacted with regards to impacts of the proposed development on school capacity in the area. Although there is currently a high level of utilization of schools within the district, many of the recent residential developments in the area have been occupied by retirees and families with few children. Some capacity exists in the district for increased enrollment, the building of a new High School and the planned reorganization of existing facilities will further increase capacity in the area. Assuming that future occupation of this development follows current trends in the area, probably the greatest impact to the school district will be the necessity of an additional bus to transport any new students. The additional assessment and taxation the School Board will receive from new development will more than cover the additional bussing costs.

2.6 Fire, Police and Emergency Services

A volunteer Fire Service for the area is provided from Owl River. Currently, the fire station is located in the north of Owl River, which results in a response time of 15 to 20 minutes. This response time is insufficient to prevent the burning of a structure but adequate to protect surrounding houses and prevent spreading. Construction methods, including sprinkling of home, which will reduce the chance of fire occurring and minimize damage, are recommended for the area. All cul-de-sac radii are of sufficient size to accommodate maneuvering requirements of emergency vehicles. Consistent with FireSmart Protection Plans being advocated by Alberta Sustainable Resource Development, it is recommended that brush areas within the plan area be cleared as an additional fire protection measure.

A proposal is currently being considered to move the fire station to the south of Owl River, which would reduce response times to between about 5 and 7 minutes.

Impact to police service in the area, which is provided by the Lac La Biche RCMP detachment, is considered to be minimal. Response times to a call are estimated to range from 10 minutes to 1.5 hours, depending on the location of the police vehicle. This situation is similar to all development around Lac La Biche.

Ambulance service in the area, which is provided by Lac La Biche Regional EMS, will be able to accommodate the proposed development.

Other measures to reduce wildfire hazards such as firebreaks and clearing of deadfall can be utilized to reduce the risk of fire.

2.7 Parks and Recreation Opportunities

Opportunities for trail development and park space exist in the Plan Area. These opportunities would provide residents in the subdivision as well as surrounding residents with new recreational opportunities. Passive recreation opportunities include potential trail development and conservation of environmentally sensitive areas. Opportunities for active recreation, such as a baseball diamond and playfields, also could be provided within the central municipal reserve area.

The presence of the Owl River Community Hall, located on the north side of Highway 881, north of Lac La Biche provides the opportunity for recreational, cultural and community-based activities for new and existing residents.

Low-lying wet area.

3.0 DEVELOPMENT CONCEPT

Map 3 – Development Concept illustrates a proposed development scenario for the subject land in keeping with the policies of Lac La Biche Lake Management Plan ASP. The Development Concept is described in the following sections.

3.1 Planning Principles

The Outline Plan will continue to respect the goals of the Lac La Biche Lake Management Plan Area Structure Plan Ministerial Order 551/01. More specifically, the Development Concept adheres to the following planning principles:

(a) allow for multi-lot country residential development while preserving the area's rural character;

(b) protect the area's ecology and hydrology;

(c) preserve environmentally sensitive areas through the provision of environmental; reserve;

(d) preserve common open space for the use and enjoyment of all residents; and

(e) install environmentally friendly sewage disposal systems for individual homes.

3.2 Opportunities and Constraints Analysis

Map 3 – Development Concept also illustrates the opportunities and constraints found on the plan area.

In the Outline Plan area, constraints include:

- A 6-meter setback from the high water mark of Lac La Biche and Savouye Lake;
- a sweet gas well and associated pipeline right-of-way;
- low-lying wet areas; and
- a cemetery designated as an archeologically significant site.

Opportunities include:

- the provision of access to a continuous strip of sand beach;
- natural areas for the conservation of wildlife and their habitats;
- provision of open space for passive recreational use; and
- soil of poor agricultural capability is well-suited for residential development.

Legend

- Site Boundary
- Residential
- Municipal Reserve
- Environmental Reserve
- Historic Cemetery Site
- Sweet Gas Well Site
- Road (25m ROW)
- Potential Trail

Land Use Statistics

Gross Area	155.9ha (385.2ac)
Environmental Reserve	64.8ha (160.1ac)
Municipal Reserve	23.5ha (58.1ac)
Internal Roadways	8.0ha (19.8ac)
Residential	59.6ha (147.3ac)

N

0 100 200 300 m

Map 3
Development Concept

ARMIN A. PREIKSAITIS & ASSOCIATES LTD.

MYSTIC BEACH Subdivision

Project No.: 04-020

Date: January 2005

File: F:\AAP Project Files\Real Estate\04-020 Dr. Birkill Subdivision - Lakeland County \Map\AAP\Map 5 - Development Concept.dwg

Lac La Biche.

3.3 Development Concept

The design for the proposed subdivision has been carried out in keeping with the best practices of cluster development. This style of design aims to reduce lot sizes while maintaining overall site density, to maintain a rural character and maximize the allocation of open space. These practices result in several benefits, to the new development and the surrounding community, outlined below.

Lots are situated in such a way that they are predominantly located on lands that are least sensitive to development while, at the same time, amenity areas are created by avoiding development of sensitive lands. In this case, the majority of lots are located in areas currently used for minor agricultural purposes. Soil quality in these areas is considered to be poorly suited for agricultural uses. Areas of environmental and historical significance have been left undeveloped and protected wherever possible to ensure they will exist for the future enjoyment of the residents of the development and the surrounding community.

Smaller lots are oriented towards the lakeshore to maximize views and access to the beach on Lac La Biche. Larger lots, located on the interior of the site, are proposed. Additionally, the area surrounding the existing sweet gas well will be developed as a municipal reserve area to serve future residents. It is anticipated that this gas facility is to be decommissioned and remediated prior to the development of the internal lots in the final stage of development. Low impact trails may be developed to link the municipal and environmental reserves, providing additional amenity to the development and increasing access to these spaces.

In addition to the protection of sensitive lands and the provision of a substantial amount of open space, the development concept also provides economic benefits for the developer, Lakeland County, and future residents. Smaller lots clustered along future road rights of way maintain the overall development density potential for the site while reducing the length of road to be developed. Reduced road development lowers construction costs for

the developer, maintenance costs for the County, and taxes to cover maintenance costs for future residents.

3.4 Lot Sizes and Densities

The subdivision will consist of a total of ninety-seven (97) country residential lots ranging in size form 0.4 ha (1.0 ac) to 2.0 ha (4.9 ac).

Smaller lots are to be located adjacent to the lakeshore in order to maximize views and larger lots are located on the interior of the development.

3.5 Environmental Reserve Dedication

As required by the Lac La Biche Management Plan ASP, a 30-meter wide buffer strip above the surveyed high water mark of Lac La Biche and Savouye Lake is to be provided.

The environmental reserve dedication will consist of a 6-meter strip above the high water mark and most of the lands in the southern portion of the plan area. Also dedicated as environmental reserve are the low-lying wetland areas. Total environmental reserve is 64.8 ha (160.1 ac) and will offer opportunities for passive recreation and, most importantly, for nature conservation.

Several options exist for the maintenance and ownership of this environmental reserve area. Some options include donation of the land to a conservation entity such as Ducks Unlimited, a homeowners association and designation of a conservation easement, or ownership by Lakeland County.

3.6 Municipal Reserve Dedication

The remainder of the buffer strip and the area surrounding the existing gas well will be dedicated as municipal reserve and will consist of 23.5 ha (58.1 ac).

In accordance with the Lakeland County MDP and the Municipal Government Act (MGA), 10% of Gross Developable Area is required as municipal reserve. This would result in a 9.1 ha requirement in the plan area. The plan as proposed dedicated an extra 14.4 ha of municipal reserve. Refer to the Land Use Statistics table on the next page.

MYSTIC BEACH SUBDIVISION - LAKELAND COUNTY

LAND USE STATISTICS

	ha	ac
GROSS AREA	**155.9**	**385.2**
From this area subtract the following items:		
Environmental Reserve[1]	**64.8**	**160.1**
GROSS DEVELOPABLE AREA (GDA) - Gross Area less ER	**91.1**	**225.1**
10% Municipal Reserve (9.1ha required)[1]	**23.5**	**58.1**
Internal Roadways	**8.0**	**19.8**
NET DEVELOPABLE AREA - Gross Developable Area less Non-Residential uses	**59.6**	**147.3**

Net Developable Area to be subdivided into ninety seven (97) residential lots, ranging in size from 0.4ha (1.0ac) to 2.0ha (4.9ac). Actual areas and boundaries of these lots are to be verified by legal survey.

Based on the development of 97 residential lots, resulting lot density (within the net developable area) is 1 lot / 0.61ha, or 1 lot / 1.52ac. Lot density within the Gross Area is 1 lot / 1.61 ha, or 1 lot / 3.97 ha.

Assuming an average household size of 3.2 persons, resulting population growth will be 310 people.

[1]Environmental Reserve and Municipal Reserve dedication will be made in accordance with the requirements in the Lakeland County Municipal Development Plan (MDP) and Municipal Government Act (MGA). Specifically, MDP Sections 5 and 6.

3.7 Trail Development Potential

The combined environmental and municipal reserves create the opportunity for potential trail development in a continuous open space consisting of wetland and lakeshore areas.

The beach is accessible from the internal subdivision roadway by access points that are located near the historic cemetery site, along environmental reserve lots, the east side of the peninsula and on the south portion of the Plan Area. Trails may be provided within these beach access points for use by future residents and the surrounding community.

In adherence to the Planning Principles described in Section 3.3, trail development would consist of low impact trails to minimize their impact to environmentally sensitive areas. A soft surface trail is recommended so that natural drainage patterns and the area's natural setting are minimally disrupted.

4.0 MUNICIPAL SERVICES

Associated Engineering Alberta Ltd. was retained to investigate site servicing options for the subdivision and provide recommendations accordingly. The following sections summarize the main findings. *(See Appendix E – Site Servicing Concept Report* for more detail*).*

4.1 Roadways

4.1.1 External Roadway

The proposed development is accessible via approximately 1.6km (1 mile) of all-weather graveled roadway to the property line. An existing rural road approximately 1.5 km in length provides access to the subdivision. This road is well graded and generally in good shape. The width of this road varies from 7.5 to 5.5 m. County staff has indicated that the Council will eventually review the road width and determine whether upgrades are required.

4.1.2 Internal Roadway

The interior subdivision roadway will consist of approximately 3.2 km of 8.0 m wide paved surface and cul-de-sac pavement radii of 15 m.

4.2 Potable Water Supply

After considering a number of options, Associated Engineering Alberta Ltd. is recommending that water servicing is to be provided by private cisterns.Thurber Engineering conducted hydrogeologic tests (*see Appendix F and G*) to determine the capacity and suitability of the aquifer to support a water supply system from wells. A test hole was drilled on November 9, 2004 to a depth of approximately 79 metres. Water bearing zones suitable for the development of an adequate groundwater supply were not found. Although deep wells may be an option, due to the associated higher cost of installation, they were not considered further. Due to the inability of an aquifer to supply water to the subdivision, and that the costs of the transmission line from Lac La Biche were deemed prohibitive relative to the number of proposed service lots, these options were not considered further. After looking at a number of options, Associated Engineering Alberta Ltd. recommended water servicing is to be provided by private cisterns.

4.3 Sewage Treatment and Disposal

Several sewage treatment and disposal options were discussed with Lakeland County. Two of the options considered, a trunkmain to Lac La Biche / internal collection system and a treatment plant and internal collection system, were deemed cost prohibitive relative to the number of proposed serviced lots.

It is recommended that sewer servicing be provided by the installation of the FAST brand of private small package treatment plants, including provisions for nitrification and phosphorus removal and field disposal systems wherever possible. (see Appendix E, Section 3.4 for detailed specification of Individual (Private) FAST Micro-Treatment Plants) Where soil conditions are prohibitive to disposal systems *(see Appendix G, Section 5.1)*, sewage holding tanks (pump outs) will need to be utilized. Alternatively, sewage holding tanks can be used throughout the subdivision.

4.4 Stormwater Management Plan

Stormwater management for the subdivision is to maintain existing topographic features. Drainage flow will need to be directed to existing depressed areas via swales and ditches. These ditches and swales are to be accommodated within the rural road cross section and directed through easements where necessary. (*See Figure 1.1 – Conceptual Drainage Plan in Associated Engineering's Site Servicing Concept Report in Appendix E*). Erosion control measures and silt fences will be installed to prevent the flow of material into Lac La Biche. The site has adequate storage capacity for all catchment areas.

4.5 Franchise Utilities

Gas servicing is to be provided by the Lac La Biche Gas Cooperative (Co-op). Telephone servicing infrastructure is to be installed by Telus. The franchise provider for power in the area is Fortis, a division of TransAlta Power. No cablevision service is available in the subdivision area.

LAC LA BICHE

SAVOUYE LAKE

A4 = 10.86 Ha
Q4 = 18.83 L/S

A3 = 3.30 Ha
Q3 = 5.57 L/S

A5 = 7.28 Ha
Q5 = 12.29 L/S

A6 = 2.83 Ha
Q6 = 4.78 L/S

A2 = 3.82 Ha
Q2 = 6.45 L/S

A7 = 6.28 Ha
Q7 = 10.60 L/S

A1 = 5.37 Ha
Q1 = 9.06 L/S

HISTORICAL SITE

LAC LA BICHE

LEGEND

- PROPOSED PROJECT BOUNDARY
- PROPOSED CATCHMENT BOUNDARY
- PROPOSED DRAINAGE EASEMENT
- NATURAL DEPRESSION
- PROPOSED CULVERT
- DRAINAGE

ARMIN A. PREIKSAITIS & ASSOCIATES LTD.

MYSTIC BEACH SUBDIVISION

CONCEPTUAL DRAINAGE PLAN

SCALE = 1 : 4,000

DEC, 2004

FIGURE 1.1

Associated Engineering

DEVELOPMENT DESCRIPTION (PD)

5.0 COMMUNITY CONSULTATION

5.1 Summary from Public Open House

It is estimated that 25-30 members of the public attended the Open House. Of these, twenty-four (24) signed the Sign-In Sheet.

A minority of those in attendance supported the ASP Amendment and rezoning as presented and only one (1) of the nine (9) comment sheets, submitted a the end of the Open House, indicated that there were no objections to the proposed rezoning.

Most of the comments voiced during the Open House related to the details of the proposed subdivision regarding sewage disposal, effects to water quality in Lac La Biche, road upgrades, access to the development, increased activity in the area, and the reduction of the minimum lot size from one (1) acre to one half (1/2) acre.

5.2 Concerns Expressed at Public Hearing and How They Were Addressed

One main concern expressed at the Public Hearing was sewage treatment and disposal. Because the lands under consideration are not within the Lakeland County service area, alternatives must be explored. These other options include a communal sewage disposal system or ecologically friendly sewage disposal systems for individual homes. The consultants have provided several options and evaluated the feasibility of each of them.

The second concern involved increased traffic in the area and the potential for this to impact the rural lifestyle, increased taxes due to potential road upgrades, decreased road safety and increased incidences of speeding. These concerns were addressed by the consultants by reiterating the relatively small scale of the proposed multi-lot country residential subdivision and the likelihood that future residents will be composed of mainly seniors, empty nesters and small families. Therefore, traffic generation is expected to be modest. Some upgrades to the access road may be required as the subdivision builds out.

6.0 IMPLEMENTATION

6.1 Plan of Subdivision

Concurrent with the Outline Plan, a tentative plan of subdivision has been submitted.

6.2 Staging

As shown on *Map 3 – Development Concept*, staging of this development will follow the logical and economical extension of services in the Plan Area. It is anticipated that development will occur in three distinct stages with each stage initiated by current market demand.

Stage 1 will consist of a double loaded road extending westward from the site access and south parallel to the shore of Lac la Biche, terminating in a cul-de-sac.

Stage 2 will be a single loaded road proceeding north on the peninsula and also terminating in a cul-de-sac. Lots will be developed on the west side of this road and north of the cul-de-sac.

Stage 3 consists of a double loaded road connecting the north-south oriented area of Stage 1 to the site entrance road. This road not only allows for the construction on large lots in the interior of the Plan Area, but also provides alternative access routes within the Plan Area.

6.3 Restrictive Covenants

In order to ensure a high quality of development within the proposed subdivision, consideration is being given by the developer to put into place restrictive covenants on lots including, but not limited to such items as house size, type of construction, and type of sewage disposal system.

6.4 Formation of Homeowners Association and Resident's Environmental Code of Conduct

Consideration is also being given by the developer to establish a Homeowners Association and develop an environmental code of conduct. As per EnviroMak's Environmental Screening and Biophysical Site Assessment contained in Appendix B, this code of environmental conduct would include:

- the restrictions on the use of pesticides and herbicides,
- the disposal of garbage,

- the control of erosion,
- boating restrictions and regulations,
- the control over the use of fertilizers,
- tree removal limitations,
- shoreline disturbances,
- fire management,
- temporary dock and beach development restrictions,
- potential environmental enhancement developments, and
- noise control.

MYSTIC BEACH SUBDIVISION
LAC LA BICHE, ALBERTA
GEOTECHNICAL INVESTIGATION

Report

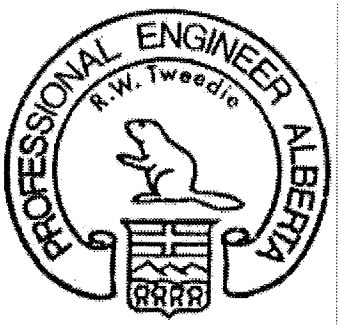
to

Armin A. Preiksaitis & Associates Ltd.

Thurber Engineering Ltd.
Suite 200, 9636-51 Avenue
Edmonton, Alberta T6E 6A5
Telephone: (780) 438-1460
Facsimile: (780) 437-7125

Gurpreet Dhaliwal, E.I.T.
Project Engineer

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature _____
Date _____
PERMIT NUMBER: P 5186
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



Date: August 9, 2004
File: 19-3836-1

R.W. Tweedie, P.Eng.
Review Principal

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) for the Mystic Beach Subdivision located northwest of the Town of Lac La Biche, Alberta. Access to the property is provided along Township Road 682A on the west side of Secondary Highway 881. This geotechnical investigation provides information and recommendations for the detailed design of the proposed residential subdivision developments.

The scope of the geotechnical investigation is summarized in Thurber's proposal to Mr. Gregory MacKenzie, C.P.T. of Armin A. Preiksaitis & Associates Ltd. (APAL) dated June 23, 2004 who gave authorization to proceed with the investigation on that date.

Use of this report is subject to the Statement of General Conditions that is included at the end of the text of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

2. PROPOSED DEVELOPMENT

The limits and layout of the proposed residential development are shown on Drawing 19-3836-1-1, Appendix A.

It is understood that the proposed development will consist primarily of residential, single family lots approximately 0.5 acres to 2 acre in area. Approximately 100 parcels of land within the subject property will be created in the subdivision. The site development will consist of road construction, underground utility installation and building structures.

3. METHOD OF INVESTIGATION

3.1 Field Program

A total of thirteen (13) test holes were drilled on June 24 and June 25, 2004 using a track mounted auger drill rig operated by Mobile Augers & Research Ltd. The test hole locations were selected by Thurber based on a preliminary layout

drawing provided by APAL and are shown on Drawing No. 19-3836-1-1, Appendix A.

Test holes TH04-1 through TH04-13 were advanced to depths of 5.8 m with in the general area of the proposed residential development.

Disturbed soil samples were obtained from the solid stem auger flights during drilling and Standard Penetration Tests (SPT's) were carried out at selected depths in the test holes. The undrained shear strength (Cpen value) of cohesive samples was estimated using a pocket penetrometer.

Slough and water levels were noted during and after completion of the drilling and standpipe piezometers were installed in eight (8) of the test holes. Water level readings were measured in the piezometers on June 25, 2004, upon completion of drilling.

This investigation did not include an assessment of soil or water for environmental purposes.

3.2 Laboratory Testing

Laboratory testing included a visual classification and the determination of the natural water content of all soil samples. In addition five Atterberg Limits, one gradation analysis and six water-soluble sulphate content tests were carried out on selected samples.

The results of the drilling and laboratory program are summarized on the test hole logs in Appendix B. An explanation of the symbols and terms used to describe observations in the test hole logs and the Modified Unified Soil Classification are also provided in Appendix B.

4. SITE DESCRIPTION

4.1 Surface Conditions

The site is partially cleared, with the remainder of the land area covered by trees. The cleared areas are covered with grasses and are not leveled. The site is bordered by undeveloped land and lakeshore.

Local muskeg areas identified during drilling are located between TH04-11 and TH04-12, and between TH04-12 and TH04-13. The location of muskeg area is shown on Drawing 19-3836-1-1, Appendix A. Additional areas of muskeg may be present on the site that were not observed during the site work.

4.2 Subsurface Conditions

A detailed description of the subsurface conditions observed in the test holes during the recent drilling is presented on the test hole logs in Appendix B.

The subsurface conditions generally consisted of a topsoil layer overlying clay, sand, and clay till. At two locations (TH04-12 and TH04-13), the topsoil is overlying sand to the full extent of drilling. Further descriptions of the main soil layers are discussed in the following sections.

4.2.1 Topsoil

Topsoil was noted in each of the test holes and varied in thickness from 75 mm to 300 mm. It should be noted that the topsoil thickness may vary between test hole locations and may be thicker in other areas of the site. If an accurate thickness is required for volume calculations, additional shallow holes should be excavated.

4.2.2 Clay

Medium to high plastic clay was encountered in all but two of the test holes underlying the topsoil or under a thin sand layer (TH04-2), and varied in thickness from about 0.35 m to 2.4 m. The clay was brown and silty with a trace of sand, and oxides pockets. SPT 'N' values ranged from 7 to 30 blows per 300 mm indicating that the clay has a consistency of firm to very hard.

Atterberg Limits testing was carried out on a clay sample at a depth of 1.6 m in TH04-1 and TH04-3, and at a depth of 1.0 m below ground surface in TH04-5. The plastic limit ranged from 15% to 29% and the liquid limit was in the order of 47% to 63% in TH04-1, TH04-3, and TH04-5, indicating that the clay is medium to high plastic. The moisture content of the clay ranged from about 6% to 30%.

4.2.3 Clay Till

Clay Till was encountered in all the test holes except TH04-11 and TH04-12 underlying the clay or sand. The clay till was brown and gray in color and silty with a trace of pebbles, gravel, oxides, and sand pockets. SPT 'N' values ranged from 15 to 34 indicating that the clay till has a consistency of stiff to hard.

Atterberg Limits testing was carried out on a clay till sample at a depth of about 1.0 m in TH04-9 and at 2.5 m in TH04-13 below ground surface. The plastic limit was 15% and the liquid limit was 45%, indicating that the clay till is medium plastic. The moisture content of the clay till ranged from about 12% to 25%.

4.2.4 Sand

Sand was encountered in test holes TH04-7, TH04-9 and TH04-13 underlying the clay and clay till at depths of 1.9 m, 5.3 m, and 4.9 m, respectively. In test holes TH04-11 and TH04-12 the sand was encountered underlying the topsoil and extended to the end of the test holes. Sand was also encountered above the clay till and below the topsoil in TH04-2.The sand was typically brown and fine to coarse grained with some silt. SPT 'N' values ranged from 11 to 26 blows per 300 mm indicating that the sand is compact. The moisture content for the sand varied from 2% to 22%.

The sand in TH04-11 and TH04-12 was typically medium to coarse grained with very few fines. A gradation test on a sample of the sand from TH04-12 indicates that the sand had less then 2% fines (silt and clay).

4.3 Groundwater, Seepage and Slough Levels

Water, seepage and slough levels measured in the open test holes during drilling are noted on the test hole logs in Appendix B. Water levels in the piezometers installed by Thurber are summarized in Table 4.1 below.

The water levels in the piezometers at 1 day after drilling varied from 1.1 m to 2.4 m below existing ground level in two test holes and was dry in the remaining standpipes. However, these are relatively short-term readings and the stabilized

water level could be higher. Also, groundwater levels may fluctuate seasonally and may rise in times of high precipitation. Hence, the actual groundwater levels may differ at the time of construction from those reported herein.

TABLE 4.1
SUMMARY OF SLOUGHING/SEEPAGE AND GROUNDWATER LEVELS

TEST HOLE	Test Hole Depth B.G.S. (m)	Slough Level on Completion B.G.S. (m)	Free Water on Completion Above Slough B.G.S. (m)	Standpipe Piezometer Water Levels June 25, 2004 B.G.S. (m)
TH04-1	5.8	5.8	5.6	No Installation
TH04-2	5.8	5.8	5.6	1.1
TH04-3	5.8	5.8	5.6	No Installation
TH04-4	5.8	5.8	None	Dry
TH04-5	5.8	5.8	None	No Installation
TH04-6	5.8	5.8	None	Dry
TH04-7	5.8	5.5	None	Dry
TH04-8	5.8	5.8	None	Dry
TH04-9	5.8	5.5	None	No Installation
TH04-10	5.8	5.6	None	Dry
TH04-11	5.8	5.8	None	Dry
TH04-12	5.8	5.8	5.5	No Installation
TH04-13	5.8	4.3	2.7	2.4

It is recommended that the standpipes be read in the future to provide stabilized groundwater level information.

4.4 Frost Effects

The near surface native silty clay and fine silty sand at this site is considered moderately frost susceptible.

The estimated frost penetration for the silty clay and sand soils are provided in Table 4.2. The estimated value for granular fill is also provided for comparison. Values given are for an average freezing index of 1950 degree-days Celsius (3500 degree-days Fahrenheit) and for a 50-year return period freezing index of 2550 degree-days Celsius (4600 degree days Fahrenheit).

The frost penetration is for a uniform soil type with no insulative cover. If the area is covered with turf or significant snow cover, the depth of frost penetration will be less.

The 50-year return estimated frost depth is generally used for design, while the mean annual value could be used for construction with some risk.

TABLE 4.2
ESTIMATED FROST PENETRATION DEPTH

SOIL TYPE	ESTIMATED FROST PENETRATION DEPTH (m)	
	Mean Annual Air Freezing Index	50 Year Return Period Air Freezing Index
Clay Soil	2.2	2.6
Sand Soil	2.7	3.4

5. GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

5.1 General

The results of the geotechnical investigation indicate that the site is suitable for the proposed residential development. Geotechnical recommendations for the site development are provided in the following sections and Recommended Construction Procedures are provided in Appendix C.

5.2 Site Preparation, Grading and General Fill Placement

Site preparation will include the removal of all topsoil/organics and all unsuitable materials under roadways and development areas. Estimates of topsoil/organics thickness at the test hole locations may be obtained from the test hole logs. As noted previously, the topsoil thickness may vary between the test hole locations.

All fill should be placed and compacted to the following specifications:

(a) Fill required to raise the site under roads and parking areas should be placed in 150 mm maximum lifts compacted thickness and compacted to at least 95% of SPMDD within 0% to 2% above Optimum Moisture Content.

(b) Fill placed under slab-on-grades should be placed in 150 mm maximum lifts compacted to at least 98% of SPMDD within 0% to 2% above Optimum Moisture Content. Prior to placing the fill, the subgrade may be proof rolled if required, to detect soft areas which should be sub-excavated and replaced with better quality fill. The procedure for proof rolling is discussed in Appendix C.

(c) General site grading fills outside the building footprints should also be placed in 150 mm lifts compacted thickness and compacted to at least 95% of SPMDD within 0% to 2% above optimum moisture content.

(d) Where possible, site grading should be designed to avoid placement of fill within the building footprints since even well compacted fill will be subject to some long term settlement. At select locations where small depths of fill (less than 2m) cannot be avoided it may be possible to construct the house footings over engineered fill compacted to at least 98 % of SPMDD under full time inspection and compaction testing. However, the details of such locations should be reviewed by us prior to finalizing the design.

(e) All fill used for landscaping purposes requires only moderate compaction (i.e.: 92% of SPMDD) to ensure future settlements do not adversely affect design drainage provisions.

Uniformity of compaction is essential to reduce the potential for differential settlement. It is recommended that fill placement be inspected and tested by qualified geotechnical personnel to ensure adequate compaction.

Permanent site drainage should be developed at early stages of construction in order to control surface water and reduce future frost effects in the subgrade. The final site grade should be sloped to shed water away from the buildings.

5.3 Underground Utilities

5.3.1 Trench Drainage

It is expected that the depth of sewer installation will be in the order of 3.0 to 4.0 m below existing ground. Based on the test holes drilled, it is expected that the excavations will be mainly in the clay, clay till, and sand.

During the field drilling program, seepage was noted in some of the test holes during drilling and the water level at 1 day after drilling varied from 1.1 to 2.4 m below ground surface in two of the standpipe piezometers installed but was dry in the remaining standpipes. Based on this information groundwater could be encountered during trench excavation at some locations of the site.

Seepage rates into trenches from the clay and clay till are expected to be relatively low. Faster seepage may occur from sand layers interbedded within the clay till however, the rate is expected to diminish over time. Generally seepage rates should be of a magnitude that can be handled by normal trench grading practices and sumps and pumps where necessary.

Utility lines affected by freezing should be located below the expected frost depths provided in Section 4.4.

5.3.2 Open Excavation

Based on the test hole information, the trench excavations will be mainly through firm to very hard clay, stiff to hard clay till, and compact sand. Open sloped excavations are considered feasible throughout the site. Braced excavations may be considered where space restrictions dictate.

The temporary excavation slope requirements will be largely governed by the type of material encountered in the trenches. For trenches excavated in the firm to very hard clay or clay till the lower 1.5 m of the excavation may be cut vertical and the section above this depth should be sloped back at a maximum trench angle of 1H to 1V.

If areas of wet sand, loose and/or softer clay are encountered, flatter slopes cut back from the base of the excavation at 1H to 1V or flatter may be required, assuming that the sand is adequately dewatered in advance of excavation.

It should be noted that the presence of water bearing sand layers and sand pockets within the clay till, if encountered, may lead to potential excavation wall instability. Care should be taken to protect workers and equipment during excavation.

It is recommended that the trenching be carried out in relatively short lengths and all trenches should be backfilled at the end of each day.

Excavated spoil material should be kept back from the top of the trench by a distance of at least the depth of the trench. Personnel should not be allowed in the open trench during installations without proper safety precautions being taken. In all cases, excavations should be consistent with Occupational Health and Safety regulations.

It is recommended that as part of the tendering process, a few test pits be excavated at selected locations in order for the contractor to observe the short and long term performance of the excavation slopes.

5.3.3 Pipe Bedding

All soft, loosened and disturbed material should be removed from the trench base before placement of bedding. The pipe should be bedded and installed according to the manufacturer's specifications. Care should be taken such that the pipe is not in contact with rigid objects such as cobbles or rocks as this will cause a stress concentration in the pipe and may result in breakage.

Where a granular bedding is specified it is recommended that a minimum thickness of 100 mm of granular bedding be placed below the pipe. The bedding material should also be placed around the pipe and should extend at least 150 mm above the crown of the pipe.

The material should be placed around the pipe in 200 mm lifts and compacted uniformly to at least 95% of the SPMDD (ASTM D698). The granular bedding should consist of well graded sand and gravel with less than 10% passing the 80 micron sieve (No. 200 sieve) and should be free from angular rocks (particularly near the pipe) and organics.

If the trench base is situated in soft clays or saturated sands below the water table where the pipe support conditions may be poor, special bedding procedures may be required to improve pipe support conditions and reduce future settlement of the pipes. Such special bedding requirements may consist of subexcavation and

placement of a gravel pad of about 300 mm minimum thickness wrapped in a geotextile fabric in the base of the trench for support of the pipe bedding. This technique has been found to provide a better working surface in the trench base and also facilitates trench drainage during pipe installation.

5.3.4 Backfilling

The remainder of the trench above the bedding zone may be backfilled with the excavated on-site materials that are free of debris or organics. Under proposed roadways, the backfill should be compacted to a minimum of 95% of SPMDD.

Results of this investigation indicate that the natural moisture content of the upper clay till material is typically below Optimum Moisture Content and may require some moisture conditioning to achieve the required compaction. The above recommendations may be affected by weather conditions before and during construction.

It should be recognized that even when compacted to the above standards, settlement of the trench backfill should be expected in the first one to two years and this should be considered in the design. Maintenance may therefore be required for trenches under roadways, including future patching or overlaying of the pavement.

The on site native material should not be placed frozen, nor placed at temperatures below freezing. Heavy compaction equipment should not be allowed to operate above the placed pipe until 1 m of backfill has been placed and compacted above the pipe.

5.4 Manholes

Manholes may be founded directly on the native undisturbed inorganic soils. If areas of soft base conditions are encountered, consideration should be given to the use of a gravel pad wrapped in geotextile or alternatively a lean concrete base, below the base of the excavation. It is recommended that the native clay till backfill be placed uniformly around the manhole in 200 mm lifts and compacted to about 95% of Standard Proctor Maximum Dry Density (SPMDD) to provide uniform and adequate support to the manholes.

Buoyancy of the manholes due to hydrostatic uplift pressures on the base should be checked against the highest water levels noted in Table 4.1. If required, one method of providing the necessary uplift resistance is to widen the base of the manholes beyond the manhole vertical walls.

5.5 Pavement Recommendations

All topsoil and any poor quality material should be removed from the proposed pavement areas. Truck traffic should be avoided on the exposed subgrade to avoid disturbance and rutting of the subgrade. Alternatively truck traffic may be concentrated along one alignment, recognizing that the subgrade will require modification prior to construction of the roadway.

It is assumed that many of the roadways will be constructed over the service trench backfill. The upper 150 mm of the exposed subgrade should be reworked and compacted to 100% Standard Proctor maximum dry density at the optimum moisture content. The recompacted surface should be inspected by qualified geotechnical personnel to confirm that all deleterious material has been removed. If required, proof rolling may be carried out (refer to Appendix C) and if any soft or loose materials are noted they should be subexcavated and replaced with better quality fill, or partially subcut and covered with a woven geotextile (Amoco 2002, or equivalent) and well compacted granular fill. The decision to use any of these treatments and what depth of treatment required should be made by qualified geotechnical personnel in the field.

Additional fill required to raise the grade to subgrade level may consist of native inorganic low to medium plastic clay or clean granular fill placed in 200 mm thick lifts (compacted thickness) and compacted to at least 95% of Standard Proctor Maximum dry density of the material at a moisture content ? 2% of optimum. The upper 150 mm of the subgrade should be compacted to 100% of the Standard Proctor maximum dry density of the material. To reduce swelling potential it is recommended that high plastic subgrade soils moisture be conditioned to no drier than +2% of optimum.

It is recommended that the finished subgrade surface be trimmed smooth and sloped at a minimum of 2% toward catch basins or perimeter drains or ditches.

The purpose of this is to drain any subsurface water from the subgrade and thereby prevent ponding of water which could result in swelling, softening, and/or possible frost heaving of the subgrade.

A soaked California Bearing Ratio (CBR) of 3 is considered applicable to the clay subgrade materials at this site. The design pavement thickness will depend on the magnitude, frequency and distribution of traffic loading anticipated in the area. In lieu of this information, the following guidelines presented in Table 5.1 below can be used for design of the pavement structures at this site.

TABLE 5.1
ROADWAY STRUCTURE SUMMARY

RESIDENTIAL MINOR COLLECTOR ($3.5x10^4$ ESALS[1] over 20 year design life)	
Material Type	**Thickness**
Asphalt Concrete Final Stage[2]	35 mm
Asphalt Concrete Initial Stage[2]	65 mm
Crushed Granular Base (20 mm)	200 mm
RESIDENTIAL MAJOR COLLECTOR ($2x10^5$ ESALS[1] over 20 year design life)	
Asphalt Concrete Final Stage[3]	35 mm
Asphalt Concrete Initial Stage[3]	75 mm
Crushed Granular Base (19 mm)	250 mm

(1) ESAL = Equivalent Single Axel Loads (80 kN)
(2) 50 Blow Marshall Density
(3) 75 Blow Marshall Density

The recommended gradation limits for the crushed granular base gravel are provided in Table 5.2. Alternative gradations may be feasible but should be reviewed and approved by a geotechnical engineer.

TABLE 5.2
TYPICAL GRADATION FOR CRUSHED GRANULAR BASE MATERIAL

Sieve Size (microns)	Percent Passing
20, 000	100
10, 000	65-86
5, 000	45-68
1, 250	26-45
630	19-38
315	14-30
160	5-18
80	2-10

The crushed granular base course materials should be placed in 150 mm lifts and compacted to 100% of Standard Proctor maximum dry density.

Asphaltic concrete should be compacted to at least 98% of the appropriate Marshall density of the mix design being utilized.

5.6 Foundations

5.6.1 General

The following foundation types are considered feasible for structures on this site:

- ?? Spread Footings
- ?? Cast-in-place concrete friction piles

5.6.2 Spread Footings

Spread footings are considered appropriate for foundation support for residential buildings at this site. Permanent footings supporting heated structures should be founded at a minimum depth of 1.5 m below finished grade to minimize frost effects. For unheated structures the recommended minimum foundation depth to minimize frost heave effects is 2.7 m. Alternatively, the foundations may be placed at shallower depths and insulated with rigid insulation (Styrofoam SM or equivalent).

An allowable bearing capacity of 150 kPa and 180 kPa may be used for design of strip and square footings, respectively.

Care should be taken during construction to minimize mechanical disturbance of the foundation soils. In the event that foundation construction is delayed, the excavated base of the foundation level should be protected from weathering and frost action to prevent the deterioration of the soil at footing level. In addition, water should not be allowed to pond in the base of the excavations as it could lead to softening of the foundation soils.

The base of the footing excavations should be inspected and any softened or disturbed soil should be removed prior to pouring concrete.

General recommendations pertaining to footing excavation, and backfill are presented in Appendix C.

5.6.3 Cast-in-Place Concrete Friction Piles

Foundation loads may also be carried on cast-in-place concrete friction piles. The piles should be designed and installed according to the recommendations given below.

(a) Cast-in-place concrete friction piles may be designed based on an allowable skin friction value of 25 kPa. Skin friction resistance should be neglected in the upper 1.5 m of the pile to allow for potential surficial drying and shrinkage of the soil away from top of the pile shaft.

(b) For exterior piles or piles located under unheated structures, a minimum pile depth of 7 m below finished site grade is recommended to resist potential frost heave forces.

(c) End-bearing resistance should not be included in calculating the allowable design load of a friction pile.

(d) A minimum pile shaft diameter of 400 mm is recommended to prevent voids from forming during pouring of the concrete.

(e) As a minimum and not including structural requirements, a nominal percentage of longitudinal reinforcement (0.5% of the sectional area of the pile shaft should be provided) is required throughout the length of the pile shaft to resist potential uplift forces on the pile due to frost action and seasonal moisture variations. If piles are designed as tension elements, the pile reinforcing should be designed to resist the anticipated uplift stresses.

(f) Concrete should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing soil.

(g) Casing should be available and should be used during pile installation if seepage or sloughing conditions are encountered.

(h) Occasional boulders could be encountered during pile excavation and the piling contractor should be suitably equipped to remove these if required.

5.7 Concrete Grade Beams

When piles are used to support building structures, a concrete grade beam is required along the top of the piles. Precautions should be taken to prevent heaving of the grade beams due to frost penetration, or swelling of the underlying soil, where the grade beams will lie less than the expected depth of frost penetration.

The recommended construction procedures for preventing heave under the grade beam is through use of a crushable non-degradable void form material (such as Beaver Plastics Frost Cushion) as shown in Figure 5.1, Appendix A. The grade beam must be designed in accordance with the crushing strength of the void filler used and the piles must be able to resist the resulting uplift load.

5.8 Basements, Excavation and Backfilling

It is expected that temporary excavation slopes for basements of up to a depth of 2 m can be cut at 1H:1.7V through the native clay till material. Flatter slopes may be required in certain areas, if silt or sand layers or seepage are encountered.

The water levels observed in the test holes during drilling indicate that the water table could be encountered within the proposed basement depth at some locations on site. However, if seepage into the excavation occurs it is expected to be of a magnitude that could be typically handled by a sump and pump.

Perimeter drains should be provided on the outside of the footings below basement floor slab elevation, to prevent build up of hydrostatic pressure below the floor slab and against the basement walls. Sumps and float controlled pumps should be provided to maintain the drains free of water.

Free-draining clean granular material (less than 5% passing a No. 200 sieve) would be the first choice of material for backfilling against the basement walls as it compacts relatively easily and does not settle significantly with time. Additional gradation recommendations are provided in Section 5.10. An equivalent fluid pressure of 9 kN/m^3 may be used for design of the perimeter wall, providing the gravel backfill is sloped back at 1 horizontal to 2 vertical or flatter from the bottom of the footings to ground level. The backfill should be carefully placed against the basement walls to avoid over-compaction of the material and distress to the walls, and should be capped with an impervious barrier, such as a compacted clay layer of about 300 mm thickness.

The on-site clay till material is not as desirable for backfilling because it remains in hard chunks and it is difficult to obtain uniform compaction resulting in non-uniform ground settlement with time. If, however, it is necessary to use clay material against the basement walls, then it should be free from organic content and should be broken down with no large chunks of clay remaining. The clay should be carefully placed and hand tamped in lifts of 150 mm or less to ensure uniform compaction. An equivalent fluid pressure of 11 kN/m^3 should be assumed for design purposes.

The ground surface should be sloped at a grade of at least 2% away from the house to shed water away from house.

5.9 Concrete Floor Slabs

Recommended procedures for site preparation for a slab-on-grade were provided in Section 5.2. If a slab-on-grade is used the following additional recommendations apply:

a) The natural clay at the site has a high swelling potential in its current condition, particularly if it has free access to moisture. Swelling of the clay under the ground floor slab may cause heaving of the slab if the moisture content is allowed to vary. Care should be taken to prevent over-drying of the clay subgrade during floor slab construction. Material which has become desiccated or exceedingly wet should be removed prior to construction of the slab. Free water should not be allowed access to the subgrade beneath the slab-on-grade. Also, utilities should be designed with water tight corrections to avoid leakage into the subgrade soils .

b) Floor slabs should be structurally separate from the building to allow for movement to occur. Non-load bearing partition walls resting on the floor slab should have a minimum clearance of 50 mm between the top plate and the ceiling to accommodate possible future heaving of the floor slab.

c) A minimum of 150 mm of clean, well-graded sand or gravel is recommended beneath floor slabs and along the outside of grade beams for leveling and drainage purposes. Coarse material greater than 50 mm in diameter should be avoided directly beneath the floor slab to prevent stress concentrations within the slab. The granular leveling course should be compacted to a uniform dry density of about 98% of Standard Proctor Maximum dry density. A recommended typical gradation for free draining granular material, for use under the floor slabs (and also on the outside of the perimeter basement walls, if required) is provided below:

SIEVE	% PASSING
1 ½ (38,000 um)	100
3/8 (10,000 um)	65 - 100
No. 4 (5,000 um)	50 - 90
No. 10 (2,000 um)	35 - 75
No. 40 (400 um)	10 - 45
No. 100 (150 um)	0 - 20
No. 200 (75 um)	0 - 5

Other appropriate materials, which fall outside the above recommended gradation limits may be suitable. Alternate materials should however, be evaluated by a geotechnical engineer prior to use.

5.10 Concrete Type

Six sulphate tests were conducted to determine the water-soluble sulphate ion content in the soil samples recovered from the boreholes. Three tests indicated negligible sulphates and the other three showed the presence of 0.35% to 1.4% water soluble sulphate (SO_4) content in the soil samples.

As per Table 12 of CSA A23.1-00, Portland cement concrete which is in contact with the tested soil at this site would fall under Class of exposure "S-2" with a "severe" Degree of exposure to sulphate attack. Therefore, use of CSA Type 50 Portland cement with a maximum water/cementing materials ratio of 0.45, appropriate air entrainment and minimum specified 56-day compressive strength of 32 MPa is recommended for such concrete. Please note that as per CSA A23.1-00 Clause 15.5.3, calcium chloride or any admixture formulation containing chloride shall not be used in the subsurface concrete which falls under exposure classification "S-1" and "S-2" as defined in Table 12. Also, other calcium salts used as accelerating admixture should also be avoided, as they may increase the severity of the sulphate attack.

The recommendations stated above for the subsurface concrete at this site may require further additions or modifications due to structural or other considerations.

6. CONSTRUCTION INSPECTIONS

The performance of the various site facilities and structures will depend upon the quality of workmanship during construction. This is particularly important in regard to foundation installations and other earthwork where variations in soil conditions could occur. Therefore, it is recommended that inspection be provided by qualified geotechnical personnel during foundation installation to confirm that the spread footings and/or piles for the buildings are installed in competent bearing material and that the stratigraphy is similar to those that have been assumed for the design. Compaction testing for backfill will also be required.

7. LIMITATION AND USE OF REPORT

There is a possibility that this report may form part of the design and construction documents for information purposes. This report was issued before any final design or construction details have been prepared or issued. Therefore differences may exist between the report recommendations and the final design, in the contract documents, or during construction. In such instances, Thurber Engineering Ltd. should be contacted immediately to address these differences.

Designers and contractors undertaking or bidding the work should examine the factual results of the investigation, satisfy themselves on to the adequacy of the information for design and construction, and make their own interpretation of the data as it may affect their proposed scope of work, cost, schedules, and safety and equipment capabilities.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)

INTERPRETATION OF THE REPORT *(continued)*

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

APPENDIX A

Drawing No. 19-3836-1-1 - Site Plan Showing Test Hole Locations
Figure 5.1 – Typical Uninsulated Grade Beam

G:\ACADFILE\19\19-3836-1\19-3836-1-1.dwg - 1 (2) - Dec. 21, 2004 12:04pm

N

LAC LA BICHE

TH04-13

TH04-12

TH04-11

TH04-1

TH04-2

TH04-3

TH04-4

TH04-5

TH04-6

TH04-7

TH04-8

TH04-9

TH04-10

LOT 79

LAC LA BICHE SETTLEMENT

NW22 68-13-4

SW22 68-13-4

SW22

SE22

NW15 68-13-4

NE16 68-13-4

NW16 68-13-4

SW16 68-13-4

SE16 68-13-4

SW15 68-13-4

ROADWAY

NE9 68-13-4

3952 TR

UR1 A

NW10 68-13-4

0 100 200 300 400 500

SCALE (m)

LEGEND

APPROXIMATE TEST HOLES WITH STANDPIPE PIEZOMETER INSTALLED

APPROXIMATE TEST HOLES

APPROXIMATE MUSKEG AREA

BASE PLAN PROVIDED BY ARMIN A PREIKSAITIS & ASSOCIATES

THURBER PROJECT #19-3836-1

ENGINEER	GSD
DRAWN	ZD
DATE	JULY, 2004
APPROVED	
SCALE	1:10000

ARMIN A PREIKSAITIS & ASSOCIATES

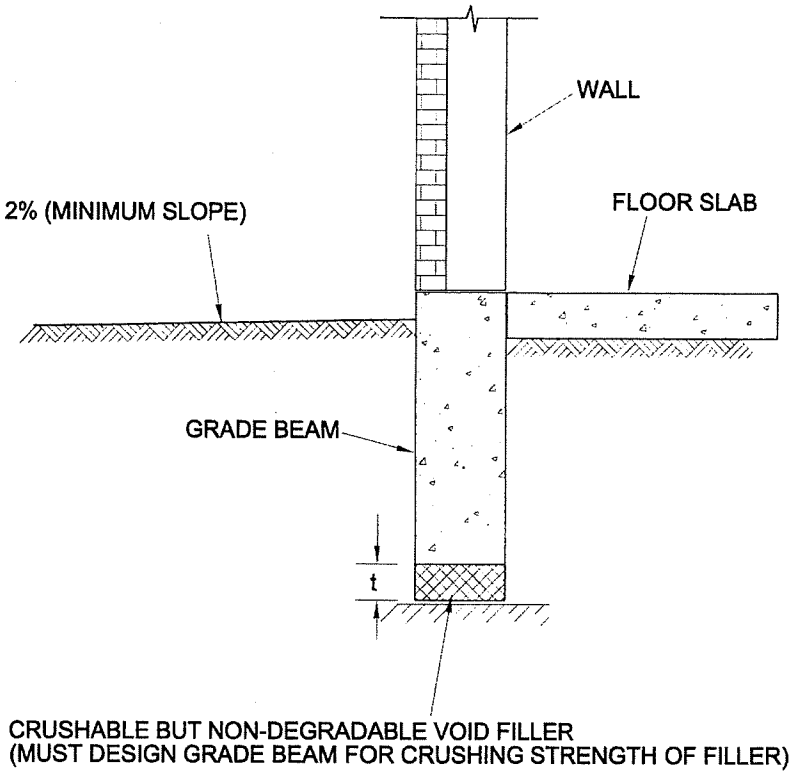
SITE PLAN SHOWING APPROXIMATE TEST HOLE LOCATIONS

DR. BIRKILL SUBDIVISON

LAC LA BICHE, AB

THURBER

DRAWING No. 19-3836-1-1



TYPICAL UNINSULATED GRADE BEAM

BASE OF GRADE BEAM ABOVE ZONE OF SEASONAL VOLUME CHANGE

FIGURE 5.1

THURBER

APPENDIX B

Symbols and Terms Used on Test Hole Logs
Unified Soils Classification
Test Hole Logs

THURBER

SYMBOLS AND TERMS USED ON TEST HOLE LOGS

1. VISUAL TEXTURAL CLASSIFICATION OF MINERAL SOILS

CLASSIFICATION	APPARENT PARTICLE SIZE
Boulders	Greater than 200 mm
Cobbles	75 mm to 200 mm
Gravel	5 mm to 75 mm
Sand	Not visible to 5 mm
Silt	Non-Plastic particles, not visible to the naked eye
Clay	Plastic particles, not visible to the naked eye

2. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	APPROXIMATE UNDRAINED SHEAR STRENGTH	
Very Soft	Less than 10 kPa	
Soft	10 - 25 kPa	
Firm	25 - 50 kPa	
Stiff	50 - 100 kPa	
Very Stiff	100 - 200 kPa	Modified from National Building Code
Hard	200 - 300 kPa	
Very Hard	Greater than 300 kPa	

3. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	STANDARD PENETRATION TEST (SPT) (Number of Blows per 300 mm)	
Very Loose	0 - 4	
Loose	4 - 10	
Compact	10 - 30	Modified from National Building Code
Dense	30 - 50	
Very Dense	Over 50	

4. LEGEND FOR TEST HOLE LOGS

SYMBOL FOR SAMPLE TYPE

■	Shelby Tube	▤	A-Casing
▨	SPT	▥	Grab
▩	No Recovery	◧	Core

● MC - Moisture Content (% by weight) as determined by sample

▼ Water Level

CPen - Shear Strength determined by pocket penetrometer

CVane - Shear Strength determined by pocket vane

Cu - Undrained Shear Strength determined by unconfined compression test

THURBER

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS
(MODIFIED BY PFRA, 1985)

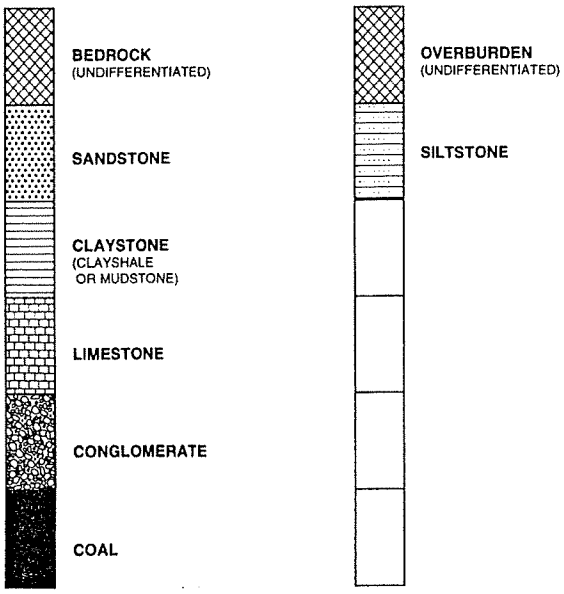
MAJOR DIVISION			GROUP SYMBOL	THURBER LOG SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP		POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR GW
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE I_p LESS THAN 4
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE I_p MORE THAN 7
	SANDS MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP		POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		SAND WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE I_p LESS THAN 4
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE I_p MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$w_L < 50\%$	ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (see below)
		$w_L > 50\%$	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$w_L < 30\%$	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	
		$30\% < w_L < 50\%$	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS	
		$w_L > 50\%$	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$w_L < 50\%$	OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW AND MEDIUM PLASTICITY	
		$w_L > 50\%$	OH		ORGANIC CLAYS OF HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE

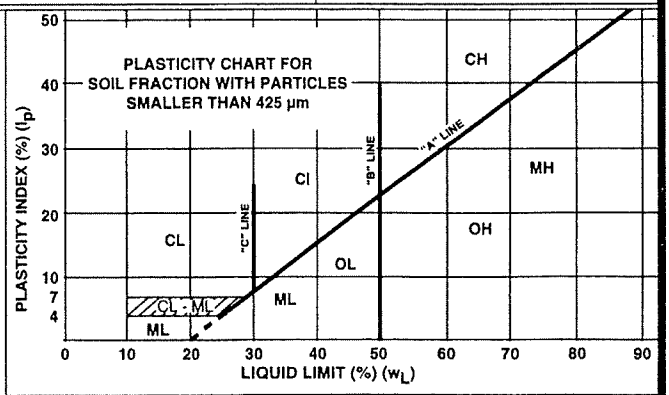
Determine percentages of gravel and sand from grain size curve. Depending on percentages of fines (fraction smaller than 75µm) coarse grained soils are classified as follows:
Less than 5% GW, GP, SW, SP
More than 12% GM, GC, SM, SC
5% to 12% Borderline cases requiring use of dual symbols

Above "A" line with I_p between 4 and 7 are borderline cases requiring use of dual symbols

Above "A" line with I_p between 4 and 7 are borderline cases requiring use of dual symbols

SPECIAL SYMBOLS



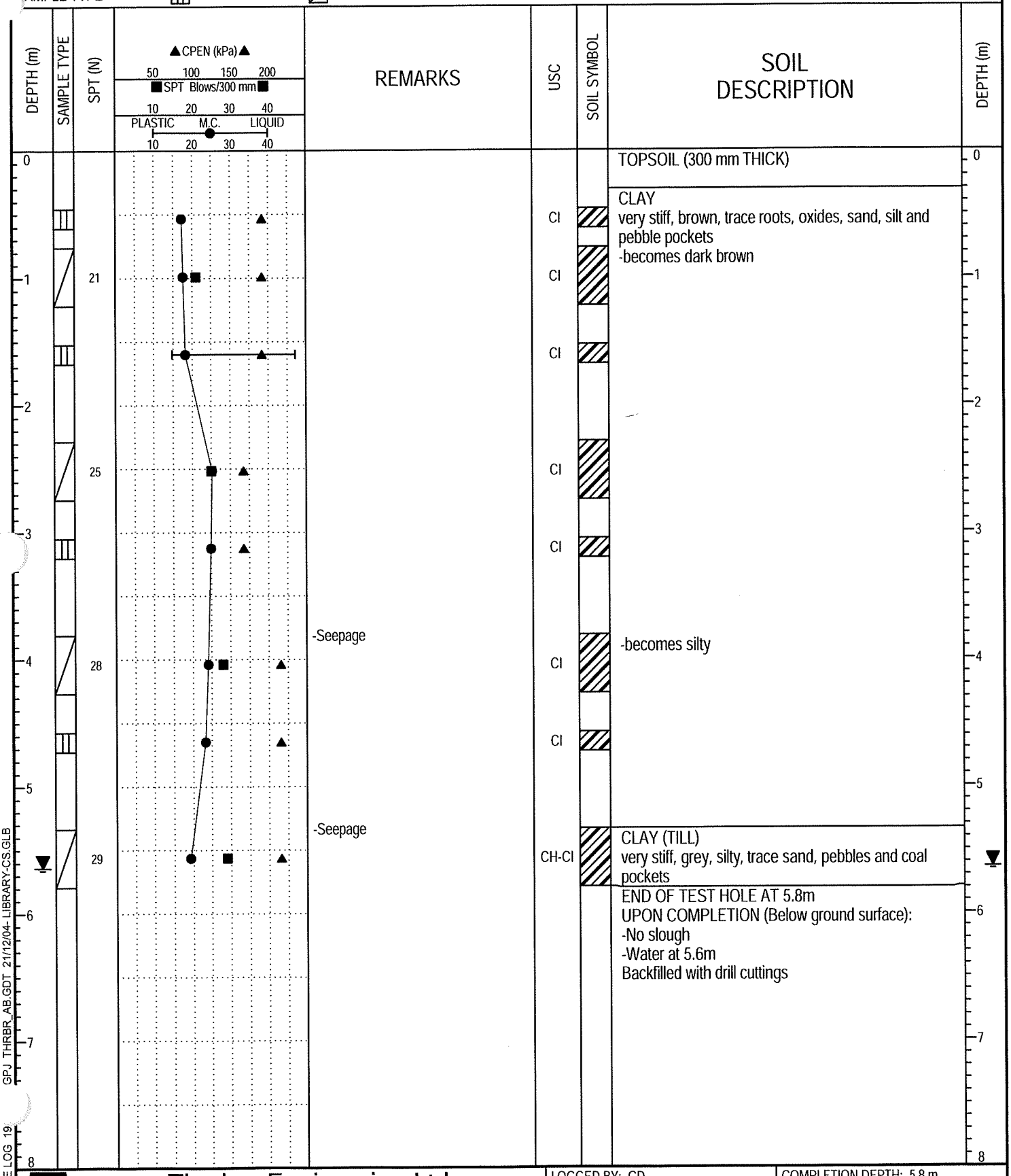


THURBER

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS
(MODIFIED BY PFRA, 1985)

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-01
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE GRAB SAMPLE SPT



GPJ THRBR_AB.GDT 21/12/04 LIBRARY-CS.GLB

BOREHOLE LOG 19

THURBER

Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-02
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	SPT (N)	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)
0						TOPSOIL (200mm THICK)	0
				SP		SAND brown, coarse grained, some clay pockets	
1		18		CI		CLAY (TILL) very stiff, brown, trace oxides, pebbles, gravel, sand and silt pockets	1
				CI			
2							2
		34	SO4 = 0.0%	CI		-becomes hard	
3				CI			3
						-becomes very stiff and dark brown	
			-Seepage				
4		26		CI			4
				CI			
5							5
		24		CI-CH			
6						END OF TEST HOLE AT 5.8m UPON COMPLETION (Below ground surface): -No slough -Water at 5.6m Standpipe piezometer installed Water level below ground surface: -June 25, 2004 at 1.1m	6
7							7
8							8

▲CPEN (kPa)▲ 50 100 150 200

■SPT Blows/300 mm■ 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

BOREHOLE LOG 19

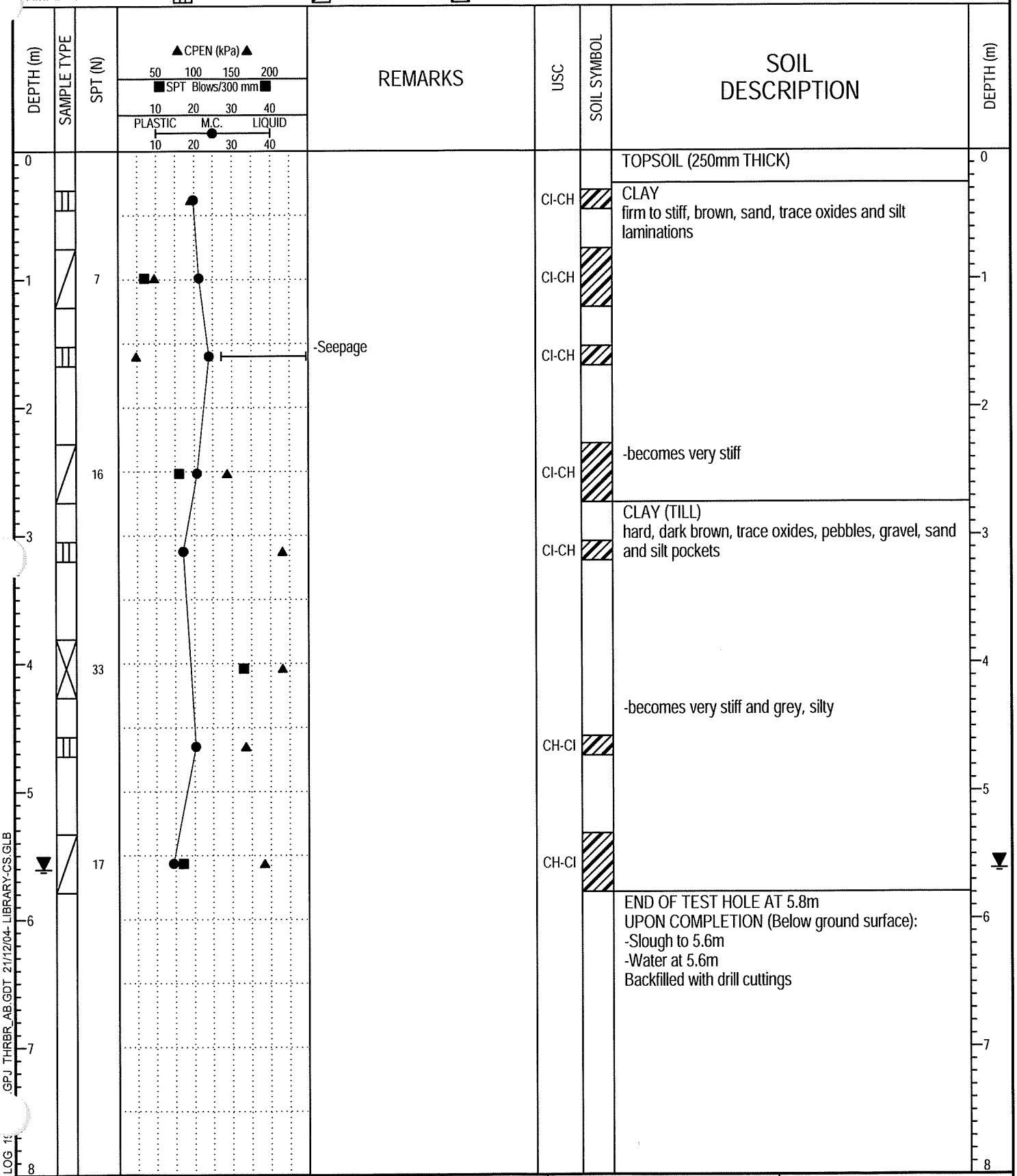
THURBER

Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-03
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE ▨ SPT ▩ NO RECOVERY



BOREHOLE LOG 1 .GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.

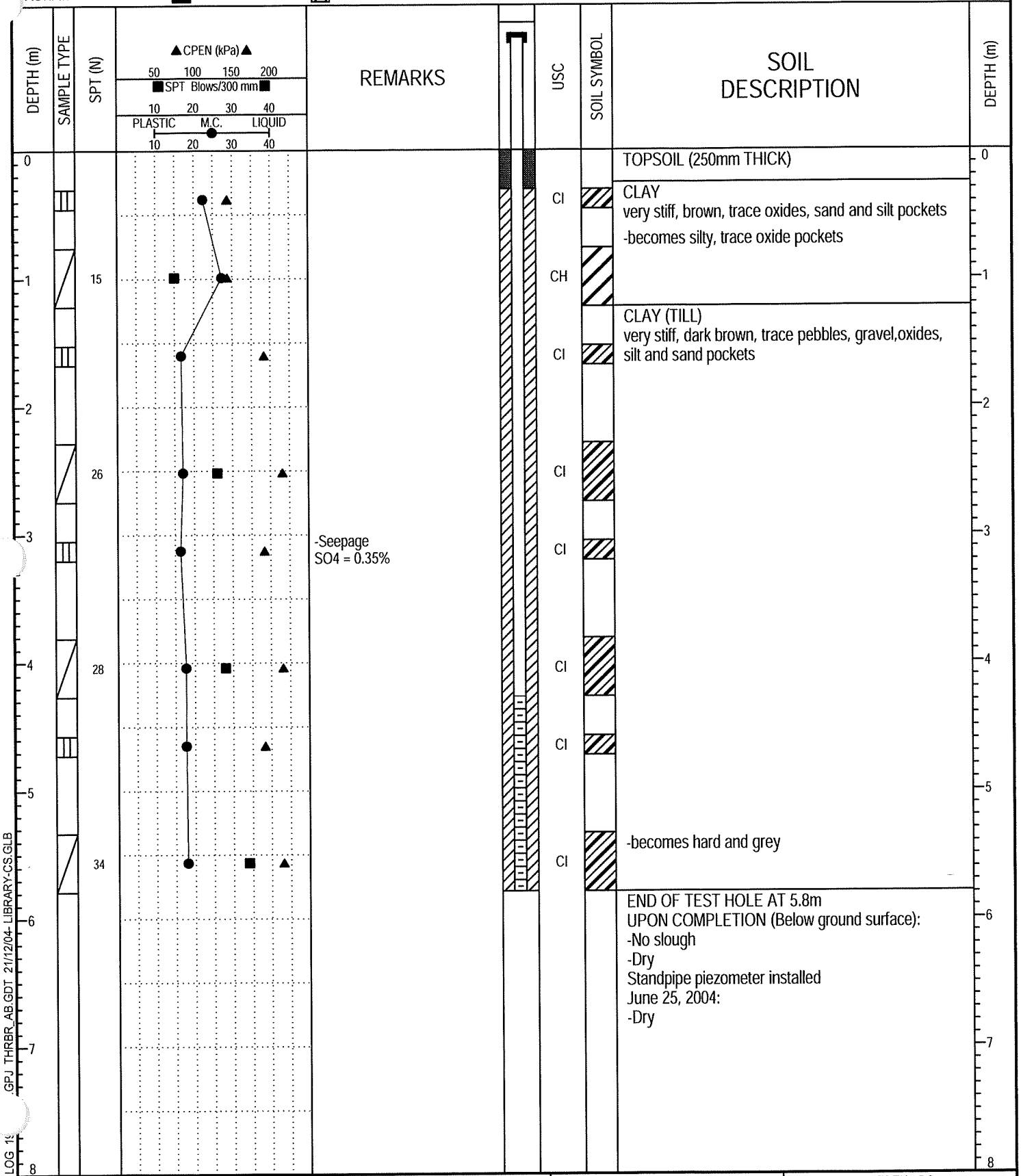
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-04
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS



BOREHOLE LOG 19.GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

THURBER

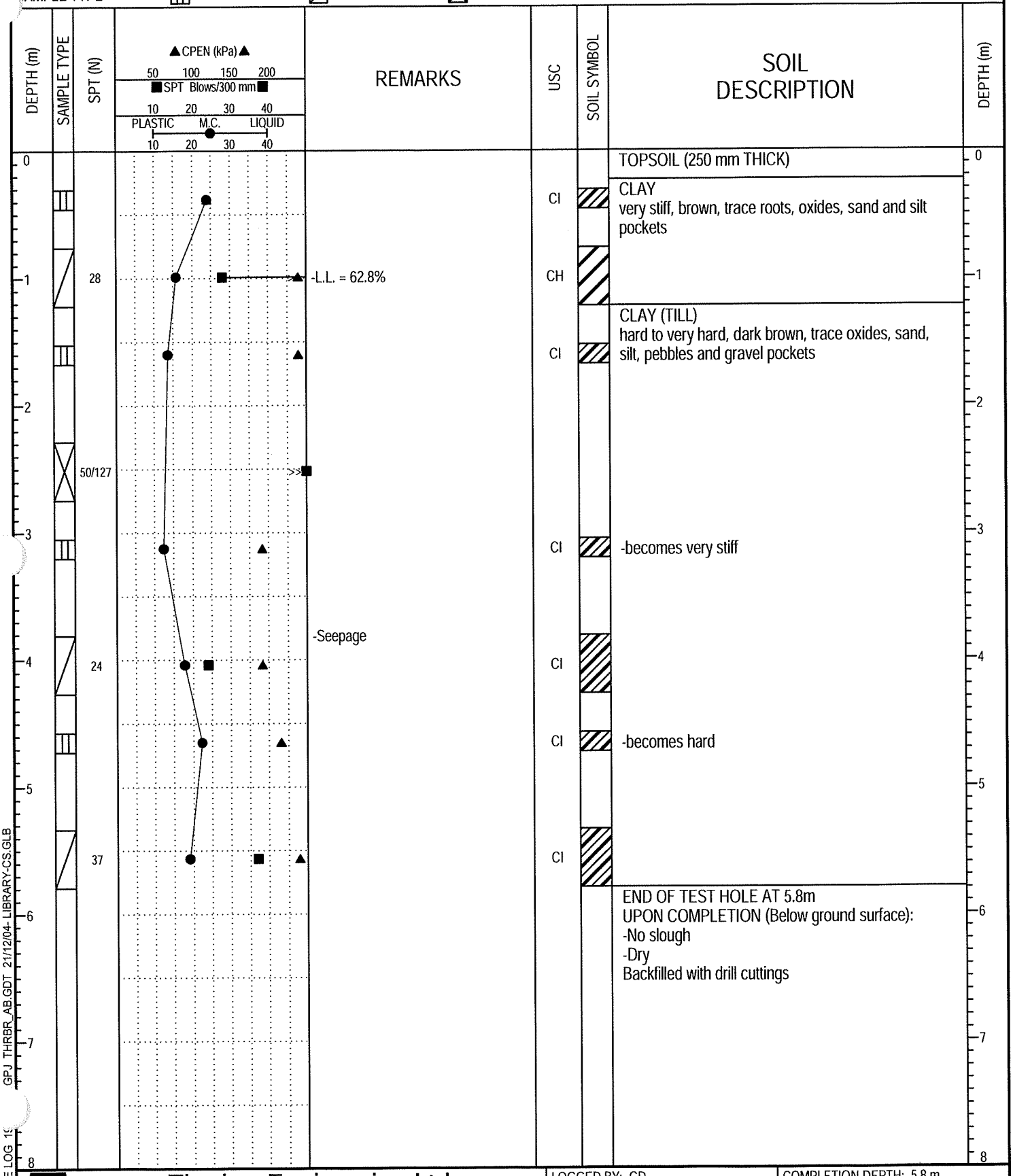
Thurber Engineering Ltd.

EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-05
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE ▨ SPT ▩ NO RECOVERY



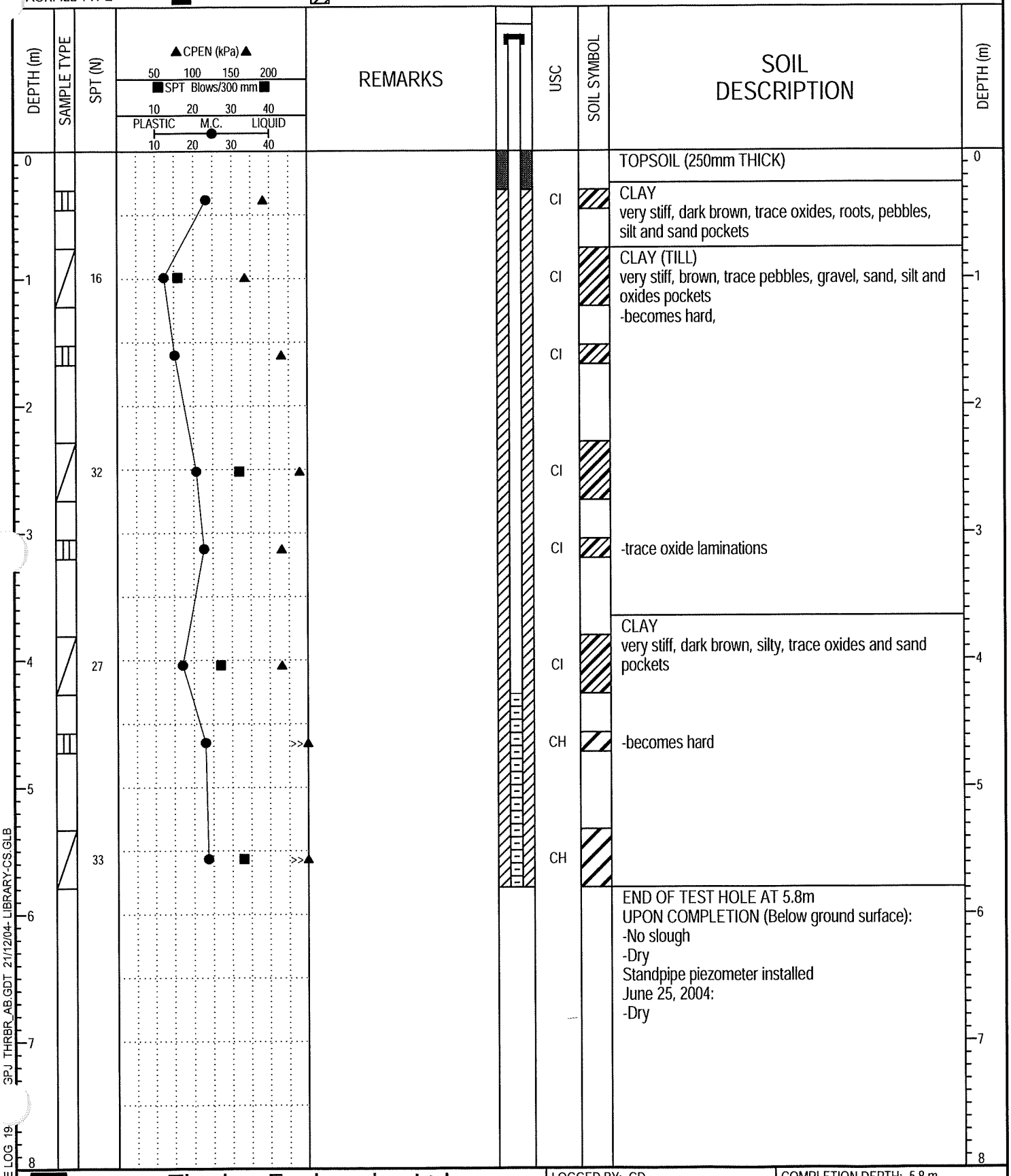
BOREHOLE LOG 19 GPJ THRBR_AB.GDT 21/12/04 LIBRARY-CS.GLB

Thurber Engineering Ltd. EDMONTON, ALBERTA	LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
	REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
		Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-06
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS



Thurber Engineering Ltd. EDMONTON, ALBERTA	LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
	REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
		Page 1 of 1

BOREHOLE LOG 19-3PJ_THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-07
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS; SLOUGH

DEPTH (m)	SAMPLE TYPE	SPT (N)	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)
0						TOPSOIL (150mm)	0
				CH		CLAY brown, silty, trace roots and oxide pockets	
1		30		CI		-hard to very stiff	1
				CH		-some white silt pockets	
2						SAND compact, brown, fine grained, some silt, some clay pockets	2
		22	SO4 = 1.4%	SM		- trace oxides and silt laminations	
3			-Seepage	SM			3
						CLAY very stiff, dark brown, silty, trace oxides and sand pockets	
4		20		CH-CI			4
						CLAY (TILL) very stiff, grey, silty, trace oxides, gravel, pebbles and sand pockets	
5				CI-CH			5
			-Seepage				
		17		CH-CI			
6						END OF TEST HOLE AT 5.8m UPON COMPLETION (Below ground surface): -Slough to 5.5m -Dry Standpipe piezometer installed June 25, 2004: Dry	6
7							7
8							8

▲CPEN (kPa)▲
50 100 150 200
■SPT Blows/300 mm■
10 20 30 40
PLASTIC M.C. LIQUID
10 20 30 40

GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

BOREHOLE LOG 19

THURBER

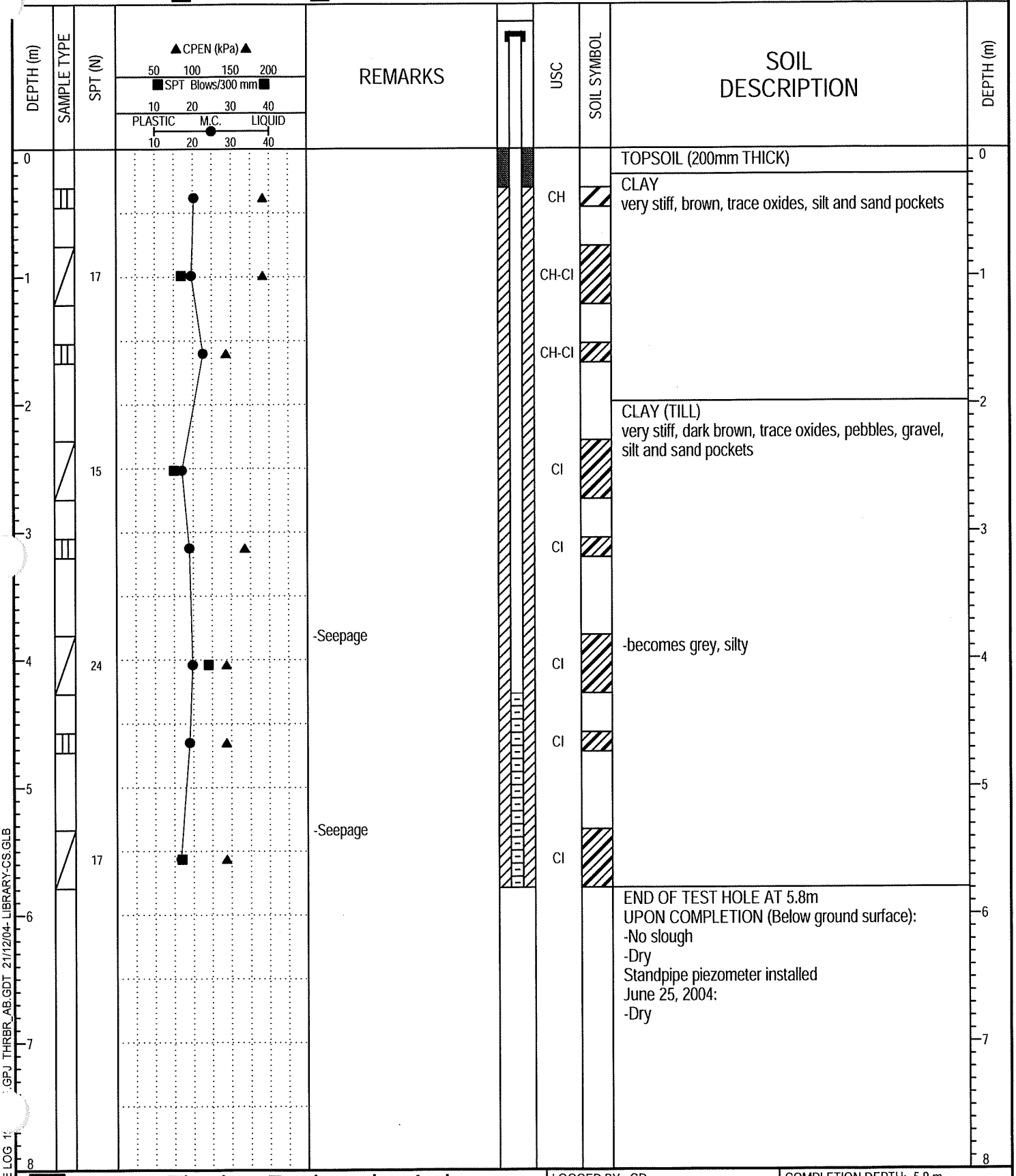
Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-08
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS



BOREHOLE LOG 1...GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

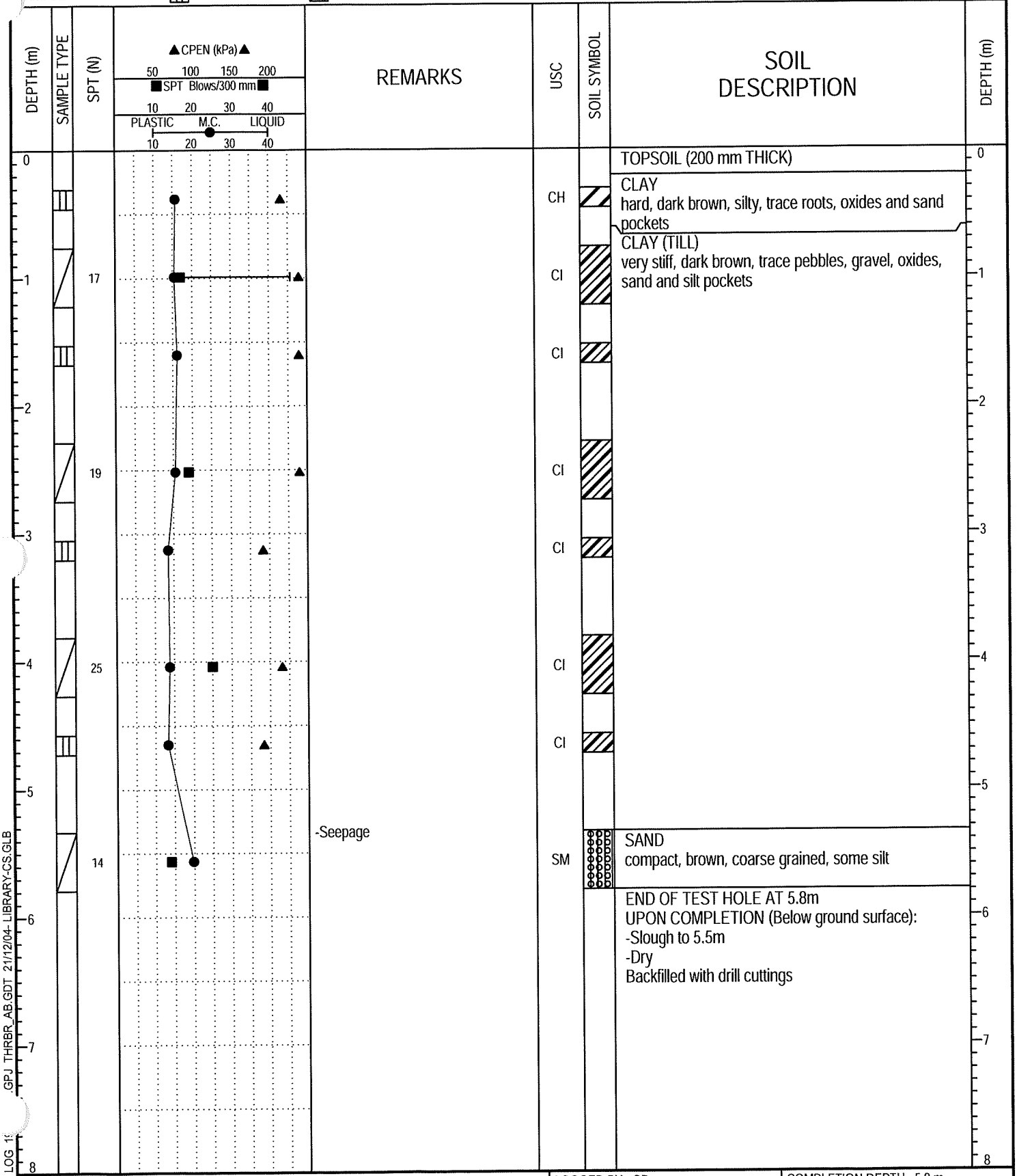
THURBER

Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-09
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

AMPLE TYPE ▥ GRAB SAMPLE ▨ SPT



BOREHOLE LOG 1 .GPJ THRBR_AB.GDT 21/12/04 LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.

EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-10
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 24, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE | SPT | NO RECOVERY

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS | SLOUGH

DEPTH (m)	SAMPLE TYPE	SPT (N)	CPEN (kPa) / SPT Blows/300 mm / PLASTIC M.C. LIQUID	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)
0							TOPSOIL (200 mm THICK)	0
					CI		CLAY very stiff, dark brown, very silty, trace oxides, sand and rook pockets	
1		28		>>Cpen>215kPa	CI			1
					CI		CLAY (TILL) very stiff, dark brown, trace pebbles, gravel, oxides, whtie silt and sand pockets	
2								2
		26			CI			
3				SO4 = 0.46%	CI			3
4		24			CI		-becomes grey, silty	4
					CI			
5								5
		17						
6							END OF TEST HOLE AT 5.8m UPON COMPLETION (Below ground surface): -Slough to 5.6m -Dry Standpipe piezometer installed June 25, 2004: -Dry	6
7								7
8								8

BOREHOLE LOG 1: .GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.

EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 24/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-11
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 25, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	SPT (N)	SPT Blows/300 mm; PLASTIC / M.C. / LIQUID (10 20 30 40)	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)
0							TOPSOIL (150 mm THICK)	0
					SP		SAND loose, brown, medium grained, some oxide pockets	
1		18			SP		-becomes compact	1
					SP			
2								2
		15		SO4 = 0.0%	SP			
3					SP			3
4		19			SP			4
					SP			
5								5
		26			SP			
6							END OF TEST HOLE AT 5.8m UPON COMPLETION (Below ground surface): -No slough -Dry Standpipe piezometer installed June 25, 2004: -Dry	6
7								7
8								8

BOREHOLE LOG 19 GPJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 25/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-12
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 25, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE ▨ SPT

DEPTH (m)	SAMPLE TYPE	SPT (N)	SPT Blows/300 mm 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)
0							TOPSOIL (280 mm THICK)	0
				Grain size analysis -Gravel = 0.0% Sand = 98.3% Fines = 1.7%	SP		SAND loose, brown, medium to coarse grained, some oxide pockets	
1		11			SP		-becomes compact	1
					SP			
2								2
		17			SP			
3					SP			3
4		17			SP			4
					SP			
5				-Seepage				5
		16			SP			
6							END OF TEST HOLE AT 5.8m UPON COMPLETION (Below ground surface): -Slough to 5.6m -Water at 5.5m Backfilled with drill cuttings	6
7								7
8								8

BOREHOLE LOG 19-3PJ THRBR_AB.GDT 21/12/04- LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.

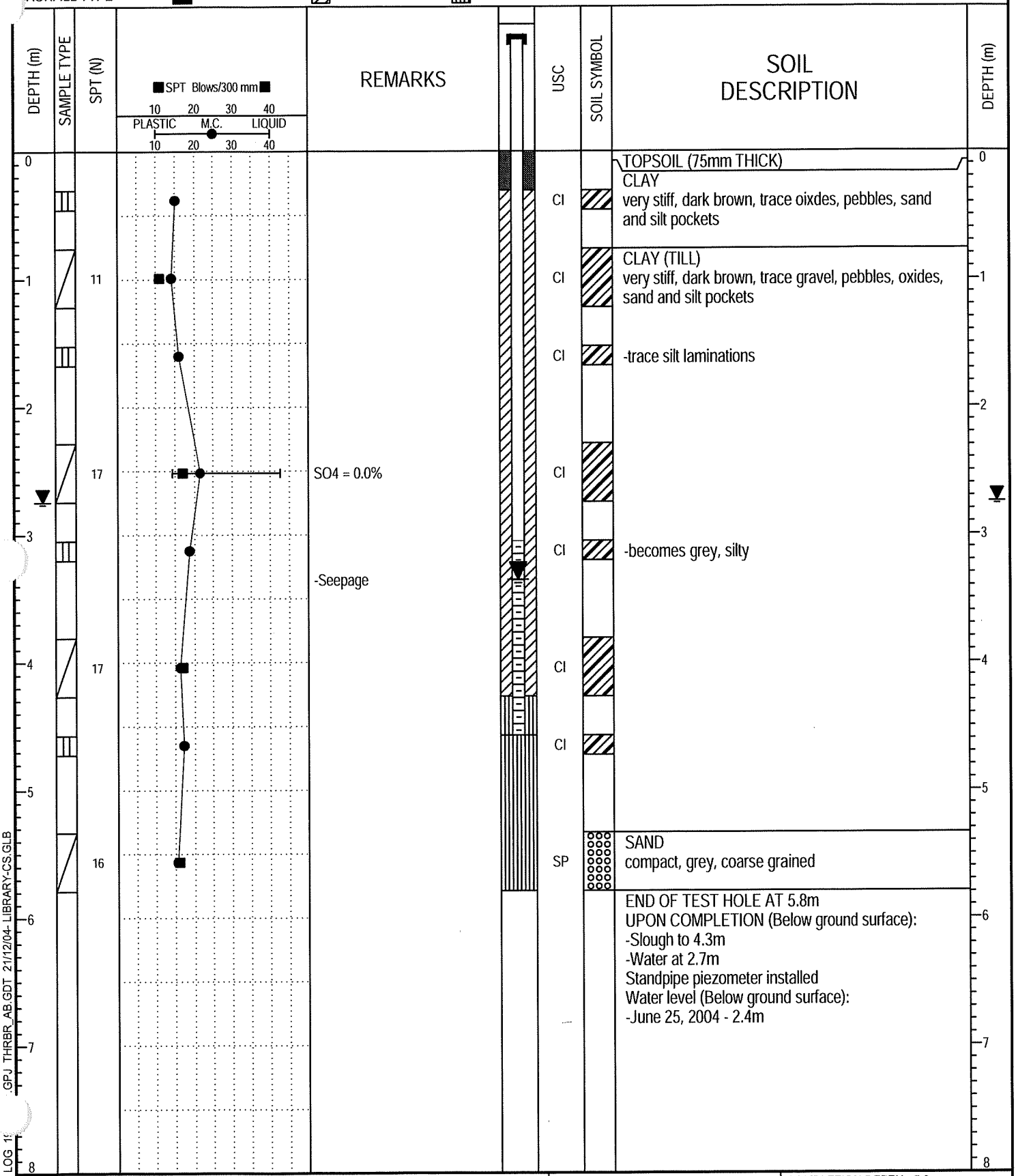
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 25/6/04
	Page 1 of 1

CLIENT: Armin A. Preiksaitis & Associates	PROJECT: Dr. Birkill Subdivison - Lac La Biche	BOREHOLE NO: TH04-13
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: June 25, 2004	PROJECT NO: 19-3836-1
DRILL/METHOD: M10 / Solid Stem Auger	LOCATION: See Drawing #19-3836-1-1	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: BENTONITE; DRILL CUTTINGS; SLOUGH



BOREHOLE LOG 19 GPJ THRBR_AB.GDT 21/12/04 LIBRARY-CS.GLB

THURBER

Thurber Engineering Ltd.
EDMONTON, ALBERTA

LOGGED BY: GD	COMPLETION DEPTH: 5.8 m
REVIEWED BY: RFM	COMPLETION DATE: 25/6/04
	Page 1 of 1

APPENDIX C

Recommended Construction Procedures

RECOMMENDED CONSTRUCTION PROCEDURES

The following construction procedures are considered to represent good practice and are to be read in conjunction with the text of this report.

1. EXCAVATED FOUNDATIONS

1.1 Excavation close to foundation level should be done carefully to avoid disturbance of the soil. It is essential to prevent the soil at foundation level from deterioration due to excessive drying or becoming wet from surface or seepage water. Good drainage both during and after construction is essential.

1.2 Sumps, if required, should be located well away from the foundation area. Softened or overdried soil must be removed and replaced by lean mix concrete or by extending the foundations.

1.3 The foundation must be kept from freezing both during and after construction. Foundation concrete should not be placed on or against frozen soil.

2. PROOF ROLLING

2.1 Proof rolling is a method of detecting soft areas in a subgrade for fill, pavement, floors or foundations. The intent is to detect softened areas not revealed by the test holes or visual examination of the site surface, and is used where normal scarification and compacting procedures would not be successful in detecting and eliminating soft areas. It is usually accomplished with the use of heavy 130 to 220 kN (15-25 ton) compaction equipment with high contact wheel pressures on independent axles, although heavily loaded single axle trucks will provide the equivalent result.

2.2 The procedure requires 2 complete passes with the heavy equipment in one direction and then a second series of 2 passes made at right angles to the first series.

2.3 While the passes are being made, any softened, rutted or displaced areas detected should be examined and either recompacted with additional fill or the existing material removed and replaced with better quality material.

3. BACKFILLING

3.1 Backfill around foundations should be placed in such a manner so as to prevent settlement and to be relatively impervious near the surface so that water does not pond against foundations nor be allowed to seep into the soil.

3.2 Backfill should not be placed until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction.

3.3 All backfill around grade beams, foundation walls, etc. must be carefully and uniformly compacted. The backfill should be placed in even layers and no frozen nor organic material should be incorporated into the fill. All lumps of material must be broken down or squeezed together during placing and compaction.

3.4 The final grade (allowing for some settlement of the backfill) should shed water away from the structure.

3.5 During construction, precautions should be taken to prevent water ponding in grade beam excavations thereby acting as a source of water to soften the soil under the floor slab area or providing a source of water for frost action if the building is not heated during freezing weather.

4. BORED CAST-IN-PLACE CONCRETE PILES

4.1 If there is evidence of water bearing and/or sloughing soil, casing should be used to seal off the water or prevent the sloughing of the sides of the hole. The concrete and reinforcing steel should be on hand and placed as soon as the pile hole has been completed and approved.

4.2 Pile bells, if used, should be formed entirely in self-supporting soil and it may be necessary in some cases to extend the pile bell if caving occurs at the location of the bell.

4.3 Water should not be left ponded on the pile base and should be removed, or dried by the use of dry cement when permitted by the engineer.

4.4 Concrete should be placed without segregation and carefully vibrated throughout the full length of the pile to ensure that voids do not exist in the pile shaft. The concrete slump should be between 75 and 125 mm with a minimum compressive strength at 28 days of 21 MPa (3000 psi). Higher compressive strengths may be required for structural or durability reasons, and higher slumps may be necessary for closely spaced reinforcing bars or where concrete is to be tremied under water.

4.5 Steel reinforcing should be tied into the grade beam reinforcing steel. This recommendation is important where the soil below grade beam can swell from a change in moisture content or by frost action before the building is heated.

4.6 Piles closer than 2 1/2 diameters should not be drilled and poured consecutively unless permitted by the engineer and depending upon soil conditions. Where the drilling operation might affect the concrete in the adjacent pile, the drilling should not be carried out until the concrete has at least 24 hours to set, or before the concrete has reached its initial set.

July 23, 2004 *File Reference #04-13*

Armin A. Preiksaitis & Associates Ltd.
#408 The Boardwalk 10310 - 102 AVE
Edmonton AB T5J 2X6

Attention: Mr. Armin Preiksaitis, Principal

RE: BIOPHYSICAL SITE ASSESSMENT OF PROPOSED LAC LA BICHE DEVELOPMENT SUBDIVISION (PT. SE16-68-13-W4, PT. NE 16-68-13-W4, PT. SW16-68-13-W4, PT. NW16-68-13-W4, PT. NE09-68-13-W4M, RL79-68-13-W4M)

This letter report is intended to provide the results of a biophysical site assessment of Pt. SE16-68-13-W4, Pt. NE 16-68-13-W4, Pt. SW16-68-13-W4, Pt. NW16-68-13-W4, Pt. NE09-68-13-W4M, RL79-68-13-W4M, a property owned by Richard Birkill and a property which is adjacent to Lac La Biche (16-68-13-W4M).

An environmental screening (biophysical assessment) was conducted for the proposed subdivision by EnviroMak Inc. Environmental Management Consultants on behalf of Armin A. Preiksaitis & Associates Ltd. and Dr. Richard Birkhill. The attached provides a description of several biophysical parameters and the results of some field assessments of specific features associated with the specific development property and the adjacent lands around the proposed development site. Additionally, some possible environmental protection opportunities to consider in developing the final subdivision plan are suggested.

Sincerely,

Ray Makowecki, M.Sc., B.Ed., P.Biol., R.P. Bio.
Principal, EnviroMak Inc.

Attachments *Environmental Screening and Biophysical Site Assessment plus Appendices*

Box 486
St. Paul Alberta Canada T0A 3A0
Phone: (780) 645-2601 Fax: (780) 645-2656
Email: rmakowec@telusplanet.net

9405 – 47th ST
Edmonton Alberta Canada T6B 2R7
Phone: (780) 425-2461 Fax: (780) 425-2466
Email: kmakowec@telusplanet.net

ENVIRONMENTAL SCREENING AND BIOPHYSICAL SITE ASSESSMENT
Proposed Lac La Biche Development - Subdivision (Pt. SE16-68-13-W4, Pt. NE 16-68-13-W4, Pt. SW16-68-13-W4, Pt. NW16-68-13-W4, Pt. NE09-68-13-W4M, RL79-68-13-W4M)

TABLE OF CONTENTS

1.0 OBJECTIVES

The purpose of this biophysical site assessment is to determine if there are any specific environmental features that would influence the subdivision development proposed for Pt. SE16-68-13-W4, Pt. NE 16-68-13-W4, Pt. SW16-68-13-W4, Pt. NW16-68-13-W4, Pt. NE09-68-13-W4M, RL79-68-13-W4M.

2.0 LOCATION

The site is located at 16-68-13-W4M and covers approximately 122.0ha (301.3ac). It is located approximately 270 km northeast of Edmonton on the northeast corner of Lac La Biche.

3.0 ECOREGION

The property (Pt. SE16-68-13-W4, Pt. NE 16-68-13-W4, Pt. SW16-68-13-W4, Pt. NW16-68-13-W4, Pt. NE09-68-13-W4M, RL79-68-13-W4M) is located in the Mid Boreal Mixedwood Ecoregion (Strong 1992). The natural landscape has been modified for many years with the development of agricultural and residential uses within this ecoregion.

4.0 CLIMATE

Lac La Biche temperature averages 0.9 °C annually; the July mean is 16.1 °C; and the January mean is –18.3 °C. Mean total precipitation is 48cm (Alberta Municipal Affairs 1982).

Agroclimate is 4H (severe heat limitation) (Pedocan Land Evaluation 1993). Growing season is P-PE = -200 to -100mm (Pedocan 1993).

5.0 SOILS AND MINERALS

The site is mainly within the Gray Soil Zone of central Alberta (Soil Correlation Area 21, Pedocan Land Evaluation Ltd. 1993) and borders the Dark Gray - Gray Soil Zone of northeast-central Alberta (Soil Correlation Area 12, Pedocan 1993). Soil Correlation Area 21 is generally characterized by Luvisolic soils with Orthic and Dark Gray Luvisols and some Dark Gray and Black Chernozemics occurring in Soil Correlation Area 12. Poorly drained soils and depressional areas are generally Organic and Gleysolic (Pedocan 1993).

There are three major soil orders found in this specific area including: luvisolic, bruinisolic and organic soils. The south, east and west shores are characterized by predominantly Orthic Gray Luvisolic soil. The north shore is dominated by poorly drained organic soils.

No aggregate minerals have been noted on these lands (Edwards, W.A.D. 1984). Some peat lands (i.e. sphagnum bog) were noted or observed at the southern end of the peninsula. No quantification was conducted. For site-specific descriptions of the surface and subsurface soils, see the geotechnical investigation of the property by Thurber Engineering Ltd. (2002).

6.0 TOPOGRAPHY

The site is located in an undulating moraine (till) landscape and has a gently rolling topography. It contributes to the watershed as a typical small drainage to Lac La Biche.

7.0 VEGETATION AND AGRICULTURE

With the agricultural influence on this landscape, a portion of the area has been converted by cultivation and surface manipulation to hay land and residential development. A breakdown of the vegetation types presently covering this 122.0 hectare (303.4ac) area are provided in Table 1 and Figures 1 and 2.

The boreal mixedwood forest is the dominant vegetative cover with 51.61 ha (42.3%), while the agricultural hay land cover forms an additional 34.58 ha (28.3%) of the landscape. The riparian/wetland contributes 34.25 ha (28.1%) and an isolated willow area contributes an additional 0.14 ha (0.1%). The natural vegetation constitutes approximately 65.4% of the existing landscape. The water-covered area within the property boundary is approximately 33.42 ha of the entire area of 155.42 ha. The land portion of the entire property constitutes 78.5% of the area.

Table 1. Vegetation coverage of the proposed subdivision on Lac La Biche in SE16-68-13-W4, SW16-68-13-W4, NE9-68-13-W4, NE16-68-13-W4, NW16-68-13-W4, a portion of NE9-68-13-W4 and a portion of Lot 79 of the Lac La Biche Settlement on June 28, 2004.

Vegetation Type	Surface Area in Hectares	Percent of landscape exclusive of water (%)	Percent of landscape including water (%)
Mixedwood Forest	51.61	42.3	33.2
Cultivated Hay/Croplands	34.58	28.3	22.2
Sphagnum Bog Wetland	1.42	1.2	0.91
Willow-marsh Wetland	0.14	0.1	0.09
Riparian area	34.25	28.1	22.0
Total area covered with vegetation	122.00		
Water area	33.42		21.5
Total area including water	**155.42**		**100**

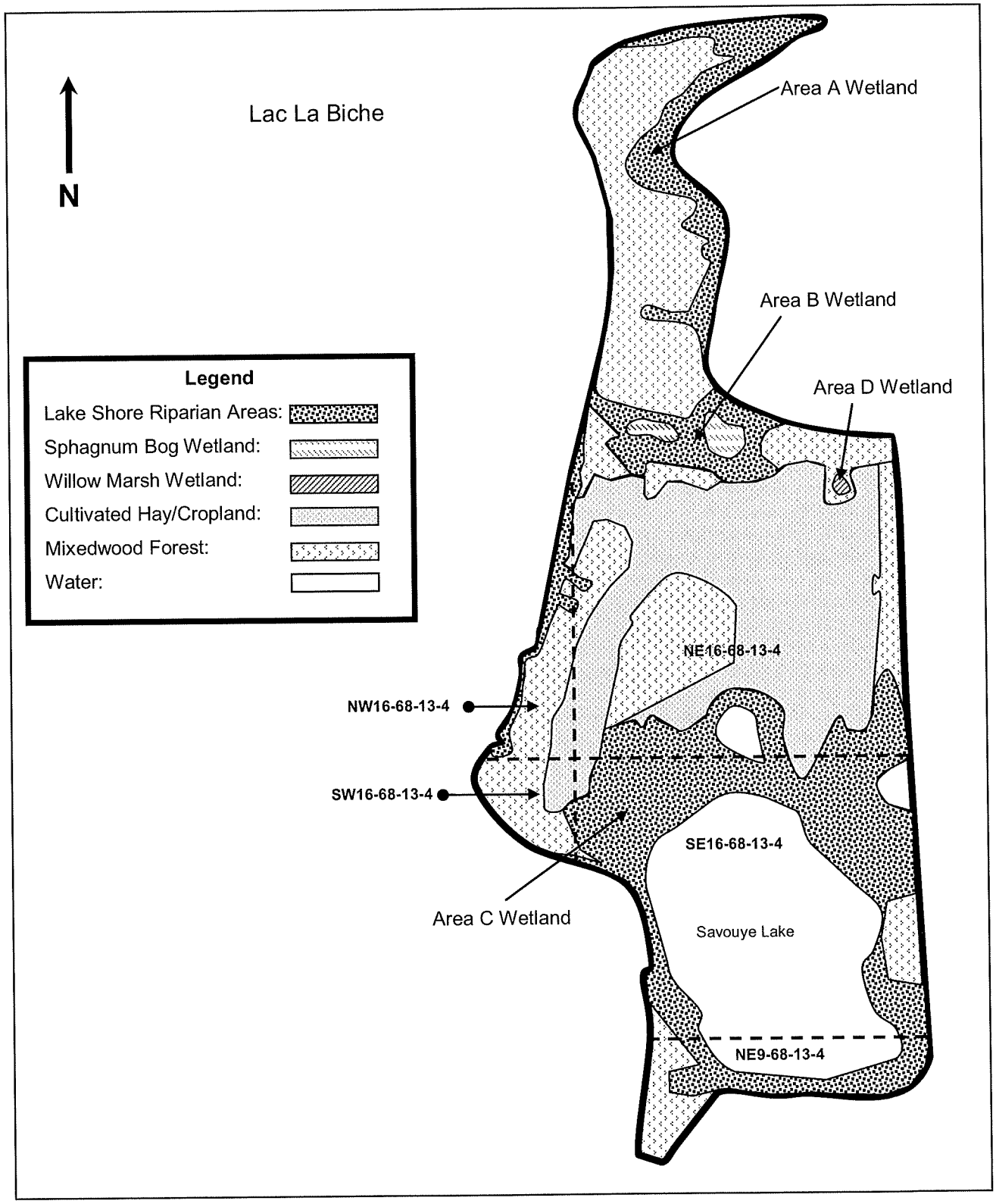


Figure 1. Vegetation coverage of the proposed Mystic Beach Subdivision on Lac La Biche in SE16-68-13-W4, SW16-68-13-W4, NE9-68-13-W4, NE16-68-13-W4, NW16-68-13-W4, a portion of NE 9-68-13-4 and a portion of Lot 79 of the Lac La Biche Settlement in June 2004.

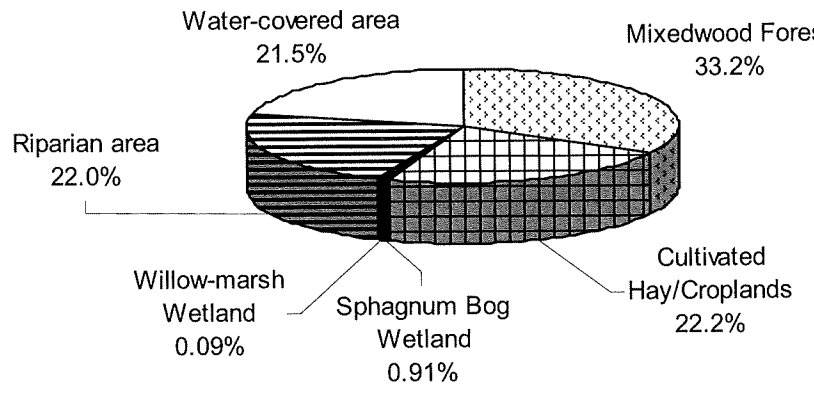


Figure 2. Vegetation coverage on the of the proposed Mystic Beach Subdivision on Lac La Biche in SE16-68-13-4, SW16-68-13-4, NE9-68-13-4, NE16-68-13-4, NW16-68-13-4, a portion of NE 9-68-13-4 and a portion of Lot 79 of the Lac La Biche Settlement (percentage of surface area).

Agriculture has been the major use for the past 25 years with hay land present and no evidence of livestock grazing. The south, west and part of the north shoreline have an agricultural capability classification of 4 (T/M indicating topography and moisture limitations). Along the east and north shoreline the land has a complex agricultural capability classification of 5 (T/M indicating topography and moisture limitations) (Alberta Municipal Affairs 1982). The present agricultural use is for the production of hay and crop on 34.58 ha.

Limited timber values were present in June 2004.

8.0 SURFACE WATER AND RIPARIAN AREA

The surface area of Lac La Biche is 25,590 ha with a shoreline of 136 km. At approximately 34km in length, Lac La Biche is the seventh-largest lake in Alberta (Brooymans 2003). The lake has a mean depth of 9.1m and a maximum depth of 22m. Throughout the lake there are ten islands, five distinct basins and several smaller sub-basins. The biggest island is 220 ha and serves as the location of Sir Winston Churchill Provincial Park. Lac La Biche drains east and north to the Athabasca River drainage system. The major inlet to the lake is the Owl River in the northeast corner. Along with its major tributaries, it drains 81.7% of the total drainage basin. The major outlet to the lake is the Lac La Biche River, which starts at the northwest corner of the lake and meanders 17.5km to the Athabasca River.

The geodetic water level at Lac La Biche on June 28, 2004 was 543.4m (Alberta Environment). During the past 28 years, the water levels of Lac La Biche have ranged from 542.809m in 1993 to 544.688m in 1997 (Figure 3). The current water level (June 2004) was 1.288m lower than the 1997 water level. The high water mark would create some increased wetness in all of the riparian areas.

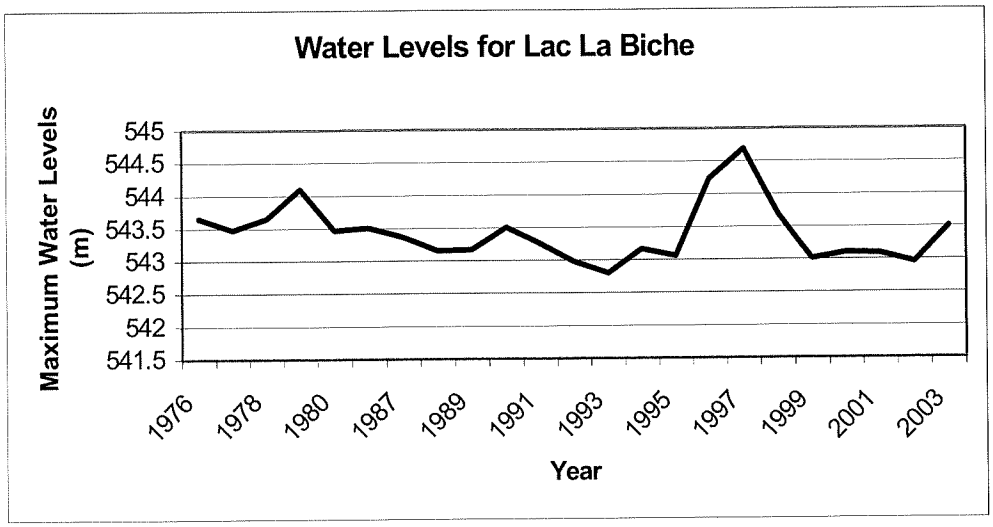


Figure 3. Geodetic water levels recorded for Lac La Biche from 1976 to 2002 (Water Survey Canada and Alberta Environment).

Lac La Biche is the key water associated with this property. This is a major recreation destination for a number of urban residents, cottage owners and visitors. Approximately 5,000 to 6,000 people reside around the lake including approximately 400 people in the village of Plamondon and 3,000 in the town of Lac La Biche (Brooymans 2003).

The specific property being assessed has a large perimeter of the lakeshore. This property contains a small lake (Savouye Lake), which drains through a short intermittent tributary to Lac La Biche. It appears to have a small drainage area within the southern portion of the property. This wetland has features that would establish it as a useful spawning and rearing habitat for Northern pike (*Esox lucius*). Its proximity to the lake further enhances its value and importance.

The tributary does have defined banks and a defined bed (Photograph 1 in Appendix 15.1); however, the vegetation composition is typically associated with wetlands and is generally considered to be riparian. Flows are likely observed in most spring runoffs and after periods of rainfall. This riparian vegetation forms 34.39ha plus 33.42ha of water or approximately 43% of the property being subdivided.

9.0 BIOPHYSICAL DESCRIPTION OF THE PROPERTY

An onsite biophysical assessment was conducted on June 28, 2004. The following specific features were observed and recorded within the riparian area of this drainage.

1. Riparian Area Along Perimeter of Lac La Biche (Photographs 2 to 7 in Appendix 15.1)
   - A total of 5.92ha of sedge (*Carex* sp.), rush (*Juncus* sp.), bulrush (*Scirpus* spp.), willow (*Salix* sp.) and cattail (*Typha latifolia*) dominated riparian areas along the perimeter of Lac La Biche.
   - The perimeter of lakeshore on these lands totaled 5250m.
   - The vegetation in this habitat type was composed mainly of willow, sedge, reed grass (*Calamagrostis canadensis*), rush and cattail.
   - Changes to the lake water level influence the extent and the degree of the wetness. The willow dominated wetland (Wetland "A") at the throat of the peninsula was quite wet on June 28, 2004, and it did extend towards the west side of the peninsula. This riparian area and lakeshore along the east side of the peninsula is considered important as a fish spawning and rearing area. Further, it contained excellent habitat for various bird species.
   - The riparian area along the west shore has less value for wildlife and contains a less diverse composition of riparian vegetation.
   - Little alteration has occurred to the area as a result of agricultural or industrial developments in the past.
   - The proximity of this wetland to a fish-bearing lake is significant.
   - Detailed assessments of the riparian areas were not conducted.
2. Riparian Area Along Perimeter Savouye Lake (Photographs 8 to 10 in Appendix 15.1)
   - The largest riparian areas were associated with Savouye Lake at the south end of the property. A total of 23.22ha of sedge, rush, bulrush, willow and cattail were present along the perimeter of Savouye Lake. The major riparian area between Lac La Biche and Savouye Lake was attributed to the Savouye Lake riparian totals.
   - Detailed assessments of the riparian area were not conducted.
   - This riparian area and lakeshore around Savouye Lake is considered important as a fish spawning and rearing area. Further, it contained excellent habitat for various bird species.
3. Willow Dominated Wetland

   This is a small willow wetland elevated above the lake and not connected to the lake water levels.
4. Sphagnum Bog Riparian Areas/Wetlands (Photograph 11 in Appendix 15.1)

   This was a typical sphagnum bog that was covered with sphagnum moss (*Sphagnum* sp.), Labrador Tea (*Ledum groenlandicum*), bog birch (*Betula glandulosa*), horsetail (*Equisetum* sp.), white birch (*Betula papyrifera*) and willow.

5. Mixedwood Forest
   - A total of 51.61ha of mixedwood forest covered the property.
   - The vegetation included aspen poplar (*Populus tremuloides*), black poplar (*Populus balsamifera*), green alder (*Alnus crispa*), rose (*Rosa acicularis*), raspberry (*Rubus strigosus*), saskatoon (*Amelanchier alnifolia*), pincherry (*Prunus pensylvanica*), bluebells (*Campanula sp.*), chokecherry (*Prunus virginiana*), sarsaparilla (*Aralia nudicaulis*), hazelnut (*Corylus sp*) and numerous other species.
   - The mixedwood forest was a relatively early seral stage of succession and, subsequently, portrayed a very diverse plant species composition.
6. Cultivated Hay and Crop Lands
   - A total of 34.58ha of cultivated lands (i.e. hay land and crop land) covered the property.
   - The vegetation coverage included brome grass (*Bromus* sp.) and alfalfa (*Medicago sativa*). Some of the lands appeared to be in summer fallow or were recently seeded.
7. Beach Area (Photographs 12 and 13 in Appendix 15.1)
   - A large natural beach area (several hundred metres long) was present on the west-central side of the property.
   - It appeared that some recreational use had occurred at this site some time previous.
   - Of note was the presence of some clumps of blue-green algae. In some areas the quantity of clumping algae was significant. This could be an issue for public swimming (Photographs 14 to 16 in Appendix 15.1).

10.0 FISH RESOURCES AND FISH HABITAT

Lac La Biche is an important fish and fish habitat and is used extensively by residents (e.g., aboriginals, anglers, commercial fishermen) and visitors. The major game fish species that are present include Northern Pike, Yellow Perch (*Perca flavescens*) and Walleye (*Stizostedion vitreum vitreum*). As well, the lake is fished commercially for Lake Whitefish (*Coregonus clupeaformis*) and Tullibee (*Coregonus artedi*). At least 11 species of fish have been documented to inhabit Lac La Biche (R. Makowecki, pers. knowledge). The fish habitats associated with the property are quite extensive with a large lakeshore perimeter and some wetlands that contribute to the spawning and rearing of Northern Pike which is one of the dominant fish species in the lake.

On June 28, 2004, several young-of-year fish of unidentified species were observed along the sand substrate on the west shore of the property. The fish habitats in this location were quite diverse and likely provide rearing habitat for several fish species. Fish habitats are also present along the shoreline areas, in the marsh wetland areas and in Savouye Lake. These habitats will

not be altered as part of this subdivision application. No specific or detailed assessments have been conducted as the aim of the proposed development is to avoid any harmful impacts.

Lac La Biche is a eutrophic lake that contains relatively high levels of nutrients such as phosphorus and nitrogen. The production of algae and the increasing potential for some winter oxygen depletion with increased eutrophication causes some concern for ensuring that additional nutrients do not enter the lake. The lake surface area (25,590 ha) is quite large as is the drainage area (4040 km^2). However, new developments in the drainage area must ensure that nutrient release and sedimentation to the lake is minimized as the algal growth is extensive.

11.0 WILDLIFE RESOURCES

The majority of the property (78%) consists of natural landscapes that have not been altered by human developments. The lands do provide a diversity of habitat types that include:

- a large lake,
- a small lake,
- open water marsh areas,
- sedge dominated wetlands,
- sphagnum bog wetlands,
- willow dominated riparian areas along the lakeshore, and
- upland areas (aspen mixedwood).

The quantification of these habitat types has not been conducted in detail. This riparian area along with the small wetland area does provide some diversity of wildlife habitat. Several bird species were observed in June 2004, and they included species associated with wetlands and upland areas. The wildlife was abundant and diverse as was the wildlife habitat. A wildlife species list was recorded on June 28, 2004 (Appendix 15.2).

12.0 ENVIRONMENTALLY SIGNIFICANT AREAS, ECOLOGICAL RESERVES, RARE AND ENDANGERED WILDLIFE SPECIES

The property does not contain any ecological reserves, special wildlife projects or recorded environmentally sensitive areas. The Alberta Natural Heritage Information Centre (ANHIC) Environmentally Significant Areas Provincial map did not identify any environmentally significant areas on these lands (2002).

According to the Natural Heritage Information Coordinator (Alberta Community Development), a data search of two townships around the crossing site in the Alberta Natural Heritage Information Centre (ANHIC) system did not identify any recorded occurrences of elements on tracking lists (J. Rintoul, pers. comm.).

The local ASRD Wildlife Biologist (A. Hubbs, pers. comm.) indicated that the Biodiversity Species Observation Directory (BSOD) had no information for the location and that Alberta Government files did not provide any information suggesting the presence of threatened, rare, or endangered species of plants or animals at this location.

No rare species were observed near the existing crossing during the visit on June 28, 2004; however, no studies have been conducted to determine if any threatened or endangered wildlife species occur. No records of such species occur in the provincial government files on this property other than the identification of bird colonies that included the common tern, the red-necked grebe and the western grebe (J. Rintoul, pers. comm.).

No rare or endangered amphibians or reptiles have been recorded in this vicinity (J. Rintoul, pers. comm.; A. Hubbs, pers. comm.). Also, no unusual or unique wildlife habitats have been recorded (A. Hubbs, pers. comm.). However, the wildlife habitat is very diverse and does provide excellent habitat for a large number of species. This was evidenced by a long-list of species encountered in a short site visit in June.

13.0 CONCLUSIONS

The examination of the biophysical factors associated with SE16-68-13-W4, SW16-68-13-W4, NE9-68-13-W4, NE16-68-13-W4, NW16-68-13-W4, a portion of NE 9-68-13-W4 and a portion of Lot 79 of the Lac La Biche Settlement is highlighted by the following:

- The majority of the natural landscape has not been altered.
- The riparian/wetland complex (marsh wetland, lakeshore, and two small riparian areas) of vegetation types does provide considerable biological diversity for wildlife.
- The current water level (June 2004) was 1.288m lower than the 1997 water level. The high water mark would create increased water in all of the riparian areas thereby influencing the land available for subdivision.
- Fisheries values are significant with a lengthy shoreline and some specific spawning and rearing areas in the adjacent marsh wetlands.
- Fish habitats are particularly of concern as they relate to the possible increases in eutrophication.
- No forestry, environmentally sensitive areas (i.e. ecological reserves, special natural projects) and/or endangered or threatened species were noted.
- The proposed development will have some influence on the riparian habitats that presently exist. To effectively mitigate any harmful effects see the "Mystic Beach Environmental Protection Plan".
- The environmental screening indicates that no major issues arise that cannot be addressed in an Environmental Protection Plan (Appendix 15.3).

14.0 REFERENCES

Alberta Soil Survey. 1967. Canada Land Inventory Soil Capability for Agriculture: Map - Edmonton 83H.

Brooymans, Hanneke. 2003. "Algae, foul odours spark study of Lac La Biche: study result of concern over lake's water quality," In: The Edmonton Journal. January 31, 2003.

Davis, Chris. 2004. Fisheries Biologist, Alberta Sustainable Resource Development (Lac La Biche). Personal communications. June 2004.

Edwards, W.A.D. 1984. Aggregate resources map of Sand River NTS 73L. Prepared for the Alberta Mineral Resources Division. Alberta Geological Survey. Edmonton, Alta. Alberta Research Council, Edmonton, Alberta

Environment Canada, 1998. http://www.cmc.ec.gc.ca/climate/normals/ALTAE005.HTM

Environment Canada, 1975. Critical capability areas. Canada Land Inventory, map series Alberta.

Environment Canada, 1975. Land capability for forestry. Canada Land Inventory, map series Alberta.

Environment Canada, 1975. Land capability for recreation. Canada Land Inventory, map series Alberta.

Environment Canada, 1975. Land capability for wildlife-ungulates. Canada Land Inventory, map series Alberta.

Environment Canada, 1975. Land capability for wildlife-waterfowl. Canada Land Inventory, map series Alberta.

Environment Canada, 1975. Soil capability for agriculture. Canada Land Inventory, map series Alberta.

Hubbs, Anne. 2004. Wildlife Biologist, Alberta Sustainable Resource Development (Athabasca). Personal communications. June 2004.

Mitchell, Pat and Ellie Prepas. 1990. Atlas of Alberta Lakes. University of Alberta Press. Edmonton, Alberta. 675 pp.

Pedocan Land Evaluation Ltd. 1993. Soil Series Information for Reclamation Planning in Alberta, Volumes 1 & 2. Report # ARTAC 93-7. Prepared for the Alberta Conservation and Reclamation Council (Reclamation Research Technical Advisory Committee).

Rintoul, John. 2004. Section Head and Information Coordinator (Edmonton), Alberta Natural Heritage Information Centre, Heritage Protection and Recreation Management Branch, Parks and Protected Areas Division, Alberta Community Development (ACD). Personal communication. June, 2004.

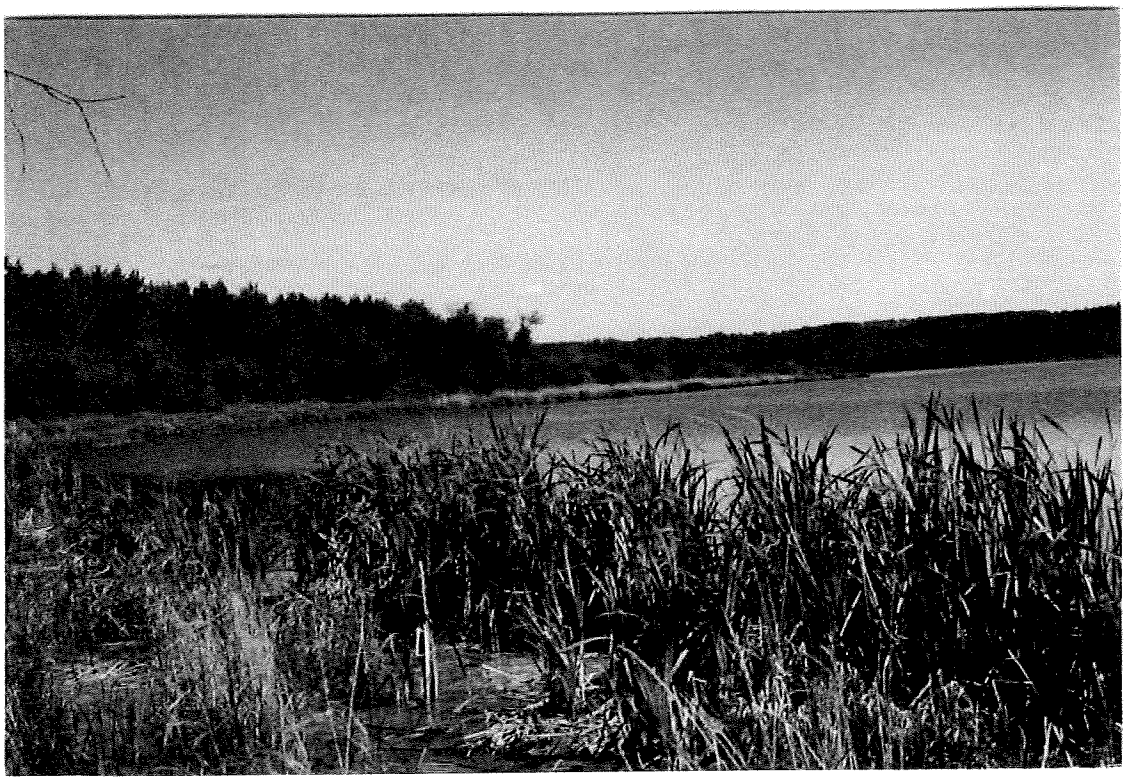
Strong, W. 1992. Ecoregions and ecodistricts of Alberta. Pub. No.: T/244. Prepared by Ecological Land Surveys Ltd. for Alberta Forestry, Lands and Wildlife, Land Information Services Division, Resource Information Branch, Edmonton, Alberta.

Treichel, B. 2004. Wildlife Technician, Alberta Environment (Edmonton). Personal communications. June 2004.

15.0 APPENDICES

15.1 Photographs

Photograph 1. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note defined watercourse connecting Lac La Biche Lake and Savouye Lake facing north.



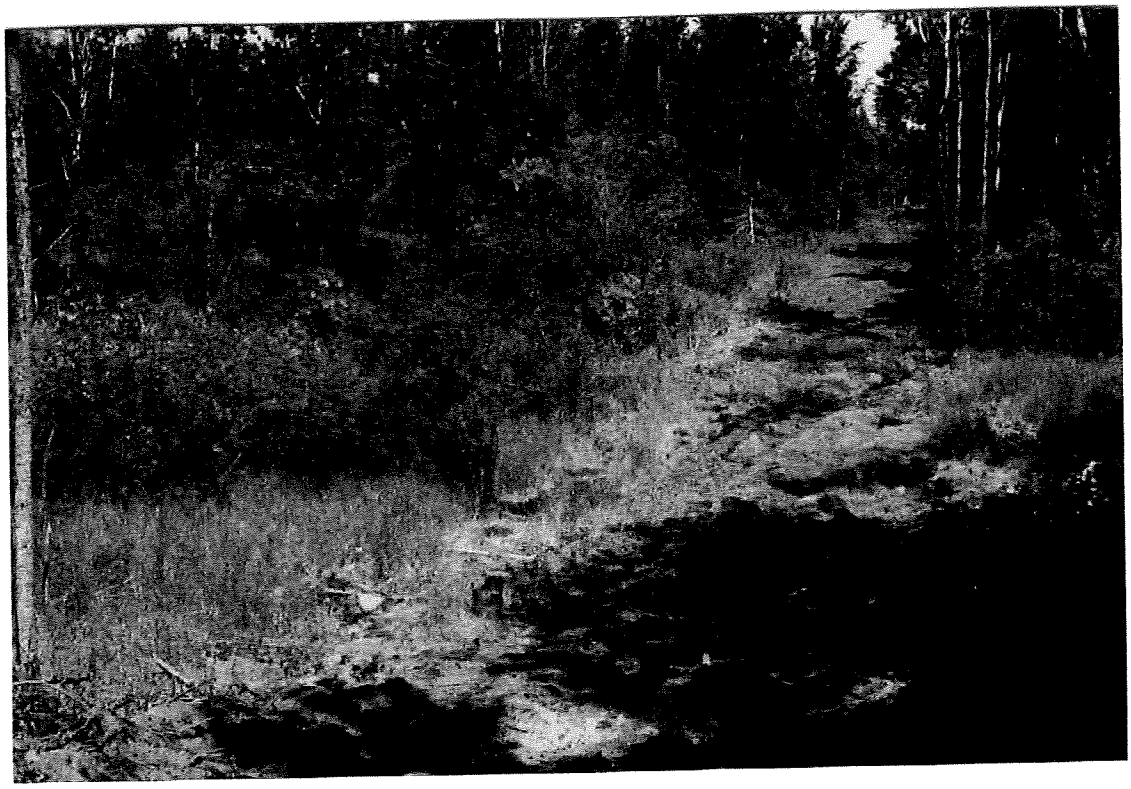
Photograph 2. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore along peninsula facing north.

Photograph 3. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore along peninsula facing north.

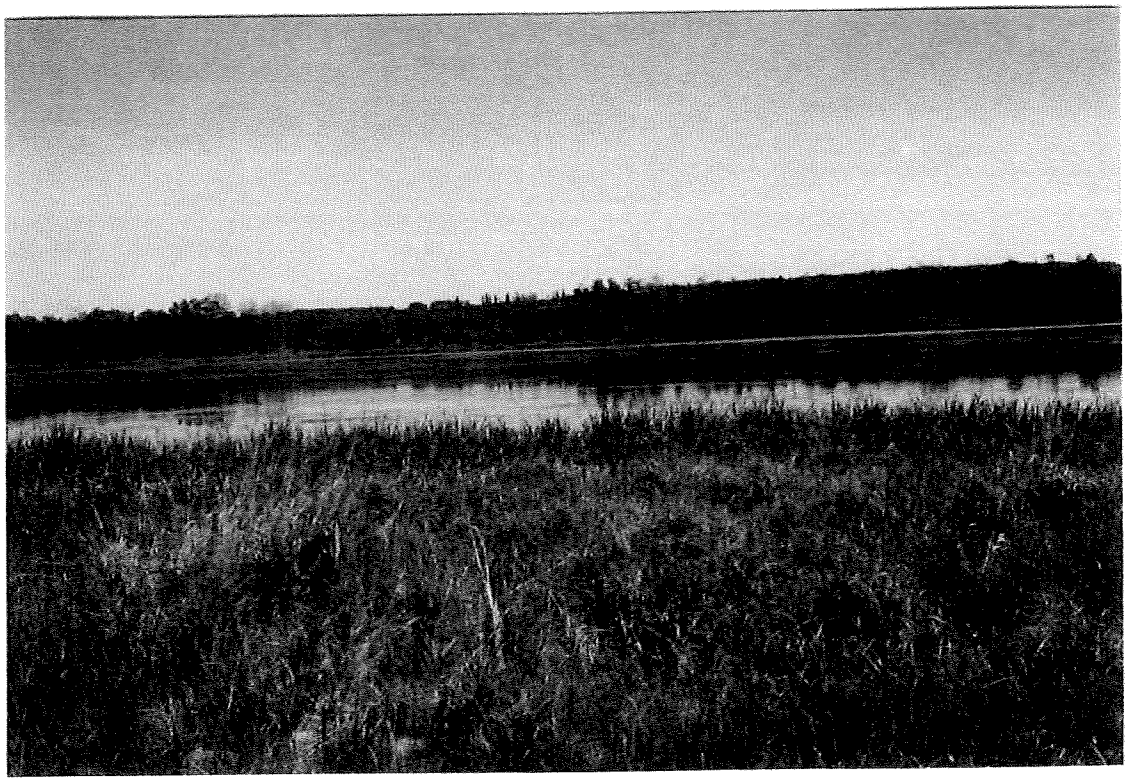
Photograph 4. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore along peninsula facing south.

Photograph 5. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore wetland at throat of peninsula facing west.

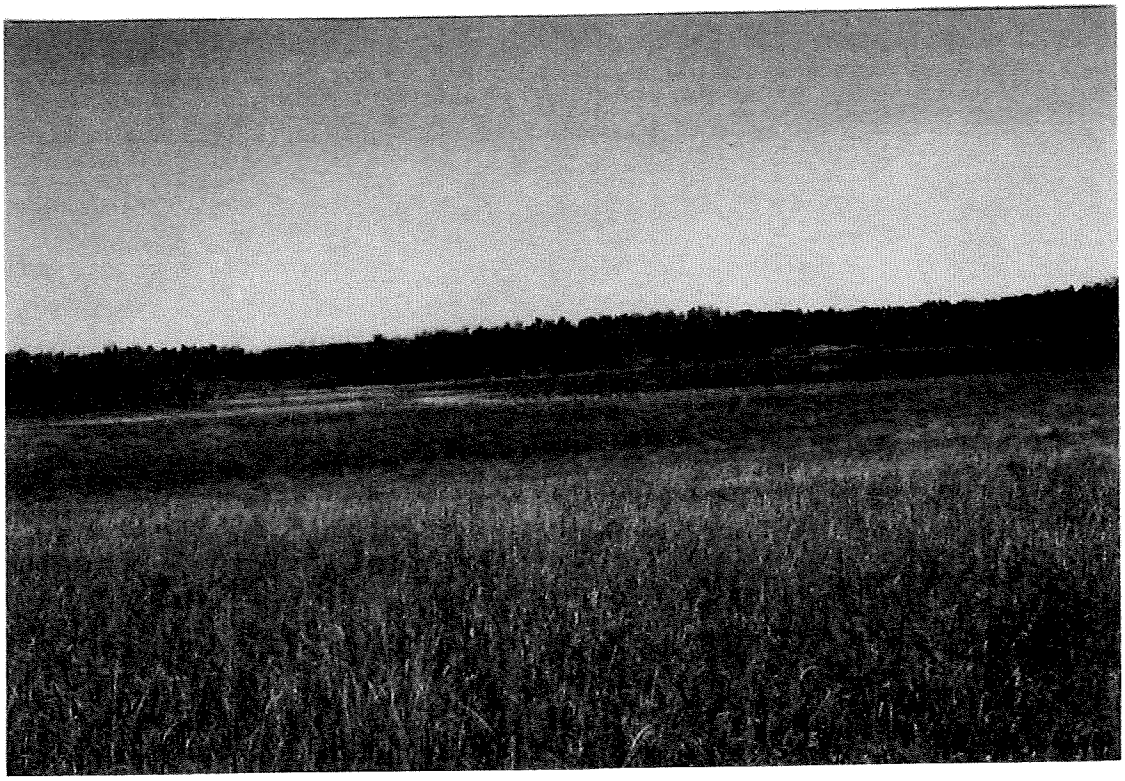
Photograph 6. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore wetland along west shore of the peninsula facing west.



Photograph 7. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note west shore wetland along west shore of the peninsula facing northwest.



Photograph 8. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note riparian area on west side of Savouye Lake facing east.

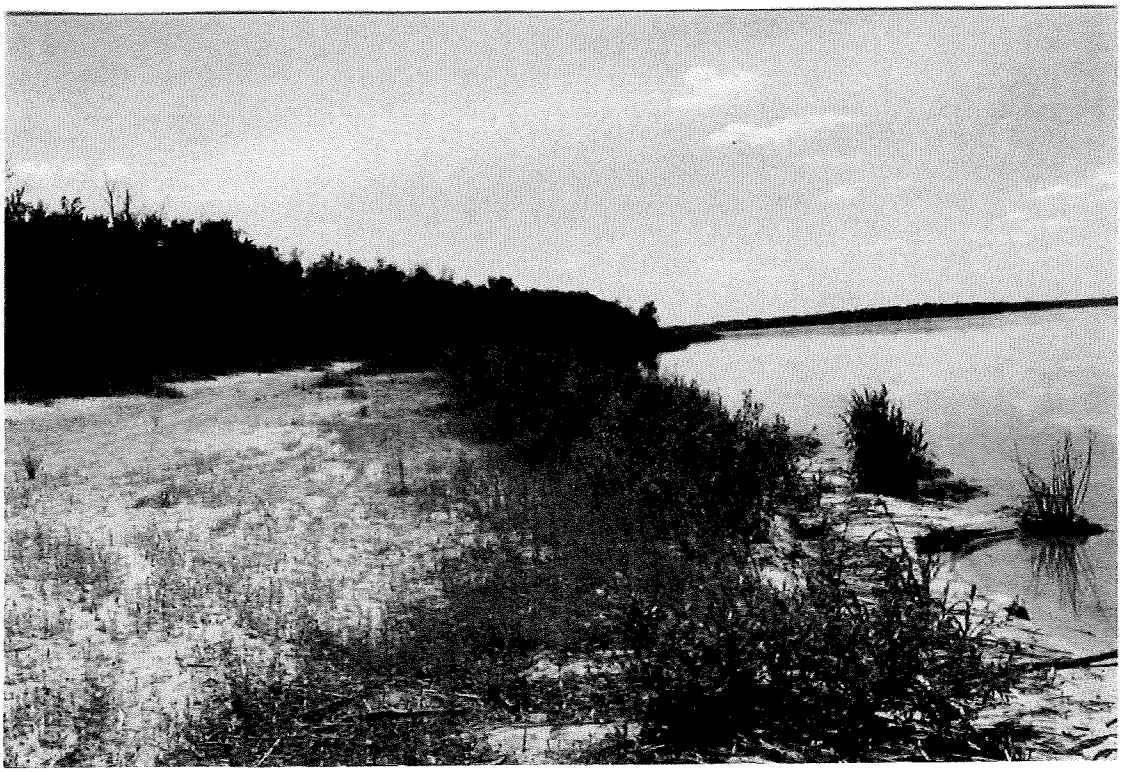


Photograph 9. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note riparian area on north side of Savouye Lake facing east.

Photograph 10. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note riparian area of Lac La Biche and Savouye Lake facing southwest.

Photograph 11. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note sphagnum bog at south end of the peninsula facing west.

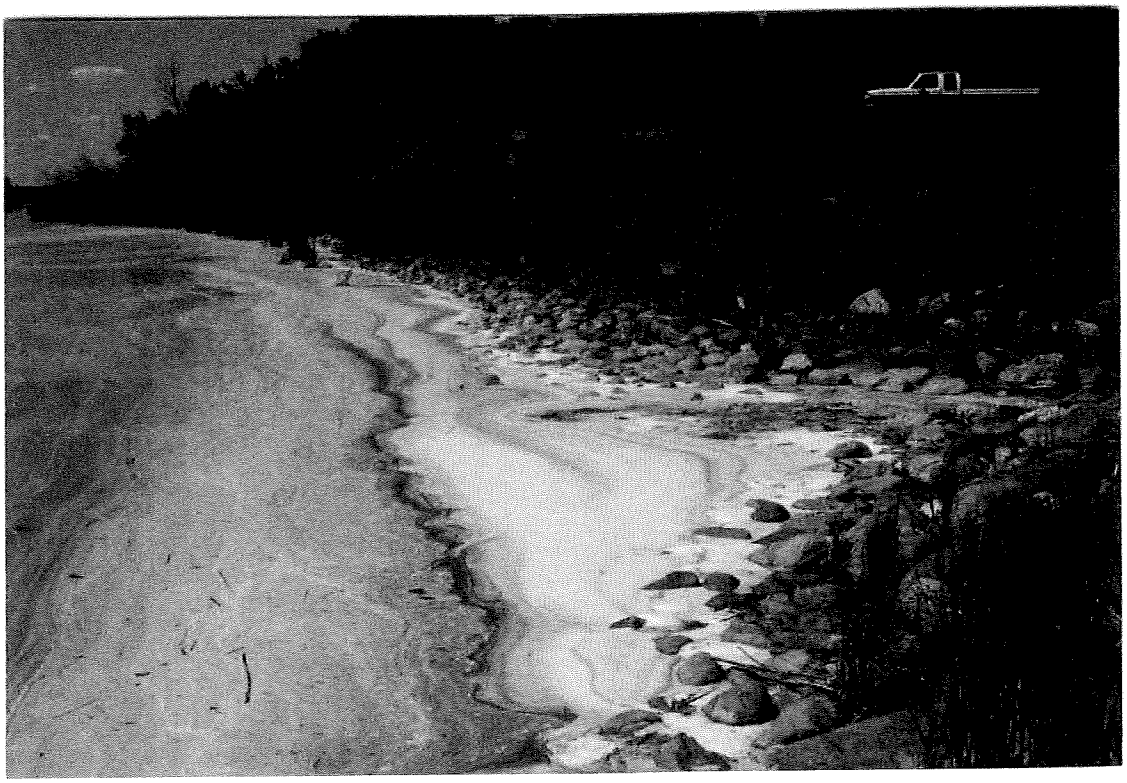
Photograph 12. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note beach area on west shore facing north.



Photograph 13. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note beach area on west shore facing south.

Photograph 14. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note blue green algae on west shore.

Photograph 15. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note blue green algae on west shore.



Photograph 16. Biophysical features of the Mystic Beach Subdivision at Lac La Biche on July 28, 2004. Note blue green algae on west shore.

15.2 Wildlife species observed at Mystic Beach Subdivision on Lac La Biche on June 28, 2004

Common Name	Scientific Name
American Coot	*Fulicca americana*
American Robin	*Turdus migratorius*
American Wigeon	*Anas penelope*
Black-Billed Magpie	*Pica pica*
Brown-Headed Cowbird	*Molothrus ater*
Gadwall nesting eggs	*Anas strepera*
Least Flycatcher	*Empidonax minimus*
Lesser Yellowlegs	*Tringa flavipes*
Moose	*Alces alces*
Northern Oriole	*Icterus galbula*
Red-Tailed Hawk	*Buteo jamaicensis*
Red-Winged Blackbird	*Agelaius phoeniceus*
Ruddy Duck	*Oxyura jamaicensis*
Ruffed Grouse	*Bonasa umbellus*
Sandhill Crane	*Grus canadensis*
Western Wood-Pewee	*Contopus sordidulus*
White Throated Sparrow	*Zonotrichia albicollis*
White-tailed Deer	*Odocoileus virginianus*
Yellow Warbler	*Dendroica petechia*

15.3 Environmental Protection Plan Concepts

The preliminary assessment of various mitigation measures associated with this subdivision project includes the following concepts and guidelines.

1. Environmental Reserve (ER) Designation

The lakeshore riparian areas will not be disturbed. The development plan describes and delineates this area as an environmental reserve along with other sensitive fish habitats (e.g. marsh spawning area for Northern Pike).

The ER is intended to ensure that:

(a) no fish habitats are altered, disrupted or destroyed;

(b) special areas are protected; and

(c) water quality is maintained and not influenced by the development.

2. Community Beaches and Docks

Community beaches or docks will be considered particularly on the west side of the property. The shoreline disturbance should be minimized. Limited beach development should occur on the east side of the peninsula.

3. Placement of Developments

Developments will be positioned and located to minimize surface disturbance and erosion of sediments that may enter Lac La Biche.

4. Surface Drainage and Stormwater Management

A plan will be developed to ensure that the water quality of the storm drainage will not contribute nutrients or sediments into Lac La Biche. This plan, prepared by Associated Engineering Ltd., incorporates numerous erosion control devices and positioned buffers to support environmental expectations.

5. Fisheries Consumers and Users

The Alberta Government has established angling regulations that support the effective management of the fish stocks in Lac La Biche. Increased numbers of lake residents might suggest increased concerns for reduction of fish stocks. The carrying capacity of users is being managed by the Alberta Government, and, with all new residents abiding by existing regulations, such fish resources should not be jeopardized.

All new residents will be encouraged to support the sharing of the fish resources of the lake.

6. Resident's Environmental Code of Conduct

An environmental code of conduct should be developed to provide an increased awareness and an expectation for all residents of the subdivision. Such a code should address numerous subjects including:

- Restrictions on the use of pesticides and herbicides
- Garbage disposal
- Erosion control
- Boating restrictions and regulations
- Control over the use of fertilizers
- Tree removal limitations
- Shoreline disturbances
- Fire management
- Temporary dock and beach development restrictions
- Potential environmental enhancement developments
- Noise control

7. Management of the Code

(a) Reporting

(b) Enforcement

(c) Meeting of the Residents

(d) Development of an Association

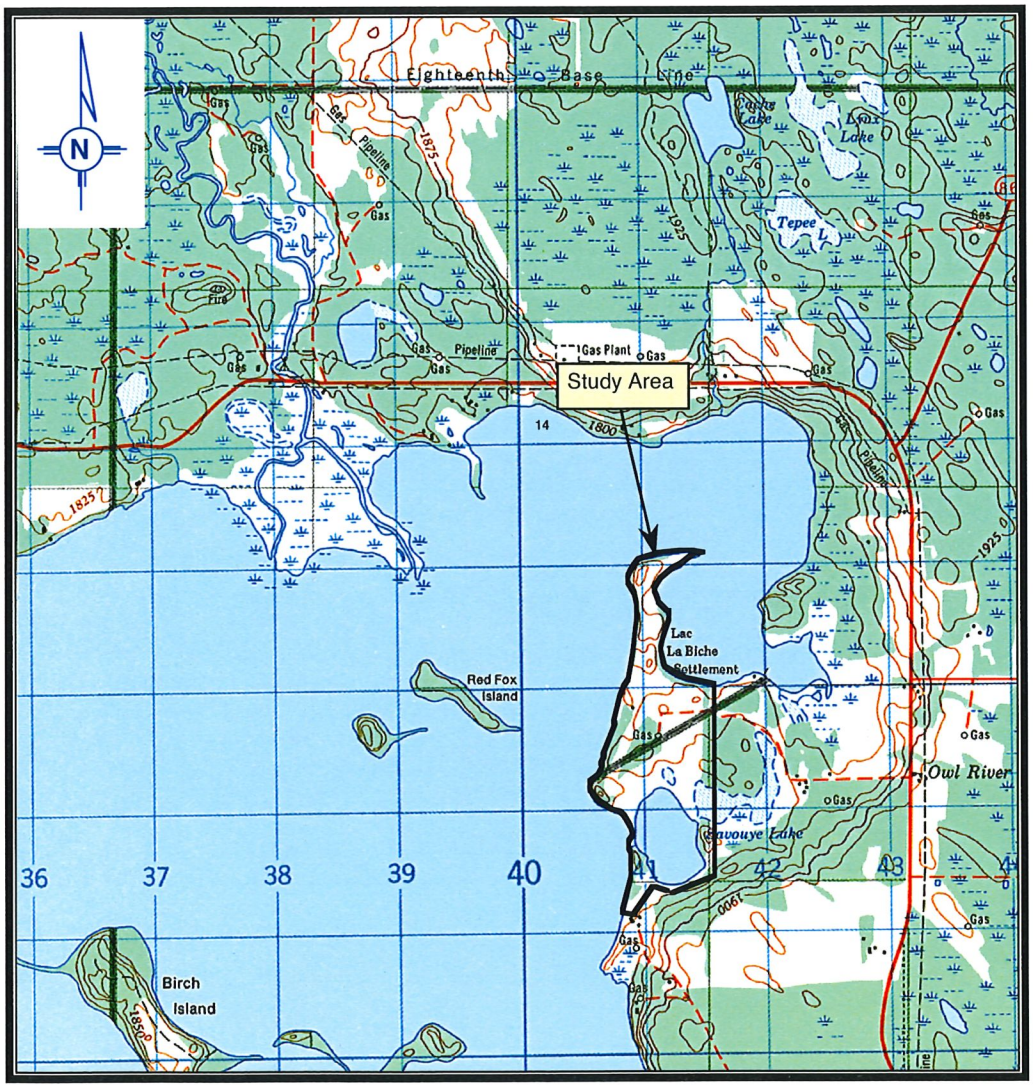
HISTORICAL RESOURCES IMPACT ASSESSMENT

PROPOSED MYSTIC BEACH SUBDIVISION
IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M
LAKELAND COUNTY, ALBERTA

Archaeological Permit 2004-240

For

Armin A. Preiksaitis & Associates Ltd.



Altamira Consulting Ltd

Final Report

HISTORICAL RESOURCES IMPACT ASSESSMENT
PROPOSED MYSTIC BEACH SUBDIVISION
IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, AND PT. E 1/2 21-68-13-W4M
LAKELAND COUNTY, ALBERTA

ARCHAEOLOGY PERMIT 2004-240

Prepared for

Greg MacKenzie
ARMIN A. PREIKSAITIS & ASSOCIATES LTD.
#408 The Boardwalk
10310 – 102 Avenue
Edmonton, Alberta
T5J 2X6
Tel. (780) 423-6824
Fax (780) 423-6850

By

Altamira Consulting Ltd.
Ste. 207, 10544 – 106 Street
Edmonton, Alberta
T5H 2X6
Tel. (780) 423-5840
Fax (780) 423-5878
e-mail: altamira@archaeology.ca

July, 2004

REPORT ABSTRACT

At the request of Mr. Greg MacKenzie of Armin A. Preiksaitis & Associates Ltd., an Historical Resources Impact Assessment (HRIA) was conducted for the proposed Mystic Beach Subdivision in PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M in Lakeland County, Alberta. The fieldwork for this project was undertaken on June 29, 30 and July 2, 2004 by Walt Kowal, Ryan Spady and Jeff Johnston of Altamira Consulting Ltd.

In-field investigations consisted of a foot survey of the entire project area, and shovel testing of select parts of the proposed development area. A total of 63 shovel tests were excavated during the survey.

Seven previously recorded sites (GfOx-4, GfOx-8, GfOx-10, GfOx-19, GfOx-20, GfOx-21 and GfOx-40) were revisited during the survey of the proposed development. Of these seven previously recorded sites only three (GfOx-4, GfOx-20 and GfOx-40) were relocated.

GfOx-4 is a surface scatter consisting entirely of lithic artifacts. All cultural materials were found on a disturbed beach surface. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-4.

GfOx-20 is a surface scatter consisting entirely of lithic artifacts. No additional cultural materials were found to be present in the undisturbed sediments in shovel tests in the forest area adjacent to the site area on the beach. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-20.

GfOx-40 is a historic burial site consisting of 3 graves. Beyond the presence of the located fence posts and barbed wire that surround the graves, no additional cultural materials were found. GfOx-40 was flagged for avoidance and relocation using surveyor's tape, and will be avoided from all developmental impacts due to the sensitive nature of the site. Further assessment work is not recommended for GfOx-40 if the site area is avoided.

Seven new sites (GfOx-50, GfOx-51, GfOx-52, GfOx-53, GfOx-54, GfOx-55, and GfOx-56) were found during the survey of the proposed development.

GfOx-50 is an isolated surface find consisting of one lithic artifact that was found on the beach by Lac La Biche. No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-50.

GfOx-51 is an isolated surface find consisting of one lithic artifact that was found on the beach by Lac La Biche. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-51.

GfOx-52 is a prehistoric surface scatter, consisting of a core reduction flake and one very weathered and rounded projectile point base that were found on the beach by Lac La Biche. No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-52.

GfOx-53 is a prehistoric surface scatter, consisting of two core reduction flakes

that were found on the beach by Lac La Biche. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-53.

GfOx-54 is an isolated surface find consisting of one lithic artifact that was found on the beach by Lac La Biche. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-54.

GfOx-55 is a surface scatter composed of both prehistoric and historic components identified atop a high knoll in a cultivated field that lies adjacent to the eastern shoreline of Lac La Biche. The prehistoric archaeological materials consist entirely of lithic artifacts but no diagnostic items were found. The historic component consists of an assortment of historic cultural items including unidentifiable glass bottle fragments, unidentifiable modern ceramic fragments, as well as metal, plastic, leather and bone fragments. These located items suggest that the historic component of GfOx-55 is not from the early historic period, but rather from the middle to late part of the twentieth century. No cultural materials were found in shovel tests at the site, and the plough zone extended into sterile matrix. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-55.

GfOx-56 is a surface scatter consisting of two core reduction flakes. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal. Further assessment work is not recommended for GfOx-56.

The recommendations resulting from this report are that No Further Historical

Resources Impact Assessment or Mitigation work is warranted for a proposed subdivision in PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M in Lakeland County, Alberta, and the development 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 of the Heritage Resource Management Section of the Historic Sites Service, Alberta Community Development.

PROJECT PERSONNEL

Project Manager & Permit Holder
Walt Kowal

Report Authors
Walt Kowal
Ryan Spady

Project Research
Walt. Kowal
Courtney Cameron

Field Work
Walt Kowal
Ryan Spady
Jeff Johnston

Assessment, Analysis & Report Preparation
Walt Kowal
Courtney Cameron

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES

At the request of Mr. Greg MacKenzie of Armin A. Preiksaitis & Associates Ltd., an Historical Resources Impact Assessment (HRIA) was conducted for the proposed Mystic Beach Subdivision in PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M in Lakeland County, Alberta (Figures 1, 2, 3, and 4).

Figure 1. Location of the study area within Alberta (after 1:250,000 NTS Map 73L – Sand River and 83I - Tawatinaw).

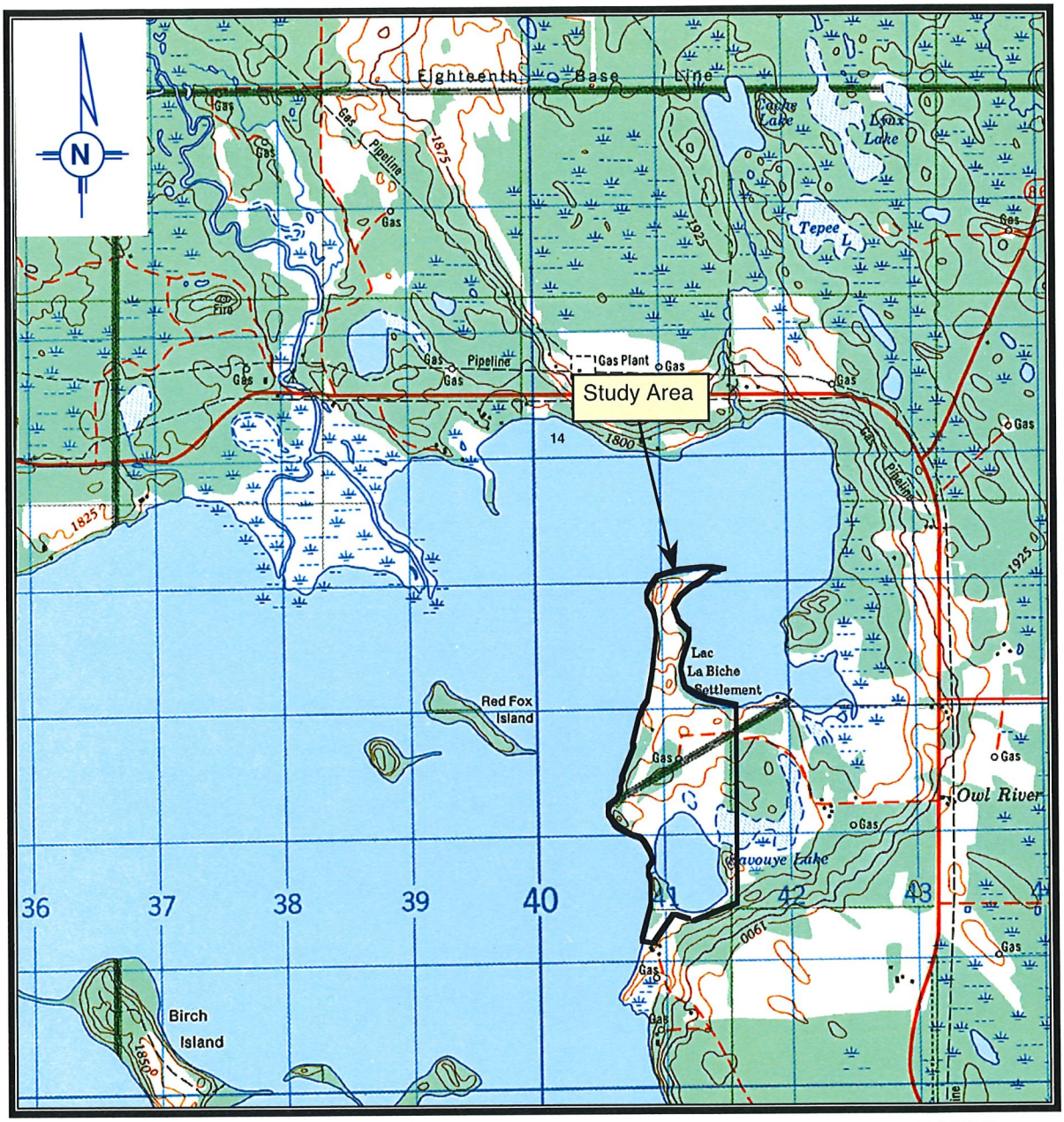


Figure 2. Map showing the location of the proposed Mystic Beach Subdivision project (after 1:50,000 NTS Map 73 L/13 – Lac La Biche).

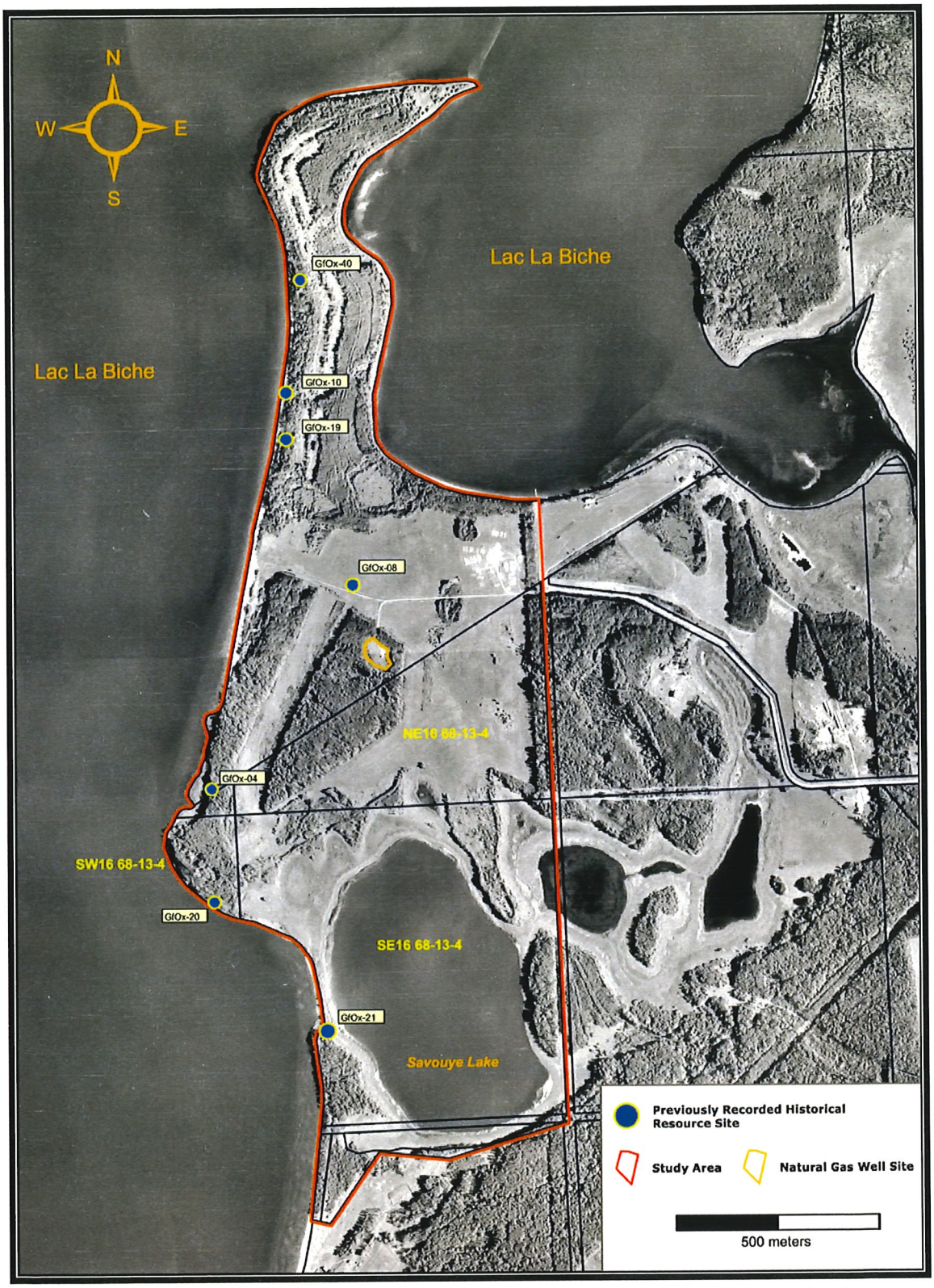


Figure 3. Airphotograph of showing the proposed Mystic Beach Subdivision area and the previously recorded Historical Resources Sites within the development area.

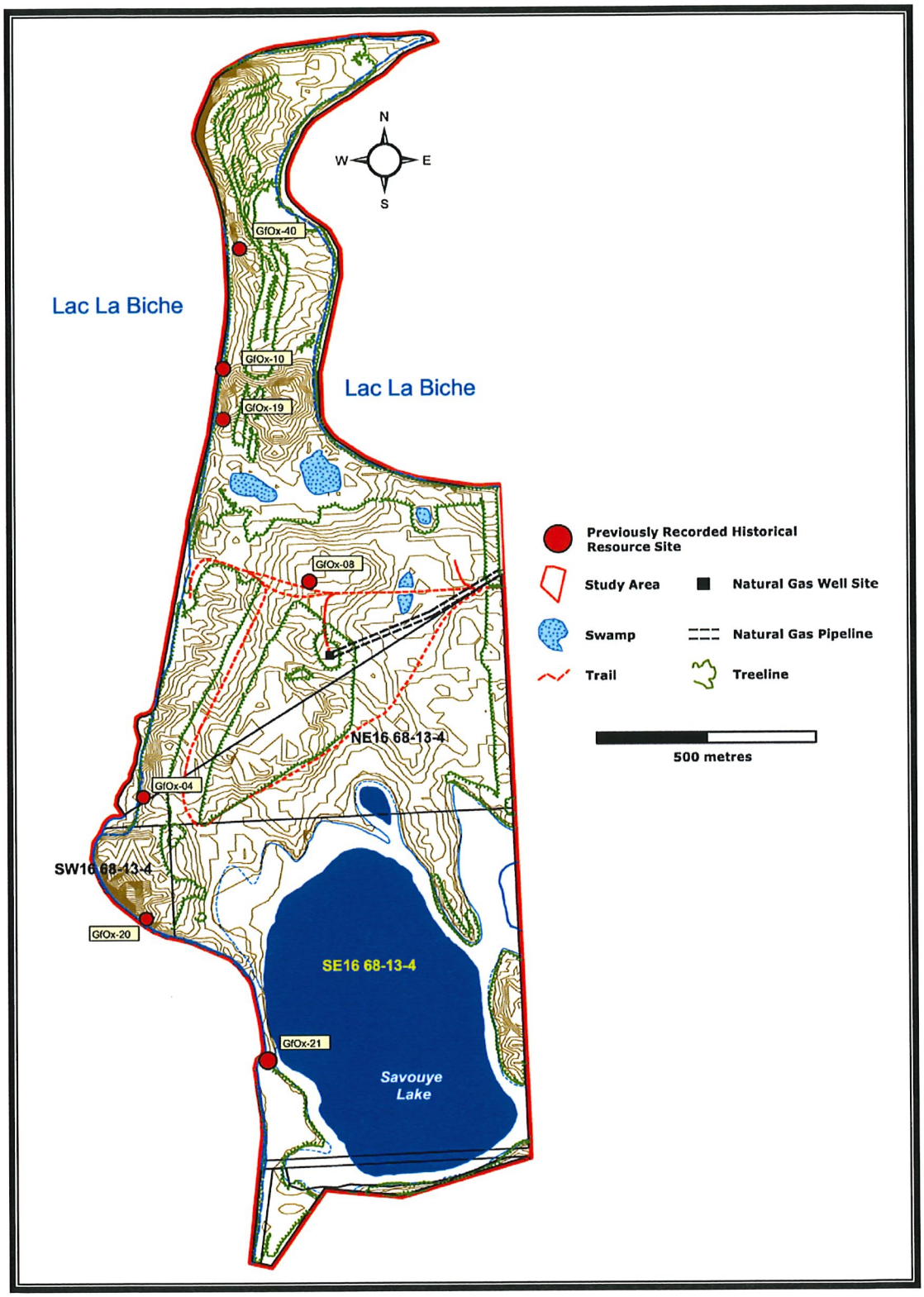


Figure 4. Contour map of the Mystic Beach development area showing the locations of previously recorded Historical Resources sites.

The fieldwork for this project was undertaken on June 29, 30 and July 2, 2004 by Walt Kowal, Ryan Spady and Jeff Johnston of Altamira Consulting Ltd.

This is the final report of the HRIA carried out for the proposed project in accordance with the HISTORICAL RESOURCES ACT (1987) 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.

1.2 PROJECT DESCRIPTION AND CONCERNS

The project lands are located approximately 20 kilometres northwest of the Town of Lac La Biche and 10 kilometres southeast of the Hamlet of Owl River, west of Highway #881, on the northwest shore of Lac La Biche (Figures 1, 2, 3 and 4). The proposed Mystic Beach Subdivision project consists of approximately 155.89 hectares of land legally described as SE-16-68-13-4, SW-16-68-13-4, NW-16-68-13-4, NE-16-68-13-4, a portion of NE-9-68-13-4, Plan 3952TR Block A, Plan 3952TR Lot R1 (reserve), and a portion of Lot 79 of the Lac La Biche Settlement, Lakeland County.

The project lands are on the eastern shore of Lac La Biche and seven Historical Resources sites (GfOx-4, GfOx-8, GfOx-10, GfOx-19, GfOx-20, GfOx-21, and GfOx-40) were previously recorded within the development area (Figures 3 and 4). All of the 7 previously located Historical Resources Sites within the Mystic Beach Subdivision area would have to be revisited and re-assessed, and new Site Forms will need to be completed as is required by Alberta Community Development. Of particular interest is the reported presence of three historical graves on the development lands (Site GfOx-40), and these graves would need to be relocated and flagged. All of the site areas could be impacted by the proposed subdivision, since disturbance in the study area will result from

clearing, grading, trenching, and excavation associated with construction and infrastructure improvements or from future recreational use within the development area, and any Historical Resources sites within the development area could be destroyed.

1.2.1 Existing Land Use

"As can be seen on the aerial photograph, less than half the project area has been cleared for agricultural purposes. There are some low-lying areas around Savouye Lake. Agricultural use is located on cleared land, generally coinciding with the more gently rolling areas of the property, primarily between the southern tip of the bay of Lac La Biche and Savouye Lake. In the western portion of the agricultural area a large, north - south oriented, area of woodland separates a narrow strip of agricultural use from the main area.

Located in a clearing within this woodland and accessed via a trail from the eastern entrance of the study area is a natural gas well. Servicing this well is a pipeline right of way running northeast from the well, underground, and continues off site in a northeast direction" (from Armin A. Preiksaitis & Associates Ltd.'s Lac La Biche Lake Management Area Structure Plan Ammendment).

1.2.2 Environmentally Sensitive Areas

"There are a number of environmentally sensitive areas that can be protected through environmental buffers. Consistent with the requirements of the ASP, a 30m wide buffer strip will be maintained from the high water mark to the building lot line, both along the shoreline of Lac La Biche and Savouye Lake. Development in areas with steep slopes and high water tables will be avoided. These areas will be confirmed through a geotechnical study being conducted by Thurber Engineering Ltd." (from Armin A. Preiksaitis & Associates Ltd.'s Lac La Biche Lake Management Area Structure Plan Ammendment).

Historical Resources are recognized in the Province of Alberta as nonrenewable resources, subject to protective measures and defined under the Historical Resources Act (Province of Alberta 1987)[1].

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 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 *Alberta Community Development.* 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 the *Cultural Facilities and Historical Resources Division, Alberta Community Development.* All recommendations regarding either the need for further work or that no further work is necessary must be ratified, in writing, by *Alberta Community Development* before they can be considered acceptable in terms of the requirements of the development.

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 . . . ".

2.0 BACKGROUND

2.1 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 give 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 (Achuff 1994): Grassland, Parkland, Foothills, Rocky Mountain, Boreal Forest, and Canadian Shield. The six Natural Regions are divided into 20 Subregions based on recurring landscape patterns relative to other parts of the Natural Region. One of the 20 Subregions is present in the study area. This is the Dry Mixedwood Subregion of the Boreal Forest Natural Region (Figure 5). The following outline of the Dry Mixedwood Subregion is from Achuff (1992).

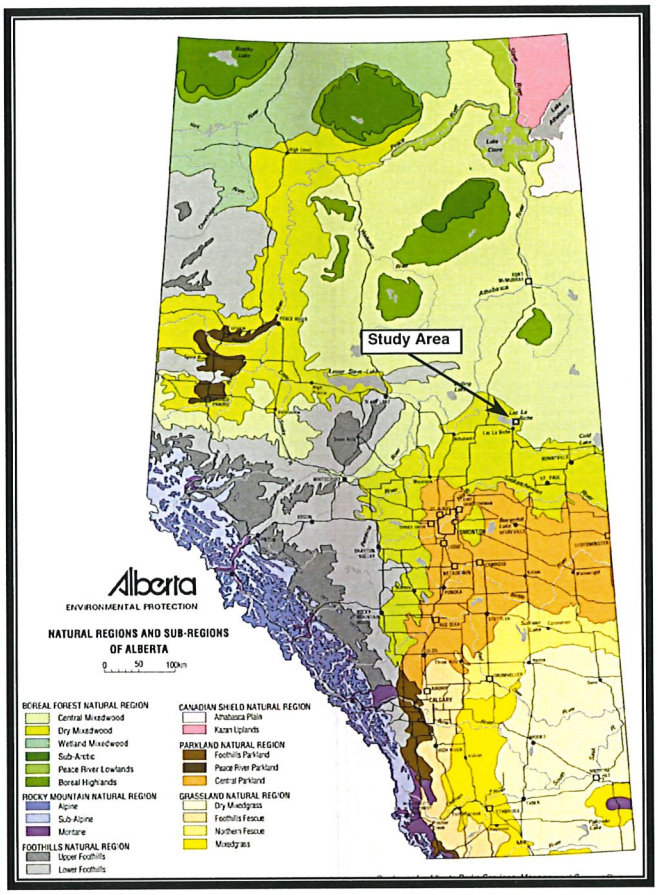


Figure 5. Map showing the location of the study area within the Dry Mixedwood Sub-region of the Boreal Forest Natural Region in the Province of Alberta (Achuff 1992:11).

2.1.1 Dry Mixedwood Subregion

2.1.1.1 Geology And Landforms

The Dry Mixedwood Subregion is characterized by low relief and level to undulating terrain. Surficial materials are mostly till as ground moraine and hummocky moraine landforms with some areas of aeolian dunes and sandy outwash plain. The Subregion includes two main areas: the southern edge of the Boreal Forest Natural Region from Cold Lake west to about Barrhead and south along the western edge of the Central Parkland Subregion to about Gull Lake and a broad land from Lesser Slave Lake to Grande Prairie then north along the Peace River to Fort Vermilion. The Cooking Lake moraine east of Edmonton is a disjunct portion of this Subregion.

Drainage is to both the Saskatchewan and Mackenzie river systems via numerous rivers and small streams.

2.1.1.2 Climate

The climate of this Subregion is subhumid, continental with short, cool summers and long, cold winters. The mean May - September temperature is about 13C and the growing period is about 90 days. Annual precipitation averages about 350 mm with June and July the wettest months. Winters are relatively dry with about 60 mm of precipitation. Overall, the climate is somewhat drier and warmer than the Central Mixedwood Subregion with somewhat higher moisture deficits.

2.1.1.3 Soils

Soils are typically Gray Luvisols in well-drained, upland till sites and Eutric Brunisols in coarse-textured sandy uplands. Organics and Gleysolics occur on wet depressional sites.

2.1.1.4 Vegetation

The vegetation of the Dry Mixedwood Subregion is transitional between the Central Parkland and Central Mixedwood Subregions and there are community types common to all three. The differences are largely in the proportion of various vegetation types and other landscape features. Populus tremuloides (aspen) is an important species in all three Subregions, occurring in both pure and mixed stands. Populus balsamifera (balsam poplar) frequently occurs with aspen especially on moister sites in depressions and along streams.

Successionally, Picea glauca (white spruce) and, eventually in some areas, Abies balsamea (balsam fir) can be expected to increase or replace aspen and balsam poplar as stand dominants. However, frequent fire seldom permits this to occur and pure deciduous stands are common in the southern part of the Dry Mixedwood Subregion. Coniferous species are more common further north in the Dry Mixedwood Subregion with mixed stands of aspen and white spruce

being widespread. Older stands in protected sites, such as islands, may have significant amounts of balsam fir.

Upland aspen forests contain a diverse understory that may include Viburnum edule (low-bush cranberry), Corylus cornuta (beaked hazel), Rosa acicularis (prickly rose), Cornus stolonifera (red-osier dogwood), Calamagrostis canadensis (marsh reed grass), Aralia nudicaulis (sarsaparilla), Rubus pubescens (dewberry), Lathyrus ochroleucus (cream-coloured peavine), Pyrola asarifolia (pink wintergreen) and Linnaea borealis (twinflower). Both balsam poplar and Betula papyrifera (paper birch) may occur in these forests as well.

Coniferous, spruce or spruce-fir forests are not common but generally have a less diverse understory with greater moss cover especially of the feathermosses (Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis).

Mixedwood forests generally contain a mosaic of deciduous and coniferous patches with species typical of each occurring through the stand.

Dry, sandy upland sites are usually occupied by Pinus banksiana (jack pine) forests. These may be quite open and have a prominent ground cover of lichens. Other understory species may include Arctostaphylos uva-ursi (bearberry), Vaccinium myrtilloides (low bilberry), Vaccinium vitis-idaea (bog cranberry) and Rosa acicularis (prickly rose).

Peatlands are common throughout the Subregion and are extensive in some areas, e.g. south of Athabasca, but are not as prevalent as in other Boreal Forest Subregions. Peatland complexes typically contain both nutrient-poor, acidic bog portions, dominated by Picea mariana (black spruce), Ledum groenlandicum (Labrador tea), and Sphagnum spp. (peatmosses) and more nutrient-rich fens, containing Larix laricina (tamarack), Betula spp. (dwarf birches), Carex spp. (sedges), and brown mosses (Aulacomnium palustre, Tomenthypnum nitens, Drepanocladus spp.). Patterned peatlands occur in several areas.

2.1.1.5 Wildlife

Characteristic species of deciduous forests in the Dry Mixedwood Subregion include least flycatcher, house wren, ovenbird, red-eyed and warbling vireos, Baltimore oriole and rose-breasted grosbeak. Species of mixedwood forests include yellow-bellied sapsucker, Swainson's thrush, solitary vireo, magnolia warbler, white-throated sparrow, pileated woodpecker and northern goshawk.

A few species are restricted to the Cold Lake area and represent an eastern faunal element. These include yellow rail, sedge wren, great-crested flycatcher, chestnut-sided warbler and blackburnian warbler. Typical mammals include beaver, moose, varying hare, black bear, wolf, lynx and ermine.

2.2 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.

The importance of defining site type has been previously noted by Ball:

> .....identification and classification of site types are considered to be the key to the definition of prehistoric settlement patterns and are almost totally dependent upon a detailed analysis and classification of the artifacts which comprise the site (Ball 1986: 139).

Ball (1986:151) goes on to note that it is extremely difficult to interpret site types from the small, predominantly lithic artifact assemblages.

A further complication in interpreting the prehistory of Alberta is that the some projectile points collected have not yet been typologically classified (Brink and Dawe 1986: 241). The typology of projectile point sequences known for the Northern Plains is generally applied, rightly or wrongly, to the northwestern materials when strong similarities are present. 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. Many of the known projectile points for instance, were discovered by farmers plowing their fields earlier this century (Wormington and Forbis 1965; LeBlanc and Wright 1990).

These difficulties have resulted in vague and often inconclusive interpretations

of sites and site types. 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 Alberta.

2.2.1 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 6).

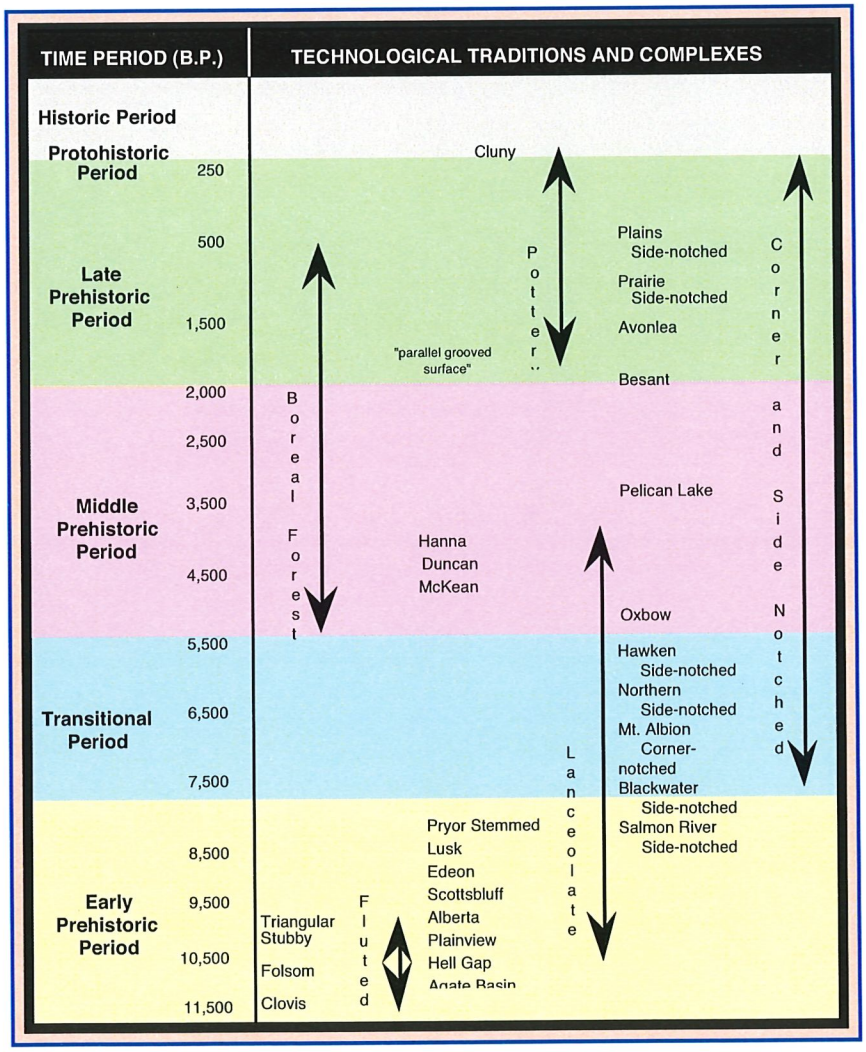


Figure 6. Culture History sequence for Alberta

These are:

1) **The Early Prehistoric Period** spans from the end of the last ice age until approximately 8,000 years BP;
2) **The Transitional Period** begins around 8,000 years BP and ends around 5,500 years BP;
3) **The Middle Prehistoric Period** dates from 5,500 years BP to roughly 2,000 years BP; and
4) **The Late Prehistoric Period** continues from approximately 2,000 years BP to the onset of the historic period which begins in 1753 when the first white man (Anthony Henday) arrived in Alberta.

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".

2.2.2 Early Prehistoric Period

The Early Prehistoric Period, dating from 11,000 to 8,000 years BP, is the first time period for which there exists material evidence of people living in Alberta. The Early Prehistoric Period is sometimes referred to as the Paleo-Indian Period (Ellis and Deller 1990). It is possible that people may have entered Alberta earlier than 11,000 years ago, and there are researchers who have advanced such speculation, but as of yet no compelling evidence of pre-11,000 year occupation exists (cf. Beaudoin et al. 1996; Forbis 1982; and Vickers 1986).

The Early Prehistoric peoples are known primarily for their use of large spear

points and an associated emphasis on big game hunting. In Alberta this coincides with the occurrence of large game such as the bison, camel, elk, horse and woolly mammoth. This period includes several different cultural traditions (based on characteristic projectile point styles including Clovis, Folsom, Agate Basin, Cody, Lusk, Alberta, and Frederick (Figure 7). These point types have slightly different spatial and temporal distributions over the Northern Plains, but generally evidence exists for these types occurring in all areas of Alberta.

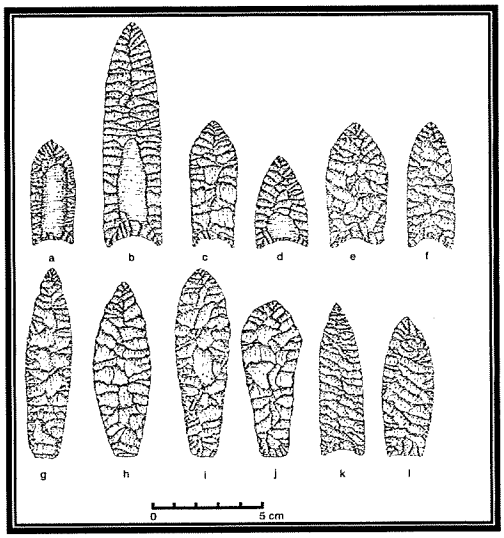


Figure 7. Examples of Early Prehistoric Period Plains projectile point styles: a & b - Clovis; c - Midland; d - "Stubby" or Basally-thinned Triangular; e – Plainview; f – Milnesand; g, h & i – Agate Basin; j – Hell Gap; k – Frederick; and l – Lusk.

2.2.3 The Transitional Period

By 8,000 years BP there is a change in the archaeological record, and side-notched and corner-notched points begin to appear, and become prominent in the archaeological record. These new point styles mark the beginning of a new technological tradition that we refer to here as the Transitional Period (Boag 1989). The Transitional Period extends from approximately 8,000 years BP to 5,500 years BP. It is in this period that we begin to see an increase in the number of archaeological sites. It correlates to changes in vegetation, fauna, and the disappearance of all remnants of glacial ice.

The inference is that for much of Alberta there occurred a change in subsistence

and settlement patterns and an increase in population. There was also a change toward a more regionalized - settled - lifestyle after 8,000 BP. It may be that sites of this period are simply more visible. Bison and other large mammals continue to be an important resource, but the archaeological evidence shows that other animals became increasingly important.

The major projectile point styles of the Transitional Period are known as Salmon River Side-notched (also called Gowen), Mt. Albion Corner-notched, Hawken Side-notched, Blackwater Side-notched, and Northern Side-notched (Figure 8).

The size of these points indicates that they were probably used for spears and darts. Salmon River points have been recovered from the Hawkwood Site (Van Dyke and Stewart 1985) in southern Alberta, and dated at 8,200 years BP. Similar points recovered from the Gowen site (Walker 1980 and 1987) in Saskatchewan were dated from 6,000 to 5,100 years BP.

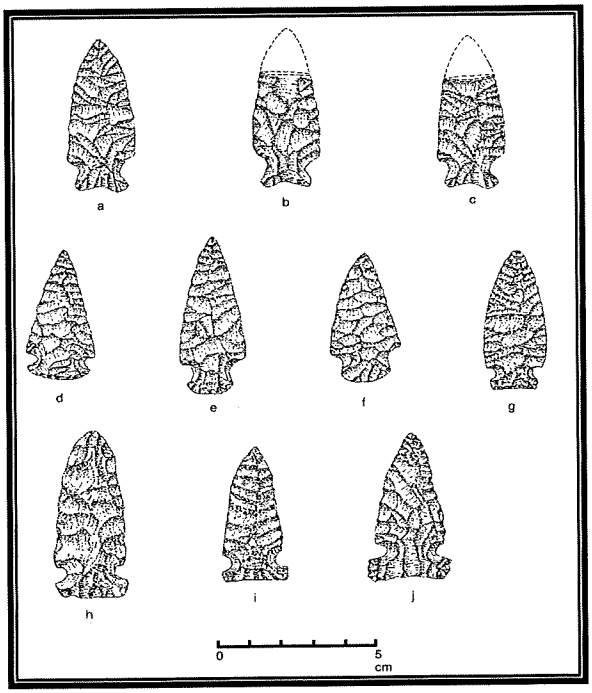


Figure 8. Examples of Plains projectile point styles from the Transitional Period: a, b & c –Salmon River Side-notch; d – Blackwater Side-notch; e & f – Mt. Albion Corner-notch; g – Hawkin Side-notch; h, I & j – Northern Side-notch also known as Bitterroot.

2.2.4 The Middle Prehistoric Period

The Middle Prehistoric Period in Alberta (ca. 5,500 - 2,000 years BP) is characterized by a shift to smaller sized notched projectile points and continues the shift in emphasis from big game hunting to a wider exploitation of the available resources including a wide variety of plants and smaller game animals. This period includes several different cultural types characterized by different projectile point styles (e.g., Oxbow, McKean, Duncan, and Hanna styles) (Figure 9). The spear thrower (atlatl), bison traps, and conical tipis are features associated with this occupation period.

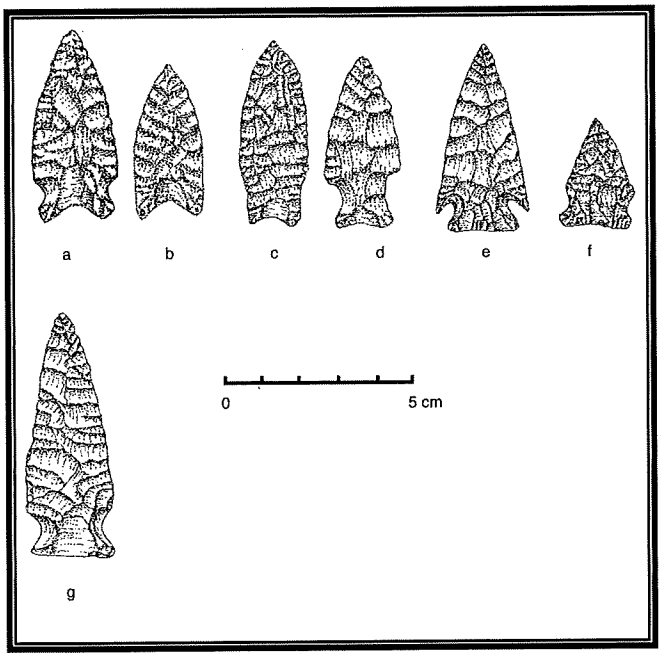


Figure 9. Examples of Middle Prehistoric Period Plains projectile point styles: a & b - Oxbow; c – Duncan; d – Hanna; e –Pelican Lake; f – Sandy Creek; g - Besant.

Like other point types in the Northwestern Plains typology, Oxbow points are also common to parts of northern Alberta. Like other styles, they too appear to date later in northern Alberta than they do in sites found farther to the south (Spurling and Ball 1981). Generally, Oxbow points seem to appear in the north after 4,000 years BP.

For the Middle Prehistoric Period, as for the Early Prehistoric Period, there is evidence of intensive lakeshore occupation. However, it should be noted that it is likely the repeated, long-term use of these lacustrine locations, that make them so prevalent in the archaeological record. While it seems likely that sites were occupied in other geographical situations, they were probably occupied for shorter periods of time, and were not revisited on a yearly basis. Such sites would not be as easy to find as sites that were occupied over a greater time span. And these sites could be expected to be smaller, have lower numbers and types of artifacts, be less well-preserved, and not have dateable materials. Therefore, the lakeshore adaptation, as well as the glacial lake occupations, must be seen as only one element of a more complex settlement pattern.

2.2.5 The Late Prehistoric Period

The Late Prehistoric Period in Alberta dates from approximately 2,000 to 250 years BP, and is characterized by the appearance of a variety of smaller projectile point styles. This change in projectile point size is believed to represent a shift in weaponry from the atlatl to the bow and arrow. The occurrence of ceramics in Late Prehistoric sites is another trait distinguishing this period from those of earlier periods. The grooved maul may be another diagnostic artifact of the Late Prehistoric Period, and grooved mauls are fairly common in the private collections found throughout the agricultural communities in Alberta, and one grooved maul has recently been found in an excavated context with Old Women's Phase Material at EhPn-56 in southwestern Alberta (Murphy 2003).

Like the previous stages, cultural complexes of the Late Prehistoric Period are, for the most part, discriminated largely on the basis of projectile point styles. Some of the salient point types of the Late Period include Avonlea (Kehoe 1966 and 1973; and Kehoe and McCorquodale 1961) as well as a variety of other small points which are termed variously as Plains Side-notched, Prairie Side-notched, Late Prehistoric Side-notched, and Corner-notched (Figure 10).

Like the other major time periods, the Late Prehistoric Period is poorly understood in northern Alberta. It is perhaps complicated by the apparent existence of artifact styles that are different from those which occur in neighboring regions. However, this latter manifestation is likely the result of data gaps and the establishment of a different subsistence and settlement pattern than is present in neighboring areas. Moreover, the information discontinuities are largely due to a lack of well organized, problem-oriented research in the region. In general, it can be said that there has been less archaeology carried out in the north than in other regions of the province.

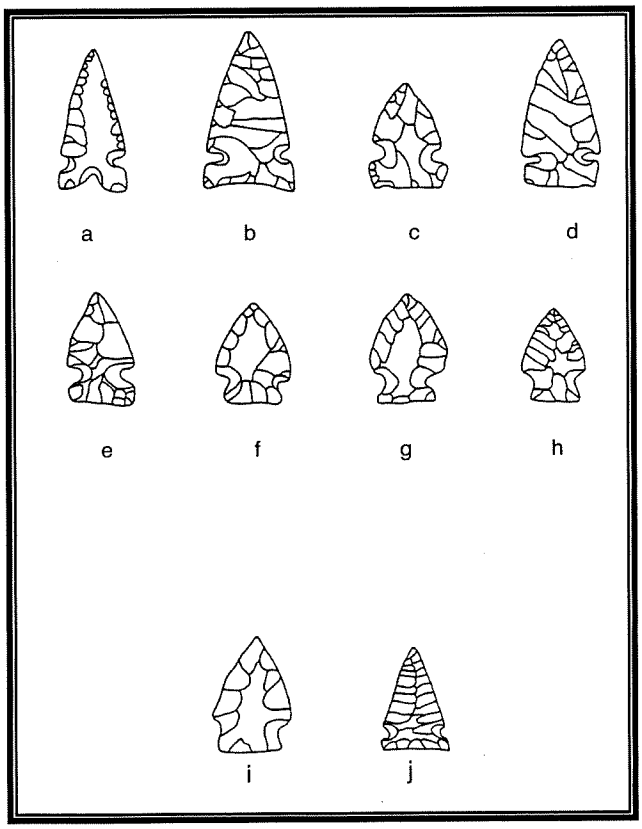


Figure 10. Examples of Late Prehistoric Period Plains projectile point styles from Vickers 1986: a, b, c & d are Plains Side-notch (Trinotch, Washita, Pekisko and Paskapoo respectively); e, f, g & h are Priarie Side-notch types (Nanton, Lewis, Irvine and High River styles); i – Samantha (Besant); and j – Timber Ridge (Avonlea).

2.3 PREVIOUSLY RECORDED RESOURCES

2.3.1 Archaeological Sites

Archaeological sites in the Province of Alberta are recorded in the Archaeological Site Inventory Data files of the *Cultural Facilities and Historical Resources Division*. Site location information is maintained using a geographical system known as the Borden System[2]. All previously identified archaeological sites are geographically 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 Historic Sites Section of the Historic Resources Division.

The current project lies within Borden Block GfOx. Seventeen Historical Resources Sites are recorded within two kilometers of the study area (Figure 11) and 157 are found in the nine Borden Blocks surrounding Lac La Biche (Table 1).

Seven Historical Resources sites (GfOx-4, GfOx-8, GfOx-10, GfOx-19, GfOx-20, GfOx-21, and GfOx-40) have been recorded previously within the study area (Figure 11). The presence of these seven sites suggests that the potential for the discovery of additional prehistoric archaeological remains in the study area is high.

[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 site, 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.

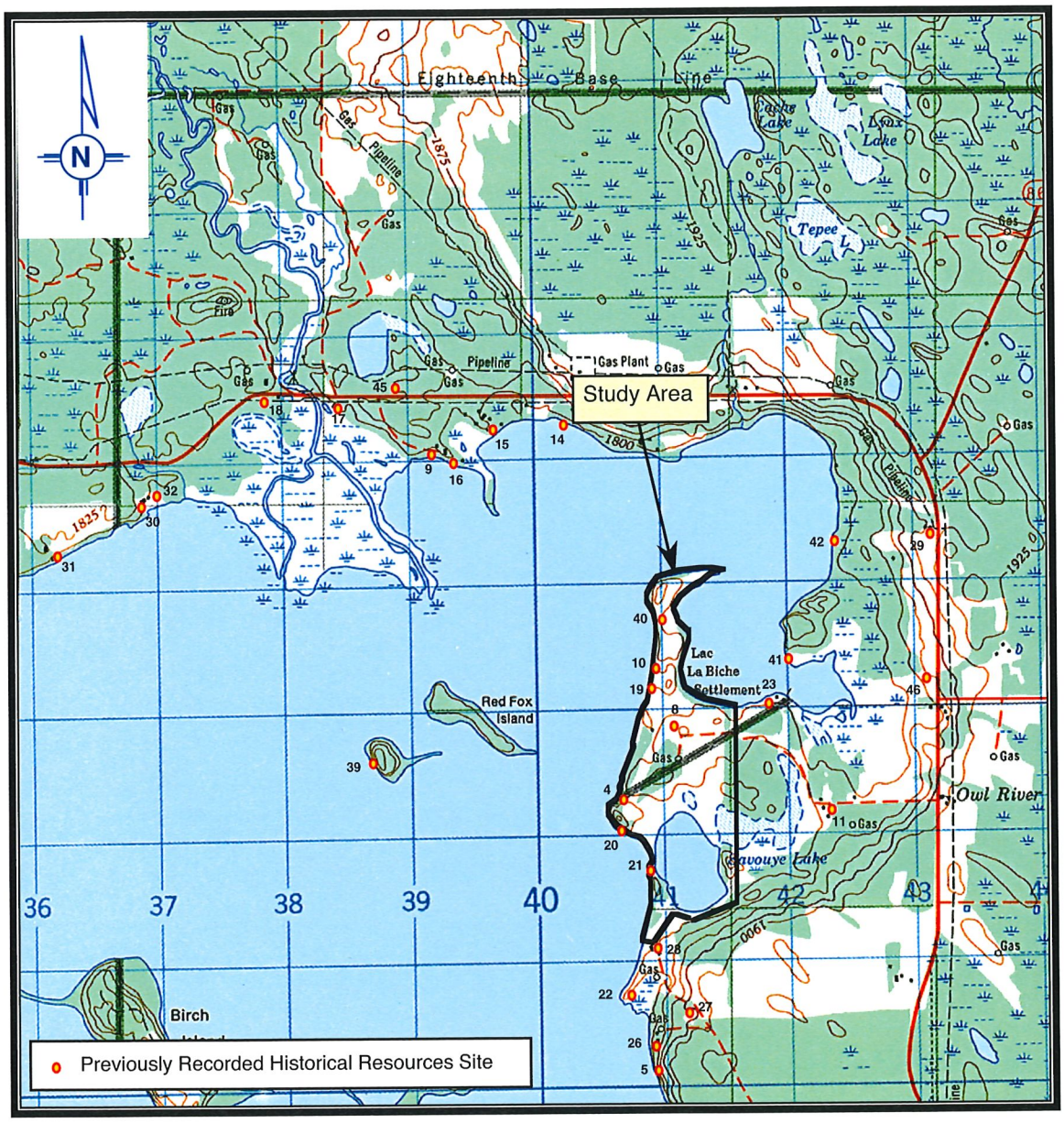


Figure 11. Map showing the project location and previously located Historical Resources Sites in the general area (after 1:50,000 NTS Map 73 L/13 – Lac La Biche).

Table 1. Previously recorded archaeological sites in the project vicinity.

Borden No.	Site Type	Site Location	Artifact Assemblage
GfOu-1	Surface Scatter	West end of Touchwood Lake	Flakes
GfOu-2	Lithic Scatter	Roadcut near lake	Flakes
GfOu-3	Isolated Find	Roadcut near lake	Flakes
GfOu-4	Surface Scatter	Near creek by lake	Flakes
GfOv-1	Campsite	On Heart Lake I.R. ball diamond	3 Flakes
GfOw-1	Isolated Find	On trail in cultivated field	Flake
GfOw-2	Historic	4 Cabins ca. 1935-46	
GfOx-1	Historic	1940's cabin	
GfOx-2	Surface Scatter	On beach at Lac La Biche	Flakes and cores
GfOx-3	Surface Scatter	On beach at Lac La Biche	Flakes
GfOx-4	**Surface Scatter**	**On beach at Lac La Biche**	**35 Flakes and 6 shatter**
GfOx-5	Surface Scatter	Natural clearing by lake	5 Flakes
GfOx-6	Surface Scatter	High bluff by Lac La Biche	4 Flakes
GfOx-7	Surface Scatter	Near shore of Lac La Biche	14 Flakes, 5 cores
GfOx-8	**Surface Scatter**	**Garden near Lac La Biche**	**2 Flakes, 1 spall, 1 core**
GfOx-9	Historic	1 Cabin	
GfOx-10	**Surface Scatter**	**Spit in Lac La Biche**	**3 Flakes**
GfOx-11	Historic	Cabin	
GfOx-12	Historic	Cabin	
GfOx-13	Campsite	Cultivated field by Lac La Biche	7 Flakes, FBR
GfOx-14	Surface Scatter	Beach on Lac La Biche	11 Flakes, 2 cores, 1 biface
GfOx-15	Historic	3 Cabins	
GfOx-16	Surface Scatter	Bluff overlooking Lac La Biche	22 Flakes, 1 biface
GfOx-17	Historic	Cabin	
GfOx-18	Surface Scatter	Knoll overlooking Owl River	7 Flakes, 1 biface
GfOx-19	**Surface Scatter**	**Beach on Lac La Biche**	**2 Flakes**
GfOx-20	**Surface Scatter**	**Beach on Lac La Biche**	**8 Flakes, 1 biface**
GfOx-21	**Surface Scatter**	**Beach on Lac La Biche**	**5 Flakes, 1 biface**
GfOx-22	Surface Scatter	High bluff overlooking Lac La Biche	10 Flakes, 1 biface
GfOx-23	Campsite	Cultivated field by Lac La Biche	Pelican Lake, McKean, Duncan projectile pts., flakes, tools
GfOx-24	Surface Scatter	Cultivated field by Lac La Biche	4 Flakes
GfOx-25	Historic	Cabin	
GfOx-26	Historic	Cabin	
GfOx-27	Historic	Cabin	
GfOx-28	Historic	Cabin	
GfOx-29	Historic	Cabin	
GfOx-30	Surface Scatter	High bluff overlooking Lac La Biche	8 Flakes, 1 projectile pt., shatter
GfOx-31	Surface Scatter	Terrace by Lac La Biche	22 Flakes, 1 biface, shatter
GfOx-32	Historic	2 Cabins	
GfOx-33	Surface Scatter	High bluff overlooking Lac La Biche	12 Flakes, 1 core, shatter
GfOx-34	Surface Scatter	Beach on island in Lac La Biche	1 Core
GfOx-35	Surface Scatter	Beach on island in Lac La Biche	1 Core, 2 flakes, shatter
GfOx-36	Surface Scatter	Beach on island in Lac La Biche	2 Flakes, 1 biface, 1 core, shatter

Borden No.	Site Type	Site Location	Artifact Assemblage
GfOx-37	Surface Scatter	Beach on island in Lac La Biche	1 Flake
GfOx-38	Surface Scatter	Bluff on island in Lac La Biche	3 Flakes, 1 biface, shatter
GfOx-39	Surface Scatter	Bluff on island in Lac La Biche	1 Flake
GfOx-40	**Historic**	**3 Graves**	
GfOx-41	Surface Scatter	High bluff overlooking Lac La Biche	6 Flakes, 1 biface, 1 core
GfOx-42	Surface Scatter	Beach on Lac La Biche	2 Flakes, 4 bifaces, 2 unifaces, shatter
GfOx-43	Surface Scatter	Beach on Lac La Biche	Flakes
GfOx-44	Campsite	Island beach ridge	Flakes, core, FBR
GfOx-45	Campsite	Roadcut through dune	2 Flakes, bone
GfOx-46	Historic, S. Scatter	Knoll near beach of Lac La Biche	Modern garbage, flakes
GgOu-1	Campsite	Beach on Heart Lake	Projectile point, 2 flakes
GgOv-1	Historic	Hudson Bay Post, homestead era	
GgOv-2	Surface Scatter	Beach on Heart Lake	7 Flakes, shatter
GgOv-3	Surface Scatter	High bluff overlooking Heart Lake	3 Flakes, 3 bifaces, shatter
GgOv-4	Surface Scatter	Near shore of Heart Lake	4 Flakes, 3 bifaces, shatter
GgOv-5	Campsite	Terrace overlooking Heart Lake	1 Projectile pt., 1 flake, 1 biface
GgOv-6	Surface Scatter	Terrace overlooking Heart Lake	McKean Point
GgOv-7	Surface Scatter	Terrace overlooking Heart Lake	1 Uniface, 4 flakes, shatter
GgOv-8	Campsite	Terrace overlooking Heart Lake	1 Projectile pt., 2 flakes, shatter
GgOv-9	Surface Scatter^	Beach on Heart Lake	4 Flakes, shatter
GgOv-10	Surface Scatter	High ground by Heart Lake	1 Projectile pt., 1 flake
GgOv-11	Isolated Find	Sandy terrace by Heart Lake	Biface
GfPa-1	Campsite	High ridge by Lac La Biche	Flakes, cores, projectile point, tools, FBR
GfPa-2	Campsite	Spit in Lac La Biche	2 Projectile pts., 8 bifaces, 3 cores, tools, 3 flakes, FBR
GfPa-3	Campsite	Spit in Lac La Biche	2 Bifaces, 1 core, 5 flakes, FBR
GfPa-4	Campsite	Spit in Lac La Biche	7 Flakes, 3 bifaces, FBR
GfPa-5	Campsite	Knoll by Lac La Biche	1 Core, 1 biface, shatter, FBR
GfPa-6	Campsite	Cultivated field on spit in Lac La Biche	2 McKean pt., Oxbow pt., tools, flakes
GfPa-7	Campsite	Near shore of Lac La Biche	39 Flakes, 1 core, 1 biface, shatter
GfPa-8	Campsite	Shore of island in Lac La Biche	32 Flakes, 3 cores, 2 bifaces
GfPa-9	Surface Scatter	Shore of Lac La Biche	Flakes
GfPa-10	Surface Scatter	High area overlooking Lac La Biche	12 Flakes
GfPa-11	Surface Scatter	Beach on Lac La Biche	5 Flakes, 3 bifaces, 1 projectile pt., shatter
GfPa-12	Surface Scatter	Knoll near marsh	2 Flakes
GfPa-13	Lithic Scatter	Lakeshore bank	1 Core, 1 biface, 1 flake
GfPa-14	Campsite	Cultivated field by Lac La Biche	2 Flakes, Bison bone
GfPa-15	Campsite	Garden by Lac La Biche	2 Flakes, shatter, FBR
GfPa-16	Campsite	Cultivated field by Lac La Biche	2 Cores, 1 flake, shatter
GfPa-17	Campsite	Cultivated field by Lac La Biche	3 Cores, 5 flakes
GfPa-18	Historic	3 Cabins	
GfPa-19	Historic	Cabin	
GfPa-20	Surface Scatter	High ridge by Lac La Biche	1 Core, 5 flakes
GfPa-21	Surface Scatter	Shoreline of island in Lac La Biche	2 Cores, 2 flakes
GfPa-22	Surface Scatter	Shoreline of island in Lac La Biche	5 Flakes
GfPa-23	Historic	Cabin cellar depression	

Borden No.	Site Type	Site Location	Artifact Assemblage
GfPa-24	Surface Scatter	Shore of island in Lac La Biche	2 Cores, 1 biface
GfPa-25	Surface Scatter	High bluff overlooking Lac La Biche	24 bifaces, 1 uniface, 1 core, 8 flakes
GfPa-26	Campsite	Cultivated field near Lac La Biche	1 Core, 2 bifaces, 3 flakes, FBR
GfPa-27	Surface Scatter	Cultivated field near Lac La Biche	2 Flakes, 1 biface, shatter
GfPa-28	Surface Scatter	Cultivated field near Lac La Biche	1 Flake, 2 cores
GfPa-29	Surface Scatter	Garden near Lac La Biche	4 Flakes
GfPa-30	Surface Scatter	Cultivated field near Lac La Biche	7 Flakes, shatter
GfPa-31	Surface Scatter	Garden near Lac La Biche	16 Flakes
GfPa-32	Campsite	Bluff on island in Lac La Biche	Flakes, pottery
GfPa-33	Campsite	Beach on island in Lac La Biche	100's of Flakes, cores, FBR
GfPa-34	Campsite	Beach on Lac La Biche	Flakes, FBR
GfPa-35	Surface Scatter	Beach on Lac La Biche	1 Core, 25 flakes, 1 biface, shatter
GfPa-36	Campsite	Spit in Lac La Biche	Oxbow projectile pt., 15 flakes, 1 biface, 1 uniface, FBR
GfPa-37	Surface Scatter	Cultivated field by Lac La Biche	1 Biface, 4 flakes, shatter
GfPa-38	Surface Scatter	Ridge by Lac La Biche	Flakes, scraper, tool
GfPa-39	Campsite	Spit in Lac La Biche	Tools, flakes, FBR
GfPa-40	Historic	Cabin cellar depression	
GfPa-41	Campsite	Beach on Lac La Biche	Pottery, bone, lithics
GfPa-42	Campsite	Beach on Lac La Biche	29 Flakes, 18 bone, FBR
GfPa-43	Isolated Find	Ridge by Lac La Biche	Flake
GfPa-44	Campsite	Ridge by Lac La Biche	39 Flakes, 7 bone
GfPa-45	Campsite	Ridge by Lac La Biche	32 Flakes, 2 bone
GfPa-46	Surface Scatter	Ridge by Lac La Biche	3 Flakes
GfPa-47	Campsite	Terrace on island in Lac La Biche	Flakes, bone, FBR
GfPa-48	Campsite	Terrace on island in Lac La Biche	8 Flakes, FBR
GfPa-49	Campsite	Terrace on island in Lac La Biche	24 Flakes, bone, FBR
GfPa-50	Historic	Cabin cellar depression	
GfPa-51	Historic	Cabin cellar depression	
GfPa-52	Historic/Scatter	Shore of island in Lac La Biche	Modern garbage, flakes
GfPa-53	Isolated Find	Bluff on island in Lac La Biche	End scraper
GfPa-54	Surface Scatter	Point in Lac La Biche	1 Biface, flakes
GfPa-55	Isolated Find	Shore of Lac La Biche	Core
GfPa-56	Isolated Find	Shore of Lac La Biche	Biface
GfPa-57	Campsite	Peninsula in Lac La Biche	Flakes, core
GfPb-1	Open		
GfPb-2	Open		
GfPb-3	Campsite	Beach on Lac La Biche	4 Flakes, 2 bifaces, FBR
GfPb-4	Campsite	Cultivated field by Lac La Biche	4 Flakes, shatter, FBR
GfPb-5	Campsite	Cultivated field by Lac La Biche	1 Biface, 1 flake, shatter, FBR
GfPb-6	Historic	Cabin	
GfPb-7	Historic	2 Cabins	
GfPb-8	Campsite	Roadcut by Lac La Biche	Tools, 22 flakes, 1 projectile pt., FBR
GfPb-9	Lithic Scatter	Roadcut by Lac La Biche	5 Flakes
GfPb-10	Campsite	Roadcut by Lac La Biche	1 Uniface, 3 flakes, shatter, FBR
GfPb-11	Campsite	High ground near Lac La Biche	Flakes, FBR
GfPb-12	Campsite	Roadcut by Lac La Biche	Flakes, FBR
GfPb-13	Campsite	Beach on Lac La Biche	McKean pt., bifaces, flakes, projectile pt.

Borden No.	Site Type	Site Location	Artifact Assemblage
GfPb-14	Surface Scatter	Beach on Lac La Biche	1 Flake, 1 spall, shatter
GfPb-15	Surface Scatter	Beach on Lac La Biche	1 Core, 1 biface, 1 scraper, 1 flake
GfPb-16	Isolated Find	Beach on Lac La Biche	Biface
GfPb-17	Surface Scatter	Beach on Lac La Biche	3 Bifaces, 2 flakes, shatter
GfPb-18	Campsite	Beach on Lac La Biche	1 Core, 2 bifaces, 1 scraper, 6 flakes, shatter, FBR
GfPb-19	Surface Scatter	Cultivated field near Lac La Biche	2 Flakes
GfPb-20	Isolated Find	High bluff overlooking Lac La Biche	Flake
GfPb-21	Surface Scatter	Beach on Lac La Biche	1 Core, 1 flake, shatter
GfPb-22	Historic	Log Cabin	
GfPb-23	Historic	Log Cabin	
GfPb-24	Lithic Scatter	Beach on Lac La Biche & road cut	1 Core, 1 biface, 2 flakes, shatter
GfPb-25	Historic Campsite	Near creek by beach on Lac La Biche	2 Hearths
GfPb-26	Historic Campsite	On beach on Lac La Biche	Hearth, net sinker, floats
GfPb-27	Historic	2 Stone cabin foundations	
GfPb-28	Historic	2 Log cabin foundations	
GfPb-29	Historic	Cabin depression	
GfPb-30	Isolated Find	Beach on Lac La Biche	Flake
GfPb-31	Campsite	High bluff on Lac La Biche	Flakes, FBR
GfPb-32	Campsite	Beach on Lac La Biche	2 Cores, 1 knife, 1 biface, 4 flakes, FBR
GfPb-33	Historic	3 Log Cabins	
GfPb-34	Campsite	Beach on Lac La Biche	1 Biface, 1 uniface, 2 flakes, FBR
GfPb-35	Surface Scatter	High bank overlooking Lac La Biche	Agate Basin projectile point, flakes
GfPd-1	Open		
GfPd-2	Historic	Historic farmstead	
GfPd-3	Isolated Find	Edge of a swamp	Scraper

Data from the adjacent Blocks (GfOu, GfOv, GfOw, GgOu, GgOv, GfPa, GfPb, GfPc, and GfPd) indicate that most of the recorded sites have been found near water sources, including streams, sloughs, rivers, but particularly lakes.

It should be noted that previous archaeological investigation in the immediate vicinity of the study area has not been comprehensive, and that the scarcity of the located sites in the general area, except for around Lac La Biche, could be attributed to this fact.

Table 2. Archaeological Site Types recorded in the project vicinity.

SITE TYPES	GfOu	GfOv	GfOw	GfOx	GgOu	GgOv	GfPa	GfPb	GfPd	Total	%
Campsites		1		4	1	2	26	12		46	29.30
Surface Scatter	2			28		7	19	6		62	39.49
Lithic Scatter	1						1	2		4	2.55
Isolated Finds	1		1			1	4	3	1	11	7.00

Misc. Historic			1	14		1	7	10	1	34	21.66
Total	4	1	2	46	1	11	57	33	2	157	100

Of the 157 Heritage Resources sites found in the general vicinity of the study area, the most common site type found overall is Surface Scatters (n=62) which constitute 39.49% of the sites in the area. Surface scatter sites consist of prehistoric lithic artifacts on the ground surface, and depending on the size or amount of material present these types may or may not be significant. Of the 62 Surface Scatter sites, 37 or 59.7%, had artifact assemblages beyond flakes and shatter which offer the least archaeological information potential. These sites contained some of the following lithic materials: projectile points, cores, bifaces, tools, flakes, and shatter and as a result, many of these sites can be considered to be archaeologically significant. The Lithic Scatter sites (n=4) consist of lithic artifacts that were located in roadcuts in the subsurface matrix. Although the Lithic Scatter sites contain similar cultural materials that are found in Surface Scatter sites, they have been classed because the artifacts were located below the ground surface. The 46 campsites (29.30% of the sites in the area) are prehistoric sites which consist of a combination of at least two of the following artifact types: lithic material, bone, pottery, or fire-broken-rock (FBR). These sites are generally considered to be important in terms of the potential information they contain. Of the 46 campsites, 11 contained projectile points and/or pottery, and these artifacts can be very important in determining site chronology, cultural affiliation, etc., and as a result are considered archaeologically significant. Eleven Isolated Finds have been documented, but isolated find sites are the least likely of all sites to hold significance in terms of their historic resource importance beyond the located artifacts themselves. All but two of the Miscellaneous Historic sites are habitation sites where extant cabins or evidence of historic cabins were discovered. The two remaining Historic sites are campsites relating to historic fishing activities on Lac La Biche.

The seven archaeological sites located within the study area (GfOx-4, GfOx-8,

GfOx-10, GfOx-19, GfOx-20, GfOx-21, and GfOx-40; Figure 11, Table 1) consist of one Historic grave site (3 graves) and six Lithic Surface Scatter sites. These 7 sites vary from being of high to moderate significance, and their presence within the study area indicates that there is good potential for the discovery of other archaeological resources on or near the project lands.

2.3.2 Palaeontological Sites

The Project area is categorized on the Palaeontological Resources Sensitivity Map as having Unknown potential (Tyrrell Museum of Palaeontology 1984).

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 *Cultural Facilities and Historical Resources Division, Alberta Community Development,* were undertaken to determine the potential for historical resources in the Project area.

3.2 SURVEY METHODS

Field survey of the area associated with the proposed project was carried out on June 29, 30, and July 2, 2003. In-field investigations consisted of foot survey and shovel testing of select parts 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 - 50 cm below surface. All matrix from the shovel tests was visually inspected and screened through 6 mm wire mesh. No deep testing was undertaken since it was considered unlikely that deeply buried materials might be found in the project area.

4.0 RESULTS

4.1 SURVEY OBSERVATIONS

The proposed Mystic Beach Subdivision is located approximately 20 kilometres northwest of the Town of Lac La Biche and 10 kilometres southeast of the Hamlet of Owl River, west of Highway #881, on the northwest shore of Lac La Biche (Figures 1, 2, 3 and 4).

The following description of the study area is derived from the development area concept plan information package compiled by Arrmin A. Prekaitis & Associates Ltd. The topography of the proposed development area is characterized by undulating to rolling hills interspersed with low-lying muskeg area, predominantly of the lucustrine/morainal landforms. The east shore of Lac La Biche is covered primarily by ground moraine. Large knobs and ridges are found in the hummocky morainal areas of the backshore and dominate the peninsular portion of the proposed development. From approximately half way along the north shore to the Owl River Delta, aeolian fluvioglacial deposits containing sand and gravel are found.

The slope of the terrain ranges between 0-5% and 9-15%. Elevations range from a low of 545 meters along the water front areas to a high of 557.6 meters near the eastern entrance to the project area. A moderately developed ridge / terrace runs parallel to the lake along much of the shoreline of the proposed development. This ridge / terrace feature varies in height and abruptness, and is associated with sporadic localities of flat, well-drained terrain. An area of lower elevation generally, backs this ridge / terrace on its shoreward side. Separating this ridge from the lake is a wide strip of flat sandy beach. Steep, densely forested ridges and hills dominate the peninsular portion of the study area. Most of the land area located south of the bay and north of Savouye Lake is characterized by gently rolling terrain, the majority of which has been impacted

by previous agricultural cultivation. While much of the land within the development is unsuitable for habitation sites, a few flatter, well-drained areas occur. The majority of these flat areas lie in association with the prominent lakeside terrace feature.

Other prominent features include; a depressed area running east and west between the southern tip of the bay and Lac La Biche, which contains two wet areas; a high ridge running parallel to this depression and directly to its north; rapidly varying high and low localities in the peninsular area, with a prominent high point at its north western extreme; two additional low-lying wet localities located south of the bay in the agricultural area; a high point located on the lake shore northwest of Savouye Lake; areas of steep terrain located within the wooded zone in the center of the agricultural portion of the project area; and wide, gently sloping areas subject to flooding north of Savouye Lake.

Soil complexes in this region include Mesisol (organic), Tucker, Newbrook, Grandin, Athabask and Tolman. These soils are predominantly suited for all types of development. Land capability for agriculture is classified as 4 or 5 with severe limitations or very severe limitations due to undesirable soil structure and/or low permeability or adverse topography.

Lac La Biche is part of the Mixed Wood portion of the Boreal Forest. Paper birch, balsam poplar, white spruce and, in low-lying areas, black spruce and tamarack are the most common tree stands. Common shrubs in the area include red osier, dogwood, Saskatoon, chokecherry, wildrose, willow, cranberry, labrador tea, mountain elder and pincherry.

4.2 SURVEY RESULTS

During the survey of the proposed development seven new archeological sites (GfOx-50, GfOx-51, GfOx-52, GfOx-53, GfOx-54, GfOx-55, and GfOx-56) were found (Figure 12; and Site Forms in Appendix I), and seven previously recorded sites (GfOx-4, GfOx-8, GfOx-10, GfOx-19, GfOx-20, GfOx-21, and GfOx-40) were revisited (see Figure 12; and Site Form Updates in Appendix I). Of the seven previously recorded sites only three (GfOx-4, GfOx-20 and GfOx-40) were relocated, and additional archaeological materials were collected from two of these sites (GfOx-4 and GfOx-20).

A total of 63 shovel tests were excavated during the survey of the development area (Figure 12), but no cultural materials or buried soils were found in any of the shovel tests.

4.2.1 Previously Recorded Sites

GfOx-4

In 1975 E.J. McCullough and T. Maccagno recorded a prehistoric lithic surface scatter consisting of 35 lithic flakes and 6 pieces of lithic shatter that were observed and collected from the surface of a sandy beach along a small cove on the shore of Lac La Biche (Figure 12; and McCullough 1975 Site Form on file with *Alberta Community Development*).

During the 2004 survey the GfOx-4 site area was relocated and an additional 2 broken lithic flakes and 1 split pebble were identified and collected from the beach surface (see Site Update Form in Appendix I; and Artifact Catalogue in Appendix II).

The site area is located on a sandy beach that extends approximately 45 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank (Figures 12 and 13; and Photograph 1). The terrain to the east of this low bank is forested, hummocky, broken, and uneven.

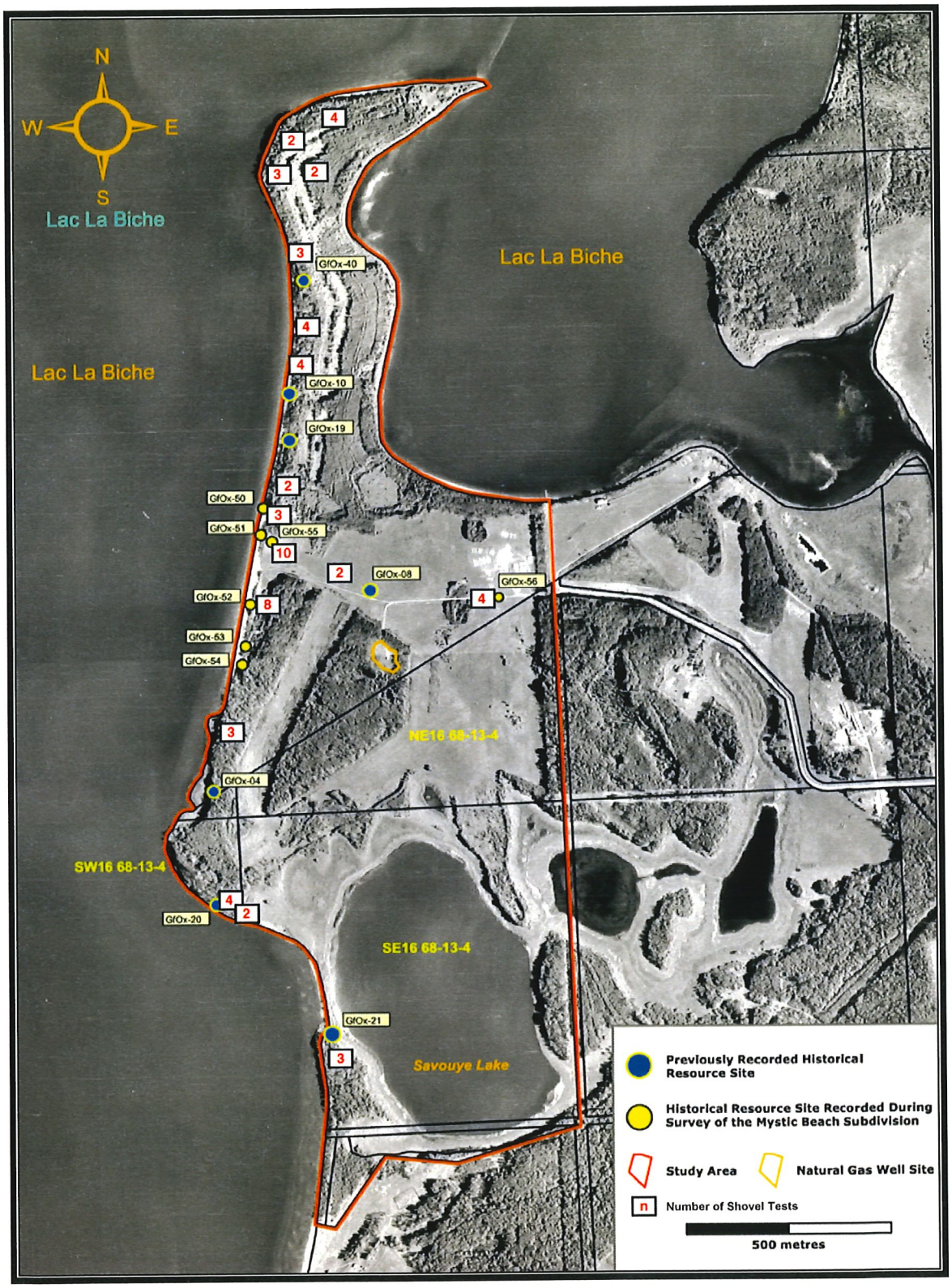


Figure 12. Photomosaic showing shovel test locations and the locations of the previously recorded and newly located Historical Resources sites found within the study area.

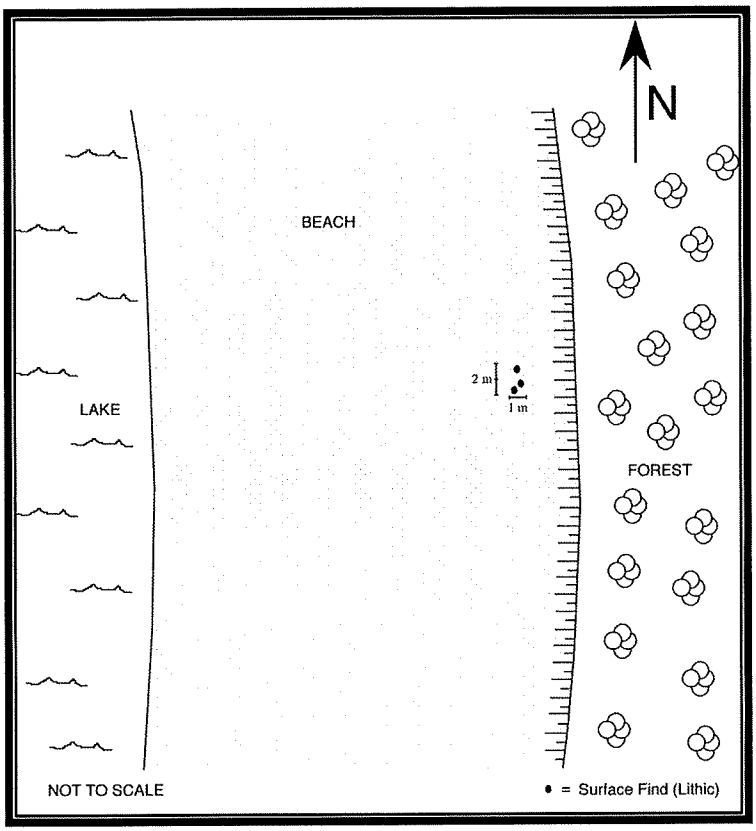


Figure 13. Sketch map of GfOx-4.

Photograph 1. View to the north showing the location of GfOx-4.

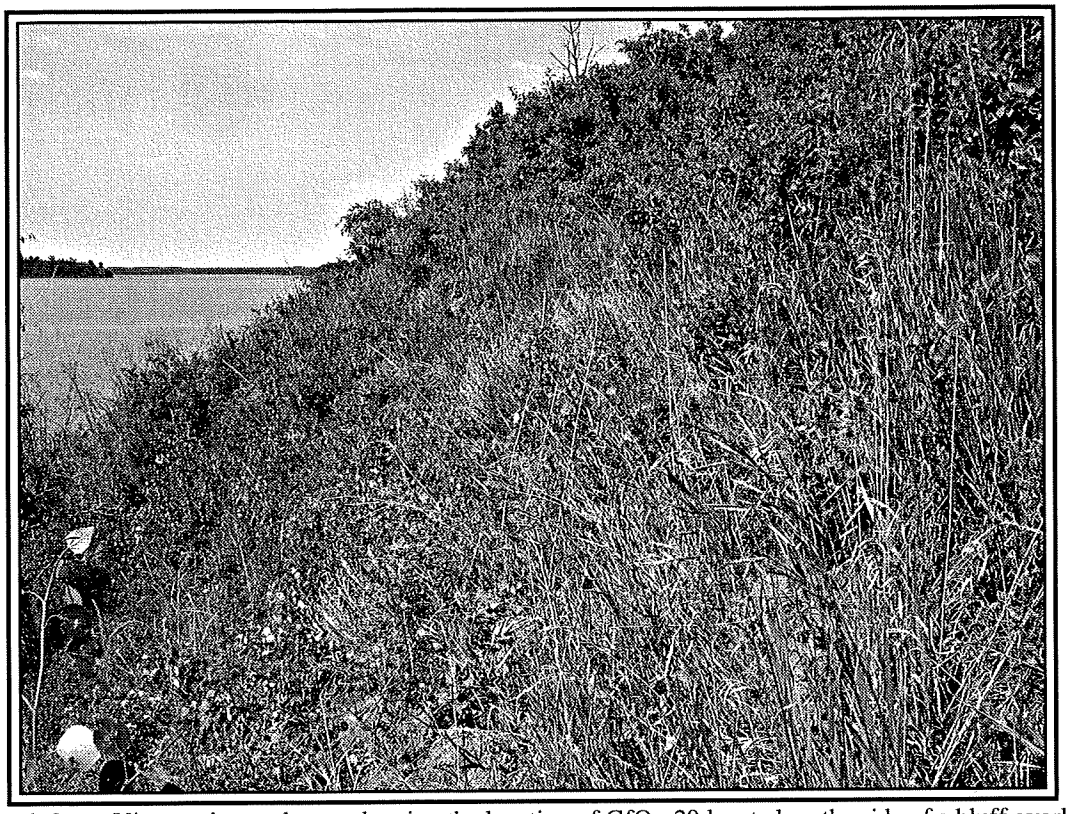
The beach is covered with soft sand that is easily disturbed, and a low bank cut is present along the forest edge, and these provided excellent surface and subsurface exposures. Since the site area is disturbed beach sand and the adjacent forested area was hummocky, broken, and uneven, no shovel tests were excavated at GfOx-4.

The found artifacts could not be ascribed to any particular cultural group, or specific chronological period. No cultural materials were found to be present in the undisturbed sediments in the cut by the forest edge. Beyond the presence of the located artifacts, the information potential offered by this site is considered to be minimal. No further assessment work appears warranted for this site.

GfOx-20

In 1975 E.J. McCullough recorded a surface lithic scatter consisting of a total of 8 flakes and 1 biface that were observed and collected from an exposure on a high bluff that overlooks Lac La Biche, approximately 25 meters below to the southwest (Figure 12 and McCullough, 1975: Site Form on file with *Alberta Community Development*).

During the 2004 survey GfOx-20 was relocated and one core and two core reduction flakes were identified and collected from the exposed cut near the top of the bluff (Photograph 2; Figures 12 and 14; see Site Update Form in Appendix I; and Artifact Catalogue in Appendix II). The terrain to the northeast of bluff's top edge is characterized by relatively flat, well-drained topography. Because all of the identified artifacts were found in the steeply-sloped side cut below the bluff's top edge, it is assumed that these cultural materials were originally located on top of the bluff, and have since become situated in the side cut due to natural processes of erosion and slumping.



Photograph 2. View to the northwest showing the location of GfOx-20 located on the side of a bluff overlooking the lake.

Four shovel tests were excavated in the flat area on top of the bluff which revealed a 3 centimetre litter mat on top of a 18 centimetre thick layer of brown-grey silty loam which in turn overlay light grey clayey silt. No buried soils or cultural materials were found in the shovel tests.

The found artifacts could not be ascribed to any particular cultural group, or specific chronological period. No cultural materials were found to be present in in the shovel tests on the top of the bluff. Beyond the presence of the located artifacts, the information potential offered by this site is considered to be minimal. No further assessment work appears warranted for this site.

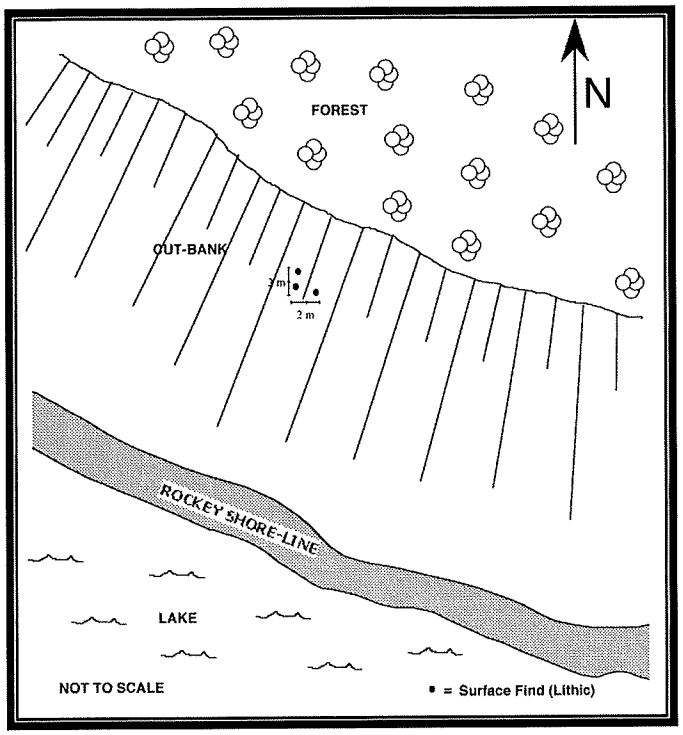


Figure 14. Sketch map of GfOx-20.

GfOx-40

In 1975 E.J. McCullough recorded a historic burial site (GfOx-40) consisting of three graves that are located on a large knoll just east of the eastern shoreline of Lac La Biche (Figure 12). McCullough describes a local "rumour" that three individuals were struck by lightening at the site location and then were buried there (McCullough, 1975: Site Form on file with *Alberta Community Development*). Gail Morin's *Metis Families A Genealogical Compendium Vol. 2* refers to two specific individuals, Absalom Desjarlais (born 1879) and Alfred Desjarlais (born 1883), who were both struck by lightening and killed in 1898 near Owl River (Morin, 2001). No reference to a third individual being struck by lightening near Owl River on this date was found.

Mr. Michel Maccagno, the current land owner, reported that he had visited the burials decades earlier when he was a child, and that the graves were surrounded by a barb wire fence enclosure.

During the 2004 survey, the fence posts and barbed wire were found lying on

the ground surface on the edge of a large knoll near the downslope to the lake which is approximately 10 meters below and to the west (Photograph 3; see Site Update Form in Appendix I; and Artifact Catalogue in Appendix II). Based on the position of the barb wire and the three posts that were found, it was estimated that the enclosure would have measured approximately 8 metres E-W by 5 metres N-S when it was constructed (see Figure 15). No visible depressions or mounds were observed to indicate individual burials within the area encompassed by the enclosure.

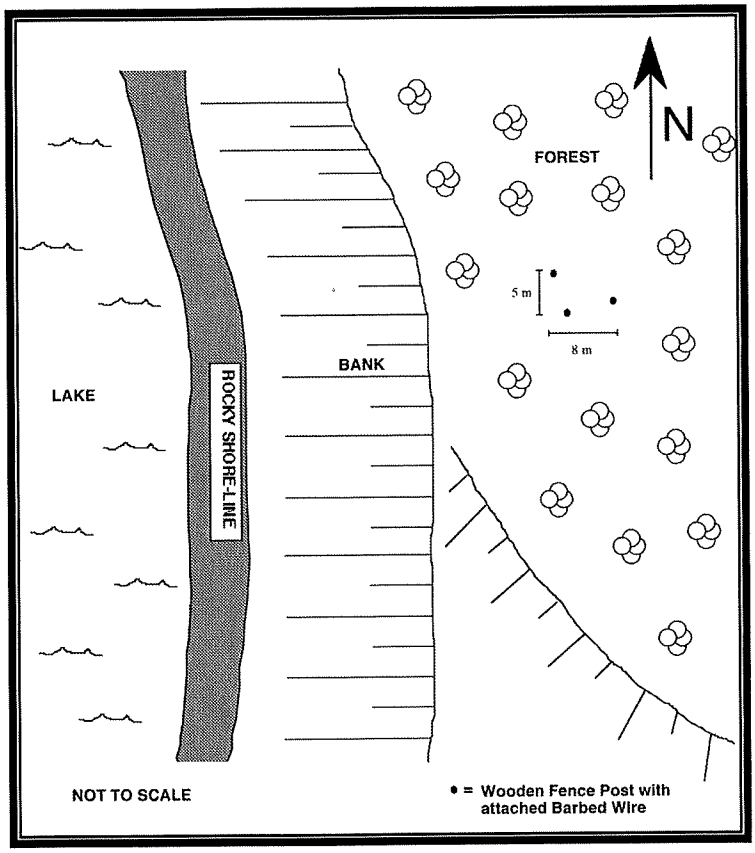


Figure 15. Sketch map of GfOx-40.

The site area was flagged with surveyor's flagging tape (Photograph 4) and the location was recorded using a hand held GPS unit. The developer was aware of the presence of the burials, and the graves were slated to be protected from disturbance and no development will take place at this location. Further assessment work is not recommended for GfOx-40.

Photograph 3. Photograph showing one of the posts with barb wire attached that formed the surround for the gravesite.

Photograph 4. Buffering the grave site with surveyor's tape.

4.2.2 Newly Recorded Historical Resources Sites

GfOx-50

GfOx-50 is an isolated find, consisting of one broken quartzite flake which was found by the shoreline of Lac La Biche (Figures 12 and 16; Photograph 5; Site Form in Appendix I; and Artifact Catalogue in Appendix II). The site area is situated on a sandy beach (Photograph 5) that extends approximately 15 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is relatively flat and well-drained.

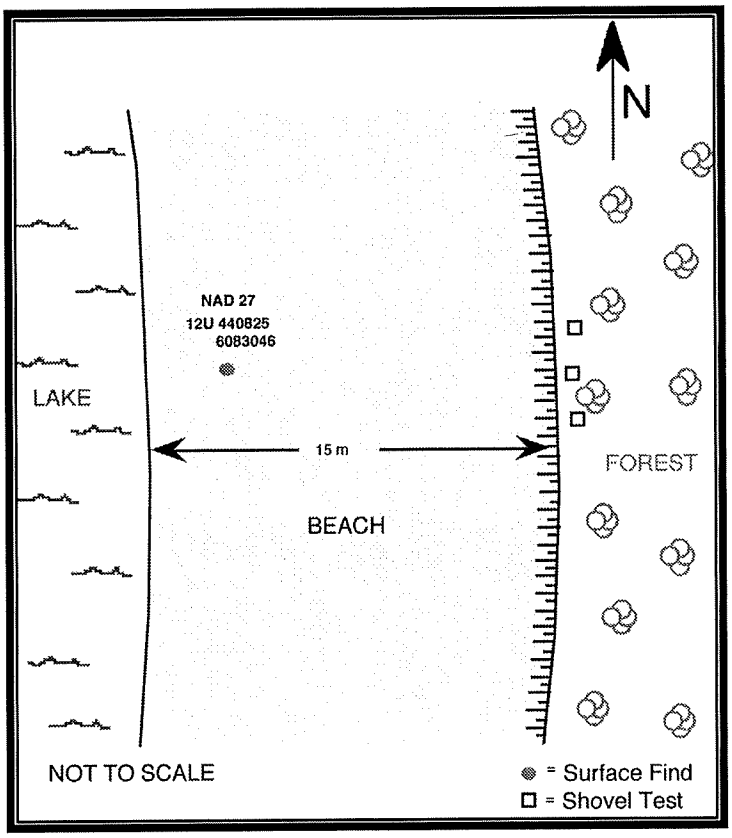
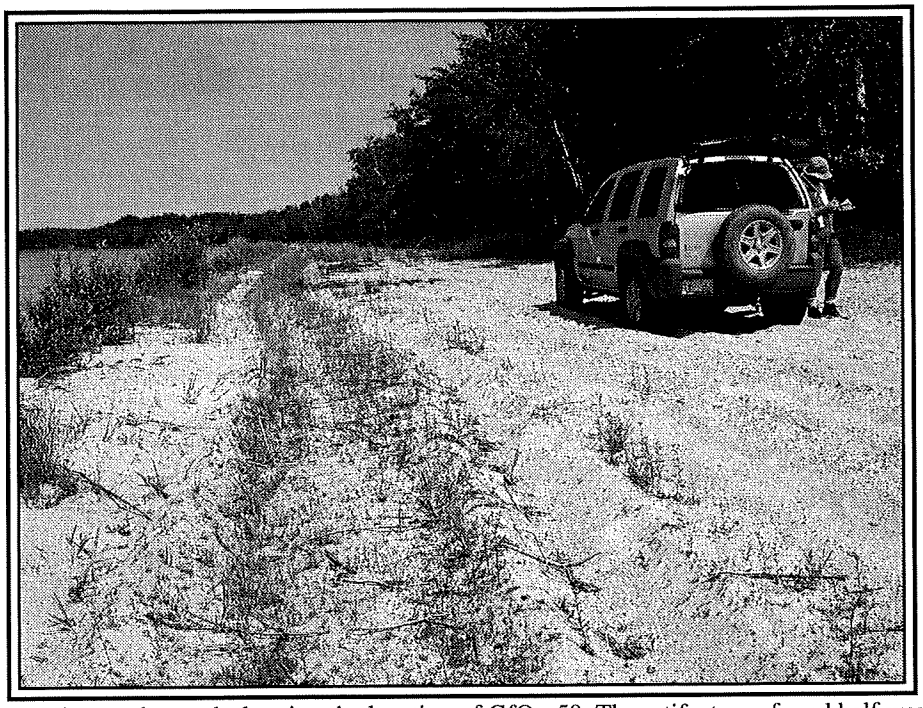


Figure 16. Sketch map of GfOx-50.

Three shovel tests were excavated in the undisturbed flat area immediately east of the low bank, which revealed a 5 centimetre litter mat overlaying dark brown sandy silt with sparse golf-ball size rounded gravels. No buried soils or cultural materials were found in the shovel tests.

No further work appears warranted at this site.



Photograph 5. View to the north showing the location of GfOx-50. The artifact was found half way between the Jeep and the lake shore.

GfOx-51

GfOx-51 is an isolated find, consisting of one quartzite core fragment found along the eastern shoreline of Lac La Biche (Figures 12 and 17; Photographs 6 and 7; Site Form in Appendix I; and Artifact Catalogue in Appendix II).

The site area is situated on a sandy beach that extends approximately 8 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is forested, hummocky, broken, and uneven.

The beach itself has been previously disturbed and, along with the low bank cut, provided much surface exposure. In addition, the site area lacks any topographical characteristics that would normally indicate potential for the presence of undisturbed sediments. Therefore no shovel tests were excavated in the vicinity of GfOx-51.

No further work appears warranted at this site.

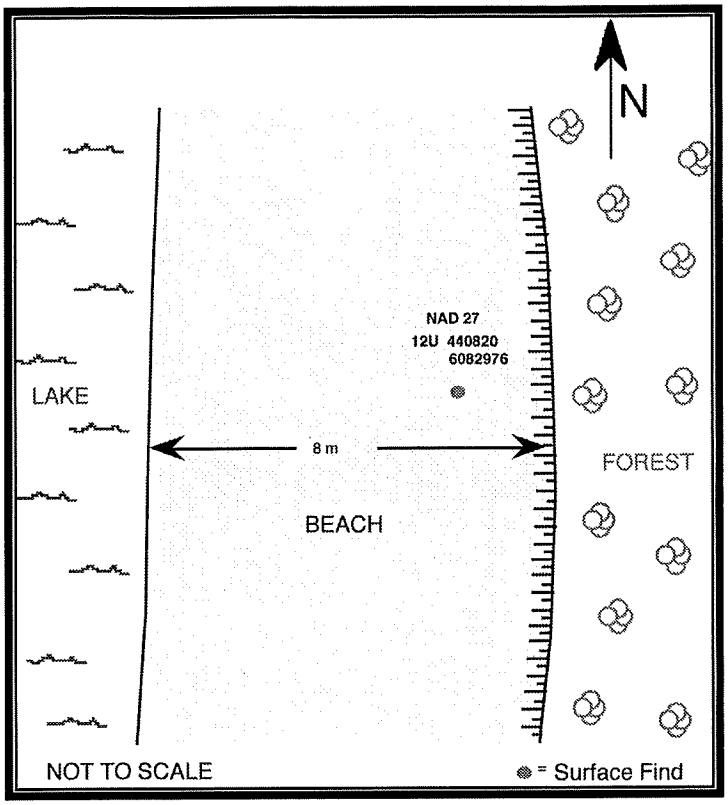
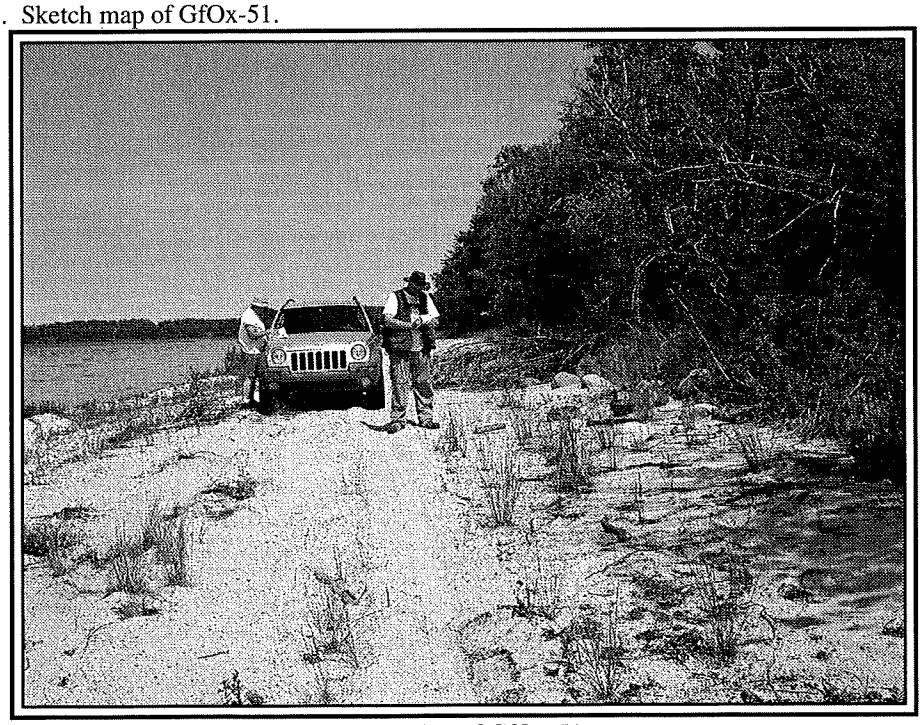
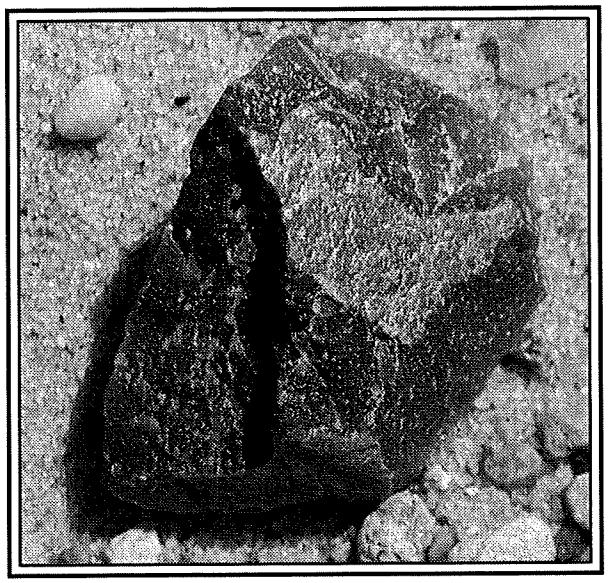


Figure 17. Sketch map of GfOx-51.



Photograph 6. View to the north showing the location of GfOx-51.



Photograph 7. Quartzite core fragment found at GfOx-51.

GfOx-52

GfOx-52 is a prehistoric surface scatter, consisting of a core reduction flake and one very weathered and rounded projectile point base that were found along the eastern shoreline of Lac La Biche (Figures 12 and 18; Photographs 8 and 9; Site Form in Appendix I; and Artifact Catalogue in Appendix II).

The site area is situated on a sandy beach that extends approximately 30 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is relatively flat, well-drained and appears relatively undisturbed.

Eight shovel tests were excavated in the undisturbed cleared flat area immediately east of the low bank, which revealed a 5 centimetre litter mat overlaying 'salt and pepper' colored silty sand. No buried soils or cultural materials were found in the shovel tests.

No further work appears warranted at this site.

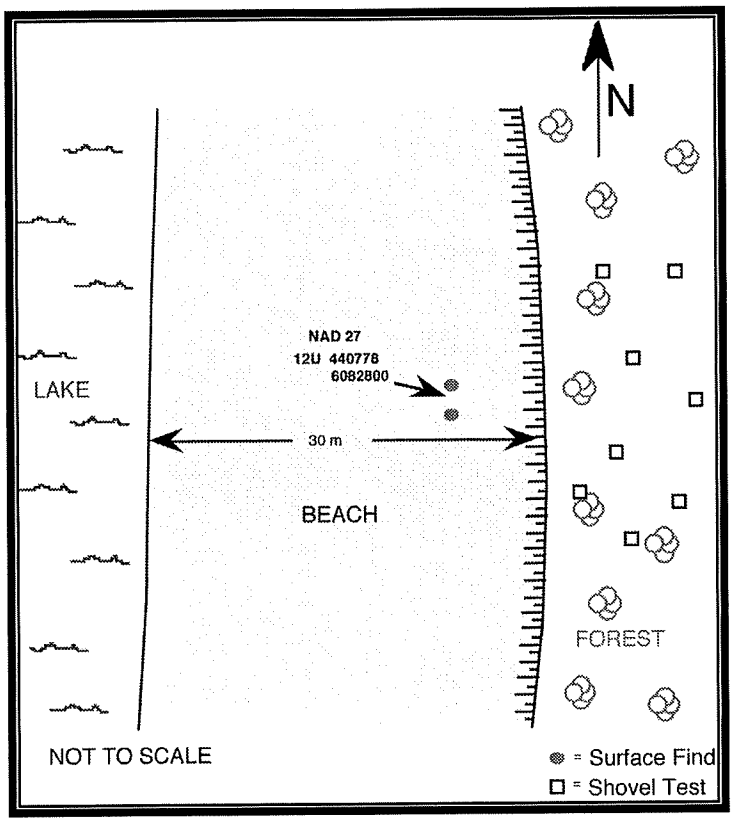
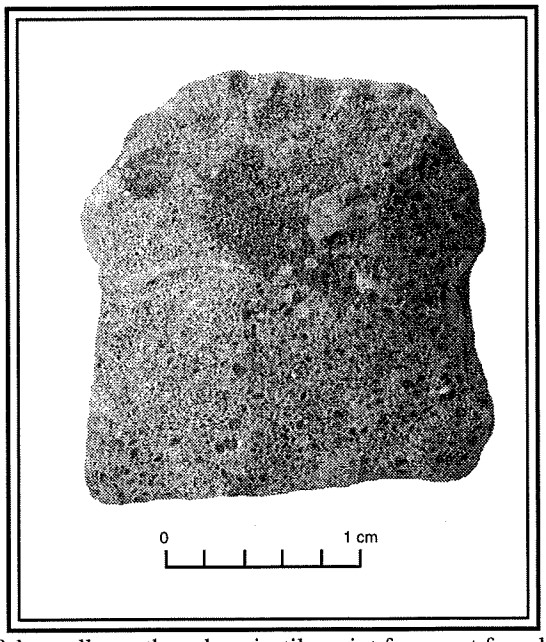


Figure 18. Sketch map of GfOx-52.

Photograph 8. View to the south showing the location of GfOx-52.



Photograph 9. Photograph of the well-weathered projectile point fragment found at GfOx-52.

GfOx-53

GfOx-53 is a prehistoric surface scatter, consisting of two core reduction flakes that were found along the eastern shoreline of Lac La Biche (Figures 12 and 19; Photograph 10; Site Form in Appendix I; and Artifact Catalogue in Appendix II).

The site area is situated on a sandy beach that extends approximately 25 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low ridge. The terrain to the east of this low ridge is low-lying and very poorly-drained.

The beach itself has been previously disturbed and, along with a cut along the low ridge, provided much surface exposure. In addition, the site area lacks any topographical characteristics that would normally indicate potential for human habitation or the presence of undisturbed sediments. Therefore no shovel tests were excavated in the vicinity of GfOx-53.

No further work appears warranted at this site.

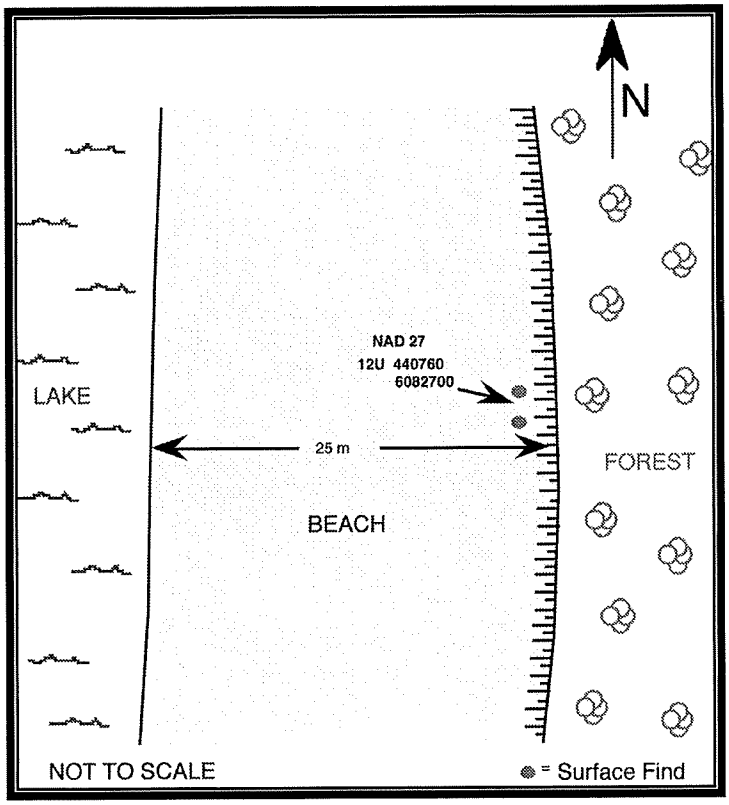
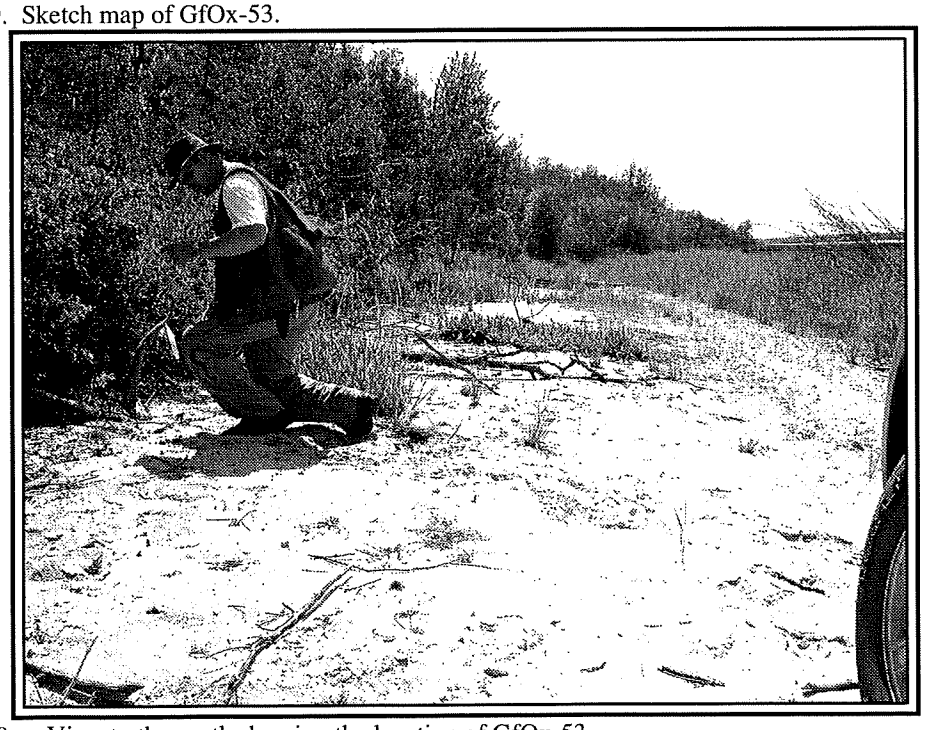


Figure 19. Sketch map of GfOx-53.



Photograph 10. View to the south showing the location of GfOx-53.

GfOx-54

GfOx-54 is an isolated find, consisting of quartzite scraper found along the eastern shoreline of Lac La Biche (Figures 12 and 20; Photographs 11 and 12; Site Form in Appendix I; and Artifact Catalogue in Appendix II).

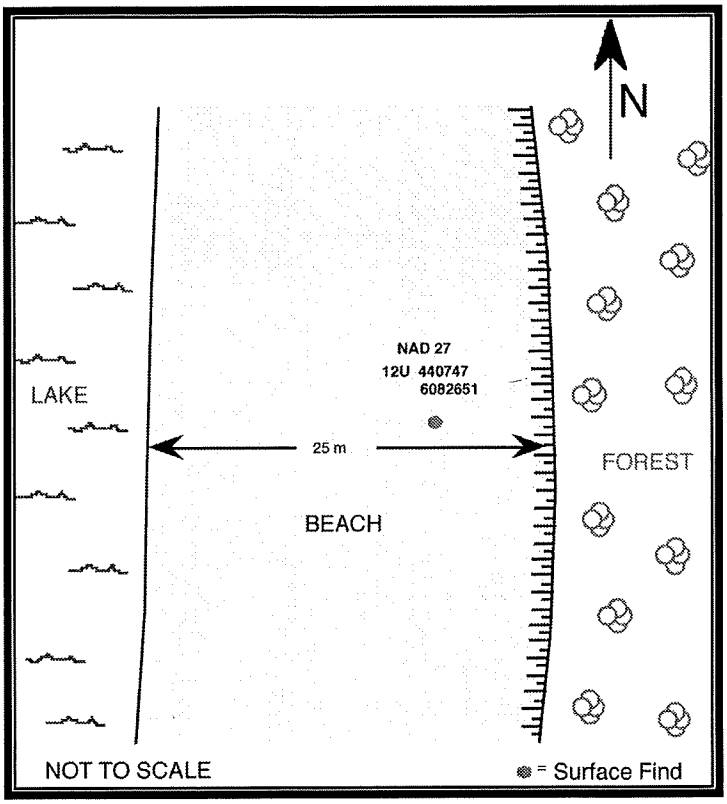
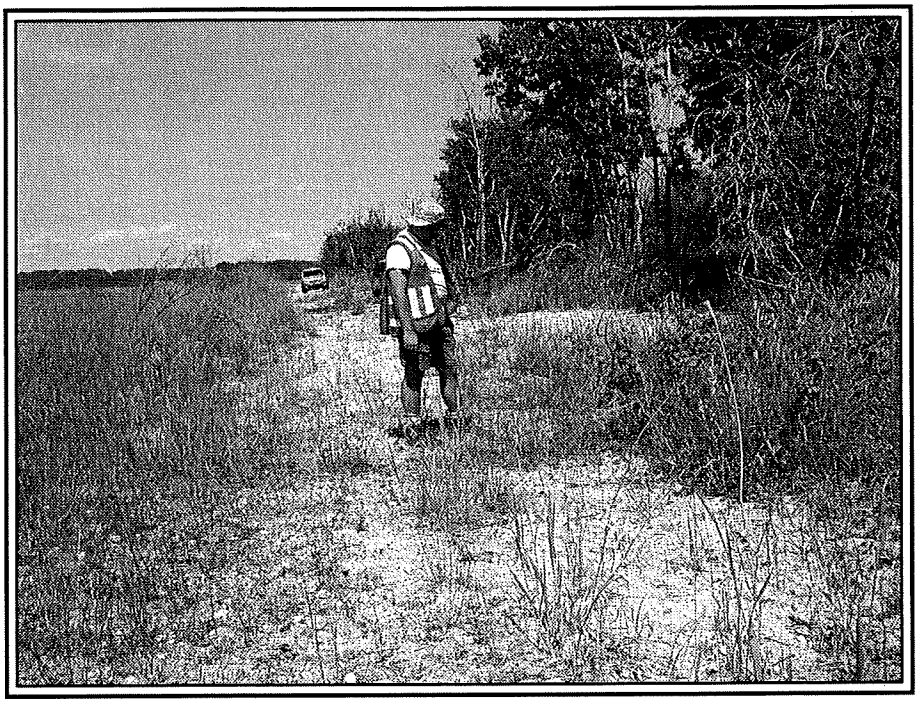
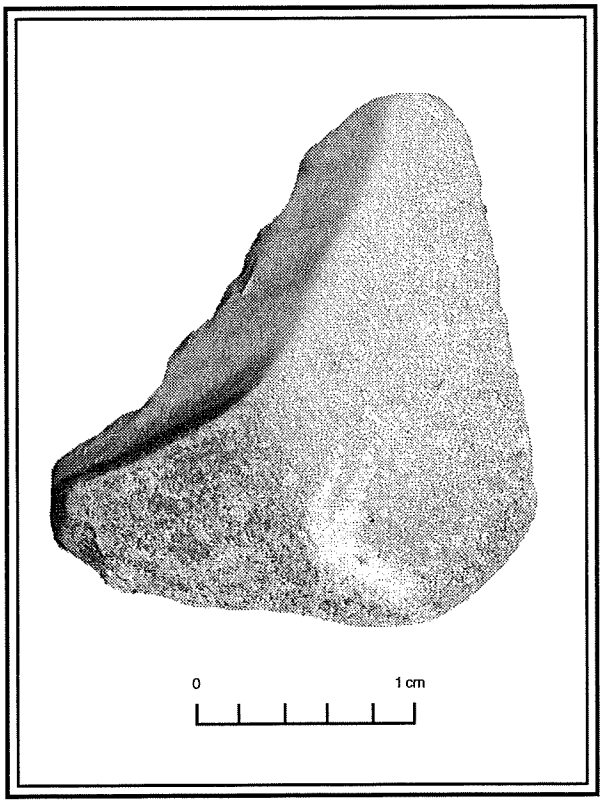


Figure 20. Sketch map of GfOx-54.

The site area is situated on a sandy beach that extends approximately 25 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is forested, hummocky, broken, and uneven.



Photograph 11. View to the north showing the location of GfOx-54.



Photograph 12. Quartzite scraper found at GfOx-54.

The beach itself has been previously disturbed and, along with the low bank cut, provided much surface exposure. In addition, the site area lacks any

topographical characteristics that would normally indicate potential for the presence of undisturbed sediments. Therefore no shovel tests were excavated in the vicinity of GfOx-54.

No further work appears warranted at this site.

GfOx-55

GfOx-55 is a surface scatter composed of both prehistoric and historic components identified atop a high knoll in a cultivated field that lies adjacent to the eastern shoreline of Lac La Biche (Figures 12, 21, and 22; Photograph 13; Site Form in Appendix I; and Artifact Catalogue in Appendix II). The prehistoric archaeological materials consist entirely of lithic artifacts including five core reduction flakes, three broken flakes, one core, one bifacial core, one core fragment, two core shatter, one angular shatter, one split pebble, one scraper (Photograph 14), and one projectile point fragment (Photograph 15).

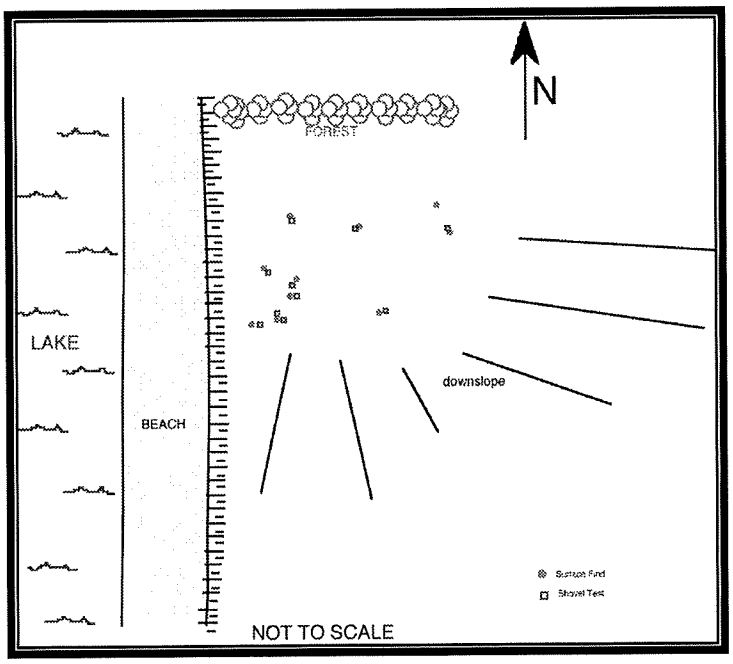


Figure 21. Sketch map of GfOx-55.

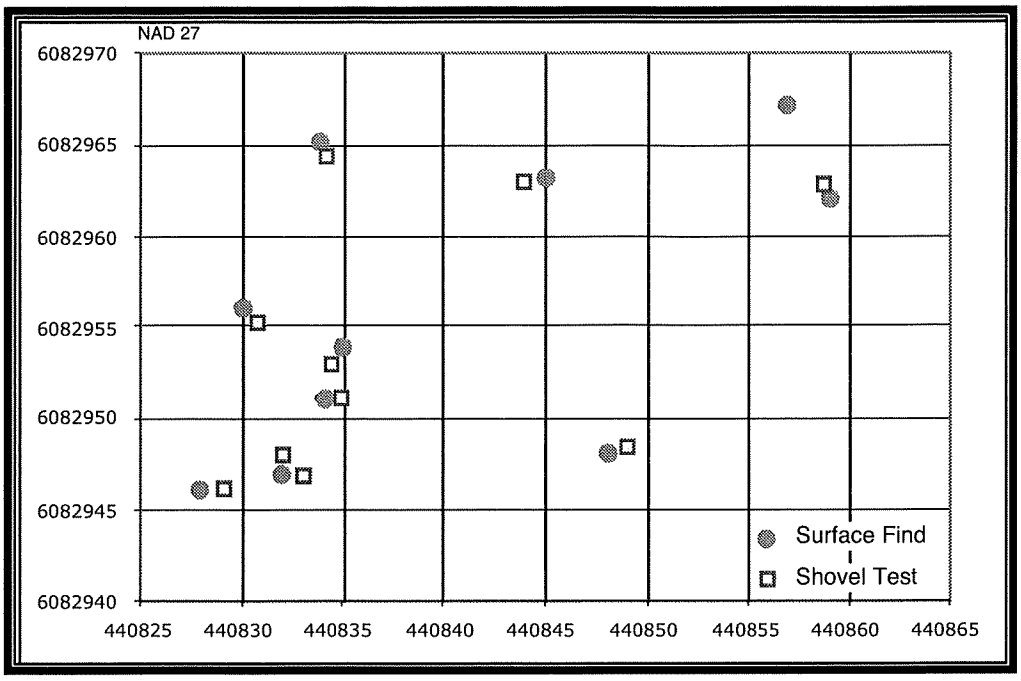


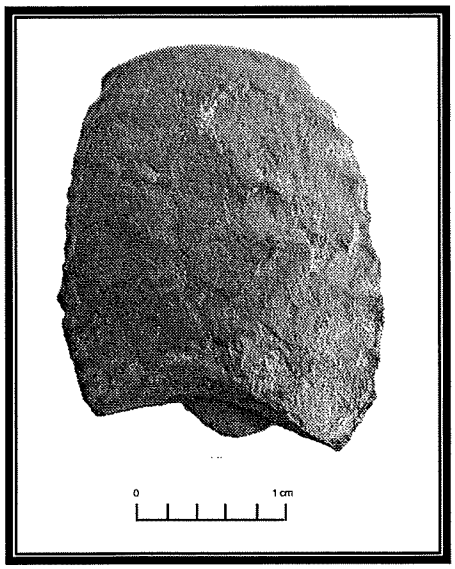
Figure 22. UTM grid map of GfOx-55 showing the shovel test locations by the prehistoric surface finds.

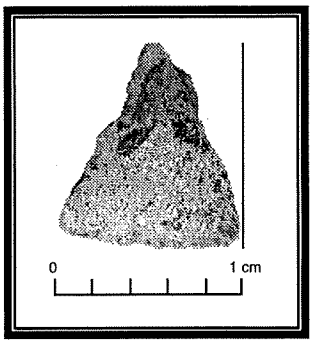
The historic component of GfOx-55 consists of an assortment of historic cultural items including unidentifiable glass bottle fragments, unidentifiable modern ceramic fragments, as well as metal, plastic, leather and bone fragments. These located items suggest that the historic component of GfOx-55 is not from the early historic period, but rather from the middle to late part of the twentieth century.

The site area is situated on a high knoll in a cultivated field overlooking Lac La Biche approximately 50 meters to the west (Photograph 13). The terrain to the east of the knoll top slopes down gently to the east at approximately 5 – 10°, while the terrain to the west of the knoll top slopes down steeply to the west at approximately 40 - 45 ° toward the eastern shoreline of Lac La Biche.

The entire site area has been previously disturbed from agricultural cultivation which provided excellent surface exposure. Ten shovel tests were excavated in the site area which revealed 12 centimetres of disturbed grey silt (plough zone) overlaying brown clayey silt. No buried soils or cultural materials were found in the shovel tests. No further work appears warranted at this site.

Photograph 13. View to the north showing the location of GfOx-55.





Photographs 14 and 15. Siltstone scraper (on left) and quartzite projectile point tip (on right) found at GfOx-55.

GfOx-56

GfOx-56 is a prehistoric surface scatter, consisting of two core reduction flakes that were found along a access road cut approximately 575 meters east of the eastern shoreline of Lac La Biche (Figures 12 and 23; Photograph 16; Site Form in Appendix I; and Artifact Catalogue in Appendix II).

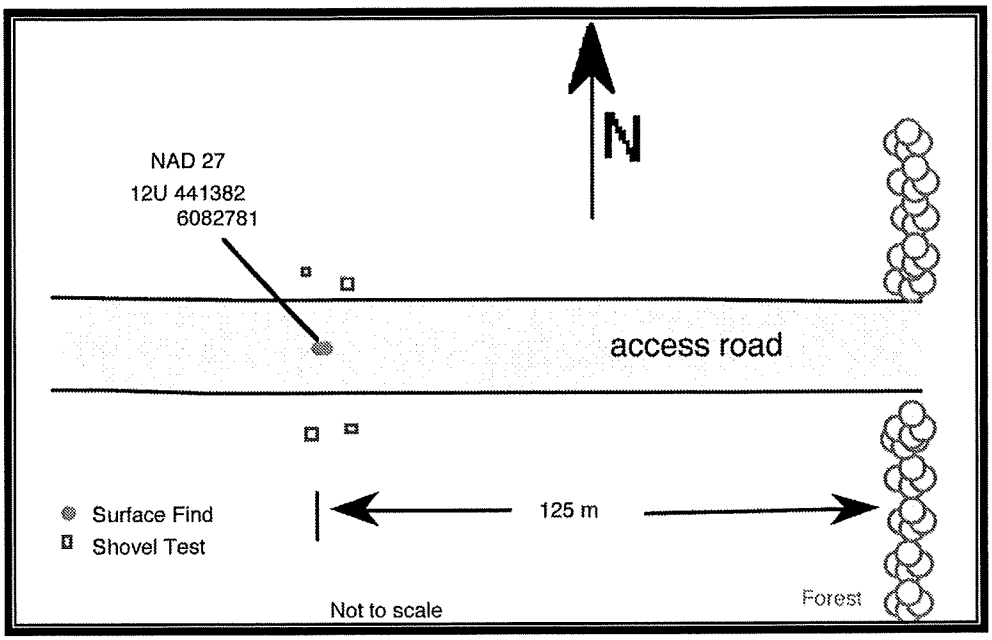


Figure 23. Sketch map of GfOx-56.

The site area is situated on a dirt access road that trends east-west, bordered on both the north and south by cultivated fields. The general topography of the site area is characterized by gently rolling terrain void of any prominent landforms.

The road cut itself revealed very high levels of disturbance and, along with the cultivated fields provided much surface exposure. Four shovel tests were excavated in the vicinity of GfOx-56 in the cultivated field to determine if there were any undisturbed sediments below the plough zone (Figure 23). The shovel tests showed approximately 12 to 18 centimetres of disturbed grey silt (plough zone) overlaying brown clayey silt. No buried soils or cultural materials were found in the shovel tests.

No further work appears warranted at this site.

Photograph 16. Ryan Spady standing by the findspot at GfOx-56.

5.0 RECOMMENDATIONS

Seven new sites (GfOx-50, GfOx-51, GfOx-52, GfOx-53, GfOx-54, GfOx-55, and GfOx-56) was found, and seven previously recorded sites (GfOx-4, GfOx-8, GfOx-10, GfOx-19, GfOx-20, GfOx-21 and GfOx-40) were revisited during the survey of the proposed development (Figure 12). Of these seven previously recorded sites only three (GfOx-4, GfOx-20 and GfOx-40) were relocated, and additional archaeological materials were collected from the two Lithic Surface Scatters (GfOx-4 and GfOx-20). Management recommendations are provided in the following.

GfOx-4

GfOx-4 is a surface scatter found on a disturbed beach surface. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-4.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-20

GfOx-20 is a surface scatter found on a disturbed beach surface. No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-20.

This recommendation is subject to approval by *Alberta Community*

Development.

GfOx-40

GfOx-40 is a historic burial site consisting of 3 graves dating to 1898.

Fence posts and barbed wire which formed a surround for the gravesite were located and the site area was flagged for avoidance.

Further assessment work is not recommended for GfOx-40 if it is avoided and no development occurs at this location.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-50

GfOx-50 is an isolated surface find consisting of one lithic artifact found on a disturbed beach surface.

No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifact itself, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-50.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-51

GfOx-51 is an isolated surface find consisting of one lithic artifact found on a disturbed beach surface.

The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifact itself, the information potential

offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-51.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-52

GfOx-52 is a surface scatter consisting of two lithic artifacts found on a disturbed beach surface.

No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-52.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-53

GfOx-53 is a surface scatter consisting of two lithic artifacts found on a disturbed beach surface.

The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-53.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-54

GfOx-54 is an isolated surface find consisting of one lithic artifact found on a disturbed beach surface.

The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-54.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-55

GfOx-55 is a surface scatter consisting of both prehistoric and historic components.

The cultural materials found at the site include 17 prehistoric lithic artifacts and an assortment of modern historic cultural items. All the prehistoric lithic artifacts were collected, but none of the historic items was collected because none were considered unique or significant.

No additional cultural materials were found to be present in the undisturbed sediments in shovel tests at the site. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-55.

This recommendation is subject to approval by *Alberta Community Development.*

GfOx-56

GfOx-56 is a surface scatter consisting of two lithic artifacts found on a dirt road.

The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

Further assessment work is not recommended for GfOx-56.

This recommendation is subject to approval by *Alberta Community Development.*

6.0 REFERENCES

Achuff, Peter L.

1992 Natural Regions, Subregions and Natural History Themes of Alberta: A Classification for Protected Ares Management. Prepared for Parks Services, Alberta Environmental Protection. Updated and Revised December 1994.

Andrefsky, William (ed)

2001 *Lithic Debitage – Context, Form, Meaning,* University of Utah Press.

Archaeological Survey of Alberta

1989 Guidelines for the Archaeological Permit Holders in Alberta. *Archaeological Survey of Alberta*, Historical Resources Division, Alberta Culture and Multiculturalism, Edmonton, Alberta.

Ball, Bruce F.

1986 Site Classification and Prehistoric Settlement Systems in the Upper Athabasca River Valley. In *Occasional Paper No. 30, Eastern Slopes Prehistory*: Selected Papers, edited by Brian Ronaghan. Archaeological Survey of Alberta. Edmonton.

Beaudoin, Alwynne B., Milt Wright and Brian Ronaghan

1996 Late Quaternary Landscape History and Archaeology in the 'Ice-Free Corridor': Some Recent Results from Alberta. *Quaternary International*, Vol. 32:113-126.

Boag, Franca E.

1989 Final Report: Project P.A.S.T. Report on Artifacts Collections of Alberta 1988-1989. Ms. on file, Archaeological Survey of Alberta. Edmonton, Alberta.

Brink, John W. and Robert J. Dawe

1986 An Introduction to the Archaeology of the Grande Cache Region in the North Alberta Rocky Mountains. In *Occasional Paper No. 30*, Eastern Slopes Prehistory: Selected Papers, edited by Brian Ronaghan. Archaeological Survey of Alberta. Edmonton.

Ellis, Chris J. and D.B. Deller

1990 Paleo-Indians. In *The Archaeology of Southern Ontario to A.D. 1650*, edited by C. J. Ellis and N. Ferris. Occasional Publication of the London a Chapter, OAS Number 5. London, Ontario.

Fedirchuck McCullough & Associates Ltd. 2001

2001 Historical Resources Impact Assessment TransAlta Utilities Corporation TransAlta Centennial Project, Permit 2001-131 Final Report

Forbis, R.G.

1982 One View of Plains Archaeology in Canada: The Past Decade. *Canadian Journal of Archaeology* 6:157-166.

Kehoe, T.F.

1966 The Small Side-notched Point System of the Northern Plains. *American Antiquity* 31:827-841.

1973 *The Gull Lake Site: A Prehistoric Bison Drive in Southwestern Saskatchewan.* Milwaukee Public Museum Publications in Anthropology and History 1. Milwaukee.

Kehoe, T.F. and B.A. McCorquodale

1961 The Avonlea Point: Horizon Marker for the Northwestern Plains. *Plains Anthropologist* 6:179-188.

LeBlanc, R. J. and Milt J. Wright

1990 Macroblade Technology in the Peace River Region of Northwestern Alberta. *Canadian Journal of Archaeology* 74: 1-11.

Murphy, Brent A.

2003 Historical Resource Mitigation Westminster Glen County Residential Subdivision, NW 1/4 Sec. 12-26-03-W5M. Permit 2003-045 Final Report.

Province of Alberta

1987 *Historical Resources Act.* Queen's Printer of Alberta, Edmonton, Alberta.

Spurling, Brian E. and Ball, Bruce F.

1981 On Some Distributions of the Oxbow 'Complex'. *Canadian Journal of Archaeology.* 5: 89-101.

Strong, W.L. and K.R. Leggat

1981 Ecoregions of Alberta. Alberta Energy and Natural Resources. Edmonton.

Strong, W.L.

1992 *Ecoregions of Alberta.* Alberta Forestry, Lands and Wildlife, Edmonton. Technical Report number T/245.

Tyrrell Museum of Paleontology

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

Van Dyke, S. and S. Stewart

1985 Hawkwood Site (EgPm-179): a multicomponent prehistoric campsite on Nose Hill. *Archaeological Survey of Alberta Manuscript Series No. 7.* Edmonton.

Vickers, J. Rod

1986 Alberta Plains Prehistory: A Review of Current Interpretations. *Archaeological Survey of Alberta Occasional Papers 27.* Edmonton.

Walker, E. G.

1980 The Gowan Site: An Early Archaic Site on the Northern Plains. University of Texas Ph.D. dissertation.

1987 The Gowan Site: Cultural Adaptation on the Northern Plains During the Altithermal Period. In *Man and the Mid-Holocene Climatic Optimum*, eds. N. A. McKinnon and G. S. L. Stuart, 111 - 22. Calgary: University of Calgary Archaeological Association.

Wormington, H.M. and Forbis, R. G.

1965 Introduction to the Archaeology of Alberta. Canada. Proceedings No. 11, Museum of Natural History, Denver.

APPENDIX I: ARCHAEOLOGICAL SITE INVENTORY DATA FORMS

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-4

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 11 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440659 To ..... Northing 6082339 To .....
U.T.M. NAD 83 12U VR Easting 440593 To ..... Northing 6082556 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 600 metres southward along the beach, and the site is located on beach in small cove before point, approximately 30 metres from the water's edge and approximately 5 metres from the high water mark by the edge of the forest.

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

The site was originally recorded as being located on the beach in a small cove. East of the beach the terrain is hummocky, broken, and uneven covered with dense aspen forest. Some side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type
☐ isolated find
☒ scatter (<10)
☐ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☐ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious .....

13. Features (frequencies if possible)
..... stone circle
..... cairn
..... stone arc
..... stone line
..... drive lane
..... medicine wheel
..... effigy
..... pictograph
..... petroglyph
..... hearth
..... pit
..... mound
..... depression
..... cabin
..... house
..... structure
..... foundation
..... cellar
..... dump
..... fence

Other Features:
....

Borden No. GfOx-4

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of 41 lithic artifacts. The site was relocated during the June 30/04 visit and an additional 3 lithic artifacts were identified and collected from the site area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
3	3	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

1 split pebble and 2 broken flakes were identified and collected. All materials are quartzite.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. _____

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... _____
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) _____

21. Radiocarbon Dates _____

Borden No. GfOx-4

Permit No. 2004-240

22. Estimated Dimensions N-S 2 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ..... No. of shovel tests
☒ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 22, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

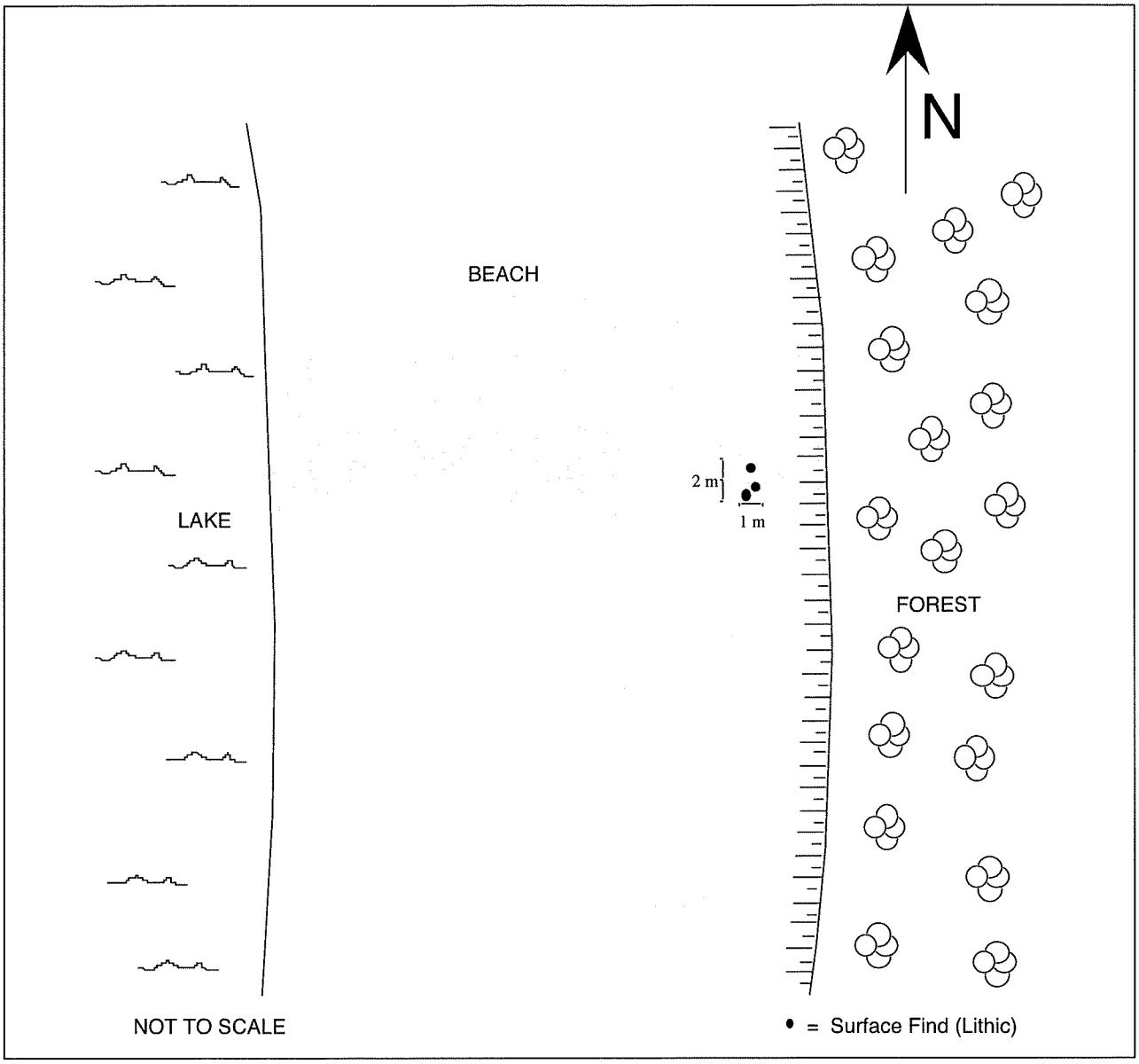
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

Borden No. GfOx-4

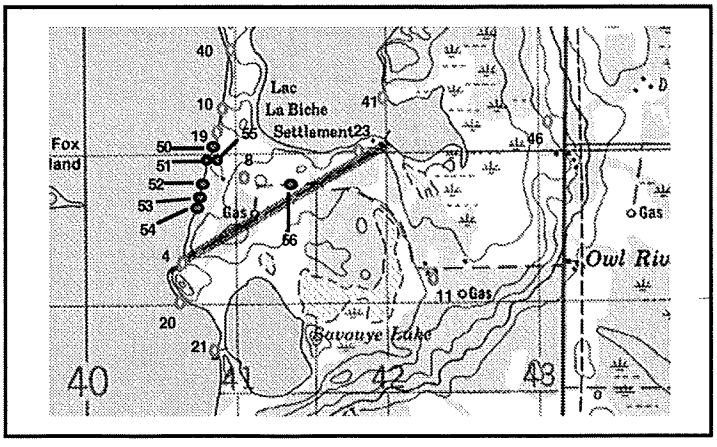
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440659 To Northing 6082339 To

U.T.M. NAD 83 12U VR Easting 440593 To Northing 6082556 To

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-8

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 15 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440952 To ..... Northing 6082754 To .....
U.T.M. NAD 83 12U VR Easting 440886 To ..... Northing 6082971 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 550 metres toward the shoreline of Lac La Biche. The site is located in a cultivated field approximately 100 metres north of this point on the farm access trail.

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

The site was originally recorded as being located in a small garden to the left of a farm access trail. Since the time of the site's initial identification, the trails have been rerouted to some degree and the garden no longer exists due to agricultural cultivation of this area. The site was not relocated.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-8

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of less than 10 lithic artifacts; however the site was not relocated during the June 30/04 visit and therefore the site area was not observed and no additional cultural materials were identified.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
		lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

The site was not relocated.

17. Collection Repository ☐ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☐ Yes ☒ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-8

Permit No. 2004-240

22. Estimated Dimensions N-S ..... m, E-W ..... m, Depth ..... m

23. Means of Estimating Dimensions ☐ surface inspection ☐ Other... ..... No. of shovel tests
☐ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the cultivated field area will undoubtedly by disturbed from development of the proposed subdivision structures, roads, and/or recreational areas.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by ..... Date (Y/M/D) .....

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 22, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

The site was originally identified in a cultivated field that has since been routinely disturbed by agricultural activities and associated vehical access. Shovel tests in the field in the general area did not reveal any undisturbed deposits below the plough zone. Further disturbance in the field area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

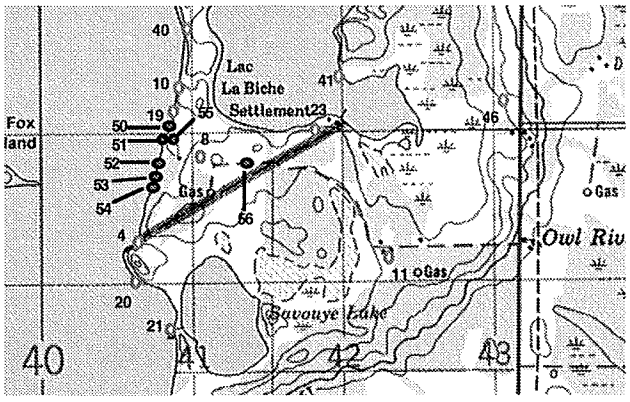
Borden No. GfOx-8

35. Site Map

Permit No. 2004-240

N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440952 To Northing 6082754 To

U.T.M. NAD 83 12U VR Easting 440886 To Northing 6082971 To

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-10
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 2 Section 21 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440800 To ..... Northing 6083300 To .....
U.T.M. NAD 83 12U VR Easting 440734 To ..... Northing 6083517 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 600 metres nothward along the beach, and the site is located approximately 10 metres from the water's edge and approximately 10 metres from the high water mark by the edge of the forest.

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

The site was originally recorded as being located on beach sand. East of the beach the terrain slopes up to the east and is covered by dense aspen forest. The upslope to the general level rises at approximately 10 - 15 degrees and is well-drained and some side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-10

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of less than 10 lithic artifacts; however the site was not relocated during the June 30/04 visit and therefore the site area was not observed and no additional cultural materials were identified.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
.....	.....	projectile points	.....	.....	faunal remains	.....	.....	shell
.....	.....	lithic tools	.....	.....	human remains	.....	.....	metal
.....		lithic debitage	.....	.....	floral remains	.....	.....	glass
.....		bone tools	.....	.....	tephra	.....	.....	other, specify
.....	.....	ceramics		.....	soil samples			.....
.....	.....	fire cracked rock	.....	.....	macrofossils			.....
.....	.....	charcoal	.....	.....	wood			

16. Collection Remarks (formed tools, raw materials,)

The site was not relocated.

17. Collection Repository ☐ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☐ Yes ☒ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-10

Permit No. 2004-240

22. Estimated Dimensions N-S ..... m, E-W ..... m, Depth ..... m

23. Means of Estimating Dimensions ☐ surface inspection ☐ Other... ..... No. of shovel tests
☐ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by ..... Date (Y/M/D) .....

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 22, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

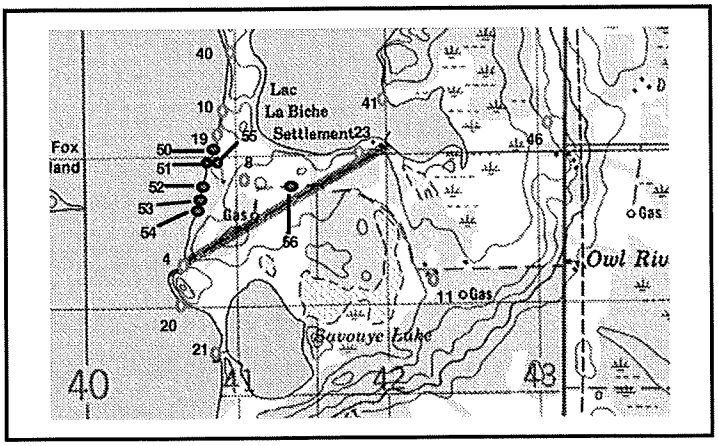
Borden No. GfOx-10

35. Site Map

Permit No. 2004-240

N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440800 To Northing 6083300 To

U.T.M. NAD 83 12U VR Easting 440734 To Northing 6083517 To

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-19
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 2 Section 21 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440866 To ..... Northing 6083034 To .....
U.T.M. NAD 83 12U VR Easting 440800 To ..... Northing 6083251 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go approximatey 450 metres nothward along the beach to the site area . The site is originally recorded as being located directly on the beach surface at this ocation.

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

The site was originally recorded as being located on beach sand. East of the beach the terrain slopes up to the east and is covered by dense aspen forest. The upslope to the general level rises at approximately 10 - 15 degrees and is well-drained and some side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-19

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of less than 10 lithic artifacts; however the site was not relocated during the June 30/04 visit and therefore the site area was not observed and no additional cultural materials were identified.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
		lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

The site was not relocated.

17. Collection Repository ☐ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☐ Yes ☒ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-19

Permit No. 2004-240

22. Estimated Dimensions N-S ..... m, E-W ..... m, Depth ..... m

23. Means of Estimating Dimensions ☐ surface inspection ☐ Other... ..... No. of shovel tests
☐ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by ..... Date (Y/M/D) .....

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

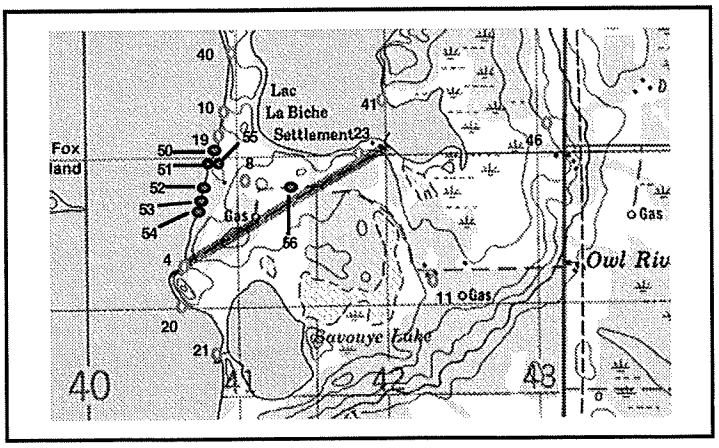
Borden No. GfOx-19

35. Site Map

Permit No. 2004-240

N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440866 To Northing 6083034 To

U.T.M. NAD 83 12U VR Easting 440800 To Northing 6083251 To

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-20

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 6 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440647 To ..... Northing 6082048 To .....
U.T.M. NAD 83 12U VR Easting 440581 To ..... Northing 6082265 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go approximately 1 kilometer southward along the beach, and the site is located on the southwestern cut-bank of a raised point, approximately 30 metres from the water's edge and approximately 10 metres downslope (SW) from the top of the point and edge of the forest.

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

The site was originally recorded as being located on a beach and a high bluff overlooking the lake. During the June 30/04 visit cultural materials were only identified in the cut-bank of the high bluff. East of the bank's top the terrain is relatively flat and covered with dense aspen forest. No prominant beach area was identified at the site location. Many side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type
☐ isolated find
☒ scatter (<10)
☐ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☐ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious .....

13. Features (frequencies if possible)
..... stone circle
..... cairn
..... stone arc
..... stone line
..... drive lane
..... medicine wheel
..... effigy
..... pictograph
..... petroglyph
..... hearth
..... pit
..... mound
..... depression
..... cabin
..... house
..... structure
..... foundation
..... cellar
..... dump
..... fence

Other Features:
....

Borden No. GfOx-20

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of 9 lithic artifacts. The site was relocated during the June 30/04 visit and an additional 3 lithic artifacts were identified and collected from the site area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
3	3	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

1 core reduction flake, 1 broken flake, and 1 core were identified and collected. All materials are quartzite.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-20

Permit No. 2004-240

22. Estimated Dimensions N-S 2 m, E-W 2 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ☒ erosion exposure

4 No. of shovel tests

No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

Regardless of whether the development proceeds, the beach area will undoubtedly continue to erode substantially. It is doubtful that the proposed development will impact the site area do to its general location and the steep nature of the terrain.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) July 2, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) July 2, 2004

29. Tested/assessed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) July 2, 2004

30. Excavated/mitigated by Date (Y/M/D)

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

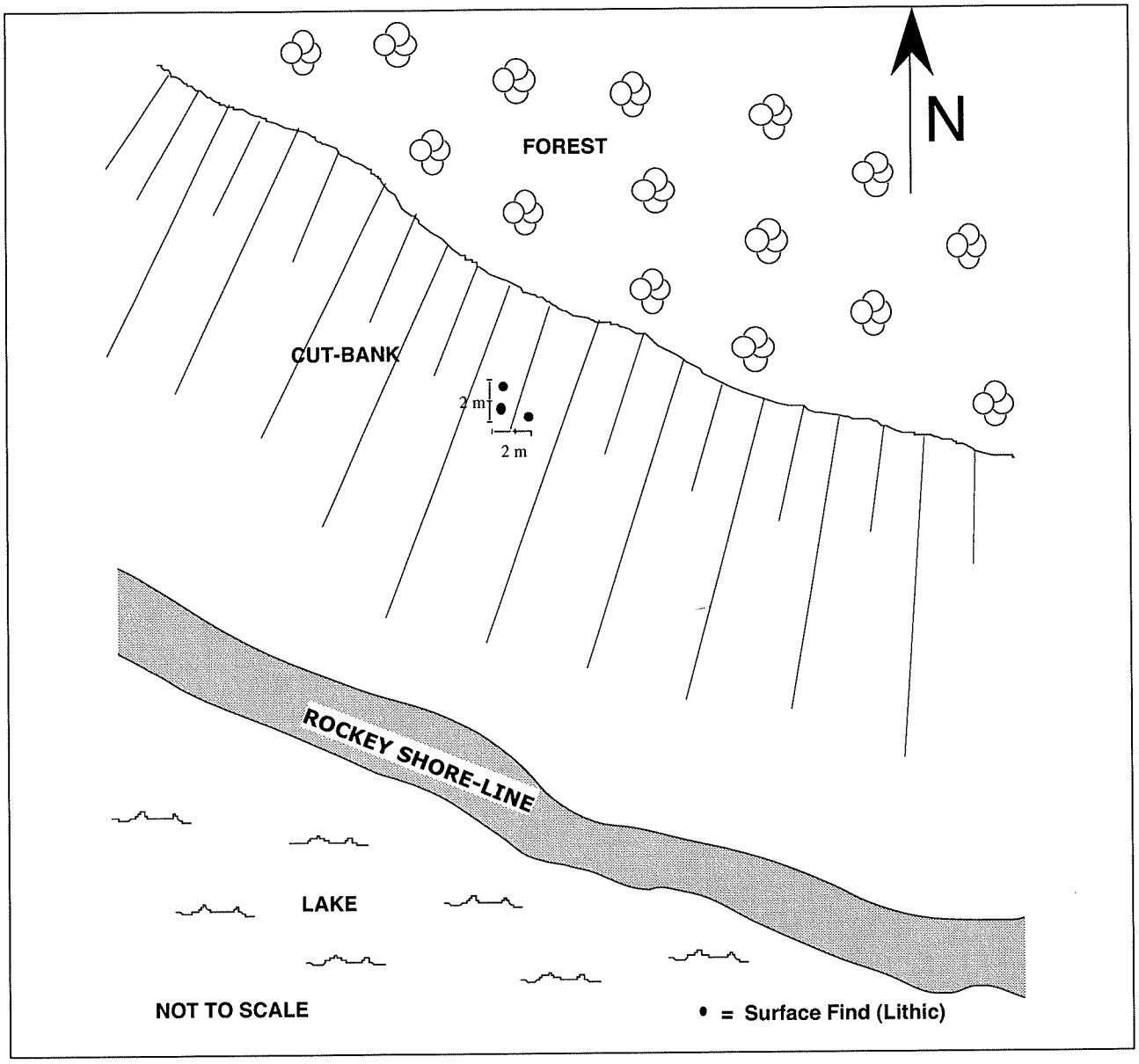
The site was found on a cut-bank that is routinely disturbed by natural erosion.

34. Additional Remarks

Borden No. GfOx-20

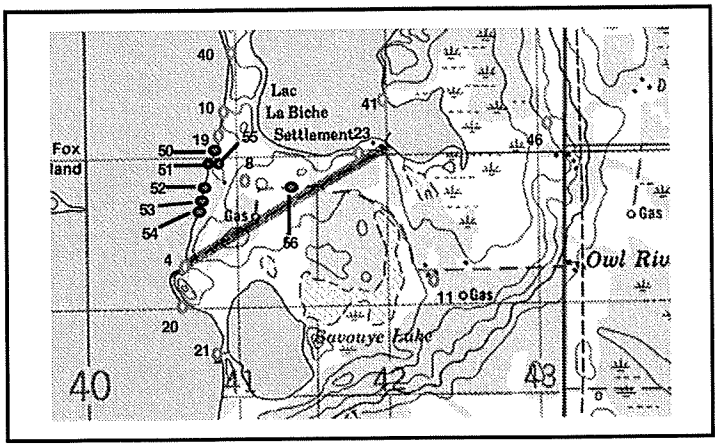
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440647 To Northing 6082048 To

U.T.M. NAD 83 12U VR Easting 440581 To Northing 6082265 To

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-21

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 2 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440884 To ..... Northing 6081642 To .....
U.T.M. NAD 83 12U VR Easting 440818 To ..... Northing 6081859 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go approximately 1.4 kilometer southward along the beach, and the site is located on the beach area of a narrow spit that separates Lac La Biche from Savouye Lake. The site is originally recorded as being located at the outlet of Savouye Lake, near the mouth of the lagoon on the Maccagno and Lemieux holdings at Owl River.

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

The site was originally recorded as being located on the beach with the area above the beach line having been cleared and put under cultivation. At the time of the June 30/04 visit the beach remains, but East of the beach there is a narrow area of broken and uneven terrain that lacks any forest cover. The spit itself is approximately 30 - 35 meters wide with a narrow (approximately 10 - 15 meters) strip of slightly raised, grass-covered terrain that seperates the Lac La Biche beach from the Savouye Lake beach. The Site was not relocated.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type
☐ isolated find
☒ scatter (<10)
☐ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☐ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious .....

13. Features (frequencies if possible)
..... stone circle
..... cairn
..... stone arc
..... stone line
..... drive lane
..... medicine wheel
..... effigy
..... pictograph
..... petroglyph
..... hearth
..... pit
..... mound
..... depression
..... cabin
..... house
..... structure
..... foundation
..... cellar
..... dump
..... fence

Other Features:
....

Borden No. GfOx-21

Permit No. 2004-240

14. 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)

The site was originally recorded as a surface scatter of less than 10 lithic artifacts; however the site was not relocated during the June 30/04 visit and therefore the site area was not observed and no additional cultural materials were identified.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
		lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

The site was not relocated.

17. Collection Repository ☐ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. _____

18. Photo/Images ☐ Yes ☒ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... _____
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) _____

21. Radiocarbon Dates _____

Borden No. GfOx-21

Permit No. 2004-240

22. Estimated Dimensions N-S ..... m, E-W ..... m, Depth ..... m

23. Means of Estimating Dimensions ☐ surface inspection ☐ Other... ..... No. of shovel tests
☐ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by ..... Date (Y/M/D) .....

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

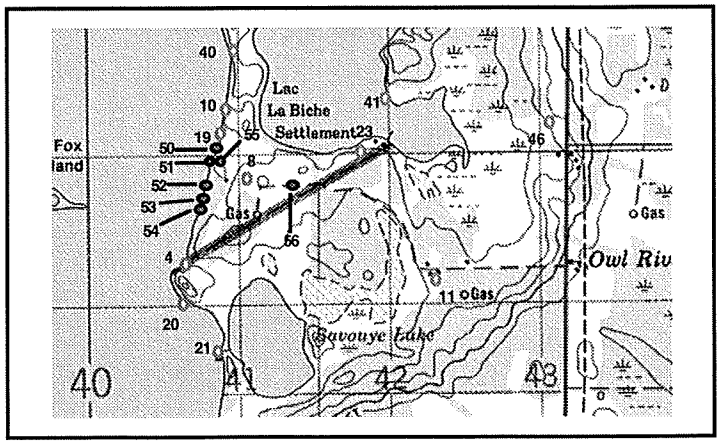
Borden No. GfOx-21

35. Site Map

Permit No. 2004-240

N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440884 To Northing 6081642 To

U.T.M. NAD 83 12U VR Easting 440818 To Northing 6081859 To

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-40
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: June 30, 2004

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 07 Section 21 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440959 To ..... Northing 6083616 To .....
U.T.M. NAD 83 12U VR Easting 440893 To ..... Northing 6083833 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. The site must be approached on foot by following the beach north for approximately 700 meters. The site is located on a high knoll immediately upslope to the ast of the beach from this point.

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

The site is located on a high knoll that overlooks Lac La Biche to the west. The terrain of the site area is hummocky, broken, and uneven, and covered with dense aspen forest. The terrain immediately west of the site area slopes down steeply to the west, toward Lac La Biche at approximately 45 - 50 degrees. The site is situated approximately 10 m east of the lake shore-line. Some side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type
☐ isolated find
☐ scatter (<10)
☐ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☒ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious .....

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	1 fence	

Borden No. GfOx-40

Permit No. 2004-240

14. 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)

The site was originally recorded as an historic grave site, situated on the Maccagno and Lemieux spit, marked by a square made of cobbles. The site was relocated during the June 30/04 visit based on information provided by the land owner. This information indicated that the burial site area was surrounded by a barbed-wire fence. During the June 30/04 survey the Fence was relocated at the location originally indicated as the site area. No other cultural materials or features were identified in the site area. The original site form refers to a rumour that three persons were struck by lightening and then buried at this location. Upon further recent research, records have been found that refer to two individuals: Absalom Desjarlais (born 1879) and Alfred Desjarlais (born 1883), both being struck by lightening in 1898 near Owl River (Gail Morin's *Metis Families A Genealogical Compendium Vol.2,* 2001). Any reference to a third individual being struck by lightening near Owl River on this date could not be found in these records.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
		lithic debitage			floral remains			glass
		bone tools			tephra	1	0	other, specify
		ceramics			soil samples			Barbed Wire
		fire cracked rock			macrofossils			
		charcoal	3	0	wood			

16. Collection Remarks (formed tools, raw materials,)

No cultural materials were collected. 3 wooden fence posts (fallen) and 1 strand of barbed wire (on ground surface) were identified.

17. Collection Repository ☐ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. _____

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☒ Historic ☐ Other... _____
☐ Middle Prehistoric ☐ Fur Trade/Contact ☐ Undetermined

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

Metis

20. Calendar Date (A.D./B.C.) 1898

21. Radiocarbon Dates _____

Borden No. GfOx-40

Permit No. 2004-240

22. Estimated Dimensions N-S 5 m, E-W 8 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ..... No. of shovel tests
☐ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

The proposed development will not impact the site area. The client has been notified of the site location and significance, and will therefore apply provisions to protect the site area from any developmental disturbance.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by ..... Date (Y/M/D) .....

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

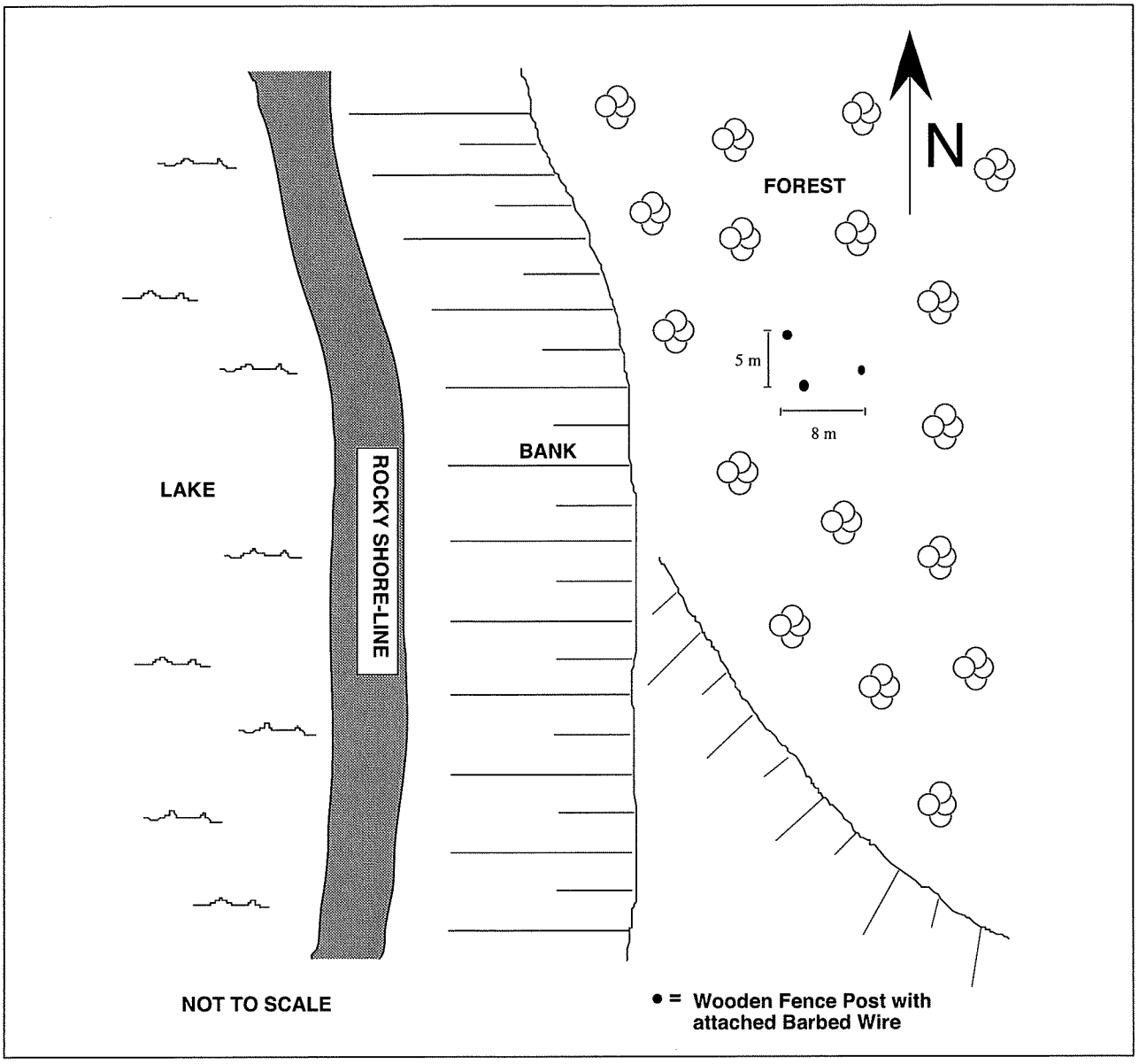
The site area will be avoided from all developmental impacts.

34. Additional Remarks

Borden No. GfOx-40

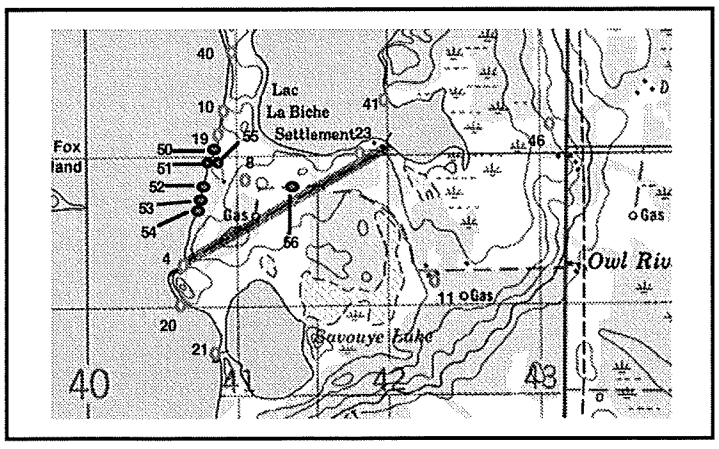
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440959 To Northing 6083616 To

U.T.M. NAD 83 12U VR Easting 440893 To Northing 6083833 To

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-50
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 15 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440825 To ..... Northing 6083046 To .....
U.T.M. NAD 83 12U VR Easting 440759 To ..... Northing 6083263 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go approximately 125 metres northward along the beach, and the site is located on the beach, approximately 2 metres from the water's edge and approximately 13 metres from the high water mark by the edge of the forest.

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

The site was identified on the beach surface approximately 2 meters east of the water's edge. The eastern edge of the beach is marked by a low bank. East of the bank's edge the terrain is relatively flat, well-drained and is covered with sparse aspen forest. Some side-bank exposures were present. 3 shovel tests, adjacent to the site area, revealed a 5 centimeter littermatt overlaying dark brown sandy silt with sparse golf-ball size rounded gravels. No buried soils or cultural materials were found in the shovel tests.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-50

Permit No. 2004-240

14. 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)

1 broken quartzite flake was identified and collected from the surface of the site area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
1	1	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

1 broken quartzite flake was identified and collected.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-50

Permit No. 2004-240

22. Estimated Dimensions N-S 1 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ☒ erosion exposure

3 No. of shovel tests

No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

30. Excavated/mitigated by Date (Y/M/D)

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify): ☐ additional investigation required (specify):

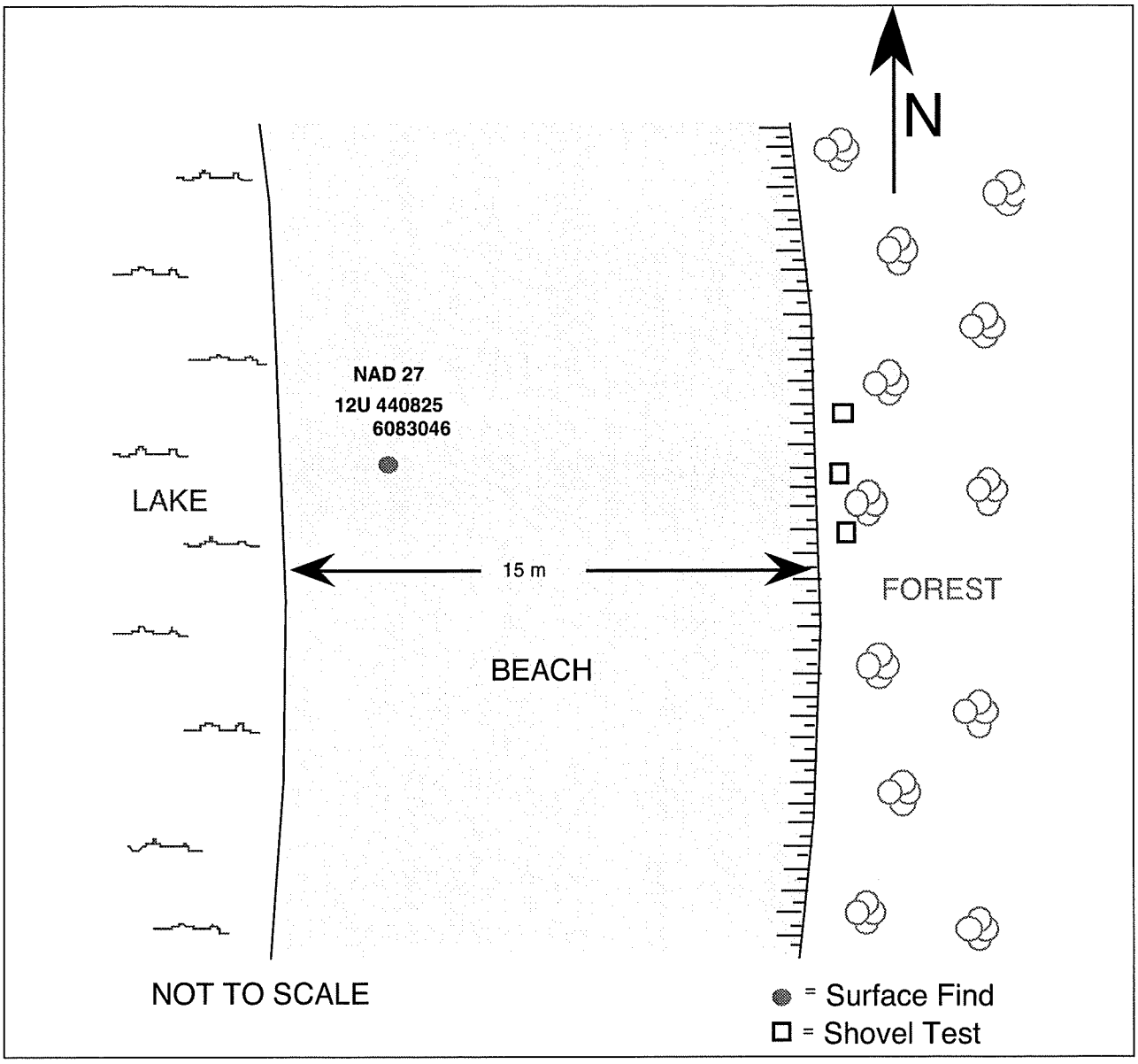
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

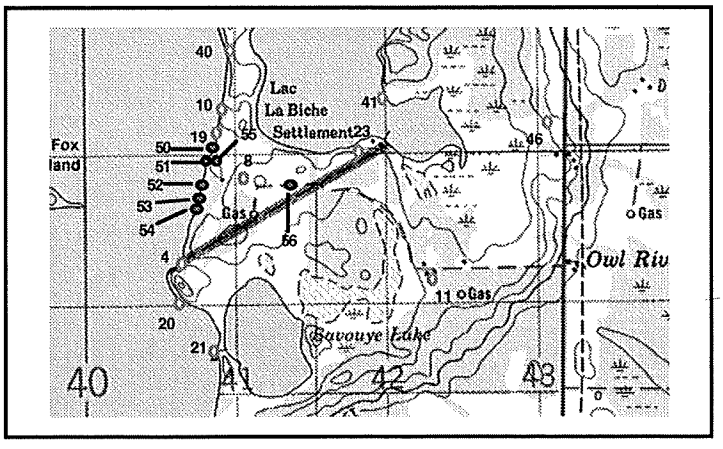
Borden No. GfOx-50

35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440825 To Northing 6083046 To

U.T.M. NAD 83 12U VR Easting 440759 To Northing 6083263 To

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-51
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: .....

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 15 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440820 To ..... Northing 6082976 To .....
U.T.M. NAD 83 12U VR Easting 440754 To ..... Northing 6083193 To .....

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 65 metres northward along the beach, and the site is located on the beach, approximately 6 metres from the water's edge and approximately 2 metres from the high water mark by the edge of the forest.

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

The site was identified on the beach surface approximately 6 meters east of the water's edge and approximately 2 meters west of the forest edge / low bank. The eastern edge of the beach is marked by a low bank. East of the bank's edge the terrain is broken, uneven and is covered with dense aspen forest. Some side-bank exposures were present.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-51

Permit No. 2004-240

14. 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)

1 quartzite core fragment was identified and collected from the surface of the site area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
1	1	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

1 quartzite core fragment was identified and collected.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-51

Permit No. 2004-240

22. Estimated Dimensions N-S 1 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ..... No. of shovel tests
☒ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

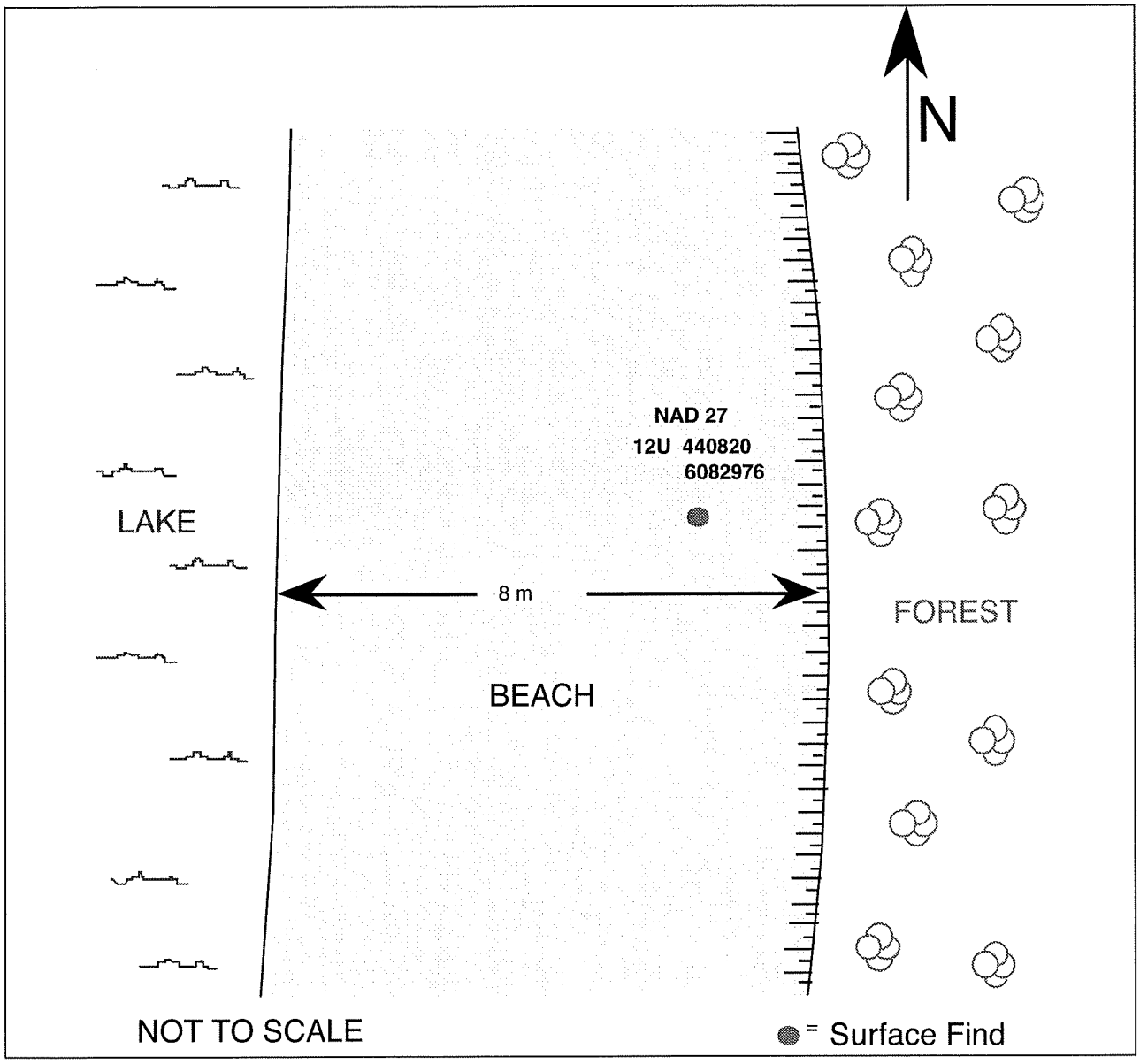
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

Borden No. GfOx-51

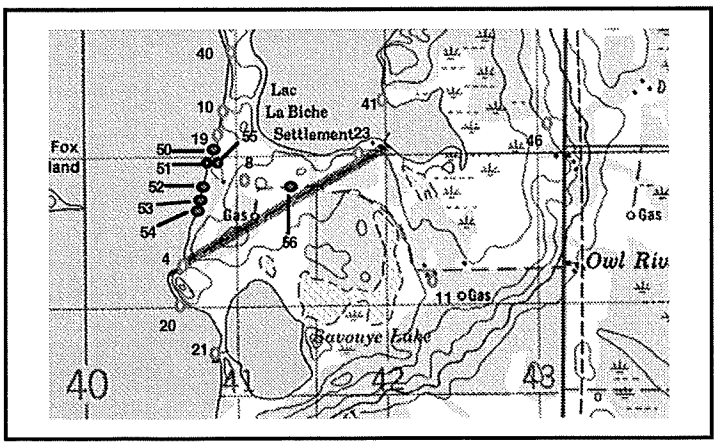
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440820 To Northing 6082976 To

U.T.M. NAD 83 12U VR Easting 440754 To Northing 6083193 To

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-52
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 15 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440778 To 440778 Northing 6082795 To 6082805
U.T.M. NAD 83 12U VR Easting 440712 To 440712 Northing 6083012 To 6083022

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 110 metres southward along the beach, and the site is located on the beach, approximately 24 metres from the water's edge and approximately 6 metres from the high water mark by the edge of the forest.

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

The site area is situated on a sandy beach that extends approximately 30 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is a relatively cleared grassy flat area that is well-drained and featureless.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-52

Permit No. 2004-240

14. 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)

One core reduction flake and one projectile point base were identified and collected from the surface of a disturbed beach area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
1	1	projectile points			faunal remains			shell
		lithic tools			human remains			metal
1	1	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

One quartzite core reduction flake and one quartzite projectile point base

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-52

Permit No. 2004-240

22. Estimated Dimensions N-S 10 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 8 No. of shovel tests
☒ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

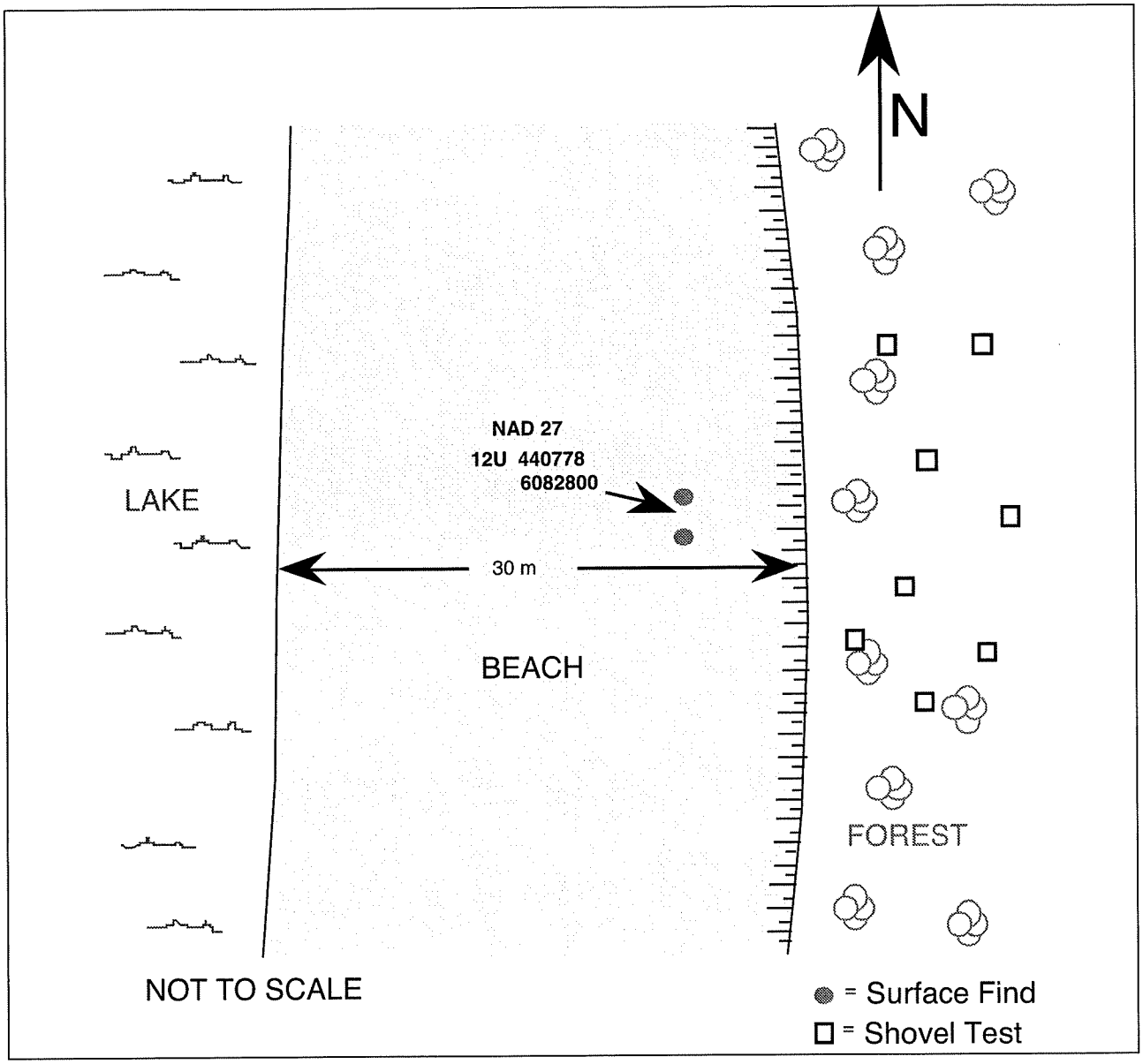
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

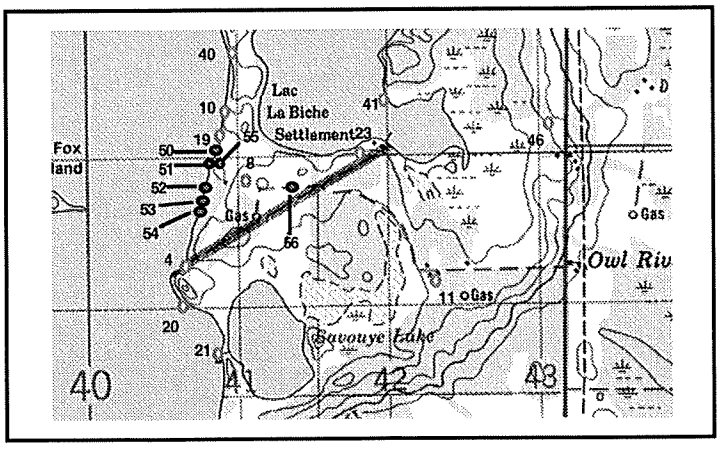
Borden No. GfOx-52

35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440778 To 440778 Northing 6082795 To 6082805

U.T.M. NAD 83 12U VR Easting 440712 To 440712 Northing 6083012 To 6083022

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-53

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: .....

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 14 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440759 To 440760 Northing 6082688 To 6082711
U.T.M. NAD 83 12U VR Easting 440693 To 440694 Northing 6082905 To 6082928

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 200 metres southward along the beach, and the site is located on the beach, approximately 24 metres from the water's edge and approximately 1 metre from the high water mark by the edge of the forest.

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

The site area is situated on a sandy beach that extends approximately 25 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low ridge. The terrain to the east of this low ridge is low-lying and very poorly-drained.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
..... # components

12. Site Type
☐ isolated find
☒ scatter (<10)
☐ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☐ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious .....

13. Features (frequencies if possible)
..... stone circle
..... cairn
..... stone arc
..... stone line
..... drive lane
..... medicine wheel
..... effigy
..... pictograph
..... petroglyph
..... hearth
..... pit
..... mound
..... depression
..... cabin
..... house
..... structure
..... foundation
..... cellar
..... dump
..... fence

Other Features:
....

Borden No. GfOx-53

Permit No. 2004-240

14. 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)

Two quartzite core reduction flakes were found on a disturbed beach area.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
2	2	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

Two quartzite core reduction flakes were found.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. _____

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... _____
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) _____

21. Radiocarbon Dates _____

Borden No. GfOx-53

Permit No. 2004-240

22. Estimated Dimensions N-S 23 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ..... No. of shovel tests
☒ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

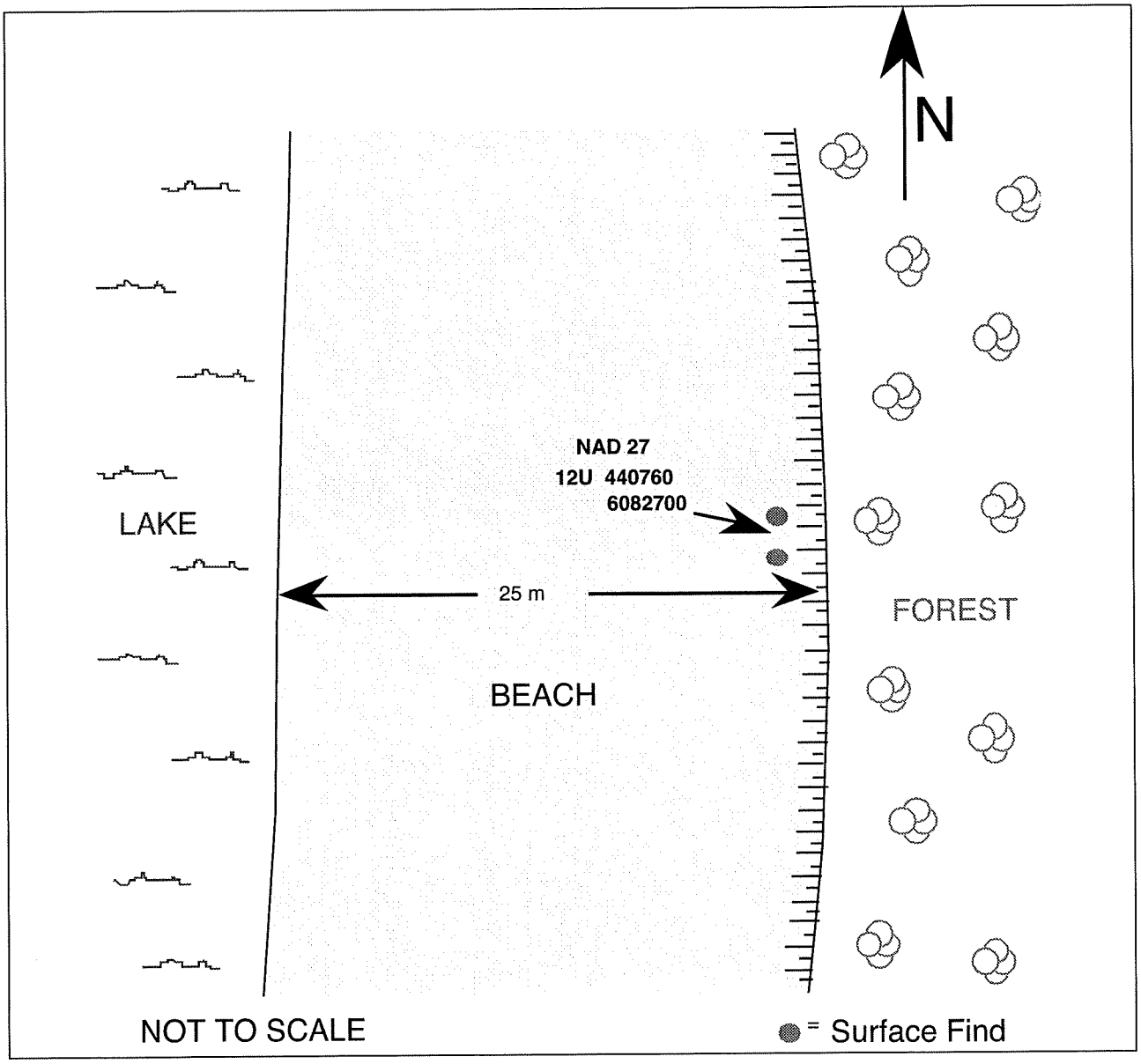
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

Borden No. GfOx-53

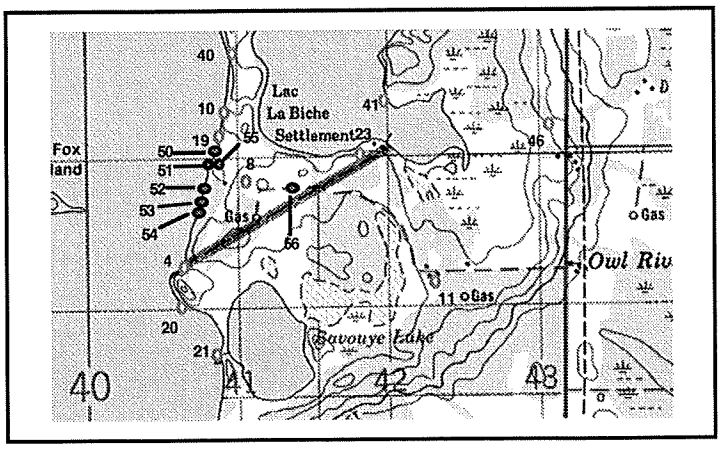
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440759 To 440760 Northing 6082688 To 6082711

U.T.M. NAD 83 12U VR Easting 440693 To 440694 Northing 6082905 To 6082928

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-54
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name
2. Field No.
3. Elevation 545
4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche
5. Legal Description: LSD 11 Section 16 Township 68 Range 13 W of 4 M
6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440747 To Northing 6082651 To
   U.T.M. NAD 83 12U VR Easting 440681 To Northing 6082868 To
7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
   Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 700 metres to the shoreline of Lac La Biche. Then go 250 metres southward along the beach, and the site is located on the beach, approximately 20 metres from the water's edge and approximately 5 metres from the high water mark by the edge of the forest.

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

The site area is situated on a sandy beach that extends approximately 25 meters from the eastern shoreline of Lac La Biche, to the east, where it meets a low bank. The terrain to the east of this low bank is forested, hummocky, broken, and uneven.

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

11. Sub Type
- ☒ surface
- ☐ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined
- ____ # components

12. Site Type

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

13. Features (frequencies if possible)

____ stone circle	____ medicine wheel	____ pit	____ structure	Other Features:
____ cairn	____ effigy	____ mound	____ foundation	____
____ stone arc	____ pictograph	____ depression	____ cellar	
____ stone line	____ petroglyph	____ cabin	____ dump	
____ drive lane	____ hearth	____ house	____ fence	

Borden No. GfOx-54

Permit No. 2004-240

14. 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)

One quartzite scraper was found on a disturbed sandy beach.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
1	1	projectile points			faunal remains			shell
		lithic tools			human remains			metal
1	1	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

One quartzite scraper was found.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-54

Permit No. 2004-240

22. Estimated Dimensions N-S 1 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ..... No. of shovel tests
☒ erosion exposure ..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the beach area will undoubtedly by utilized a great deal by recreational users.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 30, 2004

29. Tested/assessed by ..... Date (Y/M/D) .....

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify):
☐ additional investigation required (specify):

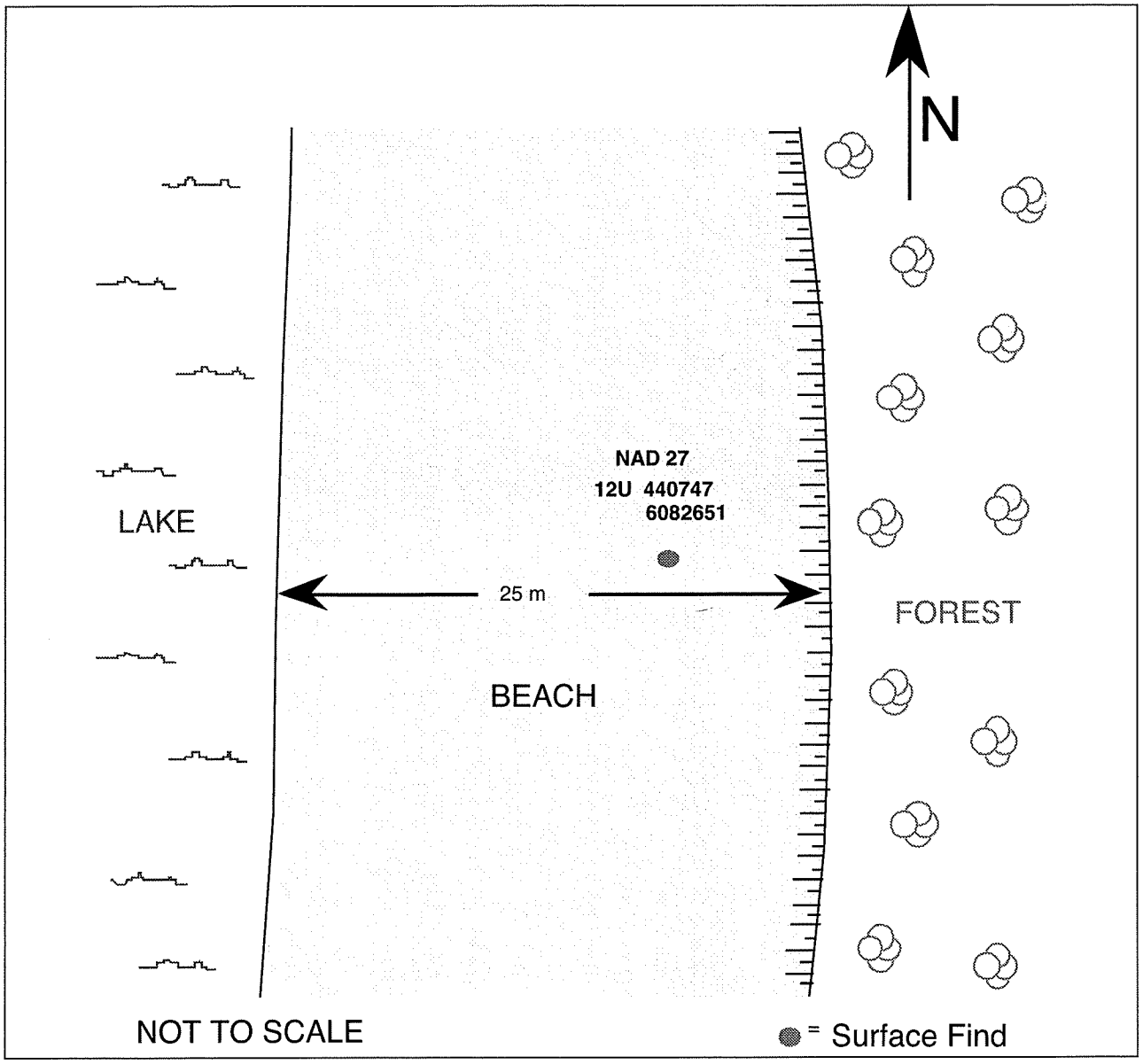
The site was found on a beach that is routinely disturbed by wave action and possibly ice heaving in the winter. Continued disturbance in the beach area will not affect any undisturbed deposits at the site location.

34. Additional Remarks

Borden No. GfOx-54

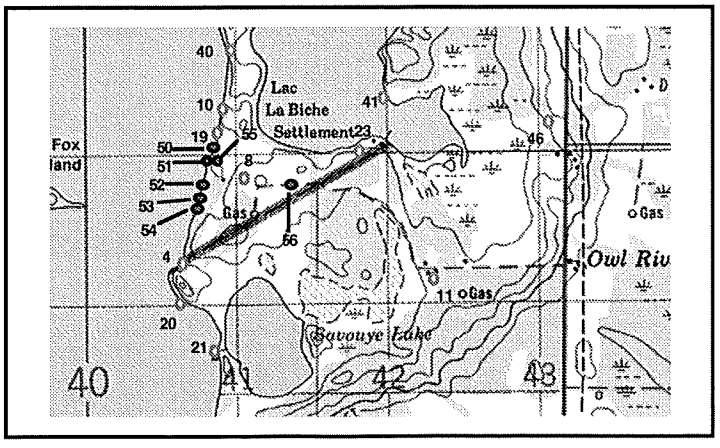
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440747 To Northing 6082651 To

U.T.M. NAD 83 12U VR Easting 440681 To Northing 6082868 To

Alberta

COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-55

Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: .....

1. Site Name ..... 2. Field No. .....

3. Elevation 545 4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche

5. Legal Description: LSD 15 Section 16 Township 68 Range 13 W of 4 M

6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 440828 To 440859 Northing 6082946 To 6082967
U.T.M. NAD 83 12U VR Easting 440762 To 440793 Northing 6083163 To 6083184

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 640 metres to just before the high water mark at the shoreline of Lac La Biche. Then go approximately 50-75 metres northward, and the site is located atop a high knoll in a cultivated field that overlooks the shoreline of Lac La Biche.

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

The site area is situated in a cultivated field on a high knoll that has great drainage. The knoll overlooks Lac La Biche and there is a steep bank down to the beach on the west side, a forested area on the northern side, with a gradual downslope from the top of the knoll to the south and east.

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

11. Sub Type
☒ surface
☐ subsurface
☐ underwater
☐ stratified
☐ undetermined

☐ single component
☒ multi component
☐ undetermined
..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-55

Permit No. 2004-240

14. 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)

The prehistoric artifacts consist entirely of lithic items including five core reduction flakes, three broken flakes, one core, one bifacial core, one core fragment, two core shatter, one angular shatter, one split pebble, one scraper, and one projectile point fragment collected from the surface of a cultivated field.

The historic component of GfOx-55 consists of an assortment of historic cultural items including unidentifiable glass bottle fragments, unidentifiable modern ceramic fragments, as well as metal, plastic, leather and bone fragments. These located items suggest that the historic component of GfOx-55 is not from the early historic period, but rather from the middle to late part of the twentieth century. None of the historic items was considered to be unique or significant.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
1	1	projectile points	7		faunal remains			shell
1	1	lithic tools			human remains	4		metal
15	15	lithic debitage			floral remains	6		glass
		bone tools			tephra	5		other, specify
4		ceramics			soil samples			leather and plastic
		fire cracked rock			macrofossils			
		charcoal	2		wood			

16. Collection Remarks (formed tools, raw materials,)

The prehistoric artifacts consist entirely of lithic items including five core reduction flakes, three broken flakes, one core, one bifacial core, one core fragment, two core shatter, one angular shatter, one split pebble, one scraper, and one projectile point fragment collected from the surface of a cultivated field.

None of the historic materials were collected.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. _____

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☒ Historic ☐ Other... _____
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

The historic component of GfOx-55 consists of an assortment of historic cultural items including unidentifiable glass bottle fragments, unidentifiable modern ceramic fragments, as well as metal, plastic, leather and bone fragments. These located items suggest that the historic component of GfOx-55 is not from the early historic period, but rather from the middle to late part of the twentieth century. None of the historic items was considered to be unique or significant.

20. Calendar Date (A.D./B.C.) _____

21. Radiocarbon Dates _____

Borden No. GfOx-55

Permit No. 2004-240

22. Estimated Dimensions N-S 21 m, E-W 31 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ☒ erosion exposure

10 No. of shovel tests

..... No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

The site area is currently cultivated, and most of this site area would be heavily disturbed if the development proceeds.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29, 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29, 2004

29. Tested/assessed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29, 2004

30. Excavated/mitigated by ..... Date (Y/M/D) .....

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E. 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify): ☐ additional investigation required (specify):

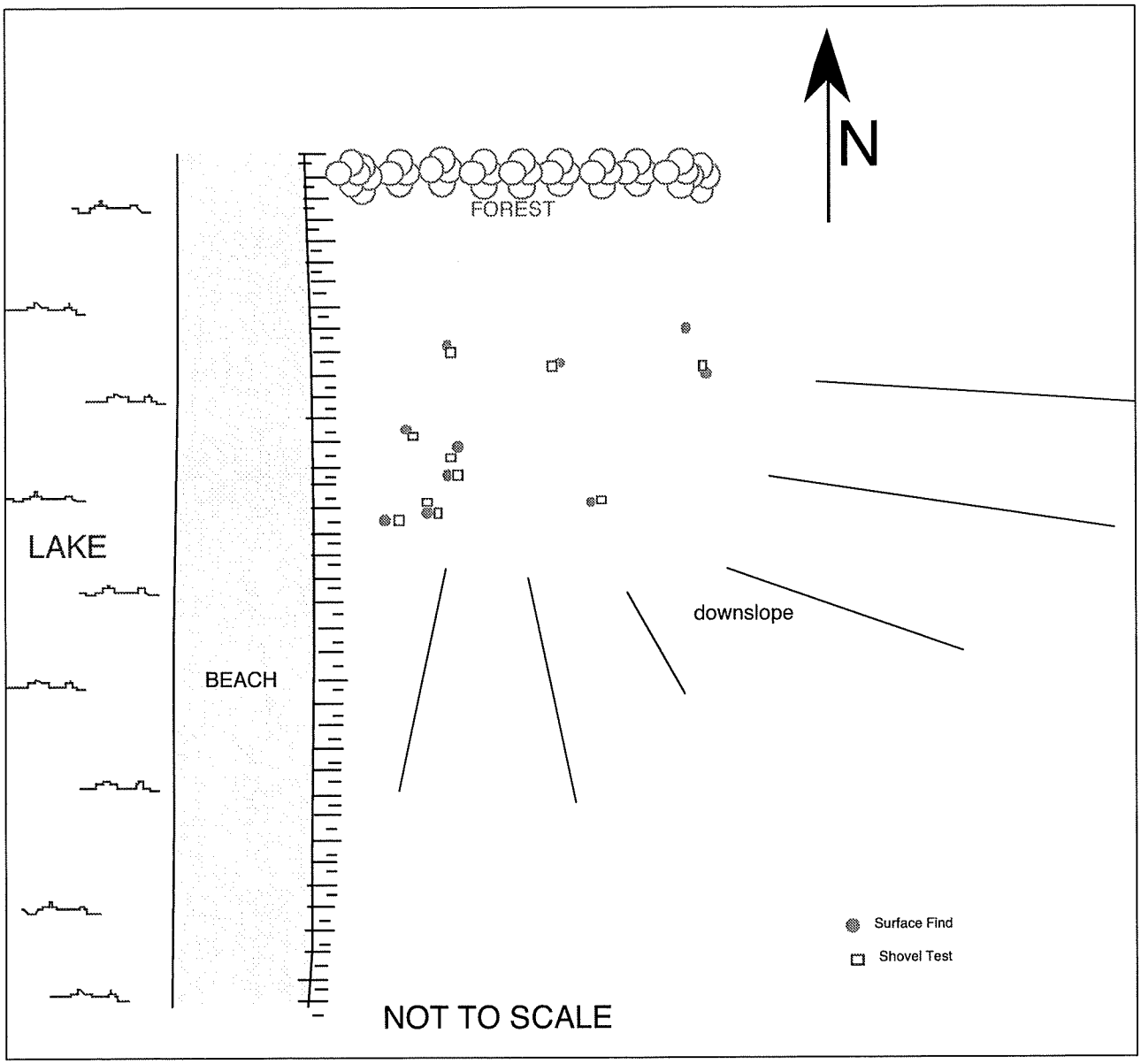
All cultural materials were found on a disturbed cultivated field. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

34. Additional Remarks

Borden No. GfOx-55

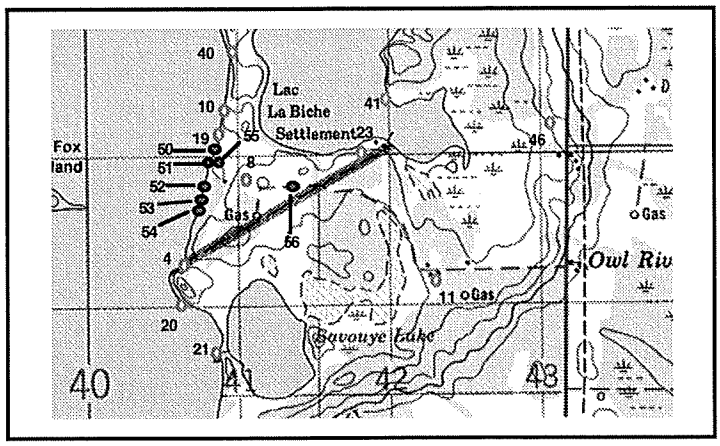
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 440828 To 440859 Northing 6082946 To 6082967

U.T.M. NAD 83 12U VR Easting 440762 To 440793 Northing 6083163 To 6083184

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Heritage Resource Management

Borden No. GfOx-56
Permit No. 2004-240

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date: .....

1. Site Name .....
2. Field No. .....
3. Elevation 545
4. N.T.S. 1:50,000 Map No. & Name 73 L/13 - Lac La Biche
5. Legal Description: LSD 16 Section 16 Township 68 Range 13 W of 4 M
6. U.T.M. NAD 27 Civilian Zone 12U VR Easting 441382 To ..... Northing 6082781 To .....
   U.T.M. NAD 83 12U VR Easting 441316 To ..... Northing 6082998 To .....
7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold
   Land Owner Name/Address Dr. Richard Birkill, P.O. Box 510, Lac La Biche, Alberta, T0A 2C0

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

From the northern town limits of the town of Lac La Biche go north on SH 868 for approximately 24.5 kilometres. Then go west on a county road for approximately 2.1 kilomtres to the end of the road. Follow a farm access trail westward approximately 125 metres, the site is located on the road as it is crossing a cultivated area.

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

The site area is situated on a dirt access road that trends east-west, bordered on both the north and south by cultivated fields. The general topography of the site area is characterized by gently rolling terrain void of any prominent landforms.

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

11. Sub Type
- ☒ surface
- ☐ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined
- ..... # components

12. Site Type

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

13. Features (frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure	Other Features:
..... cairn	..... effigy	..... mound	..... foundation	....
..... stone arc	..... pictograph	..... depression	..... cellar	
..... stone line	..... petroglyph	..... cabin	..... dump	
..... drive lane	..... hearth	..... house	..... fence	

Borden No. GfOx-56

Permit No. 2004-240

14. 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)

Two quartzite core reduction flakes were found close to each other on a dirt access road.

15. Materials observed /collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile points			faunal remains			shell
		lithic tools			human remains			metal
2	2	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials,)

Two quartzite core reduction flakes were found close to each other on a dirt access road.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ Yes ☐ No Repository Altamira Consulting Ltd

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

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

20. Calendar Date (A.D./B.C.) .....

21. Radiocarbon Dates .....

Borden No. GfOx-56

Permit No. 2004-240

22. Estimated Dimensions N-S 1 m, E-W 1 m, Depth 0 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... ☒ erosion exposure

4 No. of shovel tests

No. of backhoe tests

24. Estimated Portion Intact 0 %

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

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

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

Disturbance Factors Remarks

If the development proceeds, the site area will be destroyed.

26. Researcher/Permit Holder Walt Kowal Date (Y/M/D) June and July 2004

27. Observed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29 2004

28. Surface collected by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29, 2004

29. Tested/assessed by Walt Kowal, Ryan Spady, and Jeff Johnston Date (Y/M/D) June 29, 2004

30. Excavated/mitigated by Date (Y/M/D)

31. Form completed by Ryan Spady Date (Y/M/D) July 23, 2004

32. Project name/Report Title Proposed Mystic Beach Subdivision IN PT. NE 9-68-13-W4M, PT. 16-68-13-W4M, and PT. E 1/2 21-68-13-W4M

33. Site Significance/Recommendations ☒ no additional investigation required (justify): ☐ additional investigation required (specify):

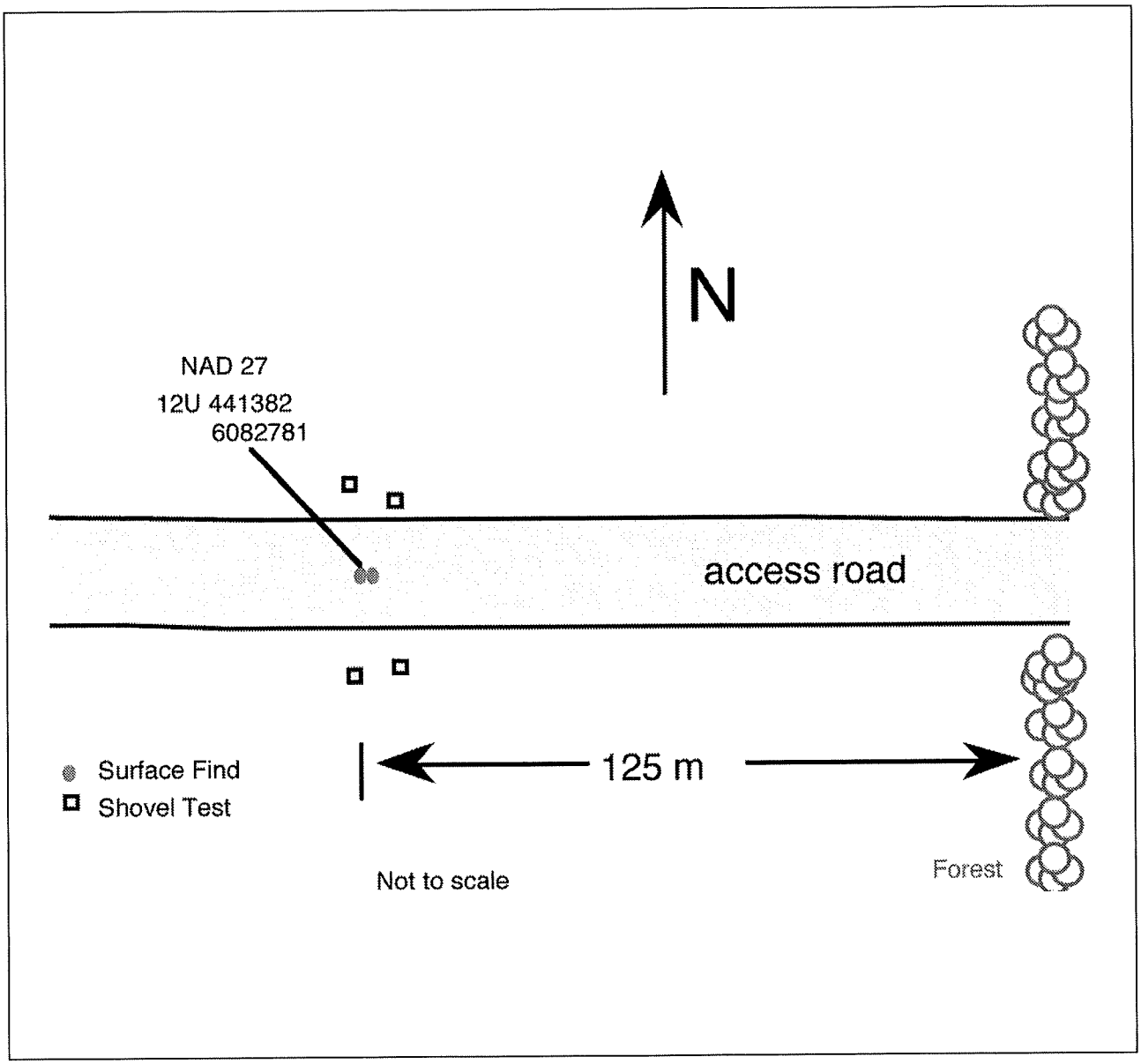
The two artifacts were found on a dirt access road and no undisturbed sediments were found in the cultivated fields beside the road. The site area lacks any potential for the presence of undisturbed sediments. Beyond the presence of the located artifacts themselves, the information potential offered by this site is considered to be minimal.

34. Additional Remarks

Borden No. GfOx-56

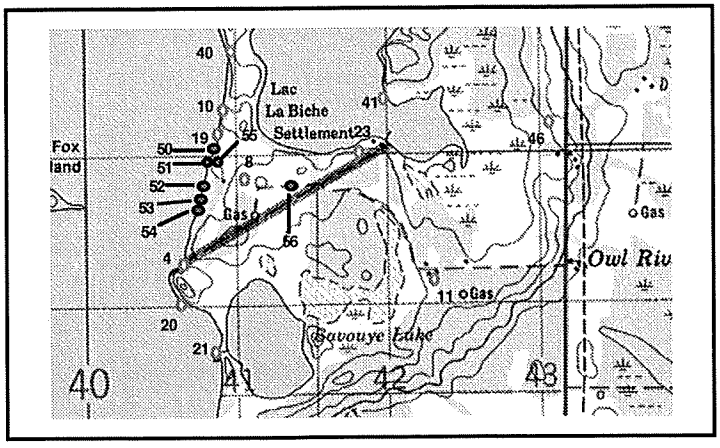
35. Site Map

Permit No. 2004-240



N.T.S. 1:50,000 Map Inset Map No.: 73 L/13 - Lac La Biche

Legend



U.T.M. NAD 27 Civilian Zone 12U VR Easting 441382 To Northing 6082781 To

U.T.M. NAD 83 12U VR Easting 441316 To Northing 6082998 To

APPENDIX II: ARTIFACT CATALOGUES FOR ARCHAEOLOGY PERMIT 2004-240

Artifact Catalogues For Archaeology Permit 2004-240

Catalogue Number		No. of Items	Depth	Artifact Type	NAD 27 UTM Zone 12U		Raw Material	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Date Collected	Date catalogued	Description
GfOx-4:	46	1	surface	Split Pebble	440659	6082339	Quartzite				3.6	June 30 / 04	July 6 / 04	
GfOx-4:	47-48	2	surface	Broken Flake	440659	6082339	Quartzite				3.3	June 30 / 04	July 6 / 04	
GfOx-20:	10	1	surface	Core Reduction Flake	440647	6082048	Quartzite				1.6	July 2 / 04	July 6 / 04	Broken
GfOx-20:	11	1	surface	Broken Flake	440647	6082048	Quartzite				0.8	July 2 / 04	July 6 / 04	
GfOx-20:	12	1	surface	Core	440647	6082048	Quartzite				122	July 2 / 04	July 6 / 04	
GfOx-50:	1	1	surface	Broken Flake	440825	6083046	Quartzite				0.8	June 30 / 04	July 6 / 04	
GfOx-51:	1	1	surface	Core Fragment	440820	6082976	Quartzite				22.5	June 30 / 04	July 6 / 04	
GfOx-52:	1	1	surface	Projectile Point	440778	6082805	Quartzite	21.89	20.27	6.29	3.5	June 30 / 04	July 6 / 04	Proximal portion (missing tip); possibly modified; naturally worn
GfOx-52:	2	1	surface	Core Reduction Flake	440778	6082795	Quartzite				7.1	June 30 / 04	July 6 / 04	Broken; Naturally worn
GfOx-53:	1	1	surface	Core Reduction Flake	440760	6082711	Quartzite				14	June 30 / 04	July 6 / 04	
GfOx-53:	2	1	surface	Core Reduction Flake	440759	6082688	Quartzite				269	June 30 / 04	July 6 / 04	
GfOx-54:	1	1	surface	Scraper	440747	6082651	Quartzite	58.25	45.63	12.22	25.2	June 30 / 04	July 6 / 04	
GfOx-55:	1	1	surface	Core Reduction Flake	440834	6082965	Quartzite				12.42	June 29 / 04	July 6 / 04	
GfOx-55:	2	1	surface	Bifacial Core	440845	6082963	Quartzite				114	June 29 / 04	July 6 / 04	
GfOx-55:	3	1	surface	Core Fragment	440857	6082967	Quartzite				42.3	June 29 / 04	July 6 / 04	
GfOx-55:	4-5	2	surface	Core Reduction Flake	440859	6082962	Quartzite				82	June 29 / 04	July 6 / 04	
GfOx-55:	6	1	surface	Core Shatter	440848	6082948	Quartzite				17.3	June 29 / 04	July 6 / 04	
GfOx-55:	7-8	2	surface	Broken Flake	440835	6082954	Quartzite				3	June 29 / 04	July 6 / 04	
GfOx-55:	9	1	surface	Core Shatter	440835	6082954	Quartzite				4.6	June 29 / 04	July 6 / 04	
GfOx-55:	10	1	surface	Core Reduction Flake	440835	6082954	Chert				4.4	June 29 / 04	July 6 / 04	
GfOx-55:	11	1	surface	Core	440835	6082954	Quartzite				496	June 29 / 04	July 6 / 04	
GfOx-55:	12	1	surface	Projectile Point	440834	6082951	Quartzite	10.5	12.52	3.5	0.5	June 29 / 04	July 6 / 04	Distal End (Tip)
GfOx-55:	13	1	surface	Core Reduction Flake	440834	6082951	Quartzite				2.7	June 29 / 04	July 6 / 04	
GfOx-55:	14	1	surface	Angular Shatter	440834	6082951	Quartzite				2.5	June 29 / 04	July 6 / 04	
GfOx-55:	15	1	surface	Broken Flake	440830	6082956	Quartzite				0.4	June 29 / 04	July 6 / 04	
GfOx-55:	16	1	surface	Scraper	440832	6082947	Siltstone	28.04	20.25	5.12	3.9	June 29 / 04	July 6 / 04	Broken
GfOx-55:	17	1	surface	Split Pebble	440828	6082946	Silicified Siltstone				24.7	June 29 / 04	July 6 / 04	
GfOx-56:	1	1	surface	Core Reduction Flake	441382	6082781	Silicified Mudstone				4.8	June 29 / 04	July 6 / 04	Broken
GfOx-56:	2	1	surface	Core Reduction Flake	441382	6082781	Chert				1.1	June 29 / 04	July 6 / 04	

Altamira Consulting Ltd
Archaeological & Historical Resource Consulting

Alberta
COMMUNITY DEVELOPMENT

Cultural Facilities and
Historical Resources Division

Office of the
Assistant Deputy Minister

Old St. Stephen's College
8820 - 112 Street
Edmonton, Alberta
Canada T6G 2P8

Telephone 780/431-2300
Fax 780/427-5598

August 17, 2004

Our File(s): 4835-04-142, 2004-240

Mr. Armin Preiksaitis
Armin Preiksaitis & Associates Ltd.
#408 The Boardwalk, 10310 – 102nd Avenue
Edmonton, Alberta
T5J 2X6

Dear Mr. Preiksaitis:

SUBJECT: PROPOSED MYSTIC BEACH SUDDIVISION
PT. NE 9, PT. SEC.16 & PT. E1/2 21-68-13-W4M
HISTORICAL RESOURCES IMPACT ASSESSMENT
FINAL REPORT, PERMIT 2004-240

The Cultural Facilities and Historical Resources Division (CFHRD) of Alberta Community Development have recently reviewed a copy of a Final Report from Altamira Consulting Ltd. regarding the results of the Historical Resources Impact Assessment (HRIA) that they conducted for the captioned project. The results of the HRIA and CFHRD's requirements are summarized in Table 1.0.

HISTORICAL RESOURCES IMPACT ASSESSMENT (PERMIT 2004-240)

Terms of Reference

Under Mitigative Research Permit 2004-240, Altamira Consulting Ltd. conducted an Historical Resources Impact Assessment on a proposed residential subdivision development located on Lac La Biche. The consultant used foot traverses, visual inspections and 63 shovel tests to assess the area.

Results

The consultant attempted to relocate 7 previously recorded sites (GfOx-4, 8, 10, 19, 20, 21 & 40) but was only able to relocate and assess three of these sites (GfOx-4 20 & 40). An additional seven new sites (GfOx-50, 51, 52, 53, 54, 55 & 56) were recorded during the course of this survey. The results of these studies are summarized in Table 1.0.

HISTORICAL RESOURCES ACT REQUIREMENTS/CLEARANCE

Alberta Community Development's requirements with regard to archaeological sites GfOx-4, 8, 10, 19 20, 50, 51, 52, 53, 54, 55 & 56 have been adequately addressed by the studies that have been completed by Altamira Consulting Ltd. From a Historical Resources perspective, development may proceed in the area of these sites and with the exception of site GfOx-40, on this project as a whole. Alberta Community Developments requirements with regard to site GfOx-40 are outlined in the attached Schedule B.

...cont.

CARMA DEVELOPERS LTD.
PROPOSED MYSTIC BEACH SUDDIVISION
PT. NE 9, PT. SEC.16 & PT. E1/2 21-68-13-W4M
***HISTORICAL RESOURCES ACT* REQUIREMENTS/CLEARANCE**
(PROJECT FILE: 4835-142)
TABLE 1.0

SITE	HRV	LEGAL DESCRIPTION	HRIA RESULTS	HRA REQUIREMENTS/COMMENTS
GfOx-4	0	LSD 11-16-68-13-W4M	Lithic surface scatter on a beach, no undisturbed archaeological deposits are present • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-8	0	LSD 15-16-68-13-W4M	Lithic surface scatter in a cultivated field. The site was not relocated. • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-10	0	LSD 2-21-68-13-W4M	Lithic surface scatter on a beach. The site was not relocated. • The site will be impacted by the proposed development	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-19	0	LSD 2-21-68-13-W4M	Lithic surface scatter on a beach. The site was not relocated. • The site will be impacted by the proposed development	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-20	0	LSD 6-16-68-13-W4M	Lithic surface scatter on a beach, no undisturbed archaeological deposits are present • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resou concerns with this site.
GfOx-21	0	LSD 2-16-68-13-W4M	Lithic surface scatter on a beach. The site was not relocated. • The site will be impacted by the proposed development	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.

...cont.

TABLE 1.0 – PAGE 2

GfOx-40	5	LSD 7-21-68-13-W4M	The site is located on a high knoll overlooking the lake to the west. The site was originally recorded as three individuals who had been struck by lightning & buried at this location. The burial area is currently surrounded by a barbed-wire fence and no other cultural material or features were identified under the current Permit. • The site is to be avoided.	Either The site is to be avoided by the current development and some form of permanent demarcation (possibly a fence) to ensure that the burials are inadvertently impacted in the future, as outlined in Schedule B (attached).
GfOx-50	0	LSD 15-16-68-13-W4M	Isolated lithic find on a beach. No undisturbed archaeological deposits are present. • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-51	0	LSD 15-16-68-13-W4M	Isolated lithic find on a beach. No undisturbed archaeological deposits are present. The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-52	0	LSD 15-16-68-13-W4M	Lithic surface scatter on a beach, no undisturbed archaeological deposits are present. The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-53	0	LSD 14-16-68-13-W4M	Lithic surface scatter on a beach, no undisturbed archaeological deposits are present. • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-54	0	LSD 11-16-68-13-W4M	Lithic surface scatter on a beach, no undisturbed archaeological deposits are present. • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-55	0	LSD 15-16-68-13-W4M	Surface scatter of lithics and historic artifacts on a high knoll in a cultivated field. No undisturbed archaeological deposits are present. • The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.
GfOx-56	0	LSD 16-16-68-13-W4M	• Lithic scatter on an access road. Additional tests near the road were negative. The site will be impacted by the proposed development.	***HRA* CLEARANCE GRANTED,** there are no further historical resource concerns with this site.

SCHEDULE B
***HISTORICAL RESOURCES ACT* REQUIREMENTS**
PROPOSED MYSTIC BEACH SUDDIVISION
(PROJECT FILE 4835-2004-142)

1. Site GfOx-40 (LSD 7-21-68-13-W4M)

Requirements

Pursuant to Section 37(2) of the *Historical Resources Act* the development proponent is required to avoid the area containing the three individual burials during development and put in place some type of long term demarcation (such as permanent fencing) to ensure that the burials are not inadvertently impacted in the future.

DEPARTMENTAL CONTACTS

Dan Spivak
Resource Management Program
Royal Tyrrell Museum of Palaeontology
Box 7500
Drumheller, Alberta
T0J 0Y0
Tel. 403-823-7707
Fax. 403-823-7131

Heinz Pyszczyk
Parklands Archaeologist
Heritage Resource Management Branch
Cultural Facilities and Historical Resources Division
Alberta Community Development
8820 - 112 Street
Edmonton, Alberta
T6G 2P8
Tel. 780-431-2344
Fax. 780-427-3956

Barry Newton
Resource Management Planner
Heritage Resource Management Branch
Cultural Facilities and Historical Resources Division
Alberta Community Development
8820 - 112 Street
Edmonton, Alberta
T6G 2P8
Tel. 780-431-2330
Fax. 780-427-3956

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Associated Engineering Alberta Ltd.
1000, 10909 Jasper Avenue
Edmonton, Alberta, Canada T5J 5B9

tel 780.451.7666
fax 780.454.7698
www.ae.ca

January 20, 2005
File: 043627 - 5.2

Armin A. Preiksaitis
Armin A. Preiksaitis & Associates Ltd.
#408 The Boardwalk
10310 - 102 Avenue
Edmonton, AB T5J 2X6

Re: MYSTIC BEACH SUBDIVISION
SITE SERVICING CONCEPT REPORT

Dear Sir:

Associated Engineering is pleased to provide you with our subdivision Site Servicing Concept Report for the proposed Mystic Beach Subdivision.

INTRODUCTION

The Mystic Beach Subdivision is located within Sec. 16-68-13-W4 and is situated approximately 28 km northeast from the Town of Lac La Biche. The Mystic Beach Subdivision lands contain approximately 155 hectares of total area. Associated Engineering (AE) was retained to investigate site servicing options for the subdivision and provide recommendations accordingly. The drawing labeled "Mystic Beach – Tentative Plan of Subdivision" shows the conceptual layout of the lots in the subdivision.

1. ROADWAY SYSTEM

The Mystic Beach Subdivision access is available from Hwy. 881. The areas next to the subdivision access roadway onto Hwy. 881 contain good sight lines and based on similar developments in the County, it is not expected that Alberta Transportation (AT) will require any improvements at this intersection. AT was contacted and provided with preliminary information regarding the subdivision. AT indicated that since the proposed development was further than 0.8 km from the highway and situated on a local road, their concerns would be directed through the County during subdivision development.

Access to the subdivision is provided by an existing rural road approximately 1.5 km in length. This road is well graded and generally in good shape. The width of this road varies from 7.5 to 5.5 m. The County staff have indicated that Council will review the road width and determine whether upgrades are required at subdivision development. At that time Council will seek input from the staff and residents of the subdivision, and provide direction as to whether any remedial steps are to be taken.

The recommended road structure for the subdivision roads, as proposed by Thurber Engineering, requires the removal of all organic and unsuitable materials within the boundary of the roadway construction. Fill

material for subgrade shall be a low medium plastic clay compacted to 95% of Standard Proctor Density (SPD). The top 150 mm of subgrade should be compacted to 100% SPD. The base course is to be 200 mm thick and asphalt is to be 100 mm thick. The EXH drawing labeled "Figure 7" presents the County's Standard cross section for a typical local road.

In accordance with County requirements, the road cross section details shall be as follows:

- Approximately 3.2 km of interior roads are required to be constructed, including two cul-de-sac bulbs at the terminus of the north/south (lakeside) roads.
- 8.0 m wide asphalt section – 7.0 m lane width plus 0.5 m for each shoulder.
- The cul-de-sac (paved) radius shall be 15 m to edge of asphalt shoulder.
- The road structure shall be in accordance with the recommendations provided in the Thurber Engineering report.
- 2% crossfall from the centerline of the road.
- 1.0 m minimum depth of ditch from the finished grade of the road.
- The minimum width of the ditch to be 1.0 m.
- 3:1 side slope from the shoulder of the finished grade of the road.
- 2:1 back slope from the ditch.

The County requires that once construction of the subgrade is completed, a settlement period of one year be implemented prior to the construction of the base and asphalt.

Test holes in the two marshy (lowland) areas along the peninsula (Phase II) are not available. The soils in this area were observed to be very moist peat or sphagnum. Since the depth of this unsuitable material is not known, additional geotechnical testing may be required to determine the appropriate road structure for this area.

2. WATER SYSTEM

The following potable water supply concepts were evaluated:

.1 Transmission Main From Lac La Biche

This option would require approximately 29 kms of watermain to be installed from the Town of Lac La Biche. In addition, 3,600 m of subdivision watermain would be required to distribute the water locally.

Firefighting capability within the subdivision will be restricted to a connection to the reservoir for tankers, alternatively larger mains and fire hydrants will be required. The anticipated works will include the construction of a 600 m^3 reservoir with tanker connections, a booster station, distribution mains within the subdivision and service connections.

Operation and maintenance of this system would be under the authority of Lakeland County. The cost for the construction of this system is estimated to be between $9.25 to $9.8 million dollars. It may be possible that some form of cost sharing could be negotiated for the construction of the transmission main, however the costs for the share of the transmission main and the balance of the infrastructure required for the subdivision servicing, estimated to be in excess of $4.1 million dollars, was deemed as being cost prohibitive relative to the number of proposed serviced lots.

.2 Procurement of Water From Wells, Construction of Treatment Facility and Internal Distribution System.

This option would require the installation of approximately 3,600 m of 100 mm diameter watermain within the subdivision, adequate wells, treatment plant as proposed by Western Pump (exclusive of iron and manganese removal systems) and service connections. Operation and maintenance of this system would be under the authority of Lakeland County. The cost for construction is estimated to be $1.1 million dollars.

Thurber Engineering conducted a Desktop groundwater evaluation and found that based on the records provided, the aquifer had the potential to provide 1,250 m^3/year of water for the subdivision and subject to an actual draw down test being conducted on the site. The water quality was deemed to be poor. Subsequently in early November, Thurber Engineering drilled to a depth of 80 m (260 ft.) onsite and did not encounter the aquifer.

Although a deeper aquifer may provide a suitable water supply, deep wells are expensive to drill and will increase the project costs. Therefore, in consideration of the groundwater supply requirements, costs for treatment and water distribution, this option was deemed prohibitive in relation to the number of lots to be serviced.

.3 Individual (Private) Water Wells

This option is fairly common for rural subdivisions in Alberta. The lot owner is responsible for drilling their well in accordance with established regulations.

As noted previously, the hydrogeologic investigations of groundwater supply determined that the aquifer is quite deep and the water quality is poor. Deep wells may yield appropriate groundwater quantities for individual use, however, they will be more costly to prospective owners, which may affect marketability of the lots.

.4 Surface Water

Surface water supply was not considered due to the significant cost of the treatment facilities. The suitability of the treatment plant will have to be examined in detail if this option is desired, however, this option was deemed as cost prohibitive relative to the number of proposed serviced lots.

.5 Individual Cistern (Private Water Hauling) Systems

This option is fairly common for rural subdivisions, and within other subdivisions around Lac La Biche, where insufficient or poor water quality exists. Cisterns could be installed as part of the house construction. Individual lot owners will be responsible for arranging the supply of potable water.

3. WASTE WATER COLLECTION SYSTEM

In addition to the traditional concepts for wastewater collection and disposal, the Owner directed AE to evaluate the utilization of smaller treatment plants as supplied by Western Pump for use in the subdivision. The following concepts were evaluated:

.1 Trunkmain to Lac La Biche, Internal Collection System

This option would require the construction of approximately 29 kms of forcemain from the subdivision to the Town of Lac La Biche wastewater treatment facility. Operation and maintenance of this system would be under the authority of Lakeland County. The cost for the construction of this system is estimated to be between $8.53 to $9.0 million dollars.

It may be possible that some form of cost sharing could be negotiated for the construction of the forcemain. Assuming that one half of the costs of the transmission main could be shared and notwithstanding the costs for the internal servicing works of the subdivision, this option was deemed as being cost prohibitive relative to the number of proposed serviced lots.

.2 Treatment Plant and Internal Collection System

This option would require the installation of about 3,600 m of sanitary collection mains and a small wastewater treatment plant capable of processing 2,050 m^3 of effluent per day to tertiary quality including disinfection. Given the environmental sensitivity of the lake, direct discharge of treated effluent to the lake may not be acceptable. Therefore, a storage/disposal facility would have to be constructed offsite, complete with discharge piping. Operation and maintenance of this system would be under the authority of Lakeland County. The treatment plant, as supplied by Western Pump, is estimated to cost $4.7 million dollars.

The suitability of the treatment plant will have to be examined in detail if this option is to be considered further. However, due to the cost of the treatment plant and the anticipated stringent requirements for disposal of the effluent, this concept was deemed cost prohibitive relative to the number of proposed serviced lots.

.3 Placement of 6 Micro-Treatment (FAST) Plants

A FAST plant is capable of treating up to 17 lots. It is intended that the operation and maintenance of these systems be the responsibility of Lakeland County. The cost per system installation, including the required collection system is estimated to be approximately $165,000. These systems are rated for a BOD/SS and nitrogen reduction of less than 10 mg/l prior to discharge to ground. A module can be added which will provide phosphorus removal as well.

AE has reviewed documentation relating to these systems from the manufacturer and supplier. Lakeland County has also indicated that any treatment system implemented would have to ensure

that the treated effluent quality be consistent for 365 days per year. Since these systems would be managing treatment flows in excess of 25 m^3 per day, the regulations stipulated by Alberta Environment would prevail. Further to this, since the process relies on ambient air being drawn into the unit, during winter, cold air will be drawn into the system and likely result in reduction of the biological treatment process due to the lowering of the temperature inside the unit. If the County insists on consistent treatment, a provision for warmed(er) inlet air will have to be designed. Since the County has not yet utilized this type of treatment process, the FAST sewage treatment system may not be approved without additional design considerations.

.4 Individual (Private) FAST Micro-Treatment Plants and Tile Field Disposal

The developer has indicated that prospective buyers will be encouraged, or required as a covenant of the purchase agreement, to install individual FAST systems as a treatment system prior to tile field disposal. These systems are also rated for a BOD/SS and nitrogen reduction of less than 10 mg/l prior to discharge to ground. A module can be added which will provide phosphorus removal as well.

As discussed previously, AE also reviewed the detailed documentation pertaining to these systems from the manufacturer and supplier. Since these systems are intended to be private, any requirement for consistent effluent treatment quality would be a specific condition prescribed by Lakeland County (and enforced by County bylaw) as the Province does not have prevailing legislation or regulations pertaining to the specific treatment processes or effluent quality for this type packaged treatment (private) systems.

Since this process also relies on ambient air being drawn into the unit, during winter cold air will be drawn into the system likely resulting in a reduction of biological treatment due to lowering of the temperature inside the unit. If the County insists on consistent treatment, a provision for warmed(er) inlet air will have to be designed. Since the County has not yet utilized this type of

treatment process, the FAST system may ultimately not be approved without conditions or additional design considerations.

It should be noted that private effluent discharges smaller than 25 m^3 /day fall under the jurisdiction of Alberta Municipal Affairs – Private Sewage Treatment Systems. The following information is excerpted from the Municipal Affairs – Private Sewage Treatment System Standard of Practice (APSTS) relative to the sanitary servicing of this subdivision:

- The minimum treatment capacity of a packaged plant shall not be less than 1.8 m^3 per day. The smallest FAST package is 5.0 m^3 per day capacity rating.
- The systems are sized based on 340 litres per person at 1.5 persons per bedroom in a dwelling of 3 bedrooms or more.
- The plant, sewage effluent tank or sewage holding tank shall not be located within 9.0 m of a water source or body of water or water course.
- The effluent disposal system shall not be located within 90 m of the shore of a body of water.
- The disposal field shall be designed and constructed in accordance with the provisions of the APSTS. A disposal field shall not have a percolation rate exceeding 5.0 minutes per 25 mm or slower than 60 minutes per 25 mm.

The attached drawing prepared by Thurber Engineering, labeled "Location of Water Table & Percolation Testing", indicates that some percolation sites tested may not be APSTS suited for a tile field disposal system. Thurber Engineering conducted 11 percolation tests in the proposed subdivision and of the 11, only 5 were deemed to be suitable to sustain a disposal field. Two were located in the northern portion of Phase II and the remaining three were located in Phase III. Generally, the percolation tests seem to indicate that Phase 1 and a portion of Phase II were deemed to be unsuitable for septic systems.

.5 Individual Sewage Holding (Pump Out) Tanks

This option is fairly common for rural subdivision in Alberta where existing soils cannot support a field disposal system, prohibitive proximity to bodies of water contravenes the APSTS or any other prohibition established by the local governing subdivision authority.

Based on the above information, and in consideration of the environmental sensitivity of the area, the FAST systems and individual holdings tanks, may be utilized.

4. STORMWATER MANAGEMENT

Upon full development, the Mystic Beach subdivision will consist of 59.6 hectares of country residential lands, yielding a total of 97 residential lots. Approximately 64.8 hectares of the property will be retained in a natural state.

Presently, the project area is mostly treed with a number of sloughs and enclosed depressions, which have been designated as environmental reserves. The subdivision catchment area consists of topographic lows near the shores of Lac La Biche and Savouye Lake which receive drainage from higher situated lands.

The stormwater management concept for the Mystic Beach subdivision is to achieve the following:

- Reduce the potential for flooding and erosion
- Establish drainage routes for the runoff during storm events
- Provide temporary storage capacity within the roadway ditches
- Implement erosion and sediment control measures to encourage water quality improvements

The stormwater management concept for the subdivision was established assuming that the natural topography of the lands be maintained and all surface runoff would be routed to the existing depressed areas throughout the subdivision via ditches and swales. The sub-catchment areas are determined by existing drainage characteristics and the assumed direction of flow (refer to attached Figure 1.1).

Assuming a rural roadway cross section for the subdivision, the proposed drainage system will consist of ditches and culverts. In order to ensure the runoff is directed to the designated low areas, 6.0 m easements will be required throughout the project area. These easements will provide an opportunity to incorporate access points to the natural areas in the subdivision.

Typically, environmental reserve areas are left in their natural state, and stormwater management facilities cannot be constructed within these areas. The existing depressions/sloughs and roadway ditches will be used as temporary storage facilities during storm events. It is expected that during major storm events, flooding will occur within the roadway ditches, and flow into the low lying areas.

The storage volume, required during rainfall events, was estimated using the Rational Method.

- the total runoff volume – Cv x area x rainfall, where Cv is a volumetric runoff coefficient (ratio of rainfall volume to runoff volume),
- all the runoff is assumed to occur during the duration of the storm, which is conservative as it neglects the time lag in the basin.

The required storage volume is the difference between runoff and outflow generated during a storm event. The calculation is repeated for storm events of 4 to 24 hours duration using the Intensity – Duration – Frequency (IDF) curves for the City of Cold Lake. Runoff coefficient (Cv) used was in accordance with the land use and assumed to be 0.15. The critical storm (requiring the greatest storage volume) is the 1:100

year 24 hour storm. Refer to Figure 1.1 and Table 1.1 for flow and storage requirements for indicated catchment area.

Table 1.1
Design Parameters for the 1:100 year 24 Hour Storm Event

Catchment Area	Area (ha)	Flow (L/s)	Storage Volume Required (m^3)	Storage Volume Available (m^3)
1	5.37	9.06	783	2,556
2	3.82	6.45	557	2,380
3	3.30	5.57	481	2,450
4	10.86	18.33	1,584	3,150
5	7.28	12.29	1,062	4,900
6	2.83	4.78	413	1,890
7	6.28	10.60	916	2,590

Assuming that the subdivision roadways are constructed in accordance with County Standards, the available storage volume within the roadway ditches for each of the catchment areas is adequate and should provide sufficient freeboard from the roadway structure.

The provincial design standards require that best management practices be used to reduce sediment from runoff and to improve water quality. Erosion and sediment control measures will be required to ensure the quality of the runoff discharging into the water bodies meet Alberta Environment Standards and Requirements. Some recommended measures are:

- Promoting silt fencing near open water bodies during construction and post construction in order to eliminate the discharge of silts into the lakes.
- Enforcing rock check dams or silt fencing to be used in roadway ditches to contain silts and debris.
- Construct rip-rap outlets at all approach culverts.
- Implementation of grass swales along easements with rock check dams or silt fencing as a water improvement measures.

The erosion control measures will require to be monitored and maintained to ensure they are efficient and effective.

The stormwater management plan requirements will need to be confirmed with Alberta Environment.

5. FRANCHISE UTILITY SERVICES

- **Gas**

The Lac La Biche Gas Cooperative (Co-op) is the franchise provider of natural gas in the area of the subdivision. Final alignment of the gas lines will be provided by the Co-op once the road design drawings are completed by AE.

- **Telephone**

The franchise provider of the telephone service is Telus. There is existing telephone infrastructure in the general vicinity of the subdivision. Telus has indicated that while there is no cost to the developer for the installation of the new infrastructure, it is their policy that for construction on new facilities to occur, Telus requires at least 4 to 5 service order requests to initiate the work. Alignment of the telephone lines is generally the same as power. Telus will provide detailed alignment information once final design drawings are available.

- **Power**

The franchise provider of electrical power to the subdivision is Fortis, a division of TransAlta Power. There are existing overhead lines in the general vicinity of the subdivision to service existing gas wells and local residences. Final alignment of power lines will be provided by TransAlta once the road design drawings are available. It is anticipated that overhead lines will be constructed in the subdivision.

- **Cablevision**

There is no cablevision service in this area.

6. CONCLUSIONS

This report provides site servicing concepts for the proposed Mystic Beach Subdivision located in Lakeland County. This subdivision servicing conclusions/recommendations are summarized as follows:

- Water servicing to be provided by private cisterns.

- Sewer servicing can be provided by installation of the FAST private small package treatment plants, including provisions for nitrogen and phosphorus removal and field disposal systems wherever possible. Where soil conditions are prohibitive to disposal systems, sewage holding tanks (pump outs) will need to be utilized. Alternatively, sewage holding tanks can be used throughout the subdivision.
- Stormwater management for the subdivision is to utilize existing topographic features for drainage flow and storage. In some catchment areas, flow will need to be directed to storage areas via easements and ditches. Erosion/siltation fencing will be required during construction. The site has adequate storage capacity for all catchment areas.
- The interior subdivision roadways will consist of approximately 3.2 km of 8.0 m wide paved surface and paved cul-de-sac radii of 15 m.
- Gas servicing is to be provided by the Lac La Biche Gas Co-op.
- Telephone servicing infrastructure is to be installed by Telus.
- The franchise provider for power in the area is Fortis.
- There is no cablevision service available in the subdivision area.

We trust the foregoing meets with your approval.

Yours truly,

[Signed]

Chris Skowronski, P. Eng.
Manager, Urban Infrastructure

[Signed]

E.A. (Gene) Sobolewski, C.E.T.
Project Manager

GS/CS/ja

LAC LA BICHE

SAVOUYE LAKE

A4 = 10.86 Ha
Q4 = 18.33 L/S

A3 = 3.30 Ha
Q3 = 5.57 L/S

A5 = 7.28 Ha
Q5 = 12.29 L/S

A6 = 2.83 Ha
Q6 = 4.78 L/S

A2 = 3.82 Ha
Q2 = 6.45 L/S

A7 = 6.28 Ha
Q7 = 10.60 L/S

A1 = 5.37 Ha
Q1 = 9.06 L/S

HISTORICAL SITE

LAC LA BICHE

LEGEND

- PROPOSED PROJECT BOUNDARY
- PROPOSED CATCHMENT BOUNDARY
- PROPOSED DRAINAGE EASEMENT
- NATURAL DEPRESSION
- PROPOSED CULVERT
- DRAINAGE

ARMIN A. PREIKSAITIS & ASSOCIATES LTD.

MYSTIC BEACH SUBDIVISION

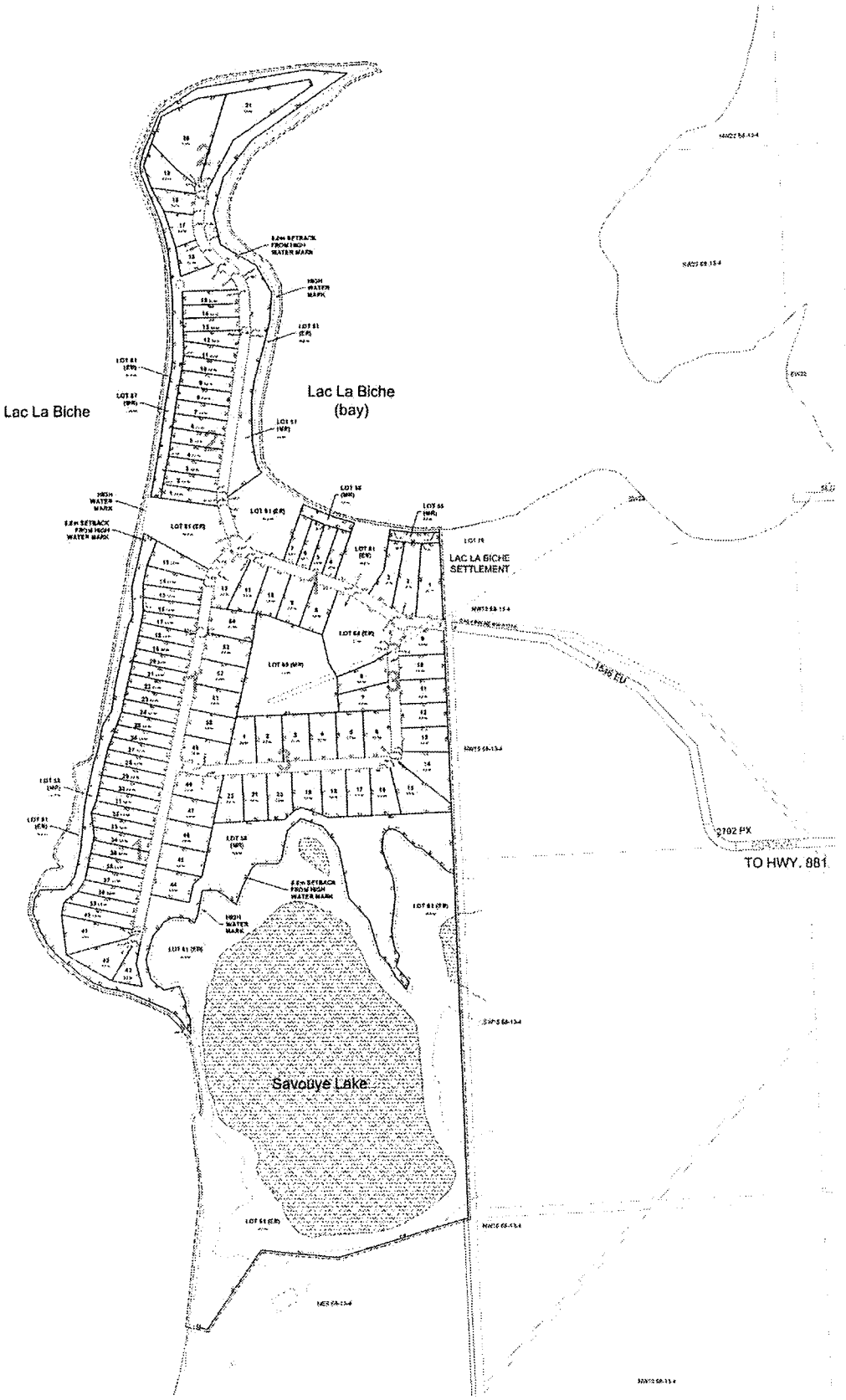
CONCEPTUAL DRAINAGE PLAN

SCALE = 1 : 4,000

DEC, 2004

FIGURE 1.1

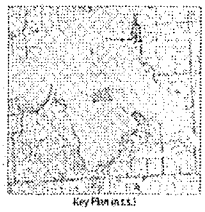
Associated Engineering



MYSTIC BEACH

SHOWING TENTATIVE PLAN OF SUBDIVISION OF

LAKELAND COUNTY - ALBERTA



Key Plan (N.T.S.)

Legend

- Site Boundary
- Water Body
- Lot Boundary
- High Water Mark
- Historic Cemetery Site
- Block Number

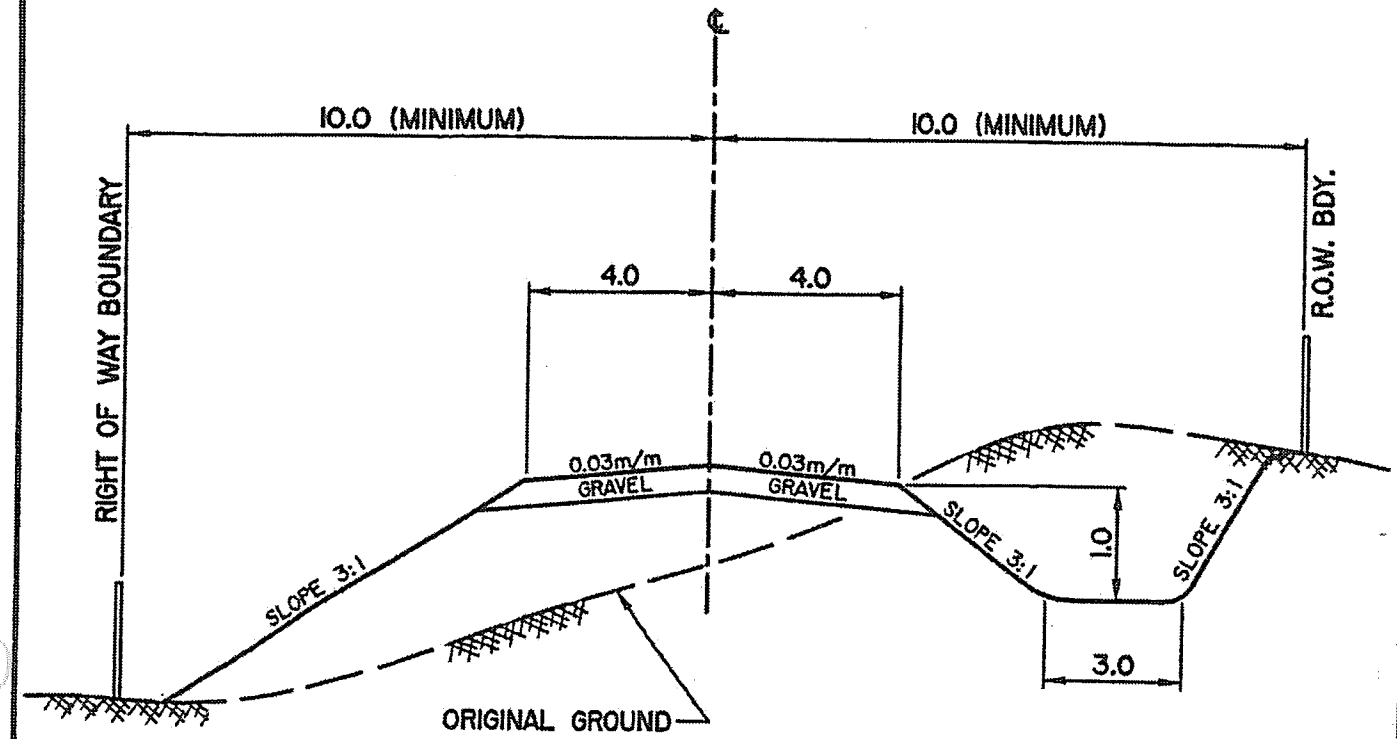
Total Area: 155.89 ha (385.21 ac)

Scale 1:5000

0 50 100 200m

N

LOCAL ROAD



SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MAXIMUM SUPER ELEVATION (m/m)
8.0	20.0	3:1	3:1	3:1	2:1	0.08

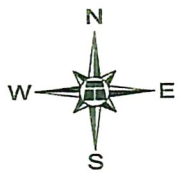
NOTE: ALL DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.

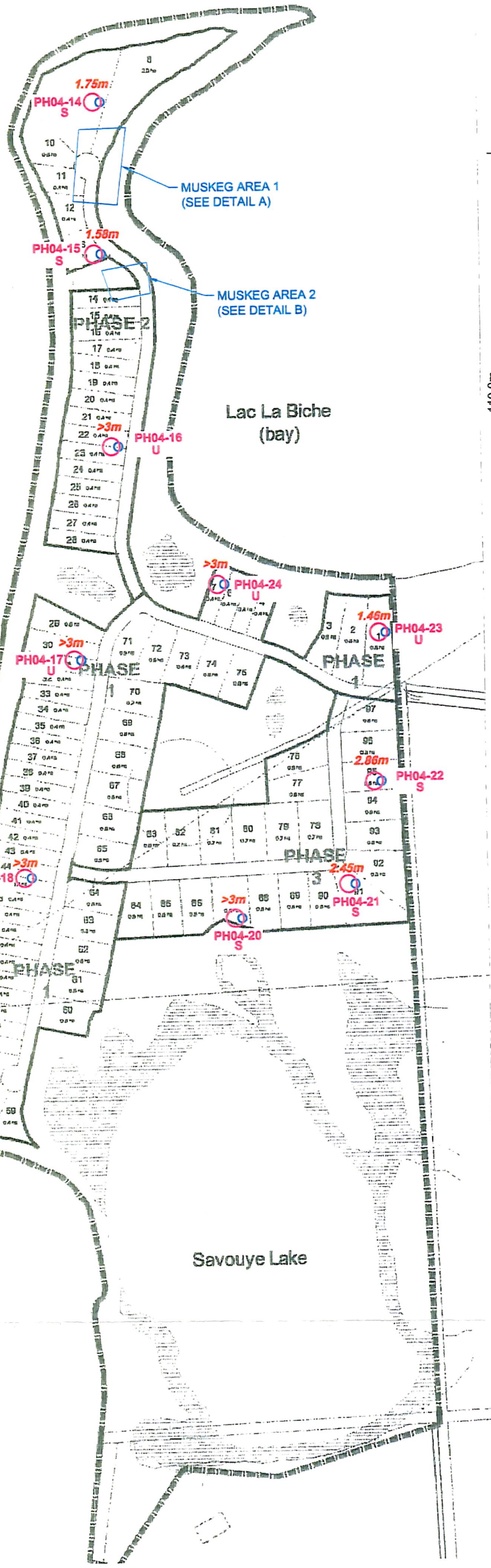
LAKELAND COUNTY

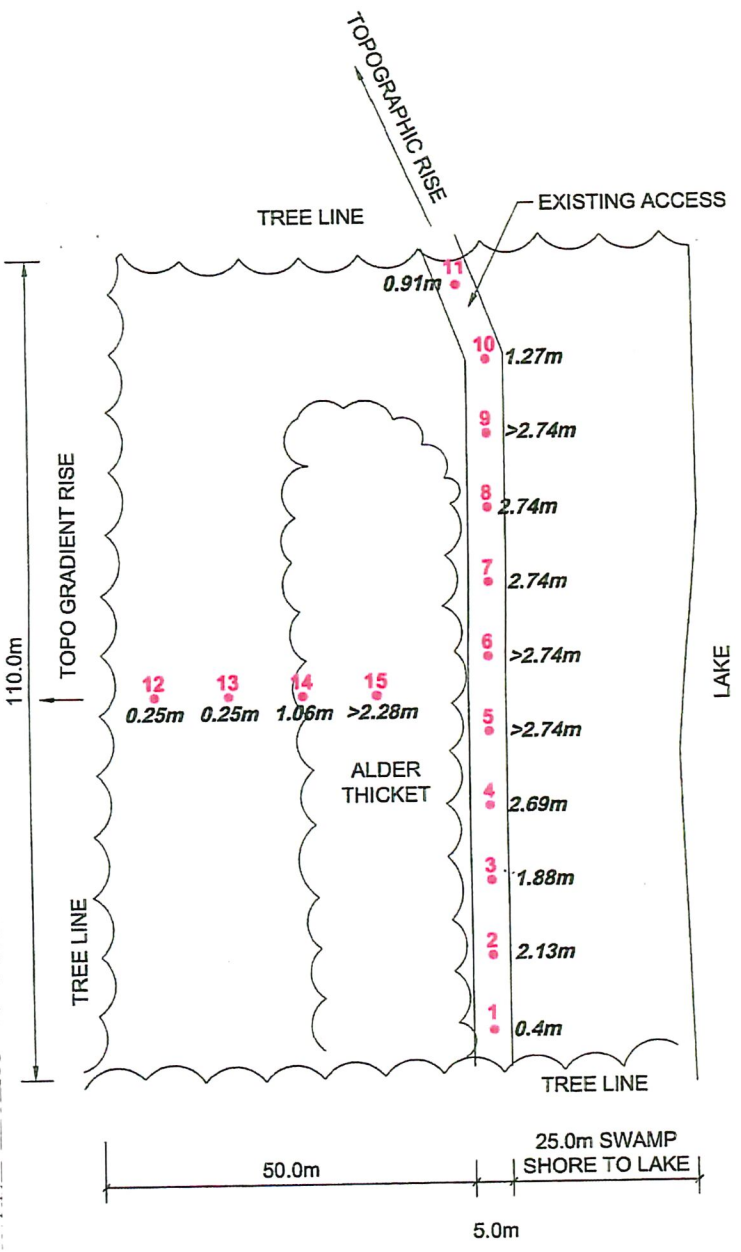
EXH Engineering Services Ltd.

PROJECT No.:	DATE:
305200	01-03-26
DRAWN:	CHECKED:
MRM	DJE

FIGURE 7
LOCAL ROAD
STANDARD CROSS-SECTION

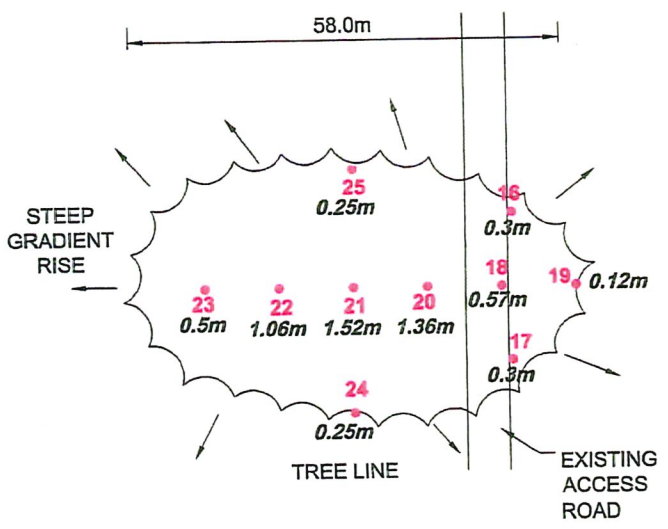






AREA 1 DETAIL A

1:1000



AREA 2 DETAIL B

1:1000

LEGEND

- SITE BOUDARY
- WET AREA
- PERCOLATION TEST
- WATER TABLE WELL
- U — UNSUITABLE FOR SEPTIC FIELD
- S — SUITABLE FOR SEPTIC FIELD
- 1.75m — DEPTH TO WATER (BELOW GROUND SURFACE)
- • 1 — PEAT / MUSKEG AUGER HOLE
- 1.75m — THICKNESS OF PEAT

BASE PLAN PROVIDED BY ARMIN A PREIKSAITIS & ASSOCIATES LTD.

THURBER PROJECT #19-3836-2

ARMIN A PREIKSAITIS & ASSOCIATES LTD.

LOCATION OF WATER TABLE WELLS, PERCOLATION TESTING, AND PEAT THICKNESS

MYSTIC BEACH SUBDIVISION — NEAR LAC LA BICHE, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER:	DRAWN:	APPROVED:
DMB	ZD	
DATE:	SCALE:	DRAWING No.
OCT., 2004	1:8000	19-3836-2-2

G:\ACADFILES\19-3836-2\19-3836-2-2.dwg - 1 - Jan. 14, 2005 4:09pm

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

October 1, 2004 File: 19-3836-2

Armin A. Preiksaitis Associates Ltd.
408 The Boardwalk
10310 – 102 Avenue
Edmonton, Alberta
T6E 5V5

Attention: Mr. G. MacKenzie

DESKTOP GROUNDWATER EVALUATION
DR. BIRKHILL SUBDIVISION, 16-68-13 W4M
NEAR LAC LA BICHE, ALBERTA

Dear Sir,

This letter report presents Thurber Engineering Ltd. (Thurber) desktop study related to a groundwater supply evaluation for the above noted proposed development area.

Use of the report is subject to the Statement of General Conditions, which is included at the end of the text of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

1. OBJECTIVE AND SCOPE OF WORK

The objective of this desktop study is to provide an evaluation of groundwater resources potential in the area of section 16-68-13-W4M. In general, the proposed development is comprised of approximately 100 parcels of 0.5 to 2 acres in size. It is understood that each household requires 1,250 m^3/year of water (Water Act).

Thurber's scope of work is outlined in our September 1st, 2004 proposal.

- Review available geological and hydrogeological reports.;
- Review water well data from the Alberta Environment (AENV) water well database via The Groundwater Centre (TGWC);
- Assess groundwater quality;
- Prepare a Cross-Section; and,

- Prepare a letter report including professional opinion on groundwater availability in the area

2. GROUNDWATER EVALUATION

2.1 Geology and Hydrogeology

Geological and Hydrogeological reports (Ozoray, G.F, and Wallick E.I[1]) and water well lithology were reviewed for the development area. These reports indicate that the area is underlain by a cover of surficial sediments (bedrock channel sediments) which can be in the order of 50 m thick. This sediment cover consists of clay, sand and gravel. A plan of the proposed development area is shown on Drawing 19-3836-2-1

Below the surficial sediments is bedrock composed of the Cretaceous Age Lea Park Formation and the Upper Colorado Group, which are mostly made up of bentonitic shale.

A hydrogeological cross section of the study area is shown on Drawing 19-3836-2-2 and the location of the cross-section is shown on Drawing 19-3836-2-1. The cross section depicts some of the geological and hydrogeological characteristics of the study area. The cross-section exemplifies the fact that based on existing water well data, the groundwater in the area is produced from the surficial sediments located above the bedrock.

2.2 TGWC Water Well Data Base

A Search of the TGWC water well database was conducted in an area centered on NE 16-68-13-W4M and covering section 09, 10, 15 and 22. There were 17 well records (Appendix A) available in the database within this area. The approximate locations of water wells are shown on Drawing 19-3836-2-2. In general, the wells have been completed to depths that range from 9 m to 429 m, however, the majority of the wells have been completed at depths ranging from 17 to 36 m.

2.2.1 Apparent Twenty-Year Safe Yield $_AQ_{20}$

The data from TGWC water well database was reviewed (Appendix A) and a few $_AQ_{20}$ yields from consultant reports have been summarized in Table 2.1. These $_AQ_{20}$ yield values range from 20440 to 48545 m^3/year (8.5 to 20 imperial gallons per minute (igpm)). The surficial deposits consist of materials such as sand, gravel. Bedrock found below would be a poor groundwater bearing unit as it is mostly composed of shale and siltstone. It should be noted that the calculated $_AQ_{20}$

[1] G. Ozoray and E. Wallick, 1979, "Hydrogeology of the Sand River Area, Alberta" Alberta Research Council report 79-1

I:\14-19\19-3836-2\19-3836-2-1.dwg-Oct. 06, 2004 8:3...

N
W E
S

RNG RD 141

RNG RD 135

Rge 14
Tp 69

Rge 13

Rge 12

CANADIAN NATIONAL TRACK

HWY 858

Square Lake

0188844
0188845
0188848
A'
0188818
0188813
0188811
0188807
0188817
Red Fox Island
Owl River
0188842
0188837
0188830
0188801
A
0188771
0188775
0188766
0169572
Dr. Berkhill Subdivision (The Site)

TWP RD 683

Tweedie

TWP RD 682

CANADIAN NATIONAL TRACK

TWP RD 681

Tp 68

Lac La Biche

Birch Island

Current Island

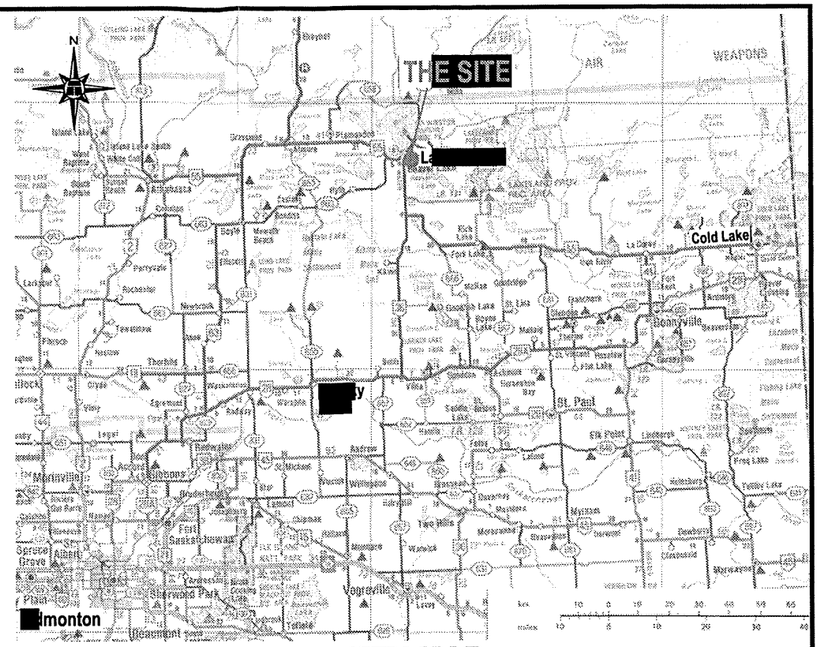
Tp 67

Big Island

HWY 881

SITE PLAN
1 : 75,000

0 1 2 3 4 5 km
SCALE 1:75000



KEY MAP
AS SHOWN

LEGEND

0188818 — WELL ID

WELL LOCATION

A ---·--- A' CROSS-SECTION TRACE

CLIENT : ARMIN A PREIKSAITIS & ASSOCIATES

PROJECT :

DR. BERKHILL SUBDIVISON
LOCATION PLAN

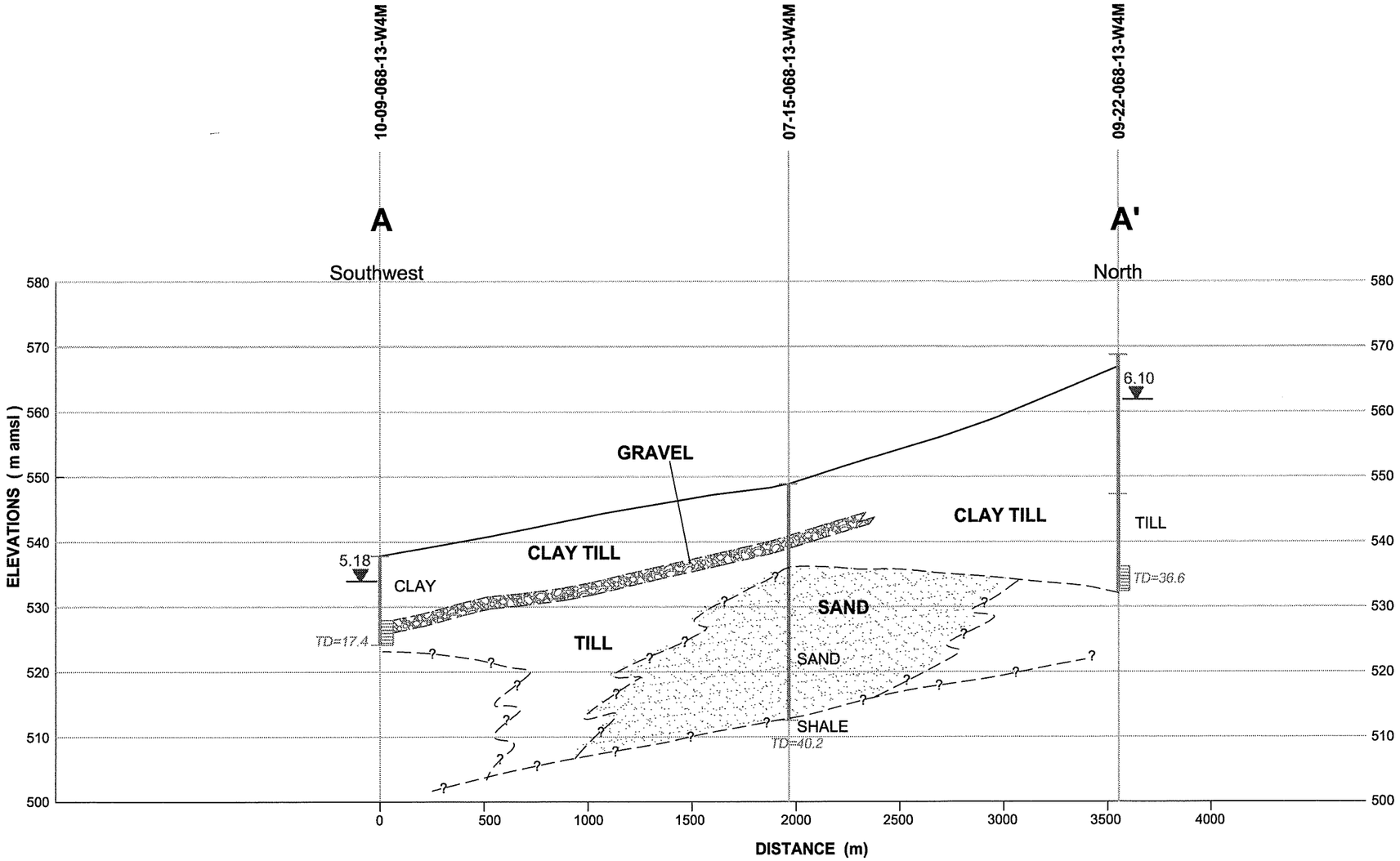
GROUNDWATER AVAILABILITY AND PERCOLATIN TESTS

SEC 16-68-13 W4M
NEAR LAC LA BICHE, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ENGINEER :	DRAWN :	APPROVED :
DMB	MNG	
DATE :	SCALE :	DRAWING No.
SEP. , 2004	AS SHOWN	19 - 3836 - 2 - 1

I:\14-19\19-3836-2\19-3836-2-1.dwg-Oct. 06, 2004 8:4



CROSS-SECTION A-A'

VERT. SCALE 1:7500
HORI. SCALE = AS SHOWN

LEGEND

WELL

TD=36.6 — TOTAL DEPTH

6.10 DEPTH OF WATER LEVEL FROM TOP OF WELL

NOTE:

1. **DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE BOREHOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.**

0 10 20 30 40 50m
VERTICAL SCALE 1:750

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES

PROJECT:

CROSS-SECTION A-A'

GROUNDWATER AVAILABILITY AND PERCOLATIN TESTS — LAC LA BICHE, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ENGINEER:	DRAWN:	APPROVED:
DMB	MNG	
DATE:	SCALE:	DRAWING No.
SEP. , 2004	AS SHOWN	19 - 3836 - 2 - 2

values may be based on short duration pumping tests of 2 hours or less. As a result, the values indicated on Table 2.1 may not take into account long-term pumping or the potential lateral changes that could occur in the surficial or bedrock hydraulic conductivity values (K) possibly resulting in lower $_AQ_{20}$ values.

Table 2.1
$_AQ_{20}$ in the vicinity of
Section 16-68-18-W4M, near Lac La Biche, Alberta
from consultant reports

Location	Depth to top of groundwater bearing unit (m)	Depth to water (m)	$_AQ_{20}$ m^3/year
10-9-68-13 W4M	14	-	48545
NE 10-68-13 W4M	26	-	37595
NW 15-68-13-W4M	4	-	43070
NE 22-68-13 W4M	17	-	37595
9-22-68-13 W4M	32	6	20440
10-22-68-13- W4M	10	-	39055

Ozoray and Wallick, 1979 hydrogeological map of the area indicates that the $_AQ_{20}$ yields in the area could be in the order of 59655 to 298000 m^3/year (25 to 100 igpm) or much larger than the 1250 m^3/year indicated in the Water Act.

2.2.2 Groundwater Quality

Eleven groundwater analyses were found in the TGWC water well database for sections 9, 10, 15, 16, and 22-068-13-W4M. These chemical analyses are included on the water well logs in Appendix A and have been tabulated in Table 2.2.

Table 2.2
Groundwater quality in the vicinity of
Section 16-68-13 W4M
Dr. Berkhill Subdivision
Lac La Biche, Alberta

Alberta Environment ID No.	Legal Description	Total depth (m)	TDS mg/L	pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO_3 mg/L	SO_4 mg/L	Cl mg/L
		CDWQ Guidelines*	<500	6 to 8	-	-	200	-	-	<500	<250
1888771	10-9-68-13 W4M	17.4	**2831**	8	8	72	**917**	7.7	614	**1080**	**435**
1888775	NE 10-68-13 W4M	9.1	**799**	7.7	146	80	15	4.3	643	46	55
188813	NW 15-68-13 W4M	15.5	**1578**	8	224	77	**202**	6.2	707	**700**	21
188817	NE 15-68-13 W4M	12.2	**2980**	7.6	392	200	**285**	8.6	794	**1667**	32
188837	NE 15-68-13 W4M	22.3	**1643**	8	194	86	**227**	6.7	788	**708**	33
188811	NW 15-68-13 W4M	20.7	**1370**	**8.3**	70	29	**390**	5	673	375	170
188807	NW 15-68-13 W4M	18.3	**1740**	7.6	161	70	**314**	10.6	395	**883**	103
188842	16-68-13 W4M	20.1	**1112**	7.8	98	41	**212**	5.8	299	**540**	63
188844	NE 22-68-13 W4M	-	**938**	7.83	106	39	197	4.7	631	228	52
188845	9-22-68-13 W4M	36.6	**733**	7.9	33	33	192	4.4	472	170	57
188848	10-22-68-13 W4M	429.8	**3718**	**8.25**	34	3	**1164**	-	1542	35	**940**

* 2002, Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines
Bold numbers indicate parameters that exceed the guidelines

Client: Armin A. Preiksaitis Associates Ltd.
File No. 19-3836-2
E file: 08\19\3836-2 let

Based on the review of the TGWC chemical analysis data and a comparison of the analyses to the Canadian Council of Ministers of the Environment, Canadian Drinking Water Quality Guidelines (2002, CCME, CDWQ), groundwater quality is poor in the general area and is of mixed types ranging from Calcium-Magnesium/Bicarbonate to Sodium/Sulfate-Chloride.

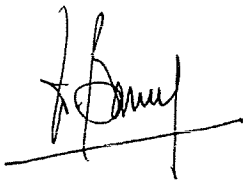
3. CONCLUSION

Based on the review of the TGWC water well database, geological map and hydrogeological report there appear to be a potential for 1250 m^3/year in the surficial deposits of poor quality groundwater for the proposed development area at depths of 9 to 36 m. However, this or the potential impact of pumping on neighbouring groundwater users can only be confirmed by conducting a long duration pumping test (24 hours of drawdown and 24 hours of recovery).

4. CLOSURE

We trust this information meets your present needs. If you have any questions please do not hesitate to call the undersigned.

Yours very truly,
Thurber Engineering Ltd.
Neal Fernuik, P. Biol. P. Eng.
Review Principal



D. Borneuf, P. Geol.
Associate, Hydrogeologist

/slp

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)

INTERPRETATION OF THE REPORT *(continued)*

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

APPENDIX A

TGWC Water well data

THURBER

Owner: *Bow Industries Ltd.*
AB
Contractor: *[unknown contractor]*

METRIC REPORT

07-09-068-13 W4M

M35377.120962

Easting (m): *197,499* ** *70/80*
Northing (m): *6,081,948* **
Elevation (m): *546* ***

Work Type: *Chemistry*
Drilling Method: *[unknown]*
Proposed Use: *Industrial*
Completion Type: *[unknown]*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Flowing: *No*
Oil Present: *No*
Gas Present: *No*

General Details

Depth Completed (m): *280.4*
Depth Drilled (m): *280.4*

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *GL*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):		Nitrate as N:		Colour:	
TDS (Calculated):		Nitrite as N:		Turbidity:	
Temperature (°C):		pH (pH Unit): *7.9*		Sulfate:	
Hardness (as CaCO3):		Oil & Grease		Fluoride:	
T-Alkalinity (as CaCO3):		Total Coliforms:		Carbonate:	
P-Alkalinity (as CaCO3):		Fecal Coliforms:		Bicarbonate: *239*	
Nitrate + Nitrite as N: *0*		Ion Balance (%):		Hydroxide: *0*	

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*491*		Mercury:		
Chloride:			Molybdenum:		
Iron:			Magnesium:	*149*	
Manganese:			Sodium:		
Aluminum:			Potassium:		
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		

Chemistry Comments: ***Chemistry hard to read.***

50477 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188766*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground ; AMSL}*

Owner: ***Alberta Environment***
AB
Contractor: ***Hi-Rate Drilling 1985 Ltd***
Well Name: ***Well No. 7***

METRIC REPORT

10-09-068-13 W4M

M35377.120964

Easting (m):	*197,482* **	*70/80*
Northing (m):	*6,082,351* **	
Elevation (m):	*544* ***	

Work Type: ***New Well***
Drilling Method: ***Rotary***
Proposed Use: ***[unknown]***
Completion Type: ***Screen***
Date Completed: ***Nov 01, 1973***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***17.4***
Depth Drilled (m): ***18.3***
Completion Aquifer: ***Bonnyville ****
Sand & Gravel Thickness (m): ***1.5 (total) — 1.5 (below 15 m) ****
Top of Bedrock: ***Surficial Water Well ****
Completion Interval (m): ***15.9 — 17.4 ****

Water Level (m): ***5.18 m — 01 Nov 1973 11:00***

Completion Details

Surface Casing: ***[unknown] — 139.7 mm (O.D.) x 6.35 mm (thick) x 14.93 m (bottom)***

Screen Material: ***Stainless Steel — 76.2 mm (I.D.) (Telescoped)***
Fittings: ***Bottom: Washdown***
Pack: ***Natural***

Intervals

-- Completion Interval(s) --

Screen: ***15.9 to 17.4 m - 15 Slot***

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (4)
538.4	*6.1*	*Dark Grey Clay*
528.3	*16.1*	*Black Clay*
526.8	*17.7*	*Gravel*
526.2	*18.3*	*Grey Till*

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: ***Nov 22, 1973 - Alberta Environment (AENV)***

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*4600*	Nitrate as N:	*0.099*	Colour:	
TDS (Calculated):	*2831*	Nitrite as N:	*0.099*	Turbidity:	
Temperature (°C):		pH (pH Unit):	*8*	Sulfate:	*1080*
Hardness (as CaCO3):	*310*	Oil & Grease		Fluoride:	*0.25*
T-Alkalinity (as CaCO3):	*503*	Total Coliforms:		Carbonate:	
P-Alkalinity (as CaCO3):		Fecal Coliforms:		Bicarbonate:	*614*
Nitrate + Nitnte as N:	*0*	Ion Balance (%):	*103*	Hydroxide:	*0*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*8*		Mercury:		
Chloride:	*435*		Molybdenum:		
Iron:	*5.5*		Magnesium:	*72*	
Manganese:			Sodium:	*917*	
Aluminum:			Potassium:	*7.7*	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		

Extractable: unfiltered sample
Dissolved: filtered sample

50482 - (1 / 1)

General Comments / Observations

Land Owned By E. Laboucane Seal Type listed as 'Driven & Grouted' but no interval defined.

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	*01 Nov 1973 11:00*	*[unknown]*				*5.18*	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188771*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground , AMSL}*

Owner: ***Skyrpan, Fred***
Box 1709, Lac La Biche, AB T0A 2C0

Contractor: ***Benn, W. Enterprises Ltd.***

METRIC REPORT

NE 10-068-13 W4M

M35377.117681

Easting (m): ***199,307*** ** 70/80
Northing (m): ***6,082,633*** **
Elevation (m): ***581*** ***

Work Type: ***New Well***
Drilling Method: ***Bored***
Proposed Use: ***Domestic & Stock***
Completion Type: ***Perforated Casing/Liner***

Date Started: ***Sep 17, 1992***
Date Completed: ***Sep 17, 1992***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

Water Required (L/day): ***1,892***

General Details

Depth Completed (m): ***17.4***
Depth Drilled (m): ***17.4***
Completion Aquifer: ***Grand Centre*** *
Sand & Gravel Thickness (m): ***0.9 (total)*** *

Top of Bedrock: ***Surficial Water Well*** *
Completion Interval (m): ***6.7 — 17.4*** *

Water Level (m): ***7.62 m — 17 Sep 1992 11:00***

Completion Details

Surface Casing: ***Galvanized Steel — 635.0 mm (O.D.) x 0.41 mm (thick) x 17.37 m (bottom)***

Pack: ***Artificial (.125) - 7 Yards***

Intervals

-- Completion Interval(s) --

Casing: ***6.7 to 17.4 m - 0.125 x 1 - Method: Other***

-- Construction Interval(s) --

AENV Seal: ***to 3.7 m -- [Cuttings]***

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (4)
574.3	7.6	*Brown Till & Rocks*
573.4	8.5	*Blue Till*
572.5	9.4	*Water Bearing Sand & Gravel*
564.6	17.4	*Blue Till & Rocks*

Chemistry Summary Details (mg/L) (most recent first)

General Comments / Observations

Measured Recovery Rate From 54-44' 2 GPM.

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	17 Sep 1992 11:00	Bailer			9.1	7.62	5.8	13.4	—			1.9		

Alternative IDs

AENV - GIC (WELLID): *0169572*

* ***TGWC*** *calculated or determined value*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground , AMSL}*

Owner: ***Shyrpan, Demetro***
Box 97, Lac La Biche, AB

Contractor: ***[unknown contractor]***

METRIC REPORT

NE 10-068-13 W4M

M35377.120973

Easting (m):	*199,307* **	*70/80*
Northing (m):	*6,082,633* **	
Elevation (m):	*581* ***	

Work Type: ***Chemistry***
Drilling Method: ***Bored***
Proposed Use: ***Domestic***
Completion Type: ***[unknown]***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***9.1***
Depth Drilled (m): ***9.1***

Water Level (m): ***3.66 m — 14 Apr 1970 11:00***

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: ***Jul 12, 1978 - Alberta Environment (AENV)***

Constituent	Result
Conductivity (µS/cm):	*1334*
TDS (Calculated):	*799*
Temperature (°C):	
Hardness (as CaCO3):	*696*
T-Alkalinity (as CaCO3):	*528*
P-Alkalinity (as CaCO3):	
Nitrate + Nitrite as N:	*30.37*

Constituent	Result
Nitrate as N:	
Nitrite as N:	*0.05*
pH (pH Unit):	*7.7*
Oil & Grease	
Total Coliforms:	
Fecal Coliforms:	
Ion Balance (%):	*96*

Constituent	Result
Colour:	
Turbidity:	
Sulfate:	*46*
Fluoride:	*0.44*
Carbonate:	
Bicarbonate:	*643*
Hydroxide:	*0*

Constituent	Extractable	Dissolved
Calcium:	*146*	
Chloride:	*55*	
Iron:	*0.07*	
Manganese:		
Aluminum:		
Arsenic:		
Barium:		
Beryllium:		
Cadmium:		
Chromium:		
Cobalt:		

Constituent	Extractable	Dissolved
Mercury:		
Molybdenum:		
Magnesium:	*80*	
Sodium:	*15*	
Potassium:	*4.3*	
Vanadium:		
Strontium:		
Nickel:		
Zinc:		
Copper:		
Lead:		

Extractable - unfiltered
Dissolved - filtered

50485 - (1 / 2)

General Comments / Observations

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	*14 Apr 1970 11:00*	*[unknown]*				*3.66*	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188775*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground ; AMSL}*

Owner: *Kamke*
Box 188, Lac La Biche, AB T0A 2C0
Contractor: *[unknown contractor]*

METRIC REPORT

NW 15-068-13 W4M

M35377.121008

Easting (m):	*198,419* **	*70/80*
Northing (m):	*6,084,219* **	
Elevation (m):	*551* ***	

Work Type: *Chemistry*
Drilling Method: *[unknown]*
Proposed Use: *Domestic*
Completion Type: *[unknown]*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Oil Present: *No*
Gas Present: *No*
Flowing: *No*

General Details

Depth Completed (m): *15.5*
Depth Drilled (m): *15.5*

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *Jul 29, 1986 - Vegreville*

Constituent	Result
Conductivity (µS/cm):	*2210*
TDS (Calculated):	*1578*
Temperature (°C):	
Hardness (as CaCO3):	*875*
T-Alkalinity (as CaCO3):	*580*
P-Alkalinity (as CaCO3):	
Nitrate + Nitrite as N:	*< 0.05*

Constituent	Result
Nitrate as N:	
Nitrite as N:	*0.05*
pH (pH Unit):	*8*
Oil & Grease	
Total Coliforms:	
Fecal Coliforms:	
Ion Balance (%):	*99*

Constituent	Result
Colour:	
Turbidity:	
Sulfate:	*700*
Fluoride:	*0.13*
Carbonate:	
Bicarbonate:	*707*
Hydroxide:	*0*

Constituent	Extractable	Dissolved
Calcium:	*224*	
Chloride:	*21*	
Iron:	*2.33*	
Manganese:		
Aluminum:		
Arsenic:		
Barium:		
Beryllium:		
Cadmium:		
Chromium:		
Cobalt:		

Constituent	Extractable	Dissolved
Mercury:		
Molybdenum:		
Magnesium:	*77*	
Sodium:	*202*	
Potassium:	*6.2*	
Vanadium:		
Strontium:		
Nickel:		
Zinc:		
Copper:		
Lead:		

50518 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188813*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground : AMSL}*

Owner: *Desjarlais, Leo*
Lac La Biche, AB

Contractor: *[unknown contractor]*

METRIC REPORT

NE 15-068-13 W4M

M35377.121009

Easting (m): *199,235* ** *70/80*
Northing (m): *6,084,255* **
Elevation (m): *547* ***

Work Type: *Chemistry*
Drilling Method: *Bored*
Proposed Use: *Domestic*
Completion Type: *[unknown]*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Oil Present: *No*
Gas Present: *No*
Flowing: *No*

General Details

Depth Completed (m): *12.2*
Depth Drilled (m): *12.2*

Water Level (m): *1.22 m — 30 Jul 1975 11:00*

Lithology Details

Completion Details

Intervals

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *Aug 20, 1975 - Alberta Environment (AENV)*

Constituent	Result
Conductivity (µS/cm)	*4090*
TDS (Calculated)	*2980*
Temperature (°C)	
Hardness (as CaCO3)	*1780*
T-Alkalinity (as CaCO3)	*651*
P-Alkalinity (as CaCO3)	
Nitrate + Nitrite as N	*< 0.1*

Constituent	Result
Nitrate as N	
Nitrite as N	*0.099*
pH (pH Unit)	*7.6*
Oil & Grease	
Total Coliforms	
Fecal Coliforms	
Ion Balance (%)	*99*

Constituent	Result
Colour	
Turbidity	
Sulfate	*1667*
Fluoride	*0.42*
Carbonate	
Bicarbonate	*794*
Hydroxide	*0*

Constituent	Extractable	Dissolved
Calcium	*392*	
Chloride	*32*	
Iron	*0.1*	
Manganese		
Aluminum		
Arsenic		
Barium		
Beryllium		
Cadmium		
Chromium		
Cobalt		

Constituent	Extractable	Dissolved
Mercury		
Molybdenum		
Magnesium	*200*	
Sodium	*285*	
Potassium	*8.6*	
Vanadium		
Strontium		
Nickel		
Zinc		
Copper		
Lead		

Extractable: undefined
Dissolved: Digested

50519 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

No	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	30 Jul 1975 11:00	*[unknown]*				1.22	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188817*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — (10TM NAD27)*
**** 80 - MT DEM — (Ground ; AMSL)*

Owner: *Jones, Christopher*
Box 502, Lac La Biche, AB T0A 2C0

Contractor: *Benn, W. Enterprises Ltd.*

METRIC REPORT

NE 15-068-13 W4M

M35377.121032

Easting (m): *199,235 *** *70/80*
Northing (m): *6,084,255 ***
Elevation (m): *547 ****

Work Type: *New Well*
Drilling Method: *Bored*
Proposed Use: *Domestic & Stock*
Completion Type: *Perforated Casing/Liner*

Date Started: *May 15, 1980*
Date Completed: *May 16, 1980*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Flowing: *No*

Oil Present: *No*
Gas Present: *No*

Water Required (L/day): *2,271*

General Details

Depth Completed (m): *22.3*
Depth Drilled (m): *22.3*

Top of Bedrock: *Surficial Water Well **

Sand & Gravel Thickness (m): *1.5 (total) — 1.5 (below 15 m) **

Water Level (m): *15.24 m — 16 May 1980 11:00*

Completion Details

Surface Casing: *Galvanized Steel — 635.0 mm (O.D.) x 1.60 mm (thick) x 22.25 m (bottom)*

Pack: *Artificial (.75) - 4.5 Yards*

Intervals

-- Construction Interval(s) --

AENV Seal: *to 3.0 m -- [Formation Packer]*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (7)
546.7	0.3	Topsoil
543.0	4.0	Brown Till & Clay
528.7	18.3	Hard Blue [see comments]
528.1	18.9	Fine Grained Grey Sand
526.3	20.7	Hard Grey Silt
525.4	21.6	Coarse Grained Sand
524.8	22.3	Blue Till & Clay

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *Nov 03, 1981 - Vegreville*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):		Nitrate as N:		Colour:	
TDS (Calculated):	*1643*	Nitrite as N:	*0.05*	Turbidity:	
Temperature (°C):		pH (pH Unit):	*8*	Sulfate:	*708*
Hardness (as CaCO3):	*838*	Oil & Grease		Fluoride:	*0.18*
T-Alkalinity (as CaCO3):	*647*	Total Coliforms:		Carbonate:	
P-Alkalinity (as CaCO3):		Fecal Coliforms:		Bicarbonate:	*788*
Nitrate + Nitrite as N:	*0.11*	Ion Balance (%):	*94*	Hydroxide:	*0*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*194*		Mercury:		
Chloride:	*33*		Molybdenum:		
Iron:	*0.16*		Magnesium:	*86*	
Manganese:			Sodium:	*227*	
Aluminum:			Potassium:	*6.7*	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		

50529 - (1 / 1)

General Comments / Observations

Driller Reports "medium Hard Water". 13'-60' Clay. Till & Sand.

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	*16 May 1980 11:00*	*Bailer*			*9.1*	*15.24*	*6.1*	*21.3*	*21.0*			*1.8*		

Alternative IDs

AENV - GIC (WELLID): *0168837*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground ; AMSL}*

Owner: ***Shukalick, Robert***
Box 1493, Lac La Biche, AB T0A 2C0

Contractor: ***Benn, W. Enterprises Ltd.***

METRIC REPORT

NW 15-068-13 W4M

M35377.121006

Easting (m):	*198,419* **	*70/80*
Northing (m):	*6,084,219* **	
Elevation (m):	*551* ***	

Work Type: ***New Well***
Drilling Method: ***Rotary***
Proposed Use: ***Domestic***
Completion Type: ***Perforated Casing/Liner***

Date Started: ***May 16, 1980***
Date Completed: ***May 16, 1980***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

Water Required (L/day): ***1,892***

General Details

Depth Completed (m): ***20.7***
Depth Drilled (m): ***20.7***

Top of Bedrock: ***Surficial Water Well*** *

Sand & Gravel Thickness (m): ***2.1 (total) — 2.1 (below 15 m)*** *

Water Level (m): ***4.57 m — 16 May 1980 11:00***

Completion Details

Surface Casing: ***Galvanized Steel — 635.0 mm (O.D.) x 1.60 mm (thick) x 20.73 m (bottom)***

Pack: ***Artificial (.75) - 4 Yards***

Intervals

-- Construction Interval(s) --

AENV Seal: *to 3.0 m -- [Packer & Cement]*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (5)
551.4	*0.3*	*Topsoil*
548.0	*3.7*	*Brown Till & Clay*
544.7	*7.0*	*Clayey Till & Rocks*
533.1	*18.6*	*Blue Till & Clay*
530.9	*20.7*	*Grey Sand*

Chemistry Summary Details (mg/L)

(most recent first)

Analysis Details: ***Mar 19, 1986 - Vegreville (3393)***

Constituent	Result
Conductivity (µS/cm):	*2070*
TDS (Calculated):	*1370*
Temperature (°C):	
Hardness (as CaCO3):	*294*
T-Alkalinity (as CaCO3):	*552*
P-Alkalinity (as CaCO3):	
Nitrate + Nitrite as N:	*< 0.05*
Nitrate as N:	
Nitrite as N:	*0.05*
pH (pH Unit):	*8.3*
Oil & Grease	
Total Coliforms:	
Fecal Coliforms:	
Ion Balance (%):	*97*
Colour:	
Turbidity:	
Sulfate:	*375*
Fluoride:	*0.22*
Carbonate:	
Bicarbonate:	*673*
Hydroxide:	*0*

Constituent	Extractable	Dissolved
Calcium:	*70*	
Chloride:	*170*	
Iron:	*1.36*	
Manganese:		
Aluminum:		
Arsenic:		
Barium:		
Beryllium:		
Cadmium:		
Chromium:		
Cobalt:		
Mercury:		
Molybdenum:		
Magnesium:	*29*	
Sodium:	*390*	
Potassium:	*5*	
Vanadium:		
Strontium:		
Nickel:		
Zinc:		
Copper:		
Lead:		

Extractable: unfiltered
Dissolved: filtered

50508 - (1 / 2)

General Comments / Observations

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	*16 May 1980 11:00*	*Bailer*			*90.9*	*4.57*	*6.1*	*10.7*	*15.2*				*22.1.*	

Alternative IDs

AENV - GIC (WELLID): *0188811*

* ***TGWC*** *calculated or determined value*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground , AMSL}*

Owner: ***Labboucane, Sam***
Lac La Biche, AB

Contractor: ***[unknown contractor]***

METRIC REPORT

NW 15-068-13 W4M

M35377.121001

Easting (m):	*198,419* **	*70/80*
Northing (m):	*6,084,219* **	
Elevation (m):	*551* ***	

Work Type: ***Chemistry***
Drilling Method: ***Bored***
Proposed Use: ***Domestic***
Completion Type: ***[unknown]***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***18.3***
Depth Drilled (m): ***18.3***

Water Level (m): ***10.97 m — 30 Jul 1975 11:00***

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: ***Aug 26, 1975 - Alberta Environment (AENV)***

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*2600*	Nitrate as N:		Colour:	
TDS (Calculated):	*1740*	Nitrite as N:	*0.099*	Turbidity:	
Temperature (°C):		pH (pH Unit):	*7.6*	Sulfate:	*883*
Hardness (as CaCO3):	*684*	Oil & Grease		Fluoride:	*0.24*
T-Alkalinity (as CaCO3):	*323*	Total Coliforms:		Carbonate:	
P-Alkalinity (as CaCO3):		Fecal Coliforms:		Bicarbonate:	*395*
Nitrate + Nitrite as N:	*0.01*	Ion Balance (%):	*100*	Hydroxide:	*0*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*161*		Mercury:		
Chloride:	*103*		Molybdenum:		
Iron:	*0.1*		Magnesium:	*70*	
Manganese:			Sodium:	*314*	
Aluminum:			Potassium:	*10.6*	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		

50506 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	30 Jul 1975 11:00	*[unknown]*				10.97	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188807*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground : AMSL}*

Owner: *Ramsay, Lloyd*
Box 546, Lac La Biche, AB

Contractor: *Benn, W. Enterprises Ltd.*

METRIC REPORT

NE(15-068-13 W4M

M35377.121013

Easting (m):	*199,235* **	*70/80*
Northing (m):	*6,084,255* **	
Elevation (m):	*547* ***	

Work Type: *Deepened*
Drilling Method: *Bored*
Proposed Use: *Domestic & Stock*
Completion Type: *Casing*

Date Started: *Sep 08, 1980*
Date Completed: *Sep 08, 1980*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Oil Present: *No*
Gas Present: *No*
Flowing: *No*

Water Required (L/day): *1,892*

General Details

Depth Completed (m): *18.3*
Depth Drilled (m): *18.3*

Top of Bedrock: *Surficial Water Well* *

Sand & Gravel Thickness (m): *0.3 (total) — 0.3 (below 15 m)* *

Water Level (m): *6.10 m — 08 Sep 1980 11:00*

Completion Details

Surface Casing: *Galvanized Steel — 406.4 mm (O.D.) x 1.60 mm (thick) x 18.29 m (bottom)*

Intervals

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (3)
534.8	*12.2*	*Predrilled*
529.0	*18.0*	*Blue Till*
528.7	*18.3*	*Coarse Grained Sand*

Chemistry Summary Details (mg/L) (most recent first)

General Comments / Observations

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m^3/day)* Apparent	Q20 (m^3/day)* Effective	Transmissivity (m^2/day)* Apparent	Transmissivity (m^2/day)* Aquifer	Transmissivity (m^2/day)* Effective
1	*08 Sep 1980 11:00*	*Bailer*			*22.7*	*6.10*	*4.6*	*10.7*	*14.0*			*7.2*		

Alternative IDs

AENV - GIC (WELLID): *0188818*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground ; AMSL}*

Owner: ***Alberta Environment***
AB
Contractor: ***Hi-Rate Drilling 1985 Ltd***
Well Name: ***Water Well No. 6***

METRIC REPORT

07-15-068-13 W4M

M35377.121024

Easting (m): ***199.058 **** *70/80*
Northing (m): ***6,083,636 *****
Elevation (m): ***555 ******

Work Type: ***New Well***
Drilling Method: ***[unknown]***
Proposed Use: ***Domestic***
Completion Type: ***Screen***
Date Completed: ***Nov 01, 1973***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***24.4***
Depth Drilled (m): ***30.5***
Top of Bedrock: ***Surficial Water Well ****
Sand & Gravel Thickness (m): ***7.0 (total) — 7.0 (below 15 m) ****

Completion Details

Surface Casing: ***Steel — 139.7 mm (O.D.) x 4.78 mm (thick) x 24.38 m (bottom)***

Screen Material: ***Stainless Steel — 76.2 mm (I.D.) (Telescoped)***
Fittings: ***Top: Packer — Bottom: Packer***
Pack: ***Natural***

Intervals

– Completion Interval(s) –

Screen: ***24.1 to 24.4 m - 15 Slot***

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (4)
553.0	1.5	*Clay & Silt*
543.3	12.2	*[see comments]*
532.0	23.5	*Till*
525.0	30.5	*Sand & Gravel*

Chemistry Summary Details (mg/L)

(most recent first)

General Comments / Observations

5'-40' Clay, Sand & Gravel Seal Type listed as 'Driven' but no interval defined.

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	01 Nov 1973 11:00	*[unknown]*				—	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188830*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground : AMSL}*

Owner: ***Alberta Environment***
AB
Contractor: ***Alberta Environment/Earth Sciences Division***
Well Name: ***No. 0958E***

Abandoned: ***with [unknown]***

METRIC REPORT

07-15-068-13 W4M

M35377.120998

Easting (m):	***199,058*** **	*70/80*
Northing (m):	***6,083,636*** **	
Elevation (m):	***555*** ***	

Work Type: ***Water Test Hole - Abandoned***
Drilling Method: ***[unknown]***
Proposed Use: ***Observation***
Completion Type: ***[unknown]***
Well Status: ***Abandoned***

Elog Taken: ***Yes***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***40.2***
Depth Drilled (m): ***40.2***
Top of Bedrock (m): ***30.5 ****

Sand & Gravel Thickness (m): ***12.2 (total) — 11.6 (below 15 m) ****

Completion Details

Intervals

Lithology Details

Elevation (AMSL)	*Depth (BGL)*	*Lithology Descriptions (9)*
549.4	*6.1*	*Till*
544.8	*10.7*	*Silty Till*
541.2	*14.3*	*Till*
540.6	*14.9*	*Gravel*
536.6	*18.9*	*Till*
535.7	*19.8*	*Coarse Grained Sand*
531.1	*24.4*	*Coarse Grained Sand*
525.0	*30.5*	*Sand & Gravel*
515.3	*40.2*	*Shale*

Chemistry Summary Details (mg/L) (most recent first)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188801*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground : AMSL}*

Owner: *Hamer, T. S.*
Box 1661, Lac La Biche, AB T0A 2C0

Contractor: *[unknown contractor]*

METRIC REPORT

Easting (m): *197,215 *** *70/80*
Northing (m): *6,083,758 ***
Elevation (m): *547 ****

··-16-068-13 W4M

M35377.121036

Work Type: *Chemistry*
Drilling Method: *[unknown]*
Proposed Use: *Domestic*
Completion Type: *[unknown]*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Oil Present: *No*
Gas Present: *No*
Flowing: *No*

General Details

Depth Completed (m): *20.1*
Depth Drilled (m): *20.1*

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *Jun 24, 1985 - Vegreville*

Constituent	Result
Conductivity (µS/cm):	*1670*
TDS (Calculated):	*1112*
Temperature (°C):	
Hardness (as CaCO3):	*413*
T-Alkalinity (as CaCO3):	*245*
P-Alkalinity (as CaCO3):	
Nitrate + Nitrite as N:	*1.1*

Constituent	Result
Nitrate as N:	
Nitrite as N:	*0.05*
pH (pH Unit):	*7.8*
Oil & Grease	
Total Coliforms:	
Fecal Coliforms:	
Ion Balance (%):	*98*

Constituent	Result
Colour:	
Turbidity:	
Sulfate:	*540*
Fluoride:	*0.16*
Carbonate:	
Bicarbonate:	*299*
Hydroxide:	*0*

Constituent	Extractable	Dissolved
Calcium:	*98*	
Chloride:	*63*	
Iron:	*0.02*	
Manganese:		
Aluminum:		
Arsenic:		
Barium:		
Beryllium:		
Cadmium:		
Chromium:		
Cobalt:		

Constituent	Extractable	Dissolved
Mercury:		
Molybdenum:		
Magnesium:	*41*	
Sodium:	*212*	
Potassium:	*5.8*	
Vanadium:		
Strontium:		
Nickel:		
Zinc:		
Copper:		
Lead:		

50533 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188842*

* *TGWC calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground ; AMSL}*

Owner: ***Lee, Larry***
Box 299, Lac La Biche, AB T0A 2C0

Contractor: ***[unknown contractor]***

METRIC REPORT

NE 22-068-13 W4M

M35377.121037

Easting (m):	*199,162* **	*70/80*
Northing (m):	*6,085,867* **	
Elevation (m):	*555* ***	

Work Type: ***Chemistry***
Drilling Method: ***[unknown]***
Proposed Use: ***Domestic***
Completion Type: ***[unknown]***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Flowing: ***No***
Oil Present: ***No***
Gas Present: ***No***

General Details

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: ***Mar 02, 1989 - Vegreville***

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*1470*	Nitrate as N:		Colour:	
TDS (Calculated):	*938*	Nitrite as N:	*0.001*	Turbidity:	
Temperature (°C):		pH (pH Unit):	*7.83*	Sulfate:	*228*
Hardness (as CaCO3):	*425*	Oil & Grease		Fluoride:	*0.17*
T-Alkalinity (as CaCO3):	*518*	Total Coliforms:		Carbonate:	
P-Alkalinity (as CaCO3):		Fecal Coliforms:		Bicarbonate:	*631*
Nitrate + Nitrite as N:	*1.01*	Ion Balance (%):	*104*	Hydroxide:	*0*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*106*		Mercury:		
Chloride:	*52*		Molybdenum:		
Iron:	*7.23*		Magnesium:	*39*	
Manganese:			Sodium:	*197*	
Aluminum:			Potassium:	*4.7*	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		

Extractable = acid digestible; Dissolved = filtered

50534 - (1 / 1)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188844*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground ; AMSL}*

Owner: ***Alberta Environment***
AB
Contractor: ***Hi-Rate Drilling 1985 Ltd***
Well Name: ***Well No. 5***

METRIC REPORT

09-22-068-13 W4M

M35377.121040

Easting (m): ***199,379*** ** 70/80
Northing (m): ***6,085,681*** **
Elevation (m): ***570*** ***

Work Type: ***New Well***
Drilling Method: ***Drilled***
Proposed Use: ***Domestic***
Completion Type: ***Screen***
Date Completed: ***Nov 01, 1973***
Well Status: ***Producing***

Elog Taken: ***No***
Gamma Taken: ***No***
Oil Present: ***No***
Gas Present: ***No***
Flowing: ***No***

General Details

Depth Completed (m): ***36.6***
Depth Drilled (m): ***36.6***
Completion Aquifer: ***Bonnyville ****
Sand & Gravel Thickness (m): ***13.1 (total) — 13.1 (below 15 m) ****
Top of Bedrock: ***Surficial Water Well ****
Completion Interval (m): ***33.5 — 36.6 ****

Water Level (m): ***6.10 m — 01 Nov 1973 11:00***

Completion Details

Surface Casing: ***Steel — 139.7 mm (O.D.) x 4.78 mm (thick) x 33.53 m (bottom)***

Screen Material: ***Stainless Steel — 76.2 mm (I.D.) (Telescoped)***
Fittings: ***Top: Packer — Bottom: Packer***
Pack: ***Artificial***

Intervals

– Completion Interval(s) –

Screen: ***33.2 to 36.6 m - 10 Slot***

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (4)
569.6	0.9	Sandy Clay
567.4	3.0	Silty Till & Clay
547.0	23.5	Till
533.9	36.6	Sand & Gravel

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: ***Nov 22, 1973 - Alberta Environment (AENV)***

Constituent	Result
Conductivity (µS/cm)	1400
TDS (Calculated)	733
Temperature (°C)	
Hardness (as CaCO3)	218
T-Alkalinity (as CaCO3)	387
P-Alkalinity (as CaCO3)	
Nitrate + Nitrite as N	0

Constituent	Result
Nitrate as N	0.099
Nitrite as N	0.099
pH (pH Unit)	7.9
Oil & Grease	
Total Coliforms	
Fecal Coliforms	
Ion Balance (%)	99

Constituent	Result
Colour	
Turbidity	
Sulfate	170
Fluoride	0.17
Carbonate	
Bicarbonate	472
Hydroxide	0

Constituent	Extractable	Dissolved
Calcium	33	
Chloride	57	
Iron	7	
Manganese		
Aluminum		
Arsenic		
Barium		
Beryllium		
Cadmium		
Chromium		
Cobalt		

Constituent	Extractable	Dissolved
Mercury		
Molybdenum		
Magnesium	33	
Sodium	192	
Potassium	4.4	
Vanadium		
Strontium		
Nickel		
Zinc		
Copper		
Lead		

Extractable - unfiltered
Dissolved - filtered

50535 - (1 / 1)

General Comments / Observations

Land Owned By Wiebel Seal Type listed as 'Driven' but no interval defined.

Aquifer Tests (most recent first)

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	01 Nov 1973 11:00	Air				6.10	—	—	—					

Alternative IDs

AENV - GIC (WELLID): *0188845*

* ***TGWC*** *calculated or determined value.*
** *70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
*** *80 - MT DEM — {Ground : AMSL}*

Owner: *[unknown]*

Contractor: *[unknown contractor]*

METRIC REPORT

10-22-068-13 W4M

M35377.121042

Easting (m): *198,967 *** *70/80*
Northing (m): *6,085,657 ***
Elevation (m): *550 ****

Work Type: *Chemistry*
Drilling Method: *[unknown]*
Proposed Use: *Industrial*
Completion Type: *[unknown]*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Flowing: *No*
Oil Present: *No*
Gas Present: *No*

General Details

Depth Completed (m): *429.8*
Depth Drilled (m): *429.8*

Completion Details

Intervals

Lithology Details

Chemistry Summary Details (mg/L) (most recent first)

Analysis Details: *Nov 16, 1969 - Core Laboratory*

Constituent	Result
Conductivity (µS/cm):	
TDS (Calculated):	*3718*
Temperature (°C):	
Hardness (as CaCO3):	
T-Alkalinity (as CaCO3):	
P-Alkalinity (as CaCO3):	
Nitrate + Nitrite as N:	*0*

Constituent	Result
Nitrate as N:	
Nitrite as N:	
pH (pH Unit):	*8.25*
Oil & Grease	
Total Coliforms:	
Fecal Coliforms:	
Ion Balance (%):	

Constituent	Result
Colour:	
Turbidity:	
Sulfate:	*35*
Fluoride:	
Carbonate:	
Bicarbonate:	*1542*
Hydroxide:	*0*

Constituent	Extractable	Dissolved
Calcium:	*34*	
Chloride:	*940*	
Iron:		
Manganese:		
Aluminum:		
Arsenic:		
Barium:		
Beryllium:		
Cadmium:		
Chromium:		
Cobalt:		

Constituent	Extractable	Dissolved
Mercury:		
Molybdenum:		
Magnesium:	*3*	
Sodium:	*1164*	
Potassium:		
Vanadium:		
Strontium:		
Nickel:		
Zinc:		
Copper:		
Lead:		

Extractable - unfiltered
Dissolved - filtered

Chemistry Comments: ***Chemistry hard to read. /// Analysis_Date assumed to be date sample collected (MT).***

50538 - (1 / 3)

General Comments / Observations

Aquifer Tests (most recent first)

Alternative IDs

AENV - GIC (WELLID): *0188848*

** TGWC calculated or determined value.*
*** 70 - MT Calculated based on legal location (ATS) — {10TM NAD27}*
**** 80 - MT DEM — {Ground ; AMSL}*

View as PDF Report (metric) | View as PDF Report (imperial) | Search New Location

Lakeland County Study Area

MOW-TECH LTD. gwQuery Results

10-09-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
gwQuery Determined Minimum	14	--	--	--	--	--
gwQuery Determined Maximum	14	133	--	1192	974	384

Detailed Results Geologic Unit Encountered	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
Bonnyville Formation	0	133	--	1192	974	384
Bedrock Surface	12					

Parameter	metre
Base of Groundwater Protection (Depth)	94
Ground Elevation (AMSL)	544

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

The information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. Actual drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

View as PDF Report (metric) | View as PDF Report (imperial) | Search New Location

Lakeland County Study Area

MOW-TECH LTD. gwQuery Results

NE-10-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
gwQuery Determined Minimum	26	103	--	1245	807	203
gwQuery Determined Maximum	26	103	--	1245	807	203

Detailed Results Geologic Unit Encountered	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
Grand Centre Formation	0	17	7	599	158	--
Empress Lake Formation	15	67	18	513	46	8
Bonnyville Formation	25	103	--	1245	807	203
Bedrock Surface	51					

Parameter	metre
Base of Groundwater Protection (Depth)	129
Ground Elevation (AMSL)	582

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

The information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. Actual drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

View as PDF Report (metric) View as PDF Report (imperial) Search New Location

Lakeland County Study Area
MOW-TECH LTD. gwQuery Results
NW-15-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
gwQuery Determined Minimum	4	118	--	1124	659	169
gwQuery Determined Maximum	4	118	--	1124	659	169

Detailed Results Geologic Unit Encountered	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
Bonnyville Formation	0	118	--	1124	659	169
L rock Surface	17					

Parameter	metre
Base of Groundwater Protection (Depth)	99
Ground Elevation (AMSL)	552

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}
Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

The information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. Actual drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

View as PDF Report (metric) View as PDF Report (imperial) Search New Location

Lakeland County Study Area

MOW-TECH LTD. gwQuery Results

NE-22-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
gwQuery Determined Minimum	17	--	--	--	--	--
gwQuery Determined Maximum	17	103	--	800	229	79

Detailed Results Geologic Unit Encountered	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
Bonnyville Formation	0	103	--	800	229	79
Bedrock Surface	5					

Parameter	metre
Base of Groundwater Protection (Depth)	101
Ground Elevation (AMSL)	556

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

The information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. Actual drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

View as PDF Report (metric) | View as PDF Report (imperial) | Search New Location

Lakeland County Study Area

MOW-TECH LTD. gwQuery Results

09-22-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	Top metre	Yield m^3/day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
gwQuery Determined Minimum	32	--	--	--	--	--
gwQuery Determined Maximum	32	97	--	874	254	82

Detailed Results Geologic Unit Encountered	Top metre	Yield m^3/day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L
Ethel Lake Formation	0	56	6	479	37	8
E[illegible]nyville Formation	5	97	--	874	254	82
Bedrock Surface	19					

Parameter	metre
Base of Groundwater Protection (Depth)	116
Ground Elevation (AMSL)	570

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

T[illegible]information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. A[illegible]dal drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

View as PDF Report (metric) | View as PDF Report (imperial) | Search New Location

Lakeland County Study Area

MOW-TECH LTD. gwQuery Results

10-22-068-13 W4M

View Consultants Report (PDF Format)

General Results Depth(s)	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
gwQuery Determined Minimum	10	--	--	--	--	--
gwQuery Determined Maximum	10	107	--	841	286	84

Detailed Results Geologic Unit Encountered	**Top** metre	**Yield** m^3/day	**NPWL** metre	**TDS** mg/L	**Sulfate** mg/L	**Chloride** mg/L
Bonnyville Formation	0	107	--	841	286	84
Bedrock Surface	1					

Parameter	metre
Base of Groundwater Protection (Depth)	96
Ground Elevation (AMSL)	551

Legend/Notes

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting work.

The information calculated with the Mow-Tech Ltd. gwQuery is meant only as a guide. Actual drilling conditions may vary. Mow-Tech Ltd. is not liable for drilling or groundwater problems as a result of using this software.

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

January 14, 2005 File: 19-3836-2

Armin A. Preiksaitis & Associates Ltd.
408, The Boardwalk
10310 – 102 Avenue
Edmonton, AB T6E 5V5

Attention : Mr. G. MacKenzie, C.P.T.

GROUNDWATER AVAILABILITY, PERCOLATION TESTING AND PEAT THICKNESS FOR THE MYSTIC BEACH SUBDIVISION NEAR LAC LA BICHE(16-68-13 W4M), ALBERTA

Dear Sir;

This letter report presents Thurber Engineering Ltd. (Thurber) results of water table investigation, percolation testing and peat thickness at the above-mentioned location.

Use of this report is subject to the Statement of General Conditions which is attached at the end of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of the report.

1. PROPOSED DEVELOPMENT

The proposed site development will consist of about 100 parcels of land ranging from 1 acre to 2 acres in area. It is understood that the site development will consist of road construction, underground utility installation, and building structures. It is also understood that individual on-site or community based sewage disposal systems will be required.

2. SCOPE OF WORK

The scope of work for this project is outlined in Thurber's September 1, 2004 proposal. In general, the scope of work was to comprise the following tasks:

- Task 1 - Hydrogeological desktop study;
- Task 2 - Aquifer testing;
- Task 3 - Percolation test, depth to the water table;

- Task 4 - The scope of work was increased to conduct muskeg/peat probes and,
- Prepare a report discussing the results of tasks 1 through 4.

3. TASK 1. HYDROGEOLOGICAL DESK TOP STUDY

The hydrogeological desktop study was conducted separately and was provided to Armin A. Preiksaitis & Associates (A. Preiksaitis) as a separate report[1].

4. TASK 2. WATER WELL DRILLING

Based on scant water well data Thurber's 2004 desk top study indicated that 1250 m^3/year (approximately 0.5 imperial gallon per minute) of groundwater could be available in this area. Therefore, a water well drilling rig was mobilized to the site (Mar Wayne Water Well Drilling of Calahoo) and a test hole was drilled on November 9, 2004 to a depth of approximately 79 metres. The water well driller did not find water bearing zones suitable for the development of an adequate groundwater supply. In discussions with Mr. Greg MacKenzie, C.E.T. of A. Preiksaitis regarding whether drilling should be extended to other areas of the property it was decided that additional groundwater exploration was not required. Therefore, the groundwater testing program was halted. The litholog of the test hole drilled at the site is located in Appendix B.

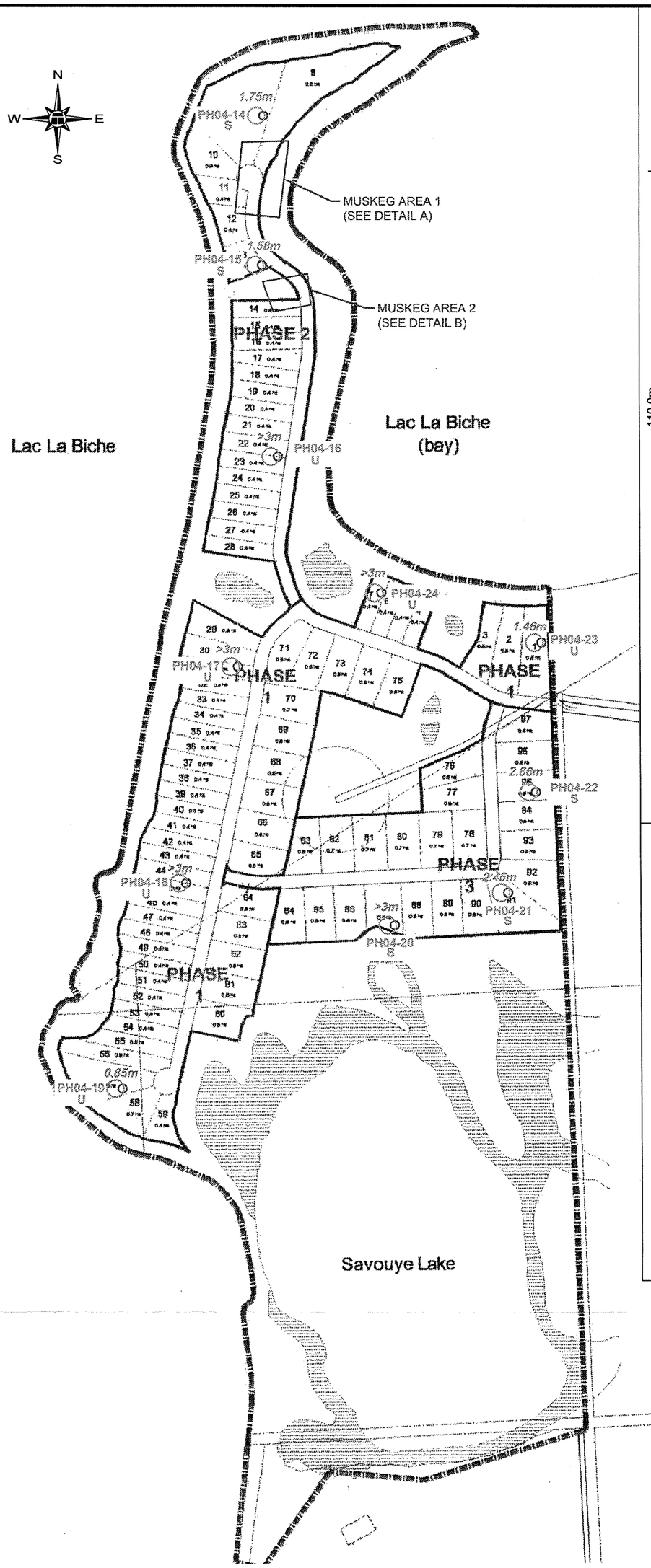
5. TASK 3. PERCOLATION TESTING AND DEPTH TO THE WATER TABLE

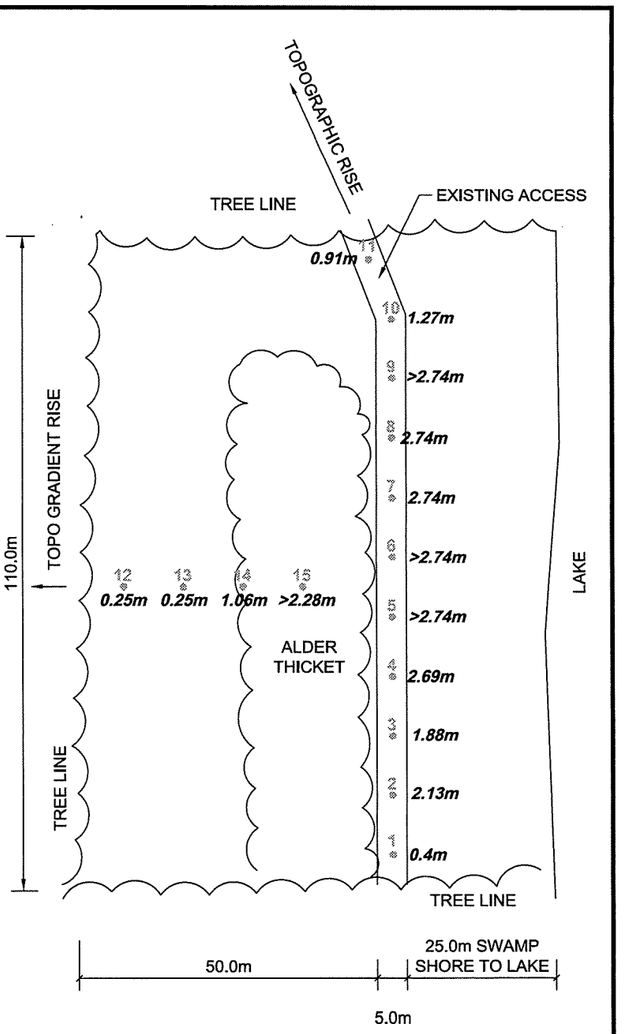
5.1 Percolation Testing

Within a distance of 5 metres from each of the water table wells percolation test holes were drilled (Drawing 19-3836-2-2) to depths of 0.9 metres. Percolation tests were run in each of these holes and the percolation rates are summarized in Table 5.1.

---

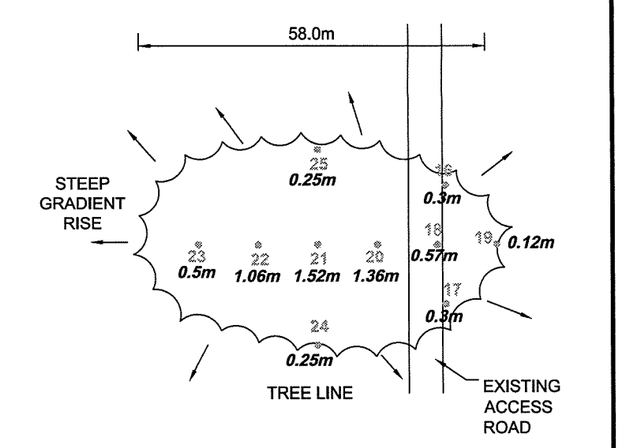
[1] Thurber Engineering Ltd., October 1, 2004, Desktop Groundwater Evaluation, Dr. Berkhill Subdivision, 16-68-13 W4M, Near Lac La Biche, Alberta.





AREA 1 DETAIL A

1:1000



AREA 2 DETAIL B

1:1000

LEGEND

- SITE BOUNDARY
- WET AREA
- PERCOLATION TEST
- WATER TABLE WELL
- U — UNSUITABLE FOR SEPTIC FIELD
- S — SUITABLE FOR SEPTIC FIELD
- 1.75m — DEPTH TO WATER (BELOW GROUND SURFACE)
- 1 — PEAT / MUSKEG AUGER HOLE
- 1.75m — THICKNESS OF PEAT

BASE PLAN PROVIDED BY ARMIN A PREIKSAITIS & ASSOCIATES LTD.

THURBER PROJECT #19-3836-2

ARMIN A PREIKSAITIS & ASSOCIATES LTD.

LOCATION OF WATER TABLE WELLS, PERCOLATION TESTING, AND PEAT THICKNESS

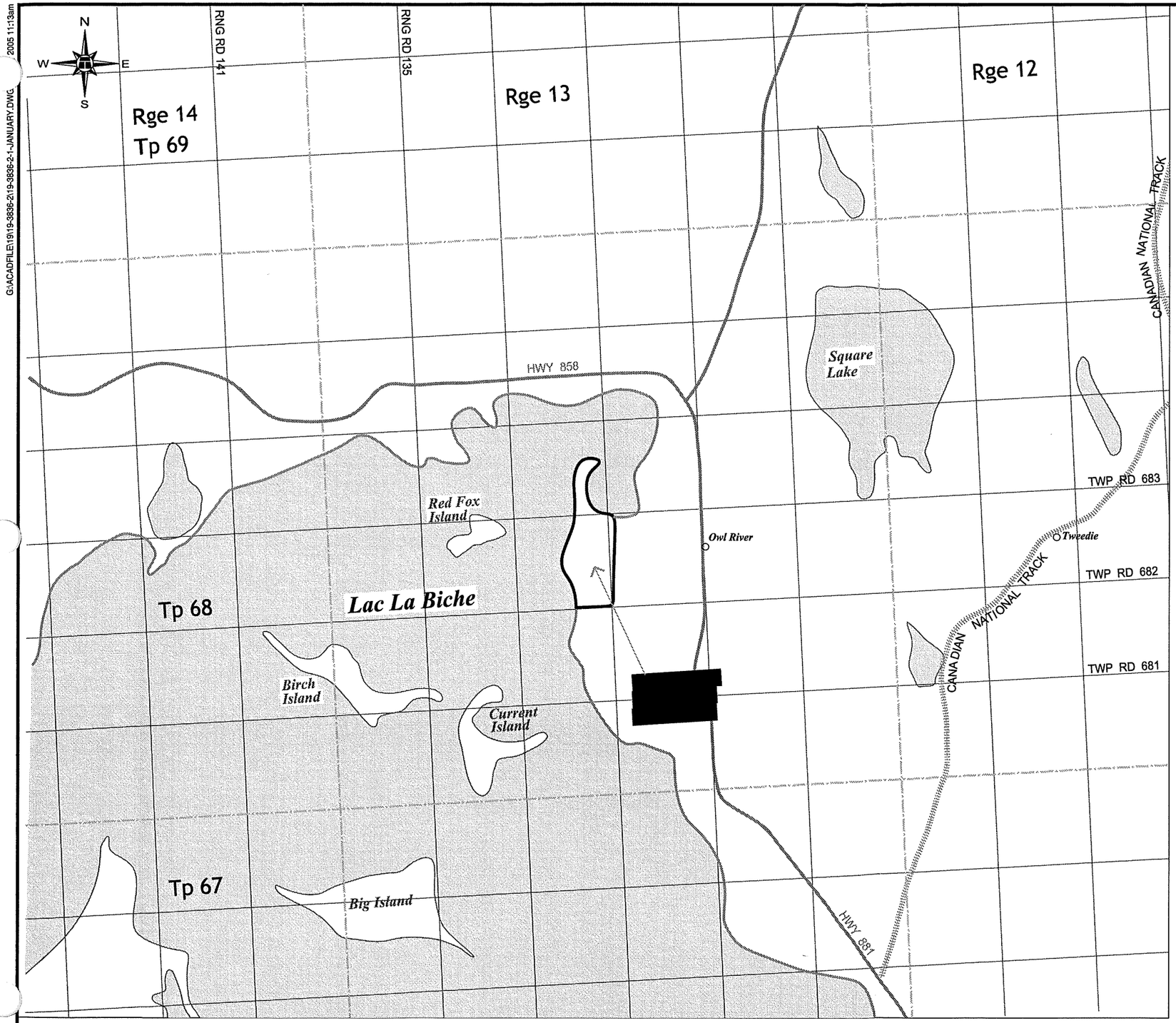
MYSTIC BEACH SUBDIVISION — NEAR LAC LA BICHE, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ENGINEER:	DRAWN:	APPROVED:
DMB	ZD	
DATE:	SCALE:	DRAWING No.
OCT., 2004	1:8000	19-3836-2-2

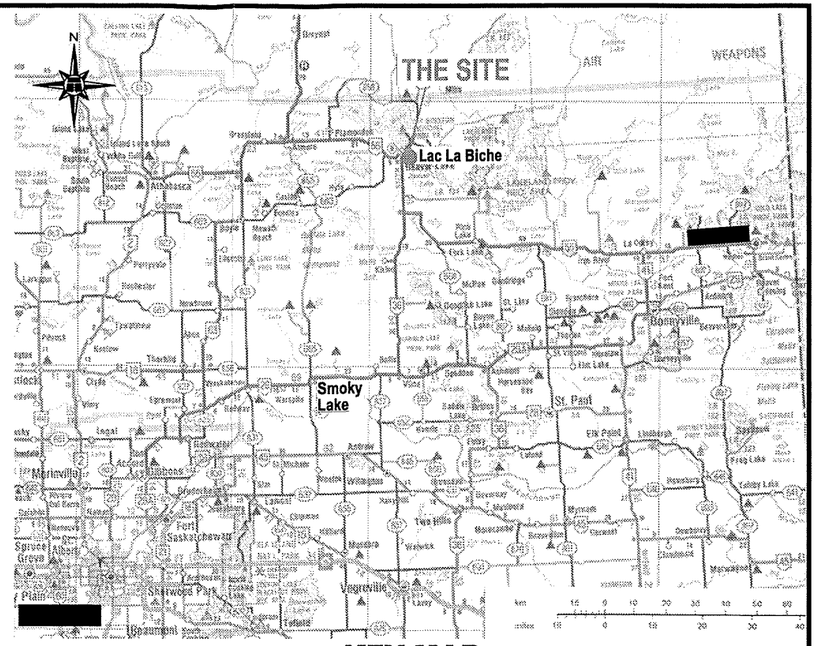
G:\ACADFILES\19\19-3836-2\19-3836-2-2.dwg - 1 (2) - Jan. 21, 2005 11:09am

G:\ACADFILE\19\19-3836-2\19-3836-2-1-JANUARY.DWG 2005 11:13am



SITE PLAN
1 : 75,000

0 1 2 3 4 5 km
SCALE 1:75000



KEY MAP
AS SHOWN

CLIENT : ARMIN A PREIKSAITIS & ASSOCIATES

PROJECT :

MYSTIC BEACH SUBDIVISON LOCATION PLAN

GROUNDWATER AVAILABILITY AND PERCOLATION TESTS

SEC 16-68-13 W4M
NEAR LAC LA BICHE, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER :	DRAWN :	APPROVED :
DMB	MNG	
DATE :	SCALE :	DRAWING No.
JAN. , 2005	AS SHOWN	19 - 3836 - 2 - 1

TABLE 5.1 - PERCOLATION RATES
MYSTIC BEACH SUBDIVISION
NEAR LAC LA BICHE

Percolation hole No.	Percolation rate (min/cm)	Suitability for septic system
PH04-14	5	Suitable
PH04-15	7.5	Suitable
PH04-16	<2	Unsuitable
PH04-17	<2	Unsuitable
PH04-18	66	Unsuitable
PH04-19	60	Unsuitable
PH04-20	7.7	Suitable
PH04-21	4.2	Suitable
PH04-22	4.4	Suitable
PH04-23	>64	Unsuitable
PH04-24	>62	Unsuitable

Range of suitability is from 2 to 23.6 min/cm

Percolation rates ranged from 5 to 66 min/cm. The percolation rates calculated met Alberta Environment (AENV) guidelines[2] at locations PH04-14, -15, -20, -21, and -22 and did not meet AENV guidelines at locations PH04-16, -17, -18, -19, -23 and -24. The suitability (S) or unsuitability (U) of the soils as it relates to percolation has been indicated at each location on Drawing 19-3836-2-2.

5.2 Water Table

The location of the proposed Mystic Beach Subdivision is indicated on Drawing 19-3836-2-1. Water table wells (PH04-14 through PH04-23) were drilled on October 5, 2004 using a track mounted drilling rig and completed under the supervision of Thurber personnel at approximate locations indicated on Drawing 19-3836-2-2. The wells were approximately three metres deep and were completed using 25 mm slotted and solid PVC pipe. Generally, clay/till was encountered at the test holes locations with sand being present from surface to 3 metre depth in test hole TH04-14 and sand was found below the clay at a depth of 2 metres in test hole TH04-15. The well lithologs are located in Appendix A.

The water levels were read in the wells approximately two weeks following their completion. Drawing 19-3836-2-2 shows depths to water below ground surface

[2] Alberta Environmental Protection, September 1988, "DRAFT Environmental Guidelines for the Review of Subdivisions in Alberta."

at the well locations. Wells TH04-16, -17, -18, -20, and -24 were dry indicating a water table depth greater than 3 metres. Overall depths to water ranged from 0.85 m to greater than 3 metres. The shallowest depths to groundwater were encountered at PH04-19 (0.85 m) located in the southwestern corner of the property in proximity to Lac La Biche and at PH04-23 (1.46m) in the northeastern corner of the property, in proximity to Lac La Biche.

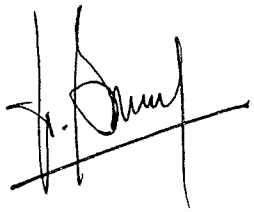
6. TASK 4. PEAT THICKNESS

Peat thickness, along the peninsula, was evaluated in two areas (Area 1 and Area 2) along a proposed road alignment. Peat thickness was measured at locations 1 through 15 (Area 1) and 16 through 25 (Area 2) using a hand operated dutch auger at the approximate locations shown on Drawing 19-3836-2-2. Peat thickness in Area 1 ranged from 0.25 m to greater than 2.7 metres and in Area 2 from 0.12 metres to 1.52 metres. Lithologs of the probe holes are located in Appendix A.

7. CLOSURE

We trust the above meets you present requirements. If you have any questions please do not hesitate to call the undersigned.

Yours very truly
Thurber Engineering Ltd.
N. Fernuik, P. Biol., P. Eng.
Review Principal



D. Borneuf, P. Geol.
Associate, Hydrogeologist

/slp

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)

INTERPRETATION OF THE REPORT *(continued)*

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

APPENDIX A

Water Table lithologs

Peat/muskeg probe logs

THURBER

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-14**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:
SAMPLE TYPE	GRAB SAMPLE	
BACKFILL TYPE	DRILL CUTTINGS	

DEPTH (m)	SAMPLE TYPE	REMARKS	SOIL DESCRIPTION
0			SAND mixed with organics, dark brown -becomes light brown, medium grained
3			END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -Slough to 1.8m -No water Standpipe piezometer installed Water level below ground surface: -Nov 9, 2004 = 1.75m

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05 LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-15**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▯ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	▲ CPEN (kPa) ▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY very stiff, mixed with topsoil -light brown and grey, trace oxides and sand	0
1		▲			1
2		▲		SAND green, silty, trace clay lumps	2
3				END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -Slough to 2.2m -No water Standpipe piezometer installed Water level below ground surface: -Nov 9, 2004 = 1.58m	3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG - 3836-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-16**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	REMARKS		SOIL DESCRIPTION	DEPTH (m)
0				SAND dark brown and grey, coarse grained -becomes orange and brown, medium grained	0
1				-trace fine gravel	1
2					2
3				END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = Dry	3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-17**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	REMARKS	SOIL DESCRIPTION
0			SAND brown, medium to coarse grained -becomes orange
1			
2			CLAY grey to brown to orange, very silty, some sand lenses
3			SAND orange and dark brown, trace clay lumps
			END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = Dry
4			
5			
6			
7			
8			
9			
10			

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05 LIBRARY.GLB

THURBER

Thurber Engineering Ltd.

Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-18**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:
SAMPLE TYPE ▥ GRAB SAMPLE		
BACKFILL TYPE ▨ DRILL CUTTINGS		

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY mixed with topsoil	0
1		▲		-very stiff, brown, trace oxides	1
2		▲		-trace silt lenses	2
3		▲		CLAY (TILL) very stiff, dark brown, trace fine gravel	3
		▲		END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = Dry	
4					4
5					5
6					6
7					7
8					8
9					9
10					10

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-19**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:
SAMPLE TYPE ▥ GRAB SAMPLE		
BACKFILL TYPE ▨ DRILL CUTTINGS		

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				TOPSOIL AND GRASS	0
1	▥	▲		CLAY (TILL) stiff, brown, trace white deposits and rootlets	1
2	▥	▲		-becomes very stiff, trace sand pockets	2
3	▥	▲		END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = 0.85m	3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05 LIBRARY: GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-20**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0			CLAY mixed with topsoil	0
1			-light brown, very silty	1
2			-becomes dark brown	2
3			-trace oxides END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = Dry	3
4				4
5				5
6				6
7				7
8				8
9				9
10				10

BOREHOLE LOG ...336-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-21**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE — GRAB SAMPLE

BACKFILL TYPE — DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY grey to brown, mixed with topsoil	0
1				-white deposits throughout, trace sand and oxides	1
2				-becomes brown, large sand lenses	2
3				-very soft, very silty, sandy	3
				END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = 2.45m	4
4					5
5					6
6					7
7					8
8					9
9					10
10					

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-22**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:
SAMPLE TYPE ▥ GRAB SAMPLE		
CKFILL TYPE ▨ DRILL CUTTINGS		

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY stiff, brown and dark brown, mixed with topsoil	0
1	▥	▲		-becomes brown, silty, trace sand	1
2	▥	▲		CLAY (TILL) very stiff, trace oxides -tace fine gravel and sand pockets	2
3	▥	▲		END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = 2.86m	3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG 1[illegible]6-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-23**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY brown and dark brown, mixed with topsoil	0
1		▲		CLAY (TILL) stiff, brown, trace fine gravel, sand pockets, and oxides	1
2		▲		-becomes very stiff	2
3		▲		-trace CH lenses	3
				END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = 1.46m	4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG '36-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.
Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

CLIENT: ARMIN A PREIKSAITIS & ASSOCIATES	PROJECT: Groundwater Availability and Percolation Tests	BOREHOLE NO: **TH04-24**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: October 5, 2004	PROJECT NO: 19-3836-2
DRILL/METHOD: Solid Stem Auger	LOCATION: See Drawing #19-3836-2-1	ELEVATION:

SAMPLE TYPE ▥ GRAB SAMPLE

BACKFILL TYPE ▨ DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	▲CPEN (kPa)▲ 50 100 150 200	REMARKS	SOIL DESCRIPTION	DEPTH (m)
0				CLAY brown to dark brown, mixed with topsoil	0
1	▥	▲		CLAY (TILL) hard, brown and grey, trace sand	1
2	▥	▲		-trace white deposits	2
3	▥	▲		-trace gravel up to 40mm diameter END OF TEST HOLE AT 3.0m UPON COMPLETION: (Below ground surface) -No slough -No water Water table well installed Water level below ground surface: -Nov 9, 2004 = Dry	3
4					4
5					5
6					6
7					7
8					8
9					9
10					10

BOREHOLE LOG 19-3836-2.GPJ THRBR_AB.GDT 14/1/05- LIBRARY.GLB

THURBER

Thurber Engineering Ltd.

Edmonton/Alberta/T6E 6A5

LOGGED BY: TM	COMPLETION DEPTH: 3.0 m
REVIEWED BY: DMB	COMPLETION DATE: 5/10/04
	Page 1 of 1

PEAT/MUSKEG PROBE HOLES

AREA 1

TH04-1

0 to 0.4 m	Peat, fine, fibrous, dark brown, moist.
0.4 to 0.5 m	Sand, medium to coarse-grained, trace gravel (well rounded, up to 25 mm in size), well sorted, saturated, grey.
0.5 to 0.91 m	Clay, some medium to fine grained sand, grey, trace organics, wet, trace oxidation.

TH04-2

0 to 0.1 m	Peat, fine, fibrous, coarse wood fragments, dark brown, moist (frozen and unfrozen).
0.1 to 2.13 m	Peat clayey, trace fine to coarse sand, dark brown peat, clay is grey.

TH04-3

0 to 1.68 m	Peat, fibrous, woody, dark brown, moist, frozen
1.68 to 1.88 m	Peat, dark brown, clayey, trace fine to coarse-grained sand, wet., clay is grey.
1.88 to 2.13 m	Clay, grey, wet, trace coarse-grained sand, trace shell fragments.

TH04-4

0 to 0.15 m	Peat, frozen, very woody, fibrous, dark brown.
0.15 to 2.69 m	Peat, woody, fibrous, dark brown, moist to wet, increasing decomposition and compaction with depth.
2.69 to 2.74 m	Clay, sandy, sand medium-grained to coarse, clayey, grey, wet, some shell fragments

TH04-5

0 to 0.15 m	Peat, frozen, very woody, fibrous, dark brown
0.15 to 2.74 m	Peat, frozen, very woody, fibrous, dark brown. Increasing compaction and decomposition with depth. Very wet at 1.82 m.

TH04-6

0 to 2.74 m	Peat (top 0.10 m frozen), dark brown, fibrous, more soil, less woody than previous holes, wet. Increasing decomposition and compaction to depth. Higher soil content than previous holes. Very wet and difficult hole due to suction.

TH04-7

0 to 2.74 m	Peat, fine, fibrous, woody, dark brown, wet, increasing decomposition and compaction with depth, trace clay. Trace of grey clay with shell fragments on the tip of the auger at 2.74 m.

TH04-8

0 to 2.74 m	Peat, fine, fibrous, trace clay, woody, dark brown, wet, increasing decomposition and compaction with depth.

TH04-9

0 to 1.22 m	Peat, fine, fibrous, trace woody, dark brown.
1.22 to 2.74 m	Peat and organic clay with shell fragments.

TH04-10

0 to 1.27 m	Peat (frozen 0.15 m), fine, fibrous, woody, dark brown, moist. Increasing decomposition and compaction with depth.
1.27 to 1.82 m	Clay, peaty (high organics), trace fine to medium - grained sand, dark brow, wet.
1.82 to 1.97 m	Clay sandy, grey, sand is medium to coarse-grained, wet, trace shell fragments.
1.97 m to 2.07 m	Clay, trace sand (fine to medium-grained), grey, saturated, trace shell fragments.
2.07 to 2.5 m	Silt, sandy, trace clay, sand is fine to medium-grained, light beige/tan, saturated.
2.5 to 2.69 m	Clay, sandy, silt, trace clay, sand is fine – medium-grained, light beige/tan, saturated.

TH04-11

0 to 0.91 m	Peat (frozen at 0.15 m). Fine, fibrous, trace to woody, dark brown, moist, mainly soil based.
0.91 m to 1.52 m	Clay, peaty (high organics), trace medium-grained sand, dark brown, et; trace gravel (fine, rounded).
1.52 to 1.82 m	Clay, some sand (fine grained), grey, moist to wet, trace shell fragments.

TH04-12

0 to 0.25 m	Peat, fine, fibrous, woody, dark brown, moist.
0.25 to 0.3 m	Sand, medium to coarse grained, some clay, grey, moist to saturated.
0.3 to 0.91 m	Clay, varied with interbedded silt layers, grey, trace fine to medium-grained sand.

TH04-13

0 to 0.25 m	Peat, fine, fibrous, woody, dark brown, moist.
0.25 to 0.55 m	Sand, medium-grained, grey, Saturated, interbeded dark brown organic clay layers (~ 0.01 m thick).
0.55 to 0.6 m	Silt with very fine sand
0.6 to 0.91 m	Clay, trace fine to medium-grained sand, grey, moist.
0.91 to 1.21 m	Interbedded sand and clay, saturated, grey, silt and very fine sand, clay, trace fine to medium-grained sand, grey, moist.

TH04-14

0 to 1.06 m	Peat, fine fibrous, high soil contact, trace woody, increasing decomposition, compaction and clay content with depth.
1.06 to 1.67 m	Sand, fine to medium-grained, grey, saturated, trace clay.

TH04-15

0 to 2.28 m	Peat, fine, fibrous, high soil contact, trace woody, dark brown, saturated, increasing compaction and decomposition with depth.

AREA 2

TH04-16

0 to 0.3 m	Peat, fine, fibrous, soily, trace woody, dark brown, moist.
0.3 to 0.96 m	Sand, medium-grained, saturated, grey, dark brown, trace organics, trace coarse sand to fine gravel.

TH04-17

0 to 0.3 m	Peat, fine, fibrous, soily, trace woody, dark brown, moist to saturated.
0.3 to 0.6 m	Sand, medium-grained, saturated, grey, dark brown organic staining in some areas.
0.6 to 0.96 m	Sand, some clay, medium-grained, saturated, grey, dark brown organic staining in some areas, trace coarse sand to fine gravel.

TH04-18

0 to 0.6 m	Peat (very woody top .05 m), fine, fibrous, soily, trace woody, dark brown, saturated.
0.6 to 0.96 m	Sand, medium-grained, saturated, grey, dark brown organic staining in some areas, trace to coarse sand to fine gravel.

TH04-19

0 to 0.12 m	Peat, fine, fibrous, soily, trace woody, dark brown, saturated.
0.12 to 0.57 m	Sand, medium-grained, trace coarse-grained sand, trace fine gravel, saturated, grey, light brown to dark brown, organic staining.

TH04-20

0 to 1.36 m	Peat, fine, fibrous, dark brown,
1.36 to 1.52 m	Sand, medium-grained, trace coarse, grey, saturated.
1.52 to 1.82 m	Clay, dark brown, trace sand

TH04-21

0 to 1.52 m	Peat (top .15 frozen), fine, fibrous, soily, trace woody, dark brown, wet.
1.52 to 1.67 m	Sand, medium-grained, trace coarse sand, et, grey,
1.67 to 1.97 m	Clay, dark brown, high organics, trace fine to medium-grained sand, moist.

TH04-22

0 to 1.06 m	Peat, fine, fibrous, dark brown, trace woody.
1.06 to 1.87 m	Sand, medium-grained, trace coarse-grained, grey, saturated.

TH04-23

0 to 0.5 m	Peat, fine, fibrous, dark brown, trace woody.
0.5 to 1.06 m	Sand, medium-grained, trace coarse gravel, grey, saturated.

TH04-24

0 to 0.25 m	Peat, fine, fibrous, dark brown, trace woody.
0.25 to 0.91 m	Sand, medium-grained, trace coarse gravel, grey, saturated.

TH04-25

0 to 0.25 m	Peat, fine, fibrous, dark brown, trace woody.
0.25 to 0.91 m	Sand, medium-grained, trace coarse gravel, grey, saturated.

APPENDIX B

Mar Wayne Water Well Drilling test hole litholog

APPENDIX B

Mar Wayne Water Well Drilling test hole litholog

THURBER

Alberta ENVIRONMENT — Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy. All information on this report will be retained in a public database.

Well I.D.
Map verified
Date report received:

1 Contractor & Well Owner Information

Company Name: MAR Wayne Water Well Drilling Ltd. Approval No: A0022327

Mail[illegible]: Box 4, Site 5, RR1 City or Town: Cochrane Postal Code: T0L-0W0

Well Owner's Name: Thurber Engineering Ltd. Well Owner has a copy of the report: ☐ Yes ☐ No

Mailing Address: Suite 200, 9636-51 Ave City or Town: Edmonton Postal Code: T6E-6A5

2 Well Location

Land LSD: 5 Sec: 16 Twp: 65 Rge: 13 W of Meridian: 4

Lot: [ ] Block: [ ] Plan: [ ] m/ft from ☐ N ☐ S

[ ] m/ft from ☐ E ☐ W

3 Drilling Information

Type of Work: ☑ Testhole ☐ New Well ☐ Reconditioned ☐ Deepened ☐ Reclaimed well Date reclaimed: Yr Mo Day

Materials Used: ☐ Cement ☐ Bentonite Product ☐ Other:

Proposed well use: ☐ Household (up to 1250 m³ per year with a residence on the property) ☑ Other Specify: Subdivision

Method of Drilling: ☐ Auger ☐ Boring ☐ Cable tool ☐ Rotary ☐ Combination ☐ Backhoe ☐ Other

4 Formation Log

Depth from ground level	Lithology Description	Fresh / Salt
0 - 17	Fine clay	
17 - 260	Fine fine sand	
260	Gray clay.	
	No Aquifer encountered.	
	Test Hole Sealed.	

Geophysical Log taken: ☐ Electric ☐ Gamma

Did you encounter: ☐ Mineralized water more than 4000 ppm TDS ☐ Gas

At w[illegible]th:

Remedial action taken:

5 Well Completion

Date Started: Yr 11 Mo 11 Day 19 Date Completed: Yr 11 Mo 11 Day 19

Are measurements in metric or imperial?

Well Depth: 260 ft. Borehole diameter: 6 3/8 "

Casing type: Liner type:

Size OD: Size OD:

Wall thickness: Wall thickness:

Bottom at: Top: Bottom:

Perforations: from: to:

from: to:

Perforation size: X

Perforated by: ☐ Saw ☐ Torch ☐ Machine ☐ Other:

Seal: ☐ Bentonite product ☐ Driven ☐ Cement / Grout ☐ Other

Sealed interval: from 260 ft. to: Surface

Screen type: Size OD:

Intervals: from: to: slot size:

from: to: slot size:

Installation: ☐ Attached to casing ☐ Telescoped

Fittings: Top: ☐ Packer ☐ Coupler Bottom: ☐ Wash-down ☐ Ball ☐ Plug

Pack: ☐ Artificial/Mechanical ☐ Natural

Grain size: Amount

6 Well Yield

Test Date: Yr Mo Day Start Time:

Test method: ☐ Pump ☐ Bailer ☐ Air

Are measurements in metric or imperial?

Non pumping static water level:

Rate of water removal:

Depth of pump intake if pump tested:

Depth Bailed or air tested from:

Distance from top of casing to ground level:

Depth to water level

Elapsed Time minutes	Pumping	Recovery
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

Total Drawdown:

If water removal was less than 2 hr. duration, reason why:

Recommended pumping rate:

Recommended pump intake:

Pump installed ☐ Yes Depth:

Type:

Any further pumptest information? ☐ Yes ☐ No

7 Contractor Certification

Driller's Name: Jerry Engstrom

Certification No.: 419-55M

This well was constructed in accordance with the *Water (Ministerial) Regulation* of the *Water Act*. All information in this report is true.

Signature: [signature] Yr 19 Mo 11 Day 14

ENVIR 1101 White copy: Alberta Environment Yellow copy: Well Owner Pink copy: Contractor