## Gregg Properties Co. Ltd.

# 27 Lot Development
## S.W. ¼ Sec. 28-47-1-W5M
## (north of Kerr Cape, Pigeon Lake)

# Area Structure Plan

June, 2002

Bel-MK Engineering Ltd.
EDMONTON • CALGARY • KELOWNA • CANMORE • GRANDE PRAIRIE

**BY-LAW NO. 14-03**

**LEDUC COUNTY**

**A BY-LAW OF LEDUC COUNTY, IN THE PROVINCE OF ALBERTA, TO AMEND THE SW 28-47-1-W5M AREA STRUCTURE PLAN ADOPTED BY BYLAW 26-02.**

WHEREAS, pursuant to Section 690(5) of the Municipal Government Act, Chapter M-26, Revised Statutes of Alberta, 2000, and amendments thereto, Leduc County has been ordered by the Municipal Government Board to amend the Area Structure Plan Bylaw No. 26-02 in accordance with a mediated agreement between the Summer Village of Sundance Beach and the County;

NOW THEREFORE, be it resolved that the Council of Leduc County, in the Province of Alberta, duly assembled, hereby enacts that the SW 28-47-1-W5M Area Structure Plan adopted by Bylaw No. 26-02 be amended as follows:

1. THAT, in Section 5.3, Sanitary Drainage, the words "In the interim, however, Leduc County has indicated that holding tanks will be mandatory" be substituted for the words "In the interim, however, it is recommended that holding tanks be utilized by all lots";
2. THAT the following paragraph be inserted after the first paragraph of Section 5.1, Transportation:
   "There is limited parking in the area so it will therefore be incumbent on the purchaser of each lot to plan the use and development of the lot in a manner that accommodates sufficient parking for both themselves and their visitors";
3. THAT, Section 5.2, Storm Drainage, the words "However, discharge rates from the area into Sundance Beach will be limited to no greater than pre-development rates. In addition, stormwater initiatives to improve stormwater run-off quality are warranted" be substituted for "However, stormwater initiatives to improve stormwater run-off quality are warranted";
4. THAT the map that is attached to and forms part of this Bylaw be substituted for Figure 4.3 "Beach Access Plan";
5. THAT the words "Summer Village of Sundance Beach," be added after the words "the County," in paragraph 5 of Section 4.3, Lake Access.

This By-law shall take effect on the date of the third reading

Read a first time this 27th day of May, 2003

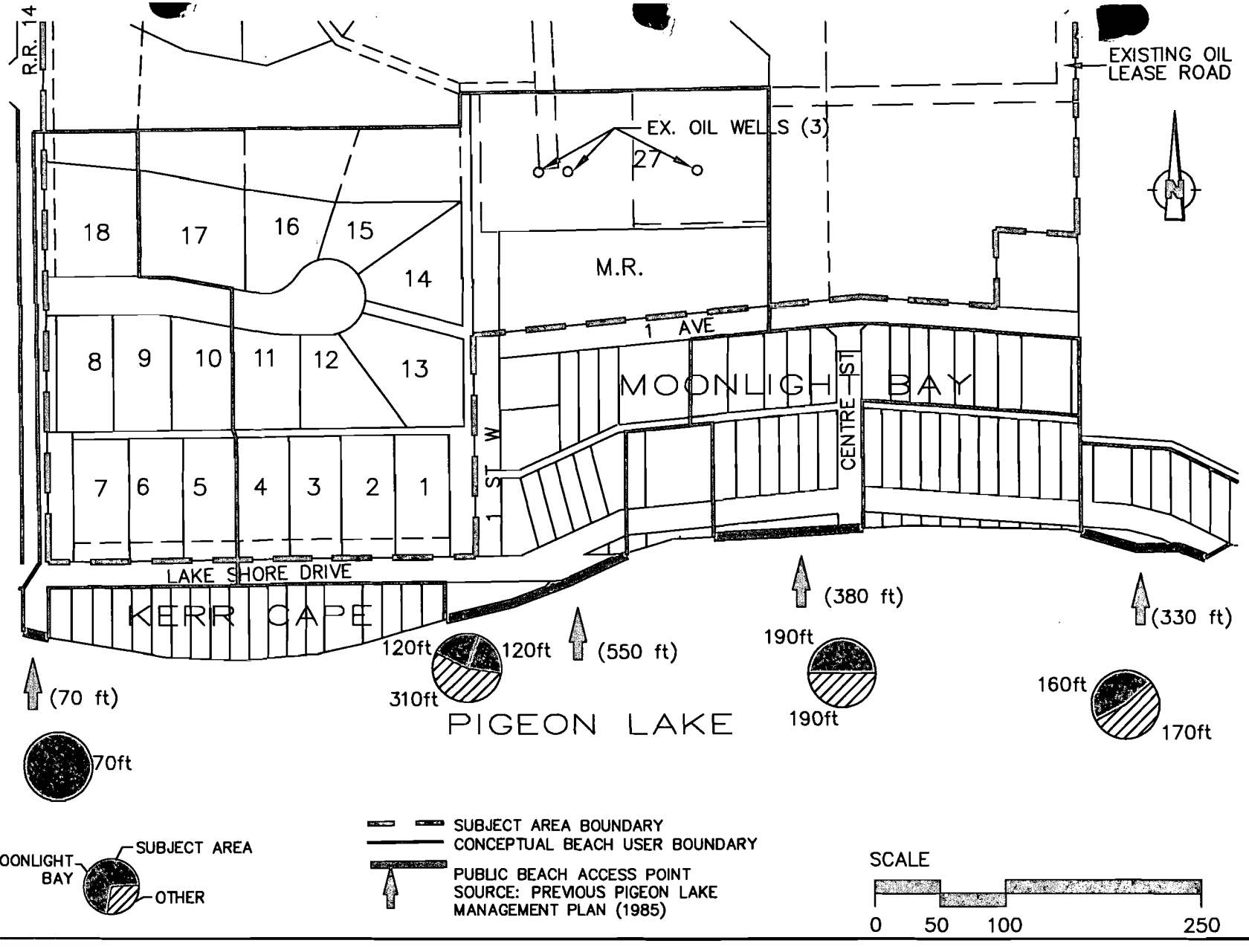
Read a second time this 27th day of May, 2003.

Read a third time with the unanimous consent of Council Members present and finally passed this 27th day of May, A.D., 2003.

Edward Schubert
REEVE

COUNTY MANAGER

By-Law No. 14-03
Exhibit "A"




GREGG PROPERTIES CO. LTD. – S.W. 1/4 SEC. 28–47–1–W5M
AREA STRUCTURE PLAN
BEACH ACCESS PLAN
(FOR LOTS WITIN APPROX. 400m OF THE LAKE)
FIGURE 4.3 (as amended)

05/02/02
3436FIG43

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AMENDED BY BY LAW NO. 14-03

**BY-LAW NO. 26-02**

**LEDUC COUNTY**

**A BY-LAW OF LEDUC COUNTY, IN THE PROVINCE OF ALBERTA, TO ADOPT AN AREA STRUCTURE PLAN FOR THE PT. S.W. 28-47-1-W5TH.**

WHEREAS Section 633(1) of the Municipal Government Act, being Revised Statutes of Alberta 2000, Chapter M-26, with amendments thereto, provides that for the purpose of providing a framework for subsequent subdivision and development of land, a Council may by by-law adopt an Area Structure Plan;

WHEREAS the Council of Leduc County deems it to be in the public interest to adopt such a by-law;

NOW THEREFORE be it resolved that the Council of Leduc County, duly assembled, hereby adopts the Gregg Properties Co. Ltd. Revised Area Structure Plan by by-law, attached hereto as Schedule "A" for the Pt. S.W. 28-47-1-W5th.

This By-Law shall take effect on the date of the third reading.

Read a first time this 10th day of September, A.D., 2002.

Read a second time this 10th day of September, A.D. 2002.

Read a third time with the unanimous consent of the Council Members present and finally passed this 10th of September, A.D. 2002.

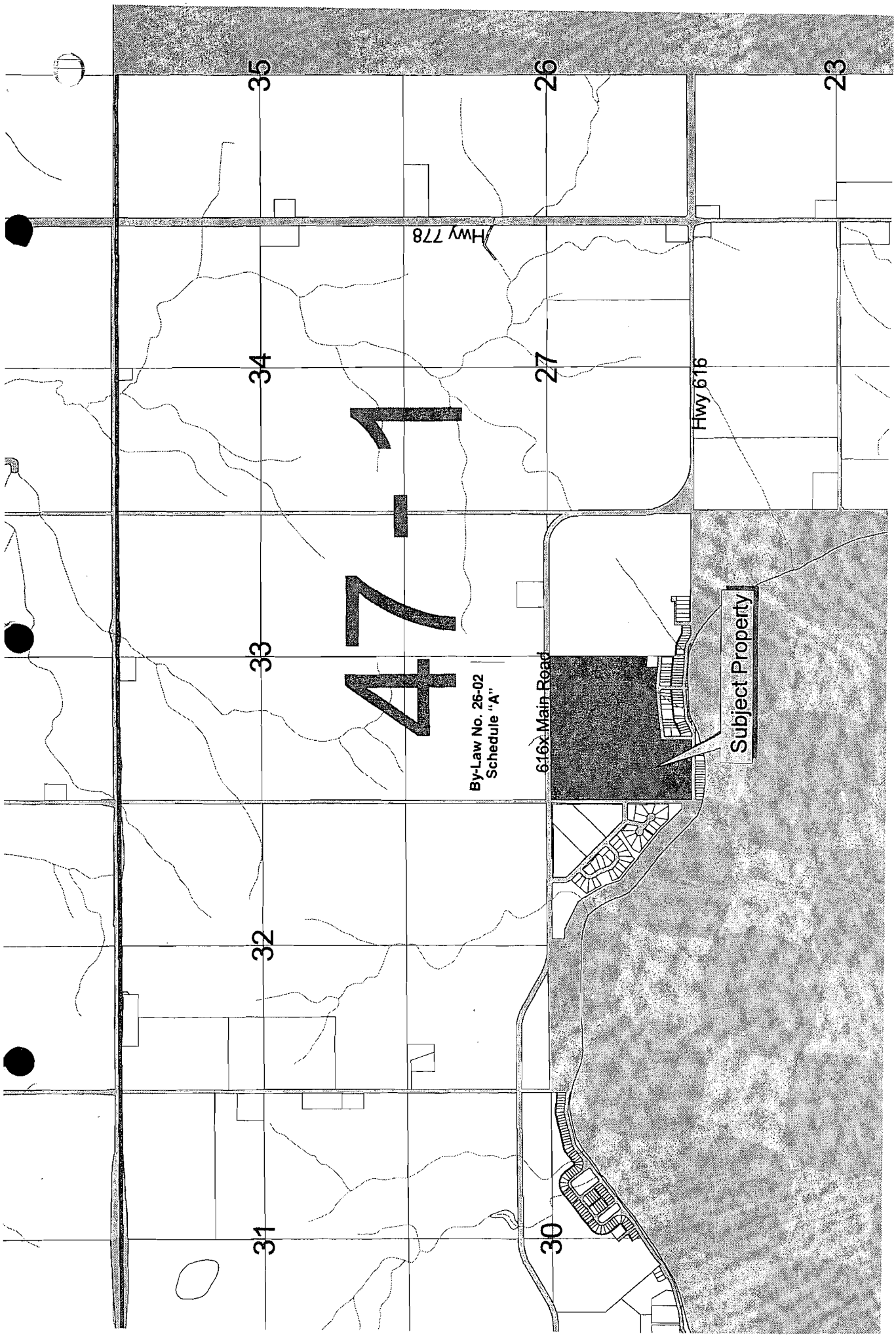
Edward Chubocka
REEVE

SEAL

COUNTY MANAGER

By-Law No. 26-02

Schedule "A"



**Gregg Properties Co. Ltd.**

# 27 LOT DEVELOPMENT
# S.W. ¼ Sec. 28-47-1-W5M
# (north of Kerr Cape, Pigeon Lake)

# Area Structure Plan

**Prepared By**
**Bel•MK Engineering Ltd.**
**10532 – 110 Street, Edmonton, Alberta T5H 3C5**
**Tel: (780) 423-4123 Fax: (780) 426-0659**

**June 2002**
**Adopted by Leduc County Bylaw No. 26-02**
**Amended by Leduc County Bylaw No. 14-03**

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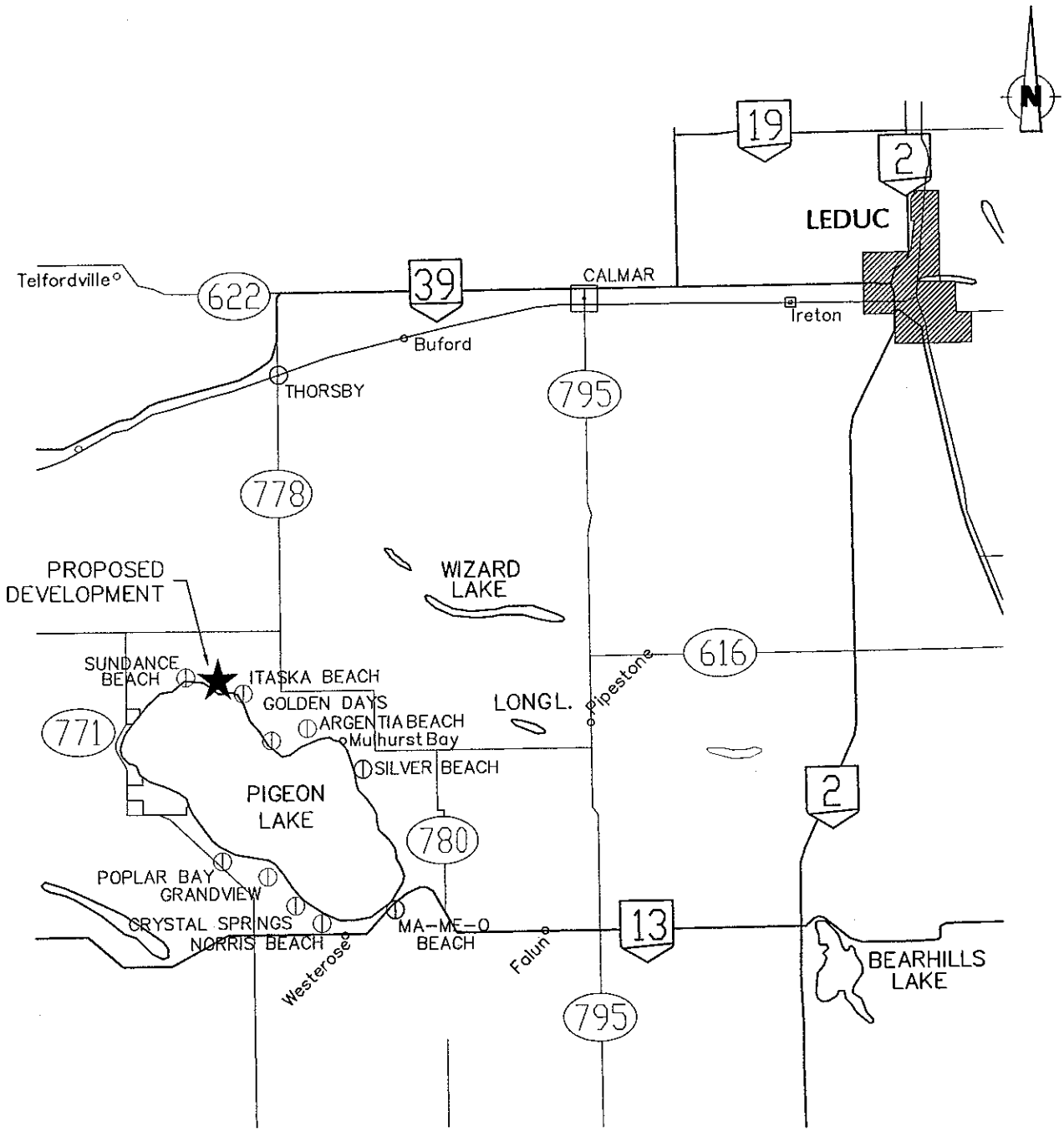
# 1.0 INTRODUCTION

## 1.1 General

The purpose of this Area Structure Plan (ASP) is to provide a framework for orderly development. The key stimulus for the development of this plan was to establish development specifics which are compatible with existing communities and which protect important aspects of the Pigeon Lake ecosystem. This ASP has been prepared by Bel•MK Engineering on behalf of Gregg Properties Co. Ltd. The general location of the subject lands is shown on Figure 1.1




GREGG PROPERTIES CO. LTD.

S.W. 1/4 SEC. 28-47-1-W5M
AREA STRUCTURE PLAN

LOCATION PLAN

FIGURE 1.1

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05/01/02
3430FIG1.0

# 2.0 EXISTING CONDITIONS

## 2.1 Plan Area

The plan area is a portion of the S.W. ¼ Sec 28-47-1-W5M, located immediately north of the Kerr Cape (lakefront) development, and between Moonlight Bay and Sundance Beach as shown on Figure 2.1. There is an oil pipeline R.O.W. that passes through the area and there are currently three pump-jacks operating on the site. The pump-jacks are situated on a surface lease which is accessible via an oil lease road.

The ASP area is a logical planning unit, which is bounded by existing development and by the boundaries of the quarter section.

## 2.2 Surrounding Land Use

Lands located to the north (across Highway 616X) and northeast consist of farmland which is predominantly cleared with pockets of forest. The land immediately east is mostly undeveloped except for approximately 5 ha (12 acres) which has been cleared for farming.

The Kerr Cape and Moonlight Bay subdivisions border the southern boundary of the subject area. Individual lot frontages in these subdivisions range from approximately 15 m (50 ft) to 56 m (186 ft).

The land adjacent to the west boundary (across Range Road 14) has been subdivided. The Summer Village of Sundance Beach comprises a portion of this land; however, most of the development to the west consists of Sundance Estates, which is an acreage development.

Oil and gas wells within 2 km of the subject area, along with the associated pipelines, are also shown on Figure 2.1.

## 2.3 Land Ownership

The ASP area is currently owned by Gregg Properties Co. Ltd. This area consists of 54.6 ha (135 acres) and is shown on Figure 2.2.

## 2.4 Existing Utilities & Access

The subject area is currently accessible via the:

- North – 616X
- West – Government Road Allowance (Range Road 14)
- South – Lake Shore Drive, Kerr Cape; 1st Avenue and 1st Street, Moonlight Bay

Existing natural gas, telephone, and power are located adjacent to the north, south and west subject boundaries.


SCALE 1: 30,000

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AREA STRUCTURE PLAN
EXISTING LAND USE OVERVIEW PLAN
FIGURE 2.1

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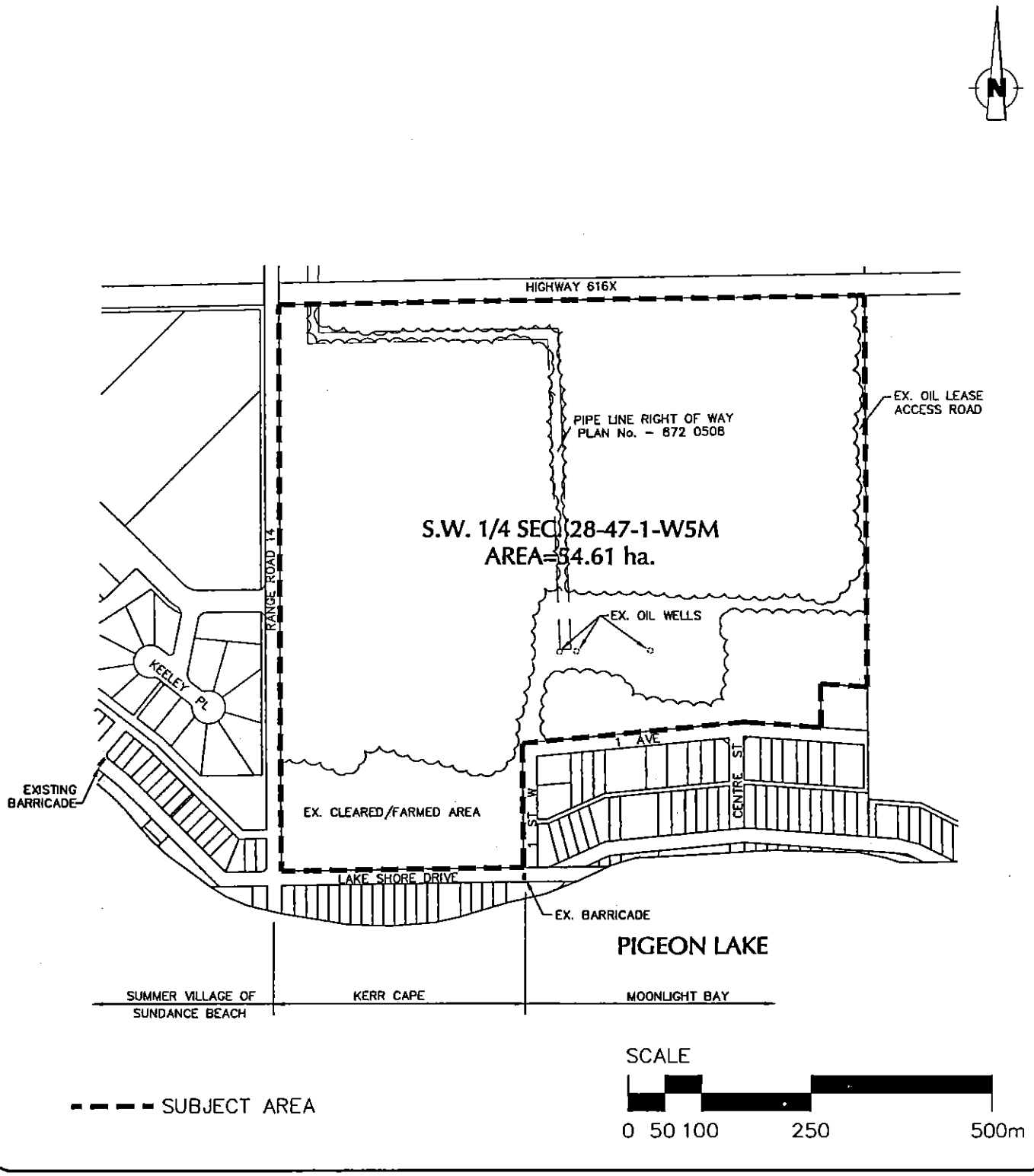


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S.W. 1/4 SEC. 28-47-1-W5M
AREA STRUCTURE PLAN

EXISTING LOT PLAN/INFORMATION

FIGURE 2.2

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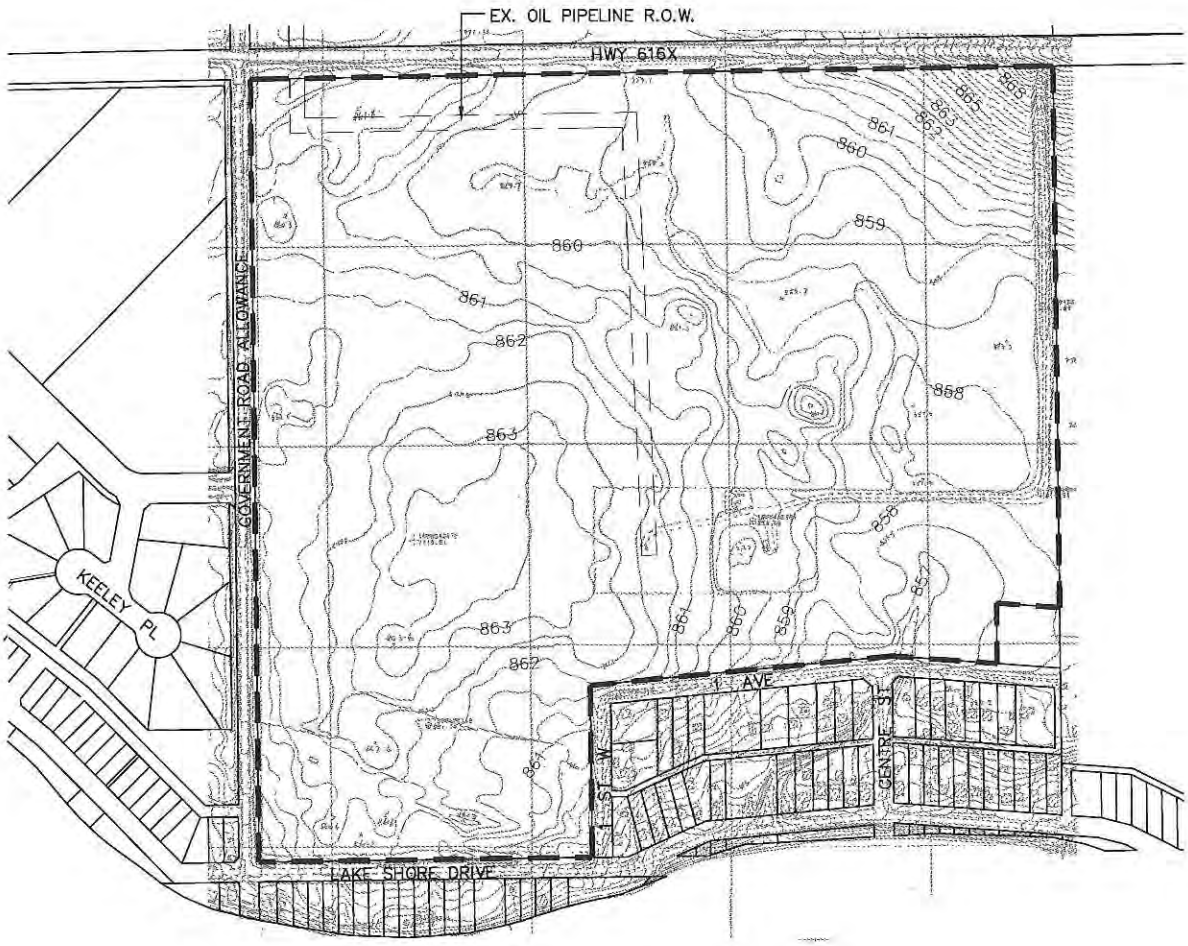
05/01/02
3436FIG2.2

## 2.5 Site Features and Topography/Drainage

The topography of the subject area falls from a high of 872 m in the north-east sector to 856m in the south as shown in Figure 2.3. The land generally slopes towards Pigeon Lake. A significant portion of the site drains to a low gradient drainage pathway which conveys flows to the south-east corner of the site. This low gradient drainage pathway conveys surface water from storm events or spring run-off to the lake. The pre-development surface drainage patterns are shown in Figure 2.4.

The area is predominantly tree covered with the exception of two cleared areas in the south-west and south-central sectors. Approximately 3.6 ha (8.9 acres) of land in the southern sector of the subject area was cleared for agricultural use and approximately 2.4 ha (5.9 acres) was cleared to accommodate the three (3) existing well heads.

SUBJECT AREA




PIGEON LAKE

SCALE

0 50 100 250 500m

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S.W 1/4 SEC. 28-47-1-W5M
AREA STRUCTURE PLAN

TOPOGRAPHIC PLAN

FIGURE 2.3

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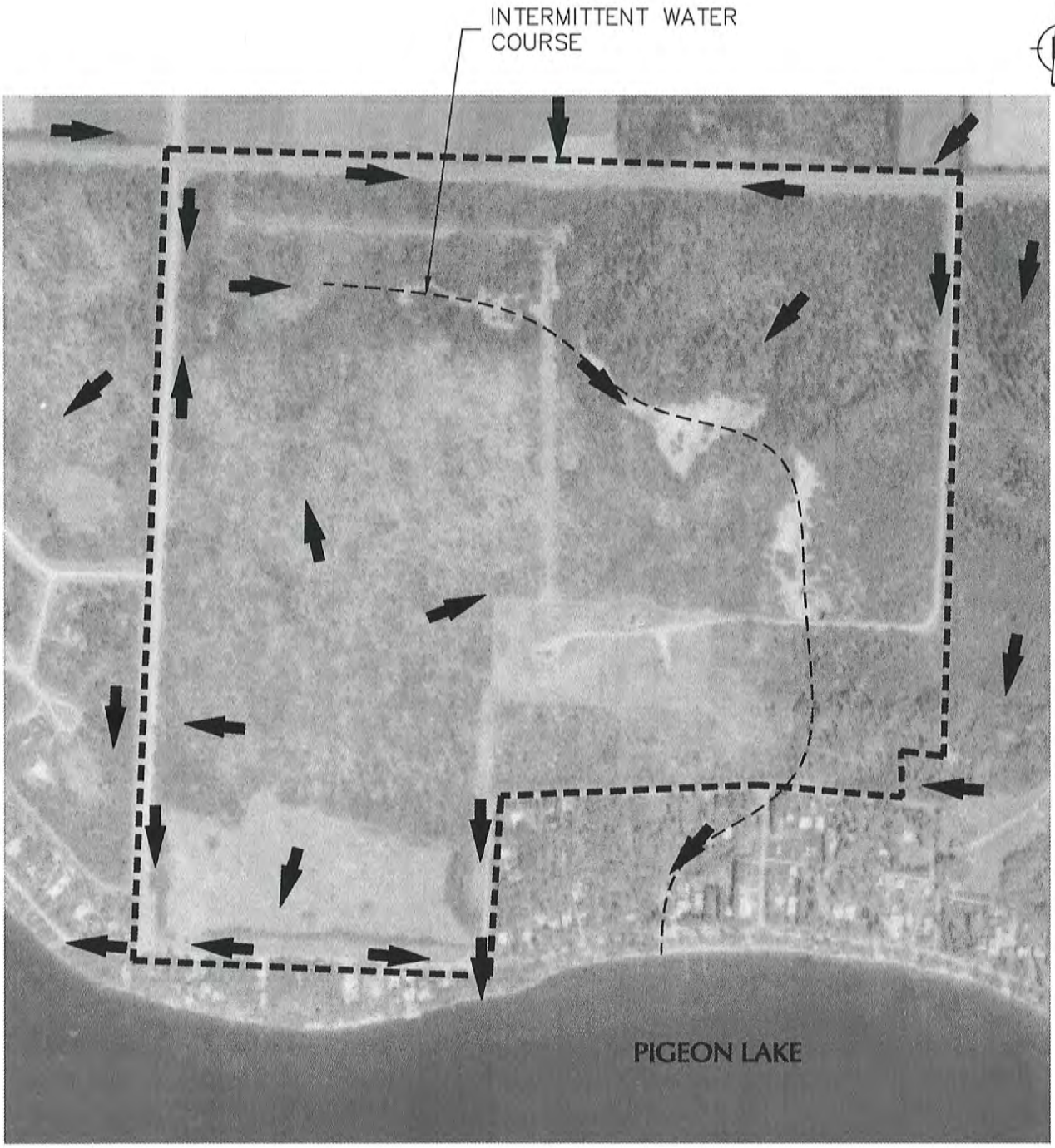
05/02/02
3436FIG25

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S.W. 1/4 SEC. 28-47-1-W5M
AREA STRUCTURE PLAN

PREDEVELOPMENT DRAINAGE PATTERN

FIGURE 2.4

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05/01/02
3436FIG2.4

# 3.0 REGIONAL POLICY

## 3.1 Municipal Development Plan

The Municipal Development Plan (Bylaw No. 35-99) was brought into force in October 1999 for the purpose of managing subdivision and development of land in Leduc County. The Pigeon Lake Watershed Management Plan (PLWMP) is designated as the Overlay Policy for the subject area. The Municipal Development Plan sets out a hierarchy of planning documents to influence and direct development and states that if there is a conflict between plans, the Overlay Policy, shall occupy the top of the hierarchy, followed by Municipal Development Plan and then the Area Structure Plan.

It is important to note that the Pigeon Lake Watershed Management Plan was passed by Council January 11, 2000, for use as a guide when making decisions affecting the watershed.

## 3.2 Land Use Bylaw

Land Use Bylaw No. 1665-83 was passed in September 1983. This bylaw asserts that an adopted lake management plan shall be used as guide for development in the plan area. The subject area is currently zoned as Lake Shoreland.

It should also be noted that the County acknowledges that the bylaw is rather dated and intends to update the Land Use Bylaw in the near future.

## 3.3 Pigeon Lake Watershed Management Plan (PLWMP)

The current PLWMP (January 2000), replaces the 1985 Pigeon Lake Management Plan. The PLWMP was prepared to assist the twelve lakeshore municipalities assess new development in the area.

Based on the Municipal Development Plan, the Land Use Bylaw and discussions with Leduc County, the PLWMP is to be used as the primary development guide for the subject area. The PLWMP recommends that new development in the Pigeon Lake drainage basin be judged according to the following 7 (seven) principles:

1. Recognize the rights of the farming community
2. Maintain water quality
3. Protect groundwater flows
4. Maintain public access to the lake
5. Protect the fishery
6. Allow suitable new development
7. Keep open communication on development proposals

# 4.0 THE DEVELOPMENT CONCEPT

## 4.1 Objectives

The development concept reflects the following objectives:

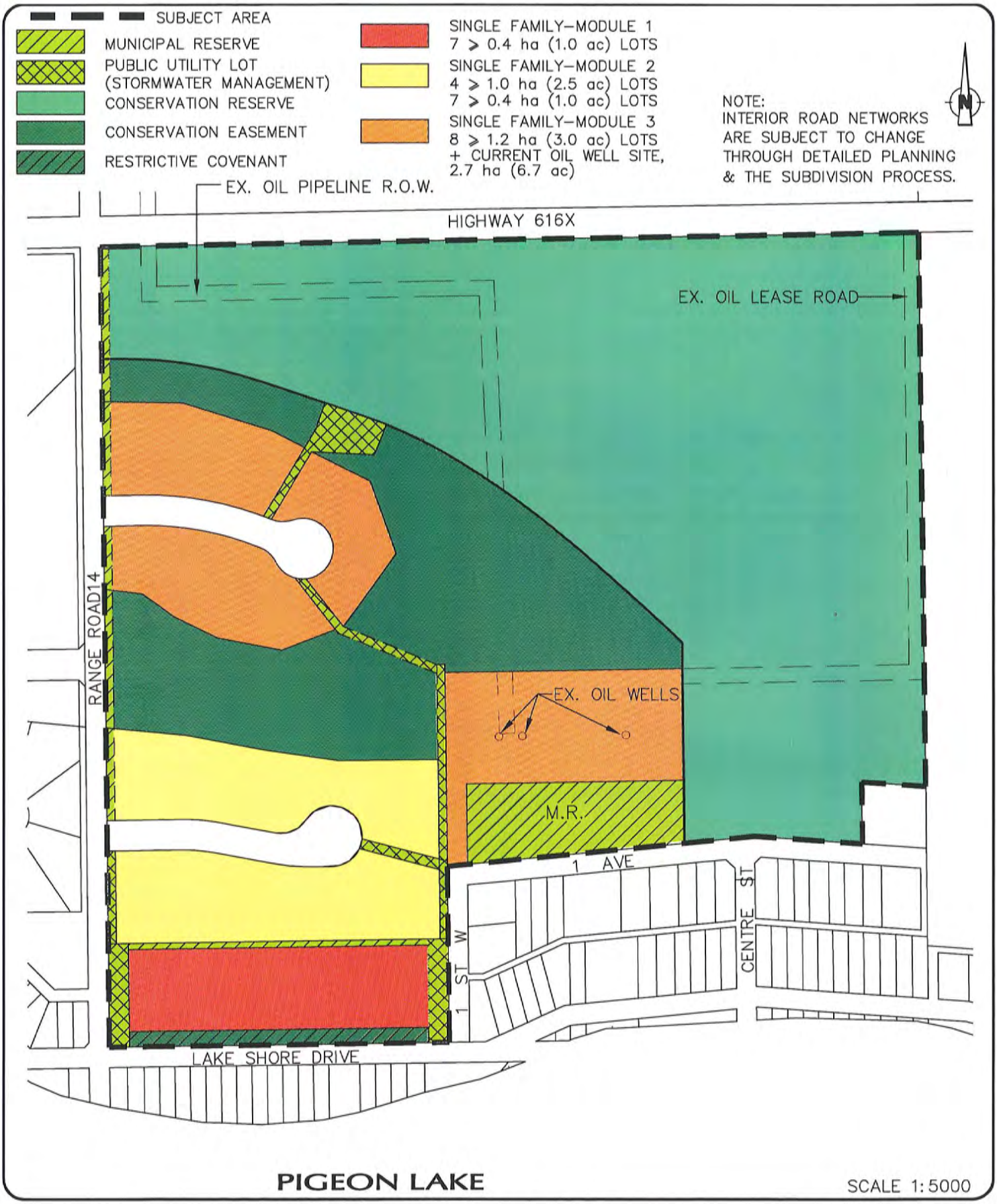
- To provide a detailed framework for the ultimate development of these lands to integrate and complement the current type of development and meet anticipated needs of the community. In particular, the proposed densities are low to maintain the character of the area.
- To preserve tree cover.
- To ensure safe pedestrian access to the lake.
- To ensure that the water quality of the lake is preserved.
- To provide a road system which utilizes existing infrastructure and improves emergency vehicle access to the area.
- Identify public land (municipal reserve) areas to benefit existing and future residents.
- To propose a staging sequence to compliment future suitable planning initiatives.

## 4.2 Overview of the "Conservation" Development Concept

The development concept for this Area Structure Plan establishes a "conservation" type of community identity comprised of low-density residential modules, as shown in Figure 4.1. Each module reflects a logical development sequence and lot size that is appropriate to the lakeshore proximity. Most importantly, over 60% of the subject area will be preserved in its current natural state. A conceptual lot plan is provided as Figure 4.2.

Module 1, fronting onto Lakeshore Drive, will consist of seven lots approximately 0.4 ha (1 acre) area each. Located in a region which has been predominantly cleared, the development of these lots is expected to have minimal impact on existing tree cover and may, through planting, result in increased tree cover. A Restrictive Covenant will be placed on the front portion of each lot to protect the existing trees. To be consistent with the conservation objective, the utilization of the existing Lakeshore Drive roadway efficiently lowers the impact (i.e. requires less new roadway) of this module to the overall development. To maximize the preservation of existing screening vegetation along Lakeshore Drive, shared accesses will be incorporated.

Module 2 consists of a mix of seven (7) lots approximately 0.4 ha (1 acre) and four (4) 1.0 ha (2.5 acre) lots. A new roadway is required to develop these lots, however the length of roadway is minimized by utilizing a cul-de-sac design with "pie-shaped" lots at the "bulb" turnaround. To reduce the impact of lot owners unnecessarily clearing their land, and to reflect the recommendations of the Environmental Assessment (by Westworth and Associates Environmental Ltd.), Conservation Easements, in the name of the County, will be placed on approximately the rear one-third (1/3) of the four 1.0 ha (2.5 acre) lots. The intent of the easements is to protect against clearing, dumping of waste, grass planting/cutting, etc. Maintenance, although minimal, will be the

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# S.W. 1/4 SEC. 28-47-1-W5M
# AREA STRUCTURE PLAN
# LAND USE PLAN
# FIGURE 4.1

3436LAND USE PLAN
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responsibility of the lot owner. The benefit of registering the easement in the name of the County is to allow them authorization for enforcement should complaints be received. It will also provide the County with authority to allow minor improvements for compatible improvements such as trails or necessities, such as utility or drainage issues. The Conservation Easements will also establish a portion of a wildlife corridor for east-west movements. A walkway for pedestrians between the end of the cul-de-sac and 1st Avenue in Moonlight Bay will be built as well as a grassed MR strip between Module 1 and 2 for light foot traffic and to provide a connection with a similar grassed walkway at the rear of the Summer Village of Sundance Beach. Foot traffic to and from the lake access areas will be accommodated with a gravel walking trail at the west and east side of Module 1/south half of Module 2. Existing trees will be maintained and additional planting will be undertaken to provide a visual screen. Also, a Municipal Reserve strip (5.0 m wide) will be dedicated along the west boundary of Lot 18 to provide for a future walking trail (to be built by others, should the need arise).

Module 3 consists of 8 lots of minimum 1.2 ha (3 acres) size. As with Module 2, a new cul-de-sac access road is proposed to develop the lots and minimize the impact due to tree clearing/road building. To conform with the PLWMP, the proposed lots will be in the 1.2 - 2.0 ha (3 - 5 acre) range, as the distance to the lake exceeds 400 m. As with the northern lots of Module 2, conservation easements will be placed on the rear 1/3 to 1/2 (or greater) of each lot to prevent unnecessary clearing and to establish a wildlife corridor network. Public Utility Lots (P.U.L.) corridors have been incorporated for pedestrian movements and drainage purposes. Also, a Municipal Reserve (5.0 m wide) will be dedicated along the west boundary for a future walking trail (to be built by others, should the need arise).

The residential lots shall be developed only for site-built detached (single family) dwellings with a minimum floor area of 100$m^2$ (1,076 sq.ft.). This requirement will be the subject of a restrictive covenant registered against the title to each lot. The covenant shall also prohibit the use of undeveloped lots for parking recreation vehicles or any other form of temporary shelter or accommodation except for a recreation vehicle used for a maximum of three months in association with the construction of a dwelling on the lot.

By-law No. 26-02

The existing oil-well site has been identified as continuing to operate for ten (10) years ±, with the potential to be developed as a large lot (approximately 2.7 ha). Development of the lot for a residential dwelling will be dependent on the remediation/reclamation requirements as per the standards and regulations in place at that time.

Generally, due to the distance to the lake from the north portion of Module 2 and Module 3, it is anticipated that the purchasers of these lots will appreciate the privacy that a large lot offers and generally not utilize the lake for regular recreational activities.

In summary, the proposed development area will consist of approximately 14 lots approximately 0.4 ha (1 acre) in area, 12 lots approximately 1.0 ha (2.5 acres) to 2 ha (5 acres) in area and 1 lot approximately 2.7 ha (6.7 acres) in area. Limiting the total number of lots to 27 serves two purposes. Firstly, it satisfies the Municipal Development Plan requirement that the maximum density of country residential lots shall not exceed 35

lots per quarter section. Secondly, low density subdivisions are an effective method of preserving tree cover (PLWMP, 2001).

Municipal Reserve (MR) will be located in a manner that improves pedestrian access to the lakeshore and in locations that can be conveniently accessed by new and existing development. A significant park site (MR) is proposed for the area immediately north of 1st Avenue and west of Centre Street in Moonlight Bay.

It should be noted that the area identified as 'Conservation Reserve' could be increased in area such that it may include part of or the entire area proposed to be developed within Stage 2 and Stage 3 as lots and conservation easement area (within Modules 2 and 3). It may also include that area of Stage 1 (Module 1) proposed as conservation easement. If the area to ultimately be dedicated as Conservation Reserve includes the area as shown in the plan as conservation easement, then the conservation easement may not necessarily be registered, provided that the area is protected through dedication and/or management by a conservation group.

By-law No. 26-02

As a result of the Environmental Assessment (Westworth), the intermittent watercourse that conveys flows to the southeast corner of the site and the surrounding mature forested areas is considered environmentally sensitive, and will be designated as a Conservation Reserve. The current intent is to dedicate ownership (and maintenance) of the Reserve to a conservation group. The areas designated as "Conservation Easement" areas are proposed primarily to preserve existing and/or encourage additional tree cover and provide wildlife corridors.

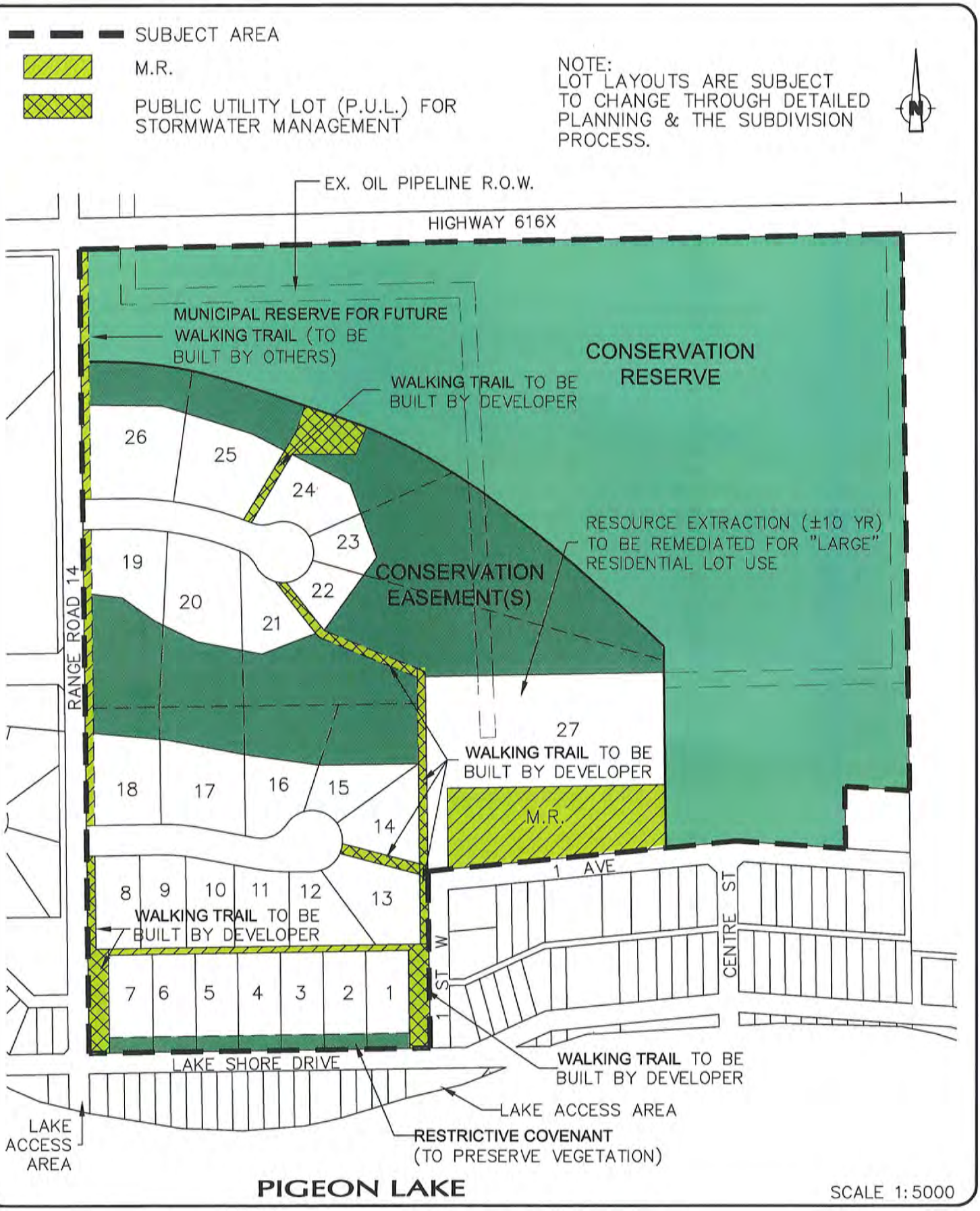
## 4.3 Lake Access

It is recognized that the majority of lots will be primarily used for recreational purposes. As such, the preservation and enhancement of recreational features is a vital part of this plan. It is also noted that the larger lot sizes (i.e. 1.0 hectares and greater) promoted by this development will allow owners/residents greater opportunity to engage in "on-lot" recreational activities.

For the residents of the proposed fourteen one acre lots, lake access will likely be an important recreational component. Based on the Pigeon Lake Watershed Management Plan (January 2000) and the 1985 Pigeon Lake Management Plan, 3.05 m (10 ft) of public beach frontage for every lot within approximately 400 m of the lakeshore was a criteria identified as a guide. As shown on the Conceptual Lot Plan (Figure 4.2), approximately 19 of the proposed lots will be within 400 m of the lake, corresponding to 58 m (190 ft) of public lakeshore access.

A conceptual projection of public beach use is presented in Figure 4.3. Based on this analysis, there is currently sufficient public lakeshore to support the existing communities and the development outlined in this ASP.

Open Space/Municipal Reserve/Public Utility Lot corridors have been located to allow for convenient pedestrian access from lots within 400m of the lakeshore. Aesthetically appropriate pedestrian pathways in the corridors will be constructed as development




# GREGG PROPERTIES CO. LTD.
# S.W. 1/4 SEC. 28-47-1-W5M
# AREA STRUCTURE PLAN
# CONCEPTUAL LOT PLAN
# FIGURE 4.2

3436fig42rev
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proceeds. In addition, improvement of the existing public lake access points is also considered as a part of new development. This would include constructing safe stairways/walkways and a terraced area(s). It is understood that the design of the Lake access areas will be to a municipal standard that meets County approval.

Existing area residents will be involved in the design process for the proposed access point improvement(s) to the lake in order that their concerns are adequately addressed. Properly engineered steps and other means of lake access as required by the County Summer Village of Sundance Beach and reviewed and approved, as necessary, by Fisheries and Oceans Canada and Alberta Sustainable Resource Development, will be required to be in place prior to registration of the first subdivision of the Plan lands, as a condition of the development agreement. Unless otherwise approved by Leduc County, the maintenance of and liability for the steps and other means of lake access shall be the responsibility of a homeowners' association established for the subdivision.

By-law No. 26-02
By-law No. 14-03

In a phone conversation with BEL on February 5, 2002, Alberta Sustainable Resource Development noted that provincial approval for the detailed design of the proposed stairway/landing is required under the *Public Lands Act*. They also indicated that while approval cannot be guaranteed, an appropriately designed stairway and related features would typically be acceptable, provided disturbance did not occur below the high water level. Given the steepness of the slope and relatively narrow area available for public access at the foot of Range Road 14 right-of-way, lake access improvements will initially be developed only within the municipal reserve located between Kerr Cape and Moonlight Bay. Any construction within the Range Road 14 right-of-way will only occur following further review and acceptance by the County, Alberta Environment and Sustainable Resource Development and Oceans and Fisheries Canada. The Beach Access Plan, Figure 4.3 is therefore revised accordingly.

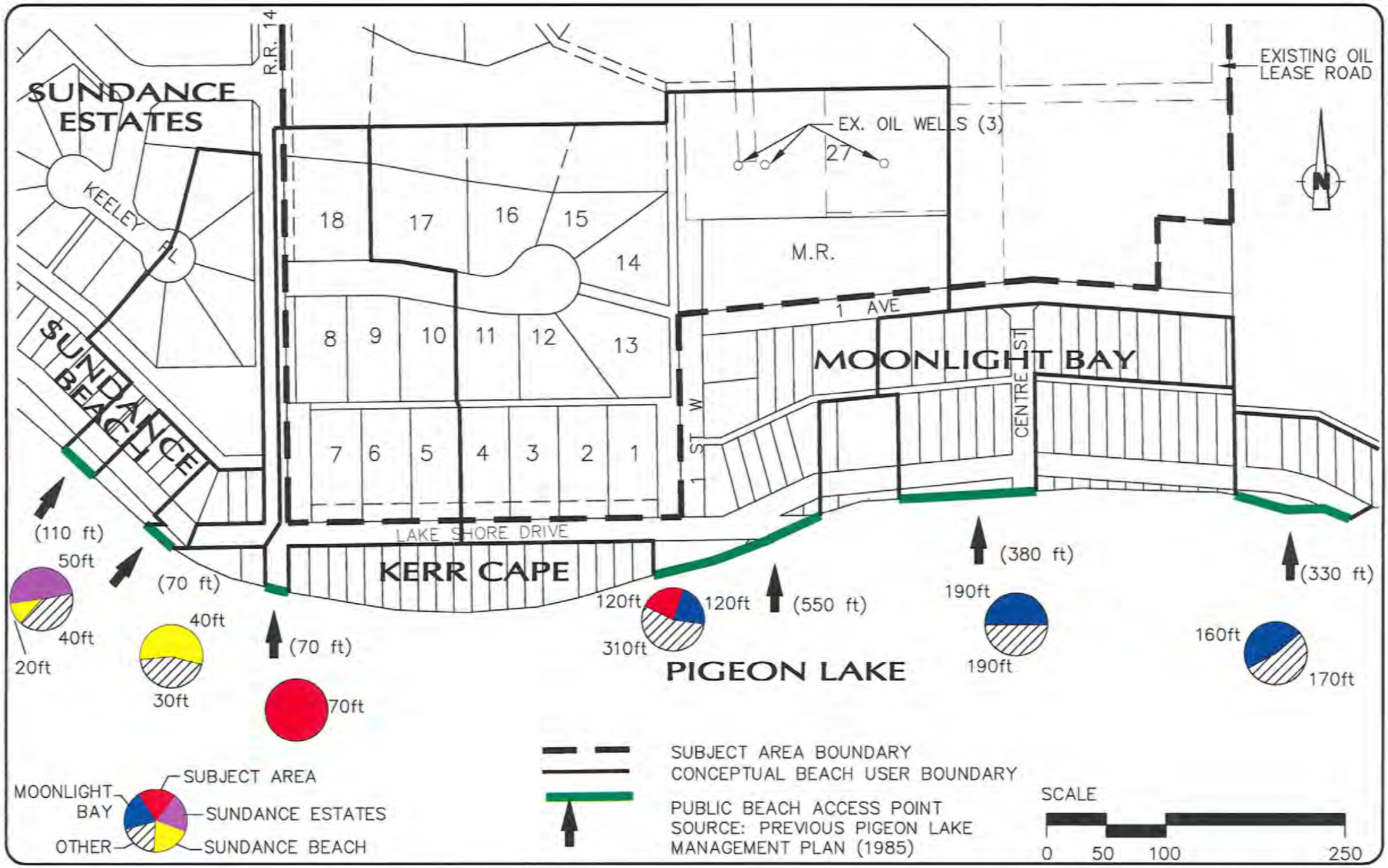
By-law No. 26-02

## 4.4 Land Use Summary

The proposed land uses outlined in this Area Structure Plan document are summarized as follows:

| Use | Area (ha) | Area (acres) |
|---|---|---|
| Residential (0.4 ha ±) | 5.9 | 14.6 |
| Residential (1.0 ha and larger) | 18.5 | 45.7 |
| Roadways | 1.7 | 4.2 |
| MR | 2.1 | 5.2 |
| P.U.L. (Stormwater Management) | 1.2 | 3.0 |
| Conservation Reserve | 25.2 | 62.2 |
| **Total** | **54.6** | **134.9** |

**Note:** The residential lot areas shown above include 9.0 ha (22.2 acres) of Conservation Easements.




**GREGG PROPERTIES CO. LTD. - S.W. 1/4 SEC. 28-47-1-W5M**

**AREA STRUCTURE PLAN**

**BEACH ACCESS PLAN**

**(FOR LOTS WITIN APPROX. 400m 0F THE LAKE)**

**FIGURE 4.3**

05/02/02
3436FIG43

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# 5.0 MUNICIPAL SERVICES

## 5.1 Transportation

It is important to appreciate that lakeside communities highly value a certain level of solitude and that unnecessary through traffic is undesirable. Existing roadway blockades on the Lakeshore Road limit access and eliminate through traffic. With the aim of respecting and preserving the character of the community, the proposed new roads do not provide interconnections between existing developed areas that would create through traffic concerns. However, an improved emergency vehicle access via "knock-down" type barricade is proposed to replace the rigid barrier structure on Lakeshore Drive at the east end of Kerr Cape.

There is limited parking in the area so it will therefore be incumbent on the purchaser of each lot to plan the use and development of the lot in a manner that accommodates sufficient parking for both themselves and their visitors.

By-law No. 14-03

New proposed roadways are identified in the Land Use Plan (Figure 4.1) and the Conceptual Lot Plan (Figure 4.2). The proposed roadways will connect to Range Road 14, immediately east of the subject area, at two locations. The northern connection will be a cul-de-sac that will service approximately 8 lots. The "south central" cul-de-sac will serve 11 lots.

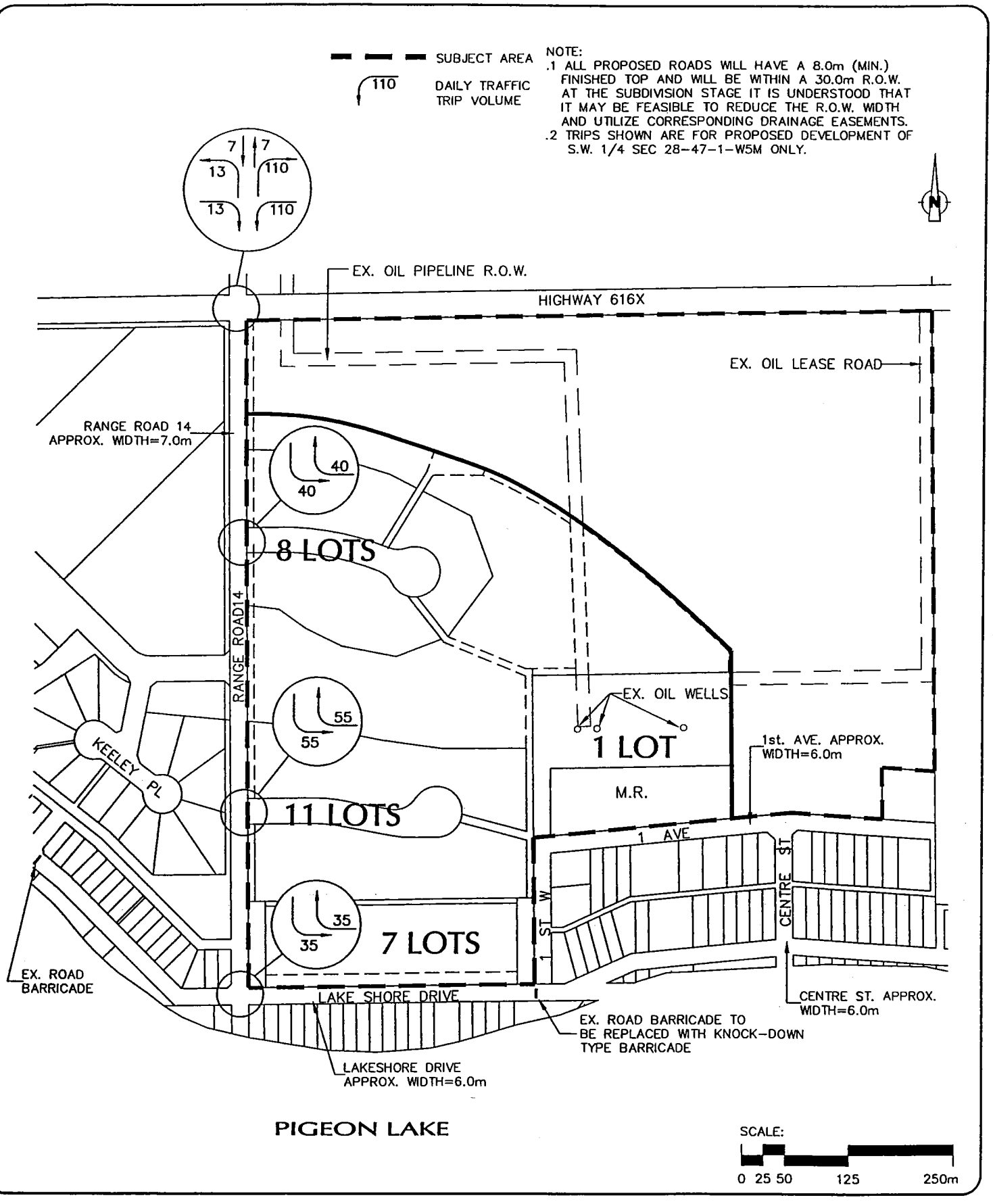
The southern most seven (7) lots will be accessed from the existing Lakeshore Drive roadway.

These 7 lots will be served by a maximum of 4 approaches/driveways off Lakeshore Drive. A contribution towards the improvement of that road and Range Road 14 will be required by Leduc County in proportion to the increase in traffic volumes caused by the subdivision.

By-law No. 26-02

In general, traffic impact on neighboring communities will be minimal. A preliminary analysis of projected traffic volumes generated by the subject development was done for a daily trip count. The analysis is based on the following criteria and assumptions:

- 10 trips/day per residential lot. This value is typical of residential units and is consistent with the Institute of Traffic Engineers' Traffic Count Report, 6th Edition.
- 85% of traffic turning east and 10% turning west onto Highway 616X. 5% of traffic traveling straight through on Range Road 14 across Highway 616X.
- All units are occupied.
- Existing and future traffic from other adjacent communities was **not** included in this analysis.
- The traffic impact of Lot 27 (current oil well site) is considered negligible.




# GREGG PROPERTIES CO. LTD.
# S.W. 1/4 SEC. 28-47-1-W5M
# AREA STRUCTURE PLAN
# TRANSPORTATION PLAN
# FIGURE 5.1

3436TRANSPORT
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A daily traffic volume of approximately 250 trips is expected to be added to Highway 616X when the area is fully developed. Additional information including existing and proposed fully-developed road top widths along with daily trip counts are shown on Figure 5.1.

It is worth noting that rural local roads typically have a traffic volume of less than 1000 vehicles per day (Manual for Geometric Design Standards for Canadian Roads, 1986). Based on this criteria, the projected traffic volumes and the existing development lot density, Range Road 14, Lakeshore Drive, First Avenue and First Street would all remain classified as local rural roads when the subject area is fully developed.

All lots (except Lots #1-7 and 27) will be serviced by an internal road network consisting of local rural roads that can be designed and built in accordance with Leduc County standards. In the spirit of the "conservation type" subdivision proposed, addressing roadside drainage (i.e. ditches) within easements and utilizing gravel roads (to increase permeability), are worthy of further discussion at the subdivision stage. However, we acknowledge the County has indicated they will be requesting cold mix surfacing as per current County standards.

## 5.2 Storm Drainage

Given the density and nature of the proposed conservation type development, overall stormwater impact from the development is expected to be minimal. Specifically, with over 60% of the area to be maintained in an existing state, increased run-off will be primarily due to roadways and roof tops.

In many development scenarios, stormwater management to limit discharge to pre-development rates is a requirement due to downstream constraints (i.e. existing pipe or stream capacities). For this development, it is adjacent to a large water body not sensitive to increased run-off rates as relatively short lengths of culverts can be installed to accommodate flow requirements. However, discharge rates from the area into Sundance Beach will be limited to no greater than pre-development rates. In addition, stormwater initiatives to improve stormwater run-off quality are warranted.

By-law No. 14-03

"Best Management Practices" to improve water quality include:

1. Stormwater Detention - It is well documented that the initial run-off water from an area is the most desirable to contain for quality improvements. It has been found that over 80% of the annual suspended solids load is transported in the run-off associated with the first 25 mm (1 inch) of rain. Therefore, it is proposed that detention areas be provided accordingly at the southeast and southwest corners of Module 1 and a detention area for run-off north of Module 3.

2. Grassed Ditches - Grassed areas act as vegetated filters to remove pollutants.

3. Ditch Checks - Ditch checks at key locations are proposed to trap silt and promote infiltration.

During construction, it will also be important to ensure that silt fencing is strategically placed to prevent sediment laden run-off from disturbed areas from reaching the lake. As

the silt builds up in the fences and ditches, it will be important that they be maintained to ensure they continue to operate properly. Disturbed areas should be re-vegetated as soon as possible following construction.

Other storm drainage recommendations include:

- Maintain tree cover where practical.
- All lakeshore outlets must include design features to correct and control erosion in recognition of future water flow if created by the new subdivision.

By-law No. 26-02

- Low gradient drainage ditches should be utilized where feasible to promote infiltration.
- The use of lawn fertilizer should be limited.

## 5.3 Sanitary Drainage

The PLWMP identifies an increase in phosphorous as a prominent potential risk to the water quality of Pigeon lake. With the aim of mitigating additional phosphorous loading to the lake, holding/pump-out tanks are recommended.

In the future, community cooperation in conjunction with improved government funding, may make a piped sanitary sewage system possible. In the interim, however, Leduc County has indicated that holding tanks will be mandatory. Holding tanks would also function as a component of a future low-pressure collection system. Since holding tanks are currently used in the surrounding communities, service is readily and economically available. A development agreement must be registered on all lots under which future owners agree to connect to municipal sewer as soon as it is available.

By-law No. 26-02
By-law No. 14-03

## 5.4 Water

Drinking water will be supplied via individually owned water wells. A Groundwater Feasibility Assessment for the area, entitled "Proposed 28 Lot Recreational Lot Development S.W. ¼-28-47-1-W5M", December 2001, Bel•MK Engineering Ltd., was completed and submitted to Leduc County. The report concludes the following:

- Based upon criteria set out in the "Interim Guidelines For The Evaluation Of Groundwater Supply For Unserviced Residential Subdivisions Using Privately Owned Domestic Water Wells" (Alberta Environment, 1994), the proposed subdivision has an adequate groundwater supply potential to meet the needs of existing development and the domestic requirements of the proposed unserviced residential subdivision, and thus approval for the development of the proposed 28 lot subdivision should not be declined based upon groundwater supply issues.

- Based upon criteria set out in the Water Act (Alberta Environment, 1999) and a letter of clarification regarding Section 23 of the Water Act to the MD of Foothills No.31 (AENV, April 27, 1999), and upon the results of investigations conducted at the site, it is concluded that the diversion of 1,250 $m^3$/year of water per

household, for each of the houses within the subdivision, will not cause a significant adverse effect on existing water users in the area. Thus, approval for the development of the proposed 28 lot subdivision should not be declined based upon groundwater supply interference issues.

- Groundwater from wells drilled at the proposed subdivision should be tested for potability parameters. Should parameters exceed Canadian Drinking Water Standards, the water may be treated for a nominal cost.

**Note:** The development was scaled back from 28 lots to 27 subsequent to preparation of the above report.

## 5.5 Shallow Utilities

Shallow utilities (i.e. natural gas, power, and telephone) are currently located along the roads south and west of the subject area. These utilities will be extended into the development in order to provide service.

## 6.0 STAGING

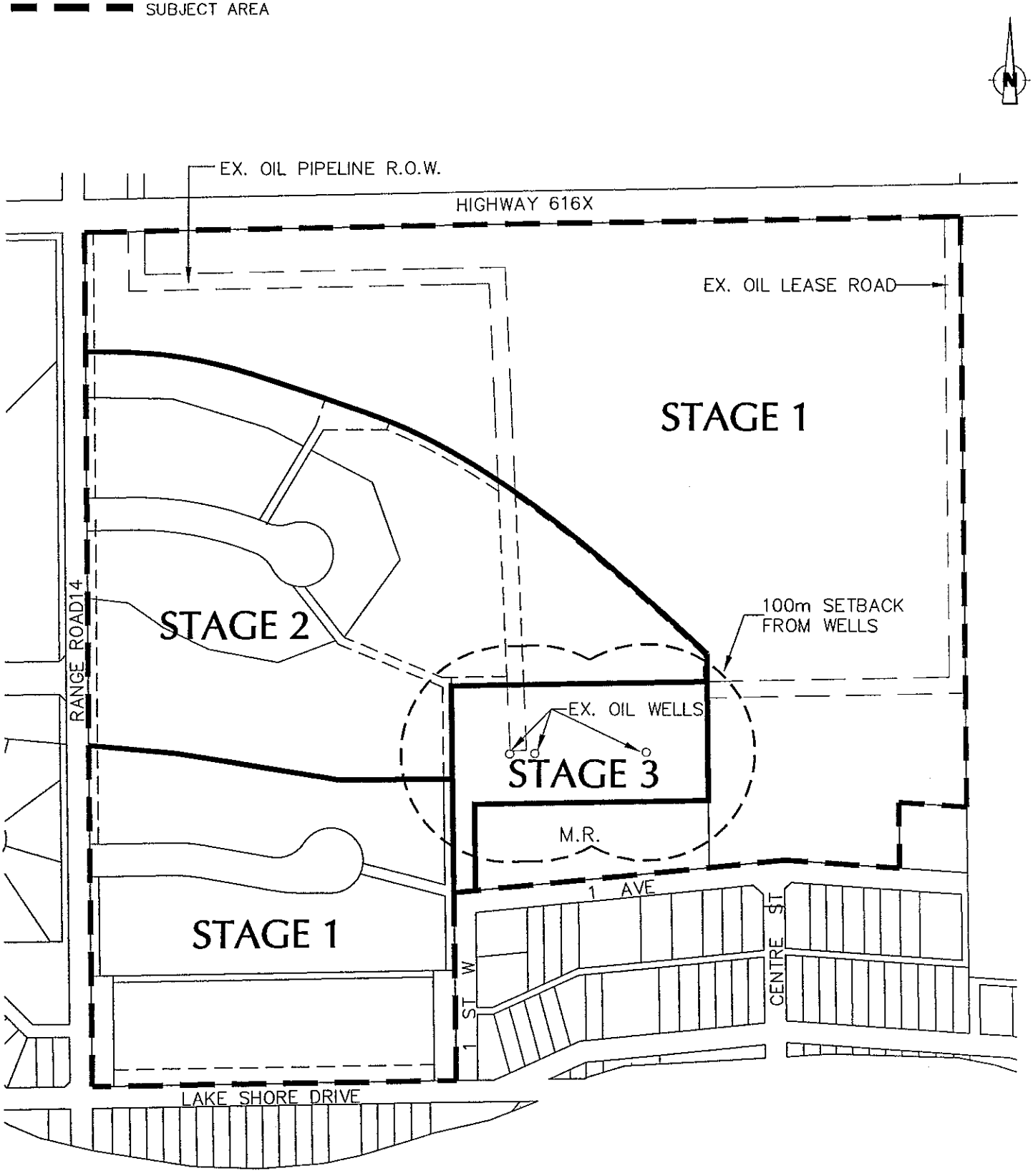
Staging of the development will be undertaken based on the logical location of infrastructure as well as marketing considerations. Development will generally progress in a south to north direction. The timing of development will be a function of the market conditions in the Pigeon Lake area. The proposed neighbourhood staging is shown in Figure 6.1. The staging shown indicates the logical order that development (i.e. road and/or house construction would occur.

At the request of the County, subdivision of Stage 1 will include the dedication of the Conservation Reserve and the Municipal Reserve. It is acknowledged that Stage 3 (Lot 27) will be created as a result of the Stage 2 subdivision process.

It is also acknowledged that the Conservation Reserve could be increased in area to include all or part of the proposed Stage 2 development and/or part of the proposed Stage 1 development.

By-law No. 26-02

The development of Lot 27 will be limited by the presence of the three existing oil well heads. Until these wells are decommissioned, all residential housing units must be located a minimum of 100 metres from the well head. Based on information provided by Acclaim Energy Inc., the existing oil wells have a minimum 10 year production life.




GREGG PROPERTIES CO. LTD.
S.W. 1/4 SEC. 28-47-1-W5M
AREA STRUCTURE PLAN
NEIGHBOURHOOD STAGING
FIGURE 6.1

3436STAGING
06/11/02

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# APPENDIX A

# Geotechnical Evaluation

## Shelby Engineering Ltd., April 2002

# GEOTECHNICAL EVALUATION

# PROPOSED RESIDENTIAL SUBDIVISION

# PORTION OF SW ¼ , 28-47-1 W 5$^{TH}$ M

# PIGEON LAKE, ALBERTA

Prepared For:

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Prepared By:

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File No. 1-8761

APRIL 2002

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## 1.0 INTRODUCTION

Shelby Engineering Ltd. has conducted a Geotechnical Evaluation at the site of the proposed Residential Subdivision located within a portion of the SW¼, 28-47-1-W5$^{th}$M. The site comprises approximately 140 acres and is located to the north of the Kerr Cape subdivision development at Pigeon Lake Alberta.

Mr. John Kelly, P.Eng. of Bel-MK Engineering Ltd. authorized Shelby Engineering Ltd. to proceed with this investigation on behalf of Gregg Properties Co. Ltd. The field drilling and sampling program was undertaken on March 8, 2002 and comprised 9 test holes. Authorization to proceed with this investigation was received after the submission of our proposal dated February 22, 2002 SEL File # 4170R. This investigation is subject to the terms and conditions contained in Appendix II.

Development is anticipated to be comprised of 28 lots developed in two stages. The first stage is comprised of 18 lots and will be located directly north of the Kerr Cape subdivision and the second stage will be 10 lots to the north of stage 1. The purpose of our investigation was to determine the subsoil stratigraphy, depth to ground water information, and to provide recommendations pertinent to development of a residential subdivision. Development will include roadways, private sewage disposal, and general building site information.

## 2.0 SITE DESCRIPTION

The proposed development is located in the SW¼ Section 28, Township 47 Range 1, West of the 5$^{th}$ Meridian. The site is an irregular shaped parcel of land that is predominately treed. The land appears level over the majority of the property with elevations varying by about 2 to 3 meters, however it does rise up in the northeast corner

about 10 meters. An intermittent drainage course runs in north south direction through the east central portion of the property.

The site is bound on the north by Highway 616X and to the west by Range Road 14, which is the access road to Kerr Cape and Sundance East subdivisions. The site is predominately tree and bush covered with some clearings immediately north of Kerr Cape. An access road is present to the centre of the property from Highway 616X. This road provides access to three producing oil wells. The wells are located in a large rectangular clearing. A pipeline right of way runs north from these wells and then west, turning north again before it crosses Highway 616X near the northwest corner of the property. The low lying marshy area present in the east central portion of the site drains fields north of Highway 616X through an intermittent stream into Pigeon Lake south of the site.

## 3.0 SUBSURFACE INVESTIGATION

The subsurface investigation was undertaken on March 8, 2002 with a track-mounted drill rig. The subsurface investigation consisted of advancing nine test borings to a maximum depth of 6.90 meters below existing grade. The site was covered at the time of the drilling with 300 to 600 mm of snow.

Disturbed soil samples were obtained at 300 mm below grade and thence at regular depth intervals of 0.76 meters from all testholes. Standard penetration tests were conducted at selected depth intervals in all deep test holes. A continuous field log was maintained and all samples were returned to our laboratory for confirmation of our field logs and for pertinent laboratory testing. The test hole elevations were obtained from a contour plan supplied by Bel MK Engineering.

Laboratory testing consisted of visual classifications, moisture contents, soluble sulphate salts, Grain size distribution, and Atterberg limits.

The results of our field and laboratory testing are contained on the test hole logs and were used in conjunction with engineering analysis to formulate the design recommendations.

## 3.1 GENERAL SOIL CONDITIONS

The generalized subsoil stratigraphy at this site is based on the findings in nine test holes and consists primarily of a thin layer of topsoil underlain by clay till and bedrock.

Topsoil encountered on this site varied in thickness from negligible to 100 mm. The exception to this was test hole 8 drilled in the low lying drainage course, which encountered 450 mm of peat over organic clay to a depth of 750 mm. The topsoil is underlain by clay till at all test hole locations except test hole 9 where clay was noted. The clay and clay till are silty, sandy, medium plastic and stiff to very stiff. The clay till is generally a thin deposit varying in thickness from 800 mm in test hole 5 to about 3 meters in test hole 8.

The clay or clay till is underlain by bedrock at all test holes. The bedrock encountered was comprised primarily of sandstone with clay shale and is part of the Paskapoo Formation. The bedrock has a very stiff to hard consistency. The shale and sandstone are not well cemented for the most part however a cemented layer of sandstone does exist. The cemented sandstone is visible along the shore of Pigeon Lake below the Kerr Cape subdivision. Although the sandstone can be cemented it is also jointed resulting in a significant increase in permeability for the formation. Auger refusal was noted in test holes 1, 2 to 6 and 9 in hard sandstone bedrock at depths as shallow as 1.3 meters.

Detailed soils logs are shown on the attached figures 1 through 9, Appendix I and the relative test hole locations are shown on the attached Drawing 10, Appendix I. Grain size distribution curves for clay till and sandstone are enclosed as figures 11 and 12, Appendix I.

## 3.2 GROUNDWATER OBSERVATIONS

Standpipes were installed in all test holes to facilitate groundwater monitoring. Groundwater levels were recorded 15 days subsequent to the completion of field drilling activities.

Sloughing was recorded upon completion of field drilling in test hole 4 at a depth of 3.8 meters. A summary of the groundwater conditions observed is presented in Table 1 below:

**TABLE 1**
**GROUNDWATER OBSERVATIONS**

| Test hole & Depth meters | Surface Elevation meters | Water Depth meters | Water Depth after 15 Days meters |
|---|---|---|---|
| TH-1 - 2.3 | 859.0 | Dry | dry to 1.2 * |
| TH- - 5.18 | 856.5 | Dry | 4.26 |
| TH-3 – 1.2 | 860.0 | Dry | dry to 1.0 |
| TH-4 – 3.35 | 860.5 | Dry | dry |
| TH-5 –1.8 | 860.5 | Dry | dry |
| TH-6 – 3.8 | 862.5 | Dry | dry |
| TH-7 – 5.3 | 861.0 | Dry | 5.13 |
| TH-8 – 5.3 | 857.5 | Dry | 2.23 |
| TH-9 – 3.96 | 862.0 | Dry | 3.35 |

* Test hole 1 appeared to be blocked at 1.2 meters. It may be a result of frost. The level will be rechecked once the thaw has occurred.

All surface elevations were obtained from the contour plan supplied by Bel-MK Engineering Ltd.

Groundwater elevations varied between a high of 858.65 meters in test hole 9 to 852.24 in test hole 2. Test hole 9 is at the northeast portion of the site and test hole 2 is in the south. Ground water elevations for the test holes in between were in the 855 meter range. A gradient exists in the ground water with flow towards Pigeon Lake. It should be noted that at the time the groundwater elevations were recorded the groundwater table is likely near the seasonal low. Also 2001 was a very dry year further suppressing the ground water levels. Groundwater elevations are expected to rise over the course of a year with normal precipitation and after the spring thaw. Further ground water measurements will be taken after the spring thaw and supplemental information will be forwarded at that time.

## 4.0 RECOMMENDATIONS

The following recommendations are believed to be feasible for use at this site based on our understanding of the proposed development and based on the results of our subsoil investigation.

Recommendations are predicated on the assumption final grades generally coincide with existing grades. Roadways may be filled to raise the grade 500 mm to 1,000 mm at the greatest. If final grades vary from these assumptions Shelby Engineering Ltd. must be so informed so we may determine the impact, if any, of the grade change on recommendations.

### 4.1 RESIDENTIAL FOUNDATION OPTIONS

The Geotechnical conditions encountered indicate that the proposed dwellings may be supported on strip and square concrete footings or drilled cast-in-place concrete friction piles. Design parameters for the above noted foundation types are outlined below.

### 4.1.1 STRIP AND SQUARE FOOTINGS

Strip and square footings may be designed utilizing a maximum allowable soil bearing pressure of 150 kilopascals and 165 kilopascals respectively combined live and dead loads. Strip and square footings should have minimum widths of 450 millimeters and 750 millimeters, respectively.

Footings must be founded in native, inorganic, undisturbed, clay till or bedrock at minimum depths of 1.40 meters below existing grade. Interior footings in heated areas should have a minimum depth of cover of 0.2 meters. Exterior footings in heated areas must have a minimum depth of cover of 1.5 meters to preclude concerns in respect of frost penetration. Footings in unheated areas should have a minimum depth of cover of 2.1 meters.

Footings must not be placed in fill or organic material. Unsatisfactory footing foundation areas not detected by test borings should be over-excavated to sound material and backfilled with an acceptable granular material compacted to a minimum of 100 percent of the corresponding Standard Proctor Maximum Dry Density. The depth of excavation will be determined in the field as verified by an appropriate inspection.

Subgrade soils should not be allowed to freeze subsequent to excavation operations or subsequent to placing of footings.

### 4.1.2 BORED, CAST-IN-PLACE CONCRETE FRICTION PILES

Bored, cast-in-place concrete friction piles must have the first 1.5 meters of pile length neglected in design due to potential soil volume changes. Friction piles may be designed on the basis of the following maximum allowable skin friction values:

| Depth Below Grade (meters) | Maximum Allowable Skin Friction (kilopascals) |
|---|---|
| 0.0 to 1.5 | 0.0 |
| Below 1.5 | 32.0 |

A minimum pile shaft diameter of 300 millimeters is acceptable for residential development. The minimum recommended pile length is 4.5 meters. Piles should be structurally designed to accommodate uplift forces, which may be generated by frost action or other potential soil volume changes. Reinforcing steel should have a minimum length of 4.5 meters.

The installation of piles may be difficult due to the presence of cemented sandstone layers. Suitable piling equipment equipped with rock bits may be required.

Qualified Geotechnical personnel should visually inspect pile excavations at the time of construction to ensure adequate depth, diameter and contact surfaces. Casing and pumping equipment should be on site and utilized if necessary to ensure clean and dry pile excavations. Concrete should be on site and placed as soon as possible to reduce the risk of seepage and sloughing from having a detrimental effect on the pile installation. The upper 3 meters of concrete should be vibrated to ensure complete consolidation of the concrete.

A void form at least 100 mm in thickness should be placed beneath all grade beams to facilitate any soil expansion due to frost action or seasonal moisture content variations.

### 4.1.3 BASEMENT WALLS

Basement walls must be designed to resist lateral earth pressures generated by backfill adjacent to the walls and any surcharge above the wall. The following formula and resulting earth pressure diagram may estimate the magnitude of anticipated lateral pressures.

$$P = 9.4\,D + 0.5\,S$$

Where P = pressure in kilopascals
D = depth below exterior grade in meters
S = surcharge (if any) adjacent to the wall in kilopascals

This equation does not account for hydrostatic pressures, and consequently a positive draining weeping tile and sump system should be installed at the base of the wall. The discharge of weeping tiles and roof leaders should be equipped with splash pads to prevent erosion and to direct water away from the foundation walls.

Backfill against the basement wall may be comprised of the native material excavated from the basement providing the organic topsoil is excluded. The backfill should be modestly compacted, in 200 mm thick lifts, to 93 percent of Standard Proctor maximum dry density. Over compaction should be avoided to prevent excessive pressures that may damage the wall.

### 4.1.4 CEMENT

Negligible concentrations of soluble Sulphate salts were found in one soil sample obtained from this site. Type 10 Normal Portland Cement may be used in concrete in contact with native soils.

Concrete should attain a minimum 28-day compressive strength of 25 Mpa. Concrete exposed to the elements should have a total air content of 5 to 7 percent.

### 4.1.5 SITE DRAINAGE

General site drainage must be designed so as to provide a means to convey all surface water away from structures. Water must not be permitted to pond or pool around dwellings, or in driveways or roadways.

The ingress of groundwater into most basement excavations is not anticipated but it is possible depending on the location and depth of the excavation and the groundwater elevation at the time of construction. The highest groundwater elevations were noted in test hole 8. De-watering of some basement excavations may be required in this area.

It is generally considered good practice to maintain footing elevations above the groundwater table when ever possible. Fill material removed from the basement excavation can be used to increase the lot grade adjacent to the dwelling.

A weeping tile drainage system must be installed to address any concerns in respect to ground water infiltration into basement areas resulting from seasonal fluctuations in groundwater elevations. This system should be installed around the perimeter of the foundation at the base of the basement excavation.

The weeping tile drainage system should consist of 150 millimeters diameter weeping tile drainage pipe. The weeping tile must be bedded in an acceptable granular material and the tile and granular materials must be wrapped in a geotextile. It is recommended that Shelby Engineering Ltd. approve the granular material and geotextile. An under slab drainage system may also be required depending on groundwater conditions encountered at the time of excavation.

The weeping tile drainage system must be supplied with a positive source of drainage through the use of a sump and pump that will discharge at grade on the exterior of the dwelling. It should be noted that a sump pump arrangement will require periodic maintenance by the homeowner and could be subject to mechanical failure.

The discharge point of the sump pump must be outside the confines of the basement excavation and additionally outside the confines of any foundation backfill to ensure ground water is not re-cycled back into the basement excavation. Backfill placed against the dwellings must be graded so as to maintain positive drainage away from the dwelling and this positive drainage must be maintained for the life of the dwelling.

Lot grading must be designed so as to direct surface drainage originating from sump pump arrangements and downspouts away from dwelling.

### 4.1.6 GRADE SUPPORTED CONCRETE SLABS

Basement floor slabs supported on grade and subjected to low floor loading may be supported on a minimum of 100 mm of compacted sand. The sand should be compacted to 95 percent of Standard Proctor maximum dry density. Concrete basement floor slabs should be a minimum of 100 millimeters in thickness.

Grade supported concrete slabs used in the garage and the driveway should be at least 125 mm thick and contain sufficient construction joints and/or saw cuts to control shrinkage cracking of concrete.

All fill placed beneath the garage or driveway floor slab should be placed and compacted in 150 mm thick lifts. The fill should be uniformly compacted to 95 percent of Standard Proctor maximum dry density at a moisture content within 2 percent of the optimum moisture content as determined by the moisture density relationship.

Grade supported concrete slabs should remain structurally separate from other foundation components.

### 4.1.7 SWELLING AND FROST POTENTIAL

The subgrade clay till soil is medium plastic and will have some swelling potential. It is recommended this soil not be allowed to desiccate or be allowed access to free water. If allowed access to water, or allowed to desiccate and then regain moisture these soils will develop swelling pressures with the resultant potential for heave.

### 4.1.8 PRIVATE SEWAGE DISPOSAL:

The use of tile fields or mounds is not recommended. Sewage disposal should utilize a holding tank and pump out by vacuum truck, with disposal at an approved sewage treatment facility. The ground water gradient is towards Pigeon Lake and the near surface sandstone has a relatively high permeability with a potential for

contamination of the Pigeon Lake. In addition, there are a number of domestic water wells in close proximity of the proposed subdivision that derives water from shallow depths within the sandstone bedrock.

## 4.2 LAKE ACCESS

Public access to the shore of Pigeon Lake for the subdivision has been proposed for the road allowance at the south end of Range Road 14, and at the east end of the Kerr Cape subdivision. Access is proposed to be comprised of a stairway and retaining walls to provide a level platform close to the water. Currently Test hole 1 drilled along south allowance of Range Road 14 met refusal at a depth of 2.15 meters in dense cemented sandstone. Test hole 2 was drilled at the proposed east access point and was drilled to a depth of 5.2 meters where refusal was encountered. The height of the bank at the shore of Pigeon Lake, near tests hole 1 and 2 is in the 5 to 6 meter range.

Temporary excavation could be completed with sideslopes not exceeding 1.0 horizontal to 1.6 vertical. Excavations should not proceed below the recorded water table depth. This depth will fluctuate and a more accurate depth will be available after the spring thaw. The sandstone that is not well cemented will be subject to erosion by rain and flowing water. Temporarily exposed surfaces should be protected. Final grades that are into the sandstone should be protected with vegetation and organic topsoil layer.

Retaining walls will be required to support the excavated slopes. The walls should be designed to resist the pressure of soil adjacent to the wall, and drainage will be required behind the wall. Retaining walls may be supported on either footings or piles. Information can be provided with respect to earth pressures and drainage once the wall positions, heights, and potential surcharge loading becomes available.

## 4.3 ROADWAYS

The anticipated traffic for the pavement areas will be light trucks and passenger cars with the occasional heavy truck. Roads proposed are residential and will be accessible from a gravel-surfaced Range Road. The roads will be subject to annual County of Leduc road ban restrictions.

### 4.3.1 SUBGRADE PREPARATION

Subgrade preparation beneath roadways will require stripping all topsoil and organic material from the roadway. Following this the subgrade can be graded to design subgrade elevation. The subgrade should be shaped to mirror the final grade of the road surface as well as to provide subgrade drainage.

Fill material required for grading purposes can be comprised of clay till native to the site. Fill material should be compacted to a minimum of 98% the Standard Proctor Maximum dry density in lifts of 150 mm in compacted thickness. The upper 300 mm of the subgrade should be compacted to 100 percent of the Standard Proctor maximum dry density.

### 4.3.2 FLEXIBLE PAVEMENT STRUCTURE

The following pavement structure options are recommended for country residential standard over the compacted subgrade:

1. Gravel Surface
   35 mm crushed gravel (20 mm maximum) initial lift
   35 mm crushed gravel at end of the maintenance period

2. Cold Mix Asphalt

   65 mm cold mix asphaltic surface
   150 mm crushed gravel (20 mm maximum)

The crushed gravel base must be compacted to 100 percent of Standard Proctor Maximum dry density within 1 percent of the optimum moisture content using vibratory equipment. Compaction lifts should not exceed 150 mm thickness.

Components of the selected pavement structure must satisfy the materials specifications contained in The County of Leduc, Municipal Engineering Standards.

Appropriate laboratory and field testing inspection must verify the acceptability of all compacted materials both native and imported. To ensure a high level of performance from roadway sections, the subgrade must not be allowed to dry and/or become wetted prior to or subsequent to construction.

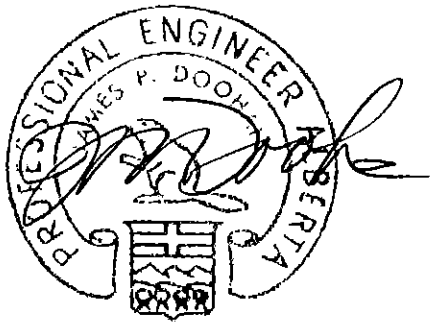
## 5.0 DISCUSSION:

All services provided by Shelby Engineering Ltd. are subject to our Standard Terms and Conditions, which are attached in Appendix II.

Respectfully Submitted,

Shelby Engineering Ltd.

PERMIT TO PRACTICE
SHELBY ENGINEERING LTD.
Signature
Date
PERMIT NUMBER: P 3580
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



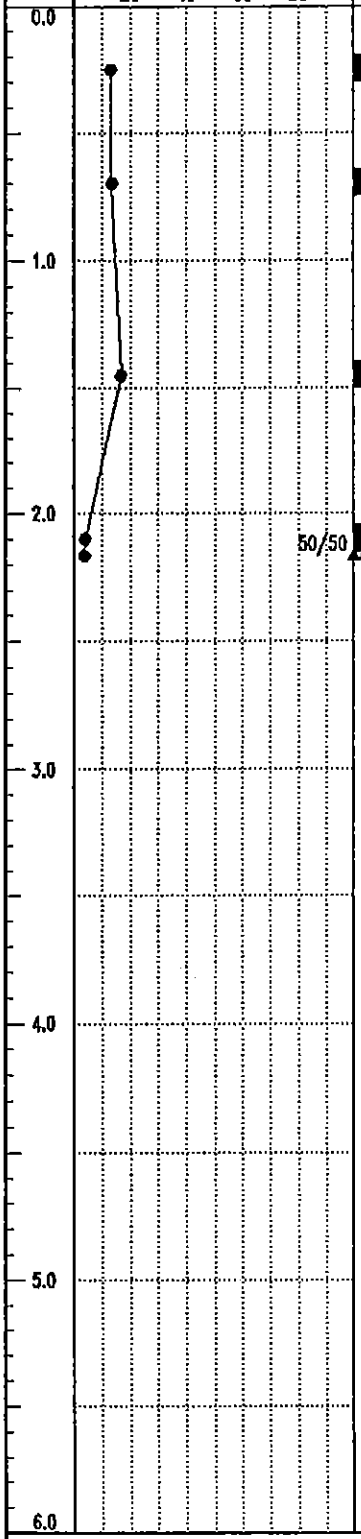

James P. Doohan, M.A.Sc., P.Eng.

JPD: epl
File No. 1-8761
April 2002

# APPENDIX I

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-1 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 859 m |

SAMPLE TYPE ■ GRAB ☒ SHELBY TUBE ☒ SPT ☰ NO RECOVERY ▯ HOLLOW STEM ▮ SOLID STEM




| Depth(m) | SAMPLE TYPE | RUN NO | SPT(N) | SOIL DESCRIPTION | USC | SOIL SYMBOL | ADDITIONAL TESTING | ELEVATION(m) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | 859.0 |
| | ■ | 1 | | CLAY TILL: Brown silty, sandy, medium plastic, trace oxides, gravel, black organics, rootlets to 150mm depth. | | | | |
| | ■ | 2 | | -trace oxides, fine sand. | | | | |
| 1.0 | | | | | CI | | | 858.0 |
| | ■ | 3 | | | | | | |
| 2.0 | ■ | 4 | | | | | | 857.0 |
| | ■ | 5 | 50/50 | CLAY SHALE: Brown, hard. | CS | | N = 50 @ 50mm | |
| | | | | AUGER REFUSAL @ 2.15 METRES. | | | Dry after 15 days. | |
| | | | | DRY ON COMPLETION. | | | | |
| | | | | STANDPIPE INSTALLED. | | | | |
| 3.0 | | | | | | | | 856.0 |
| 4.0 | | | | | | | | 855.0 |
| 5.0 | | | | | | | | 854.0 |
| 6.0 | | | | | | | | 853.0 |

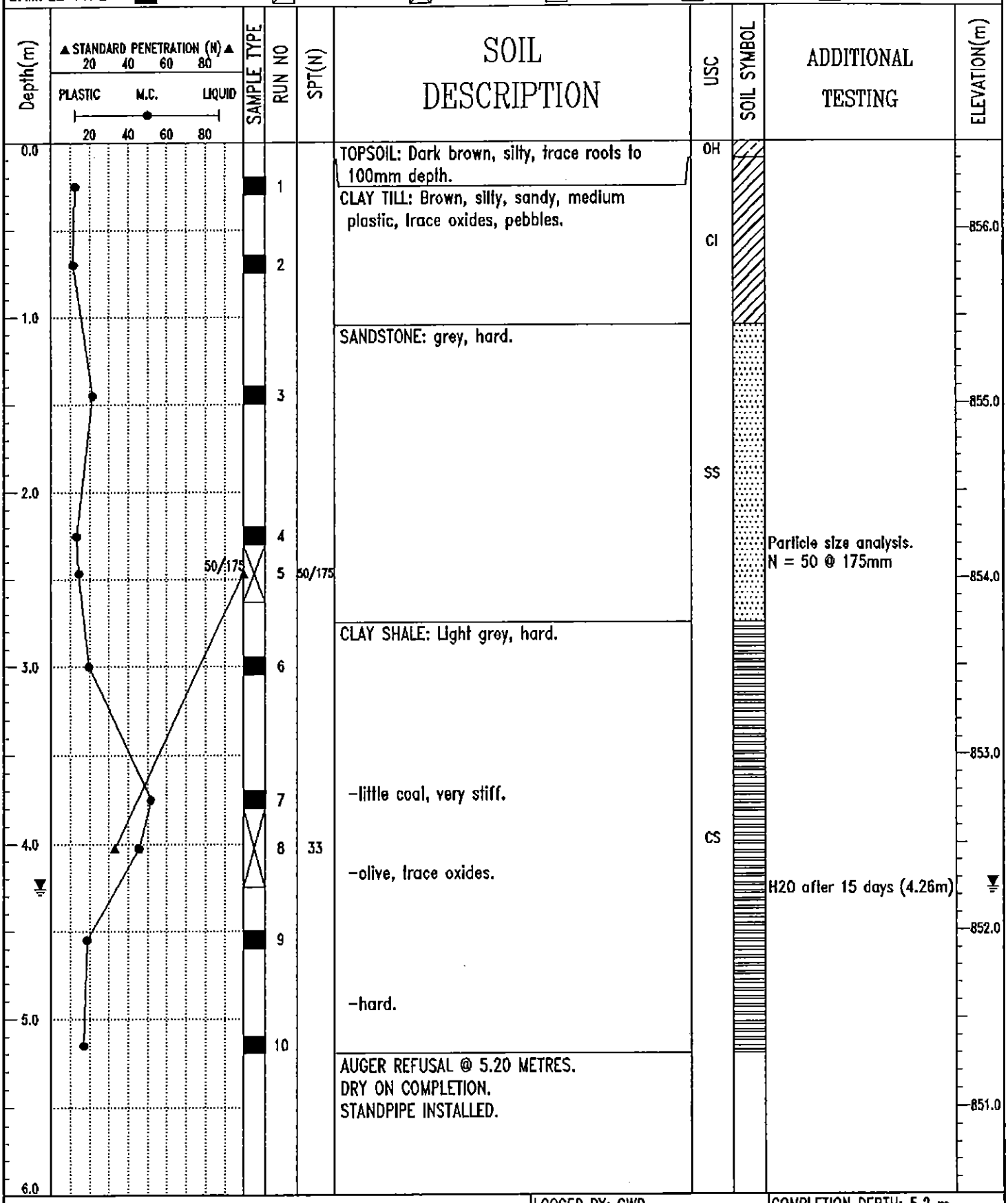
SHELBY ENGINEERING LTD.
Edmonton, Alberta

| | |
|---|---|
| LOGGED BY: GWD | COMPLETION DEPTH: 2.18 m |
| REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| Fig. No: 1 | Page 1 of 1 |

02/04/02 02:41PM (6.0M)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-2 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 856.5 m |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ⊠ SPT ▤ NO RECOVERY ▥ HOLLOW STEM ▮ SOLID STEM

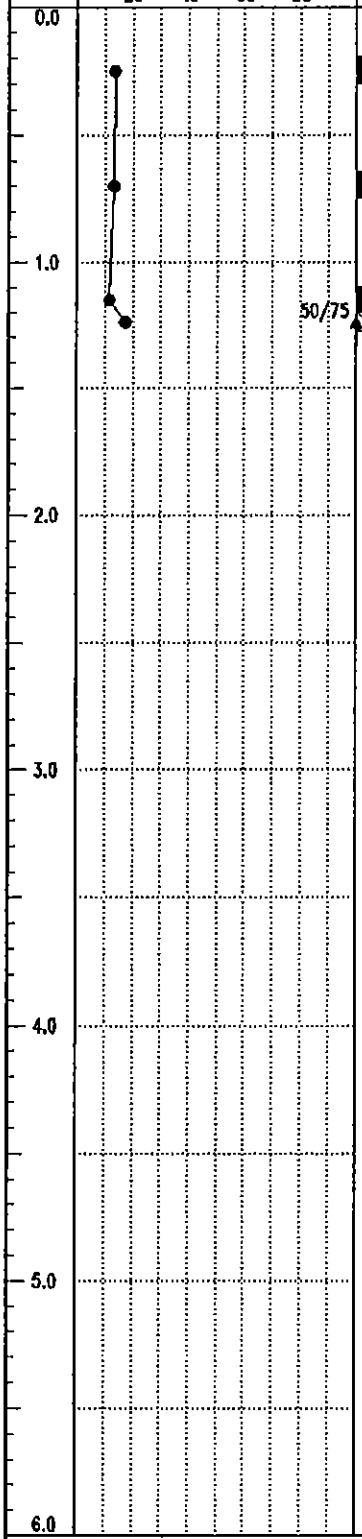



| | | |
|---|---|---|
| SHELBY ENGINEERING LTD. Edmonton, Alberta | LOGGED BY: GWD | COMPLETION DEPTH: 5.2 m |
| | REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| | Fig. No: 2 | Page 1 of 1 |

02/04/02 02:58PM (6.0W)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-3 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 860 m |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ⊠ SPT ▤ NO RECOVERY ▯ HOLLOW STEM ▮ SOLID STEM




| Depth(m) | SAMPLE TYPE | RUN NO | SPT(N) | SOIL DESCRIPTION | USC | SOIL SYMBOL | ADDITIONAL TESTING | ELEVATION(m) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | ■ | 1 | | CLAY TILL: Brown, silty, sandy, medium plastic, trace pebbles, oxides, rootlets. | | | | 860.0 |
| | ■ | 2 | | -trace pebbles, oxides from 100mm depth. | CI | | | |
| 1.0 | ■ | 3 | | SANDSTONE: Olive, hard. | SS | | N = 50 @ 75mm | 859.0 |
| | ⊠ | 5 | 50/75 | AUGER REFUSAL @ 1.20 METRES. DRY ON COMPLETION. STANDPIPE INSTALLED. | | | Dry after 15 days. SO4 = 0.00% | |
| 2.0 | | | | | | | | 858.0 |
| 3.0 | | | | | | | | 857.0 |
| 4.0 | | | | | | | | 856.0 |
| 5.0 | | | | | | | | 855.0 |
| 6.0 | | | | | | | | 854.0 |

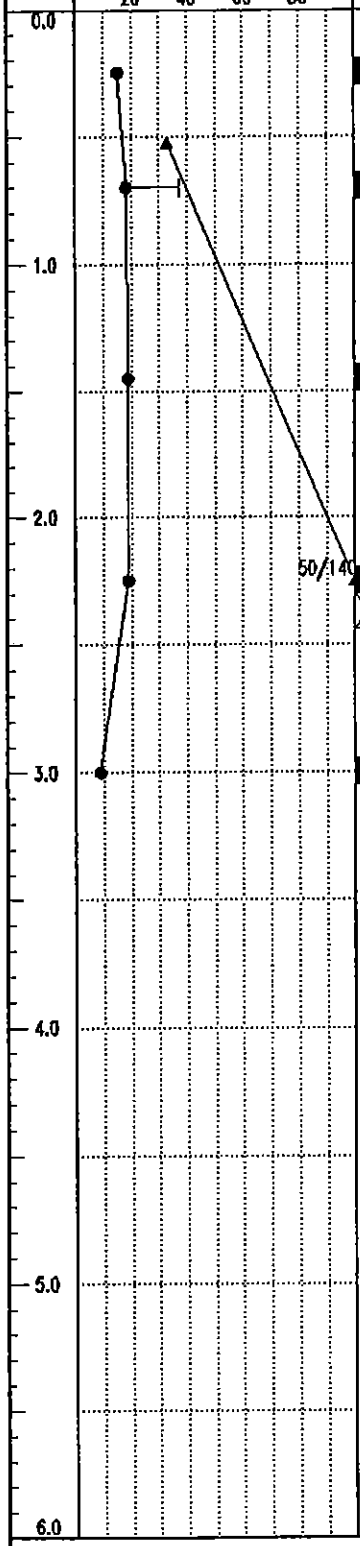
SHELBY ENGINEERING LTD.
Edmonton, Alberta

| | |
|---|---|
| LOGGED BY: GWD | COMPLETION DEPTH: 1.28 m |
| REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| Fig. No: 3 | Page 1 of 1 |

02/04/02 03:01PM (6.04)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-4 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 860.5 m |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ⊠ SPT ▤ NO RECOVERY ▥ HOLLOW STEM ▮ SOLID STEM




| SAMPLE TYPE | RUN NO | SPT(N) | SOIL DESCRIPTION | USC | SOIL SYMBOL | ADDITIONAL TESTING | ELEVATION(m) |
|---|---|---|---|---|---|---|---|
| | | | CLAY TILL: Brown, silty, sandy, medium plastic, trace pebbles, oxides, rootlets. | | | | 860.0 |
| | 1 | | –trace pebbles, oxides from 125mm depth. | | | | |
| | 2 | 33 | | CI | | SO4 = 0.00% | |
| | | | SANDSTONE: Olive, hard. | | | | 859.0 |
| | 3 | | | | | | |
| | 4 | 50/140 | | SS | | N = 50 @ 140mm | 858.0 |
| | 5 | | | | | | |
| | 6 | | | | | | 857.0 |
| | | | AUGER REFUSAL @ 3.35 METRES. DRY ON COMPLETION. STANDPIPE INSTALLED. | | | Dry after 15 days. | 856.0 |
| | | | | | | | 855.0 |

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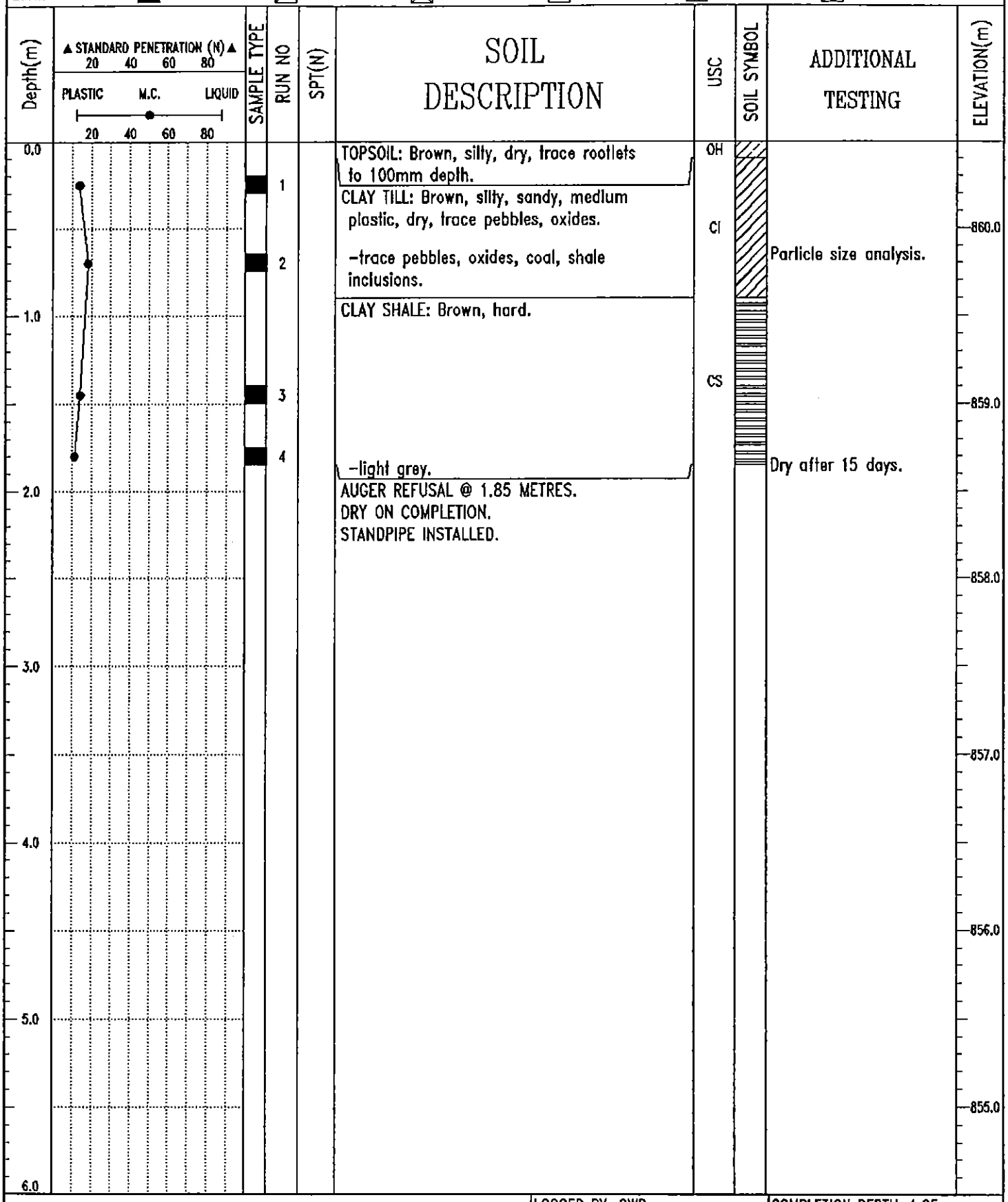
| | |
|---|---|
| LOGGED BY: GWD | COMPLETION DEPTH: 3.35 m |
| REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| Fig. No: 4 | Page 1 of 1 |

02/04/02 03:01PM (6.0W)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-5 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 860.5 m |

SAMPLE TYPE ■ GRAB ⊘ SHELBY TUBE ⊠ SPT ⊟ NO RECOVERY ⫼ HOLLOW STEM ◧ SOLID STEM

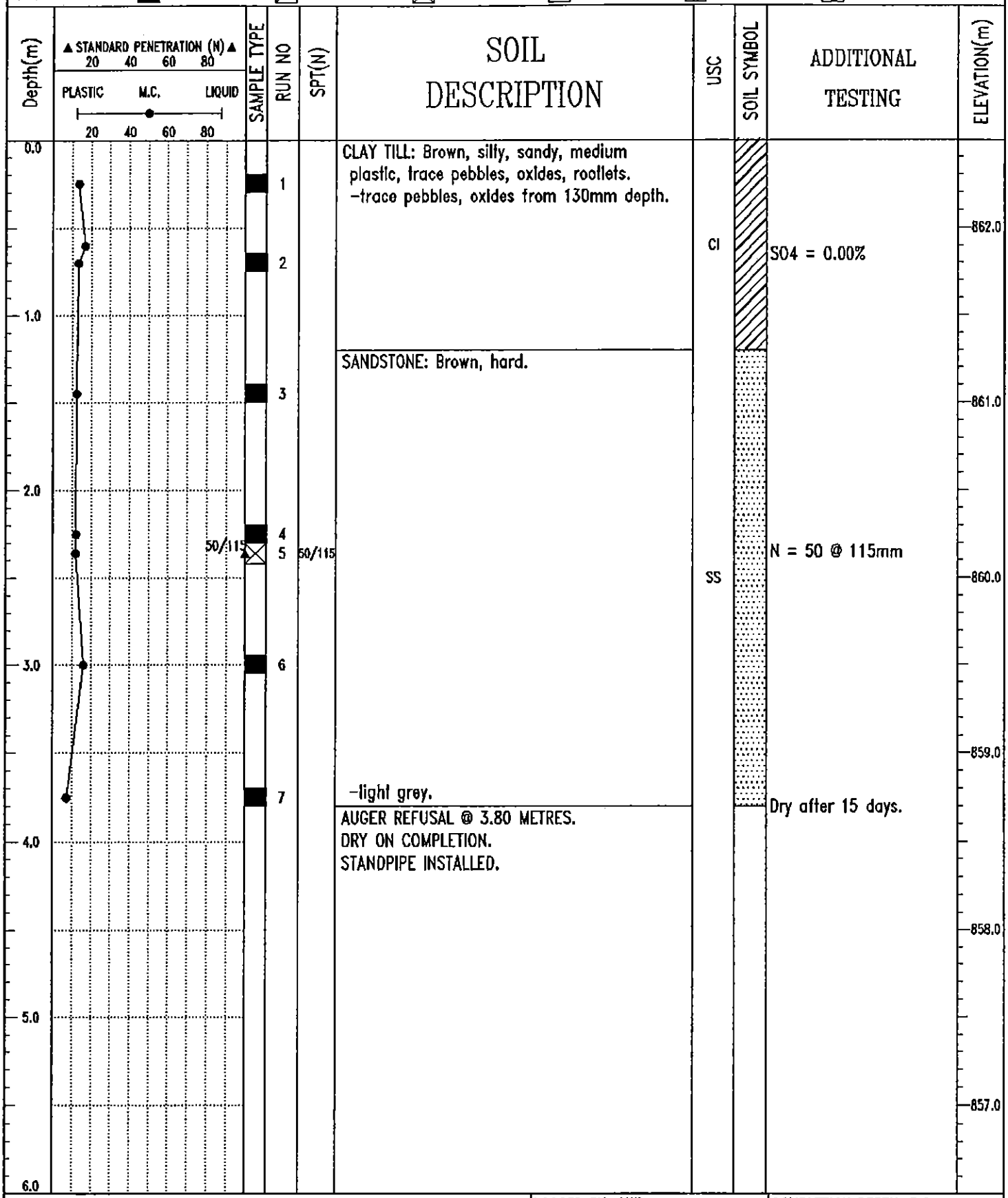



| | | |
|---|---|---|
| SHELBY ENGINEERING LTD. Edmonton, Alberta | LOGGED BY: GWD | COMPLETION DEPTH: 1.85 m |
| | REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| | Fig. No: 5 | Page 1 of 1 |

02/04/02 03:05PM (6.04)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-6 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 862.5 m |

SAMPLE TYPE ■ GRAB ⊘ SHELBY TUBE ⊠ SPT ▭ NO RECOVERY ▯ HOLLOW STEM ◧ SOLID STEM

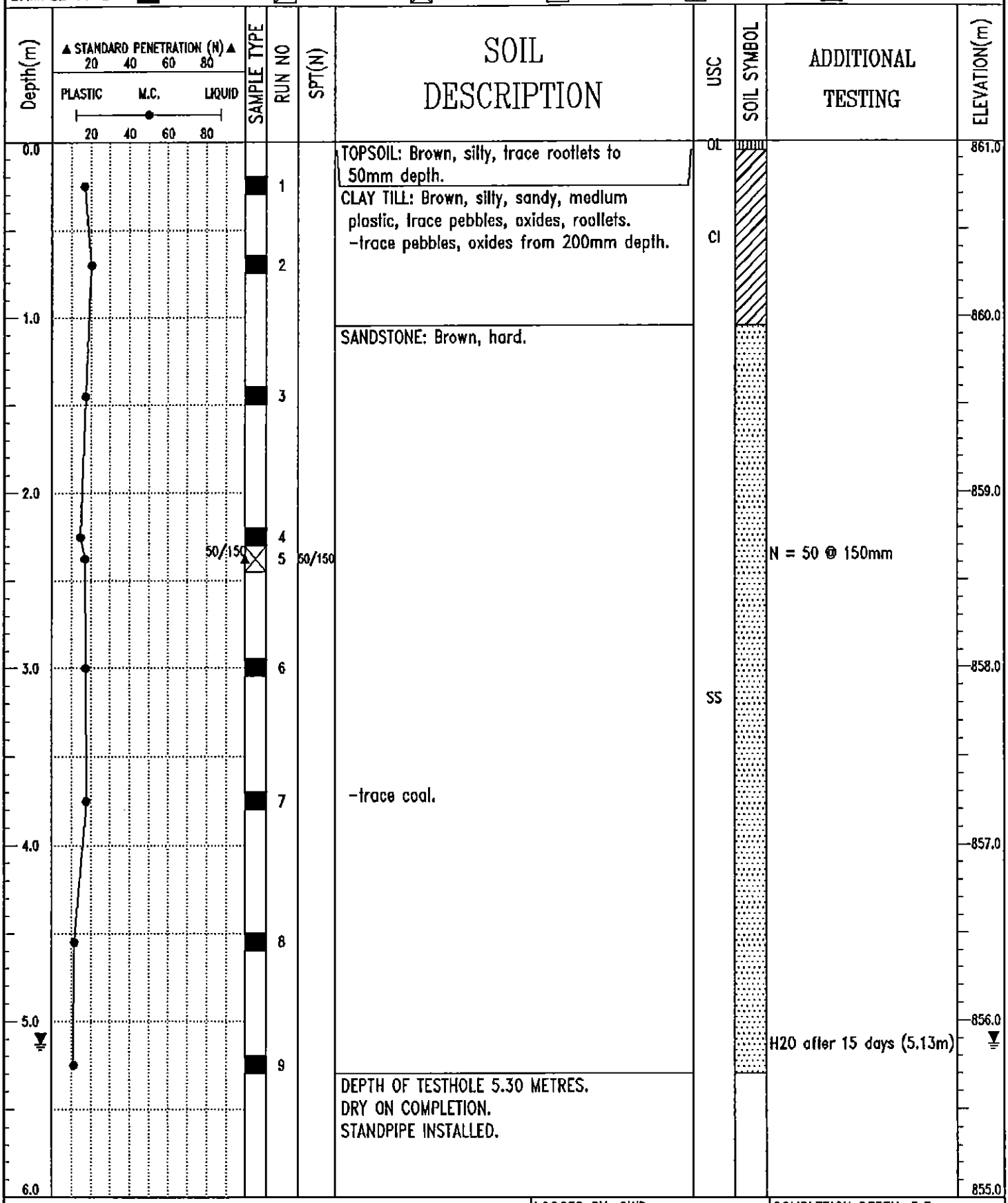



| | | |
|---|---|---|
| SHELBY ENGINEERING LTD. Edmonton, Alberta | LOGGED BY: GWD | COMPLETION DEPTH: 3.8 m |
| | REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| | Fig. No: 6 | Page 1 of 1 |

02/04/02 02:51PM (6.0W)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-7 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 861 m |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM

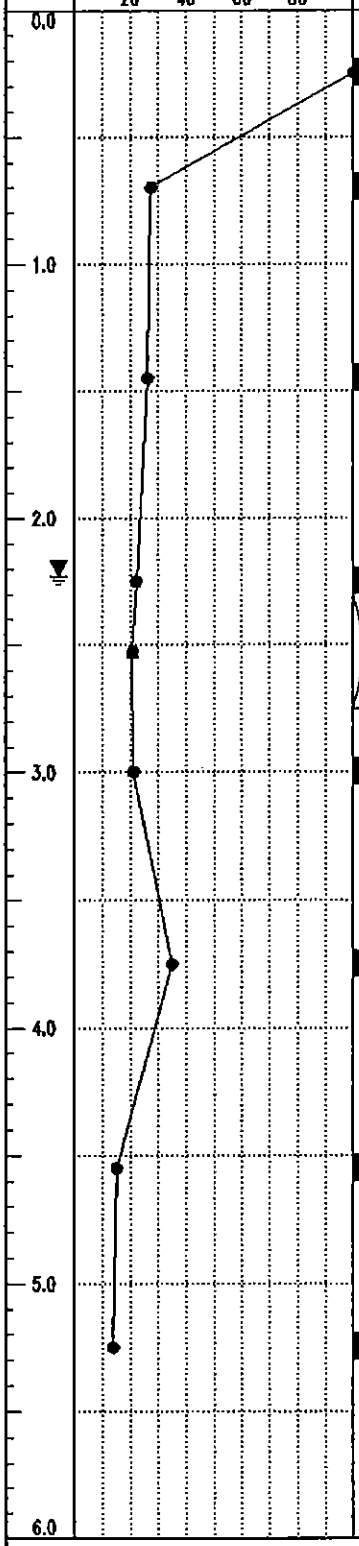



| | | |
|---|---|---|
| SHELBY ENGINEERING LTD. Edmonton, Alberta | LOGGED BY: GWD | COMPLETION DEPTH: 5.3 m |
| | REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| | Fig. No: 7 | Page 1 of 1 |

02/04/02 02:41PM (6.0M)

| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-8 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 857.5 m |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ⊠ SPT ▤ NO RECOVERY ▥ HOLLOW STEM ◧ SOLID STEM




| Depth(m) | SAMPLE TYPE | RUN NO | SPT(N) | SOIL DESCRIPTION | USC | SOIL SYMBOL | ADDITIONAL TESTING | ELEVATION(m) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | PEAT: Brown to 450mm depth. | PT | | | |
| | | 1 | | | | | | |
| | | | | ORGANIC CLAY: Black. | OH | | | 857.0 |
| | | 2 | | -light grey to 750mm depth. | | | | |
| 1.0 | | | | CLAY TILL: Brown & grey, silty, sandy, medium plastic, stiff, trace oxides. | | | | |
| | | 3 | | -trace pebbles, oxides, coal, shale inclusions. | | | | 856.0 |
| 2.0 | | | | | | | | |
| ▼ | | 4 | | | CI | | H20 after 15 days (2.23m) | ▼ |
| | | 5 | 21 | | | | | 855.0 |
| | | | | -very stiff. | | | | |
| 3.0 | | 6 | | | | | | |
| | | | | | | | | 854.0 |
| | | 7 | | CLAY SHALE: Grey, hard, trace coal. | | | | |
| 4.0 | | | | -olive. | | | | |
| | | 8 | | | CS | | | 853.0 |
| 5.0 | | | | | | | | |
| | | 9 | | DEPTH OF TESTHOLE 5.30 METRES. DRY ON COMPLETION. STANDPIPE INSTALLED. | | | | 852.0 |
| 6.0 | | | | | | | | |

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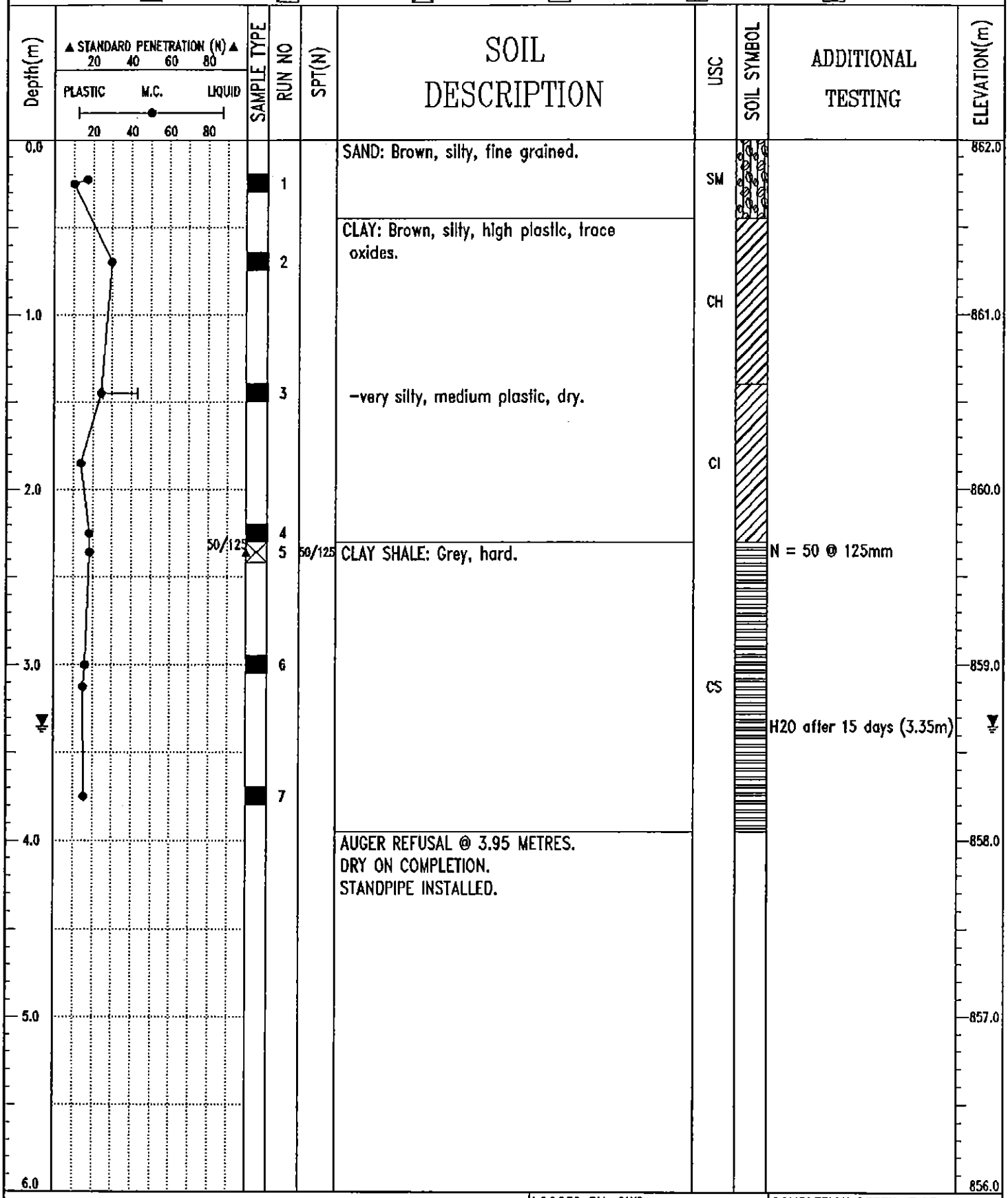
Edmonton, Alberta

| | |
|---|---|
| LOGGED BY: GWD | COMPLETION DEPTH: 5.3 m |
| REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| Fig. No: 8 | Page 1 of 1 |

02/04/02 02:41PM (6.0M)

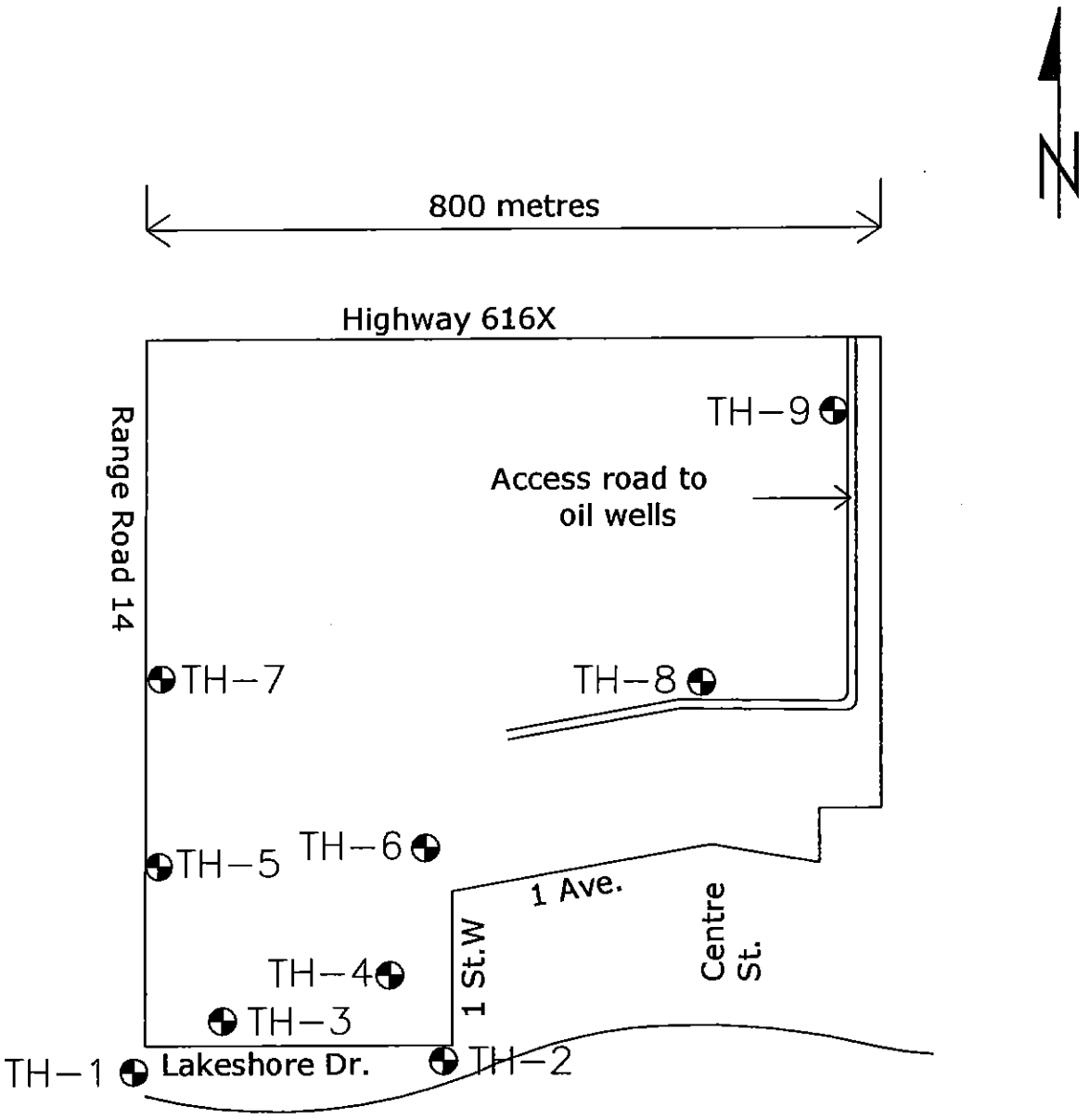
| | | |
|---|---|---|
| MOONLIGHT POINTE ESTATES | GREGG PROPERTIES CO. LTD. | TEST HOLE NO: TH-9 |
| | START DATE: 08/03/02 | PROJECT NO: 1-8761 |
| PROJECT ENGINEER: JPD | SOLID STEM AUGERS & SPT'S | ELEVATION: 862 m |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM




| | | |
|---|---|---|
| SHELBY ENGINEERING LTD. Edmonton, Alberta | LOGGED BY: GWD | COMPLETION DEPTH: 3.95 m |
| | REVIEWED BY: JPD | COMPLETE: 08/03/02 |
| | Fig. No: 9 | Page 1 of 1 |

02/04/02 02:41PM (6.01d)

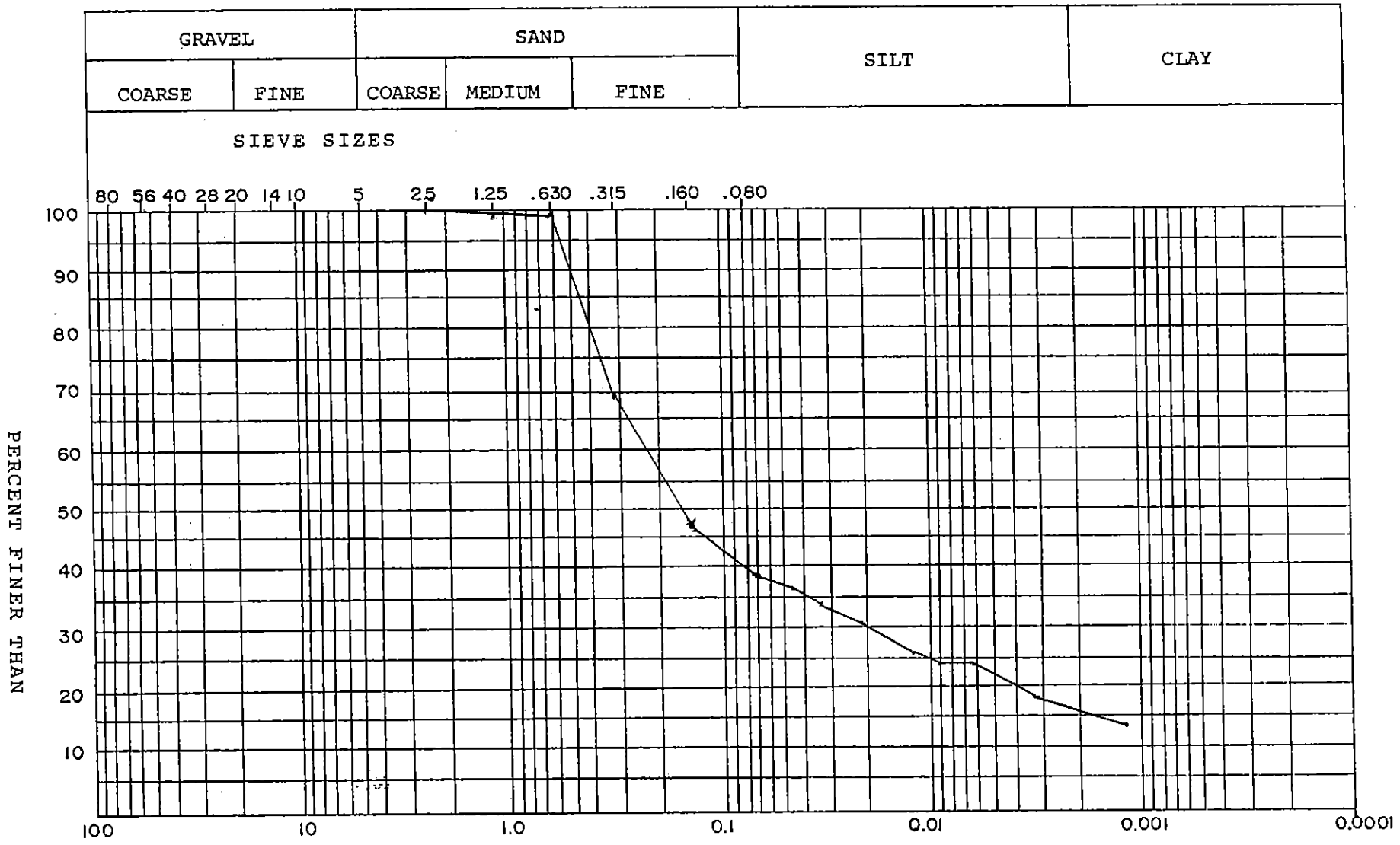



Approximate elevations taken from drawing supplied by Bel–Mk Engineering Ltd.

TH–1 859.0m
TH–2 856.5m
TH–3 860.0m
TH–4 860.5m
TH–5 860.5m
TH–6 862.5m
TH–7 861.0m
TH–8 857.5m
TH–9 862.0m

| | | | |
|---|---|---|---|
| SHELBY ENGINEERING LTD. | JOB NO.: 1–8761 | DATE: March 2002 | |
| | SCALE: As Shown | DWN BY: GWD | DWG NO: 10 |

SHELBY ENGINEERING LTD.




GRAIN SIZE GRADATION CURVE

TEST HOLE 2 DEPTH 2.25m

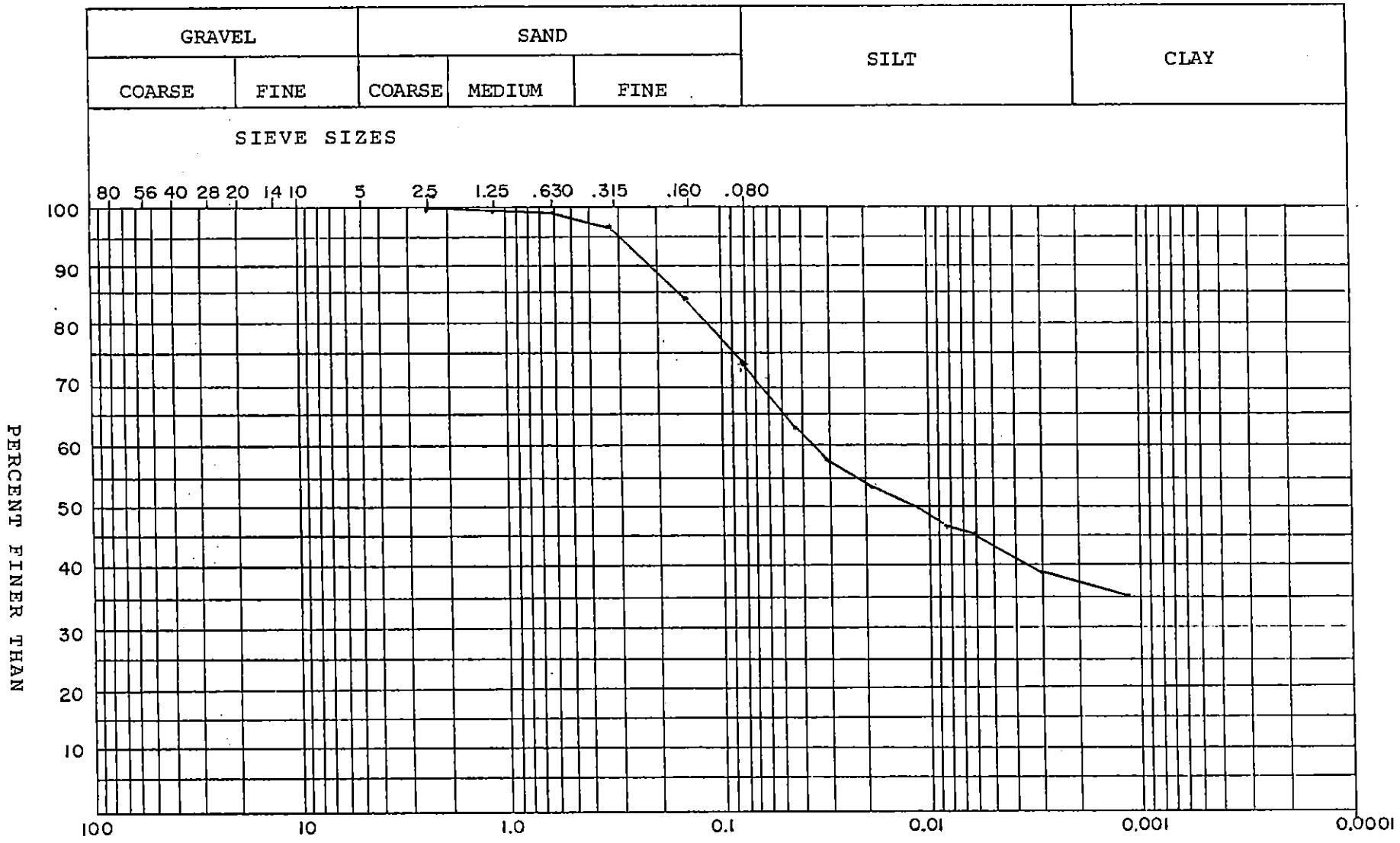
DESCRIPTION Fine Sand Little Silt and Clay

CLIENT Gregg Properties Co. Ltd.

JOB NO. 1-8761

DRAWING NO. 11

SHELBY ENGINEERING LTD.




GRAIN SIZE GRADATION CURVE

TEST HOLE 5 DEPTH 700mm

DESCRIPTION Silt with some fine sand and clay.

CLIENT Gregg Properties Co. Ltd.

JOB NO. 1-8761

DRAWING NO. 12

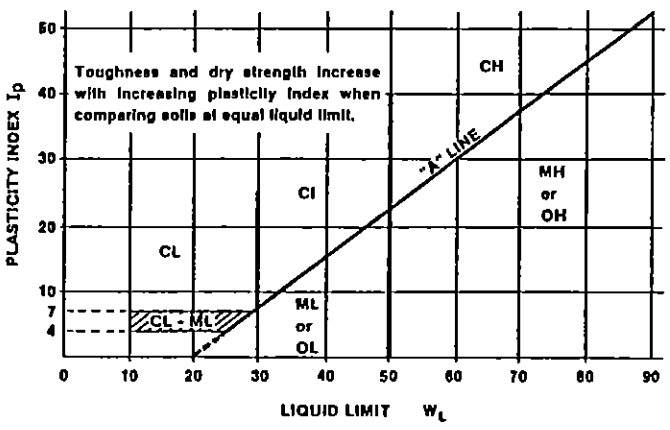
# SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.)

| MAJOR DIVISION | | | GROUP SYMBOL | GRAPHIC SYMBOL | COLOR CODE | TYPICAL DESCRIPTION | LABORATORY CLASSIFICATION CRITERIA | |
|---|---|---|---|---|---|---|---|---|
| HIGHLY ORGANIC SOILS | | | Pt | | ORANGE | PEAT AND OTHER HIGHLY ORGANIC SOILS | STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE | |
| COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE) | GRAVELS MORE THAN HALF COARSE FRACTION LARGER THAN NO. 4 SIEVE SIZE | CLEAN GRAVELS | GW | | RED | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, < 5% FINES | $C_u = \frac{D_{60}}{D_{10}} > 4 \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ | |
| | | | GP | | RED | POORLY-GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, < 5% FINES | NOT MEETING ALL ABOVE REQUIREMENTS | |
| | | DIRTY GRAVELS | GM | | YELLOW | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES > 12% FINES | ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$ | |
| | | | GC | | YELLOW | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES > 12% FINES | ATTERBERG LIMITS ABOVE "A" LINE, $I_p > 7$ | |
| | SANDS MORE THAN HALF COARSE FRACTION SMALLER THAN NO. 4 SIEVE SIZE | CLEAN SANDS | SW | | RED | WELL-GRADED SANDS, GRAVELLY SANDS, < 5% FINES | $C_u = \frac{D_{60}}{D_{10}} > 6 \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ | |
| | | | SP | | RED | POORLY-GRADED SANDS, OR GRAVELLY SANDS, < 5% FINES | NOT MEETING ALL ABOVE REQUIREMENTS | |
| | | DIRTY SANDS | SM | | YELLOW | SILTY SANDS, SAND-SILT MIXTURES > 12% FINES | ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$ | |
| | | | SC | | YELLOW | CLAYEY SANDS, SAND-CLAY MIXTURES > 12% FINES | ATTERBERG LIMITS ABOVE "A" LINE OR $I_p > 7$ | |
| FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES NO. 200 SIEVE SIZE) | SILTS BELOW "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT | | ML | | GREEN | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY | $W_L < 50$ | SEE CHART BELOW |
| | | | MH | | BLUE | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS | $W_L > 50$ | |
| | CLAYS ABOVE "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT | | CL | | GREEN | INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS | $W_L < 30$ | |
| | | | CI | | GREEN-BLUE | INORGANIC CLAYS OF MEDIUM PLASTICITY SILTY CLAYS | $W_L > 30, < 50$ | |
| | | | CH | | BLUE | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS | $W_L > 50$ | |
| | ORGANIC SILTS & ORGANIC CLAYS BELOW "A" LINE ON PLASTICITY CHART | | OL | | GREEN | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY | $W_L < 50$ | |
| | | | OH | | BLUE | ORGANIC CLAYS OF HIGH PLASTICITY | $W_L > 50$ | |

1. All sieve sizes mentioned on this chart are U.S. Standard, ASTM E11.
2. Boundary classifications possessing characteristics of two groups are given combined group symbols eg GW-GC is a well-graded gravel-sand mixture with clay binder between 5% and 12%.
3. Soil fractions and limiting textural boundaries are in accordance with the Unified Soil Classification System, except that an inorganic clay of medium plasticity (CI) is recognized.
4. The following adjectives may be employed to define percentage ranges by weight of minor components:

| | |
|---|---|
| and | 50 - 36% |
| some | 35 - 21% |
| little | 20 - 11% |
| trace | 10 - 1% |

PLASTICITY CHART




SHELBY ENGINEERING LTD

GEOTECHNICAL AND MATERIALS CONSULTANTS

# APPENDIX II

# STANDARD TERMS AND CONDITIONS FOR THE PROVISION OF SERVICES BY SHELBY ENGINEERING LTD.

1. "The services ("the Services") performed for the client (the "Client") by Shelby Engineering Ltd. ("Shelby") described in the report to which these Standard Terms and Conditions are attached (the "Report") have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the engineering profession currently practicing in the jurisdiction in which the Services have been provided."

2. In consideration of the provision of the Services, the Client agrees to the limitation of liability provisions herein contained, both on its own behalf, and as agent on behalf of its employees and principals.

3. The total amount of all claims the Client may have against Shelby with respect to the Services, including, without limitation, claims in tort or contract, shall be strictly limited to the amount of the fee charged to the Client by Shelby for the Services. Shelby shall not be liable for loss, injury or damage caused by delays beyond Shelby's control, or for any indirect, economic or consequential loss, injury or damage incurred by the Client, including, without limitation, claims for loss of profits. No claim shall be brought by the Client against Shelby more than two (2) years after completion of the Services or termination of the agreement to provide the Services.

4. The Client shall have no right to set off against any amounts owed to Shelby with respect to the Services.

5. The Client agrees that Shelby's employees and principals shall have no personal liability with respect to the Services and the Client shall make no claim or bring any proceedings of any kind whatsoever whether in contract, tort or any other cause of action in law or equity, against Shelby's employees and principals in their personal capacity.

6. The Client acknowledges that the Services entail an investigation which by its nature involves the risk that certain conditions between points investigated will not be detected, and that certain other conditions may change with time after provision of the written report of the Services. The Client acknowledges and accepts such risk and is aware that the Report can only provide for the conditions at the investigated points at the time of investigation. Extrapolation between the investigated points is at the Client's risk. If the Client requires additional or special investigations outside the scope of the Report, the Client must request such additional investigations from Shelby.

7. The Report has been prepared for a specific site and in light of the specific purposes communicated to Shelby by the Client. Shelby accepts no responsibility for the findings contained in the Report if applied to a different site, or if there is a material change in the purposes communicated to Shelby by the Client. The information and opinions described in the Report are provided solely for the benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THE WRITTEN CONSENT OF SHELBY. The Client shall maintain confidentiality of the Report and ensure that the Report is not distributed to third parties. The Client hereby agrees to indemnify Shelby for any claims brought against Shelby by third parties and arising out of the Client's failure to maintain the confidentiality required under this paragraph 7.

8. Except as stipulated in the Report, Shelby has not been retained to address, investigate or consider, and has not addressed, investigated or considered environmental or regulatory issues with respect to the site on which the Services have been performed. Notwithstanding the foregoing, Shelby may be required to disclose to regulatory bodies certain hazardous conditions discovered through provision of the Services, and the Client shall not make any claim against Shelby for such disclosure.

# APPENDIX B

# Environmental Assessment of the Proposed Moonlight Pointe Estates Subdivision at Pigeon Lake, Alberta

Westworth Associates Environmental Ltd., April 2002

# ENVIRONMENTAL ASSESSMENT OF THE PROPOSED 27 LOT DEVELOPMENT (S.W. ¼ SEC. 28-47-1-W5M) AT PIGEON LAKE

Prepared for:

Bel-MK Engineering Ltd. on behalf of Gregg Properties Co. Ltd.

April 2002

Westworth Associates Environmental Ltd.

Edmonton, Alberta

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# LIST OF PHOTOS

# 1

# 1.0 INTRODUCTION

The following report constitutes an initial environmental assessment of a proposed Area Structure Plan (ASP) for a portion of SW 28-47-1-W5 (Figure 1), situated adjacent to the northeast side of Pigeon Lake in the County of Leduc. The assessment was conducted to assist with the development of the ASP and to provide Leduc County with information on the likely environmental effects of development of this property.

## 1.1 Background

The plan area is located north of the Kerr Cape (lakefront) development, between Moonlight Bay and Sundance Beach. This quarter section of land is a predominantly forested parcel bordered by existing residential development on the south and southwest sides, cultivated agricultural land to the northwest, and natural vegetation on the northeast, east, and west sides (Figure 2). The property does not front directly on Pigeon Lake, although the southwest portion of the property is within 100m of the lakeshore.

# 2

## 2.0 Project Description

The proposed development concept (Figure 3) is a 27 lot subdivision planned as a cluster-type development that would be developed in two stages. The initial stage, consisting of 18 lots, would be located in the southwest corner of the property, directly north of the Kerr Cape subdivision. The second cluster of 8 lots would be located along the west side of the property. The two clusters would be separated by a 100m wide wildlife corridor. The development concept also includes the potential conversion of land within an existing wellsite to a residential lot at some point in the future once the current lease has expired.

A conservation planning approach involving use of conservation easements and other appropriate planning tools was used to protect important wildlife habitats and other significant natural features on the property. This plan was developed following an evaluation of the sites natural features and discussion with County staff and representatives of provincial regulatory agencies.

# 3

## 3.0 Approach and Methodology

Maps, aerial photographs, reports and unpublished information from a number of organizations were compiled. Public and private agencies were also contacted regarding the biophysical attributes of the Pigeon Lake area and their potential significance.

A reconnaissance-level field inspection was used to verify vegetation communities, determine characteristic plant species and existing wildlife use of the property and surrounding area, and to identify drainage patters and environmentally significant features. The reconnaissance field survey was conducted in March 2002, consequently information on wildlife use was limited to winter resident species. The timing of the assessment did not permit a field inspection for rare vegetation species and the assessment is limited to an evaluation of the potential for occurrence of rare plant species based on habitat types present and records of the occurrence of rare plant species in existing provincial databases.

# 4

# 4.0 Biophysical Overview

## 4.1 Geographic Setting and Environmental Significance

Pigeon Lake is located approximately 60 km southwest of Edmonton within the Dry Boreal Mixedwood Section of Alberta's Boreal Forest Natural Region (Achuff *et al.* 1992). With a surface area of 97 $km^2$, Pigeon Lake is one of the largest lakes in southcentral Alberta. Portions of the lake lie within both the County of Leduc and the County of Wetaskiwin. Pigeon Lake is also one of the most popular and intensively used recreation lakes in the province. This is due to its relatively clear water, abundant fisheries, and proximity to the City of Edmonton and the Towns of Leduc, Wetaskiwin, Calmar, and Thorsby.

Pigeon Lake has been identified as a provincially-significant, environmentally sensitive area (D.A. Westworth & Associates Ltd. 1991, Sweetgrass Consultants 1997). Its significance was attributed to the value of its fisheries resource, the presence of a great blue heron colony, and the value of remaining wildlife habitats adjacent to the lake. This ESA was rated as having moderate to high sensitivity because of the potential for further degradation of water quality, overexploitation of fish stocks, and loss of wildlife habitat due to agricultural activities or recreational development.

## 4.2 Climate

The area experiences long, cold winters and short, warm summers characteristic of a cool summer humid continental climate. Daily mean temperatures range from –13.4 degrees Celsius in January (mean daily maximum –7.8 degrees Celsius, mean daily minimum –19.1 degrees Celsius) to 16.3 degrees Celsius in July (mean daily maximum 23.0 degrees Celsius, mean daily minimum 9.6 degrees Celsius). The heaviest snowfall occurs in December (21.7 cm) and January (23.2 cm) and the heaviest rainfall occurs in June (81.2 mm), July (100.0 mm) and August (67.7mm).

## 4.3 Soils and Terrain

Soils surrounding the north end of Pigeon Lake, including the subject property, are predominantly orthic gray luvisols of the Breton soil series (Lindsay et al. 1986). These

moderately-well to well drained soils are found in the mixed forest-grassland transition zones. Breton soils are formed on glacial till of Paskapoo Formation origin. A geotechnical investigation of the subject property found that soil thickness are variable across the property ranging from negligible to 100mm (Shelby Engineering Ltd. 2002). On upland sites the thickness of till varied from 0.8 to 3 m among 8 test holes. A single test hole situated within the low-lying drainage course near the east central part of the property indicated surficial material comprised of 450 mm of peat over organic clay to a depth of 750 mm.

Breton soils have severe agricultural limitations due to nutrient deficiencies (Nitrogen, Potassium, Sulfur) and are also mildly acidic. Silicate clays are found in the subsoil under a thin Ae horizon. These soils are considered undesirable topsoil for landscaping purposes.

Lands in the area are gently undulating to rolling in nature with a gradual slope towards the lake (Figure 4). Elevations on the property range from 871 meters in the northeast to 856 meters in the southeast. The steepest slopes on the property occur in the northeast corner, although slopes do not exceed 10% on this portion of the site.

The primary drainage feature is an intermittent watercourse that transects the property in a north-south direction, along the east side. Drainage is not well defined and this watercourse consists primarily of a series of wet depressions containing herbaceous or shrubby vegetation. These depressions may function as groundwater recharge areas. Although the landowner indicates that surface runoff does flow toward the lake from the southeast corner of the property, the absence of a well-defined channel at this location suggests that flows are of low magnitude and relatively short duration.

## 4.4 Vegetation

Vegetation on the site is characteristic of the Dry Mixedwood Subregion. Aspen forest is the predominant vegetative cover on upland sites. Aspen stands characteristically support a well-developed shrub and herb understory that includes red-osier dogwood, low bush cranberry, wild rose, and willow. Low areas support willow thicket and herbaceous communities.

On the basis of airphoto interpretation and a field reconnaissance survey, seven different habitat types were delineated on the property (Figure 5). The areal extent of each of these types is indicated in Table 1. These habitat types are described below.

**Table 1.** Existing habitats associated with SW28-47-1-W5.

| Habitat Type | Area (ha) | Area (%) |
|---|---|---|
| Anthropogenic | 8.6 | 15.6 |
| Wet Meadow | 2.1 | 3.8 |
| Wet Shrub | 4.4 | 8.0 |
| Immature Deciduous-open | 13.6 | 24.9 |
| Immature Deciduous-closed | 19.5 | 35.8 |
| Mature Deciduous Mixed with Immature Deciduous | 2.7 | 4.9 |
| Mature Deciduous | 3.8 | 7.0 |
| **Total** | **54.7** | **100.0** |

### *4.4.1 Anthropogenic*

This habitat type contains the man made disturbed portions of the site (Photos 1 and 2). A total of 8.6 hectares or 15.6 percent of the site falls into this category. These lands are divided into two distinct categories one consisting of a field, just under 4 hectares in size located in the south-west portion of the site and the other consisting of oil leases and a pipeline, located roughly in the center of the site (Figure 5). These lands are dominated with grass and the occasional scattered shrub, with the exception of the pipeline right of way, which has an abundance of 2 to 3 meter high regenerating aspen. The moisture regime of these polygons is generally mesic. Acclaim Energy Inc. predicts the oil leases to be in use for at least the next ten years.

### *4.4.2 Wet Meadow*

This habitat type is made up of poorly drained areas unable to support commercial tree species (Photos 3 and 4). A total of 2.1 hectares or 3.8 percent of the site falls into this category. Bluejoint grass is the dominant herb in this habitat type, however scattered willow shrubs are also evident. The moisture regime is generally subhydric, although these meadows may contain standing water for period following snowmelt runoff or major storm events.

### *4.4.3 Wet Shrub*

This habitat type is also poorly drained and is a probable groundwater recharge area. It comprises 4.4 hectares or 8% of the area and is located on the east side of the site. This habitat type is predominantly made up of willow over grasses with scattered birch. The willow ranges in height from 5 to 7 meters and has a crown closure of approximately 70 percent. Red-osier dogwood and low bush cranberry are present in the shrub layer. The moisture regime of this habitat type is hygric to subhydric (Photos 5 and 6).

### *4.4.4 Immature Deciduous - Open*

This habitat type is dominated by immature aspen ranging in height from 7 to 14 meters, averaging approximately 8 to 9 meters. There are also scattered balsam poplar, birch and white spruce throughout the habitat type. The crown closure averages approximately 40 percent and is variable in nature. It is 13.6 hectares in size and occupies 24.9 % of the site. Shrubs found in this habitat type include red-osier dogwood, low bush cranberry, wild rose and saskatoon. The moisture regime is mesic to submesic and the soils appear to be well to rapidly drained. The vigour of the trees appears to be rather poor, likely due to the soil conditions (Photos 7 and 8)

### *4.4.5 Immature Deciduous – Closed*

This habitat type is dominated by immature trembling aspen ranging in height from 11 to 17 meters, averaging approximately 13 to 14 meters. There are also scattered balsam poplar and birch throughout the habitat type. The crown closure is approximately 65 to 70 percent. This is the most prevalent habitat type on the site occupying 19.5 hectares or 35.8 percent of the area. Shrubs found in this habitat type include red-osier dogwood, gooseberry, low bush cranberry, wild rose and saskatoon (Photos 9 and 10). The moisture regime is generally mesic. There are also scattered mature deciduous trees throughout this habitat type. The vigour of the trees in this habitat type appear fairly good.

### *4.4.6 Mature Deciduous Mixed with Immature Deciduous*

This habitat type consists of a healthy mix of both mature and immature deciduous trees, primarily trembling aspen. There are also scattered balsam poplar, birch and white spruce throughout the habitat type. The mature trees are approximately 18 to 20 meters in height while the immature trees are approximately 13 meters. The crown closure of this habitat type is approximately 65 percent. The habitat type occupies 2.7 hectares or 4.9 % of the site. Shrubs found in this habitat type include red-osier dogwood, gooseberry, low bush cranberry, wild rose and saskatoon (Photo 11). The moisture regime in this habitat class is generally mesic with some scattered subhygric patches. The vigour of the trees appears generally good with the exception of some of the mature trees which have conks.

### *4.4.7 Mature Deciduous - Closed*

This habitat type consists of mostly mature deciduous trees, primarily aspen, with the exception of the stand in the extreme southeast of the site. This stand is less well drained than the others and consists primarily of balsam poplar (Photo 12). The remainder of this habitat type is generally mesic. The height of the trees in this habitat type ranges from 15 to 20 meters with the average being approximately 17 meters. Shrubs found in this habitat type include red-osier dogwood, gooseberry, low bush cranberry, wild rose and saskatoon.

The vigour of the trees appears generally good with the exception of some of the overmature trees which have conks.

### *4.4.8 Rare Vegetation Species*

A search of recorded occurrences of rare vegetation species through the Alberta Natural Heritage Information Centre indicated no previous records of listed rare plant species for this property; however, it is quite likely that rare plant surveys have not been conducted on this site. A number of listed rare species do occur within the vicinity (ie. within 10 km) of the property. These include the broken-leaf moss (*Dicranum tauricum*), Carolina wild geraneum (*Geranium carolinianum*), tinged sedge (*Carex tincta*), fox sedge (*Carex vulpinoidea*), Clinton's bulruch (*Trichophorum clintonii*) and Canadian rice grass (*Oryzopsis canadensis*). Most of these species are associated with either wetlands or mature woodland habitats, although the Carolina wild geraneum is sometimes associated with open or disturbed sites.

## 4.5 Wildlife

During the winter reconnaissance survey, abundant sign of deer, moose and coyotes was observed on the property. This supports the suggestion that remaining forested areas around Pigeon Lake provide important habitat for deer and moose. The property is also expected to support a diversity of other mammalian and avian wildlife species, typical of aspen-dominated boreal mixedwood forests.

Recent ungulate surveys of WMU 334, which includes the plan area, show that white-tailed deer is the most abundant ungulate species in the region followed by mule deer and moose (Froggatt 2000). In February 2000, observed densities averaged 1.31/km$^2$ for white-tailed deer, 0.53/km$^2$ for mule deer and 0.35/km$^2$ for moose.

The wetlands on the site are not classified as permanent open-water wetlands, and as such, have limited capability for production of waterfowl. Water that accumulates within these low areas following snowmelt runoff may provide temporary habitat for waterfowl breeding pairs; however, these habitats do not provide secure habitat for nesting or brood-rearing.

Pigeon Lake itself is considered to have severe limitations for waterfowl production due to the excessive water depth and lack of shoreline emergent vegetation (Canada Land Inventory 1969). Suitable nesting habitat for ducks and Canada geese is largely restricted to marshy shorelines that occur along the northwest side of the lake. Pigeon Lake has been rated an important fall staging area for waterfowl and a significant non-breeding habitat for red-necked grebes (Poston et al. 1990). Great blue herons have historically nested near

Pigeon Lake Provincial Park on the west side of the lake. Since 1977 the size of this colony has varied between 5 and 16 nests.

### *4.5.1 Species at Risk*

The Biodiversity/Species Observation Database (BSOD) maintained by Alberta Environment and the Alberta Conservation Association was queried to determine whether records exist for the occurrence of rare, threatened or endangered species in the vicinity of the property. As well a list of species at risk that could potentially occur in the area was compiled from existing provincial range maps.

Wildlife species in Canada are classified at both the federal and provincial levels on the basis of rarity. Federally, species are classified as (COSEWIC 1999):

- ***Endangered*** - the species is facing imminent extirpation or extinction.
- ***Threatened*** - the species may become endangered if limiting factors are not reversed.
- ***Vulnerable*** – the species is sensitive to human activities or natural events.
- ***Not at risk.***

In Alberta, wildlife species have been classified into 6 lists based on the risk of species extirpation in the province (Natural Resources Service 1996):

- ***Red List*** - species that are at risk based on current knowledge.
- ***Blue List*** - species which, based on current knowledge, may be at risk of extirpation in Alberta.
- ***Yellow A List*** - species that may be at risk because of long-term population declines.
- ***Yellow B List*** - sensitive species that are not currently believed to be at risk but are vulnerable to human-related changes in the environment and thus may require special management.
- ***Green List*** – species that are not considered to be at risk.
- ***Undetermined Status List*** - species that are not known to be at risk but for which sufficient information to determine their status is lacking.

Of the over 250 wildlife species that could potentially occur in the general area, 26 are listed federally or are on the Red, Blue or Yellow A lists in Alberta (Table 2). Many of these species, however, are unlikely to occur in the ASP area. The study area does not provide suitable habitat for the leopard frog and is along the western limit of the range of the

Canadian toad. The last record for the occurrence of the Canadian toad near Pigeon Lake appears to be 1976 (Hamilton et al. 1998).

Several reports of bay-breasted warblers exist for the Pigeon Lake area (BSOD database), however this species shows a close association with mature or old-growth coniferous stands (Norton 2001) and is not expected within the younger deciduous forest that occurs on the property. The loggerhead shrike is also unlikely to occur in the study area. Surveys conducted in 1987 indicated that, in Alberta, the species occurs primarily south of 52° latitude (Telfer et al. 1989). Pigeon Lake also lies within the breeding range of the trumpeter swan; however this species prefers to nest on isolated lakes.

The upland sandpiper and Sprague's pipit prefer open habitats and would not be expected to occur within the predominantly forested habitats in the plan area. The nearest nesting location of the federally-listed peregrine falcon is north of Pigeon Lake at the Genesee power plant.

Pigeon Lake is within the range of the northern long-eared bat, however, this species is usually associated with mixedwood and coniferous forests, and hibernates in caves. These habitats do not occur within the plan area.

An osprey nest exists on the property on a telephone pole or power pole along the west side of the well site. Although the osprey is not presently considered to be at risk (Yellow B list) in Alberta, it is considered a sensitive species that is vulnerable to human disturbance during the nesting period. Alberta Sustainable Resource Development has indicated that a need exists to protect this nest site (K. Froggatt, pers. comm.).

**Table 2.** Federally and provincially listed wildlife species that may occur in the study area.

| Common Name | Scientific Name | Provincial Status | Federal Status |
|---|---|---|---|
| **Birds** | | | |
| Horned grebe | *Podiceps auritus* | Yellow A | Not listed |
| Red-necked grebe | *Podiceps grisegena* | Yellow A | Not at risk |
| Pied-billed grebe | *Lanius ludovicianus* | Yellow A | Not listed |
| American bittern | *Botaurus lentiginosus* | Yellow A | Not listed |
| Trumpeter swan | *Cygnus buccinator* | Blue | Not at risk |
| Northern harrier | *Circus cyaneus* | Yellow A | Not at risk |
| Swainson's hawk | *Accipiter swainsonii* | Yellow A | Not listed |
| Peregrine falcon | *Falco perigrinus* | Red | Threatened |
| Sharp-tailed grouse | *Tympanuchus phasianellus* | Yellow A | Not listed |
| Lesser yellowlegs | *Tringa flavipes* | Yellow A | Not listed |
| Upland sandpiper | *Bartramia longicauda* | Yellow A | Not listed |
| Black tern | *Chilidonias niger* | Yellow A | Not at risk |
| Short-eared owl | *Asio flammeus* | Blue | Vulnerable |
| Loggerhead shrike | *Lanius ludovicianus* | Yellow A | Not listed |

| Common Name | Scientific Name | Provincial Status | Federal Status |
|---|---|---|---|
| Brown thrasher | *Toxostoma rufum* | Yellow A | Not listed |
| Bay-breasted warbler | *Dendroica castanea* | Blue | |
| Sprague's pipit | *Anthus spraguee* | Blue | Threatened |
| Clay-colored sparrow | *Spizella pallida* | Yellow A | Not listed |
| Western meadowlark | *Sturnella neglecta* | Yellow A | Not listed |
| **Amphibians** | | | |
| Canadian toad | *Bufo hemiophrys* | Red | Not listed |
| Leopard frog | *Rana pipiens* | Red | Vulnerable |
| **Reptiles** | | | |
| Red-sided garter snake | *Thamnophis sirtalis* | Yellow A | Not listed |
| **Mammals** | | | |
| Northern long-eared bat | *Myotis septentrionalis* | Blue | Not listed |
| Richardson's ground squirrel | *Spermophilis richardsonii* | Yellow A | Not listed |
| Thirteen-lined ground squirrel | *Spermophilis tridecemlineatus* | Yellow A | Not listed |
| Long-tailed weasel | *Mustela frenata* | Yellow A | Not listed |
| Badger | *Taxidea taxus* | Yellow A | Not at risk |

## 4.6 Pigeon Lake

### *4.6.1 Hydrology and Water Quality*

With a surface area of 96.7 km$^2$, Pigeon Lake is one of the largest lakes in central Alberta. The lake has a comparatively small watershed however, with the area of the effective watershed (187 km$^2$) only about twice the area of the lake itself (Bothe 1994). Although several small streams drain into Pigeon Lake, groundwater inflow makes a greater contribution to lake levels than does surface runoff (Bothe 1994). Since 1929, water levels in the lake have fluctuated within a range of about 1.4m, with annual fluctuations averaging 0.26m (Bothe 1994). The lake is drained by Pigeon Lake Creek, which flows south into the Battle River.

Regulation of lake levels began in 1914, with the construction of an outlet structure on Pigeon Lake Creek to alleviate the effects of flooding on downstream hay fields. The original control structure was rebuilt in 1980 and then replaced with a new structure in 1986 following the completion of the Pigeon Lake Regulation Feasibility Study (Northwest Hydraulic Consultants Ltd. 1981). Currently, management of water levels in Pigeon Lake attempts to balance agricultural and recreational interests.

Pigeon Lake has an average depth of 6.2m and a maximum depth of 9.1m (Mitchell and Prepas 1990). From a recreational standpoint the water quality is considered quite good. The lake is "mildly eutrophic" with algae blooms of a magnitude that do not restrict recreational use or threaten the survival of fish (Crosby 1994). The principal water quality concern is related to the potential for increased eutrophication resulting from elevated nutrient input to the lake. It has been estimated that phosphorus input to the lake has more

than doubled as a result of agricultural runoff and sewage from surrounding cottage developments (Crosby 1994).

### *4.6.2 Fish*

Eleven species of native fish are found in Pigeon Lake. These include lake whitefish, walleye, northern pike, white sucker, yellow perch, burbot, spottail shiner, emerald shiner, brook stickleback, trout-perch and Iowa darter (Buckwald 1994). Walleye, northern pike, yellow perch and lake whitefish support an active sport fishery. The lake whitefish has also been the mainstay of a commercial fishery that has operated on Pigeon Lake since 1918 (Buckwald 1994).

Although walleye occurred in the lake historically, they are thought to have been extirpated during the 1960s as a result of increased angling pressure and shoreline habitat alteration (Buckwald 1994). A restocking program initiated in 1979 led to the reestablishment of a walleye populaiton in the lake. Studies were undertaken by D.A. Westworth & Associates Ltd. with the assistance of Alberta Fish and Game Association volunteers in 1992 and 1993 to determine the status of walleye in the lake and to identify spawning areas. These studies showed that, although there had been successful natural reproduction of walleye in the lake every year since 1984, spawning appeared to be occurring priimarily in two small creeks (Tide Creek and an unnamed creek) in the northwest part of the lake (Jacobson and Boag 1992, D.A. Westworth & Associates Ltd. 1993). In 1994 the Alberta Fish and Wildlife Division implemented a number of measures to conserve walleye stocks in the lake, including restrictions on angling in the northwest part of the lake and enhancement of spawning habitat in Tide Creek (Buckwald 1994).

Northern pike stocks in Pigeon Lake are considered low. Removal of rooted aquatic vegetation by cottage development has been identified as a major limiting factor for pike in the lake (Bidgood 1973, Buckwald 1994). D.A. Westworth & Associates Ltd. (1993) reported that Tide Creek and Unnamed Creek provide important spawning and post-spawning feeding habitat for pike in Pigeon Lake.

# 5

# 5.0 Potential Environmental Effects and Mitigative Measures

## 5.1 Terrestrial Resources

### *5.1.1 Habitat Loss and Alteration*

Loss or alteration of natural habitat was identified as the major concern by the Fish and Wildlife Division, Alberta Sustainable Resource Development (K. Froggatt, correspondence of Feb. 28/02). Habitat loss is widely considered the principal factor contributing to the decline of wildlife populations and loss of natural biodiversity across North America.

Protecting important habitat areas and the range of ecological functions that these habitat areas provide therefore became a key design consideration for the ASP. Measures incorporated into the proposed design to minimize effects of habitat loss include:

- **Minimizing the Development Footprint.** Proposed measures to minimize the development footprint include minimizing lot sizes, reducing road widths, and maximizing use of existing access and of previously disturbed sites. Of the 27 lots proposed under this plan, 14 lots occur either wholly or partially within previously cleared sites. In addition to reducing the widths of new roadways, use of the existing Kerr Cape roadway to access the southernmost lots and building relatively short cul-de-sac roadways off of Range Road 14 are recommended to reduce the development footprint. Although it is expected that measures (e.g., building scheme restrictive covenants) will be incorporated into the final design to limit tree removal within lots, we have assumed that most of the habitat within proposed lot lines will be lost to development. The total area affected by the proposed development is expected to be approximately 13.6 ha (Table 3), of which 9.7 ha are currently forested and 3.9 ha have been previously cleared. This constitutes approximately 25% of the land base. Of the remaining 75% of the area, 4.6 ha is currently under lease for oil development and is expected to remain in use for at least 10 years after which it could become available for residential development. Overall, 36.8 ha or 66.9% of the property will be conserved in a natural state with the use of conservation easements together with environmental reserve or municipal reserve dedications.

- **Providing Protection of Key Habitats.** Wetlands (wet meadow and wet shrub) and mature forest stands are considered key habitats because of their expected importance for wildlife and their sensitivity in comparison to modal

upland aspen-dominated forest types. The proposed ASP would protect these habitats in their entirety. Of the habitats that exist on the site, wetlands are the habitat type that has the greatest potential for occurrence of rare species. Protection of these areas will minimize the risks of development to species of concern.

- **Maintaining Wildlife Corridors.** In fragmented landscapes, such as the agriculturally-dominated landscape of the Pigeon Lake watershed, maintaining functional linkages between remaining blocks of habitat is essential for conserving biodiversity and maintaining populations of wide-ranging species such as deer. During the winter reconnaissance survey, networks of deer trails were observed crossing the property; however, well-defined wildlife corridors were not evident. We do expect however, that the series of wetlands that extend along the drainage channel that crosses the east side of the property functions as a movement corridor for a variety of wetland and upland wildlife species. We also believe that it is important to maintain linkages with forested areas on the east and west sides of the subject property. The proposed ASP, which protects wetlands and other key habitats as an intact block and maintains wide corridors of forested habitat between this core habitat area and adjacent forested lands (Figure 5), satisfies these requirements.

- **Disturbance of Sensitive Species.** During recent years a pair of ospreys have nested on an abandoned power pole along the west side of the well site. Although the ospreys have apparently habituated to the level of industrial (well servicing) or recreational activity that currently occurs on the property, ospreys are considered vulnerable to human disturbance during the nesting and incubation period. Efforts should be made to minimize human activity around the nest site during the nesting period. It is recommended that no tree removal be carried out within a minimum distance of 50m of the nest site and that trails and other intensive recreational facilities be sited to minimize disturbance in the vicinity of the nest site. Signage should also be installed to inform residents and visitors of the need to protect the nest site. Despite these measures, a possibility exists that the increased level of human activity on the property will result in nest abandonment.

**Table 3.** Potential habitat losses associated with proposed plan for SW28-47-1-W5.

| Habitat Type | Residential Lots (ha) | Roads (ha) | Total (ha) |
|---|---|---|---|
| Immature Deciduous-closed | 4.5 | 0.6 | 5.1 |
| Immature Deciduous-open | 4.1 | 0.5 | 4.6 |
| Anthropogenic | 3.9 | n/a | 3.9 |
| **Total** | **12.5** | **1.1** | **13.6** |

### *5.1.2 Fire Risk*

Increased residential development may result in an increased risk of wildfire. The likelihood of wildfire from the proposed development reaching adjacent forested areas is considered relatively low. The perimeter of the proposed development is almost entirely surrounded by existing roads. These roads will act as a guard, significantly reducing the risk of fire spreading outside the proposed development, or into the proposed development, from the surrounding areas. It should also be noted that having occupants in the vicinity increases the ability to take action on fires regardless of whether they are caused by man or nature.

In addition to the roads, a very wet closed shrub habitat type occupies a significant area along the east portion of the quarter section and also continues well into the quarter section to the east. This habitat type will act as a natural fire inhibitor as the risk of fire penetrating this habitat type is very low.

## 5.2 Aquatic Resources

### *5.2.1 Effects on Water Quality*

Residential development has potential to adversely impact the water quality of lakes and streams by increasing sediment deposition or through the introduction of nutrients, pesticide residues or pathogens. The Pigeon Lake Watershed Management Plan, which was approved by Leduc County Council in January 2000, identified the potential for increased phosphorus loadings and introduction of coliform bacteria as major risks to the water quality in Pigeon Lake. Conversion of forest land to agriculture has been identified as the principal source of increased phosphorus, although private sewage systems are also a source of fecal coliforms and plant nutrients reaching the lake.

The proposed use of pump-out septic tanks is considered an effective means of ensuring that nutrients or bacteria from domestic sewage do not enter Pigeon Lake either through surface runoff or through the groundwater. There is some potential for nutrients applied as lawn or garden fertilizers to enter the lake, although these risks are minimized by the use of small lots and plans to maintain natural vegetation over most of the site. Although the proposed development does not front directly on Pigeon Lake, its proximity to the lake warrants special measures to control nutrient leaching into the lake. This could include restrictions on the use of lawn fertilizer and awareness programs to inform landowners of the risks of these chemicals to lake water quality.

Although the property drains toward Pigeon Lake, there is no indication that the property contributes sediment to the lake. The intermittent drainage course that crosses the east side of the property in a north to south direction appears stable and well-vegetated.

Maintaining wide buffers of natural vegetation, as proposed under this ASP, will reduce the risk of sediment deposition into this drainage course or into the lake during project construction. The main concern is controlling runoff from the southwest corner of the property, which slopes directly toward the lake. It is recommended that the final design incorporate Best Management Practices to prevent sediments from entering the lake. With implementation of these measures, the proposed development is not expected to have a significant adverse effect on the water quality of Pigeon Lake.

### *5.2.2 Effects on Watershed Values*

Removal of forest cover or drainage of wetlands can adversely affect groundwater recharge, which in turn can affect the quantity and quality of water reaching receiving waterbodies. Protection of watershed values is an important goal of the Pigeon Lake Watershed Management Plan.

The proposed ASP is consistent with this goal. No significant alteration of natural drainage patterns is proposed under the plan, and plans to retain the natural forest cover over most of the site will help to ensure that effects on aquifers are minimized. To maximize infiltration from the land surface it is recommended that use of impervious materials for surfacing roads or parking areas be avoided wherever possible.

### *5.2.3 Loss or Alteration of Fish Habitat*

The ASP includes provisions for lake access for subdivision residents. These include pedestrian access points at two locations at the south end of the property. One access point would be along the road allowance at the south end of Range Road 14, while the other would be along the east end of the Kerr Cape subdivision. Proposed access development would entail construction of a wooden stairway and a small deck or platform adjacent to the lake. The developer has indicated that no development is planned below the high water level of Pigeon Lake.

Construction of lake access facilities should incorporate best practices to prevent erosion and removal of lakeshore vegetation. Removal of rooted aquatic vegetation from the shores and nearshore areas of lakes is strictly controlled by Alberta Sustainable Resource Development and the federal Fisheries Act prohibits the unauthorized destruction of fish habitat or the deposition of silt or other deleterious substances into fish habitat. The Pigeon Lake Management Plan (1985) also calls for retention of rooted aquatic vegetation to maintain fish habitat in the lake. By adhering to these laws and best management practices, adverse impacts on fish and fish habitat can be prevented.

## 5.3 Monitoring and Future Studies

On the basis of the initial environmental assessment the following follow-up investigations and monitoring activities are warranted:

- In light of the potential for occurrence of provincially-listed rare vegetation species on this property, a rare plant survey should be carried out in spring or early summer.
- Surface runoff from the property should be observed during spring snowmelt to assist in the identification of drainage patterns.
- Monitoring is required during construction to ensure that erosion and sediment control measures are functioning effectively.
- Monitoring of use of the osprey nest should be carried out during and following Phase 1 construction to evaluate the effects of human disturbance on nesting success.

# 6

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# 7.0 Figures

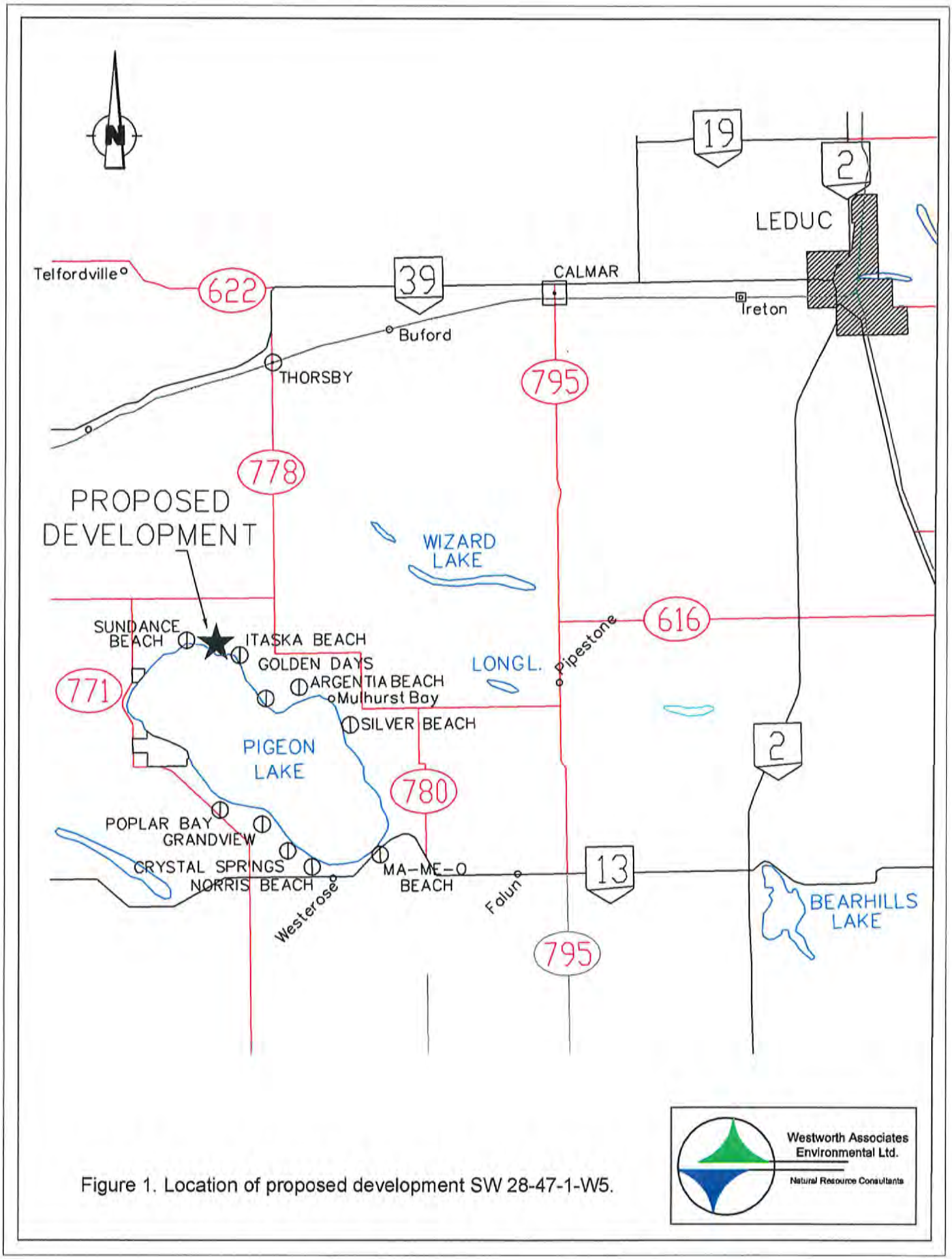


Figure 1. Location of proposed development SW 28-47-1-W5.

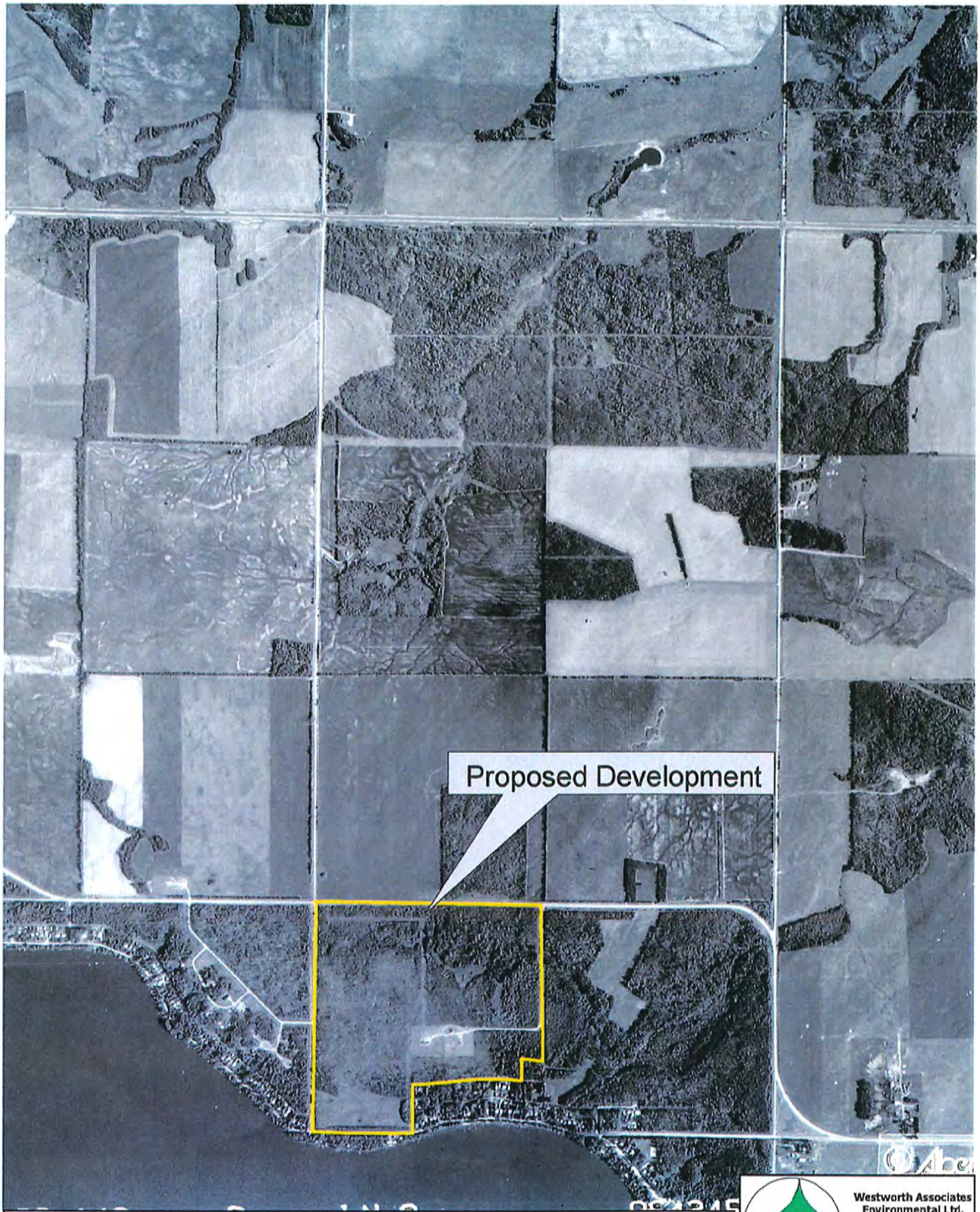


Figure 2. Aerial photograph displaying the proposed development of lands located in SW 28-47-1-W5.

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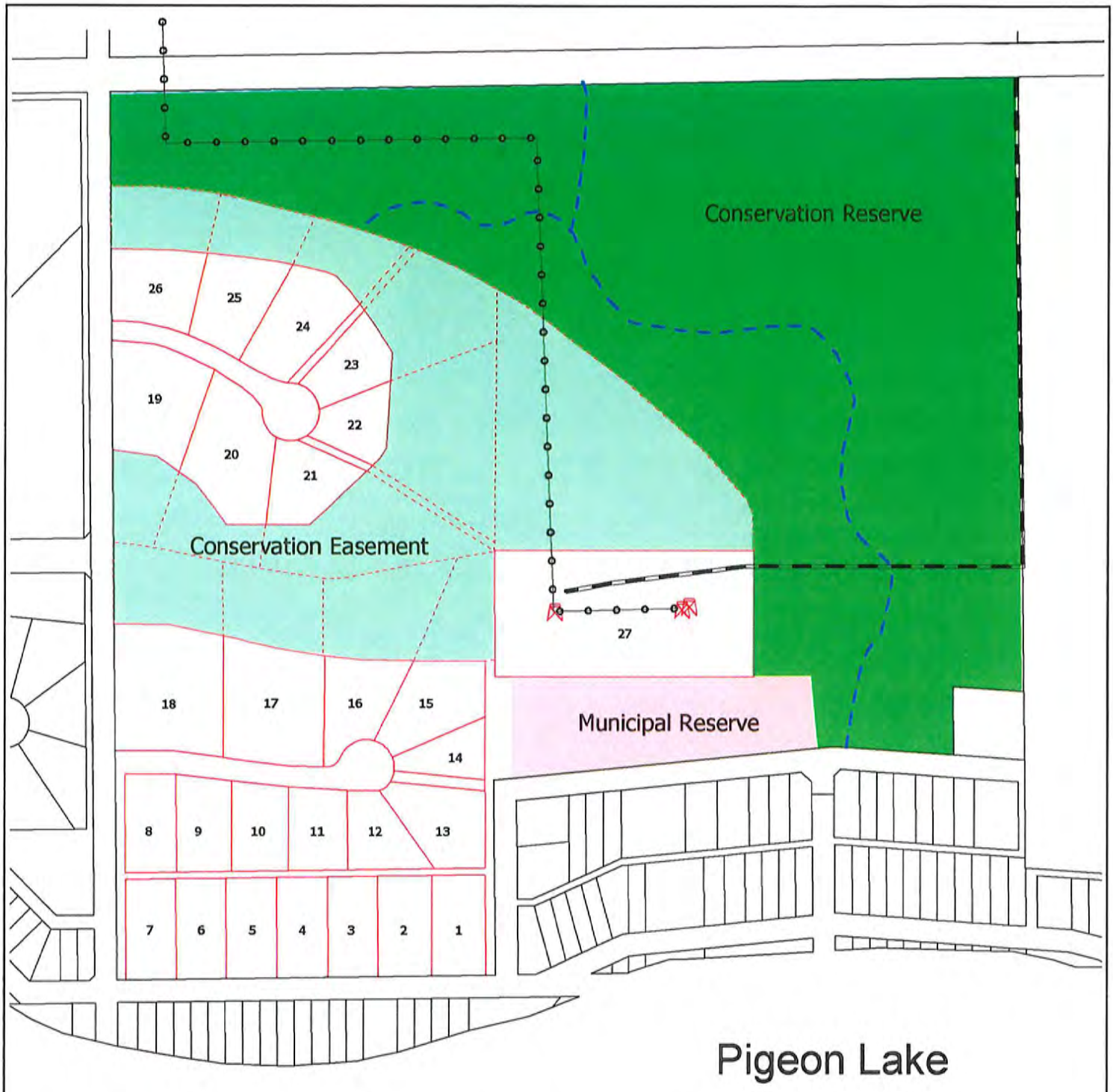


Figure 3. Proposed lot layout and conservation land dedications for the proposed development of SW 28-47-1-W5. (Note: Proposed lot layout is conceptual only.)

Existing and Proposed Features

- Existing Wellhead
- Drainage
- Pipeline
- Existing Lots
- Proposed Lots
- Proposed Conservation Easements
- Oil Lease Road

Conservation Classes

- Conservation Easement
- Conservation Reserve
- Municipal Reserve

N

Scale 1:5000

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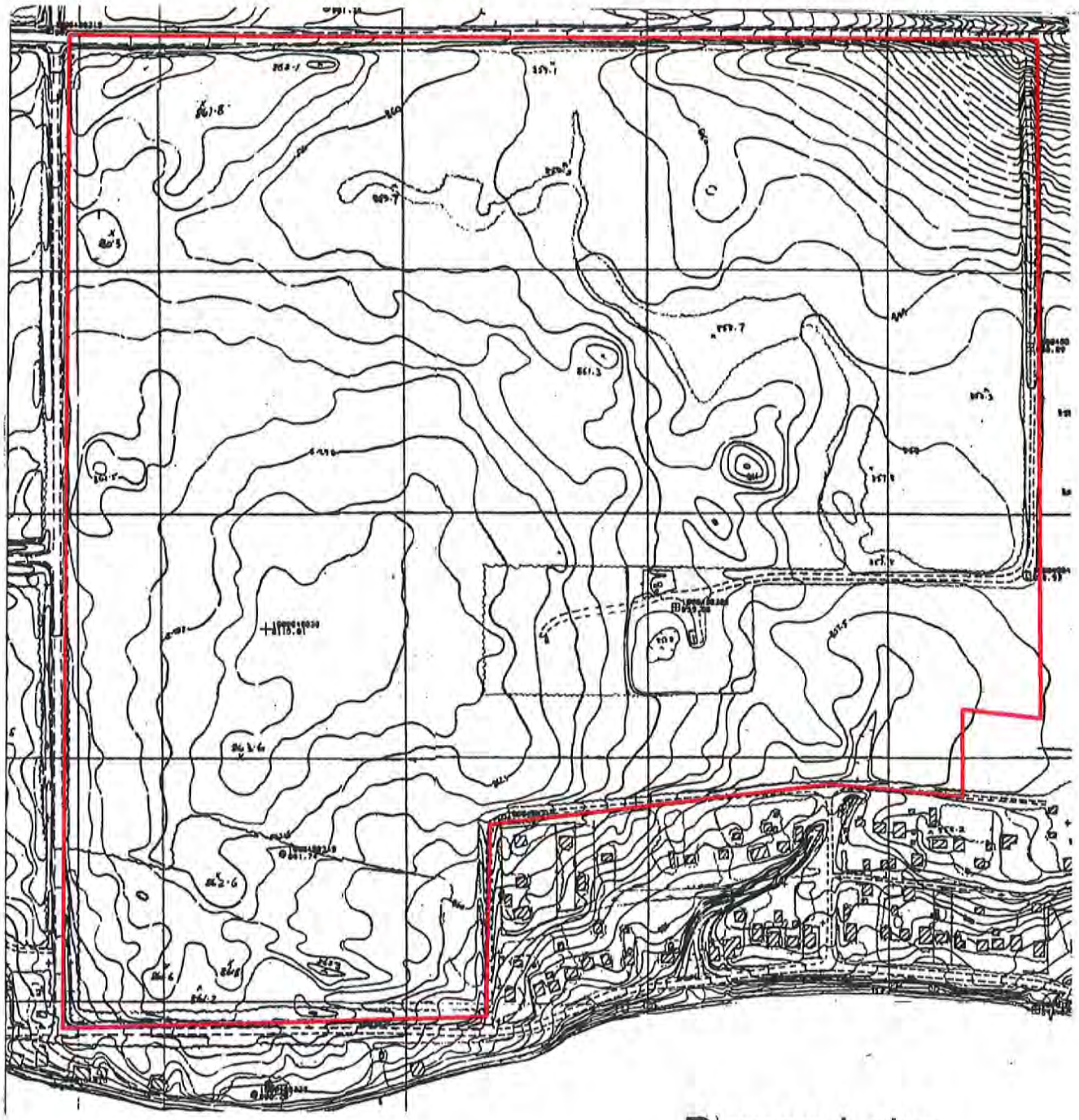
GIS Technician: G.Sather
Wildlife Biologist: D. Westworth



Pigeon Lake

N

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Figure 4. Topography of SW 28-47-1-W5.

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Figure 5. Habitat classes and potential wildlife movement corridors in relation to the proposed development of SW 28-47-1-W5. (Note: Proposed lot layout is conceptual only.)

Habitat Classes
- Anthropogenic
- Wet Meadow
- Wet Shrub
- Immature Deciduous-open
- Immature Deciduous-closed
- Mixed Immature/Mature Deciduous
- Mature Deciduous-closed

Wildlife Movement Corridor

Existing and Proposed Features
- Existing Wellhead
- Drainage
- Pipeline
- Existing Lots
- Proposed Lots
- Oil Lease Road

N

Scale 1:5000

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# 8.0 Photographs

**Photo 1.** Anthropogenic habitat class showing three active wellheads. Osprey nest in the distance.

**Photo 2.** Osprey nest located on the west side of Acclaim Energy Ltd. oil leases.

**Photo 3.** Wet meadow habitat class with mature deciduous forest habitat in the background.

**Photo 4.** Wet Meadow habitat class. Heavily used game trail in foreground.

**Photo 5.** Wet Shrub habitat class, consisting primarily of dense willow over various shrubs and grasses.

**Photo 6.** Wet Shrub habitat class with scattered birch.

**Photo 7.** Immature Deciduous-Open habitat class. Various shrubs, herbs and grasses are present under the deciduous canopy.

**Photo 8.** Immature Deciduous-Open habitat class. Trees have poor vigour.

**Photo 9.** Immature Deciduous-Closed habitat type.

**Photo 10.** Immature Deciduous-Closed habitat type.

**Photo 11.** Mature Deciduous mixed with Immature Deciduous. Note the nesting cavity in broken snag.

**Photo 12.** Mature Deciduous-Closed habitat type. Many overmature stems scattered throughout. The abundance of snags provide good habitat for cavity dependent wildlife.