COUNTY OF LETHBRIDGE
IN THE PROVINCE OF ALBERTA

BY-LAW NO. 1306

A BY-LAW OF THE COUNTY OF LETHBRIDGE BEING A BYLAW PURSUANT TO SECTION 633(1) OF THE MUNICIPAL GOVERNMENT ACT, CHAPTER M.26.1

WHEREAS Jurrie Vandenberg wishes to develop a Grouped Country Residential Subdivision on the North ½ of the S.W. 31-10-21, West of the Fourth Meridian;

AND WHEREAS an application to reclassify the above land for Country Residential was approved by County Council on April 19, 2007;

AND WHEREAS the Developer has submitted the "Deer Run Estates Area Structure Plan" which will provide a framework for subsequent subdivision and development of the area;

NOW THEREFORE BE IT RESOLVED that the Council of the County of Lethbridge does hereby adopt the "Deer Run Estates Area Structure Plan" attached as Appendix "A".

GIVEN first reading this 7th of February, 2008.

Reeve

County Manager

GIVEN second reading this 3rd day of April, 2008.

Reeve

County Manager

GIVEN third reading this 3rd day of April, 2008.

Reeve

County Manager

LETHBRIDGE COUNTY
IN THE PROVINCE OF ALBERTA

BY-LAW NO. 1428

A BY-LAW OF LETHBRIDGE COUNTY BEING A BY-LAW PURSUANT TO SECTION 633(1) OF THE MUNICIPAL GOVERNMENT ACT, REVISED STATUTES OF ALBERTA 2000, CHAPTER M.26

WHEREAS Westcott Consulting Group on behalf of the subdivision developer wishes to amend the "Deer Run Estates Area Structure Plan" Bylaw No.1306 pertaining to lands located at North ½ of SW 31-10-21-W4 (Registered Plan 1210184).

AND WHEREAS the County's Municipal Development Plan requires that developers prepare an Area Structure Plan that must include architectural controls;

AND WHEREAS the developer wishes to amend the architectural controls by removing the existing architectural controls stipulated within the Area Structure Plan and replace them with revised architectural controls to conform to the Restrictive Covenant as registered on titles within the Deer Run Estates subdivision.

NOW THEREFORE BE IT RESOLVED, under the Authority and subject to the provisions of the Municipal Government Act, Revised Statutes of Alberta, 2000, Chapter M-26, as amended, the Council of Lethbridge County in the Province of Alberta duly assembled does hereby enact the following:

1. The "Deer Run Estates Area Structure Plan" Bylaw 1306, Architectural Controls, are hereby rescinded and replaced with the Architectural Controls of amending Bylaw No. 1428 attached as "Appendix A".
2. Bylaw No.1306 being the "Deer Run Estates Area Structure Plan" Bylaw 1306, is hereby amended.
3. This Bylaw 1428 comes into effect upon 3rd and final reading hereof.

GIVEN first reading this 7th day of August, 2014.

Reeve

Chief Administrative Officer

GIVEN second reading this 4th day of September, 2014.

Reeve

Chief Administrative Officer

GIVEN third reading this 4th day of September, 2014.

Reeve

Chief Administrative Officer

Appendix A

Deer Run Estates

Architectural Design Guidelines

1.0 INTRODUCTION

Deer Run Estates, Southern Alberta's newest community offers an exciting approach to rural residential living. Our unique community embraces diversity in topography, panoramic views and architectural styling through the implementation of architectural controls reflecting our rural character and identity. This unique vision creates both a sense of place and a sense of community.

This community is designed to provide the country living atmosphere on carefully selected lot profiles and sizes. These lots are sized to enhance the privacy and respect of each home owner. This will create the ambience so desirable considering the busy lifestyles of today. The intent is to enhance homeowner satisfaction through outdoor activities, healthier lifestyles and community interaction. This is achieved with large green spaces; access to natural areas and with full community amenities only a short drive away.

The intent of these guidelines is to provide a unified approach to style, character, massing, architectural detailing, and to present an expression of harmony for this country community. Variety is encouraged within these guidelines to create the unique atmosphere desired. Through consistent home quality, styling and character, these architectural guidelines will enrich and preserve the uniqueness of the community while allowing for individuals to express personal preferences and tastes.

In recognizing the richness and diversity of the rural community it is important that future residents acknowledge that agriculture is the primary resource with Lethbridge County.

Considering the importance of this valued resource rural residents must strive to work in harmony with agriculture. To achieve this balance Lethbridge County has prepared an information guide for new residents entitled "A Guide to Rural Living".

This informational brochure identifies some of the nuances of rural living which are not usually encountered in an urban community. It is important that new residents who choose to relate to the rural community acknowledge and understand that agriculture activities or practices may inconvenience or disturb others. It is these very activities which enhances the character of the rural community.

New residents should read and become familiar with the "A Guide to Rural Living", which is attached hereto, prior to relocating to the County and should you have any further questions relating to the guide, you are encouraged to contact the County Office.

2.0 GENERAL REQUIREMENTS

In order to ensure Deer Run Estates is unequalled in quality and presentation and for the benefit of the homeowners, it may be required for each homeowner and / or builder to provide evidence of building experience.
It is generally recommended for homeowner's designers and or builders to make submission to the Approval Committee as soon as possible prior to final drawings being completed. Decisions regarding a proposed house plan's conformance to these Architectural Design Guidelines rest with the Approval Committee consisting of representatives from the community developer and the selected committee members.

In addition to these Architectural Design Guidelines, all building designs must comply with the current Lethbridge County Land Use Bylaw and to all applicable Alberta Building Code regulations.

Each purchaser must inspect the condition of the particular property in and around the lot prior to commencement of construction in order to determine if any concerns are visible. Written notice of any damages must be submitted at this time or the costs of repairing damages shall become the sole responsibility of the purchaser.

3.0 DESIGN

A number of key features shall be given serious consideration for the designs intended for Deer Run Estates. This includes: Massing, Roof design, Exterior cladding, and Exterior features. Interest in any subdivision comes from a variety of house types in them. A well-planned community will only enhance the overall value and appeal. In preparation of the design on the home for the particular lot, the homeowner and designer shall review the subdivision plans with the grading information to design their home for the specific lot. Major changes in grading will not be allowed and therefore grading stipulations are to be strictly followed.

The intent to have the homes in this subdivision built on site. Ready to move house proposals will be considered on an individual basis with sufficient accurate information and drawings provided to ensure compliance to the controls and to show an upgraded appearance.

3.1 Massing

Prior to completing the final house plans, it is highly recommended that the Purchaser or Builder contact the Approval Committee to ensure proposed design is meeting with the intent of these design guidelines to avoid delay or possible major changes of the final plans.

Bungalows shall be used on Lots 6, 12-14 in Block 1 and Lots 1 - 5 in Block 2.

Walkout lots shall avoid the use of three storey full height flat appearance. The use of dormers, recessed second floor and/or decks shall be provided to break up the elevation.

Bonus rooms or extended second floors over the garage on the front elevation shall not be flush to the front of the garage. Careful attention in the design shall be taken to create an attractive appearance and to avoid this area of the home to be more dominate.

Identical or similar houses will not be constructed within 4 adjacent lots or within 4 sites across the street. Reverse plans and different finishes and colors are not sufficient changes.

All houses shall have attached garages which shall be located on the side of the residence rather than in front. The front of the garage shall not protrude any further than 8' (2.438m) from the front of the home. The front of the home is defined as the front face of a directly adjacent veranda or the front wall on the home directly adjacent to the garage. Each home with garage shall take advantage of the generous lot width and designs not in compliance with these requirements will not be approved.

3.1.1 House and Ancillary Building Sizes

Minimum house square footage will be as per the following. The garage area, verandas, and decks, etc. are not included in the minimum area.

Lots 1-4, Block 1

Bungalows	1150 Sq. Ft.
Bi-levels	1150 Sq. Ft.
Split levels	1150 Sq. Ft. (2 levels)
Two Storey	1550 Sq. Ft.

All other lots

Bungalows	1250 Sq. Ft.
Bi-levels	1250 Sq. Ft.
Split levels	1250 Sq. Ft.
Two storey	1700 Sq. Ft.

A house's square footage may be reduced at the discretion of the Approval Committee if appropriate frontal massing and elevation treatment is incorporated into the design.

Ancillary buildings are permissible on all lots with the maximum area being 1200 Sq. Ft. for the first building and 100 Sq. Ft. for the second building. No more than two ancillary buildings will be allowed on any one lot other than the use of deck style gazebos. All ancillary buildings shall be built using the same exterior materials, colors etc. as the principle dwelling. Gazebo's if used shall be complementary to the home. Metal garden sheds are not acceptable.

3.2 Roof Design

The roof designs for this subdivision will show variety. No particular roof style or design will be required with the general request to use gable roof styles. It will be a requirement that the front elevations will have some variety in the roof design. Single plane roof designs will not be acceptable. Verandas and planned covered entries are strongly encouraged to provide the county living atmosphere.

Primary roof slopes must not be less than 5/12 for all houses. Secondary roof slopes over verandas, etc. can be 4/12 roof slope and accepted at the discretion of the Approval Committee.

All eave overhangs shall be 24". Eave overhangs less that that will be considered for decorative gables but not the main roof. All fasciae shall be a minimum of 6" high with larger fascia's being recommended.

Roofing materials are limited to laminated architectural asphalt shingles, or wood shakes. Any form of metal roofing is not acceptable. Other roofing materials will need to be reviewed by the Approval Committee prior to use on the home. Acceptable architectural shingles are:

- IKO Cambridge
- IKO Chateau
- BP Harmony
- BP Eclipse

3.3 Exterior Cladding

A wide range of cladding materials is considered acceptable and is encouraged for use in this subdivision. Acceptable exterior cladding materials are as follows:

- Hardiplank or Hardishingle siding
- Vinyl siding
- Canexel hardboard
- Cedar shingles
- Brick or stone
- Stucco with window trim build outs on the front elevation (minimum)

All siding must be predominately installed in the horizontal direction. Vertical siding in board and batten style is acceptable only in exposed gable ends on a limited basis.

All brick or stone shall be used in a panel effect, and not as a trim accent. All trim and masonry details MUST be returned 24" around corners. All brick and stone must use individually placed units rather than large sections of pre-manufactured units.

3.4 Exterior Features

The following elements should be chosen selectively to impart a sense of distinction and elegance of simplicity to each home and to create the consistent presentation desired for the community:

- Verandas or covered entries are strongly encouraged on the front elevation to promote the sense of invitation and community.

- Where the home design is presented without brick or stone accents, then 10" high water table and drip board trim is required on the front elevation and side elevation of corner lot homes.

- All columns supporting verandas or covered entries shall be a minimum of 10" square with additional top and bottom trims.

- Vertical style windows are strongly encouraged in single or multiple uses. Curved windows are acceptable only in segmented or oval style. Palladian windows are not acceptable.

- Muntin bars are encouraged on the front elevation and side elevation of corner lots and are limited to traditional square style with either the top portion grilled or the entire window. Perimeter grilles in either square or linear style are not acceptable. Windows without any grilles may be acceptable on an individual basis.

- All windows and doors shall have a minimum 3 ½" surround either in painted MDX, Harditrim, or Smart Wood materials, smooth metal clad lumber, or vinyl when used in conjunction with vinyl siding. On stucco homes the window and door surrounds shall be a minimum of 4" in width. More substantial surrounds are strongly encouraged.

- All entry doors must be clearly visible from the street. Side entries are not acceptable. Angled entries will be reviewed on an individual basis. All entry doors shall have a large door window, sidelight or transom window.

- Gable end louvers with surrounds are encouraged to match in color to the trims on the home.

- Exposed parged foundations on the front elevations shall be limited to a maximum of 12" above grade.

- Windows in overhead doors are strongly encouraged.

4.0 SITE PLANNING

The Deer Run Estates Area Structure Plan, (adopted by Lethbridge County), was prepared to provide the planning framework for the subsequent subdivision and development of Deer Run Estates. A series of technical investigations were commissioned by Deer Run Estates Ltd. is support of the preparation of the Area Structure Plan amongst which included a detailed geotechnical investigation.

The geotechnical investigation is an integral part of the Area Structure Plan and establishes as series of parameters with respect to development setbacks and slope protection, sewage treatment and disposal field placement, and irrigation system placement and best practices.

It should be further noted that no excavation, construction or development, including the installation of fencing may occur within the Pengrowth Energy Inc. Right of Way 971-0808 which is contained within Lots 14, Block 1 and Lots 4, 10, 11 & 12 Block 2, Plan 121-0184 without the prior written consent of Pengrowth Energy Inc. Under no circumstances will building placement be permitted within the Pengrowth Energy Inc. Right of Way.

Prior to purchase each prospective homeowner is required to acknowledge and agree to the implementation of best practices predicated in the geotechnical report referenced as 'Geotechnical Evaluation, Deer Run Estates, Country Residential Subdivision, County of Lethbridge dated November 2007 and attached hereto.

Careful attention to planning of the home and site are critical in attaining a desired effect in creating both a sense of place and a sense of community. The establishment of site planning criteria will greatly enhance the implementation of this vision.

4.1 Setbacks

All front, rear and side yard setbacks are to be as per the requirements of the Land Use Bylaws of the Lethbridge County. All homes with the garage shall take advantage of the generous lot width. .

4.2 Building Height

Building height shall not exceed the maximum as noted in the Land Use Bylaws of the Lethbridge County

4.3 Garage Locations

Garage location will not be determined on each property but shall only face the street. Any variations are reviewed on an individual basis.

4.4 Lot Grades

Careful attention shall be given to lot grading in the selection of the height of the grade around the residence relative to the remainder of the property. Lot grades shall conform to generally accepted practice with consideration to positive drainage away from each building. Consideration must be given to adjoining properties to ensure that storm water will not cause complications or undesirable water levels beyond each property. Many difficulties can be eliminated through careful planning based on the grading plan and all designs will reflect this requirement. All submitted lot plans shall show the lots grades to be in conformance to these plans. An approved final grading certificate on the real property report is a prerequisite for the final inspection and the release of the security deposit.

The intended profile for the community is low and grounded. Entry steps should be a maximum of four risers. Exceptions to this will be at the discretion of the Approval Committee.

4.5 Waste Water Treatment

The installation of an 'on-site' waste water treatment shall be the responsibility of the individual homeowner. Prior to issuance of a development permit or building permit by Lethbridge County, the home owner shall provide to the County, a plumbing permit issued by the appropriate Provincial regulatory authority and shall include confirmation that the sewage treatment system and disposal field is in compliance with the best management practices incorporated within the geotechnical investigation referred to above.

4.6 Irrigation

Raw water for irrigation purposes will be provided to each lot. Each homeowner, as part of the homeowner design guideline approval procedure shall provide an irrigation schematic and best practices report for Approval Committee and Lethbridge County approval.

4.7 Colors

The intent of these controls is to provide a new approach to the colors of the homes in this community. The following notes are provided to assist in this color selection:

- All fascia, soffits, window and door trims, veranda railings, eaves troughs and downspouts, etc. shall be uniform in color.

- Garage doors on homes with darker trims and cladding shall not be white or off white. They shall be painted to avoid the sharp contrast to the remainder of the home.

- White siding or stucco will not be permitted.

- A wide array of cladding colors will be acceptable and approved individually for each home. Owners and builders are encouraged to use more intense colors within the earth tone range.

- All roof materials shall be chosen from the wide range of darker colors. Lighter tones will not be permitted.

- Variations of the stated color palette will be at the discretion of the Approval Committee.

- Approval Committee reserves the right to approve colors and will have the final authority with regard to the colors of the homes.

4.8 Driveways

Front driveways and walkways may be constructed of the following materials:

- Standard concrete or concrete pavers.

- Stamped or colored and stamped concrete.

- Exposed aggregate concrete.

- Asphalt pavement.

All driveways etc. shall be completed within one year of occupancy of the home. The security deposit will not be released until such a time these are completed.

4.8.1 Controlled Access

- Access to Lot 11 & Lot 12, Block 2, Plan 121-0184 shall be a joint approach and shall be located adjacent to the property line between the two affected lots.

- Access to Lot 10, Block 2, Plan 121-0184 shall only be permitted from Antler Ridge Road.

- Access to Lot 14, Block 1, Plan 121-0184 shall be from Antler Ridge Road and located north of Right of Way Plan 971-0808.

- Access to Lot 4, Block 2 Plan 121-0184 shall be from Antler Ridge Road and located south of Right of Way Plan 971-0808.

4.9 Landscaping

Use of professional designed landscape plans will greatly enhance the character and appeal to your home and will be encouraged. All front yards must be grassed. Major use of rock or gravel as the predominate landscape material will not be accepted.
A minimum of three trees will be required within the front yard setback using a mix of coniferous and deciduous trees. Minimum height of coniferous will be 5' (1.5m) and for deciduous, 8' (2.4m). A minimum of three shrubs can be used in lieu of two of the three required trees.

Retaining walls along property lines will not be permitted. Landscaping retaining walls should be avoided and in no case shall be greater in height than 3'-0" (.9m). All retaining walls shall be complimentary to the house finish and color. Homeowner or builder shall submit to Approval committee the type, quality and details of the retaining walls prior to construction.

Landscaping for the use of each homeowner shall not extend beyond the property lines of the lot even if next to open green spaces except on the street side of the property. All property outside of the lots other than along a street shall be left in its natural state.

4.10 Fencing

Fencing is permitted but will be at the expense of the homeowner. All fencing designs are to be reviewed by the Approval Committee prior to installation. Full vinyl or white chain link are acceptable choices. Fences shall not exceed 5' (1.5m) in height. Fences shall not extend beyond the front face of the house.

4.11 General Requirements and Notes

Each homeowner shall provide a clearly visible large scale house number either on the home or near the roadway.

Satellite dishes or antennas must not be visible from the street or public adjacency.

No storage of low use vehicles, and materials etc. shall be visible from the streetscape and the parking of motor homes and RV's shall not be permitted in the front year.

Animals will not be permitted on any lot in this subdivision which includes horses, goats, chickens etc., except typical household pets.

5.0 APPROVAL PROCEDURE

All submissions to the Approval Committee must be made prior to application to the Lethbridge County for the Building Permit. The following items shall be included at the time of submission:

- Three copies of the Lot Inspection Report and Site Grading Plan, signed by a professional engineer authorized to practice in the Province of Alberta, and shall include confirmation of compliance with the geotechnical report 'Geotechnical Evaluation, Deer Run Estates, Country Residential Subdivision, County of Lethbridge dated November 2007' and attached hereto.

- Three copies of the final blueprints showing the plans, elevations and sections.

- Completed application form as per attached.

- Irrigation schematic with best practices report.

- Any brochures, color chips or samples deemed required for the proper presentation.

- Security deposit cheque in the amount of $2500 payable to Deer Run Estates Ltd., of which Three Hundred & Fifty Dollars will be retained as an application fee.

The approval Committee will review the application and recommend approval or rejection based on the compliance with these Architectural Guidelines. All sets of drawings etc. will be returned to the applicant upon approval or otherwise. Approval committee will photocopy pertinent information for their files and for future reference.

NOTE: Applications must be finalized with elevations that reflect the CORRECT materials and details of the work to be built. Written notes explaining the changes to elevations are not acceptable. Marked up sets and incomplete applications will be returned.

Applications shall be submitted to:

Richard Mack
Mack Architectural Design Consultants
2808-48th Avenue S.
Lethbridge, Alberta, T1K 7B3
Phone Number: 403-329-6106
Fax Number: 403-329-3364
Email Address: mackarch@telusplanet.net

6.0 FINAL INSPECTION, SECURITY DEPOSIT RELEASE

To initiate the Final Inspection, the following must be done:

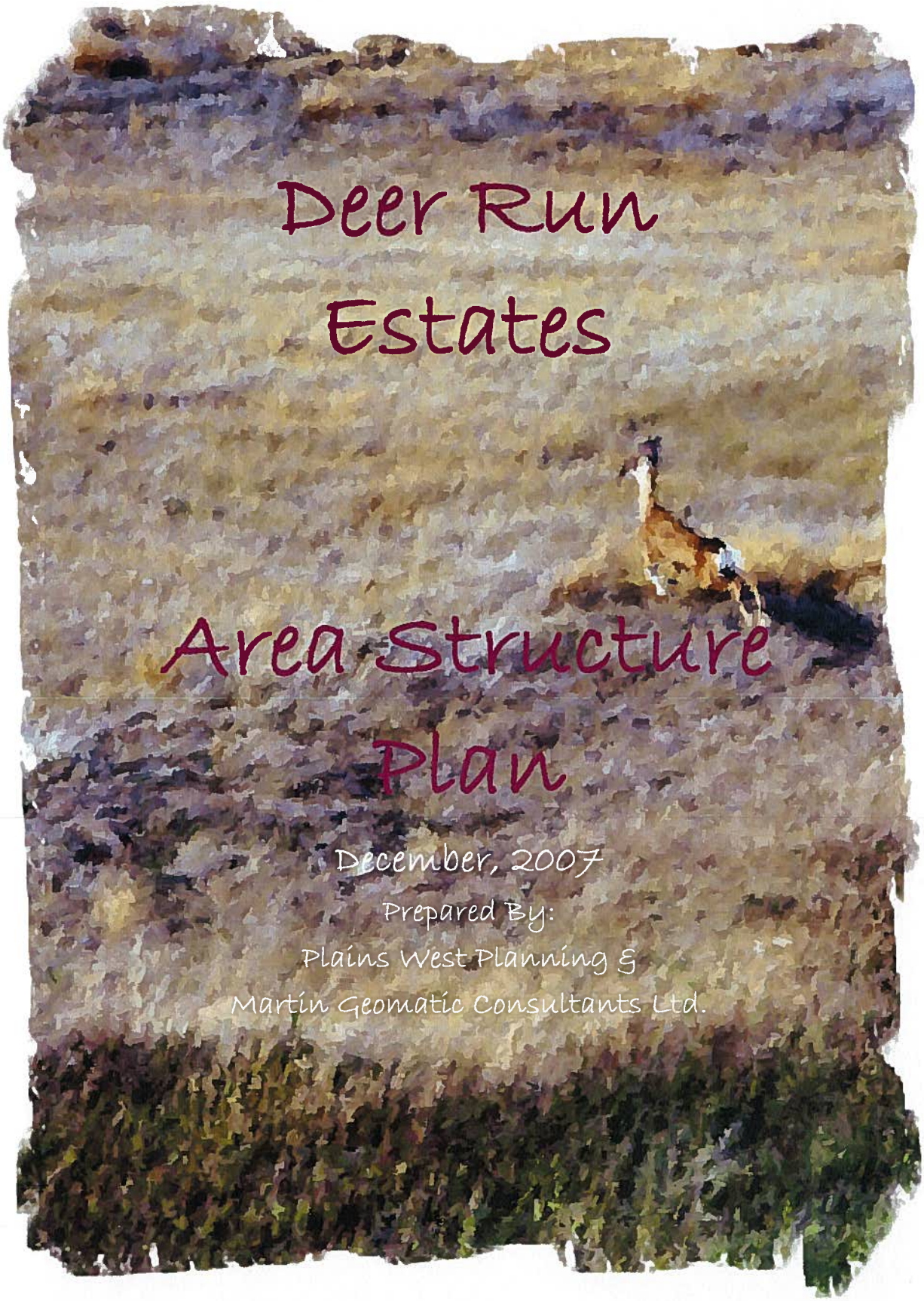
- Construction of residence is completed; exterior completed in accordance to these Architectural Guidelines and as per the approved submitted drawings etc.

- Final grading completed, driveways and sidewalks completed, and minimum of front yard grassed and trees planted.

A representative from the approval committee will visit the site to confirm compliance to these Architectural Guidelines once the above items have been submitted and completed. Assuming complete compliance, a letter will be forwarded to the developer to release the developer's portion of the security deposit.

Dated this ____day of _____2011

Deer Run Estates per: _____



Deer Run Estates

Area Structure Plan

December, 2007

Prepared By:
Plains West Planning &
Martin Geomatic Consultants Ltd.

COUNTY OF LETHBRIDGE
DEER RUN ESTATES
AREA STRUCTURE PLAN

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Figure 3 – Existing Land Use
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Figure 6 – Storm Water Management – Drainage
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I. Introduction

A. Purpose

1. The Deer Run Estates Area Structure Plan has been produced in accordance with Section 633 of the Municipal Government Act. It is the intention of this plan to create a framework for the future subdivision and development of this Grouped Country Residential area.

2. This Area Structure Plan is also intended to support re-classification By-law #1291, passed on April 19, 2007, which amended County Land Use By-law #1211 from Rural Agriculture (RA) to Grouped Country Residential (GCR) [refer to Appendix 1].

3. The purpose of the GCR District is to provide for residential development in areas where there is minimal conflict with adjacent land uses.

4. The proposed Area Structure Plan By-law will establish Deer Run Estates as a district to accommodate the location of country residential development. This will be accomplished through planning and design of the site within the intent of the Municipal Development Plan as well as the Grouped Country Residential Land Use District classification of Land Use Bylaw #1211.

5. The potential lot layout proposed within the area structure plan has been designed to fit into the shape and contours of the existing parcel. Through careful planning future subdivision is also intended to blend into the adjacent area.

B. Location

This document has been prepared as an Area Structure Plan to establish the framework for subdivision and development of the following property:

North $\frac{1}{2}$ of the Southwest Quarter of section 31; Township 10; Range 21; West of Meridian 4 in the County of Lethbridge.[1] (Please refer to Figure 1.)

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[1] Approximate: Elevation} 2970 ft (822 m); Latitude} 49°51′ 44.02″ N; Longitude} -112°50′ 46.09″ W

C. Ownership

1. The site is owned by Jurrie and Susan Van Den Berg.

2. Other land ownership within the immediate area of the proposed Deer Run Estates Area Structure is indicated on Figure 1.

D. Site Area

1. The proposed site is 78.28 acres (31.67 ha.) in area. A copy of the land title is attached as Appendix 2.

II. Area Structure Plan Goals

A. The primary goal of the Deer Run Estates Area Structure Plan (DREASP) is to provide sufficient information to enable the County of Lethbridge Council, its planning advisors and approval authorities to make timely and well informed decisions regarding the future disposition of this property.

B. It is the further goal of this Area Structure Plan to create certainty regarding land use, subdivision design and other features of the proposed development for the land owner, adjacent landowners in the vicinity of the site and future residents

III. Area Structure Plan Objectives

A. General Objectives

1. The primary objective of the DREASP is to establish a strategic framework that will enable the development of a country residential subdivision of enduring quality.

2. The DREASP will respond to the needs, issues and requirements identified by Mr. and Mrs. Van Den Berg, the County of Lethbridge and those agencies and organizations having an interest in the planning of this area.

3. This document will include:

a. sequence of development;

b. proposed land use;

c. proposed lot layout

d. access and circulation;

e. location of public utilities; and

f. other related matters.

B. Deer Run Estates Area Structure Plan Objectives:

1. To mesh the development pattern and circulation system with that of surrounding, existing development;

2. To establish supporting internal transportation network and public utilities;

3. To design and construct a storm water management system that responds to both public utility functions and amenity considerations;

4. To utilize water from the North County Water Co-op system for domestic water supply purposes and from the Lethbridge Northern Irrigation District for raw water; and

5. To create a distinctive residential area by establishing quality development standards.

IV. Site Analysis

A. Site Location

1. The site is located approximately 15 miles north of the centre of downtown Lethbridge (24 km.), 2 1/2 miles (4 km.) south-east of the Town of Picture Butte and ½ mile (0.8 km.) north of the Hamlet of Shaughnessy.

2. The site is located along the east side of Highway 25 and includes approximately 78.28 ac. (31.67 ha).

B. Site Characteristics

1. The site consists of 3 distinct areas - two flat but slightly sloping top land pieces divided by a significant drainage course.

a. The portion of the site lying south of Piyami Coulee (also known as 12 Mile-Coulee) slopes gradually towards the coulee for the most part however, the slope increases significantly within approximately 165 feet (50 m.) of the centre of the creek running through the coulee bottom.

b. The portion of the site lying north of Piyami Coulee also slopes towards the coulee however the slope is less gradual with one section near the north central area of the site being very steep.

c. Piyami Coulee, meanders through the site from the northwest corner to the southwest corner and occupies approximately 30 acres (12.5 ha) or approximately 37% of the total site area.

d. The creek provides a source for irrigating the tree farm, watering livestock and habitat for deer, birds, and other wildlife.

C. Soil Classification

1. Canada Land Inventory (CLI)

The site exhibits two basic CLI Classifications.

a. The two aforementioned "flat" pieces are both Class 4 soils which under normal circumstances are considered to be good agricultural land capable of being irrigated by sprinkler irrigation systems. However, due to the small size and irregular shape of each piece the suitability for cultivation is reduced (refer to Appendix 3).

b. The Piyami Coulee piece is not suitable for cultivation due to rough, broken topography. It is also a drainage course and flood plain of unpredictable extent, suitable only for limited livestock grazing.

2. Soil Types

a. Both of the "flat" pieces are dominated by Rego Dark Brown Chernozoemic soils lying atop clay loam to silty lacustrine soils.

b. Generally, the topsoil has been determined to be approximately 100mm in depth. In addition, brown inorganic clay is quite common in this area, underlying the topsoil for an additional 100mm to 150mm (refer to Appendix 4).

c. The northerly piece is further characterized by some potential for ponding due to the presence of high clay content.

d. No bedrock was encountered in the E.B.A. testing and is expected to be well below the base of the valley elevation.

e. A summary of the soil assessment is found within Appendix 4.

D. Water & Hydrology

1. The effects of water on the site are primarily those created by creek which flows through the relatively narrow Piyami Coulee at the northwest corner of the site. This condition renders this location as unsuitable for bridging the creek for access to developable lands on the northeast part of the site.

   The coulee becomes wider with more gradual slopes as it leaves the site at the southeast corner. This vicinity provides better opportunities for bridging the creek for access to the developable lands on the northeast part of the site

   Aside from the creek, there appear to be no other natural water features on the site.

2. An active irrigation canal also runs through this corner and exhibits some signs of seepage however; discussions with the Lethbridge Northern Irrigation District have indicated that the canal will likely be relocated.

3. Concern for water quality in the larger drainage basin (off-site) emphasizes the need to carefully design the storm water management and sewage disposal systems to service the future subdivision.

E. Habitat & Vegetation

1. The portion of the site lying on the north side of Piyami Coulee appears to be native prairie grassland having not been cultivated recently or perhaps ever.

2. Piyami Coulee provides natural habitat for deer and a variety of birds. There is also evidence on the site of burrowing animals such as badgers and the ubiquitous Richardson's Ground Squirrel. Most of this natural area is undevelopable due to either sloping or drainage course conditions. This area is suitable for dedication as environmental reserve at the time of subdivision.

3. The southwest portion of the site is occupied by a tree farm, heavily planted with trees which are watered through an underground irrigation system fed by a reservoir on the site. These trees, many of which are relatively tall, will enhance development of this area as a country residential development and should be retained or transplanted wherever possible.

F. Environmental, Historical & Archaeological Significance

Prepared for the County of Lethbridge, a report entitled "Environmentally Significant Areas in the Oldman River Region" indicates:

1. no environmentally significant sites within the plan area;
2. no hazard lands; and
3. no archaeologically significant sites.

G. Existing Land Use

1. Existing use of the site (and surrounding lands) is indicated in Figure 3 and consists of:
   a. a tree farm on the southwest portion;
   b. an apiary in the north central area;
   c. livestock grazing on both the coulee bottom and the northeast areas;
   d. an irrigation dugout is situated on the west side of Piyami Coulee;
   e. an earthen berm runs along most of the west side of the site;
2. Mixed farming operations, primarily irrigated crops, are evident in the surrounding area particularly west and north of the site.
3. The nearest livestock feeding operation is approximately 1 mile west and $\frac{3}{4}$ of a mile south of the site.
4. The nearest farmstead is directly south of the site while the nearest Country residence is situated directly opposite the site, west of Highway 25. Several other Country residences are situated within $\frac{1}{2}$ mile of the site on the west and north sides of Highway 25.
5. Adjacent to the southeast of the plan area, is the Picture Butte Golf and Winter Club.
6. The Shaughnessy sewage treatment lagoon is approximately $\frac{1}{2}$ mile south of the site.

H. Constraints & Opportunities

The site and surrounding area contain both constraints and opportunities that will influence the land use as well as the planning and design of future development. These aspects are illustrated in Figure 4.

1. Constraint Evaluation

a. Potable water supply

There is not an acceptable, natural source of potable water on the site. Therefore, to secure domestic water supply, an agreement with the North County Water Co-op for City of Lethbridge water will be required. Water will need to be piped to the site before distribution throughout the site (refer to Appendix 5).

b. Sewage disposal

Although the site is close to the Shaughnessy sewage lagoons, it would be desirable to connect to this sewage treatment system. However, there is insufficient capacity in the lagoons to accept and treat the effluent generated by the proposed Deer Run Estates development.

c. Soil Capability for Residential Development

The soil conditions of the developable areas, on either side of Piyami Coulee, pose no limitations to residential development. The soils are suitable for both building foundations and accepting sewage effluent (refer to Appendix 4).

d. Topography

Sloping land, the creek and the flood plain associated with Piyami Coulee pose constraints to development. There is evidence of some slope slumping in the area indicating that accurate setbacks from the "top-of-bank" will be necessary. (refer to Appendix 4).

Land below the "top-of-bank" will not be developable for residential purposes. In addition, an appropriate location and design for bridging the creek will be required to facilitate access and to manage creek flows through the site.

The northeast corner will also require further evaluation due to the possibility of saturated soils.

These topographical conditions will also require engineered solutions for storm water management.

e. Access Considerations

1. Site access from Highway 25 exists near the southwest corner of the site. This appears to be the best location for accessing the site in the future as well. A Traffic Impact Assessment (T.I.A.), conducted by iTrans Consulting Inc., was undertaken for the proposed development of Deer Run Estates (refer to Appendix 7), The T.I.A. indicates that intersection sight distances for access to Highway 25 match Alberta Infrastructure and Transportation (A.I.T.) requirements.
2. Based on ***iTrans*** analysis, construction of an Alberta Infrastructure and Transportation (A.I.T.) Type IIa intersection for two-lane highways is a consideration to ensure safe access to Highway 25. However, this would not be undertaken unless agreed to in consultation with A.I.T. (refer to Appendix 7).
3. An unimproved road currently loops through the site south of Piyami Coulee. In the southeast area of the site, there is a field access across a culvert, through which Piyami Creek flows. This field access continues through the coulee then up to the developable land. Some of this road configuration may be incorporated into the future circulation system.

f. Fire Suppression

1. There is a buried pipeline, originating from the L.N.ID. system, that fills the existing dugout on the west side of the site. This dugout provides water to the tree farm and could be upgraded and utilized for fire protection (refer to Appendix 5).
2. Raw water for fire protection would be available from the L.N.I.D. upon securing a satisfactory agreement with the District.

g. Water for non-potable purposes

Raw water for lawn, garden, and tree watering may also be made available through the site dugout upon an agreement with the L.N.I.D. Depending on the volume of water which can be provided to the site, the existing dugout's 3.7 acre-foot (4,540 m^3) capacity may need to be increased (refer to Appendix 5).

h. Agricultural Considerations

The proposed development of this site is not likely to constrain any existing agricultural land use.

1. Distances between country residential development and existing livestock confinement operations meet required separation distances (MDS).
2. Agricultural operations in the vicinity of the development area may, at times, create dust or noise. This is normal rural farming activity which may have to be explained to potential residents as a factor to consider when choosing rural living.

i. Gas Pipeline Right-of-way Plan 971 0808

Devlan Exploration Company Ltd.[2] possesses a right-of-way agreement for a gas pipeline, registered against the property, covering 2.63 ac. This agreement forbids the registration of any person as a transferee or owner, of any instrument affecting that estate or interest, unless the Certificate of Title is subject to the Devlan Exploration Company Ltd. claim.

j. Irrigation Canal Right-of-way plan IRR 884

The Deer Run Estates site is within the Lethbridge Northern Irrigation District (L.N.I.D.) and there is currently an irrigation canal passing through the site. It is the intention of the L.N.I.D. to remove the canal in the north-east corner of the site. Further, it is anticipated that the irrigation rights on the property would be

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[2]Recent information indicates that this pipeline may now be owned by Pengrowth Corporation.

commutated upon subdivision and development of the land.

2. Opportunities

   a. Location

      Being adjacent to Highway 25, Deer Run Estates is within commuting distance of both Lethbridge and Picture Butte. Deer Run Estates residents will thus be able to optimize the amenities available in each municipality.

      The presence of the Hamlet of Shaughnessy and existing country residential areas in the vicinity has resulted in an area that experiences little in the way of incompatible land use impact. What little impact that exists is related to the normal farming practices employed in the surrounding area.

   b. Existing Trees

      The existing tree farm provides the site with a head-start in terms of aesthetics and character. Through careful siting of homes and property improvements, many of the existing taller trees can be utilized for landscaping and buffering of wind. Thus retaining as many trees as possible is an important consideration. Those trees that can not be retained in their current locations should be salvaged and replanted elsewhere in the future subdivision - perhaps on the north/east side of Piyami Coulee where there are currently no trees.

   c. Picture Butte Golf Club

      Proximity to the Picture Butte Golf Club course is an asset that can be further capitalized upon if an access agreement can be secured with both the Golf Course board and an adjacent land owner near the southeast corner of the site .

   d. Lifestyle

      For those families choosing to build and live in Deer Run Estates, the subdivision will provide a rural lifestyle in an urban-like setting.

   e. Existing land use classification

The site enjoys the benefit of having already been reclassified for Grouped Country Residential use by the County of Lethbridge Council. The County required that an Area Structure Plan be prepared to ensure the appropriate level of planning, engineering and design is undertaken before subdivision and development can occur.

VI. Proposed Land Use & Design

A. Proposed Land Use

The primary land use in Deer Run Estates will be low density residential supported by a variety of other uses as indicated below:

1. Residential

   a. The site will consist of 32 single detached residential acreage lots ranging in area from 1 acre (0.40 ha.) to 1.5 acres (0.6 ha.) that will be created by plan of subdivision.

   b. The County of Lethbridge minimum lot size is 0.4 ha. (1.0 acre). Lots within the Deer Run Area Structure Plan will thus meet or exceed the County minimum requirement.

   c. Owing to the variety of lot shapes, frontages will vary somewhat adding interest to the subdivision.

2. Public Utility Lots

   The existing water reservoir and associated pump house are intended to be contained within public utility lots. A site will be established for a second pump-house that will likely be required in the southeast corner of the site.

3. Recreational Vehicle Storage

   In order to maintain an uncluttered residential subdivision, Deer Run Estates will include a landscaped and fenced recreational vehicle storage compound that will likely be combined with the pump-house site in the southeast corner.

4. Municipal Reserve

   The County has indicated that no land will be required for Municipal Reserve (MR) thus the MR requirements will be met through money-in-place of land in accordance with the Municipal Government Act.

5. Environmental Reserve (ER)

Piyami Coulee, between the identified top-of-bank setbacks on either side of the coulee, is undevelopable (refer to Appendix 4). As such, the land is eligible for designation as Environmental Reserve.

The County of Lethbridge does not always require Environmental Reserve. Thus there are alternatives for the County to consider should there not be a desire to designate ER.

(a.) Undevelopable land that might otherwise be designated as environmental reserve could be differentiated from developable land with a designation suitable to the land tiles office.

(b.) This land may be established as a bareland condominium to which each lot owner, within Deer Run Estates, has an equal ownership share.

(c.) Responsibility for maintenance and issues that may arise with in this undevelopable land could be managed by a committee of the landowners.

6. Roadways & Utility Lots

(a) Access to each of the proposed lots will be provided within a 20 meter road allowance built to a standard acceptable to the County of Lethbridge.

(b) There will be no direct access to Highway 25 as stipulated by A.I.T. and the County of Lethbridge.

5. Pedestrian Access to Piyami Coulee

One of the primary amenities of Deer Run Estates is Piyami Coulee and it is anticipated that there will be a strong desire for residents to access this area.

(a) Pathway-like access to Piyami Coulee will be provided at several locations to enable residents more convenient access to the coulee for walking and wildlife viewing.

(b) Such access points would be designated as part of the Environmental Reserve, if the County designates the land

as such or part of the bareland condominium if the land is so designated.

B. Population & Housing Densities

1. The gross site area is 31.67 ha. (78.28 ac.).
2. Projected population for the proposed development is calculated as follows:
   - Block1 - 19 lots @ 3 persons per dwelling unit = 57 persons
   - Block 2 - 4 lots @ 3 persons per dwelling unit = 12 persons
   - Block 3 - 9 lots @ 3 persons per dwelling unit = 27 persons
   - Total Blocks 1, 2, & 3 = 96 persons
3. Population density is calculated as follows:
   - Block 1 - 57 persons/9 ha. (22.2 ac) = approximately 6.3 persons per ha. or 2.6 persons per ac.
   - Block 2 - 12 persons/1.8 ha. (4.4 ac) = approximately 6.6 persons per ha. or 2.7 persons per ac.
   - Block 3 - 27 persons/3.8 ha. (9.4 ac) = approximately 7.1 persons per ha. or 2.9 persons per ac.
4. Housing density is calculated as follows:
   - ◊ Block 1 - 19 homes/9 ha. (22.2 ac.) = 2.1 units per ha. or 0.9 units per ac.
   - ◊ Block 2 - 4 homes/1.8 ha. (4.4 ac.) = 2.2 units per ha. or 0.9 units per ac.
   - ◊ Block 3 - 9 homes/3.8 ha. (9.4 ac.) = 2.4 units per ha. or 1 unit per ac.

C. Development Setbacks

1. In accordance with County of Lethbridge Land Use Bylaw #1211, no part of any building or structure will be located within 53.3 meters (175 feet) of Highway 25.
2. Special standards for setbacks, access and service roads may also be required by A.I.T. or pursuant to the Highway Development Control Regulation.
3. Roads within the new subdivision will become municipal roads and as such, development setback restrictions will be applicable. Therefore, in keeping with the scale of development, minimum

yard development setbacks will be a minimum of 15.2 meters (50 feet) from front property lines and 6.1 meters (20 feet) from side property lines unless otherwise required by the County of Lethbridge.

4. In order to maintain a minimum Factor of Safety for development in relative proximity to steeper slopes present on the site, top-of-bank contour lines have been identified. In addition to these top-of-bank lines, additional parameters have been identified which indicate the maximum limit to which site development may extend. Actual development setbacks may vary somewhat depending on the degree of the slope encountered and the type of development proposed. In no case is it intended that a property line be down-slope of an identified top-of-bank line (Refer to Appendix 4).

IV. Proposed Infrastructure

A. Roadways

1. Site Access & Circulation

   a. The plan area will derive one access point from Highway 25 along the western site boundary which will be designed according to the Alberta Infrastructure Type IIa two-lane highway intersection treatment or as agreed with A.I.T.

   b. When a subdivision application is considered, upon the approval of this area structure plan, the Provincial Subdivision Regulation will require consideration of a service road since the land is adjacent to a primary highway. A service road will not be necessary in this case since there will be no direct access to Highway 25 other than through the intersection indicated above.

2. Road Dimensions

   Local roads will be constructed within a 20 meter right of way. Proposed cul-de-sacs will have a minimum radius of 15 meters. Road dimensions will be adequate to provide for traffic movements and emergency access. Where parking cannot be accommodated on-street, signage will be provided.

3. Road Construction

   Roadway construction will meet or exceed A.I.T. specifications for local (minor) roads. Road cross-sections will provide for drainage by means of ditches or concrete curbs and gutters.

4. Lot Access

   Lots will be accessed by way of an approach or driveway to each individual lot.

B. Servicing

1. Potable Water

   a. Water needs for this development will be best met through the creation of a Water Co-operative

   b. The subdivision will be supplied with potable water via a pressurized, underground, frost protected piping system.

   c. Based on consumption calculations, 10,000 Imperial gallons (45,000 L) of potable water will be required per day (refer to Appendix 5). This corresponds to a daily requirement of 20 units of water at 500 Imperial gallons per unit.

2. Waste Disposal

   a. Sewage

      E.B.A. Engineering Consultants Ltd. conducted an on-site wastewater treatment feasibility assessment for the property in October, 2007 (refer to Appendix 4). The results of the assessment indicate that the surface soils generally satisfy the requirements noted in the *Alberta Private Sewage Systems Standard of Practice (Alberta Municipal Affairs/Safety Codes Council, 1999)* for design and construction of on-site wastewater treatment and disposal systems.

      Installers of on-site wastewater treatment and disposal systems require a private sewage (PS) installer's license from Alberta Municipal Affairs - Plumbing and Gas.

      Private sewage disposal systems are inspected by private inspectors accredited by Alberta Labour.

b. Solid Waste

1. Construction phase

During the construction of homes, builders will be required by the developer to regularly collect and remove construction debris. Efforts will be made to control litter especially that which can be carried off site by the wind. Builders will also be encouraged to recycle materials that can be recycled.

2. Developed subdivision

Landowners will be responsible for their own solid waste disposal and recycling. This may be accomplished in a communal fashion through a home owner's association.

3. Fire Suppression

The County of Lethbridge Fire Chief will review this plan and subsequent subdivision and development applications for adherence to County fire prevention requirements. Deer Run is also within the Town of Picture Butte fire response area. The Picture Butte fire hall is approximately 5 kilometers (3 miles), by paved roads, from the development area. The fire department has a full-time chief but the majority of the firefighters are volunteers. The county has agreements in place with both the Town of Picture Butte and the City of Lethbridge.

4. Storm Water Management

a. Piyami Coulee – Pre Development Flows

Piyami Coulee crosses the subject parcel from the northwest corner to midway along the south boundary. The coulee cuts a 260 to 670-foot (80 to 200-m) wide valley across the parcel. The coulee's main channel is approximately 6 feet (2 m) wide by 4 feet (1.2 m) deep and meanders within the valley. One culvert crossing of the channel exists within the subject parcel to allow access to land east of the coulee.

The section of Piyami Coulee at the south boundary of the subject parcel drains approximately 30 square miles (78

km^2) of upstream land. From a review of County aerial photography, it is observed that the land upstream is primarily agricultural.

Piyami Coulee is part of the L.N.I.D. drainage system, providing the following amenities to the irrigation district:

1. discharge of return water from irrigation to the Oldman River;
2. discharge of water to the Oldman River during annual drawdown;
3. discharge of canal overflows resulting from storm runoff; and
4. as part of the floodway system in the event of overtopping or a breach of the Keho Lake dam

Immediately upstream of the subject parcel, Piyami Coulee crosses under Highway 25 in two 5'-4" (1600-mm) diameter corrugated metal culverts. The next major crossing of the coulee exists approximately 1½ miles (2 km) downstream of the subject parcel. This is a single 8-foot by 8-foot (2.4 by 2.4-m) concrete box culvert which carries the channel through the Canadian Pacific Railway embankment immediately east of Shaughnessy.

No records of any gauges measuring stream flow or water level in Piyami Coulee have yet been located. No written records of flood levels in Piyami Coulee have yet been located. Therefore, estimation of peak flows is difficult. The culverts under Highway 25 have a full-flow discharge capacity of approximately 300 cubic feet per second (8.6 m^3/s). A.I.T. has no record of water levels at this location exceeding the depth of the culverts.

(b) Subject Parcel – Pre-Development Flows

Within the subject parcel, 74.7 acres (30.2 ha) drains directly into Piyami Coulee. An additional approximately 25 acres (10 ha) drains onto the subject parcel from lands to the north and east. In the northeast corner of the site, approximately 3.4 acres (1.4 ha) north of the existing L.N.I.D. canal drains towards the northeast, onto adjacent

property. As it exists, an estimate of the average annual runoff from the subject parcel is 0.8 inches (20 mm).

(c) Effect of Development

When fully developed, the site will likely consist of approximately 7.3% hard surfaces (roads, roofs, driveways). This is predicted to increase average annual runoff to Piyami Coulee by 10% to 0.9 inches (22 mm).

(d) Given the relative size of the upstream catchment versus the size of the parcel and analysis of the channel itself, Piyami Coulee has adequate capacity to discharge the runoff from the subject parcel at full build-out.

The following best management practices are recommended for this development:

1. as much as practical, existing ground should be left undisturbed – particularly along the coulee slopes;
2. where ground is disturbed, erosion and sediment control best management practices will be required;
3. drainage from the developed areas will be routed through ditches to points where it can be discharged onto existing grass and routed as sheet flow down into the coulee; and
4. where concentrated flows are discharged into the coulee, engineered energy dissipaters, channel armour and revetment will be provided to protect against erosion and sedimentation.

(e) Recommended Best Management Practices – Piyami Coulee Crossing

The Piyami Coulee crossing will require an embankment and larger (likely multiple-barrel) culverts. Study of the area indicates that to ensure no overtopping and flooding of the road surface, the culverts must have a rated capacity greater than the capacity of those under Highway 25 (300 cfs or 8.6 m^3/s). The existing farm crossing is not considered adequate in either length or cross-section to be incorporated into a public road crossing of Piyami Coulee. Therefore, this crossing should be removed and the coulee rehabilitated at this point.

A.I.T. best practices for the design and construction of large-diameter ("bridge") culverts (i.e. those greater than 5-foot or 1500-mm diameter) will govern the design and construction of this crossing. The exact location of the crossing will be chosen (during detail design) to minimize disturbance to the channel alignment and floodway while allowing an economical crossing. Engineered channel armour and revetment (using rip-rap or other approved materials) will be provided to protect against erosion at culvert ends. Dissipation of energy at the downstream end of the culvert will be considered in design of channel armour.

C. Public Utilities

1. Electricity

Electrical power is available by means of an overhead power line along the south plan boundary. Arrangements will be made with Fortis Alberta United Inc. for access to this utility. It is the intention of the developer to provide the power supply within the Deer Run Estates from underground lines. Power distribution will normally follow the road network however, detailed design will be determined at the subdivision stage.

It is anticipated that the County of Lethbridge will require power lines to be located within a registered utility easement or right-of-way on each lot, rather than within the road allowance.

2. Natural Gas

Atco Gas has a natural gas line situated at the southwestern corner of the plan area. Gas distribution will normally follow the road network and detailed design will be determined at the subdivision stage as well.

3. Communications

Telephone service is also available along the west property line where a buried TELUS fiber optic cable is located.

D. Policing & Emergency Services

1. Police Service

Policing in the County of Lethbridge is provided by the R.CM.P. which has detachments in both Picture Butte and Lethbridge approximately 5 km. north (3 miles) and 24 km south (15 miles) of the plan area.

2. Emergency Medical Service

The Picture Butte Hospital is approximately 5 km (3 miles) from the plan area while the emergency ambulance service is available through the Town of Picture Butte Emergency Services, which is located approximately 5 km., (3 miles) from the plan area. The County of Lethbridge has an emergency services agreement with the Town of Picture Butte.

E. Postal Service

A location for mail boxes will be situated near the subdivision entrance at on the west of the site if required. Location and other arrangements will have to be made to the satisfaction of Canada Post and the County of Lethbridge. Alternatively, there is postal service available in Shaughnessy and Picture Butte.

V. Subdivision & Development Staging

A. Future subdivisions will comply with the land use concept illustrated on Figure 7 and in accordance with engineering standards acceptable to the County of Lethbridge.

B. Deer Run Estates will be serviced in two stages at the beginning of development. Lots may however be created in a series of subdivisions in response to market conditions which will also influence future phases.

VI. Development Control

A. The developers of Deer Run Estates intend to establish a homeowners association to manage matters of "communal interest" within the Deer Run Estates subdivision.

B. The developers of Deer Run Estates intend to engage a "consulting designer" to assist the developers, the homeowner's association, the County of Lethbridge and prospective lot owners in the

implementation of architectural controls to achieve a consistently high standard of development within the subdivision.

C. Deer Run lot purchasers must apply for development approval according to the process in effect for the Grouped Country Residential Land Use District in the County of Lethbridge Land Use Bylaw #1211.

D. Livestock grazing will not be allowed in Deer Run Estates when residential development has begun however may be allowed to continue until development commences unless otherwise stipulated by the County of Lethbridge.

E. Deer Run Estates is a country residential subdivision only and no commercial land use will be allowed except as provided by existing provisions of the County of Lethbridge Land Use Bylaw.

   a. Home occupations, as defined in Schedule 13 of Land Use Bylaw #1211, may possibly be permitted by the County of Lethbridge in accordance with the rules stipulated for discretionary uses however; such uses will be generally discouraged by the developers and the homeowner's association.

F. No storage of heavy equipment or large trucks will be allowed except during construction.

G. Recreation vehicles, if their owners wish to have them stored within the development, will be required to be placed within the on-site recreational vehicle storage compound when not in use off-site.

VII. Development Agreement

The Developer will enter into a Development Agreement with the County of Lethbridge regarding the following:

A. access and egress to the municipal road allowance along the west side of the development site;

B. road construction;

C. storm water management; and

D. other services or matters considered necessary by the County of Lethbridge.

VIII. Building Control Standards

A. Development Quality

In addition to the technical features noted previously, a basic level of development control will be utilized on individual sites within Deer Run Estates. This is intended to achieve uniform quality and to protect property values within the subdivision.

B. Architectural Controls

Detailed architectural controls will be prepared prior to subdivision then registered as a restrictive covenant on each developable lot title. These controls will provide more substance to general development restrictions as outlined below:

1. Housing Form

   (a) single detached houses, constructed on-site, will be the only dwelling type allowed within the development;

   (b) modular homes, mobile homes and moved-in homes will not be allowed within the development; and

   (c) any garages must be a component of the primary dwelling since free-standing garages will not be allowed.

2. House Size

   Primary dwellings within the subdivision will be required to have a minimum footprint area of 1200 square feet (111.5 m^2).

3. Site Design Features

   (a) House Design

   Residents will be encouraged to work with the developer's design consult in the planning and design of their homes to ensure that a consistent level of development is achieved.

   (b) House Placement

   Residents will be encouraged to work with the developer's design and engineering consults in the siting of their homes to ensure that:

   i. on-site sewage treatment and disposal is compatible with site soil conditions, predicted sewage hydraulic and biological loading and applicable standards;

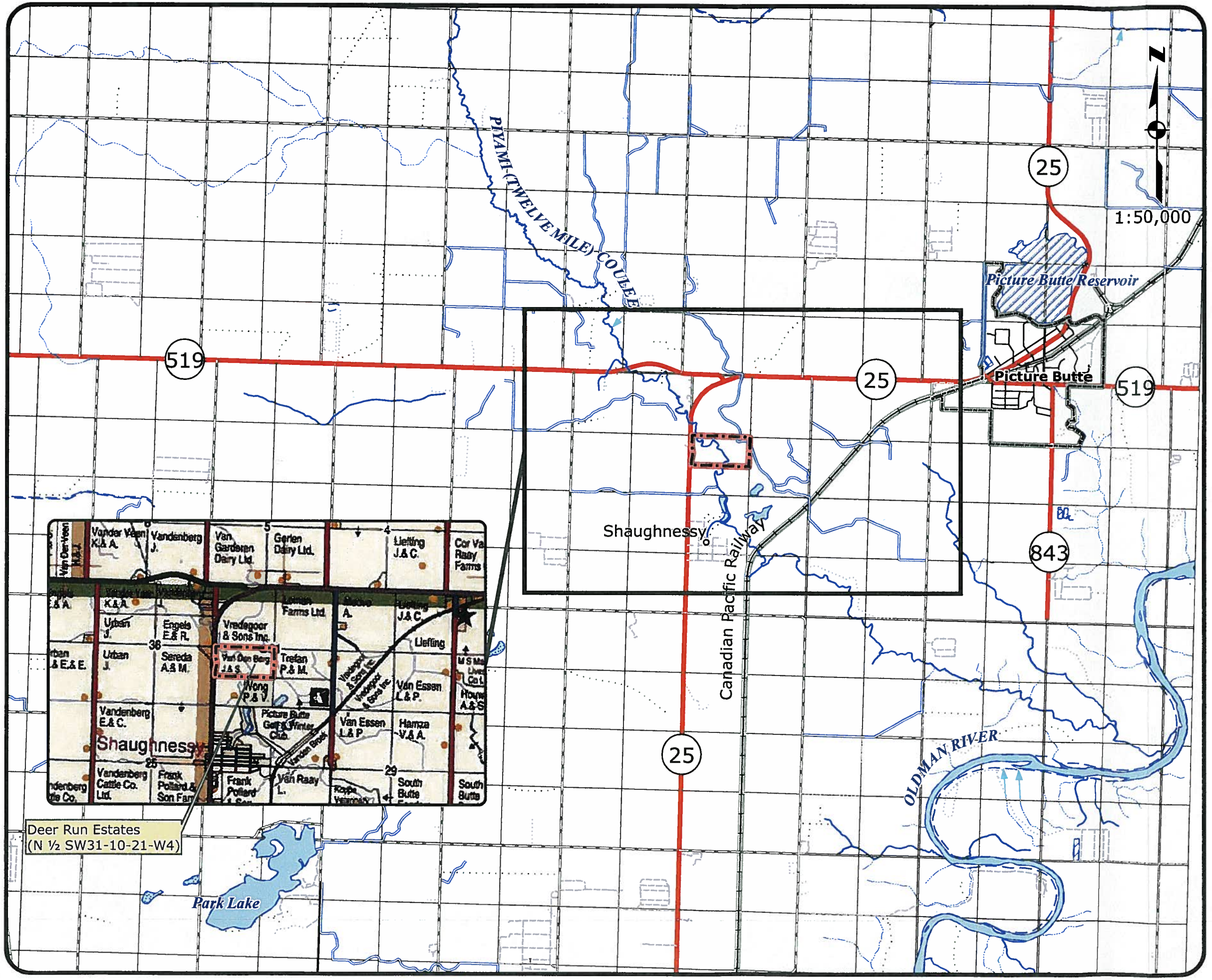
ii. uniform site grading takes place especially for drainage purposes in conformance with the site drainage plan;
iii. driveway locations are optimized;
iv. trees from the existing site nursery are utilized as much as practical;
v. additional landscaping details are coordinated as much as practical; and
vi. owner privacy is optimized.

(c) Accessory Buildings

Only accessory buildings of 100 square feet (9.2 m^2) or less will be allowed subject to the appropriate control guidelines and approval by the County development authority.

4. Building Materials

With the assistance of the developer's design consult, residents will be encouraged to co-ordinate the finishing materials for their homes in order to achieve a unified appearance within the development site.



Deer Run Estates

Area Structure Plan

Figure 1

General Location

Subject Parcel

Town Boundary

Plains West Planning

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Deer Run Estates

Area Structure Plan

Figure 2

Land Ownership

Subject Parcel

Existing Rights-of-way

North Half of SW Quarter of
Section 31, Township 10,
Range 21 West of the 4th Meridian

Owners:
Jurrie Van Den Berg
Susan I. Van Den Berg

Plains West Planning

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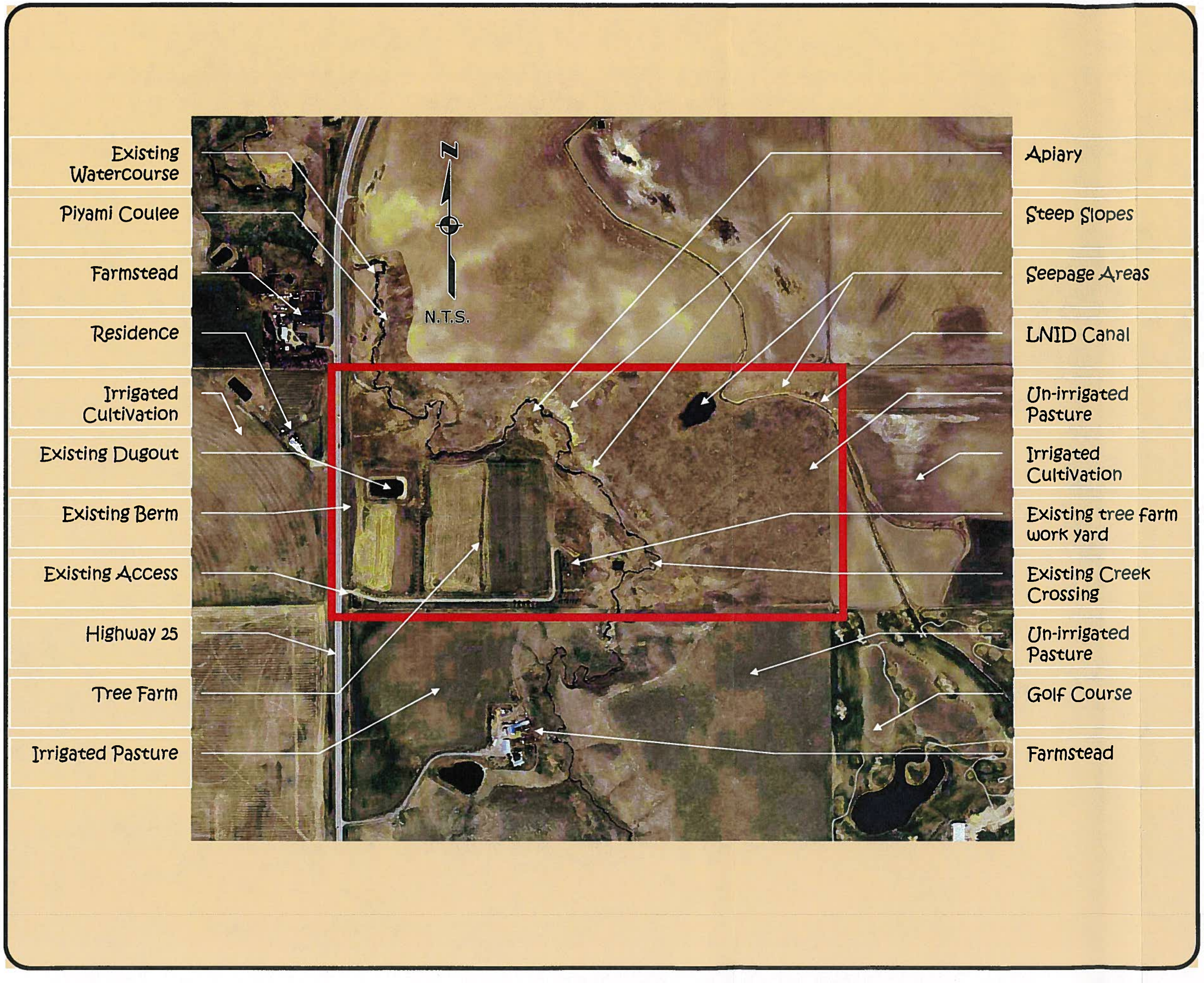
GEOMATIC CONSULTANTS LTD



Deer Run Estates

Area Structure Plan

Figure 3

Existing Land Use

Plan Area

Plains West Planning

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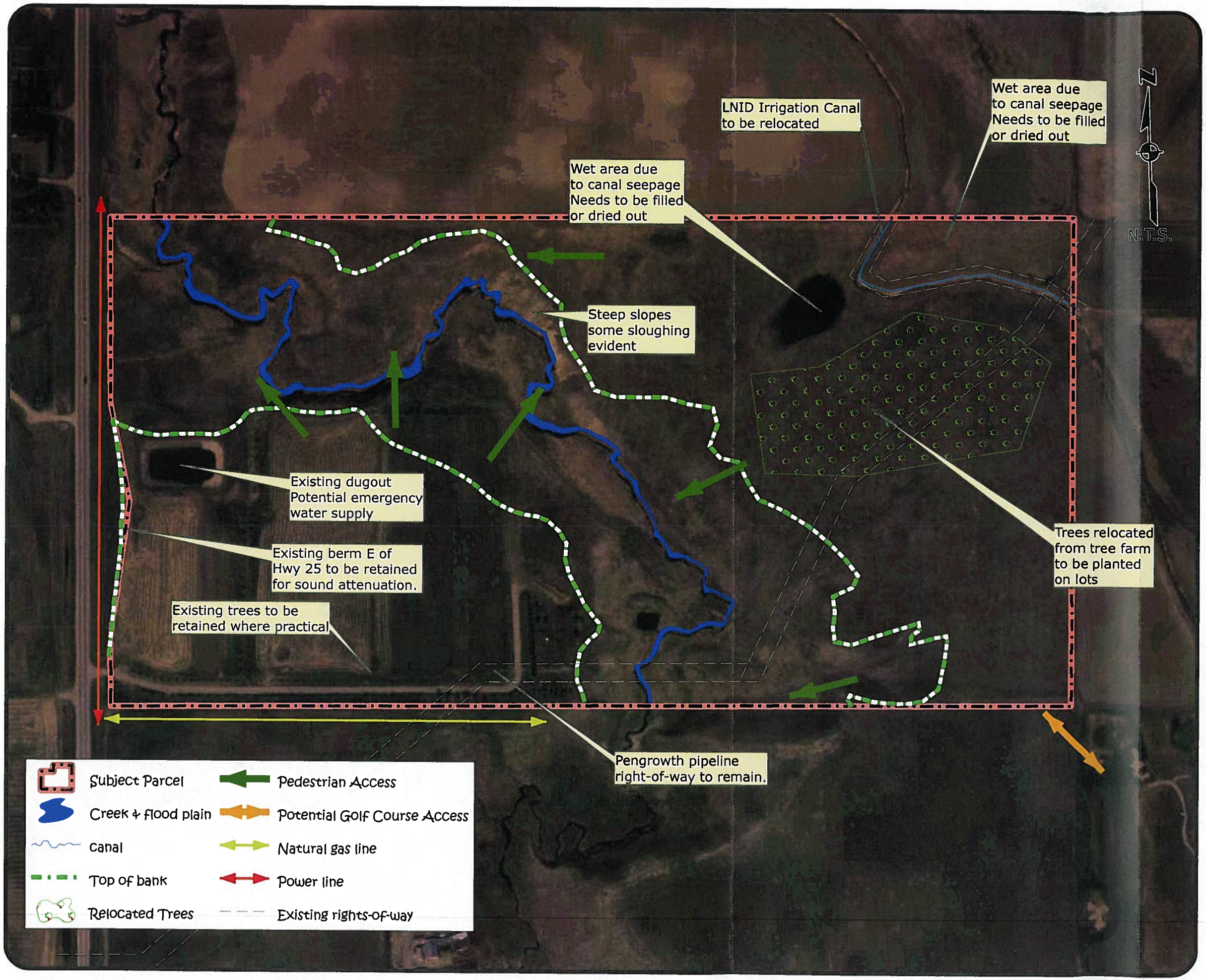

Deer Run Estates

Area Structure Plan

Figure 4

Constraints & Opportunities

Plains West Planning

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Deer Run Estates

Area Structure Plan

Figure 5

Land Use Concept

- Environmental Reserve (ER)
- Public Utility
- Water Supply & Possible RV Parking
- Residential
- Coulee Crossing
- ER Access
- Potential Golf Course Access
- Roads

Plains West Planning

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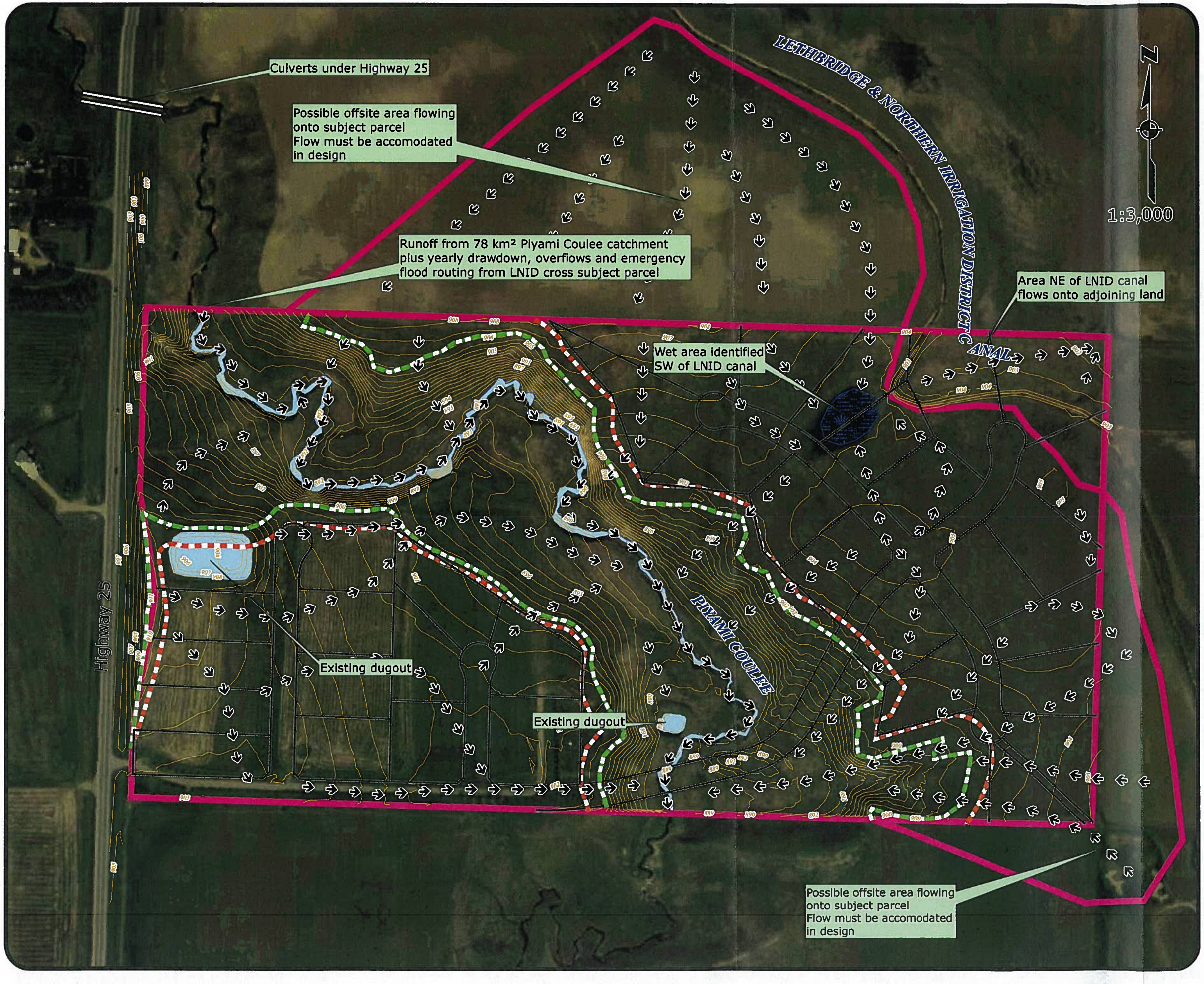

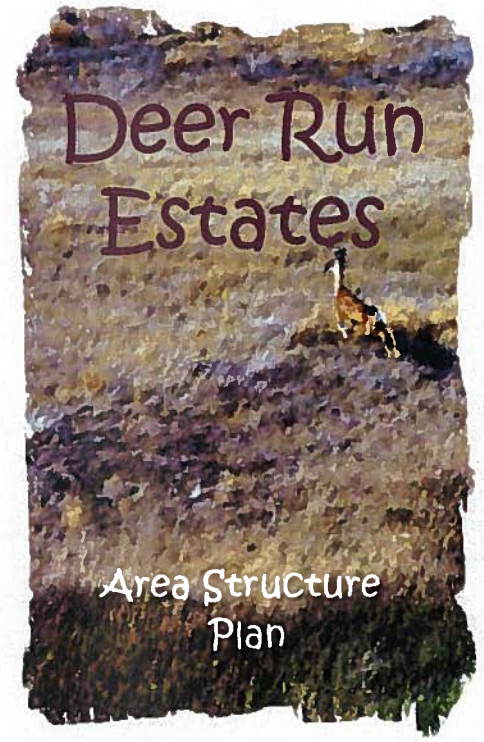

Figure 6

Stormwater Management - Drainage

- Drainage Catchment
- Overland Flow
- Elevation Contour (1-m Interval)
- Slope Setback Line
- Top of Bank
- Potential Lot Line

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D5. Public Hearing Re: By-Law 1291 - Amendment to Land Use By-Law - Porcupine Ridge Estates - N 1/2 of S.W. 31-10-21-W4 - Jurrie & Susan Van Den Berg

222/07 M. OSAKA MOVED that the Public Hearing for By-Law 1291 - Amendment to Land Use By-Law - Porcupine Ridge Estates - N 1/2 of S.W. 31-10-21-W4 - Jurrie & Susan Van Den Berg open at 2:01 p.m.
CARRIED

Reeve Hickey declared the public hearing is being held pursuant to the Municipal Government Act as amended for By-Law 1291 - Amendment to Land Use By-Law - Porcupine Ridge Estates - N 1/2 of S.W. 31-10-21-W4 - Jurrie & Susan Van Den Berg.

Reeve Hickey welcomed the delegation to the meeting at 2:02 p.m. The delegation consisted of:

B. Barnett	G. Van Den Berg	K. Hage	D. Brown
G. Weadick	P. Wong	J. Haarman	V. Nemeleu

Reeve Hickey invited Mr. Nick Paladino, Supervisor of Planning and Development to give an overview of the proposal.

Mr. Paladino, Supervisor of Planning and Development reported that Martin Geomatics on behalf of Jurrie Van Den Berg has submitted an application to reclassify an 80 acre parcel from Rural Agriculture (R-A) to Grouped Country Residential (G.C.R.). A large coulee traverses the property creating two distinct halves of approximately 28.8 acres on the east side and 20.25 acres on the west for a total of 49.05 acres of developable land. This total is for greater than the 20 acre definition of poor agricultural land. First reading was passed on February 14, 2007. The public hearing was advertised in the Sunny South News and neighbours were notified in writing.

Reeve Hickey asked if there were any questions from Council to Mr. Paladino. There were no questions for Mr. Paladino at this time.

Reeve Hickey asked if anyone present would like to speak in favour of By-Law 1291. Mr. Greg Weadick of Martin Geomatics introduced himself to Council and discussed the following:

- Raw water on site;
- City of Lethbridge potable water being used indoors;
- Plan to construct a road way;
- Plan to build a bridge in north east area canal (12 mile coulee substantial distance);
- This is a very poor farming area but good for residential;
- Two almost triangular parcels separated by coulee;
- The large parcel is a Class 6, non-irrigable;
- The balance of two smaller parcels are Land Class 4, restricted irrigable with fresh water (difficult to irrigate and dominant soil is high in clay content, poor quality farm land);
- Access to parcel comes via Hwy 25, adjacent on west side of property which minimizes pressures on County to pave roads:
- Proposed location is one mile from Shaughnessy and close to Picture Butte;
- Potential to provide revenue for County of Lethbridge;
- Proposed portions of 12 mile coulee given to County as environmental or municipal reserve;
- Demand is high for this type of development in the County and there will only be more.

Mr. Weadick introduced Bruce Barnett, Land Surveyor with Martin Geomatics. Mr. Barnett stated the following:

- Martin Geomatic did a good job of utilizing the land in a most productive way for Grouped Country Residential;
- The proposed location is ideal for moving residents together in a community setting;
- 12 mile coulee set aside as reserve land for the County (and benefit to the residents of the community).

Reeve Hickey asked Council if there were any questions for Mr. Weadick or Mr. Barnett.

Council inquired if the North County Water Co-op had been approached for water and if Shaughnessy had been contacted regarding septic water. Mr. Barnett replied that yes, both organizations have been approached.

Council inquired if there are irrigation rights on the land. Mr. Barnett replied that no, it is operated as dry land. Mr. Weadick added that the land is good for a septic field, but not for farming.

There were no further presentations in favour of By-Law 1291.

Reeve Hickey asked if anyone present would like to speak in opposition to By-Law 1291. John Haarman addressed Council and stated that he is representing his son-in-law, an acreage owner to the west. Mr. Haarman stated the following:

- Why do we have to build a 'town' in an agriculture area; communities such as the one proposed should be built near existing hamlets;
- People subdivide in the County and the neighbours end up cleaning up the mess, tar paper and plastic. The County should have a clause for subdividers to clean up the property;
- Where is the County's commitment to agricultural land?

Reeve Hickey asked if anyone else present would like to speak in opposition to By-Law 1291. Mr. Perry Wong confirmed that Council received his letter which states his concerns, specifically drainage and the 'potential' for contamination to the creek that divides the property. Mr. Wong also stated that he was concerned about the walkway to the corner of the golf course and the impact of foot traffic onto his property. Also of concern, Mr. Wong had given the purchaser of the property unlimited access to his water pipeline for their agricultural needs. Since that time, the drainage of excess water has flooded onto his hay field on several occasions.

Reeve Hickey asked if there would be any further presentations regarding By-Law 1291.

There were no further presentations regarding By-Law 1291.

Reeve Hickey thanked the delegation for attending the meeting.

223/07	M. OSAKA	MOVED that the Public Hearing for By-Law 1291 - Amendment to Land Use By-Law - Porcupine Ridge Estates - N 1/2 of S.W. 31-10-21-W4 - Jurrie & Susan Van Den Berg close at 2:39 p.m.	CARRIED
224/07	J. KOLK	MOVED second reading of By-Law 1291.	CARRIED
225/07	M. OSAKA	MOVED third reading of By-Law 1291.	CARRIED.

Reeve

County Manager

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0029 935 435	4;21;10;31;SW	031 179 086

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHIP 10
SECTION 31
THE NORTH HALF OF THE SOUTH WEST QUARTER
EXCEPTING THEREOUT

	PLAN	NUMBER	HECTARES	ACRES	MORE OR LESS
A)	CANAL RIGHT OF WAY	IRR884	0.295	0.73	

B) THE UNCANCELLED PORTION OF ROAD ON PLAN 9411883
CONTAINING 0.402 HECTARES (0.99 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: COUNTY OF LETHBRIDGE

REFERENCE NUMBER: 021 188 157

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
031 179 086	02/06/2003	NOTIFICATION - RD ABAND & CONSOL		

OWNERS

JURRIE VAN DEN BERG

AND
SUSAN I VAN DEN BERG
BOTH OF:
BOX 556
PICTURE BUTTE
ALBERTA T0K 1V0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
741 091 031	27/09/1974	IRRIGATION ORDER/NOTICE THIS PROPERTY IS INCLUDED IN THE LETHBRIDGE NORTHERN IRRIGATION DISTRICT
971 148 209	27/05/1997	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - CANADIAN HUNTER EXPLORATION LTD.. C/O BURLINGTON RESOURCES CANADA (HUNTER) LTD PO BOX 4365, STATION C CALGARY ALBERTA T2T5N2 AS TO PLAN 9710808 (DATA UPDATED BY: TRANSFER OF CAVEAT 021087396) (DATA UPDATED BY: CHANGE OF ADDRESS 031256257)
071 033 689	22/01/2007	CAVEAT RE : AGREEMENT CHARGING LAND CAVEATOR - CANADIAN WESTERN BANK. 744-4 AVE S LETHBRIDGE ALBERTA T1J0N8 AGENT - PATTI FINNERTY.

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF NOVEMBER, 2007 AT 09:04 A.M.

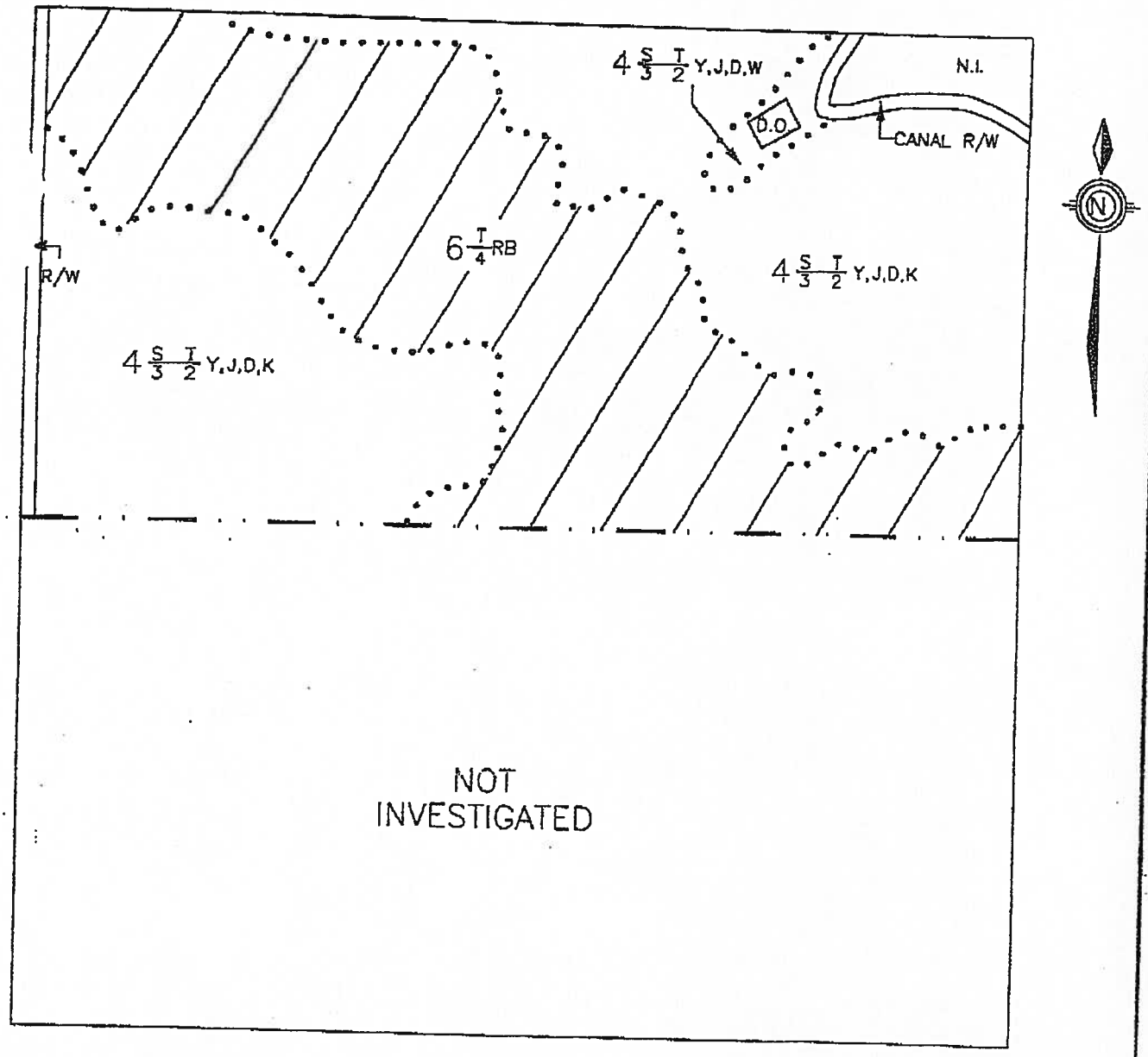
ORDER NUMBER:9876962

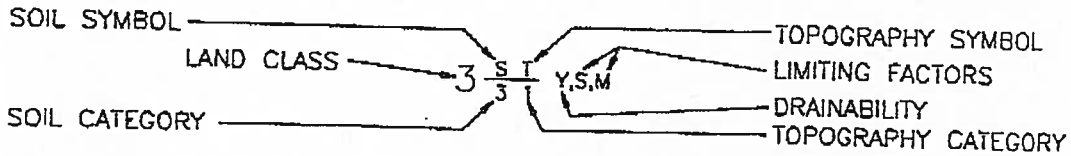
CUSTOMER FILE NUMBER: 070149ce

END OF CERTIFICATE

(CONTINUED)

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).





LEGEND

- INVESTIGATION BOUNDARY
- LAND CLASS BOUNDARY
- FIELD BOUNDARY
- NONIRRIGABLE
- SLOUGH OR WETLAND
- COULEE OR LOW AREA
- DRAINAGE CHANNEL
- FARM IRRIGATION DITCH

F.S.	FARMSTEAD
D.O.	DUGOUT
B.P.	BORROW PIT
D.L.	DISTURBED LAND

GENESIS ENVIRONMENTAL LTD.

LAND IRRIGABILITY CLASSIFICATION

S.W. 31-010-21-4

SCALE 1 : 5 000 | FILE NO. 03-2370

AERIAL PHOTO - AS. 4831 NO. 045

LEGEND

LAND CLASSES

1 - Excellent irrigation capability
2 - Good irrigation capability
3 - Fair irrigation capability
4 - Restricted irrigation capability with freshwater
4 - Nonirrigable with wastewater
5R - Temporarily irrigable, undergoing reclamation
5 - Nonirrigable pending further study
6 - Nonirrigable

SOIL CATEGORIES

1 - Irrigable - Excellent
2 - Irrigable - Good
3 - Irrigable - Fair
4 - Nonirrigable

TOPOGRAPHY CATEGORIES

1 - Irrigable - Gravity
2 - Irrigable - Sprinkler
3 - Irrigable - Special System
4 - Nonirrigable

SOIL LIMITATIONS

A - combination of minor soil limitations
D - low permeability/undesirable structure
E - erosion damage
K - shallow profile development
L - geological layering
M - low moisture holding capacity
N - sodicity
R - shallowness to bedrock
S - salinity
W - excessive wetness

TOPOGRAPHY LIMITATIONS

B - brush/tree cover
F - surface drainage
G - steep slopes
I - periodic flooding
J - field size, shape
P - stoniness
RB - rough-broken
U - earth moving

DRAINABILITY

X - moderately to rapidly permeable
Y - slowly permeable
Z - relatively impermeable

REMARKS

The Class 4 units are suitable for irrigation. The Class 6 unit is not suitable for irrigation due to rough-broken topography. The topography ranges from rolling to steeply inclined with slopes ranging from 2 to 30%. Topographic limitations make this parcel suitable for sprinkler irrigation only.

$4\ \frac{ST}{32}\ Y,J,D,K$	Restricted irrigation suitability due to the small size and irregular shape of the fields (J). The dominant soils are Rego Dark Brown Chernozemic developed on clay loam to silty clay lacustrine. Reduced permeability, due to high clay contents, and shallow profile development (K) are soil limitations in this unit.
$4\ \frac{ST}{32}\ Y,J,D,W$	Restricted irrigation suitability due to the small size and irregular shape of the fields (J). The dominant soils are Rego Dark Brown Chernozemic developed on clay loam to silty clay lacustrine. Reduced permeability, due to high clay contents, and potential ponding (W), due to the lower landscape position, are soil limitations in this unit.
$6\ \frac{T}{4}\ RB$	Nonirrigable due to rough-broken topography.

STATISTICAL SUMMARY (acres, approximately)

Irrigable	41.4
Nonirrigable	34.3
Not Investigated	82.4
Road Widening	1.0
Canal Right-of-Way	0.7
Dugout	0.2

PREPARED [signature], Alberta, [illegible].

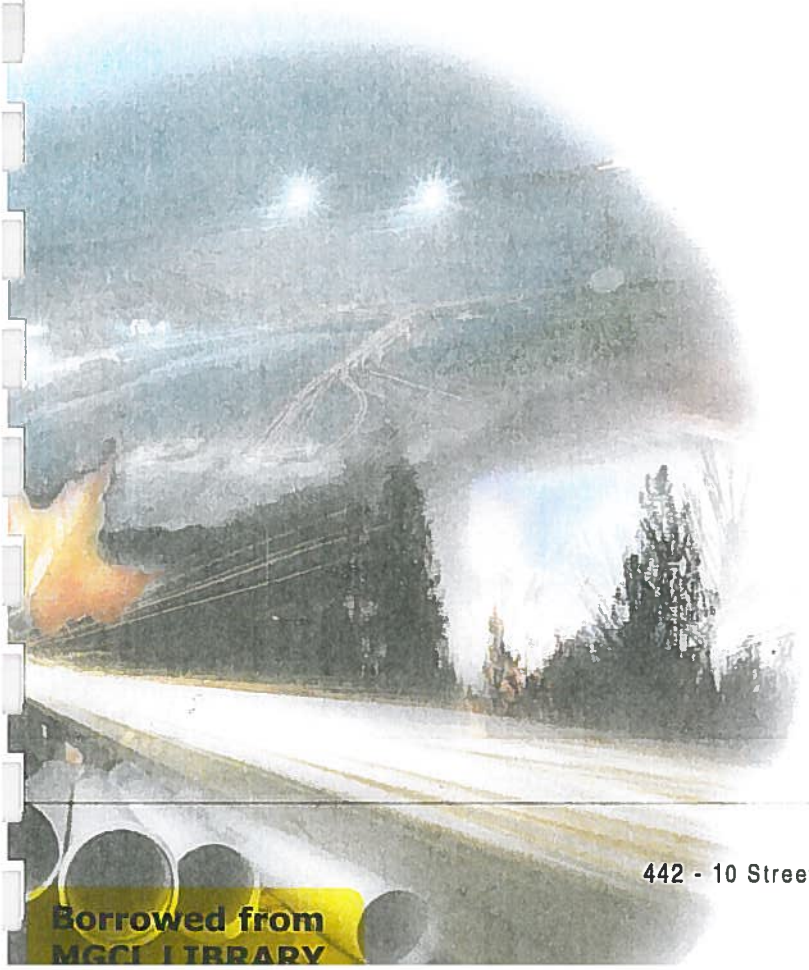
REVIEWED [signature], P. Ag.

LOCATION SW 31-10-21-W4

DATE December 1, 2003

Martin Geomatic Consultants Ltd.

GEOTECHNICAL EVALUATION
DEER RUN ESTATES
COUNTRY RESIDENTIAL SUBDIVISION
COUNTY OF LETHBRIDGE, NEAR SHAUGHNESSY, ALBERTA



L12101170

November 2007

EBA Engineering Consultants Ltd.
p. 403.329.9009 • f. 403.328.8817
442 - 10 Street N • Lethbridge, Alberta T1H 2C7 • CANADA

TRANSMITTAL

TO: Mr. Ed Martin
Martin Geomatic Consultants Ltd.
255 – 31 Street North
Lethbridge AB T1H 3Z4

DATE: December 17, 2007

RECEIVED
DEC 17 2007

C:

FROM: J.A. (Jim) Ryan, P.Eng.
Project Director

FILE: L12101170

PROJECT: Country Residential Subdivision

ENCLOSED: Three copies of our report entitled:

'Geotechnical Evaluation
Deer Run Estates
Country Residential Subdivision
County of Lethbridge, Near Shaughnessy, Alberta'

X	As requested		Mail
	For your information		Courier
	For your approval	X	Hand delivered
	Approved as noted		Pick up

COMMENTS: **Please note that this report replaces the report issued in October 2007 entitled:**

**'Geotechnical Evaluation
Country Residential Subdivision
Shaughnessy, Alberta'**

EBA Engineering Consultants Ltd.
p. 403.329.9009 • f. 403.328.8817
442 - 10 Street N • Lethbridge, Alberta T1H 2C7 • CANADA

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APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by EBA Engineering Consultants Ltd. (EBA) for a proposed Deer Run Estates, Country Residential Subdivision, to be located near Shaughnessy Alberta (County of Lethbridge). It is understood that the results of this evaluation pertaining to safe development setback lines from the defined Top of Bank (Section 6.2.3) will be incorporated into the Area Structure Plan for this subdivision.

The scope of work for the geotechnical evaluation was described in a proposal issued to Mr. Ed Martin, P.Eng., of Martin Geomatic Consultants Ltd. (MGCL) on September 5, 2007 (EBA File PL12101170). The objective of this evaluation was to determine the general subsurface conditions in the area of the proposed development and to provide geotechnical recommendations, specifically with respect to development setback distances from the slopes within and adjacent to the subdivision as well as the suitability of the site soils for septic field disposal of residential wastewater. It is understood that an additional geotechnical evaluation will be requested at a later date to address geotechnical issues with respect to the general subdivision development pertaining to foundations, grading, roadways, utilities, etc.

Authorization to proceed with this evaluation was provided by Mr. Martin.

2.0 PROJECT DETAILS AND SCOPE OF WORK

The legal land description of the property is a portion of SW ¼ Section 31-10-21-W4M, located east of Highway 25, within the County of Lethbridge, near Shaughnessy, Alberta. The property to be developed is shown on Figure 1 (a recent aerial photograph), including a preliminary subdivision concept provided by MGCL. Within the central area of the property are slopes leading down to a small creek within the floor of the valley.

It is understood that the proposed subdivision concept will include approximately 34 country residential lots, as shown on Figure 1. It is understood that the final lot layouts and road accesses will incorporate the development setback distances from the top of bank of these slopes as recommended in this report. The report also includes a preliminary assessment of the feasibility of septic disposal fields which are under consideration for the subdivision.

The work scope for this evaluation consisted of a slope stability assessment, including the installation of four (4) geotechnical boreholes, as well as four percolation test locations (for the assessment of the feasibility of septic disposal fields). A laboratory program was completed to assist in classifying the subsurface soils and this report provides the following geotechnical recommendations.

- Recommendations for development setback considerations, in consideration of the slope stability evaluation completed by EBA.

- Recommendations for the feasibility of septic disposal fields.

3.0 SITE DESCRIPTION

As part of the assessment, a detailed site reconnaissance was carried out by Mr. Jim Ryan, P.Eng., of EBA. The reconnaissance included a visual assessment of the slopes and property at the crest and toe of the slopes. The following pertinent points were noted.

The current surface condition of the property is shown on Figure 1, presented on a relatively recent aerial photograph. The property was noted to be divided into two separate portions at the time of fieldwork, as the property is bisected by a creek valley running from northwest to southeast. This drainage system (creek) includes a culvert underlying Highway 25 to the west.

To the north of the valley, the property comprises moderately undulating agricultural lands (Figure 1). Within the northeast corner of the property is an existing irrigation canal (LNID). Based on EBA's current knowledge of the proposed subdivision, it is understood that the LNID IRR land will be bought by the developer and the existing canal will be rerouted outside of the subject property.

To the south of the valley, much of this area is occupied by a tree farm area, with an even slope to the northeast, and several narrow gravel surfaced roads. Within the northwest corner of this south area, south of the creek, is an existing raised wet pond area. There appears to be a pipe outlet from the pond which discharges into the creek to the northeast. It is understood that this pond will be retained and used for irrigation and fire suppression.

Based on EBA's knowledge of this property's history, it is understood to have been utilized mainly for agricultural purposes such as crop cultivation or pastureland. The ground surface Geodetic Elevation (Elevation) is depicted on an elevation contour plan provided to EBA by MGCL, indicating drainage towards the valley.

As noted, the site is bisected by a creek valley drainage system. The topography of the slopes was taken from the topographic elevation contours received by EBA from MGCL. The crests of the valley slopes (Top of Bank) have been derived from these contours and confirmed by field site reconnaissance and are shown on Figure 1. It is noted that the 'Top of Bank' is defined as the point where the general trend of a slope changes from greater than 15 percent to less than 15 percent and remains at less than 15 percent.

Cross Sections A-A' through E-E' are shown on Figure 2, to present a general impression of the valley slopes and valley depth. The valley depth appeared to vary between approximately 10 m and 13 m, with variable valley slope profiles. As shown on Section A-A', to the northeast of the pond, the valley slope is relatively steep, in the order of approximately 1.0 horizontal to 1.0 vertical. This section of slope is being actively eroded by the creek and active slumping was noted at the time of fieldwork as well as tension cracking along the slope crest. Further to the east (Sections B-B' and E-E'), the south valley

slopes are shallower, in the order of 3.0 to 5.0 horizontal to 1.0 vertical. These shallower slopes were surfaced with grasses, with no evidence of recent slope instability.

Along the north valley slopes, in the extreme north area of the site, steep slopes were also noted (Section D-D'), in the order of 2.0 horizontal to 1.0 vertical, with some sections noted to be somewhat steeper. The clay soil face is exposed along this section of slope and although the creek is not actively eroding the slope toe at the time of reporting, it is expected that this may occur at times of heavy creek flow. Further to the east (Section C-C'), the north valley slopes are shallower, in the order of 3.0 to 4.0 horizontal to 1.0 vertical. These shallower slopes are surfaced with grasses, with no signs of recent slope instability.

As part of the slope stability assessment, EBA reviewed aerial photographs of the site taken between 1950 and present day. Based on the photographs, little evidence of slope instability was noted, with the exception of shallow slope face failures in the northwest area of the site due to creek toe erosion (Section A-A') and very minor slope face slumping in the area of Section D-D'. The site appears to have been historically undeveloped, except for the pond located in the northwest corner of the site and the irrigation canal in the northeast corner of the site.

4.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for the geotechnical evaluation for the proposed residential development was carried out on September 21 and 25, 2007 using a truck mounted drill rig contracted from Reclamation Wellsite Services & Leasing Ltd. of Lethbridge, Alberta. The rig was equipped with 150 mm diameter solid stem continuous flight augers. EBA's field representative was Mr. Jackson Meadows. The location of buried utilities was first carried out through Alberta First Call.

Four boreholes were drilled near the top of bank areas, to depths varying between approximately 10.7 m and 18.8 m below ground surface (Boreholes (BH)001 through BH004). The borehole locations are depicted on Figure 1.

In all of the boreholes, disturbed grab samples were obtained at 600 mm intervals. The Standard Penetration Test (SPT) was generally carried out at depth intervals of 1.5 m in BH001 and BH002. All soil samples were visually classified in the field and the individual soil strata and the interfaces between them were noted. The borehole logs are presented in Appendix B. An explanation of the terms and symbols used on the borehole logs is also included in Appendix B.

Slotted 25 mm diameter PVC standpipe was installed in all of the boreholes in order to monitor the groundwater level at each location. Auger cuttings were used to backfill around the standpipes and they were sealed at the ground surface with bentonite chips.

The locations of the boreholes were initially selected based on the proposed subdivision layout shown on Figure 1 (provided by MGCL). The Geodetic Elevations of the existing ground surface at the borehole locations were subsequently estimated by EBA based on the

elevation contours, also shown on Figure 1. The borehole elevations are indicated on the borehole logs.

Classification tests, including natural moisture content, Atterberg Limits, and soluble sulphate content were subsequently performed in the laboratory on samples collected from the boreholes, to aid in the determination of engineering properties. The results of the laboratory tests are presented on the borehole logs in Appendix B.

The drilling program also included four percolation testholes (200 mm diameter) drilled to depths of approximately 900 mm (P001, through P004) adjacent to the respective borehole locations, on September 25, 2007. The locations of these boreholes are also shown on Figure 1 and the testhole logs included in Appendix B of this report.

The percolation test conducted at each location included half filling the percolation testhole with water and allowing the testhole to saturate for a period of approximately 24 hours. On September 26, 2007, the percolation holes (P001 through P004) were refilled with water to approximately 0.45 m below existing ground surface and maintained at 0.45 m below existing ground surface for 2 hours. Commencing directly after this, the subsidence of the water was measured versus time by EBA (refilling to the same level every 30 minutes and measuring the drop in water level). The results of the percolation testing are discussed in subsequent sections of this report.

5.0 SUBSURFACE CONDITIONS

5.1 GENERAL

The subsurface stratigraphy of the prairie levels of the property generally comprises topsoil overlying deposits of lacustrine clay, overlying a glacial deposit of clay till. Specific details of the stratigraphy encountered at each borehole location are presented on the borehole logs and are discussed in this section.

It should be noted that geological conditions are innately variable. Glacial deposits in particular are seldom spatially uniform. At the time of preparation of this report, information on subsurface stratigraphy is available only at discrete borehole locations. In order to develop recommendations from the information, it is necessary to make some assumptions concerning conditions other than that at borehole locations. Adequate monitoring should be provided during construction to check that these assumptions are reasonable.

5.2 SOIL CONDITIONS

In general, the site was surfaced with prairie grasses at the time of the fieldwork. The topsoil thickness across the property was generally determined to be approximately 100 mm. However, brown stained inorganic clay (B Horizon) is quite common in this area, underlying the topsoil for an additional depth of 100 mm to 150 mm. In addition, wind blown topsoil deposits of greater thickness may exist in areas downwind of topographic high areas. Variable thickness of topsoil should be expected across the site.

Below the topsoil layer, surficial deposits of lacustrine clay were encountered at the borehole locations to typical depths below ground surface varying between 2 m and 5 m. The clay was described as silty, with some sand to sandy, damp, medium plastic, and very stiff in consistency. Trace sand lenses were noted throughout the clay layer.

Standard Penetration Tests (SPT) values within the lacustrine layers ranged between 23 and 29 blows per 300 mm penetration, indicating a very stiff consistency.

One of the unique characteristics of the cohesive lacustrine deposit is a tendency to swell with increasing moisture content. The results of Atterberg Limit testing (one test) carried out on a surficial clay soil sample indicated a Plastic Limit of 12 percent and a Liquid Limit of 48 percent, indicative of medium plasticity. Therefore, based on the limited testing conducted, the clay has a moderate swelling potential due to its plasticity as well as its existing, variable moisture content, which varied between 6 and 18 percent on random samples retrieved.

Underlying the lacustrine layer, glacial clay till was encountered at the borehole locations and extended to the full depths penetrated. The clay till was silty, with some sand, a trace of gravel, damp to moist near surface, becoming moister with depth, medium plastic, and stiff to very stiff in consistency. Occasional thin sand lenses, sand layers, and high plastic clay layers were noted within the clay till, as well as coal and oxide specks. The results of Atterberg Limit testing (three tests) carried out on clay till soil samples indicated Plastic Limits of 11 to 13 percent and Liquid Limits of 40 to 46 percent, indicative of medium plasticity. Moisture contents, taken on random clay till samples, typically varied between 9 percent and 19 percent. Standard Penetration Tests (SPT) values within this layer ranged between 17 and 41 blows per 300 mm penetration, indicating a very stiff to hard consistency.

High plastic clay layers were encountered within the clay till deposit. At depths below grade of approximately 9 m to 13 m, high plastic layers within the clay till were found at all four borehole locations. Atterberg Limit testing (one test) carried out on a representative sample within this zone (BH001 at a depth of 10 m) indicated a Plastic Limit of 22 percent and a Liquid Limit of 92 percent, indicative of high plasticity. In addition, soil moisture contents within this zone were elevated, up to 23 to 39 percent.

Bedrock was not encountered during this evaluation and is expected to be well below the base of the valley elevation.

It is noted that the areas in close proximity to the pond and the canal were not evaluated at this time. It should be noted that wetter soil conditions should be expected in close proximity to these features.

A more complete description of the subsurface conditions encountered at the borehole locations is provided on the borehole logs presented in Appendix B.

5.3 GROUNDWATER CONDITIONS

Seepage and sloughing was generally not encountered at the boreholes during the borehole drilling program. The groundwater level was measured within the standpipes approximately 7 days following drilling. The following table summarizes the groundwater monitoring data.

Borehole Number	Depth of Standpipe (m)	Ground Elevation of Borehole (m)	Groundwater Monitoring Data	
			Depth to Groundwater (m)	Elevation of Groundwater (m)
001	18.8	902.2	dry	--
002	18.8	902.2	dry	--
003	10.7	903.4	dry	--
004	10.7	901.8	dry	--

It should be noted that groundwater levels will fluctuate seasonally and in response to climatic conditions and may be at a different depth when construction commences. Groundwater levels should be monitored periodically prior to development. The intent is to provide an early indication of dewatering requirements during excavation for foundations or utility trenches. The above-noted groundwater levels have also been considered in the stability analysis of the subject slopes.

Further comments regarding groundwater issues are provided in subsequent sections.

6.0 GEOTECHNICAL RECOMMENDATIONS

6.1 GENERAL SUBDIVISION DEVELOPMENT CONSIDERATIONS

Specific geotechnical discussion and recommendations that apply to this project are provided for general feasibility of site development and lot grading, development setback distance recommendations as well as restrictions in consideration of the adjacent slopes, as well as the feasibility of septic disposal fields.

Other development issues such as groundwater issues, trench excavation and backfill for underground utility shallow footings and basements, concrete type and pavement structures were not included in the work scope of this evaluation. It is understood further geotechnical assessments will be conducted at a future date, once the final plans for the subdivision are completed.

For general development consideration, the initial topsoil stripping depth is of particular importance. For such a development, following removal of the surficial organic topsoil, the majority of any underlying B Horizon layer (organic stained, but essentially inorganic clay) can likely remain in place during site stripping and incorporated into the fill mass during general site grading. It is important to note that based on the proposed stripping methodology (i.e. equipment usage) the thickness of stripping may vary. The method of

stripping should therefore be taken into account when determining stripping volumes. In addition, monitoring by geotechnical personnel to ensure approved subgrade materials are stripped to may reduce the risk of over stripping volumes due to excavation methodology.

Subgrade preparation is required in all subdivision development areas as well as all paved areas to City of Lethbridge Standards (or equivalent). This includes stripping of topsoil and deleterious soil materials, scarification and moisture conditioning and compaction.

The native clay and clay till soils should be adequate for site grading purposes, provided they are acceptably moisture conditioned to reduce the swelling potential of the clay soils and to achieve the compaction standards recommended. Proof-rolling within roadways to detect soft areas is also recommended.

Conventional excavation trench cuts should be feasible for most areas of the site, provided the trenches are cut back for stability in accordance with Occupational Health and Safety, with little groundwater seepage expected.

An adequate level of monitoring is recommended during construction and all construction should be carried out by suitably qualified contractors, experienced in foundation and earthworks construction. For earthworks, an adequate level of monitoring is considered to be full-time monitoring and compaction testing.

All such monitoring should be carried out by suitably qualified persons, independent of the contractor. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

Recommendations with respect to the slopes are provided in the following section.

6.2 SLOPE STABILITY EVALUATION

EBA's slope stability evaluation for this project comprised an analysis of the present stability of the slopes abutting the upland plain of the subject site, an analysis of the impact of development on the stability of the slopes and an analysis of the impact of any potential slope instability on the development, i.e. setback requirements. These aspects are detailed in the following sections. The minimum Factor of Safety (FS) used to determine the setback requirements was 1.5. This FS is typically used for developments of this nature and is considered to be the current state of practice in this area.

6.2.1 Present Slope Stability

The present stability of the slopes of this study has been evaluated based on site reconnaissance and analytical techniques for circular and block failures.

Visual observations of the slopes in the project area indicate the slopes are currently "meta-stable", as evidenced by a lack of recent slope instability (air photo review) (i.e. Factor of Safety of 1.0 or slightly higher). The exception includes the area of Profile A-A', where the slope is currently experiencing ongoing creeping and slumping (i.e. Factor of Safety of 1.0

or slightly less). The mechanism of failure in this area appears to be ongoing toe erosion by the creek, possibly contributed to by overland water flow.

Soil strength parameters assumed by EBA were based on the results of moisture content and Atterberg Limit tests conducted by EBA on soil samples recovered from the development site and from EBA's experience on other sites in this area within similar deposits. Groundwater conditions (pore pressure parameters), reasonably expected from the data collected in the fieldwork, laboratory program, and from information reviewed from past site studies were then selected by EBA to satisfy the observed conditions.

The soil strength and groundwater parameters selected for the analyses, modelling current conditions (pre-development), are as follows. The soil profile is taken from ground surface to below the base of the slopes being analyzed.

- Material: Lacustrine Clay Deposit and Clay Till

Unit Weight:	18 kN/m^3
Cohesive Intercept c':	10 kPa
Friction Angle ϕ':	27°
Pore Water Pressure Parameter r_u =	0.1

- Material: High Plastic Clay Zone at Depth of 10 m to 13 m

Unit Weight:	18 kN/m^3
Cohesive Intercept c':	10 kPa
Friction Angle ϕ':	19°
Pore Water Pressure Parameter r_u =	0.2

The current stability of the slopes adjacent to the project site has been evaluated by means of limit equilibrium analyses conducted on five cross-sections of the slope (Sections A-A', B-B', C-C', D-D', and E-E'. The slope profiles for the cross-sections were taken from topographic elevation data provided to EBA by MGCL. Figure 1 depicts the location of the five cross-sections and the slope profiles and stratigraphic cross sections are shown on Figure 2.

Slope stability analyses on the cross-sections, using the above parameters, indicate that the existing slopes are "meta-stable". Factors of Safety for shallow slope face failures are close to 1.0 for the steeper slopes and slightly higher than 1.0 for shallower slopes. With respect to moderate depth instability affecting the slope crests, the factor of safety varies between 1.0 and 1.4. From this analysis, it is confirmed that theoretical slope failures which exit the slope just above creek level, founded on the high plastic clay zone at this elevation, appears to be the governing slope failure mechanism for the slopes of this study, in addition to relatively shallow slope face failures.

6.2.2 Impact of Development on Slope Stability

The relatively steep valley slopes in this area rely upon low degrees of soil saturation for stability. Any increase in the level of soil saturation reduces the stability of the slopes.

Development of the site will bring about changes in the factors which contribute to the present stability of the slopes. Evaporation of soil moisture will be reduced by the presence of ground cover such as buildings and roadway structures. Irrigation and possible leakage of water from underground utilities and septic disposal fields will increase the amount of water infiltrating the site subsoils. This combination of reduced evaporation of subsoil moisture and increased infiltration of water to the subsoils is considered to be the most significant influence of development on the factors that contribute to the present stability of the slopes. Increasing soil moisture content produces a reduction in the total cohesion as the apparent cohesion is reduced or lost and an increase in the pore pressure ratio reduces the effective stress. The result is a corresponding decrease in the factor of safety.

For post-development stability analyses, the pore pressure parameter r_u was revised to suit anticipated increases in soil moisture and a reduction in the cohesion in the upper till. Specifically, for the stability analysis of worst case post-development conditions, the cohesion in the upper till layer and the high plastic clay zone was revised to 0 kPa and the r_u value was revised to 0.20 and 0.30, respectively.

The results of the stability analyses, assuming the development setback line as presented in this report, using the revised soil and groundwater parameters, have confirmed a minimum Factor of Safety of 1.5 for slope failures affecting the development setback line.

6.2.3 Recommended Development Guidelines

The 'Top of Bank'[1] for the property is shown on Figure 1, as determined by EBA during the field reconnaissance and from interpretation of the elevation contours provided. For post-development conditions, the recommended 'Development Setback Line'[2] is also as shown on Figure 1. The setback distances typically vary between 6 m from top of bank adjacent to the shallowest slope areas to 15 m from Top of Bank adjacent to the steepest slope areas. Generally, the development setback distances have been determined by establishing a point within the property which results in a minimum factor of safety of 1.5 against slope instability. The exceptions are where a minimum setback distance of 6 m is recommended from top of bank in order to allow access to the top of bank area after the subdivision (for fire access and slope access, etc.). This is also considered to be standard practice in this area.

---

1 Top of Bank: means the line where the general trend of the slope changes from greater than 15 percent to less than 15 percent, as determined by field survey.

2 Development Setback Line: established by survey which subsequently is registered on a plan of subdivision which determines the extent of development in relation to the Top of Bank.

In summary, the recommended development setback lines presented in Figure 1 are based on the analysis techniques described in the preceding sections. The setback distances have also been transitioned along the perimeter of the slope, based on three dimensional effects. It is recommended that the development setback lines be established by field survey given the setback distances determined by the topographic model derived for this site by EBA. EBA should then be contacted to review and confirm the location of the development setback line prior to any development of the proposed land.

Precautionary measures which should be included in the design of the proposed development (with respect to slope stability issues) are outlined as follows:

- The development setback line should be established as the rear property line for the lots in each case.
- Any fill excavated from the basements or from regrading of the site should not be disposed of within the development restriction zone unless directed otherwise after a review by the project geotechnical engineer. The development restriction zone is the area of land between the development setback line and the top of bank and the slope faces themselves.
- Positive grading should be provided, to keep drainage away from the slopes as far as practical. In no case should concentrated drainage flow be allowed down the slope without review by qualified personnel.
- All utilities and plumbing should be carefully installed and inspected to ensure they are in good working order.
- Irrigation within the restrictive development zone should be prohibited. Automatic sprinkler systems for the properties should also be prohibited.
- Any outdoor swimming pool or similar water retention structure constructed residential should be designed such that any leakage can be collected and diverted to a sump for disposal. A granular drainage layer with an underlying impervious barrier graded toward a sump would generally be suitable. Details of such systems should be reviewed by a qualified geotechnical engineer prior to construction.
- Normal, prudent design and construction procedures should be followed during development.
- The development recommendations of this geotechnical report should be closely adhered to.

The upper coulee slopes should be treated as a restricted development zone. This involves:

- No excavation on the valley slope without review by a geotechnical engineer.
- No clearing of vegetation.
- No fill to be placed on the crest of the slopes.

- No water is to be discharged on to the slope faces, including septic field discharge.
- Maintain vegetation cover along the crest and on the slope.

Notwithstanding the setback distances recommended, some sloughing and slope movements may occur. The development may result in a general increase in the degree of saturation of the site subsoils which may cause minor sloughing of the top portion of the slope. The setback distance is not intended to prevent failure of the slope but rather to prevent such failures from directly affecting developed areas of the site.

6.3 SEPTIC DISPOSAL FIELDS

6.3.1 Percolation Test results

The following table provides the results of the field program and percolation test results.

Percolation Test	BH Location	Subsurface Stratigraphy (0.3 m to 0.9 m)	Percolation Test Result (min/cm)
P001	BH001	Clay, silty, some sand to sandy, damp, medium plastic, very stiff, brown	16
P002	BH002	Clay, silty, some sand to sandy, damp, medium plastic, very stiff, brown	3
P003	BH003	Clay, silty, some sand to sandy, damp, medium plastic, very stiff, brown	3
P004	BH004	Clay, silty, some sand to sandy, damp, medium plastic, very stiff, brown	4

6.3.2 Septic Disposal Field Design

The Safety Codes Council's, Alberta Private Sewage Systems Standard of Practice 1999, states that a subsurface effluent disposal system that uses the absorption of effluent into the soil for treatment and disposal, should absorb the effluent into the soil at a rate of:

- not faster than 5 minutes per 2.5 cm (2 minutes / cm); and
- not slower than 60 minutes per 2.5 cm (24 minutes / cm),

as determined by a percolation test. In addition, the natural separation between the point of effluent infiltration into the soil and the groundwater should be a minimum of 1.5 m.

The percolation test results ranged between 3 and 16 minutes/cm. These results indicate that the surface soils for design and construction of septic disposal fields generally satisfy the requirements of the Safety Code Council's guidelines.

Groundwater was not encountered within the standpipes installed during the geotechnical evaluation above depths of 10 m. Therefore, it is considered that the phreatic surface is generally a minimum 1.5 m below the disposal field elevations, which satisfies the Safety Codes Council guidelines.

Based on the results of this assessment, the use of septic disposal fields for the country residential developments is generally considered feasible. However, it is noted that the specific site selection of the proposed fields needs careful consideration by the septic field installer to satisfy the requirements of the Regulator Having Jurisdiction (Municipality, AENV, Alberta Labour). This requirement is in accordance with the provincial regulations, which state that two percolation tests are required within the final footprint of the field by the installer with tests results satisfying the recommended percolation limits. Following the site-specific testing, the septic disposal field should be designed and sized accordingly by the disposal field designer or alternate disposal system considered where the native soils are not considered suitable. It is further recommended that the design footprint of the residences be determined once the final disposal field is selected, to ensure the appropriate gravity flow or pumping requirements are satisfied.

During installation of the weeping trenches, the installer should pay close attention to the soil conditions encountered, to define the extent of any silt or sand pockets (areas subject to faster percolation rates) or medium plastic clay till (areas of slower percolation rates). These should be immediately reported to the disposal field designer for review prior to completion of the septic disposal field.

The information provided herein is intended to be a preliminary assessment of the feasibility of septic disposal fields for the proposed residential lot developments as per the provincial regulations. Site specific municipal regulations or septic field siting requirement guidelines with respect to the local health unit, if applicable, have not been addressed.

7.0 DESIGN AND CONSTRUCTION GUIDELINES

Recommended general design and construction guidelines are provided in Appendix C, under the following headings.

- Construction Excavations
- Backfill Materials and Compaction
- Proof-Rolling

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that these guidelines will be followed. The design and construction guidelines are not intended to represent detailed specifications for the works although they may prove useful in the preparation of such specifications. In the event of any discrepancy between the main text of this report and Appendix C, the main text should govern.

8.0 REVIEW OF DESIGN AND CONSTRUCTION

EBA should be given the opportunity to review details of the design and specifications, related to geotechnical aspects of this project, prior to construction.

Pond construction should be monitored by qualified geotechnical personnel during construction. EBA will provide these services, if requested.

9.0 LIMITATIONS

Recommendations presented herein are based on a geotechnical evaluation of the findings in four geotechnical boreholes, four percolation testholes, historical air photo review, site reconnaissance, and a slope stability evaluation. The conditions encountered during the fieldwork are considered to be reasonably representative of the site. If, however, conditions other than those reported are noted during subsequent phases of the project, EBA should be notified and given the opportunity to review our current recommendations in light of new findings. Recommendations presented herein may not be valid if an adequate level of monitoring is not provided during construction.

This report has been prepared for the exclusive use of Martin Geomatic Consultants Ltd., and their agents, for specific application to the development described in Section 2.0 of this report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No warranty is either expressed or implied.

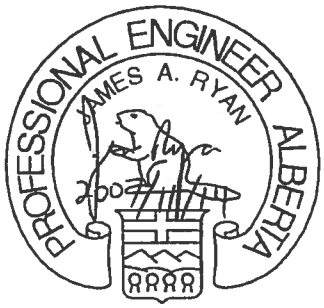
For further limitations, reference should be made to the General Conditions in Appendix A of this report.

10.0 CLOSURE

We trust this report satisfies your present requirements. We would be pleased to provide further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents. Should you require additional information or monitoring services, please do not hesitate to contact our office.

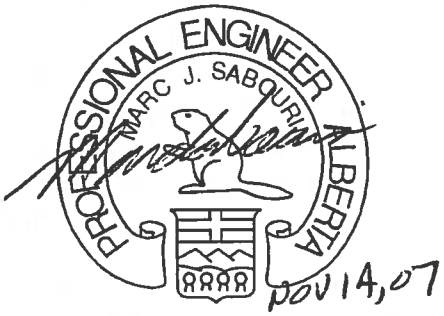
Respectfully submitted,
EBA Engineering Consultants Ltd.

Prepared by:



J.A. (Jim) Ryan, M.Eng., P.Eng.
Project Director

Reviewed by:



Marc J. Sabourin, P.Eng.
Senior Project Director

/cld

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.

Signature _____

Date November 14, 2007

PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

FIGURES

LEGEND

- BH# BOREHOLE LOCATION
- P# PERCOLATION TESTHOLE LOCATION
- A A' CROSS SECTION
- TOP OF BANK
- DEVELOPMENT SETBACK LINE
- FENCE LINE

0 50 100m

1:2500

\\sharepoint\L\12101170\L12101170 site plan.dwg

CLIENT

Martin Geomatic Consultants Ltd.

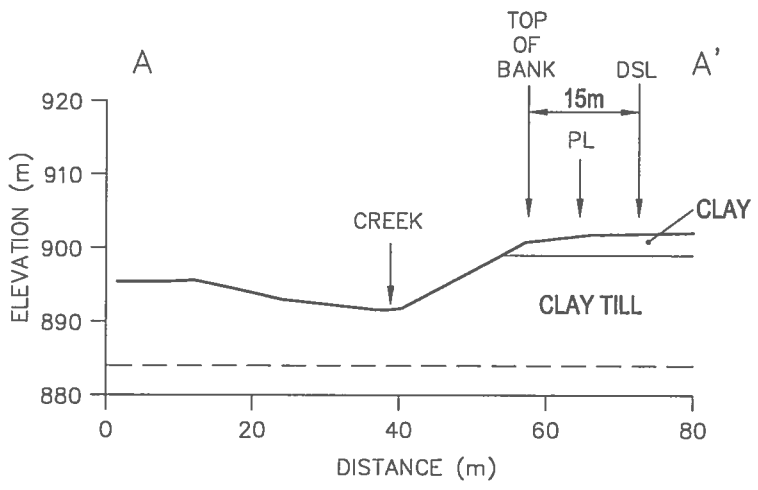
COUNTRY RESIDENTIAL SUBDIVISION
SW 1/4 SEC 31-10-21 W4M, SHAUGHNESSY, ALBERTA

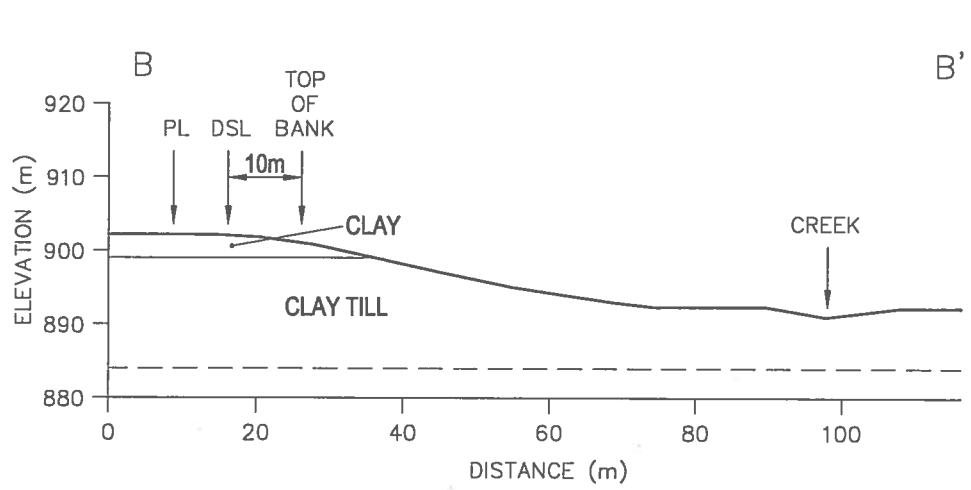
SITE PLAN AND BOREHOLE LOCATIONS

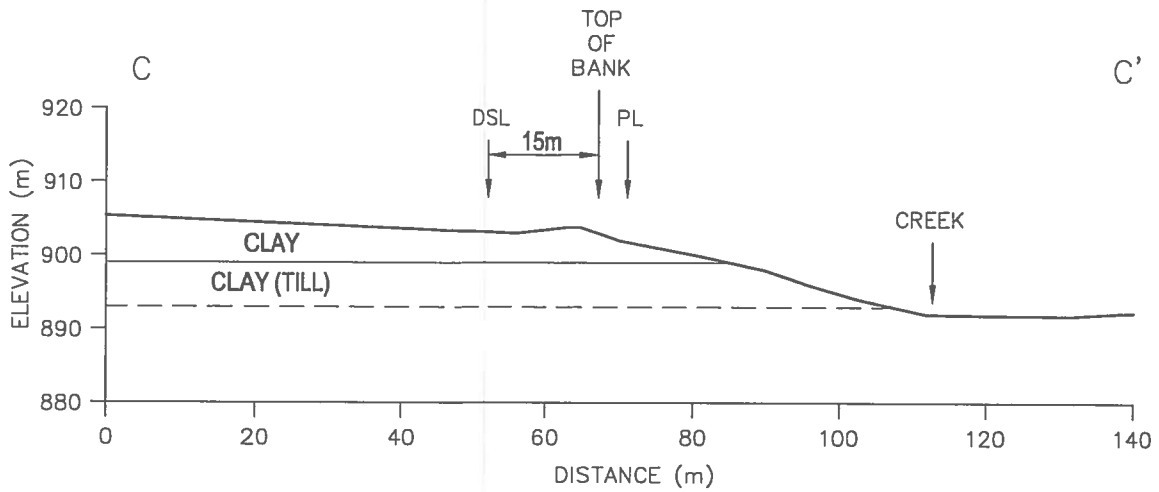
EBA Engineering Consultants Ltd.

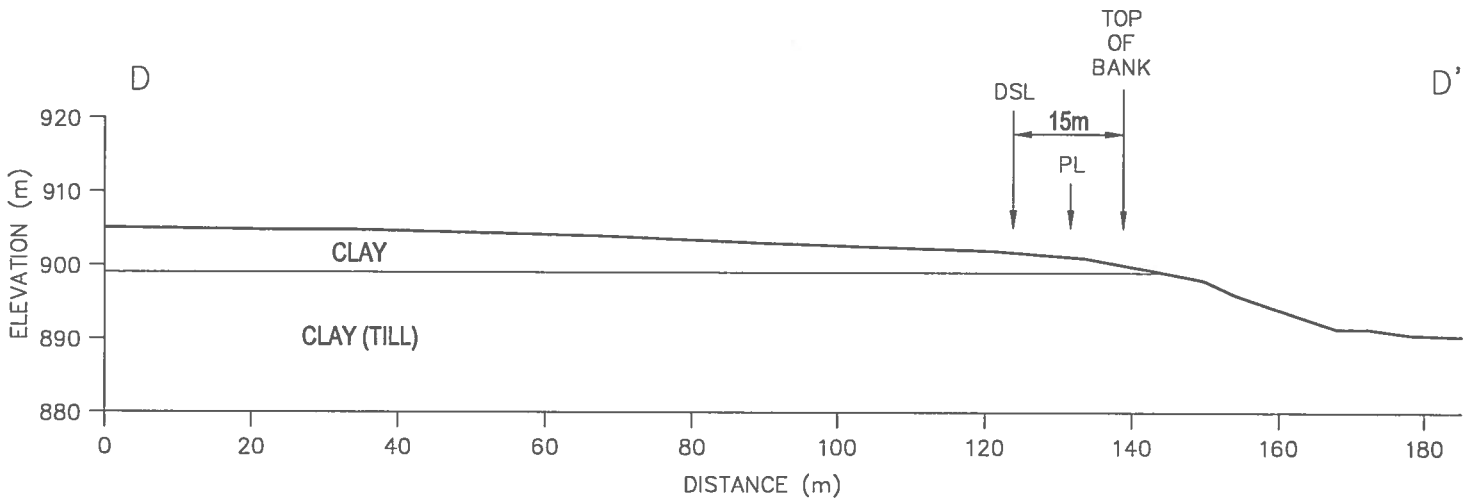
PROJECT NO.	DWN	CKD	REV
L12101170	LCH	JR	0
OFFICE: EBA-Lethbridge	DATE: October 2, 2007		

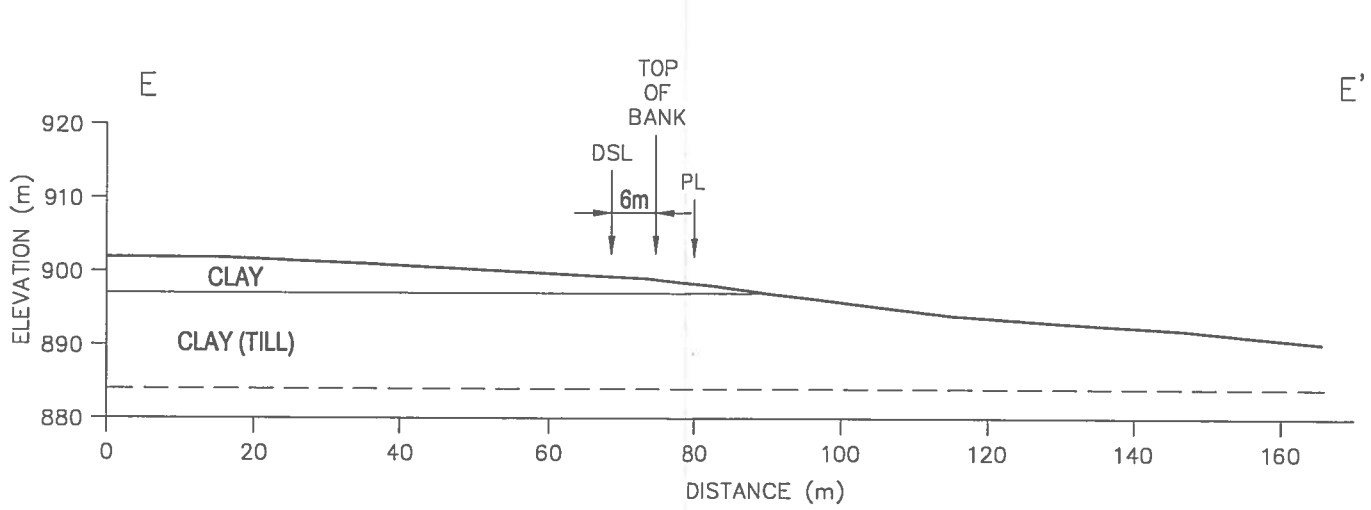
Figure 1











\\sharepoint\L\12101170\L12101170 sections.dwg

0 10 30 50m

SCALE 1:1000

LEGEND

PL = PROPERTY LINE

DSL = DEVELOPMENT SETBACK LINE

CLIENT

Martin Geomatic Consultants Ltd.

COUNTRY RESIDENTIAL SUBDIVISION
SW 1/4 SEC 31-10-21 W4M, SHAUGHNESSY, ALBERTA

CROSS SECTIONS

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
L12101170	LCH	JR	0
OFFICE: EBA-Lethbridge	DATE: October 2, 2007		

Figure 2

APPENDIX

APPENDIX A GEOTECHNICAL REPORT – GENERAL CONDITIONS

GEOTECHNICAL REPORT – GENERAL CONDITIONS

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

1.0 USE OF REPORT AND OWNERSHIP

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

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

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

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

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

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

3.0 LOGS OF TESTHOLES

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

4.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

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

5.0 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorologic conditions; and with development activity. Interpretation of water conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

6.0 PROTECTION OF EXPOSED GROUND

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

7.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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

8.0 INFLUENCE OF CONSTRUCTION ACTIVITY

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

9.0 OBSERVATIONS DURING CONSTRUCTION

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

10.0 DRAINAGE SYSTEMS

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

11.0 BEARING CAPACITY

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

12.0 SAMPLES

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

13.0 STANDARD OF CARE

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

14.0 ENVIRONMENTAL AND REGULATORY ISSUES

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

15.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

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

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

APPENDIX

APPENDIX B BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 to 20%	0 to 4
Loose	20 to 40%	4 to 10
Compact	40 to 75%	10 to 30
Dense	75 to 90%	30 to 50
Very Dense	90 to 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (kPa)
Very Soft	Less Than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater Than 400

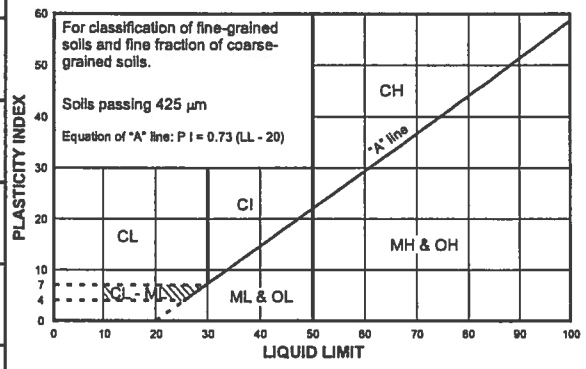
NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	- composed of thin layers of varying colour and texture.
Interbedded	- composed of alternate layers of different soil types.
Calcareous	- containing appreciable quantities of calcium carbonate.
Well Graded	- having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded	- predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION †

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines: Less than 5% Pass No. 200 sieve; More than 12% Pass No. 200 sieve; 5% to 12% Pass No. 200 sieve; Bordering Classification requiring use of dual symbols: GW, GP, SW, SP, GM, GC, SM, SC. $C_U = D_{60}/D_{10}$ Greater than 4; $C_U = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Not meeting both criteria for GW
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures	Atterburg limits plot below "A" line or plasticity index less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterburg limits plot above "A" line or plasticity index greater than 7
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands,little or no fines	$C_U = D_{60}/D_{10}$ Greater than 6; $C_U = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures	Atterburg limits plot below "A" line or plasticity index less than 4
			SC	Clayey sands, sand-clay mixtures	Atterburg limits plot above "A" line or plasticity index greater than 7
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	PLASTICITY CHART
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils	



*Based on the material passing the 3 in. (75 mm) sieve
†ASTM Designation D 2487, for identification procedure see D2488

SOIL COMPONENTS

FRACTION	SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm		
fine	425 µm	75 µm	>0 to 10 %	"trace"
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior	

OVERSIZE MATERIAL

Rounded or subrounded

COBBLES	75 mm to 200 mm
BOULDERS	> 200 mm

Not rounded

ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: 001
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 902.2m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	PLASTIC M.C. LIQUID (20 40 60 80)	STANDARD PENETRATION (N) 20 40 60 80 / UNCONFINED (kPa) 50 100 150 200 / POCKET PEN. (kPa) 100 200 300 400	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots, organics							902.0
1	CLAY - silty, some sand to sandy, MOIST, very stiff, medium plastic, light brown, white precipitates		B1		15.9			901.0
	... greybrown mottling, thin sand lenses		B2		14.2			
	... thin silt lenses		D1	23				
2	CLAY (TILL) - silty, some sand, trace gravel, damp to moist, hard, medium plastic, light brown with dark brown mottling, coal and oxide specks, white precipitates, oxide staining		B3					900.0
			B4		12.8			
3	... soluble sulphate content = 0.5% @ 2.4m		D2	36				899.0
	... thin silt lenses, occasional sand lenses		B5					
4	... very stiff		B6		11.9			898.0
5			D3	24				
	... hard, moderatly weathered		B7					897.0
			B8		15.8			
6			D4	32				896.0
			B9					
7	... blocking, high plastic inclusions		B10		18.5			895.0
8			D5	30				
	... thin sand lenses		B11					894.0
			B12		13.9			
9			D6	36				893.0
10	... very stiff		B13					892.0
			B14		18.2			
11			D7	17				
	... trace to some sand, medium to high plastic, dark brown		B15					891.0
			B16		17.8			
12			D8	17				890.0
13			B17					889.0
			B18		17.5			
14	... grey, hard		D9	27				888.0
			B19					
15	... dark brown		B20		17			887.0
	... grey		D10	41				
16	... very stiff, high plastic inclusions		B21					886.0
			B22		18.3			
17			D11	18				885.0
			B23					
18			B24		31.5			884.0
			D12	20				
19	End of Hole @ 18.8m							883.0
	No Seepage or Sloughing							
20	Slotted PVC Standpipe Installed to 18.8m							882.0
20.5								

EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 18.6m
	REVIEWED BY: JAR	COMPLETE: 9/21/2007
	DRAWING NO: B1	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: 002
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 902m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

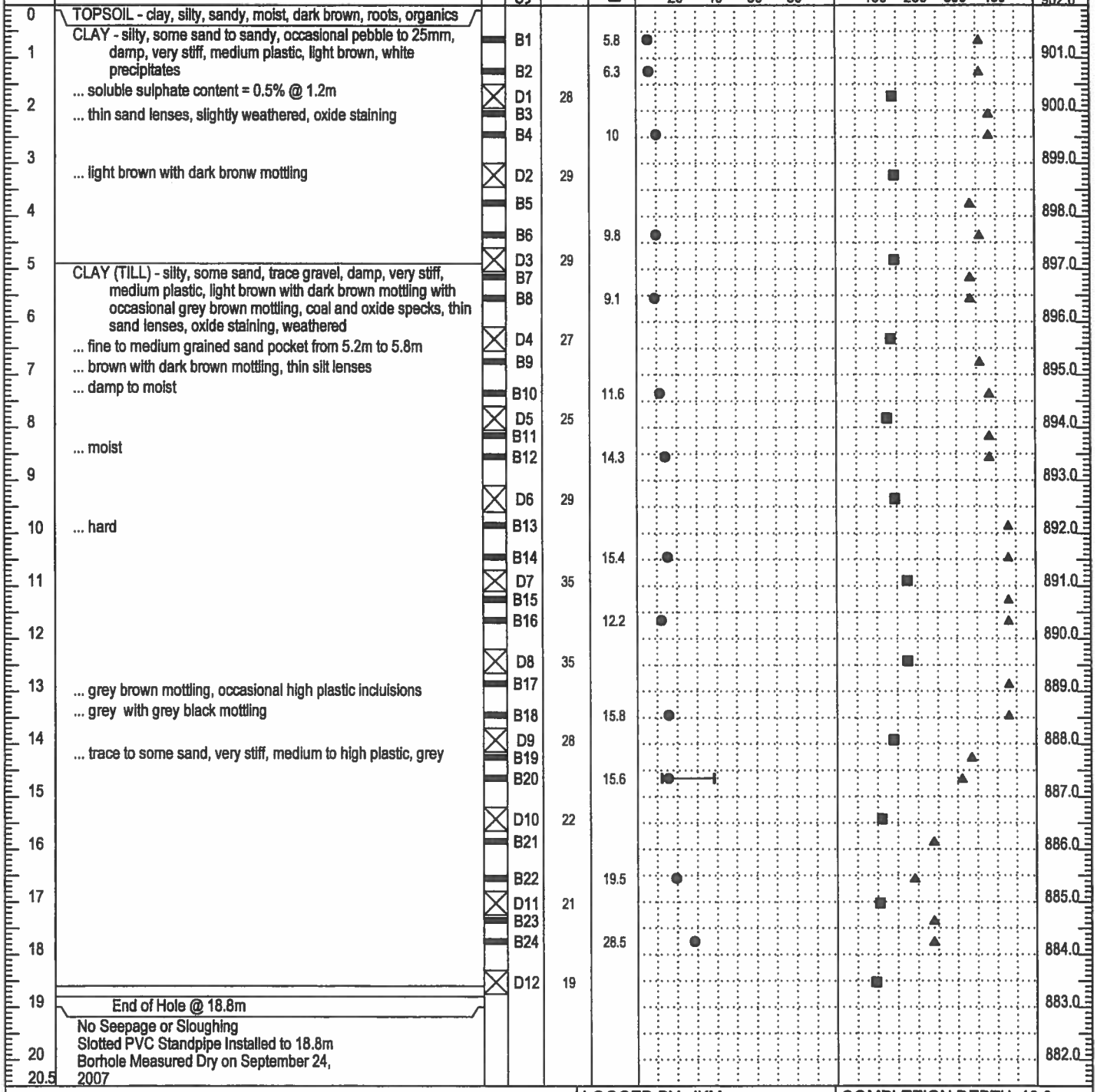
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots, organics					902.0
1	CLAY - silty, some sand to sandy, occasional pebble to 25mm, damp, very stiff, medium plastic, light brown, white precipitates		B1		5.8	901.0
			B2		6.3	
	... soluble sulphate content = 0.5% @ 1.2m		D1	28		
2	... thin sand lenses, slightly weathered, oxide staining		B3			900.0
			B4		10	
3	... light brown with dark bronw mottling		D2	29		899.0
			B5			
4						898.0
			B6		9.8	
5			D3	29		897.0
	CLAY (TILL) - silty, some sand, trace gravel, damp, very stiff, medium plastic, light brown with dark brown mottling with occasional grey brown mottling, coal and oxide specks, thin sand lenses, oxide staining, weathered		B7			
			B8		9.1	
6	... fine to medium grained sand pocket from 5.2m to 5.8m		D4	27		896.0
7	... brown with dark brown mottling, thin silt lenses		B9			895.0
	... damp to moist		B10		11.6	
8			D5	25		894.0
			B11			
	... moist		B12		14.3	
9						893.0
			D6	29		
10	... hard		B13			892.0
			B14		15.4	
11			D7	35		891.0
			B15			
			B16		12.2	
12						890.0
			D8	35		
13	... grey brown mottling, occasional high plastic inclusions		B17			889.0
	... grey with grey black mottling		B18		15.8	
14			D9	28		888.0
	... trace to some sand, very stiff, medium to high plastic, grey		B19			
			B20		15.6	
15						887.0
			D10	22		
16			B21			886.0
			B22		19.5	
17			D11	21		885.0
			B23			
18			B24		28.5	884.0
			D12	19		
19	End of Hole @ 18.8m					883.0
	No Seepage or Sloughing					
20	Slotted PVC Standpipe Installed to 18.8m					882.0
20.5	Borhole Measured Dry on September 24, 2007					

PLASTIC M.C. LIQUID (20 40 60 80)

STANDARD PENETRATION (N) (20 40 60 80)

UNCONFINED (kPa) (50 100 150 200)

POCKET PEN. (kPa) (100 200 300 400)



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LOGGED BY: JKM	COMPLETION DEPTH: 18.6m
REVIEWED BY: JAR	COMPLETE: 9/21/2007
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PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: 003
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 903.4m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots, organics				903.0
1	CLAY - silty, some sand to sandy, damp, very stiff, medium plastic, light brown, white precipitates		B1	5.4	
			B2	5.9	902.0
2	... moist, brown with dark bronw mottling, occasional coal specks		B3		
			B4	13.6	901.0
3			B5		
	... trace to some sand, moist, medium to high plastic, light brown with dark brown mottling, thin silt lenses				900.0
4			B6	18.3	
			B7		899.0
5	CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff to hard, medium plastic,brown with dark brown mottling, coal and oxide specks		B8	14	
			B9		898.0
6			B10	11.6	
	... thin sand lenses, high plastic inclusions, moderatly weathered				897.0
7			B11		
			B12	15.8	896.0
8			B13		
			B14	22.7	895.0
9	... trace sand, very stiff, high plastic, grey		B15		
					894.0
10			B16	27.9	
			B17		893.0
11	End of Hole @ 10.7m				
	No Seepage or Sloughing				892.0
12	Slotted PVC Standpipe Installed to 10.7m Borhole Measured Dry on September				891.0
13					890.0
14					889.0
15					888.0
16					887.0
17					886.0
18					885.0
19					884.0
20					
20.5					883.0

PLASTIC M.C. LIQUID (20 40 60 80)

◆UNCONFINED (kPa)◆ (50 100 150 200)

▲POCKET PEN. (kPa)▲ (100 200 300 400)

EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 10.7m
REVIEWED BY: JAR	COMPLETE: 9/25/2007
DRAWING NO: B3	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: 004
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 901.8m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots, organics				
1	CLAY - silty, some sand to sandy, damp, very stiff, medium plastic, light brown, white precipitates, moderatly weathered		B1	6.7	901.0
			B2	8.4	
2			B3		900.0
			B4	12.1	
3	... damp to moist, thin sand lenses		B5		899.0
	... moist, stiff, oxide staining				
4			B6	12.7	898.0
			B7		
5	CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff, medium plastic,brown, coal and oxide specks, weathered		B8	14.4	897.0
			B9		
6			B10	16.6	896.0
7			B11		895.0
			B12	15.6	
8			B13		894.0
			B14	15.1	
9			B15		893.0
	... trace sand, very moist, stiff to very stiff, high plastic				
10			B16	38.7	892.0
			B17		
11	End of Hole @ 10.7m				891.0
	No Seepage or Sloughing				
12	Slotted PVC Standpipe Installed to 10.7m				890.0
	Borhole Measured Dry on September				
13					889.0
14					888.0
15					887.0
16					886.0
17					885.0
18					884.0
19					883.0
20					882.0
20.5					

PLASTIC — M.C. — LIQUID (20 40 60 80)

◆UNCONFINED (kPa)◆ (50 100 150 200)

▲POCKET PEN. (kPa)▲ (100 200 300 400)

EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 10.7m
REVIEWED BY: JAR	COMPLETE: 9/25/2007
DRAWING NO: B4	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: PH 001
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 902.2m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT (PLASTIC — M.C. — LIQUID; 20 40 60 80)	◆UNCONFINED (kPa)◆ 50 100 150 200; ▲POCKET PEN. (kPa)▲ 100 200 300 400	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots & root hairs, organics				
	CLAY - silty, some sand to sandy, damp, very stiff, medium plastic, light brown, white precipitates				902.0
	End of Hole @ 0.9m				
1	No Seepage or Sloughing on Completion				901.0
1.5					

EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 0.9m
	REVIEWED BY: JAR	COMPLETE: 9/25/2007
	DRAWING NO: B6	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: PH 002
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 902m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT (PLASTIC — M.C. — LIQUID; 20 40 60 80)	◆UNCONFINED (kPa)◆ 50 100 150 200; ▲POCKET PEN. (kPa)▲ 100 200 300 400	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots & root hairs, organics				902.0
	CLAY - silty, some sand to sandy, damp, very stiff, medium plastic, light brown, white precipitates				
	... trace to some gravel				
	End of Hole @ 0.9m				
1	No Seepage or Sloughing on Completion				901.0
1.5					

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LOGGED BY: JKM	COMPLETION DEPTH: 0.9m
REVIEWED BY: JAR	COMPLETE: 9/25/2007
DRAWING NO: B7	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: PH 003
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 903.4m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT: PLASTIC — M.C. — LIQUID (20 40 60 80)	◆UNCONFINED (kPa)◆ 50 100 150 200 / ▲POCKET PEN. (kPa)▲ 100 200 300 400	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots & root hairs, organics				
	CLAY - silty, some sand, damp, very stiff, medium plastic, light brown, white precipitates				903.0
	End of Hole @ 0.9m				
1	No Seepage or Sloughing on Completion				902.0
1.5					

EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 0.9m
REVIEWED BY: JAR	COMPLETE: 9/25/2007
DRAWING NO: B8	Page 1 of 1

PROJECT: COUNTRY RESIDENTIAL SUBDIV.	CLIENT: MARTIN GEOMATIC CONSULTANTS LTD	BOREHOLE NO: PH 004
LOCATION: SW 1/4 SECTION 31-10-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	PROJECT NO: L12101170
CITY: NORTH OF SHAUGHNESSY	PROJECT ENGINEER: JIM RYAN	ELEVATION: 901.8m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT (PLASTIC — M.C. — LIQUID; 20 40 60 80)	◆UNCONFINED (kPa)◆ 50 100 150 200; ▲POCKET PEN. (kPa)▲ 100 200 300 400	Elevation (m)
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots & root hairs, organics				
	CLAY - silty, some sand to sandy, damp, very stiff, medium plastic, light brown, white precipitates				901.0
	End of Hole @ 0.9m				
1	No Seepage or Sloughing on Completion				
1.5					

EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 0.9m
REVIEWED BY: JAR	COMPLETE: 9/25/2007
DRAWING NO: B9	Page 1 of 1

APPENDIX

APPENDIX C RECOMMENDED GENERAL DESIGN AND CONSTRUCTION GUIDELINES

CONSTRUCTION EXCAVATIONS

Construction should be in accordance with good practice and comply with the requirements of the responsible agencies.

All excavations greater than 1.5 m deep should be sloped or shored for worker protection.

Shallow excavations up to 3 m depth may use temporary side slopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3 m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to EBA for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in-situ conditions and the movement of the system. If anchors are used, they should be load tested. EBA can provide further information on monitoring and testing procedures, if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down at 45° from a horizontal, from the base of foundations of adjacent structures, intersects the extent of the proposed excavation, then these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

BACKFILL MATERIALS AND COMPACTION

Maximum density, as used in this section, means Standard Proctor Maximum Dry Density (ASTM Test D698) unless specifically noted otherwise. Optimum moisture content is as defined in this text.

"General engineered fill" materials should comprise clean, well-graded granular soils or inorganic, low-plastic cohesive soils. Such material should be placed in compacted lifts not exceeding 200 mm and compacted to not less than 98% of maximum density, at a moisture content at or slightly above optimum.

"Structural fill" materials should comprise clean, well-graded inorganic granular soils. Such fill should be placed in compacted lifts not exceeding 150 mm and compacted to not less than 98% of maximum density, at a moisture content near or slightly above optimum.

"Landscape fill" material may comprise soils without regard to engineering quality. Such soils should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90% of maximum density.

Backfill adjacent to and above footings, abutment walls, basement walls, grade beams and pile caps or below highway, street or parking lot pavement sections should comprise general engineered fill materials as defined above.

Backfill supporting structural loads should comprise structural fill materials as defined above.

Backfill adjacent to exterior footings, foundation walls, grade beams and pile caps and within 300 mm of final grade should comprise low-plastic cohesive general engineered fill as defined above. Such backfill should provide a relatively impervious surface layer to reduce seepage into the sub-soil.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflection is apparent, the compactive effort should be reduced accordingly. In order to reduce potential compaction induced stresses, only hand held compaction equipment should be used in the compaction of fill within 500 mm of retaining walls or basement walls.

Backfill materials should not be placed in a frozen state or placed on a frozen subgrade. All lumps of materials should be broken down during placement.

Where the maximum-sized particles in any backfill material exceed 50% of the lift thickness or minimum dimension of the cross-section to be backfilled, such particles should be removed and placed at the other more suitable locations on site or screened-off prior to delivery to site.

Bonding should be provided between backfill lifts, if the previous lift has become desiccated. For the fine-grained materials, the previous lift should be scarified to 75 mm in depth followed by proper moisture conditioning and recompaction.

Recommendations for the specifications for various backfill types are presented below.

"Pit-run gravel" should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight
200 mm	100 of Total Sample
150 mm	96 - 100 of Total Sample
75 mm	60 - 80 of Total Sample
25 mm	70 - 100 of Material Passing 75 mm Sieve
4.75 mm	25 - 63 of Material Passing 75 mm Sieve
1.18 mm	14 - 41 of Material Passing 75 mm Sieve
0.60 mm	7 - 30 of Material Passing 75 mm Sieve
0.15 mm	3 - 18 of Material Passing 75 mm Sieve
0.075 mm	2 - 9 of Material Passing 75 mm Sieve

Any grading variation from the above should be at the discretion of the Engineer; however, the percent of material passing the 0.075 mm sieve should not exceed 2/3 of the material passing the 0.6 mm sieve. The pit-run gravel should be free of any form of coating and any gravel containing clay, loam or other deleterious materials should be rejected. No oversized material should be tolerated.

"Crushed gravel" should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing by Weight (Nominal Gravel Size)		
	100 mm	50 mm	25 mm
100 mm	100	—	—
75 mm	90 - 100	—	—
50 mm	—	100	—
40 mm	60 - 80	90 - 100	—
25 mm	—	—	100
20 mm	40 - 66	50 - 75	95 - 100
10 mm	25 - 54	25 - 52	60 - 80
4.75 mm	15 - 43	15 - 40	40 - 60
2.36 mm	10 - 35	10 - 33	28 - 48
0.60 mm	5 - 23	5 - 23	13 - 29
0.30 mm	—	—	9 - 21
0.15 mm	3 - 12	2 - 14	6 - 15
0.075 mm	2 - 10	1 - 10	4 - 10

Gravel:

100 mm Crushed Gravel: At least 13% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

50 mm Crushed Gravel: At least 13% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

25 mm Crushed Gravel: At least 50% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

Any gravel containing deleterious material should be rejected.

"Coarse gravel" for bedding and drainage should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight (Nominal Gravel Size)	
	50 mm	40 mm
50 mm	100	—
40 mm	90 - 100	100
25 mm	—	95 - 100
20 mm	35 - 70	—
15 mm	—	25 - 60
10 mm	10 - 30	—
4.75 mm	0 - 5	0 - 10
2.36 mm	—	0 - 5

"Coarse sand" for bedding and drainage should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight
10 mm	100
4.75 mm	95 – 100
2.36 mm	80 – 100
1.18 mm	50 - 85
0.60 mm	25 - 60
0.30 mm	10 - 30
0.15 mm	2 - 10

"Lean-mix concrete" should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

PROOF-ROLLING

Proof-rolling is a method of detecting soft areas in an "as-excavated" subgrade for fill, pavement, floor or foundations or detecting non-uniformity of compacted embankment. The intent is to detect soft areas or areas of low shear strength not otherwise revealed by means of testholes, density testing or visual examination of the site surface and to check that any fill placed or subgrade meets the necessary design strength requirements.

Proof-rolling should be observed by qualified geotechnical personnel.

Proof-rolling is generally accomplished by the use of a heavy (15—60 tonne) rubber-tired roller having four wheels abreast on independent axles with high contact wheel pressures [inflation pressures ranging from 550 kPa (80 psi) up to 1,030 kPa (150 psi)].

A heavily-loaded truck may be used in lieu of the equipment described in the paragraph above. The truck should be loaded to approximately 10 tonnes (22,000 lbs) per axle and a minimum tire pressure of 550 kPa (80 psi).

Ground speed to be maximum of 8 km/hr (133 m/min) (5 mph) (400 ft/min). Recommended speed is 4 km/hr (65 m/min) (2.5 mph) (200 ft/min).

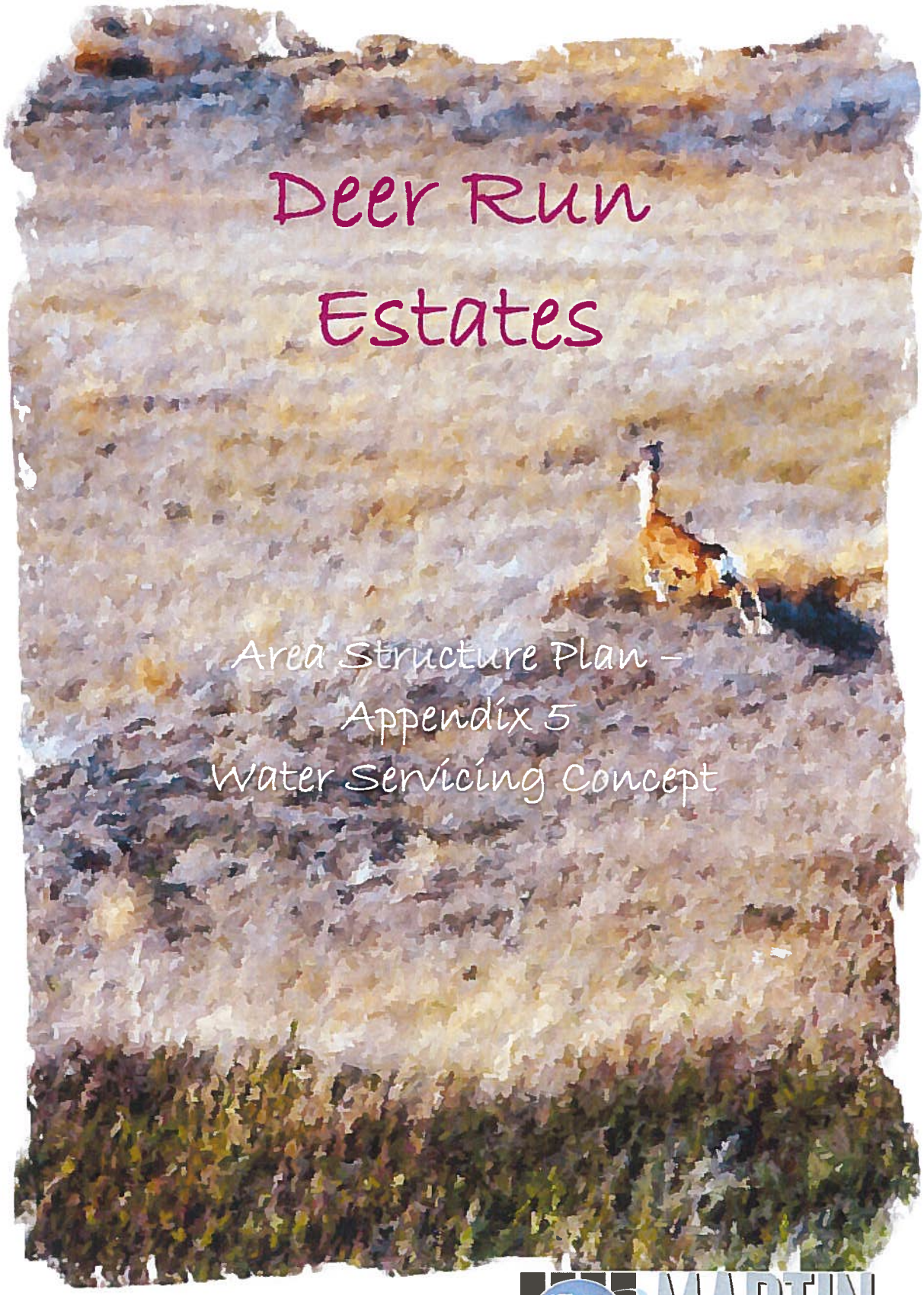
The recommended procedure is two complete coverages with the Proof-rolling equipment in one direction and a second series of two coverages made at right angles to the first series; one "coverage" means that every point of the proof-rolled surface has been subjected to the tire pressure of a loaded wheel. Less rigorous procedures may be acceptable under certain conditions subject to the approval of an engineer.

Any areas of soft, rutted or displaced materials detected should be either recompacted with additional fill or the existing material removed and replaced with general engineered fill or properly moisture conditioned as necessary.

The surface of the grade under the action of the proof-rolling should be observed, noting visible deflection and rebound of the surface or shear failure in the surface of granular soils as ridging between wheel tracks.

If any part of an area indicates significantly more distress than other parts, the cause should be investigated, by, for example, shallow auger holes.

In the case of granular subgrades, distress will generally consist of either compression due to insufficient compaction or shearing under the tires. In the first case, proof-rolling should be continued until no further compression occurs. In the second case, the tire pressure should be reduced to a point where the subgrade can carry the load without significant deflection and subsequently, gradually increased to its specified pressure as the subgrade increases in shear strength under this compaction.



Deer Run Estates

Area Structure Plan – Appendix 5
Water Servicing Concept

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GEOMATIC CONSULTANTS LTD

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1. PROJECT BACKGROUND

Deer Run Estates is a country residential development located approximately 1 km north of the Hamlet of Shaughnessy in the County of Lethbridge. Legally, Deer Run Estates comprises the north half of the Southwest Quarter of Section 31, Township 10, Range 21 West of the 4th Meridian. The parcel area is approximately 31.6 ha (78 acres). The subject parcel is located on either side of Piyami (Twelve Mile) Coulee, an ephemeral watercourse which provides drainage for 78 km^2 of upstream land as well as drainage of return water and overflows from the Lethbridge and Northern Irrigation District (LNID).

The land use on the site is presently agricultural – a tree farm is located in the part of the parcel west of Piyami Coulee. The developer intends to subdivide approximately 33 lots – each lot is to be approximately 0.4 ha (1 acre). The site location and proposed lot layout shown on **Figure 1**.

Although, the area is adjacent to an irrigation canal but is not presently within the Lethbridge and Northern Irrigation District (LNID). The site presently contains two dugouts which are fed, sporadically, by a pipe from the land to the south. Presently, the dugout to the west (near Highway 25) has a storage capacity of **4,540 m^3** (3.4 acre-feet or 1,000,000 Imperial gallons). Another small dugout is located is located in the coulee bottom, west of the stream. The locations of the dugouts are shown on **Figure 1**.

Presently, there is a base flow in Piyami Coulee for much of the year due to surface runoff and irrigation water return to the Oldman River. However, diversion of LNID water from canals to pipelines may reduce or, during dry periods, remove this base flow.

From discussions with LNID, it is understood that a new irrigation water pipeline is to be provided to the south of the subject parcel.

The subject parcel is proposed to be serviced with pressurized, potable water and a separate raw (non-potable) water system for fire-protection and irrigation.

2. SERVICING REQUIREMENTS

The following summarizes the assumed servicing requirements for potable water, irrigation and fire protection for Deer Run Estates. These are consistent with Alberta Environment's published guidelines.[1]

2.1. Potable Water

The following summarizes the requirements for the potable water system:

1. Based on a 33 lot development and an average of 3.4 people per home; the population equivalent would be 112. Average daily consumption of potable water is generally 400 L per person per day for domestic in-home use. Based on the above, average daily potable water demand is predicted to be **45,000 L** (45 m^3/day or 0.52 L/s).
2. The peak daily water use (peaking factor, PF) is generally 2.0 times the average day usage. For Deer Run Estates, the peak daily usage is estimated at **90,000 L** (90 m^3/day or 1.04 L/s).
3. Peak hourly demand is estimated at **10.0 L/s**.
4. The system's operating pressure shall be greater than **350 kPa** (50 psi).
5. The potable water reservoir should have a capacity equal to twice (2x) the peak daily demand or **180,000 L**.

2.2. Raw Water for Fire Protection

The following summarizes the requirements for the fire protection system:

1. System will have the capacity to deliver a combined flow at two hydrants of **63 L/s** for a duration of at least **2 hours**. Therefore, the required capacity in the reservoir is **454 m^3**.
2. The maximum distance from a dwelling to the nearest fire hydrant will not exceed **90 m**.

2.3. Raw Water for Irrigation

The development will be supplied with raw water to allow irrigation of the lots. This system will provide **300 mm** (12") of raw water per lot per year for irrigation during the spring, summer and autumn (approximately 1 inch of water per week). Therefore, the yearly volume of raw water to be supplied for irrigation of the approximately 16 ha of developed land is approximately **48,000 m^3** (39 acre-feet).

It should be noted that, in 2007, LNID supplied 430 mm (17") of raw water per unit area. For the 33.5 ha (80 acre) parcel, this equates to approximately 140,000 m^3 (113 acre-feet).

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[1] *Standards and Guidelines for Municipal Water, Wastewater, and Storm Drainage Systems* (Alberta Environment, January 2006)

3. RESULTS AND RECOMMENDATIONS

Based on the proposed lot layout and the servicing requirements noted in Section 2, servicing schemes for the raw and potable water systems were devised. These proposed servicing schemes are shown on Figures **2** (potable water) and **3** (raw water).

3.1. Recommended Servicing Scheme – Potable Water

The following is recommended for providing potable water to Deer Run Estates:

1. Daily usage is predicted to be **45,000 L/day**. This requires a daily supply of **20 units** of 2,273 L (500 Imperial gallons) of water from the County of Lethbirdge or the North Country Water Co-op. Such arrangements will be negotiated by the owner.
2. A separate potable water reservoir with a capacity of at least **180,000 L** should be provided.
3. The pumping system should be capable of sustaining a pressure of **350 kPa** (50 psi) for flows of 0-10 L/s. A triplex pumping system which provides variable flow rates is recommended. If a separate fire protection system is to be provided, a back-up generator is not required for the potable water system.
4. Required watermains are 75-mm to 150-mm inside diameter, C900 PVC or equivalent HDPE CSA-approved for potable water use. Piping should be rated for pressures of greater than **1.0 MPa** (150 psi).
5. Services to lots will be 25-mm diameter, Municipex or copper.
6. All pipelines will be buried 2.5-3.0 m depth to ensure they are protected from frost.

3.2. Recommended Servicing Scheme – Fire Protection

The following is recommended for providing fire protection to Deer Run Estates:

1. The owner should submit a proposal to LNID for the supply of raw water to the site. It is understood that LNID is constructing a new irrigation line to the south of the subject parcel and will agree to provide raw water for fire protection during the irrigation season. Provision of a fill line from the LNID pipeline to the dugout is at the owner's cost and responsibility.
2. To provide the required two-hydrant flow of 63 L/s for 2 hours, **454 m^3** of water is required. The existing dugout has a storage capacity of **4,540 m^3 –** ten (10x) times the required capacity. Therefore, the existing dugout is has adequate capacity for fire protection.
3. To provide the above-noted flow, an adequate fire pumping system will be required, complete with back-up power generation. The pumping system should be capable of delivering the required 63 L/s at a pressure of 350 kPa (50 psi).
4. The residual pressure at any point in the system when delivering the 63 L/s fire flow should be not less than **138 kPa** (20 psi).
5. All raw water mains for fire protection will be minimum 200-mm inside diameter, C900 PVC or equivalent HDPE CSA-approved for potable water use. Piping should be rated for pressures of greater than **1.0 MPa** (150 psi).
6. Ten (10) fire hydrants will be required on-site to provide adequate coverage. Hydrant design will comply with County of Lethbridge standards.
7. All pipelines will be buried 2.5-3.0 m depth to ensure they are protected from frost.

3.3. Recommended Servicing Scheme – Irrigation

The following is recommended to provide raw water for tree, shrub and lawn irrigation in Deer Run Estates:

1. The owner should submit a proposal to LNID (Lethbridge Northern Irrigation District) to secure an agreement for the Cooperative for the conveyance of raw water for irrigating – in addition to raw water required for fire protection. LNID requests that the irrigation system should be operated as a co-operative of landowners.
2. Raw water for irrigation can be supplied through the fire-protection system. However, the capacity of the existing dugout (4,540 m^3 or 3.7 acre-feet) may have to be increased to provide the stated **1,233 m^3/lot/year** (1 acre-foot/lot/year). The amount of increase (if any) to the capacity of the raw-water reservoir will depend on the rate at which water can be supplied to the development by LNID. It would be desirable for the reservoir to be filled automatically as necessary. However, the method of supply of raw water will need to be negotiated between the future water co-operative and LNID.
3. Each lot should be provided with a 25-mm diameter raw water service from the fire protection system. These services will be equipped with a flow restrictor to prevent over-irrigation.
4. No cross-connections will be allowed between the potable and raw water systems.

3.4. Results of Water Network Models

The potable and raw water schemes were each analyzed using WaterCAD. The following results were obtained. **Table 1** summarizes the pressure predicted for various noted in the potable water system (see **Figure 2**) given the pump system recommended above.

Table 1 - Potable Water System Pressures at Maximum Daily Demand

Label	Elevation (m)	Base Flow (L/s)	Pattern	Demand (Calculated) (L/s)	Calculated Hydraulic Grade (m)	Pressure (kPa)	Pressure (psi)
J-1	906.00	1.30	Fixed	1.30	940.61	339	49.13
J-2	906.00	1.30	Fixed	1.30	944.43	376	54.56
J-3	903.50	1.30	Fixed	1.30	945.82	414	60.07
J-4	902.00	1.30	Fixed	1.30	943.74	409	59.25
J-5	905.00	1.30	Fixed	1.30	949.30	434	62.88
J-6	905.00	1.30	Fixed	1.30	946.81	409	59.34
J-7	904.00	1.30	Fixed	1.30	948.28	433	62.85
J-8	906.00	1.30	Fixed	1.30	946.16	393	57.00
J-9	904.00	1.30	Fixed	1.30	951.23	462	67.04
PUMP HOUSE	904.00	0.00	Fixed	0.00	954.85	498	72.18

Table X summarizes the pressure predicted in at various nodes (hydrant locations) in the fire protection system when delivering the required fire flow of 63 L/s.

Table 2 - Fire Protection System Pressures at Required Fire Flow (63 L/s)

Label	Needed Fire Flow (l/s)	Available Fire Flow (l/s)	Calculated Residual Pressure (kPa)	Calculated Residual Pressure (psi)	Calculated Minimum Zone Pressure (kPa)	Calculated Minimum Zone Pressure (psi)	Calculated Minimum System Pressure (kPa)	Calculated Minimum System Pressure (psi)	Minimum System Junction
HYD - 1	63	130.00	343	49.72	348	50.43	348	50.43	HYD - 8
HYD - 2	63	130.00	193	27.92	193	27.92	193	27.92	HYD - 8
HYD - 3	63	110.06	162	23.55	138	20.00	138	20.00	HYD - 8

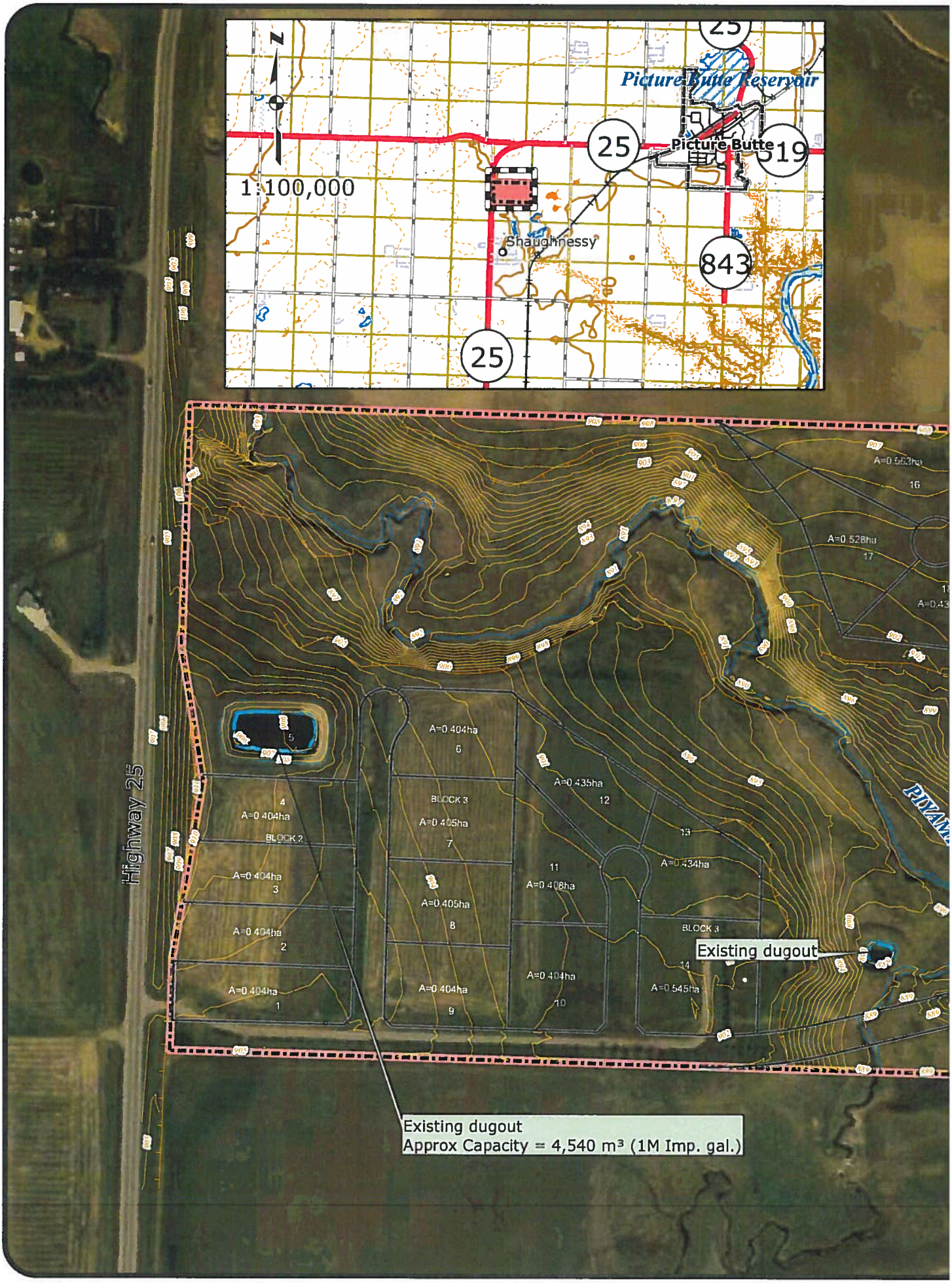
HYD - 4	63	102.05	138	20.00	176	25.55	176	25.55	HYD - 8
HYD - 5	63	73.31	148	21.42	138	20.00	138	20.00	HYD - 8
HYD - 6	63	68.51	138	20.00	172	25.01	172	25.01	HYD - 8
HYD - 7	63	68.61	157	22.84	138	20.00	138	20.00	HYD - 8
HYD - 8	63	64.12	138	20.00	192	27.84	192	27.84	HYD - 7
HYD - 9	63	72.52	138	20.00	138	20.00	138	20.00	HYD - 10
HYD - 10	63	68.64	138	20.00	168	24.38	168	24.38	HYD - 9

4. CLOSING

This report details the concept for providing potable water, irrigation and fire protection for the proposed Deer Run Estates subdivision and mitigating its effects. We are satisfied that it provides sufficient detail for approval of an Area Structural Plan. This document will provide the direction for the detailed design of the water servicing for Deer Run Estates.

Per:
Martin Geomatic Consultants Ltd.

Jim Hellofs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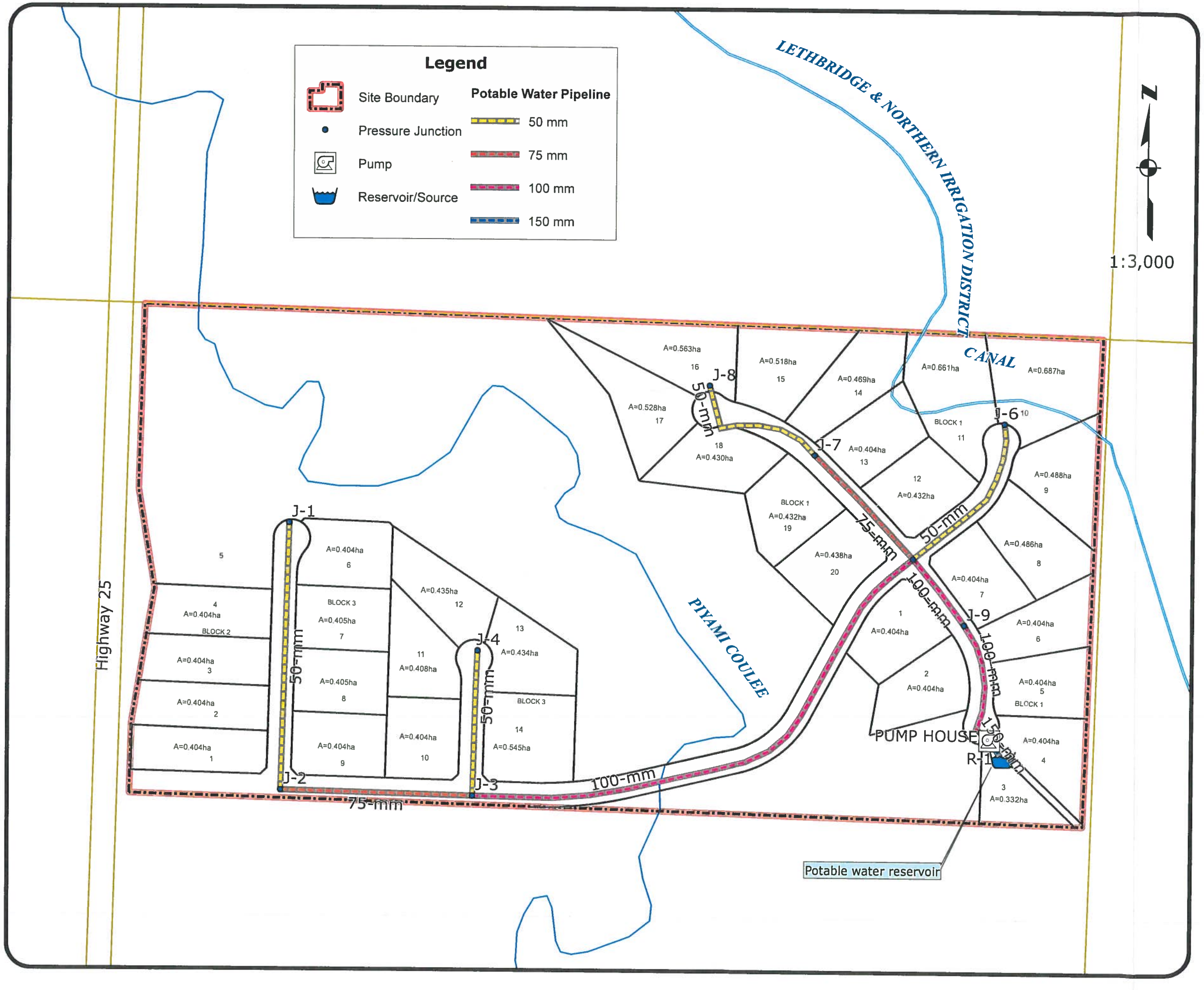
BLOCK 2
BLOCK 3
Existing dugout
Existing dugout
Approx Capacity = 4,540 m³ (1M Imp. gal.)



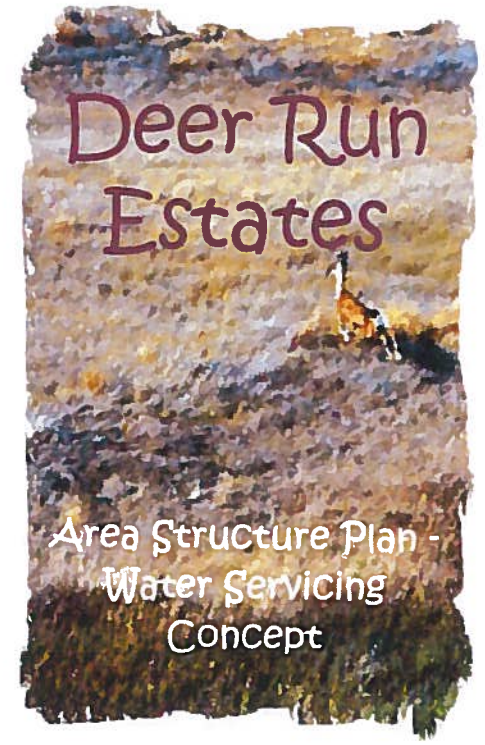


Figure 2

Potable Water Servicing Scheme

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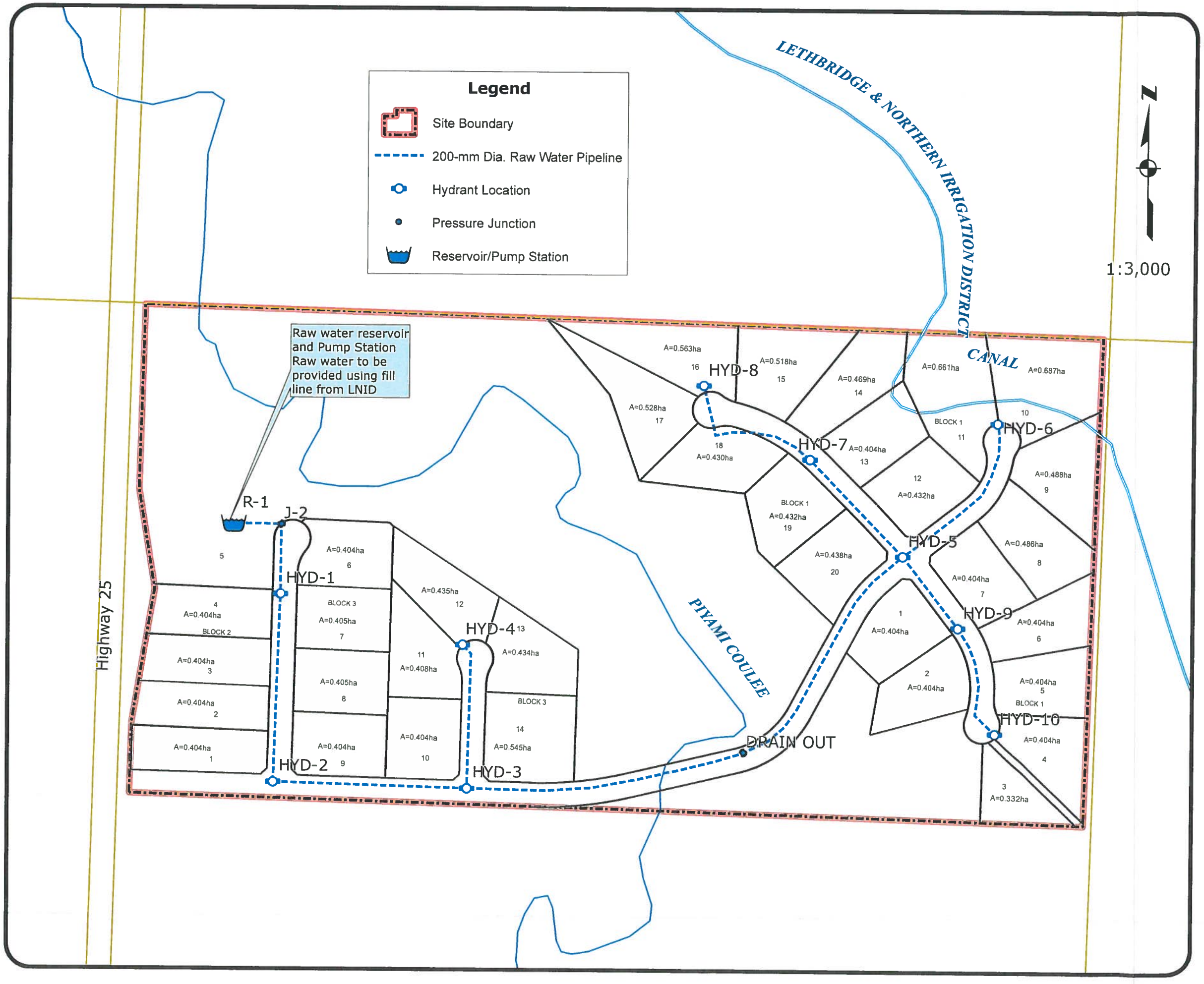

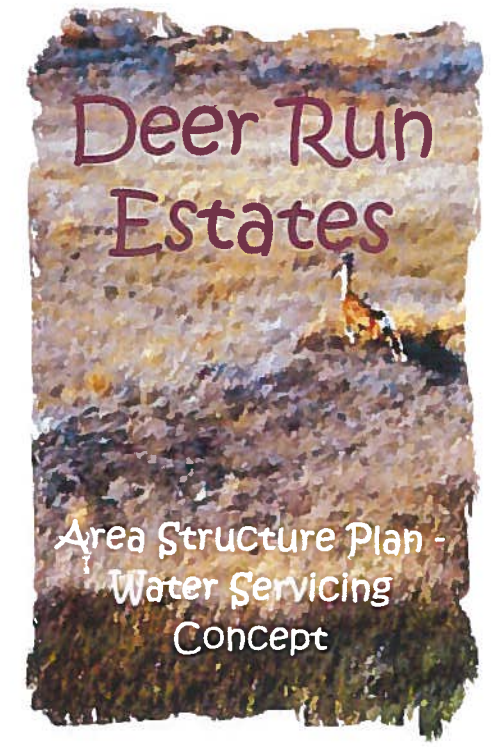

Figure 3

Fire Protection/ Irrigation Supply Scheme

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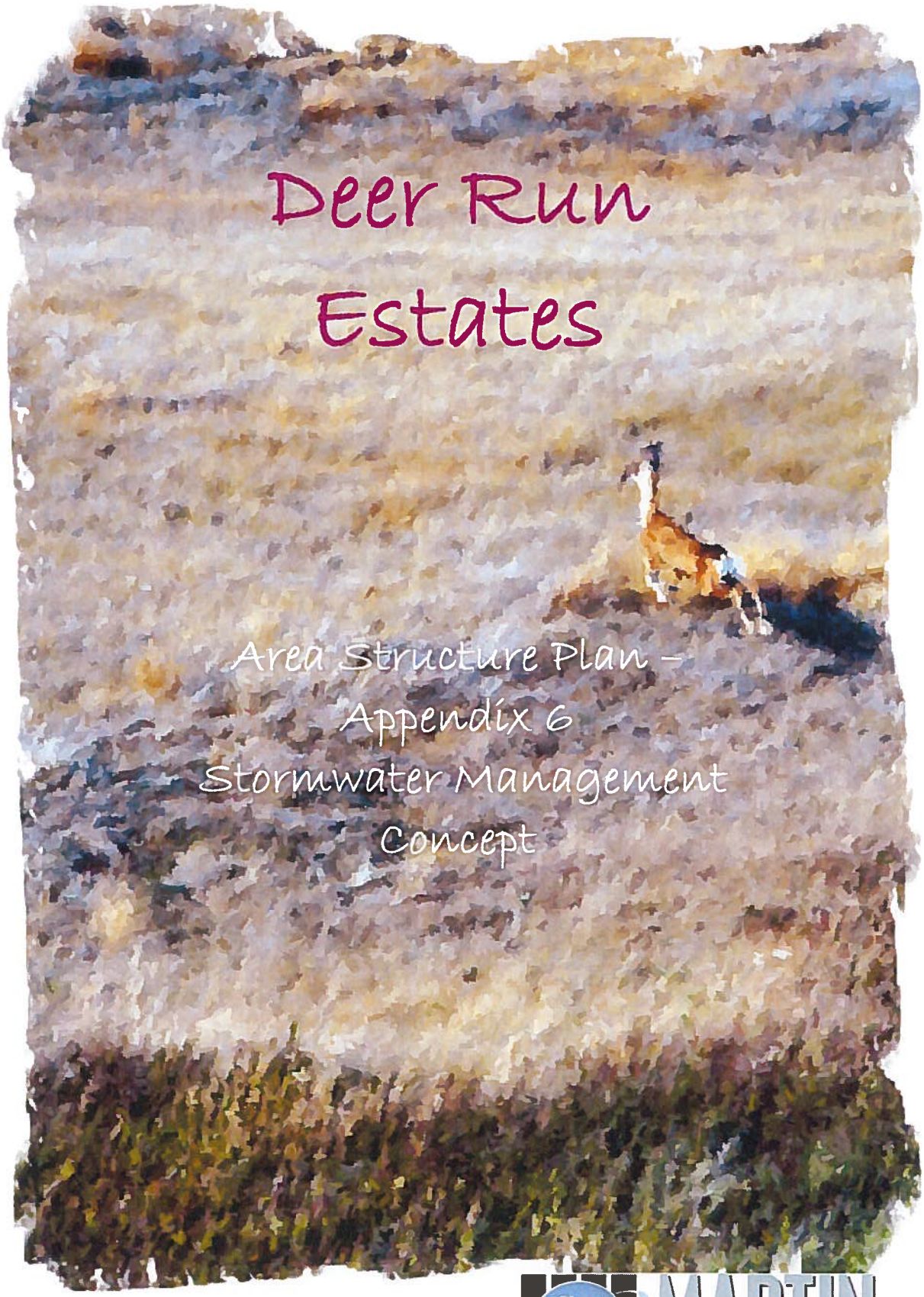
Deer Run Estates



Area Structure Plan – Appendix 6 Stormwater Management Concept

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1. PROJECT BACKGROUND

Deer Run Estates is a proposed country residential development located immediately east of Highway 25, approximately 1 km north of the hamlet of Shaughnessy in the County of Lethbridge. Legally, the subject parcel is the North Half of the Southwest Quarter of Section 31, Township 10, Range 21 West of the 4th Meridian. The parcel area is approximately 31.6 ha (78 acres). The developer intends to subdivide approximately 32 lots – each lot is to be approximately 0.4 ha (1 acre). The subject parcel is located on either side of Piyami (Twelve Mile) Coulee, an ephemeral watercourse which drains approximately 79 km^2 of agricultural land.[1] The location of the site in relation to the watershed of Piyami Coulee is shown on **Figure 5**.

Piyami Coulee is presently part of the Lethbridge Northern Irrigation District's (LNID) canal system. The coulee provides the following amenities for LNID:

- Return water to the Oldman River from irrigation laterals
- Discharge wasteway for yearly canal drawdown
- Provides routing for overflows
- Provides emergency flood routing in the event of a dam breach at Keho Lake

LNID is intending to replace some of its canal laterals with pipelines in the next few years. As such, much of present base flow in Piyami Coulee will cease. However, the coulee will still be used as a wasteway for yearly system drawdown, for overflow routing when runoff into the canals exceeds their discharge capacity and emergency flood routing.[2]

Figure SWM-1 shows the coulee, areas drained and existing surface features.

At the Highway 25 crossing (approximately 200 m upstream of the north boundary of the subject parcel), the coulee is channeled through two (2) 1600-mm (5'-4") diameter corrugated steel pipe (CSP) culverts. The culverts are 60 m in length and the approximate drop along their length is 1.60 m (an average slope of 2.7%. These culverts were installed in 1990 through a previous dual 1.8-m x 1.8-m (6'-0" x 6'-0") concrete box culvert as part of a highway widening project.[3] A photo of the culverts as they exist today (23 October 2007) is provided as **Figure 1**.

Figure 1 – Upstream (left) and Downstream (right) Ends of Highway 25/Piyami Coulee Culverts (Photo by MGCL, 23 October 2007)

[1] Source: AltaLIS base features for map sections 82H14SE, 82H14SW, 82H15NE and 82H15NW. Data Copyright © 2007 AltaLIS.
[2] Source: Meeting with Mr. Ralph Oldenburger, Operations and Maintenance Manager, Lethbridge & Northern Irrigation District, 25 October 2007.
[3] Source: Documents provided by Alberta Infrastructure and Transportation, Lethbridge Office.

Approximately 1.5 km downstream from the subject parcel, the Canadian Pacific Railway's now-disused Turin branch line crosses Piyami Coulee. According to LNID, the culvert under the railway is a single 2.4-m x 2.4-m (8'-0" x 8'-0") concrete box structure.[4] MGCL observed this culvert on 9 November 2007 – a photo of the discharge end is provided as **Figure 2**. No high-water lines, debris marks or visible indications of flooding were visible. The downstream slope of the railway embankment and the culvert discharge does show signs of erosion. MGCL does not yet have any further data on this culvert or the elevation of the railway where it crosses Piyami Coulee.

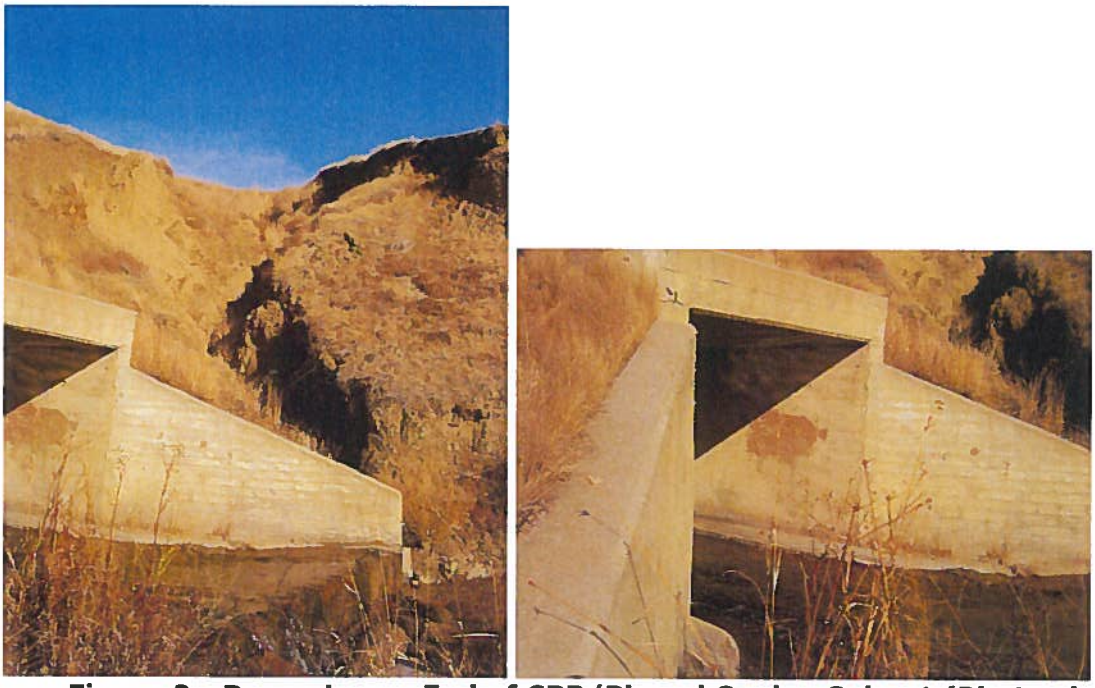


Figure 2 - Downstream End of CPR/Piyami Coulee Culvert (Photos by MGCL, 9 November 2007)

Within the subject parcel, there presently exists a tree farm on the west side of Piyami Coulee. This operation is irrigated by means of a 4,540 m^3 dugout. Crossing Piyami Coulee is a gravel access with a single corrugated metal pipe arch culvert. On the east side of Piyami Coulee there exists a LNID irrigation canal. On either side this canal, there are adjacent low, wet areas which may be the result of canal seepage. **Figure 5** shows details the surface features in the subject parcel.

[4] Source: LNID.

2. METHODOLOGY

Design of stormwater management references the following documents:

- *Standards and Guidelines for Municipal Water, Wastewater and Storm Drainage Systems* (Alberta Environment, January 2006).
- *Municipal Policies and Procedures Manual* (Alberta Environment, April 2001)
- *Design Guidelines* (City of Lethbridge, 2007)

2.1. Models Used

The performance of the stormwater management system was checked using the United States Environmental Protection Agency Stormwater Management Model version 5.0 (SWMM5) build 5.0.009. Models were constructed for the following scenarios:

1. *Minor system design storm*: 4-hour duration, 5-year return period design storm with no overland flow to check minor system performance,
2. *Major system design storm*: 24-hour duration, 100-year return period design storm with surface ponding and overland flow to model flows offsite into public rights-of-way.
3. *Continuous Modeling*: A continuous model incorporating 36 years of hourly rainfall data collected at Lethbirdge Airport was constructed to determine average annual runoff from the subject parcel.

If requested by the County, MGCL will provide digital copies of model input and output files.

2.2. Design Storms and Data Sources

For this study, MGCL has used City of Lethbridge rainfall data and IDF parameters. The City of Lethbridge IDF parmeters used are provided in **Table 1**. Hyetographs of the design storms are provided in **Figure 3**.

Table 1 - IDF Parameters for Lethbridge[5]

For the design of	Event used	IDF Parameters			Total Runoff (mm)
		a	b	c	
Storm sewers (minor system), predevelopment flow (allowable discharge)	4-hour duration, 5-year return period	789.6	5.409	0.796	39.54
Overland flows, retention pond	24-hour duration, 100-year return period	2067.45	7.067	0.840	109.86

[5] *Design Standards 2006* (City of Lethbridge, 2006).

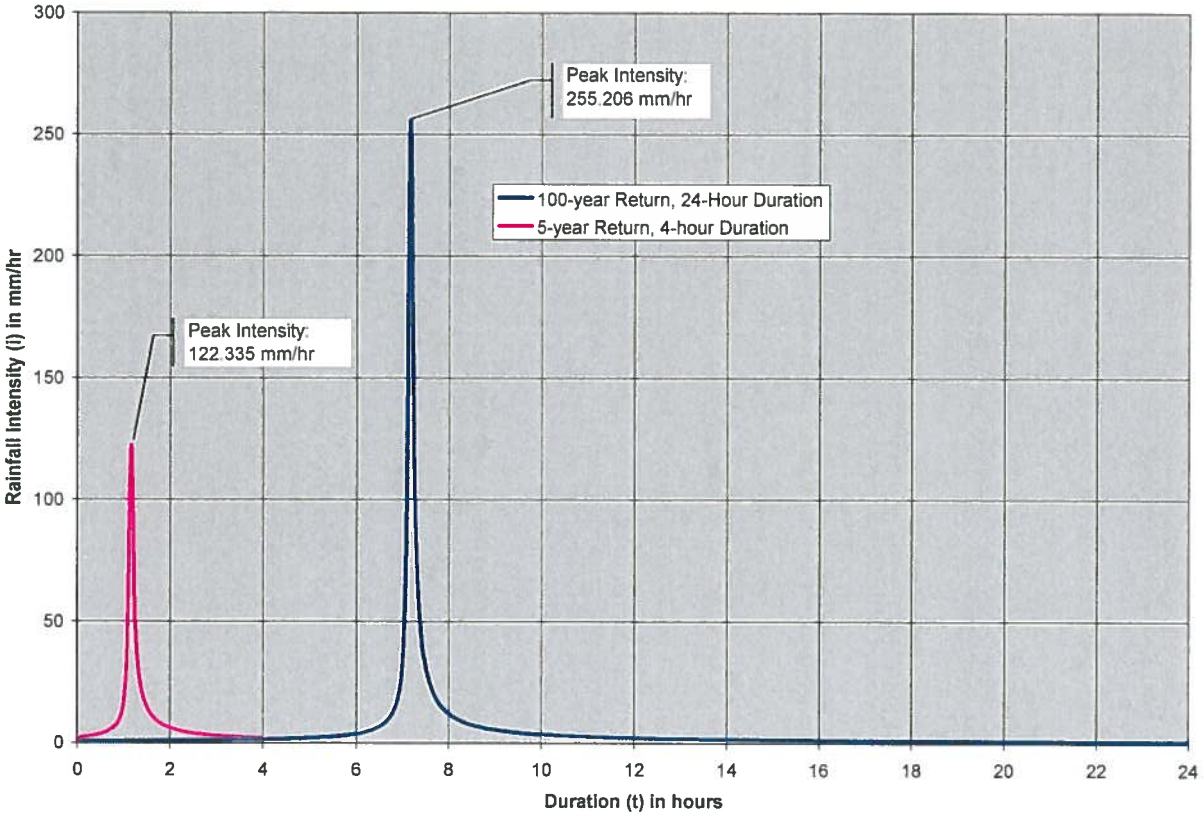


Figure 3 - Hyetographs for City of Lethbridge Design Storms

The maximum of the single-event and extrapolated continuous model is used to determine the required size of detention storage facilities.

2.3.Hydrologic Assumptions

Other hydrologic parameters used in modeling hydrology in SWMM5 are as follows:

Table 2 - Hydrologic Parameters Used in SWMM Model

Parameter	Value
Subcatchment Width	Gross Area [m^2]/length of longest drainage path [m]
Depression Storage	Pervious Areas: 3.2 mm Impervious Areas: $0.77(\text{Catchment Slope [\%]})^{-0.49}$ [mm]
Soil Infiltration Method	Green-Ampt
Soil Infiltration Parameters	Pervious Areas Pervious Areas (Predevelopment): Soil Type Assumed: silty clay K = 0.5 mm/hr ψ = 292.2 mm IMD = 0.26
Roughness	Pervious Areas (Post-Development): n = 0.1 (short grass)

	Pervious Areas (Predevelopment): n = 0.15 (assume short prairie grass) Impervious Areas: n = 0.015 (assume asphalt or concrete)
Imperviousness	Predevelopment: 0% Post-development: 7.3%

2.4. Culvert Hydraulics

Culvert hydraulic capacity and performance rating curves were produced using Hy8 software.[6] Hy8 analyzes the performance of culverts using methods described by the US Department of Transportation, Federal Highway Administration.[7] These methods are used for assessing culvert capacity across North America.

[6] *Hy-8* version 7.0 (United States Department of Transportation – Federal Highway Administration, Washington, DC, March 2007)
[7] *Hydraulic Design of Highway Culverts – HDS5* (United States Department of Transportation – Federal Highway Administration, Washington, DC, September 1985)

3. CURRENT DRAINAGE AND STORMWATER MANAGEMENT

Based on discussions with LNID, Alberta Infrastructure and Transportation (AIT) and Alberta Environment (AENV), there is no record of any gauging stations or historical records of flows in Piyami Coulee. Given the relatively large areas drained and the inflows from the LNID canal, conventional methods of runoff estimation are not readily applicable. Therefore, any estimates of expected flows in the coulee should be considered order-of-magnitude, at best.

Given the above data, a rating curve for the culvert was estimated. **Figure 4** shows the relationship between expected culvert capacity (in m^3/s) to water surface elevation immediately upstream of the culvert. The top of the culvert is at elevation 896.0. If the water level upstream of the culvert were at this elevation, MGCL predicts the approximate discharge through the culverts to be **8.6 m^3/s**. Alberta Infrastructure and Transportation (AIT) monitors flows in the major (bridge) culverts along provincial highways during major storms. According to AIT, there are no recorded instances of culvert surcharge or road overtopping at this location in the extreme storms in 1995 or 2005.[8]

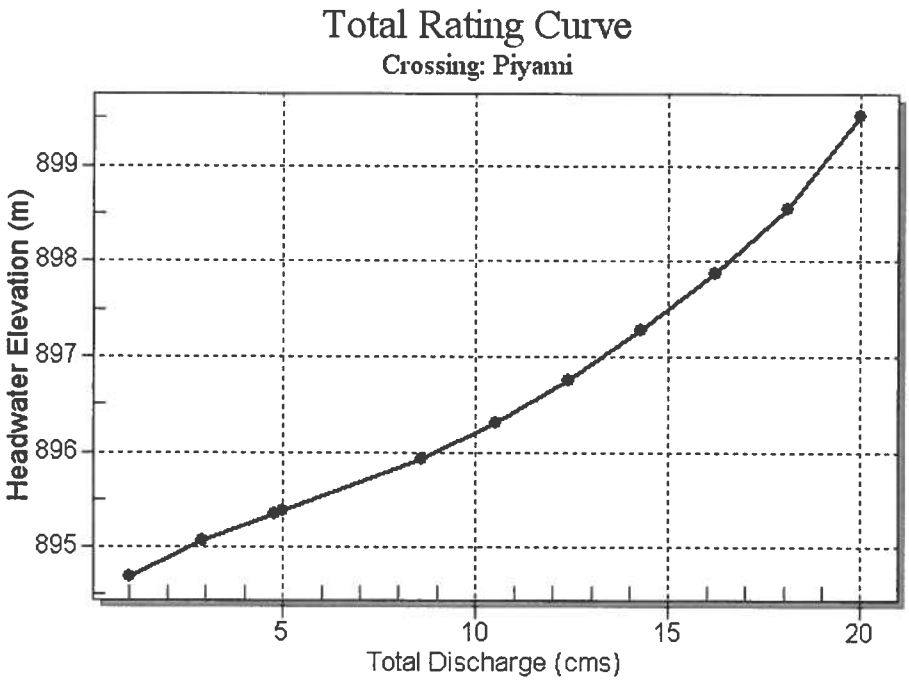


Figure 4 - Rating Curve for Highway 25/Piyami Coulee Culverts

The subject parcel is approximately 31.6 ha (78 acres). The site is currently used for agricultural purposes (the area south of Piyami Coulee is a tree farm) and is otherwise not intensively developed. Much of the site (30.2 ha) surface drains directly into Piyami Coulee. It is also assumed (based on surface feqature mapping and provincial aerial photography) that the subject parcel receives runoff from approximately 10 ha of land to the east and north. The northeast corner of the site contains an existing LNID lateral irrigation canal. The area northeast of this canal (approx. 1.4 ha) drains toward the northeast. Existing drainage from the site is shown on **Figure 6**.

Given the topography and soil conditions onsite, MGCL estimates mean annual runoff from the 31.6-ha parcel of approximately 20 mm. The above is based on a stormwater model using 35 years of hourly rainfall data (years 1960-1995) collected at Lethbridge County Airport.

[8] Source: Meeting with Mr. Lorenz Bonhert, AIT, Lethbirdge, 26 October 2007.

Peak runoff from the subject parcel and adjacent upland areas resulting from City of Lethbirdge 5- and 100-year design storms are shown on **Figure 7**.

4. DEVELOPMENT IMPACTS

The following impacts are anticipated due the development of Deer Run Estates.

4.1. Impacts on Rate and Volume of Runoff

Given this level of development intended for the site – 33 lots of approximately 0.4 ha (1 acre) area each, the amount of impervious surfaces (paved areas and roofs) in the subject parcel is expected to be approximately 7.3% of the total area. Based on SWMM modeling, it is estimated that this increase in impervious area will increase average annual runoff from the subject area to by 10% over predevelopment to approximately 22 mm. Predicted 5-year and 100-year peak runoff are shown on **Figure 7**.

4.2. Water-Quality Impacts

Erosion and sediment suspension due to residential development adversely impacts surface water quality. Runoff from established residential developments contains many chemicals (fertilizers, hydrocarbons, heavy metals and other chemicals) which are deleterious to the natural environment. However, given Piyami Coulee's present use as a conveyance for agricultural drainage and the lack of existing baseline water quality data, MGCL cannot provide a quantitative estimate of the effects of this development on Piyami Coulee.

5. RECOMMENDATIONS FOR STORMWATER MANAGEMENT

As stated, the subdivision design considers both the routing of runoff within the subdivision from a safety and level-of-service perspective:

- As is typical in rural residential development, all drainage is overland.
- At this time, it is assumed that streets will be paved.
- Roadways will have concrete curbs and gutters on either side, eliminating the need for driveway culverts and most of the roadside ditching.
- Where flows are required to cross streets, concrete swales or culverts will be provided depending on the rate of runoff that must be discharged (where the depth of crossflows in a 5-year, 4-hour Lethbridge design storm is predicted to exceed 50 mm, a culvert will be provided).
- The road cross-section will be designed to contain runoff resulting from a City of Lethbridge 24-hour, 100-year return period storm within the road right-of-way.
- Where any ponding is predicted to cross onto private property, appropriate restrictive covenants and/or easements will be registered. Runoff flows over the road will not exceed Alberta Environment's depth-velocity guidelines detailed on **Table 3**. Where these guidelines cannot be met, runoff will be routed into dedicated open channels.

Table 3 - AENV Depth-Velocity Guidelines[9]

Water Velocity (m/s)	Permissible Depth (m)
0.5	0.80
1.0	0.32
2.0	0.21
3.0	0.09

Note: Based on a 20-kg child and concrete-lined channels.
Larger persons may be able to withstand deeper flows.

As previously noted, the low areas adjacent the LNID canal are wet. This may be due, in part, to seepage from the canal – which may be corrected when the canal is abandoned. However, to protect homeowners, particularly in Lots 10-14 of Block 1, foundation drainage will be specifically addressed in the detail design. Possible methods used to protect foundations and ameliorate saturated areas may include lot grading, ditching, provision of dedicated foundation drain pipes or other methods.

As much as possible, existing native vegetation should be retained to reduce the possibility of erosion and sedimentation in Piyami Coulee and downstream. Prior to release into the coulee, much of the lot runoff will have been routed overland as sheet flow or shallow channel flow through grass. Concentrated discharges will be avoided wherever possible. Where concentrated flows at outfalls cannot be avoided, appropriate engineered armouring (rip-rap, turf reinforcing mat, geotextiles, etc...) to maintain the channel bed and sides will be provided.

Given the upstream area drained (78 km^2) compared to the area of the proposed development (31 ha or 0.31 km^2), Piyami Coulee itself has adequate capacity to discharge the runoff from the developed site. As such, the above-noted best management practices should provide

[9] *Stormwater Management Guidelines for the Province of Alberta* (Alberta Environment, January 1999), p. 3-9.

adequate protection for the environment and downstream landowners. Installation of stormwater detention facilities (e.g. wet or dry ponds) for this development is contraindicated for the following reasons:

1. Due to the existing site grading and the location of Piyami Coulee, it is likely several upstream facilities would be required to control all overland flows.
2. If such a facility were located within the floodway of Piyami Coulee, significant concern exists relating to long-term performance – as the facility would be likely trap sediment from upstream erosion. Removal of this sediment would require ongoing maintenance by the County.
3. Installation of a stormwater facility in the coulee would alter the hydraulics of the coulee itself.
4. Installation of stormwater detention facilities would likely entail more disturbances of the channel in Piyami Coulee thus increasing the short- and medium-term possibility of downstream erosion and sedimentation.

As stated, a roadway crossing of Piyami Coulee is required to service land in the northeast corner of the subject parcel. The crossing is proposed in the south part of the parcel – near an existing farm crossing (which is to be removed). To ensure safe access across the coulee and to ensure adequate hydraulic capacity of the coulee floodway without excessive backwater effects, culverts under the proposed road will be designed to allow a full-flow discharge equal to or greater than those under Highway 25. Culvert design and construction methods will be consistent with current AIT best practices for large-diameter "bridge"-culvert crossings.

Work in the coulee will be done during dry times and proper control of sediment will be provided for construction runoff. Engineered channel armour and revetments similar to that installed at the Highway 25 crossing will be installed to ensure channel stability is protected. Dissipation of energy resulting from high-velocity flows exiting the culverts will be addressed in the detail design.

6. REGULATORY CONSIDERATIONS

As the development will alter the hydrology in Piyami Coulee, a license to construct works will be required, pursuant to the Water Act. This application is made to Alberta Environment (AENV). The developer will be required to advertise that a license is being sought. Wording for the advertisement is provided by AENV. AENV, at their discretion, may require certain affected parties to be informed personally by letter. Landowners who are affected by the application are allowed to submit statements of concern to AENV. AENV, at their discretion, may grant appeals against the license based on these statements of concern. The wording and amount of time required for advertisement is at AENV's discretion.

A letter of authorization under the Environmental Protection and Enhancement Act from AENV is also required for the stormwater management plan. Notification of project to AENV is required for any upland drainage works.

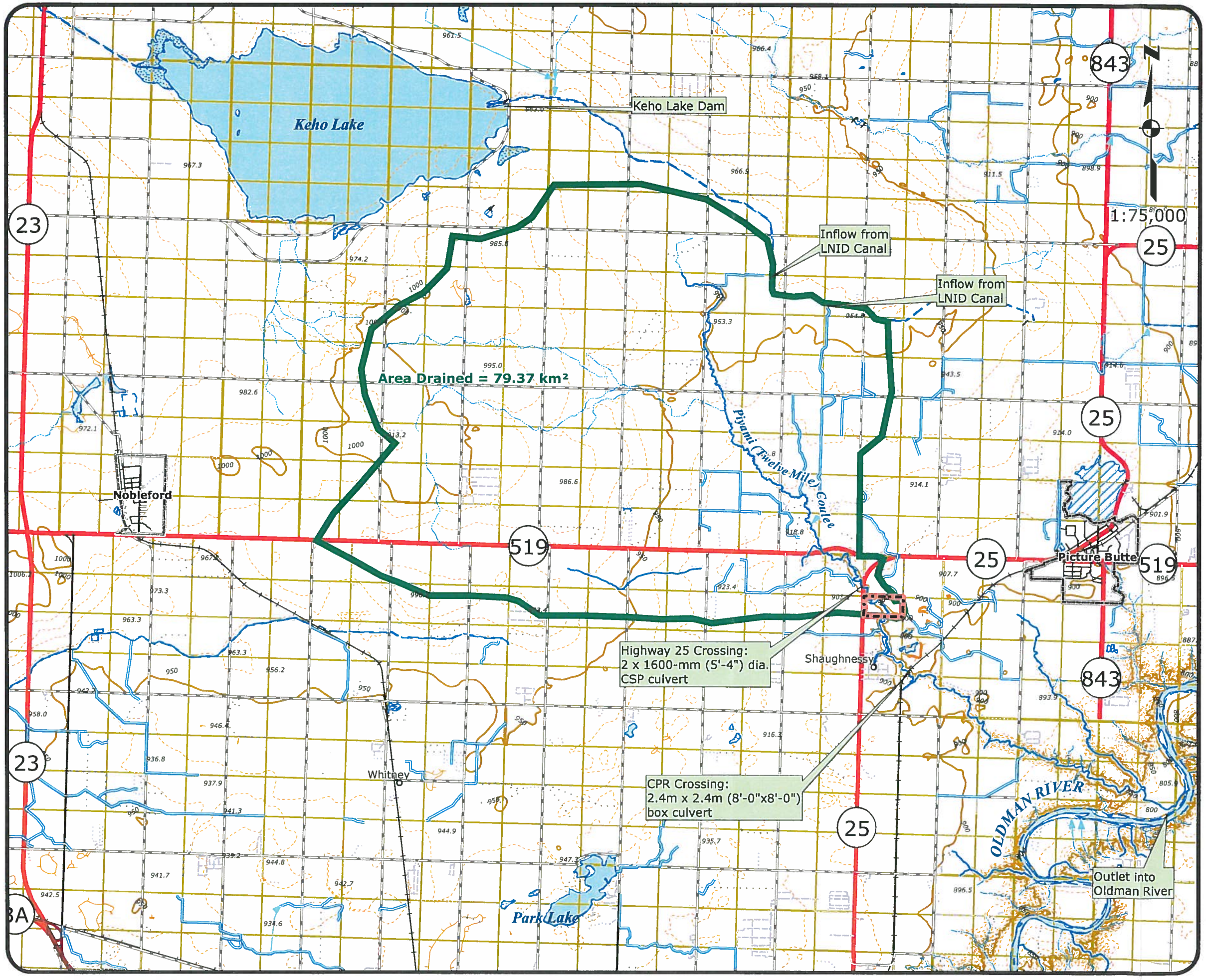
MGCL is not aware of any documents designating Piyami Coulee as a "navigable waterway" nor is MGCL aware of any documents designating it a "fish-bearing" stream. However, to ensure compliance with federal law, MGCL strongly advises the client to inform Fisheries and Oceans Canada (DFO) of the proposed works.

7. CLOSING

This report details the concept for providing drainage of runoff from the proposed Deer Run Estates subdivision and mitigating its effects. We are satisfied that it provides sufficient detail for approval of an Area Structural Plan. This document will provide the direction for drainage and stormwater management in the detail design.

Per:
Martin Geomatic Consultants Ltd.

Michael A. Kitchen, P.Eng.



Deer Run Estates

Area Structure Plan - Stormwater Management Concept

Figure 5

Location of Site in Piyami Watershed

Legend

- Subject Parcel
- Upstream Watershed
- Contour (10-m)
- Depression Contour (10-m)
- Index Contour (50-m)
- Depression Index Contour (50-m)

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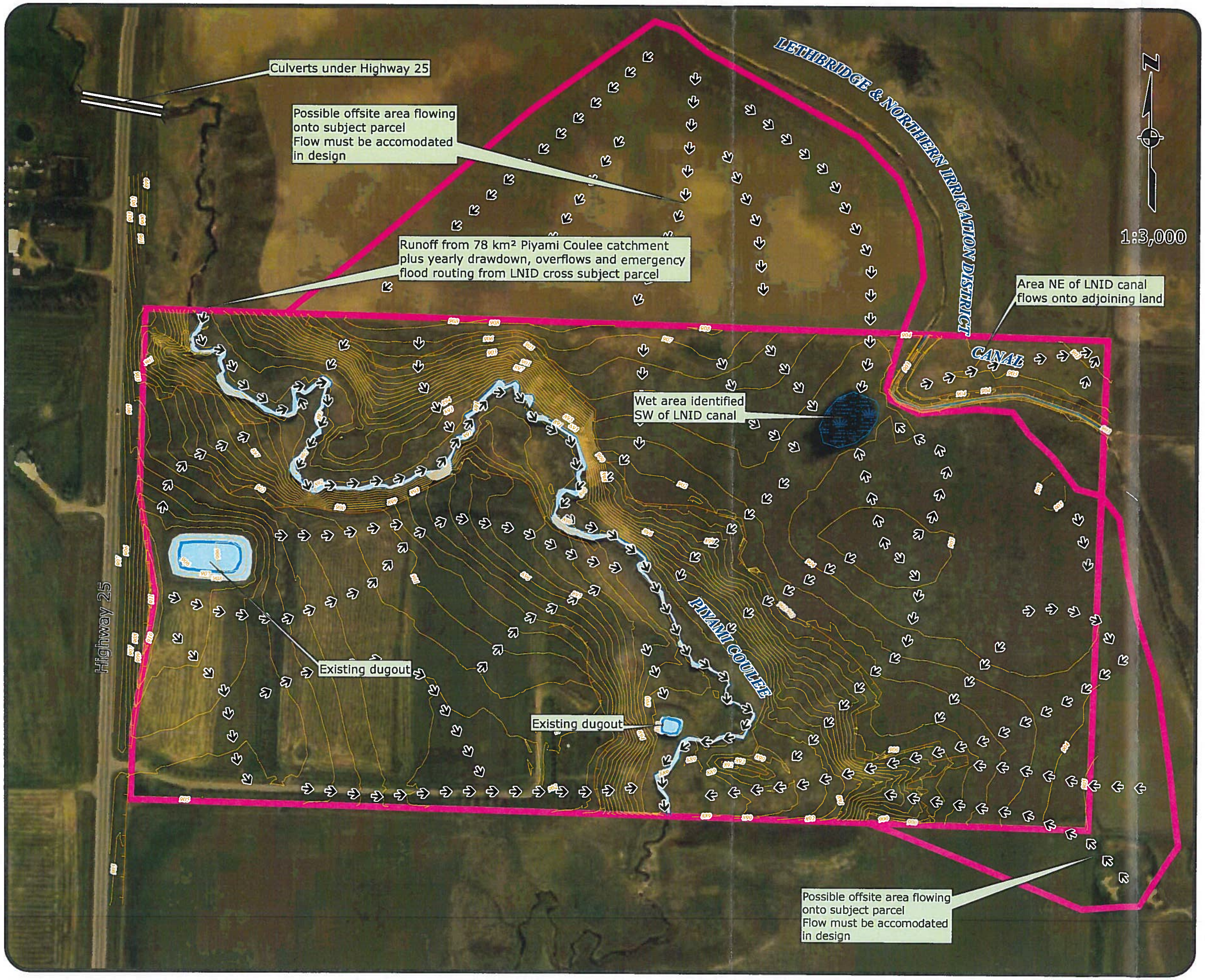

Deer Run Estates

Area Structure Plan - Stormwater Management Concept

Figure 6

Existing Site Drainage

Legend

Drainage Catchment

Overland Flow

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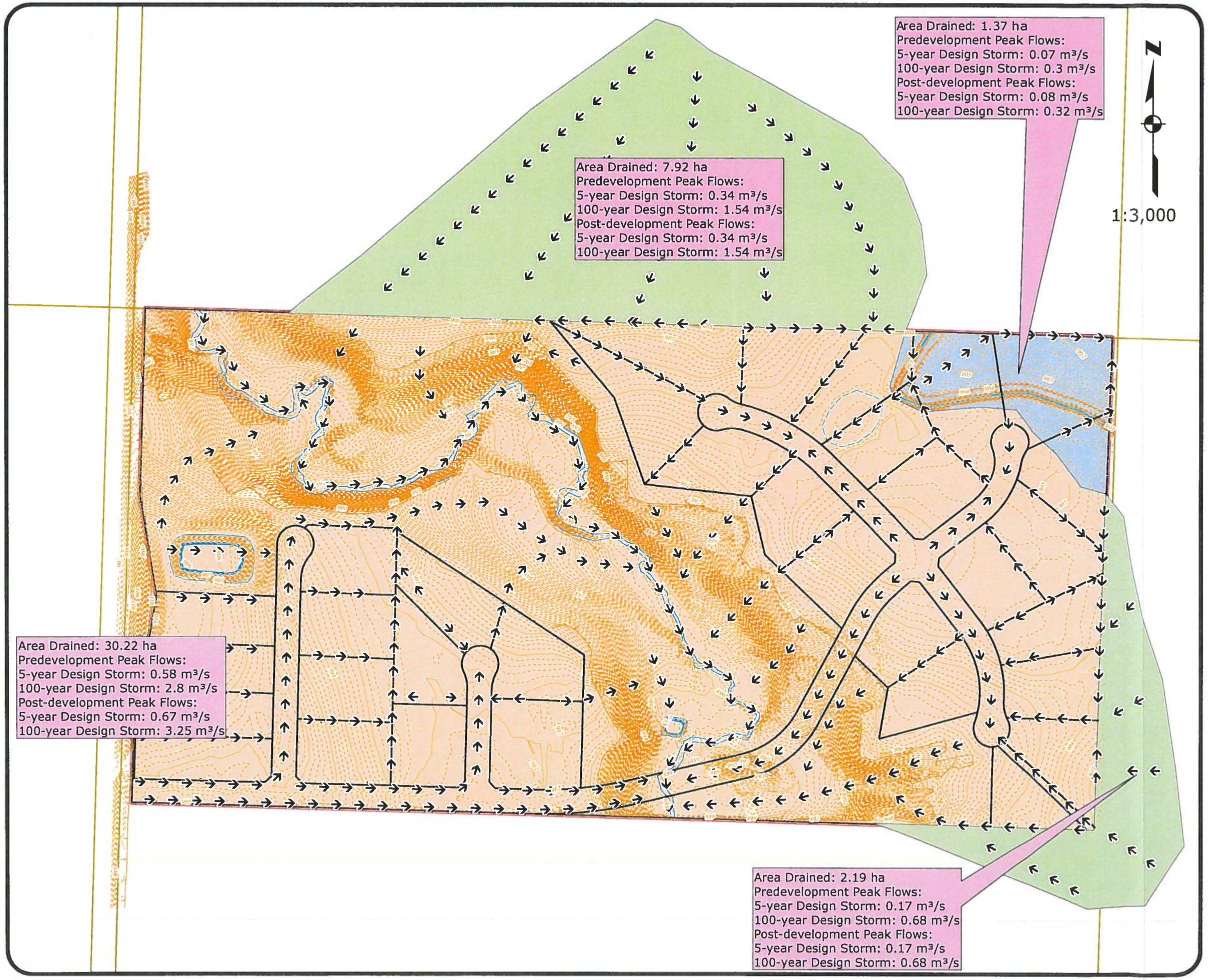

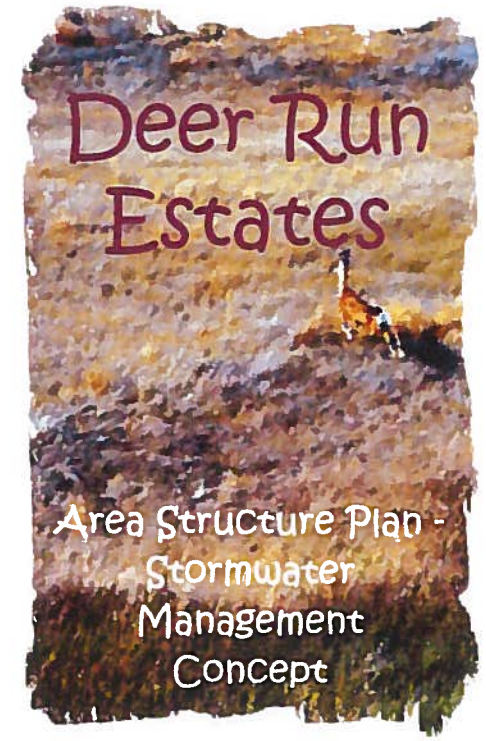

Figure 7

Predicted Runoff and Proposed Drainage Concept

Legend

→ → → Proposed Overland Flow Route

Drainage Catchment

- Drains to northeast
- Drains from offsite
- Site flows directly to Piyami Coulee

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iTRANS
transportation planning &
engineering consultants

Martin Geomatics Consultants Ltd.

Proposed Development in SW-31-10-21-4 Traffic Impact Assessment

Lethbridge, Alberta

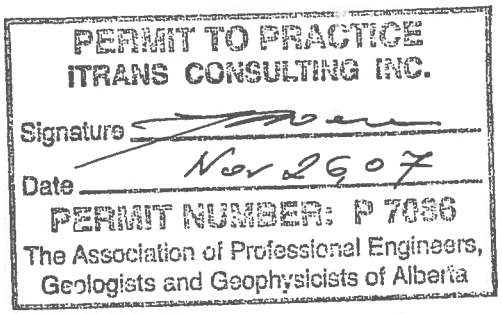
November 2007

Martin Geomatics Consultants Ltd.

Proposed Development in SW-31-10-21-4 Traffic Impact Assessment

Lethbridge, Alberta

November 2007



iTRANS Consulting Inc.
700-926 5th Avenue, S.W.
Calgary, AB T2P 0N7
Tel: (403) 537-0250
Fax: (403) 537-0251
Email: itrans@itransconsulting.com
www.itransconsulting.com

Project # 4412

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Appendices

1. INTRODUCTION

Martin Geomatics Consultants Ltd., representing a developer, proposes to develop a residential area in SW-31-10-21-4-south of Picture Butte. The proposed development will be located east of Highway 25 (**Figure 1**) and include 35 country residential lots.

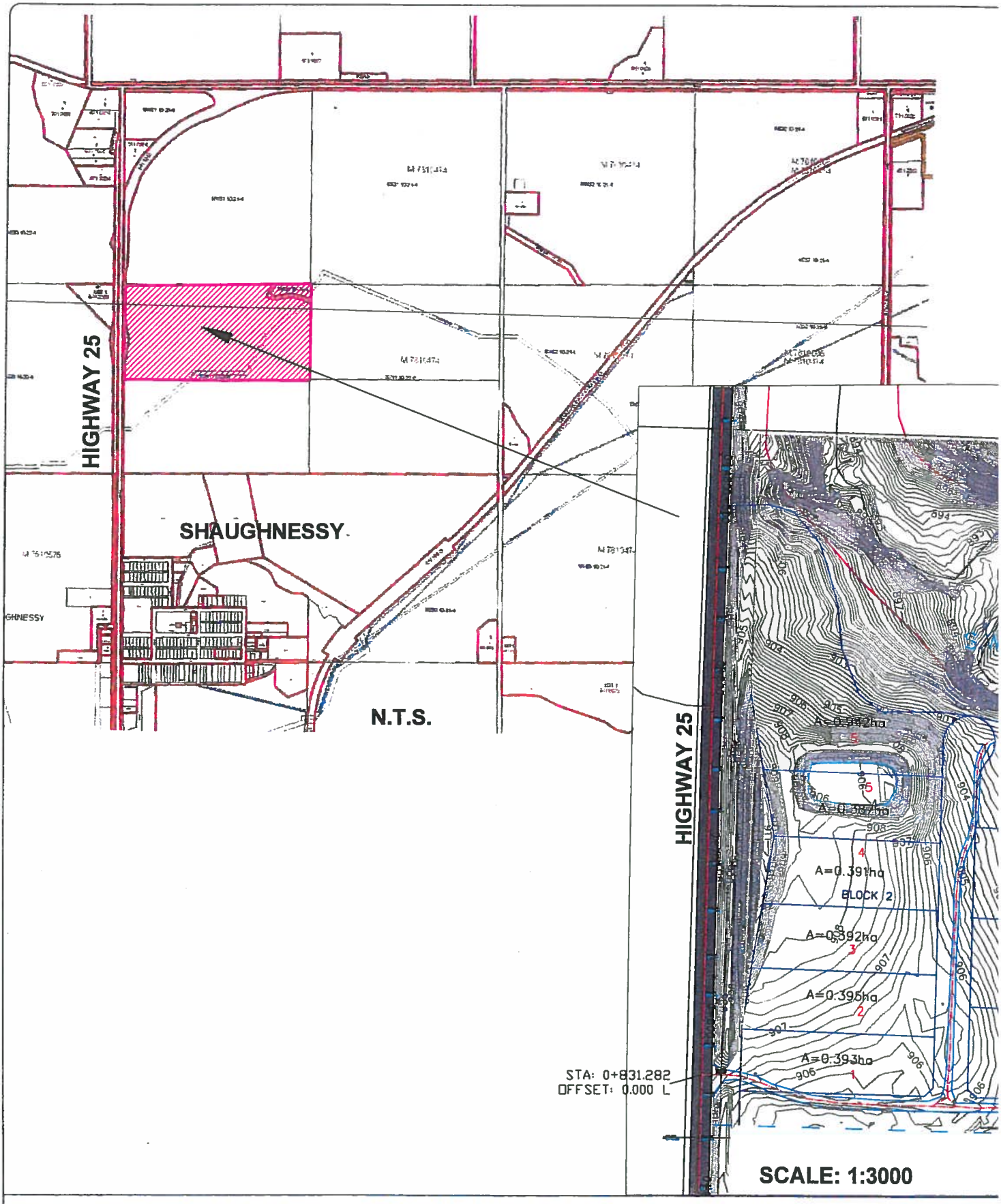
Martin Geomatics Consultants Ltd. retained iTRANS Consulting Inc. to prepare a traffic impact assessment for the proposed development. The approval for this development has to be obtained from Alberta Infrastructure and Transportation (AIT). Consequently, to ascertain that the analysis will match AIT's requirements, the scope of the TIA was verified with the AIT personnel representing AIT's Calgary Office. Requirements outlined by AIT included:

- Estimate of traffic for full build-up of the development,
- Review of the expected operational conditions assuming current traffic volumes and full build-up of the development;
- Review of the expected operational conditions at the 10 and 20 horizon year, and;
- Review access intersection in terms of the adequacy of the intersectional sight distance.

The analysis was based on the traffic information obtained from the AIT database for the 100 design hour.

ITE Trip Generation table were used in the estimate of the anticipated traffic volumes which are expected to be generated by the proposed development. The anticipated PM peak hour traffic volumes generated by the development were used in the analysis.

This report presents the study methodology, conclusions and recommendations.


HIGHWAY 25
SHAUGHNESSY
N.T.S.
HIGHWAY 25
A=0.392ha
A=0.387ha
A=0.391ha
BLOCK 2
A=0.392ha
A=0.395ha
A=0.393ha
STA: 0+831.282
OFFSET: 0.000 L
SCALE: 1:3000

2. TRAFFIC ANALYSIS METHODOLOGY

Traffic analysis for each required scenario, was evaluated using the Synchro/SimTraffic software based on the U.S. Highway Capacity Manual (HCM).

In the HCM methodology, Level-of-Service (LOS) is the primary evaluation criteria for operating conditions. For unsignalized intersections, the level-of-service (LOS) is based on the computed delays. LOS 'A' represents minimal delays to minor road traffic movements, and LOS 'F' represents a scenario with an insufficient number of gaps on the major road for minor street motorists to complete their movements without significant delays.

The HCM intersections capacity evaluation criteria for both unsignalized and signalized intersections are summarized in **Table 1**.

Table 1: Level of Service Criteria

Level of Service (LOS)	Average Delay for UNSIGNALIZED Intersection Movements
A	0 – 10 sec. per vehicle
B	> 10 – 15 sec. per vehicle
C	> 15 – 25 sec. per vehicle
D	> 25 – 35 sec. per vehicle
E	> 35 – 50 sec. per vehicle
F	> 50 sec. per vehicle

In accordance with AIT criteria, a level of service of C, and a v/c ratio of 0.90 are desirable upper limits. For the purpose of this analysis, a LOS C or higher and a v/c lower than 0.90 were assumed acceptable operational conditions.

3. ANALYSIS

3.1 Existing Conditions

The area is currently undeveloped and used for agricultural activities. Consequently, there is no traffic generated by the site on the day to day basis.

3.2 Development Staging

The proposed development of 35 residential lots will be realized in one continuous stage.

3.3 Analyzed Network

Since the proposed development includes only 35 residential lots, the analysis was limited to the access intersection on Highway 25.

3.4 Trip Generation

Based on ITE Trip Generation Tables number of trips which are expected to be generated by the proposed development was calculated as shown in **Table 2.** All trips were assumed to be vehicular trips. The results of the sensitivity analysis indicate that the highest number of trips should be expected in the PM peak based on the results received from ITE equation.

Although the AIT traffic volumes used in the analysis represent the 100 highest traffic volumes in the year, both the higher estimated AM and PM peak traffic volumes (34 trips and 42 trips, respectively) were used in the analysis.

Table 2: Trip Generation

Land Use:	Single-Family Detached Housing	
Independent Variable:	35	Dwelling Units
AM Peak		**# of trips/h**
Trip Gen Source:	ITE 7th Ed (LU 210) Page 270, rate-based with average rate = 0.75	**26**
Trip Gen Source:	ITE 7th Ed (LU 210) Page 270, based on the equation T = 0.7(X) + 9.43	**34**
PM Peak		
Trip Gen Source:	ITE 7th Ed (LU 210) Page 271, rate-based with average rate = 1.01	**35**
Trip Gen Source:	ITE 7th Ed (LU 210) Page 271, based on the equation T = EXP(0.9LN(x) + 0.53)	**42**

3.5 Trip Distribution

To establish trip distribution at the access intersection the AIT turning movement information for the intersection #101090 at Highway 25 and Highway 519 West of Picture Butte was used **(Appendix I)**.

Based on this information a trip distribution matrix was established and is summarized in **Table 3**.

Table 3: Trip Distribution

AM

Peak Hour	Total Trips	Directional Split
In	9	25%
Out	26	75%
Total	34	100%

	% In	% Out	New Trips In	New Trips Out
Highway 25 North	71.7%	96.1%	6	25
Highway 25 South	28.3%	3.9%	3	1

PM

Peak Hour	Total Trips	Directional Split
In	26	63%
Out	16	37%
Total	42	100%

	% In	% Out	New Trips In	New Trips Out
Highway 25 North	84.7%	90.4%	22	14
Highway 25 South	15.3%	9.6%	4	2

3.6 Growth Factor

To establish the long term growth factor historic AIT traffic data for Highway 25 were analyzed (**Table 4**).

Table 4: Growth Factor

Highway	Location	AADT									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
25	West of Range Road 213 (Barhill Rd.)	3830	4110	4150	3930	3910	3680	3720	3740	3860	3930
25	East of Range Road 213 (Barhill Rd.)	3940	4240	4280	4030	4010	3790	3830	3850	3920	3990

Year	Growth Rate	
	W. of RR 213	E. of RR 213
1998	7.31%	7.61%
1999	0.97%	0.94%
2000	-5.30%	-5.84%
2001	-0.51%	-0.50%
2002	-5.88%	-5.49%
2003	1.09%	1.06%
2004	0.54%	0.52%
2005	3.21%	1.82%
2006	1.81%	1.79%
Average	**0.36%**	**0.21%**
	0.29%	

Historical traffic volumes, as per Alberta Infrastructure and Transportation (AIT) Data:
http://www.infratrans.gov.ab.ca/INFTRA_Content/docType181/production/TVH2006.pdf

Assuming linear growth correlation between 1997 traffic volumes and 2006 traffic volume in the same locations a growth factor was estimated at 0.29%/annum.

The average provincial growth factor varies in the range of 2 to 2.5% per annum. Consequently it was decided, in consultation with AIT Lethbridge staff, that a 2.5% growth factor should be adopted in this analysis and that 2006 AIT traffic information should be used as a base to establish horizon background traffic volumes.

4. FUTURE CONDITIONS

4.1 Future Traffic Volumes

Anticipated future traffic volumes are shown in **Appendix II**.

4.2 Capacity and Operational Analysis

Capacity and operational analysis was carried out using Synchro/SimTraffic micro simulation software. Detailed result sheets are included in **Appendix II** while **Table 5** summarizes results of the analysis.

Table 5: Summary of Synchro Results

2007 Operating Conditions

Intersection/Movement			A.M. Peak hour				PM Peak Hour			
			LOS	Delay (s/veh)	v/c ratio	95 Q (m)	LOS	Delay (s/veh)	v/c ratio	95 Q (m)
Highway 25 & Site Access (unsignalized)	WB	LT/RT	A	9.0	0.03	0.7	A	9.2	0.02	0.4
	NB	Thru/RT	A	0.0	0.07	0.0	A	0.0	0.09	0.0
	SB	LT/Thru	A	0.4	0.00	0.1	A	1.0	0.02	0.4
	Intersection Summary		**A**	**1.0**	**0.07 (max)**		**A**	**1.0**	**0.09 (max)**	

2017 Operating Conditions

Intersection/Movement			A.M. Peak hour				PM Peak Hour			
			LOS	Delay (s/veh)	v/c ratio	95 Q (m)	LOS	Delay (s/veh)	v/c ratio	95 Q (m)
Highway 25 & Site Access (unsignalized)	WB	LT/RT	A	9.0	0.03	0.7	A	9.2	0.02	0.4
	NB	Thru/RT	A	0.0	0.07	0.0	A	0.0	0.09	0.0
	SB	LT/Thru	A	0.3	0.00	0.1	A	1.0	0.02	0.4
	Intersection Summary		**A**	**1.0**	**0.07 (max)**		**A**	**0.9**	**0.09 (max)**	

2027 Operating Conditions

Intersection/Movement			A.M. Peak hour				PM Peak Hour			
			LOS	Delay (s/veh)	v/c ratio	95 Q (m)	LOS	Delay (s/veh)	v/c ratio	95 Q (m)
Highway 25 & Site Access (unsignalized)	WB	LT/RT	A	9.1	0.03	0.7	A	9.2	0.02	0.4
	NB	Thru/RT	A	0.0	0.08	0.0	A	0.0	0.09	0.0
	SB	LT/Thru	A	0.4	0.00	0.1	A	1.0	0.02	0.4
	Intersection Summary		**A**	**0.9**	**0.08 (max)**		**A**	**0.9**	**0.09 (max)**	

4.3 Discussion of Results

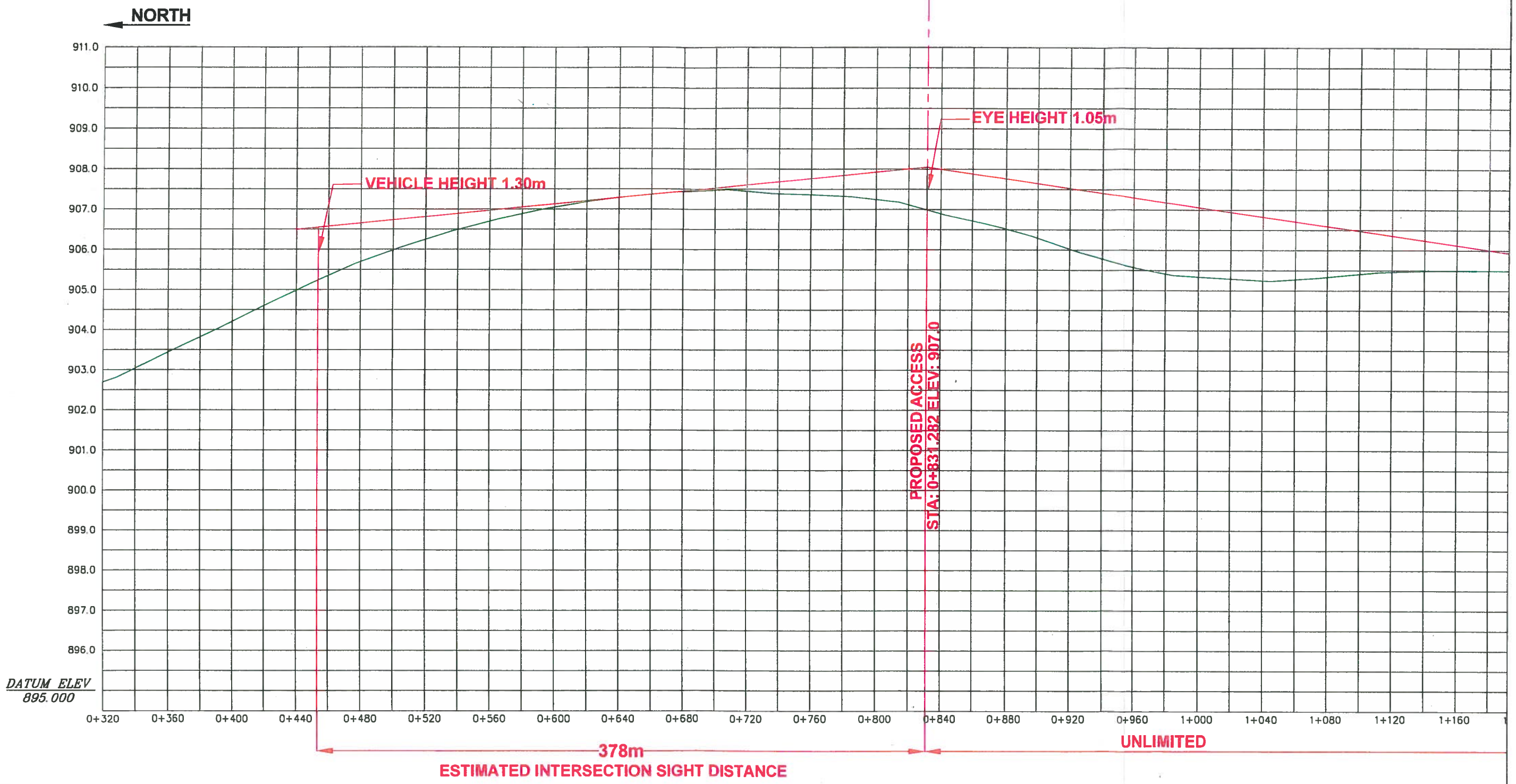
As shown in **Table 5,** results of the analysis indicate the access intersection will operate at the LOS A past 2017 horizon year and that maximum delays will not exceed 9.5 seconds.

5. INTERSECTION SIGHT DISTANCE

According to AIT Highway Geometric Design Guidelines the required intersection sight distance for the access intersection on Highway 25 assuming 100 km/h speed should be:

- At least 375 m in case of WB 21 design vehicle
- At least 240 m in case of SU design vehicle
- At least 170 m in case of a personal vehicle.

As illustrated on **Figure 2,** the intersection sight distance to the south of the proposed intersection is unlimited while to the north of the proposed intersection the intersectional sight distance is approximately 378 m. Consequently, the proposed location of the intersection matches AIT requirements in terms of intersectional sight distance.



SCALE: H 1:2500
V 1:100

PRELIMINARY
FOR DISCUSSION ONLY

PROPOSED DEVELOPMENT in SW
31 - 10 - 21 - 4
TRAFFIC IMPACT ASSESSMENT
Figure 2: Intersection Sight Distance
Date: November, 2007

6. CONCLUSIONS AND RECOMMENDATIONS

Results of our review indicate the following:

- The proposed development will have negligible impact on the operation of Highway 25.
- The proposed access intersection should be constructed as a Type IIa intersection as per Figure # D-7c in AIT Highway Geometric Design Guidelines (see **Appendix III**).

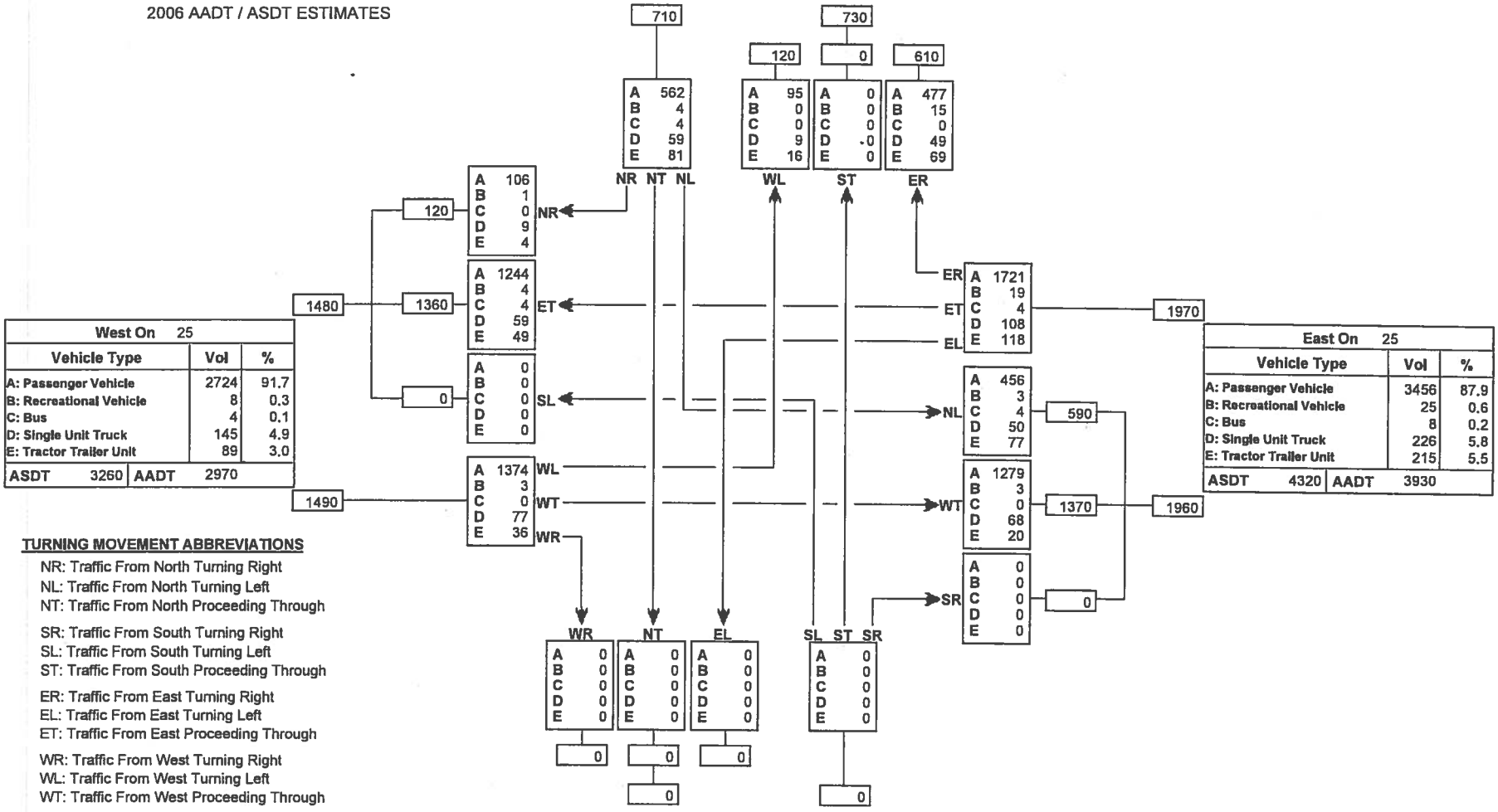
Appendix I AIT Traffic Data

Reference No.: 101090

Intersection of:
25 & 519 W OF PICTURE BUTTE WJ

2006 AADT / ASDT ESTIMATES

Turning Movement Summary Diagram



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)

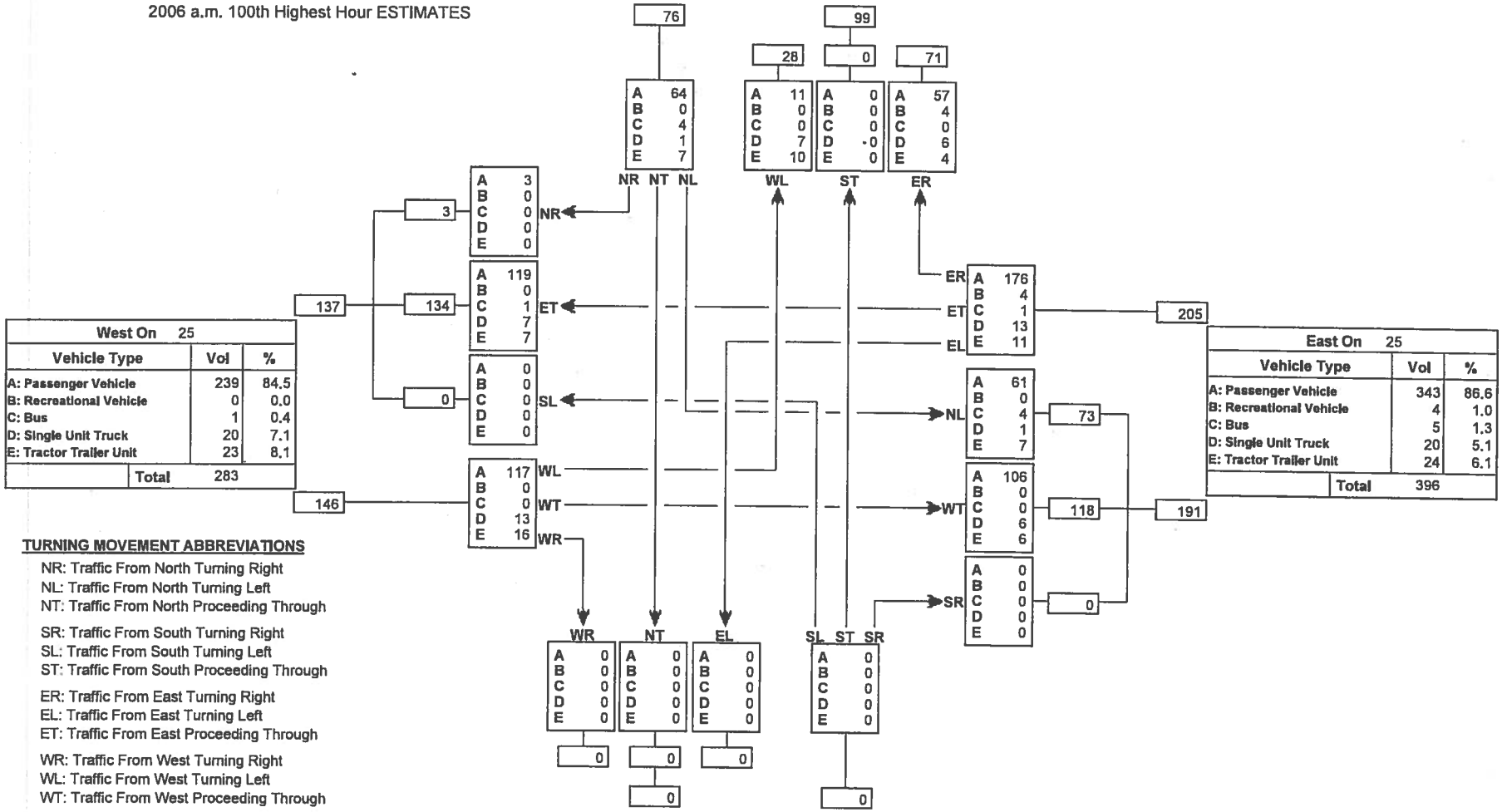
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 101090

Intersection of:
25 & 519 W OF PICTURE BUTTE WJ

2006 a.m. 100th Highest Hour ESTIMATES



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WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 101090

Intersection of:
25 & 519 W OF PICTURE BUTTE WJ

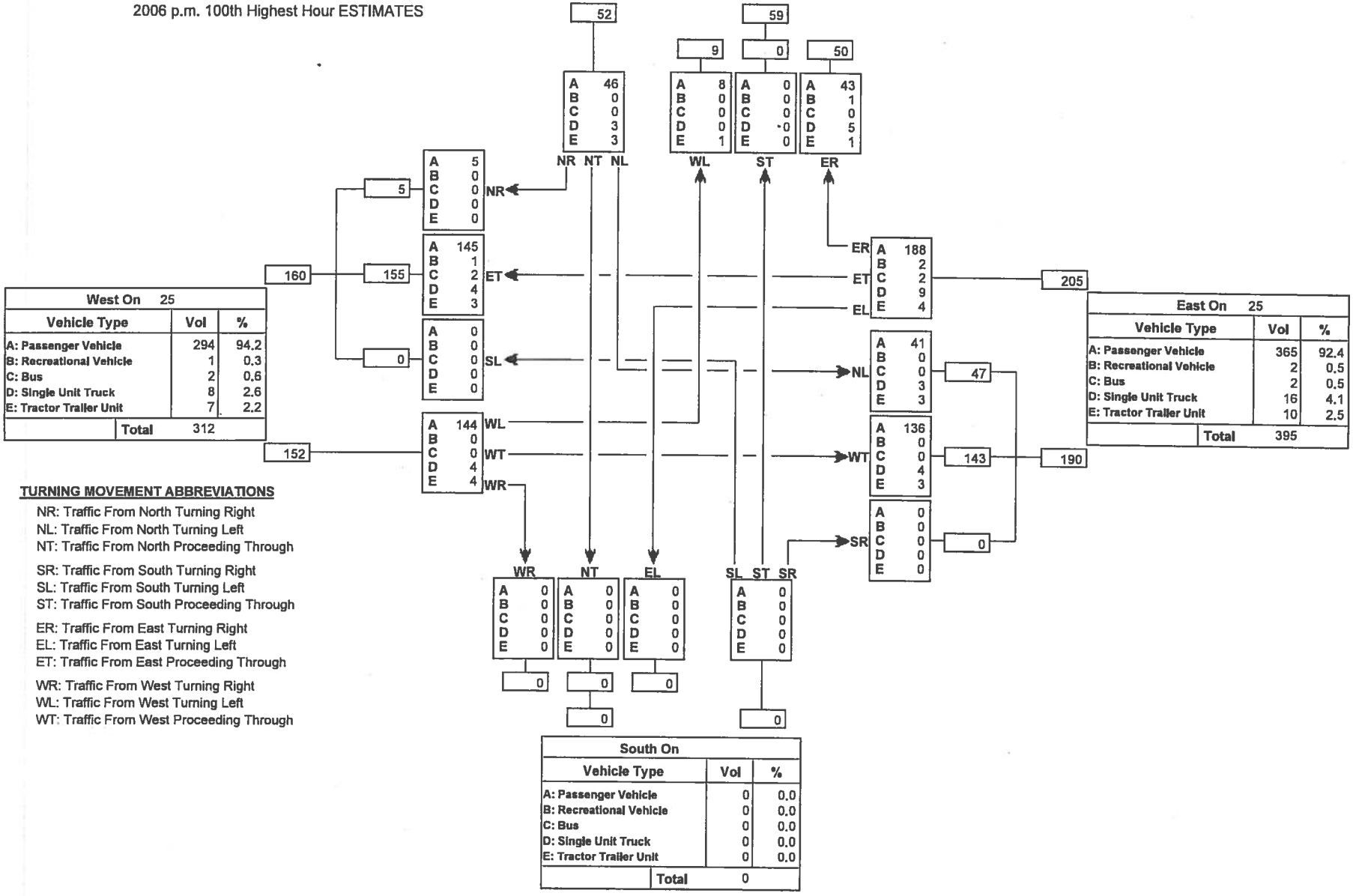
2006 p.m. 100th Highest Hour ESTIMATES

North On 519		
Vehicle Type	Vol	%
A: Passenger Vehicle	97	87.4
B: Recreational Vehicle	1	0.9
C: Bus	0	0.0
D: Single Unit Truck	8	7.2
E: Tractor Trailer Unit	5	4.5
Total	111	

West On 25		
Vehicle Type	Vol	%
A: Passenger Vehicle	294	94.2
B: Recreational Vehicle	1	0.3
C: Bus	2	0.6
D: Single Unit Truck	8	2.6
E: Tractor Trailer Unit	7	2.2
Total	312	

East On 25		
Vehicle Type	Vol	%
A: Passenger Vehicle	365	92.4
B: Recreational Vehicle	2	0.5
C: Bus	2	0.5
D: Single Unit Truck	16	4.1
E: Tractor Trailer Unit	10	2.5
Total	395	

South On		
Vehicle Type	Vol	%
A: Passenger Vehicle	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	0	



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EL: Traffic From East Turning Left
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WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME, VEHICLE CLASSIFICATION, TRAVEL and ESAL STATISTICS REPORT
2006

Alberta Infrastructure and Transportation
Program Management Branch
Network Planning and Performance

Produced: 08-Mar-2007 By CornerStone Solutions Inc. Updated P. Kilburn P.Eng. 2006 03 28

Hwy	CS	TCS	Muni	From	To	From Km	To Km	Length In Km	Volume WAADT	Volume WASDT	Classifications %PV	%RV	%BU	%SU	%TT	%CM	Travel MVKM Annual	Travel MVKM Summer	ESAL / Day / Dir SU	ESAL / Day / Dir TC	ESAL / Day / Dir Total
22	32	4	Yelw	N OF 16A E OF STYAL	S OF 647 S OF MAYERTHORPE	0.630	33.290	32.660	1550	1660	73.8	6.5	0.4	5.3	14.0	19.7	18.5	8.3	36.2	224.9	261.1
22	32	8	LSAn	N OF 647 S OF MAYERTHORPE	MAYERTHORPE S.C.L.	33.290	38.960	5.670	1740	1870	77.8	4.5	0.3	7.0	10.4	17.7	3.6	1.6	53.7	187.6	241.3
22	32	10	LSAn	MAYERTHORPE S.C.L.	S OF 43 AT MAYERTHORPE	38.960	39.580	0.620	2360	2540	82.4	2.3	1.2	5.1	9.0	15.3	0.5	0.2	53.0	220.2	273.2
22	32	12	LSAn	N OF 43 AT MAYERTHORPE	MAYERTHORPE N.C.L.	39.580	41.340	1.760	4180	4490	87.2	1.3	1.2	4.5	5.8	11.5	2.7	1.2	82.9	251.3	334.2
22	32	16	LSAn	MAYERTHORPE N.C.L.	S OF 18 N OF MAYERTHORPE	41.340	46.524	5.184	1140	1250	89.8	3.1	0.3	4.3	2.5	7.1	2.2	1.0	21.6	29.5	51.1
22	32			N OF 16 S OF STYAL SJ	S OF 18 N OF MAYERTHORPE			46.524	1640	1760	76.9	5.4	0.5	5.4	11.8	17.7	27.8	12.5	38.9	201.1	240.0
22				**N OF 3 E OF BURMIS**	**S OF 18 N OF MAYERTHORPE**			**531.867**	**3230**	**3740**	**78.9**	**5.1**	**0.6**	**4.9**	**9.4**	**14.9**	**627.0**	**304.3**	**69.4**	**315.6**	**384.9**
22 X	2	4	Fthl	E OF 22 NE OF PRIDDIS	CALGARY W.C.L.	0.000	6.482	6.482	8520	9630	89.2	3.3	1.1	3.2	3.2	7.5	20.2	9.5	120.1	282.6	402.7
22 X	2			E OF 22 NE OF PRIDDIS	CALGARY W.C.L.			6.482	8520	9630	89.2	3.3	1.1	3.2	3.2	7.5	20.2	9.6	120.1	282.6	402.7
22 X	4	8	Rkyv	CALGARY E.C.L.	W OF 791 SE OF INDUS	0.000	9.710	9.710	6000	6990	63.5	1.9	0.3	5.7	28.6	34.6	21.3	10.4	150.7	1778.6	1929.3
22 X	4	10	Rkyv	E OF 791 SE OF INDUS	W OF 797 NW OF DALEMEAD	9.710	16.270	6.560	4010	4680	64.2	2.7	0.5	5.8	26.8	33.1	9.6	4.7	102.5	1113.9	1216.4
22 X	4	12	WhtL	E OF 797 NW OF DALEMEAD	W OF 24 NW OF CARSELAND	16.270	26.137	9.867	3420	3990	59.2	3.4	0.4	6.5	30.5	37.4	12.3	6.0	97.9	1081.2	1179.1
22 X	4			CALGARY E.C.L.	W OF 24 NW OF CARSELAND			26.137	4530	5280	62.4	2.5	0.4	6.0	28.7	35.1	43.2	21.1	118.6	1348.5	1467.1
22 X				**E OF 22 NE OF PRIDDIS**	**W OF 24 NW OF CARSELAND**			**32.619**	**5320**	**6140**	**71.0**	**2.8**	**0.6**	**5.1**	**20.6**	**26.3**	**63.3**	**30.6**	**118.9**	**1136.7**	**1255.6**
23	4	4	Leth	N OF 3 E OF MONARCH	S OF 519 SW OF NOBLEFORD	0.000	8.090	8.090	4820	4910	77.9	2.7	0.4	3.8	15.4	19.4	14.2	6.1	76.4	769.4	845.8
23	4	8	Leth	N OF 519 SW OF NOBLEFORD	S OF 520 S OF BARONS SJ	8.090	21.100	13.010	3090	3150	77.7	1.8	0.3	3.8	16.4	20.5	14.7	6.3	51.7	525.3	577.0
23	4	12	Leth	N OF 520 S OF BARONS SJ	S OF 520 N OF BARONS NJ	21.100	26.170	5.070	3050	3110	76.2	3.4	0.3	4.3	15.8	20.4	5.6	2.4	57.8	499.5	557.3
23	4	16	Leth	N OF 520 N OF BARONS NJ	LITTLE BOW RIVER	26.170	39.014	12.844	2370	2410	73.2	2.9	0.4	6.0	17.5	23.9	11.1	4.7	62.6	429.9	492.5
23	4			N OF 3 E OF MONARCH	LITTLE BOW RIVER			39.014	3210	3270	76.5	2.5	0.4	4.3	16.3	21.0	45.7	19.5	61.2	541.1	602.4
23	6	4	Vulc	LITTLE BOW RIVER	S OF 529 NW OF CHAMPION	0.000	13.980	13.980	2380	2420	72.6	3.4	0.7	5.2	17.9	23.8	12.1	5.2	54.5	441.6	496.1
23	6	8	Vulc	N OF 529 NW OF CHAMPION	S OF 534 SE OF VULCAN	13.980	31.690	17.710	2530	2580	72.0	4.1	0.8	4.5	18.6	23.9	16.4	7.0	50.2	487.8	538.0
23	6	12	Vulc	W OF 534 SE OF VULCAN	E OF 24 N OF VULCAN	31.690	51.257	19.567	2430	2810	75.6	5.0	1.1	6.1	12.2	19.4	17.4	8.4	65.3	307.3	372.6
23	6			LITTLE BOW RIVER	E OF 24 N OF VULCAN			51.257	2450	2620	73.6	4.3	0.9	5.3	16.0	22.2	45.8	20.5	57.1	406.3	463.4
23	8	4	Vulc	W OF 24 N OF VULCAN	E OF 804 N OF BRANT	0.000	17.660	17.660	1150	1240	69.6	4.7	0.8	6.8	18.1	25.7	7.4	3.4	34.4	215.7	250.1
23	8	8	Fthl	W OF 804 N OF BRANT	E OF 799 S OF BLACKIE	17.660	26.290	8.630	1460	1580	74.0	3.4	1.2	6.5	14.9	22.6	4.6	2.1	41.8	225.5	267.3
23	8	12	Fthl	W OF 799 S OF BLACKIE	E OF 2 AT HIGH RIVER	26.290	42.910	16.620	2060	2220	78.6	3.3	0.9	5.3	11.9	18.1	12.5	5.6	48.1	254.1	302.2
23	8	16	Fthl	W OF 2 AT HIGH RIVER	E OF 2A AT HIGH RIVER	42.910	44.524	1.614	10120	10980	90.5	1.3	0.7	4.0	3.5	8.2	5.9	2.7	178.3	367.1	545.4
23	8			W OF 24 N OF VULCAN	E OF 2A AT HIGH RIVER			44.524	1870	2030	78.0	3.3	0.9	5.6	12.2	18.7	30.4	13.8	46.2	237.4	283.6
23				**N OF 3 E OF MONARCH**	**E OF 2A AT HIGH RIVER**			**134.795**	**2480**	**2610**	**75.8**	**3.4**	**0.7**	**5.0**	**15.2**	**20.8**	**122.0**	**53.8**	**54.7**	**389.5**	**444.2**
24	2	4	Vulc	N OF 23 N OF VULCAN	S OF 547 E OF MOSSLEIGH EJ	0.000	16.870	16.870	1600	1870	67.5	5.7	0.5	5.3	21.0	26.8	9.9	4.8	37.4	348.3	385.7
24	2	8	Vulc	W OF 547 E OF MOSSLEIGH EJ	E OF 547 W OF MOSSLEIGH WJ	16.870	26.050	9.180	1810	2120	66.5	4.9	0.4	6.3	21.9	28.6	6.1	3.0	50.2	410.9	461.1
24	2	12	Vulc	N OF 547 W OF MOSSLEIGH WJ	BOW RIVER (REGIONAL BOUNDARY)	26.050	38.670	12.620	1730	2030	63.2	5.2	0.1	7.1	24.4	31.6	8.1	4.0	54.1	437.5	491.6
24	2			N OF 23 N OF VULCAN	BOW RIVER (REGIONAL BOUNDARY)			38.670	1690	1980	65.8	5.3	0.3	6.2	22.4	28.9	23.9	11.7	45.9	392.3	438.1
24	4	2	WhtL	BOW RIVER (REGIONAL BOUNDARY)	E OF 817 SE OF CARSELAND	0.000	2.220	2.220	2260	2870	66.1	4.3	0.4	6.2	23.0	29.6	1.8	1.0	61.7	538.8	600.5
24	4	4	WhtL	W OF 817 SE OF CARSELAND	S OF 22X NW OF CARSELAND	2.220	16.270	14.050	2050	2600	61.3	3.8	0.1	6.1	28.7	34.9	10.5	5.6	55.1	609.8	664.9
24	4	8	WhtL	N OF 22X NW OF CARSELAND	S OF 1 W OF STRATHMORE	16.270	30.849	14.579	1820	2310	76.5	5.4	0.4	5.1	12.6	18.1	9.7	5.1	40.9	237.7	278.6
24	4			BOW RIVER (REGIONAL BOUNDARY)	S OF 1 W OF STRATHMORE			30.849	1960	2480	68.4	4.5	0.3	5.7	21.1	27.1	22.1	11.7	48.9	428.8	477.7
24				**N OF 23 N OF VULCAN**	**S OF 1 W OF STRATHMORE**			**69.519**	**1810**	**2200**	**67.0**	**5.0**	**0.3**	**5.9**	**21.8**	**28.0**	**45.9**	**23.4**	**47.2**	**408.5**	**455.7**
25	2	8	Leth	N OF 3 AT LETHBRIDGE	DIAMOND CITY S.C.L.	0.000	10.200	10.200	3980	4370	88.1	1.6	0.2	5.9	4.2	10.3	14.8	6.8	103.4	173.3	276.7
25	2	12	Leth	DIAMOND CITY S.C.L.	S OF 519 W OF PICTURE BUTTE WJ	10.200	20.110	9.910	2970	3260	86.8	0.5	0.5	6.2	6.0	12.7	10.7	4.9	81.1	184.7	265.8
25	2	16	Leth	E OF 519 W OF PICTURE BUTTE WJ	PICTURE BUTTE N.C.L.	20.110	24.890	4.780	3670	4030	85.1	0.9	0.8	5.8	7.4	14.0	6.4	2.9	93.8	281.5	375.3
25	2	20	Leth	PICTURE BUTTE N.C.L.	S OF 843 W OF IRON SPRINGS	24.890	30.370	5.480	1290	1460	79.0	0.4	1.8	6.1	12.7	20.6	2.6	1.2	34.7	169.8	204.5
25	2	24	Leth	E OF 843 W OF IRON SPRINGS	W OF 845 NE OF IRON SPRINGS	30.370	42.260	11.890	840	950	72.2	0.6	1.7	7.6	17.9	27.2	3.6	1.7	28.1	155.8	183.9
25	2	28	Leth	E OF 845 NE OF IRON SPRINGS	S OF 521 NE OF TURIN	42.260	52.725	10.465	620	700	78.8	0.6	1.2	8.0	11.4	20.6	2.4	1.1	21.8	73.3	95.1

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME, VEHICLE CLASSIFICATION, TRAVEL and ESAL STATISTICS REPORT
2006

Alberta Infrastructure and Transportation
Program Management Branch
Network Planning and Performance

Produced: 08-Mar-2007 By CornerStone Solutions Inc. Updated P. Kilburn P.Eng. 2006 03 26

Hwy	CS	TCS	Muni	From	To	From Km	To Km	Length In Km	Volume WAADT	Volume WASDT	Classifications %PV	%RV	%BU	%SU	%TT	%CM	Travel MVKM Annual	Travel MVKM Summer	ESAL / Day / Dir SU	ESAL / Day / Dir TC	ESAL / Day / Dir Total
25	2			N OF 3 AT LETHBRIDGE	S OF 521 NE OF TURIN			52.725	2110	2330	84.7	1.0	0.7	6.3	7.4	14.3	40.6	18.8	58.0	161.1	219.1
25	4	4	Leth	N OF 521 NE OF TURIN	S OF 526 & 847 SW OF ENCHANT	0.000	19.432	19.432	350	390	73.2	1.3	0.0	11.6	13.9	25.5	2.5	1.2	17.9	50.4	68.3
25	4			N OF 521 NE OF TURIN	S OF 526 & 847 SW OF ENCHANT			19.432	350	390	73.2	1.3	0.0	11.6	13.9	25.5	2.5	1.2	17.9	50.4	68.3
25				N OF 3 AT LETHBRIDGE	S OF 526 & 847 SW OF ENCHANT			72.157	1630	1810	84.3	1.0	0.6	6.6	7.8	15.0	42.9	20.0	47.2	131.3	178.5
26	10	4	Camr	CAMROSE E.C.L.	W OF 834 E OF CAMROSE	0.000	10.580	10.580	2590	2820	85.1	3.3	0.3	4.9	6.4	11.6	10.0	4.6	56.9	171.8	227.7
26	10	8	Camr	E OF 834 E OF CAMROSE	W OF 854 E OF CAMROSE	10.580	23.600	13.020	1830	1990	79.8	6.2	0.1	4.9	9.0	14.0	8.7	4.0	39.5	170.7	210.2
26	10	12	Camr	E OF 854 E OF CAMROSE	W OF 855 S OF HOLDEN	23.600	36.551	12.951	1530	1670	78.7	7.9	0.2	4.1	9.1	13.4	7.2	3.3	27.6	144.3	171.9
26	10			CAMROSE E.C.L.	W OF 855 S OF HOLDEN			36.551	1940	2120	81.5	5.6	0.2	4.7	8.0	12.9	25.9	11.9	40.0	161.7	201.7
26	12	4	Beav	E OF 855 S OF HOLDEN	W OF 36 SW OF VIKING	0.000	27.346	27.346	1270	1440	76.1	6.2	0.2	5.2	12.3	17.7	12.7	6.0	29.1	161.9	191.0
26	12			E OF 855 S OF HOLDEN	W OF 36 SW OF VIKING			27.346	1270	1440	76.1	6.2	0.2	5.2	12.3	17.7	12.7	6.0	29.1	161.9	191.0
26				CAMROSE E.C.L.	W OF 36 SW OF VIKING			63.897	1560	1830	79.5	5.8	0.2	4.8	9.4	14.4	38.7	17.9	36.4	161.8	197.1
27	6	2	MntV	E OF 22 AT SUNDRE	W OF 760 E OF SUNDRE	0.000	2.280	2.280	9070	10570	88.5	2.6	0.4	4.0	4.5	8.9	7.5	3.7	159.8	423.0	582.8
27	6	4	MntV	E OF 760 E OF SUNDRE	W OF 22 N OF WESTWARD HO EJ	2.280	12.480	10.200	5600	6530	82.3	6.1	0.4	5.1	6.1	11.6	20.8	10.2	125.8	354.1	479.9
27	6	8	MntV	E OF 22 N OF WESTWARD HO EJ	W OF 766 W OF OLDS	12.480	23.340	10.860	3630	4230	80.0	6.0	0.3	4.4	9.3	14.0	14.4	7.0	70.4	349.9	420.3
27	6	12	MntV	E OF 766 W OF OLDS	OLDS W.C.L.	23.340	36.490	13.150	4500	4990	84.2	1.4	0.5	4.4	9.5	14.4	21.6	10.0	87.2	443.1	530.3
27	6	16	MntV	OLDS W.C.L.	W OF 2A AT OLDS	36.490	39.720	3.230	8830	9390	90.2	0.7	0.5	3.5	5.1	9.1	10.4	4.6	136.1	466.8	602.9
27	6	20	MntV	E OF 2A AT OLDS	W OF 2 E OF OLDS	39.720	44.609	4.889	7180	7620	83.7	4.1	0.6	4.5	7.1	12.2	12.8	5.7	141.9	526.9	668.8
27	6			E OF 22 AT SUNDRE	W OF 2 E OF OLDS			44.609	5380	6050	84.1	3.7	0.4	4.4	7.4	12.2	87.6	41.3	105.2	409.9	515.1
27	8	4	MntV	E OF 2 E OF OLDS	W OF 791 W OF TORRINGTON	0.000	15.020	15.020	2120	2400	78.3	6.0	0.8	5.9	9.0	15.7	11.6	5.5	55.1	197.8	252.9
27	8	8	MntV	E OF 791 W OF TORRINGTON	W OF 805 AT TORRINGTON	15.020	29.680	14.660	1240	1410	75.1	6.0	0.3	6.6	12.0	18.9	6.6	3.2	36.1	154.2	190.3
27	8	12	Knee	E OF 805 AT TORRINGTON	W OF 21 S OF TROCHU NJ	29.680	54.118	24.438	810	1030	70.5	4.9	0.6	7.5	16.5	24.6	6.1	3.9	30.1	155.6	185.7
27	8			E OF 2 E OF QLDS	W OF 21 S OF TROCHU NJ			54.118	1340	1510	75.1	5.7	0.6	6.6	12.1	19.2	26.5	12.5	38.6	166.9	205.6
27	10	4	Knee	E OF 21 & 582 S OF THREE HILLS SJ	W OF 836 S OF GHOST PINE CREEK	0.000	11.430	11.430	1850	2110	74.9	7.1	0.5	6.1	11.4	18.0	7.7	3.7	49.7	218.6	268.3
27	10	8	Knee	E OF 836 S OF GHOST PINE CREEK	W OF 837 NW OF NACMINE	11.430	17.950	6.520	1810	2070	74.3	7.2	0.3	6.0	12.2	18.5	4.3	2.1	47.8	228.9	276.7
27	10	12	Knee	E OF 837 NW OF NACMINE	W OF 839 SW OF MORRIN	17.950	28.800	10.850	1670	1910	74.1	6.8	0.0	6.3	12.8	19.1	6.6	3.2	46.3	221.6	267.9
27	10	16	Stri	E OF 839 SW OF MORRIN	W OF 9 & 56 SE OF MORRIN	28.800	36.989	8.189	1940	2220	77.9	4.9	0.3	5.4	11.5	17.2	5.8	2.8	46.1	231.2	277.3
27	10			E OF 21 & 582 S OF THREE HILLS SJ	W OF 9 & 56 SE OF MORRIN			36.989	1810	2070	75.3	6.5	0.3	6.0	11.9	18.2	24.4	11.7	47.6	224.1	271.7
27				E OF 22 AT SUNDRE	W OF 9 & 56 SE OF MORRIN			135.716	2790	3160	80.9	4.6	0.5	5.1	9.1	14.6	138.2	65.6	63.0	262.4	325.3
28	2	8	Stur	EDMONTON N.C.L.	S OF 28A S OF LANCASTER PARK	0.000	0.530	0.530	14270	15520	94.6	0.4	0.5	3.0	1.5	5.0	2.8	1.3	186.6	221.9	410.5
28	2	12	Stur	N OF 28A S OF LANCASTER PARK	S OF 37 W OF NAMAO	0.530	7.800	7.270	7940	8640	92.5	1.7	0.6	2.8	2.4	5.8	21.1	9.6	97.9	197.5	295.4
28	2	16	Stur	N OF 37 W OF NAMAO	S OF 642 N OF EXCELSIOR	7.800	17.820	10.020	6360	6920	91.1	1.2	1.2	2.6	3.9	7.7	23.3	10.6	72.8	257.1	329.9
28	2	20	Stur	N OF 642 N OF EXCELSIOR	S OF 803 W OF BON ACCORD	17.820	20.480	2.660	5310	5770	88.9	2.0	0.6	4.7	3.8	9.1	5.2	2.3	109.9	209.1	319.0
28	2	24	Stur	N OF 803 W OF BON ACCORD	W OF 28A N OF GIBBONS	20.480	32.989	12.509	3980	4430	85.2	2.3	1.2	4.6	6.7	12.5	18.2	8.5	80.6	276.4	357.0
28	2			EDMONTON N.C.L.	W OF 28A N OF GIBBONS			32.989	5850	6400	90.0	1.7	0.9	3.3	4.1	8.4	70.4	32.3	86.2	246.8	333.0
28	4	4	Stur	N OF 28A N OF GIBBONS	W OF 651 E OF REDWATER	0.000	13.460	13.460	5550	6280	88.3	2.5	0.6	2.8	5.8	9.2	27.3	12.9	68.5	333.6	402.1
28	4	8	Stur	E OF 651 W OF REDWATER	W OF 38 W OF REDWATER	13.460	21.040	7.580	5310	6010	88.0	3.3	0.6	3.0	5.1	8.7	14.7	7.0	70.2	280.7	350.9
28	4	12	Thor	N OF 38 W OF REDWATER	W OF 827 S OF EGREMONT	21.040	30.030	8.990	3750	4250	85.0	7.6	0.3	2.2	4.7	7.2	12.3	5.8	36.3	182.7	219.0
28	4	16	Thor	E OF 827 S OF EGREMONT	W OF 63 & 829 S OF RADWAY	30.030	36.699	6.669	3240	3670	85.0	8.3	0.3	2.0	4.4	6.7	7.9	3.7	28.5	147.8	176.3
28	4			N OF 28A N OF GIBBONS	W OF 63 & 829 S OF RADWAY			36.699	4640	5250	87.2	4.5	0.5	2.6	5.2	8.4	62.2	29.5	53.7	252.0	305.6
28	6	4	Thor	E OF 63 & 829 SW OF RADWAY	W OF 831 N OF WASKATENAU	0.000	16.630	16.630	2250	2670	87.5	3.9	0.4	3.8	4.4	8.6	13.7	6.8	37.7	102.6	140.3
28	6	8	SmkL	E OF 831 N OF WASKATENAU	NORTH OF WARSPITE	16.630	28.106	11.476	3190	3660	82.1	2.0	0.8	5.1	10.0	15.9	13.4	6.4	71.7	330.6	402.3
28	6			E OF 63 & 829 SW OF RADWAY	NORTH OF WARSPITE			28.106	2630	3070	84.8	3.0	0.6	4.4	7.2	12.2	27.0	13.2	51.5	195.7	247.3
28	8	4	SmkL	NORTH OF WARSPITE	W OF 855 N OF SMOKY LAKE	0.000	11.310	11.310	3020	3480	86.9	1.5	0.5	4.7	6.4	11.6	12.5	6.0	62.5	200.3	262.8

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME HISTORY 1997 - 2006

Alberta Infrastructure and Transportation
Program Management Branch
Network Planning and Performance

Produced: 09-Mar-2007 By CornerStone Solutions Inc.

Hwy	CS	TCS	Muni	From	1997 AADT	1998 AADT	1999 AADT	2000 AADT	2001 AADT	2002 AADT	2003 AADT	2004 AADT	2005 AADT	2006 AADT	2006 ASDT
23	8	16	Fthl	E OF 14 ST IN HIGH RIVER 31-18-28-404700000	7230	8180	8600	8190	10230	10610	11290	13790	14230	12740	13830
23	8	16	Fthl	W OF 14 ST IN HIGH RIVER 31-18-28-404700000	7880	8800	9090	8750	11000	11330	12050	14680	15150	13570	14730
23	8	16	Fthl	E OF 2A AT HIGH RIVER	7860	8400	8710	8750	11020	11330	12050	14680	15150	13570	14730
24	2	4	Vulc	N OF 23 & 542 N OF VULCAN	1420	1420	1420	1520	1770	1780	1790	1620	1540	1590	1860
24	2	4	Vulc	1 KM N OF 23 & 24 & 542 VULCAN	1420	1570	1570	1660	1770	1780	1770	1560	1530	1580	1850
24	2	4	Vulc	E OF 547 E OF MOSSLEIGH EJ	1290	1330	1330	1560	1670	1670	1680	1520	1580	1620	1900
24	2	8	Vulc	W OF 547 E OF MOSSLEIGH EJ	1660	1720	1720	1710	1820	1820	1830	1650	1780	1820	2130
24	2	8	Vulc	E OF 547 W OF MOSSLEIGH WJ	1730	1790	1790	1840	1890	1880	1890	1710	1760	1790	2100
24	2	12	Vulc	W OF 547 W OF MOSSLEIGH WJ	1600	1640	1660	1740	1870	1830	1840	1680	1720	1730	2030
24	4	2	Whtl	E OF 817 SE OF CARSELAND	2030	2050	2260	2360	2560	2480	2590	2300	2380	2260	2870
24	4	4	Whtl	W OF 817 SE OF CARSELAND	1730	1750	1940	2020	2110	2060	2230	1980	2040	1960	2490
24	4	4	Whtl	2.6 KM W OF 24 & 817 CARSELAND	1770	1800	1990	2080	2140	2090	2260	1960	2060	1980	2510
24	4	4	Whtl	S OF 22X & 901 NW OF CARSELAND	2040	2200	2440	2550	2620	2170	2360	2140	2200	2160	2740
24	4	8	Whtl	N OF 22X & 901 NW OF CARSELAND	1440	1650	1820	1790	1840	1670	1800	1860	1870	1870	2370
24	4	8	Whtl	S OF GLENMORE TR 22-23-26-400000000	1680	1820	1930	1910	1950	1560	1680	1720	1730	1730	2190
24	4	8	Whtl	N OF GLENMORE TR 22-23-26-400000000	1660	1800	1910	1890	1930	1720	1780	1820	1830	1830	2320
24	4	8	Whtl	S OF CHEADLE MAIN ACC 3-24-26-400000800	1680	1820	1920	1890	1960	1750	1800	1840	1850	1850	2350
24	4	8	Whtl	N OF CHEADLE MAIN ACC 3-24-26-400000800	1780	1940	2060	2030	2100	1870	1880	1940	1950	1950	2470
24	4	8	Whtl	S OF 1 W OF STRATHMORE	1760	1910	2020	2000	2040	1810	1820	1880	1890	1890	2400
25	2	8	Leth	S OF 3 AT LETHBRIDGE	870	2090	2190	2930	2860	5120	5200	5210	5280	6170	6770
25	2	8	Leth	N OF 3 AT LETHBRIDGE	4290	4340	4550	4550	4540	4520	4570	4590	4590	4670	5130
25	2	8	Leth	3.4 KM N OF 3 & 25 LETHBRIDGE	4000	4060	4090	4130	4110	4090	4060	4150	4120	4190	4600
25	2	8	Leth	S OF KIPP RD 22-9-22-400000000	4010	4070	4090	4130	4120	4070	4110	4130	4130	4200	4610
25	2	8	Leth	N OF KIPP RD 22-9-22-400000000	3850	3910	3930	3970	3960	3910	3950	3970	4070	4140	4550
25	2	8	Leth	S OF RGE RD 222 (PARK LK RD) 34-8-22-400001500	3820	3880	3900	3900	3900	3860	3890	3910	4090	4160	4570
25	2	8	Leth	E OF RGE RD 222 (PARK LK RD) 34-8-22-400001500	2890	2930	2950	3010	3010	2970	3000	3020	3110	3160	3470
25	2	12	Leth	W OF 519 W OF PICTURE BUTTE WJ	2960	3000	3020	3010	3010	2800	2820	2840	2920	2970	3260
25	2	16	Leth	E OF 519 W OF PICTURE BUTTE WJ	3830	3890	3910	3930	3930	3680	3720	3740	3860	3930	4320
25	2	16	Leth	W OF RGE RD 213 (BARHILL RD) 32-10-21-401300000	3830	4110	4150	3930	3910	3680	3720	3740	3860	3930	432'
25	2	16	Leth	E OF RGE RD 213 (BARHILL RD) 32-10-21-401300000	3940	4240	4280	4030	4010	3790	3830	3850	3920	3990	4380
25	2	16	Leth	W OF 519 AT PICTURE BUTTE EJ	3940	4240	4280	4030	4030	3790	3830	3850	3920	3990	4380
25	2	16	Leth	N OF 519 AT PICTURE BUTTE EJ	3450	3190	3210	3030	3030	2950	2970	2990	3030	3080	3380
25	2	16	Leth	W OF 4 ST N IN PICTURE BUTTE 3-11-21-400001050	4980	4150	4200	4000	4000	3770	3810	3830	3860	3920	4300
25	2	16	Leth	E OF 4 ST N IN PICTURE BUTTE 3-11-21-400001050	4320	3450	3470	3300	3300	3240	3260	3280	3310	3370	3700
25	2	16	Leth	S OF FACTORY DR IN PICTURE BUTTE 2-11-21-412700805	1900	2020	2040	1780	1780	1760	1760	1770	1850	1870	2050
25	2	16	Leth	N OF FACTORY DR IN PICTURE BUTTE 2-11-21-412700805	2010	2140	2140	1810	1810	1790	1790	1800	1790	1810	1990
25	2	20	Leth	S OF 843 W OF IRON SPRINGS	1150	1280	1280	1220	1280	1280	1280	1300	1290	1290	1460
25	2	24	Leth	E OF 843 W OF IRON SPRINGS	1050	1030	1020	980	1020	1020	1020	1030	1020	1020	1150
25	2	24	Leth	W OF 845 NE OF IRON SPRINGS	540	520	520	530	660	660	660	670	660	660	750
25	2	28	Leth	E OF 845 NE OF IRON SPRINGS	670	630	630	660	790	790	790	820	810	720	810
25	2	28	Leth	S OF 521 NE OF TURIN	520	500	500	520	570	520	520	540	530	520	590
25	4	4	Leth	N OF 521 NE OF TURIN	330	320	320	370	400	400	400	420	410	400	450
25	4	4	Tabr	3.9 KM S OF 25 & 526 ENCHANT	180	160	310	360	350	320	320	330	320	310	350

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME HISTORY 1997 - 2006

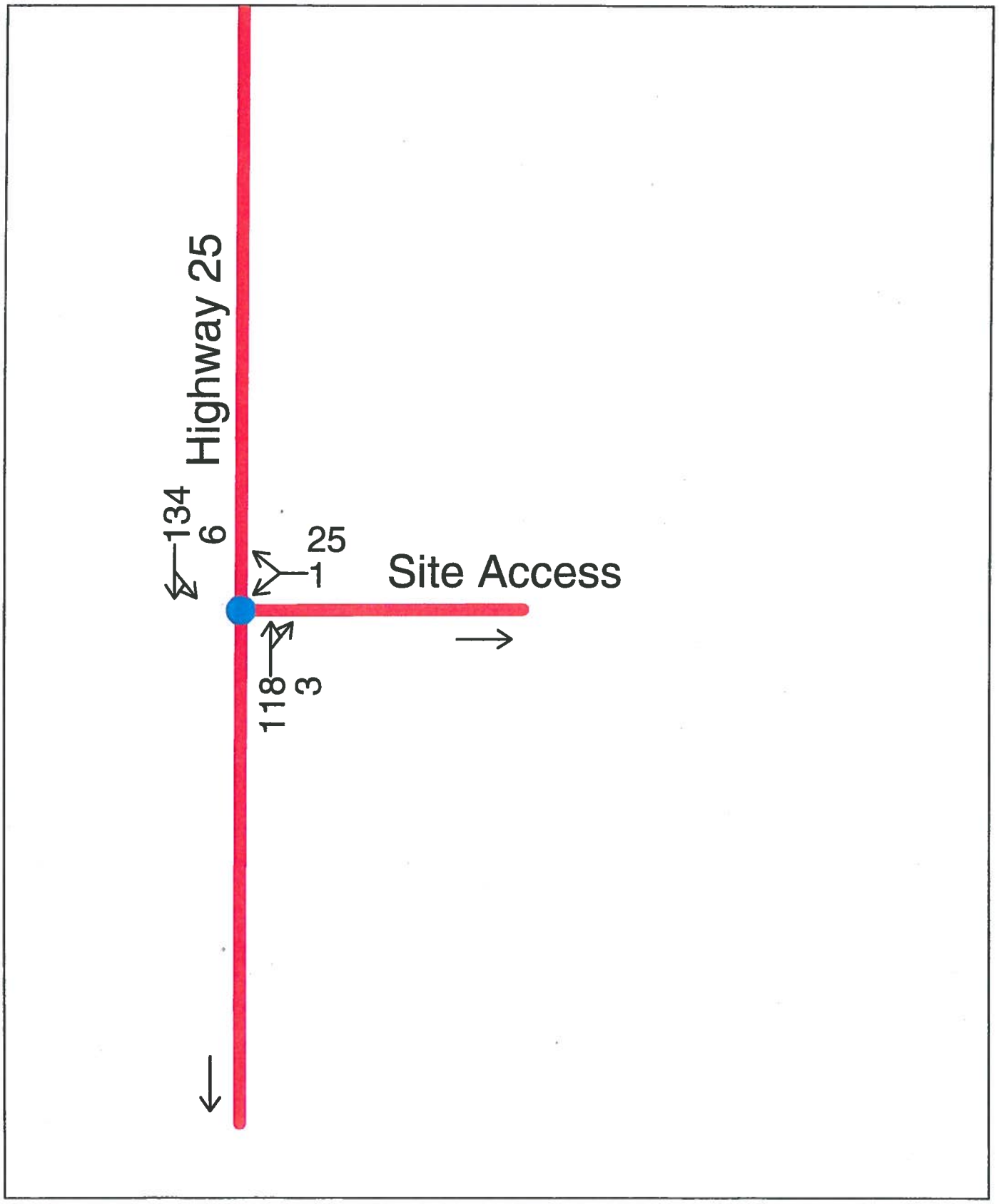
Alberta Infrastructure and Transportation
Program Management Branch
Network Planning and Performance

Produced: 09-Mar-2007 By CornerStone Solutions Inc.

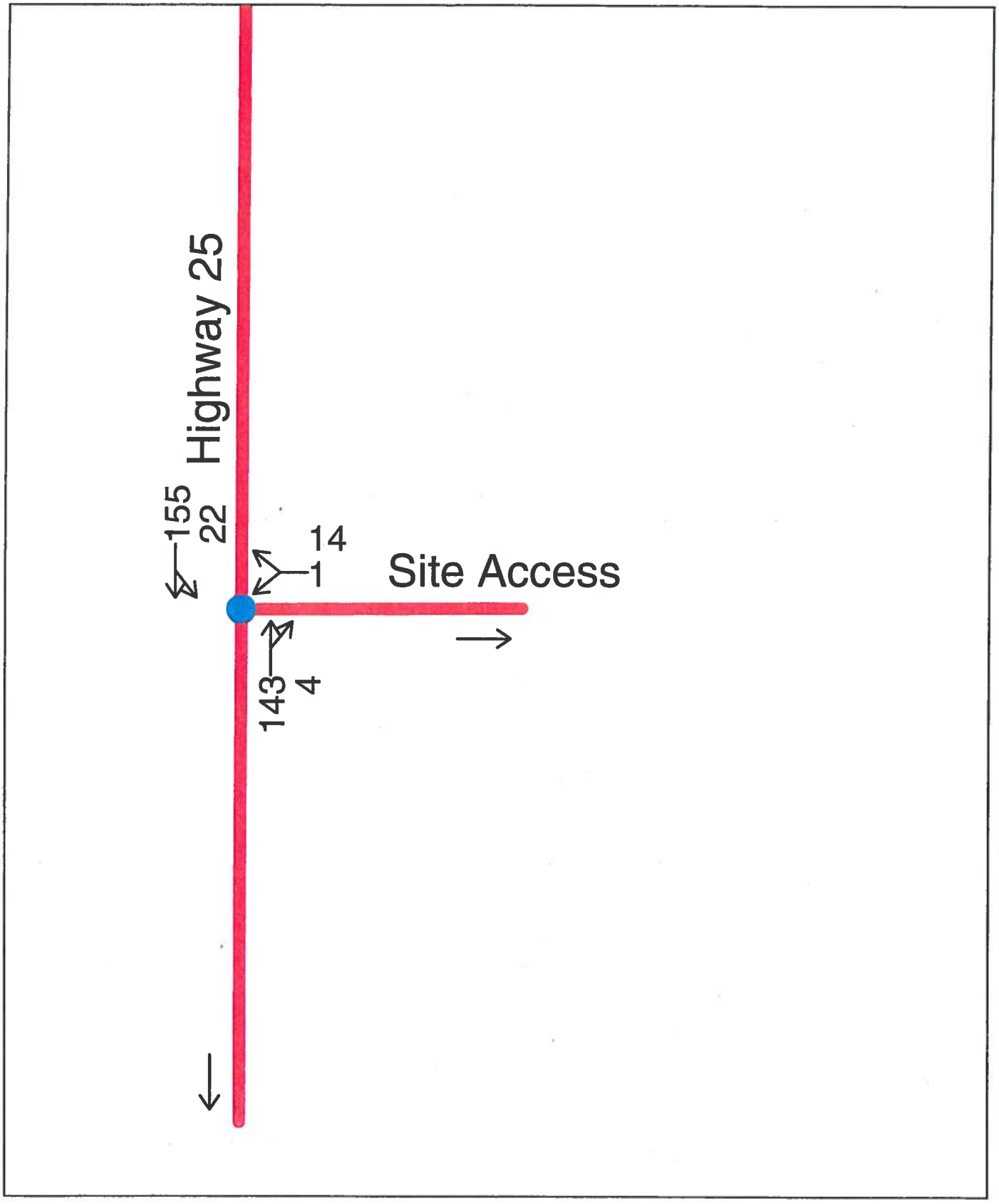
Hwy	CS	TCS	Muni	From	1997 AADT	1998 AADT	1999 AADT	2000 AADT	2001 AADT	2002 AADT	2003 AADT	2004 AADT	2005 AADT	2006 AADT	2006 ASDT
25	4	4	Tabr	S OF 526 SW OF ENCHANT	190	170	340	390	360	330	330	340	330	320	360
26	10	4	Camr	1.8 KM E OF 13 & 26 CAMROSE	2520	2510	2560	2500	2620	2710	2790	2860	2830	2890	3150
26	10	4	Camr	W OF 834 E OF CAMROSE WJ						2630	2400	2540	2500	2550	2780
26	10	4	Camr	E OF 834 E OF CAMROSE WJ						2620	2440	2580	2540	2590	2820
26	10	4	Camr	W OF 834 E OF CAMROSE EJ	2030	2030	2010	1950	2050	2250	2280	2440	2380	2440	2660
26	10	8	Camr	E OF 834 E OF CAMROSE EJ	1450	1450	1410	1370	1430	1610	1630	1940	1920	1960	2140
26	10	8	Camr	W OF 854 E OF CAMROSE	1260	1260	1500	1440	1510	1550	1570	1650	1650	1690	1840
26	10	12	Camr	E OF 854 E OF CAMROSE	1200	1200	1410	1350	1420	1460	1480	1530	1530	1570	1710
26	10	12	Beav	W OF 855 S OF HOLDEN	1200	1200	1240	1160	1230	1260	1270	1310	1470	1490	1620
26	12	4	Beav	E OF 855 S OF HOLDEN	1230	1230	1270	1100	1160	1190	1200	1240	1300	1320	1500
26	12	4	Beav	W OF 857 S OF BRUCE	990	990	1030	1050	1120	1150	1160	1200	1220	1240	1410
26	12	4	Beav	E OF 857 S OF BRUCE	950	950	990	1010	1090	1120	1130	1170	1190	1270	1440
26	12	4	Beav	0.9 KM W OF 26 & 36 VIKING	980	980	1010	1040	1100	1130	1160	1190	1200	1260	1430
26	12	4	Beav	W OF 36 SW OF VIKING	980	980	1010	1040	1100	1130	1140	1180	1200	1260	1430
27	6	2	MntV	E OF 22 & 584 W OF SUNDRE	4040	4200	4270	4500	5230	5130	5260	5260	6540	6760	7900
27	6	2	MntV	W OF 3 ST IN SUNDRE 4-33-5-504101480		7850	7910	8000	8020	8020	8140	9450	9950	10280	11970
27	6	2	MntV	E OF 3 ST IN SUNDRE 4-33-5-504101480		7950	8010	8100	8120	8120	8240	9470	9970	10290	11990
27	6	2	MntV	W OF CENTRE ST IN SUNDRE 4-33-5-500001350										10370	12080
27	6	2	MntV	E OF CENTRE ST IN SUNDRE 4-33-5-500001350										9550	11120
27	6	2	MntV	W OF 760 IN SUNDRE	7150	7310	7370	7450	7570	7710	7780	8000	8410	8680	10110
27	6	4	MntV	E OF 760 IN SUNDRE	5660	5790	5830	5900	5980	6040	6070	6230	6550	6770	7890
27	6	4	MntV	W OF 22 N OF WESTWARD HO EJ	3780	3410	3500	3540	3610	3860	3960	4060	4270	4430	5160
27	6	8	MntV	E OF 22 N OF WESTWARD HO EJ	2940	3040	3090	3140	3210	3190	3270	3360	3560	3700	4310
27	6	8	MntV	1.2 KM E OF 22 & 27 SUNDRE EJ	2780	2940	2990	3040	3090	3100	3200	3290	3440	3580	4170
27	6	8	MntV	W OF HARMATTAN RD 36-32-4-501000750	3430	3510	3570	3010	3050	3050	3130	3210	3420	3560	4150
27	6	8	MntV	E OF HARMATTAN RD 36-32-4-501000750	3350	3430	3490	2960	3000	3000	3080	3150	3410	3550	4140
27	6	8	MntV	W OF 766 W OF OLDS	3270	3350	3130	3200	3250	3250	3330	3430	3610	3750	4370
27	6	12	MntV	E OF 766 W OF OLDS	3630	3710	3400	3450	3500	3500	3580	3670	3870	4020	4680
27	6	12	MntV	W OF 70 AVE IN OLDS 36-32-2-500000000									4810	4970	5290
27	6	16	MntV	E OF 70 AVE IN OLDS 36-32-2-500000000									5550	5750	6120
27	6	16	MntV	W OF 65 AVE IN OLDS 31-32-1-508050000									5300	5490	5840
27	6	16	MntV	E OF 65 AVE IN OLDS 31-32-1-508050000									5990	6210	6600
27	6	16	MntV	W OF 61 AVE IN OLDS 31-32-1-503300000									6040	6250	6650
27	6	16	MntV	E OF 61 AVE IN OLDS 31-32-1-503300000									10420	10690	11370
27	6	16	MntV	W OF 57 AVE IN OLDS 31-32-1-500000000	7680	7840	10310	10430	10610	8780	9040	9360	10620	10890	11580
27	6	16	MntV	E OF 57 AVE IN OLDS 31-32-1-500000000	8520	8710	11450	11570	11790	9600	9890	10240	11280	11570	12300
27	6	16	MntV	W OF 52 AVE IN OLDS WJ 32-32-1-509300000								11480	11840	12140	12910
27	6	16	MntV	E OF 52 AVE IN OLDS WJ 32-32-1-509300000								11440	11800	12100	12870
27	6	16	MntV	W OF 52 AVE IN OLDS EJ 32-32-1-507000000								11590	11970	12270	13050
27	6	16	MntV	E OF 52 AVE IN OLDS EJ 32-32-1-507000000								10490	10830	11110	11810
27	6	16	MntV	W OF 50 AVE IN OLDS 32-32-1-505150000	9730	9960	11690	11830	12040	9660	9940	10250	10980	11270	11990
27	6	16	MntV	E OF 50 AVE IN OLDS 32-32-1-505150000	9680	9900	11640	11800	12000	9380	9650	9940	11240	11530	12260
27	6	16	MntV	W OF 49 AVE IN OLDS 32-32-1-504100000									11240	11530	12260

Appendix II Future Traffic Volumes and Results of Synchro Analysis

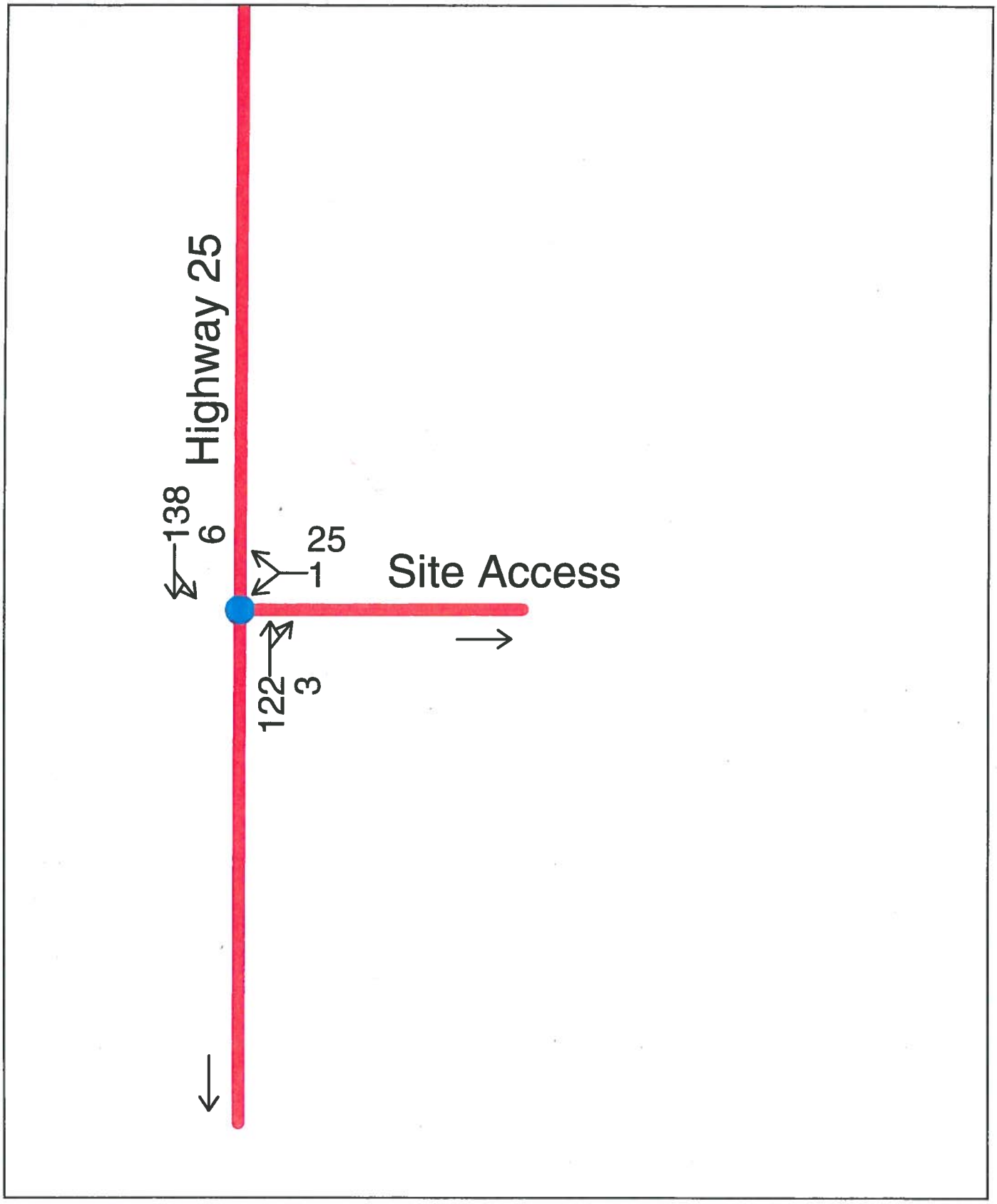
2007 AM Peak Hour Volumes



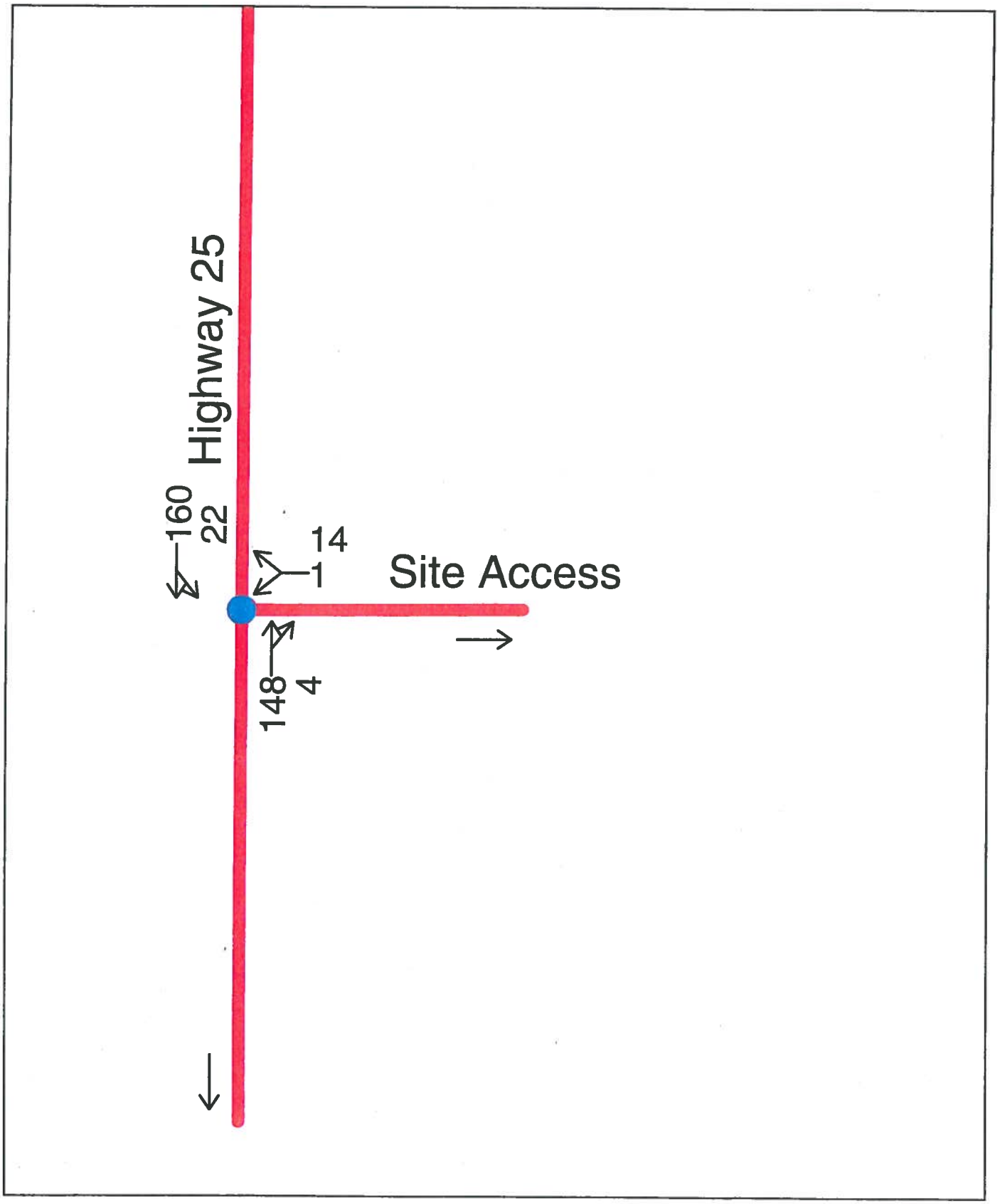
2007 PM Peak Hour Volumes



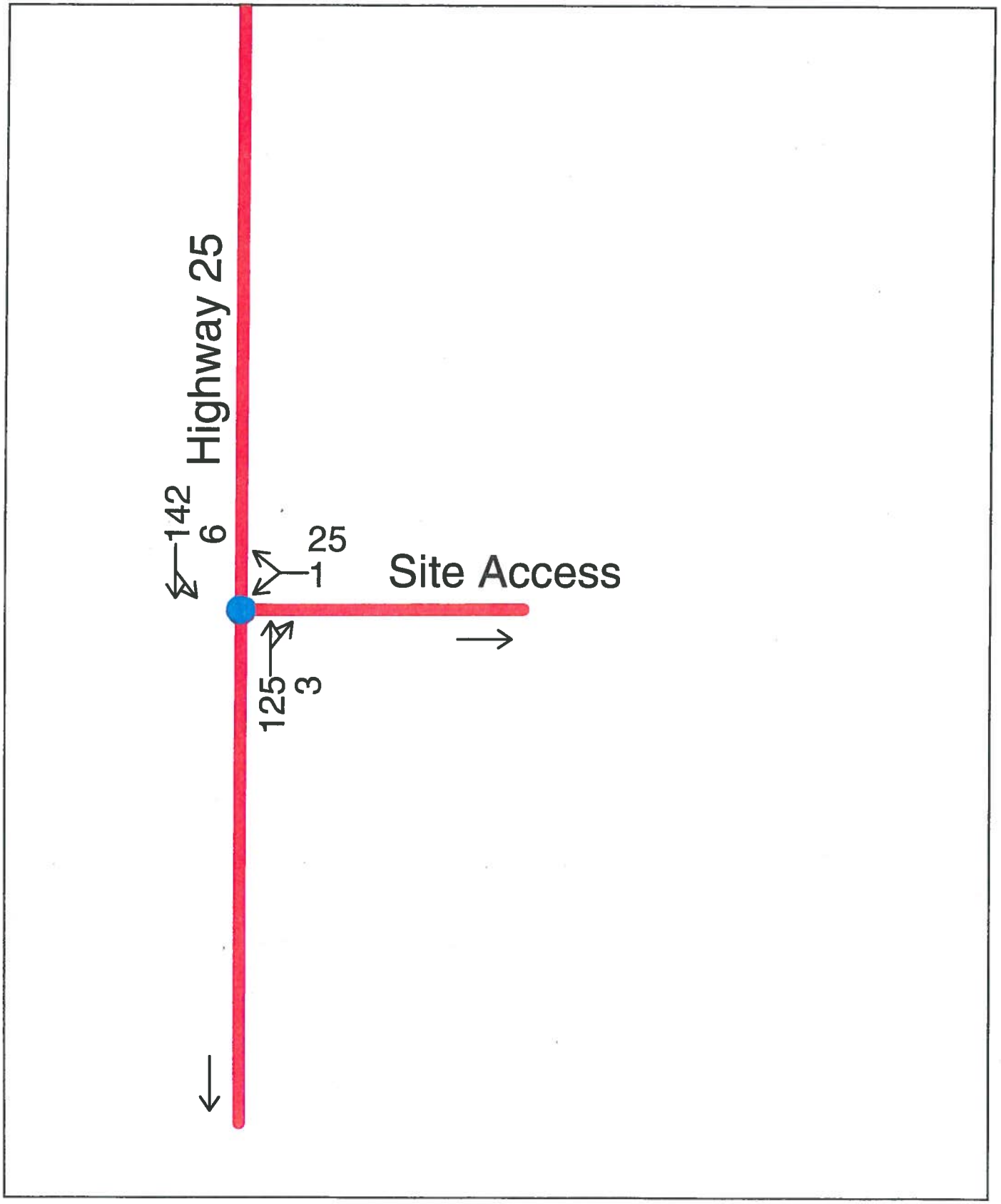
2017 AM Peak Hour Volumes



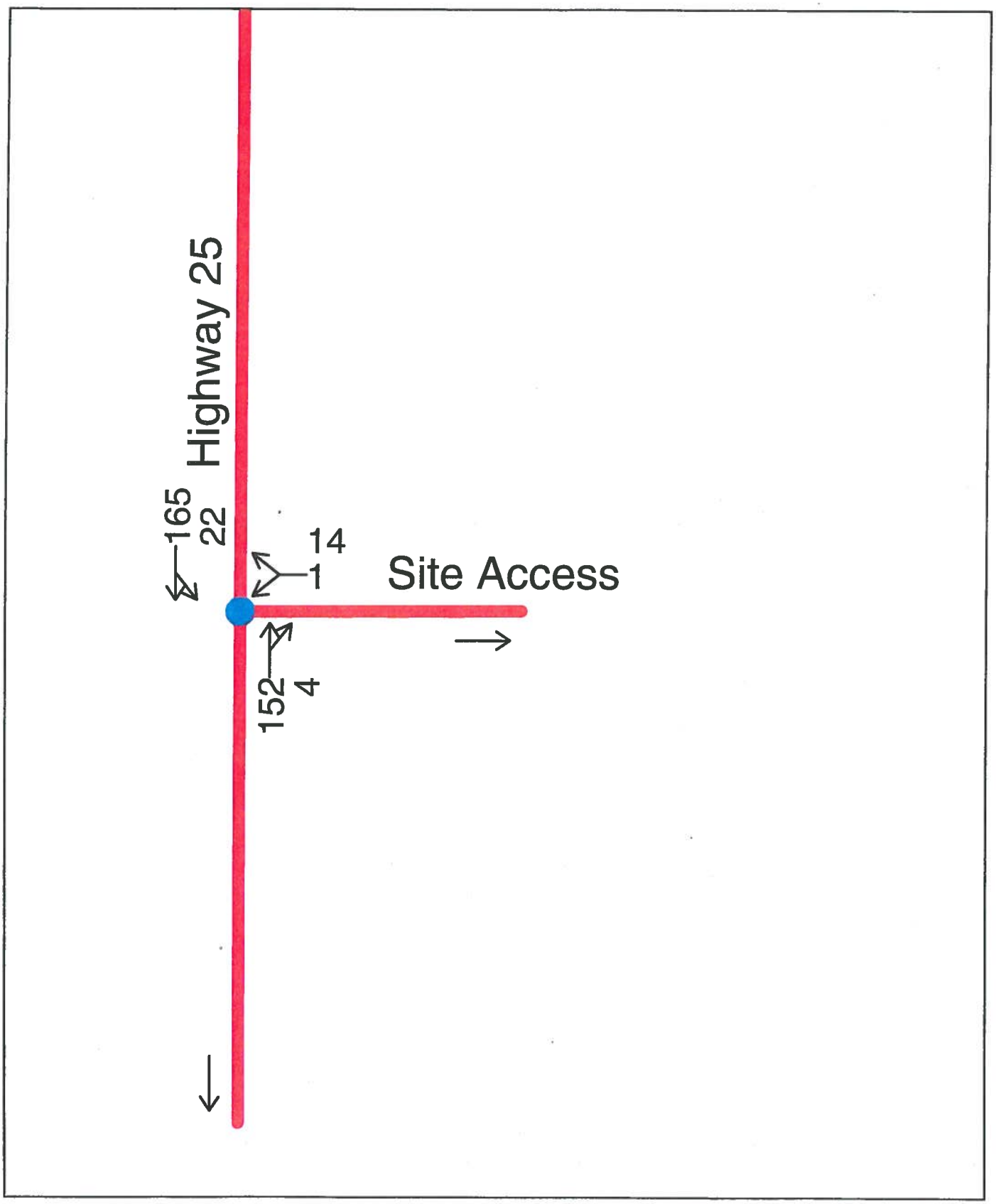
2017 PM Peak Hour Volumes



2027 AM Peak Hour Volumes



2027 PM Peak Hour Volumes



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	25	118	3	6	134
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	25	118	3	6	134
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	266	120			121	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	266	120			121	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			100	
cM capacity (veh/h)	721	932			1467	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	26	121	140
Volume Left	1	0	6
Volume Right	25	3	0
cSH	922	1700	1467
Volume to Capacity	0.03	0.07	0.00
Queue Length 95th (m)	0.7	0.0	0.1
Control Delay (s)	9.0	0.0	0.4
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	0.4
Approach LOS	A		

Intersection Summary			
Average Delay		1.0	
Intersection Capacity Utilization		21.9%	ICU Level of Service A
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	14	143	4	22	155
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	14	143	4	22	155
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	344	145			147	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	344	145			147	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			98	
cM capacity (veh/h)	642	902			1435	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	15	147	177
Volume Left	1	0	22
Volume Right	14	4	0
cSH	879	1700	1435
Volume to Capacity	0.02	0.09	0.02
Queue Length 95th (m)	0.4	0.0	0.4
Control Delay (s)	9.2	0.0	1.0
Lane LOS	A		A
Approach Delay (s)	9.2	0.0	1.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	30.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	25	122	3	6	138
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	25	122	3	6	138
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	274	124			125	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	274	124			125	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			100	
cM capacity (veh/h)	713	927			1462	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	26	125	144
Volume Left	1	0	6
Volume Right	25	3	0
cSH	917	1700	1462
Volume to Capacity	0.03	0.07	0.00
Queue Length 95th (m)	0.7	0.0	0.1
Control Delay (s)	9.0	0.0	0.3
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	0.3
Approach LOS	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	22.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	14	148	4	22	160
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	14	148	4	22	160
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	354	150			152	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	354	150			152	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			98	
cM capacity (veh/h)	634	896			1429	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	15	152	182
Volume Left	1	0	22
Volume Right	14	4	0
cSH	872	1700	1429
Volume to Capacity	0.02	0.09	0.02
Queue Length 95th (m)	0.4	0.0	0.4
Control Delay (s)	9.2	0.0	1.0
Lane LOS	A		A
Approach Delay (s)	9.2	0.0	1.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	25	125	3	6	142
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	25	125	3	6	142
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	280	126			128	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	280	126			128	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			100	
cM capacity (veh/h)	707	924			1458	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	26	128	148
Volume Left	1	0	6
Volume Right	25	3	0
cSH	913	1700	1458
Volume to Capacity	0.03	0.08	0.00
Queue Length 95th (m)	0.7	0.0	0.1
Control Delay (s)	9.1	0.0	0.3
Lane LOS	A		A
Approach Delay (s)	9.1	0.0	0.3
Approach LOS	A		

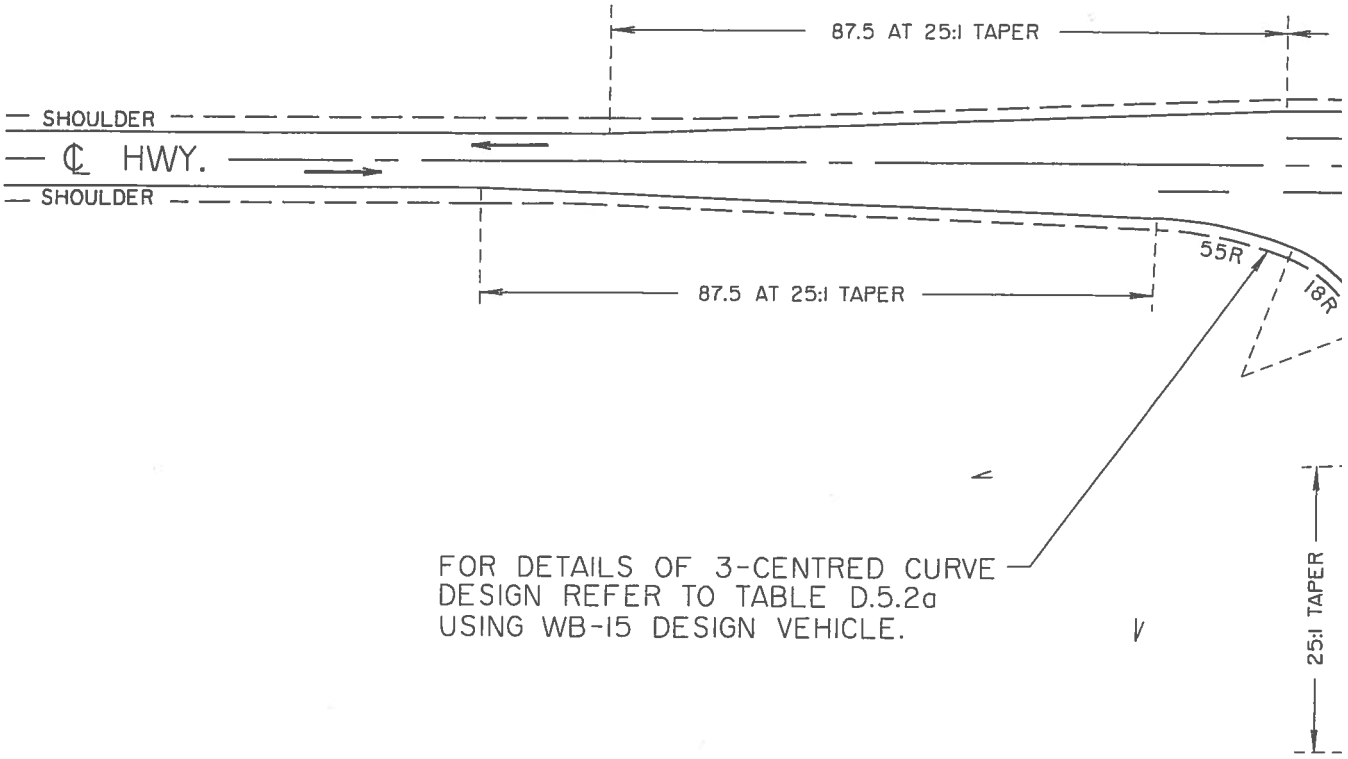
Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	22.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	1	14	152	4	22	165
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	14	152	4	22	165
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	363	154			156	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	363	154			156	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			98	
cM capacity (veh/h)	626	892			1424	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	15	156	187
Volume Left	1	0	22
Volume Right	14	4	0
cSH	867	1700	1424
Volume to Capacity	0.02	0.09	0.02
Queue Length 95th (m)	0.4	0.0	0.4
Control Delay (s)	9.2	0.0	1.0
Lane LOS	A		A
Approach Delay (s)	9.2	0.0	1.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix III Type IIa Intersection



HIGHWAY DESIGNATION	LANE/SHOULDER WIDTHS (m)	SHOULDER WIDTH AT INTERSECTION (m)
RAU-213.4	3.7/3.0	1.5
RAU-211.8	3.7/2.2	1.5
RAU-210.0	3.5/1.5	1.5
RAU-209.0	3.5/1.0	1.0
RAU-208.0	3.5/0.5	0.5

* AUXILIARY LANE WILL BE 3.5m IN ALL CASES