COUNTY OF LETHBRIDGE
IN THE PROVINCE OF ALBERTA

BY-LAW NO. 1231

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

WHEREAS Glenn & Joyce Plowman wish to develop a Grouped Country Residential Subdivision on a portion of the East Half of Section 28, Township 9, Range 21, West of the Fourth Meridian;

AND WHEREAS an application to reclassify the above land for Country Residential has been TABLED by County Council pending further information;

AND WHEREAS the Developer has submitted the "Plowman 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 "Plowman Area Structure Plan" attached as Appendix "A".

GIVEN first reading this 21st day of March, 2002.

Reeve

County Manager

GIVEN second reading this 3rd day of June, 2002.

Reeve

County Manager

GIVEN third reading this 3rd day of June, 2002.

Reeve

County Manager

File/Lorraine/115-001/Bylaw 1231 - Plowman

3739.00.00

Bylaw 1231 Plowman Area Structure Plan Approved June 3 2002

GLENN & JOYCE PLOWMAN CONCEPT PLAN

LOCATED IN THE COUNTY OF LETHBRIDGE NO. 26

E 1/2 SECTION 28-9-21-4

LOT 3 BLOCK 1 PLAN 927L.K

RE: LAND USE BY-LAW AMENDMENT

BY-LAW #1224

FROM: LETHBRIDGE URBAN FRINGE "LUF"

TO: GROUPED COUNTRY RESIDENTIAL "GCR"

JANUARY 2002

1. INTRODUCTION

1.1 Purpose

This document has been prepared as a concept plan to support the proposed re-classification By-law #1224 submitted to the County of Lethbridge #26 by Lorne Schmid on behalf of the landowners, Glenn and Joyce Plowman. The proposed re-classification will amend the County of Lethbridge Land Use By-law from Lethbridge Urban Fringe (L.U.F.) to Grouped Country Residential (G.C.R.).

The amendment to the Land Use By-law will establish these acreages for single-family dwellings. Residential developmental controls laid out in this document will assure a high quality development minimizing any conflicts between this development and the adjacent property owners.

1.2 Area Structure Plan

Please see the enclosed area structure plan outlining not only the area south of the irrigation right-of-way, north of the quarter line and east of the canal right-of-way as requested at the August 16, 2001 public hearing, but also including the entire lot directly west of the proposed subdivision and the subdivision directly south. Including these areas creates a tract of land that can work quite nicely upon completion of the development of the entire area.

1.3 Development Concept

The concept used for lot layout is based on the theme displayed on the concept plan provided by the Oldman River Intermunicipal Service Agency. The lot scheme set up on this plan has placed proposed property boundaries so existing buildings can be included on Lot 18, which is the owner's existing residence. Fence lines not on property lines at this time shall be moved to the new property lines once they have been created.

1.4 Applicants Interest

Lorne Schmid, Surveyor, (phone: 403-850-5439) is the authorized agent for the owners, Glenn and Joyce Plowman (phone: 403-329-4131).

2. SITE ANALYSIS

2.1 Site Location

See Figure 1, Location Plan, in EBA Engineering Consultants Ltd. report dated November 8, 2001 for preliminary assessment for septic disposal fields.

2.2 Soils and Groundwater

See EBA Engineering Consultants Ltd. Report dated November 8, 2001 for soils information and groundwater status.

2.3 Water and Hydrology

EBA Engineering Consultants Ltd. report dated December 17, 2001 covers the area study and our proposals for maintenance of the pre-development runoff flow rate.

2.4 Land Ownership

See Proposed Subdivision Plan.

2.5 On-Site Land Use

This property is presently used as an acreage producing hay on the flood irrigated land west of the residence and out buildings. Pets and horses are housed on the area east of the residence.

2.6 Adjacent Land Use

See Proposed Subdivision Plan.

2.7 Constraints and Opportunities

.1 Constraints

.1 *Slope Stability*

Addressed in EBA Engineering Consultants Ltd. Report dated November 8, 2001 (see 3.3 Site Reconnaissance). Slope stability is not an issue because of the relatively flat land.

.2 *Land Suitability*

The matter of suitability of the land base to sustain the proposed development is also a concern. Public health and environmental concerns relative to the capability of the soil environmental concerns relative to the

capability of the soil to absorb sewage effluent also require diligence in determining that capability. Testing also provides an indication of the water table level which has further developmental implications such as foundation requirements, basement materials and sump pumps and associated matters. Percolation tests have been conducted at five separate locations on the site and have yielded favourable results on all but one location. The report suggests testing other locations for a suitable site on that lot. Details of results are outlined in EBA Engineering Consultants Ltd. report dated November 8, 2001. Three groundwater monitoring wells have also been installed.

.2 Opportunities

.1 *Ease of Development*

The basic services are near or on the site which will make it easier and cheaper to service and develop the new lots.

.2 *Value*

The taxes generated through this type of development are an important income source for the County and its education system. The conversion of marginal agricultural land to country residential use will also help diversify the County economy.

3. PROPOSED LAND USE AND DESIGN CONSIDERATIONS

3.1 Proposed Land Use

.1 Residential

Re-subdivision of Block 1 will be comprised of eight family residential lots. These lots will range in size from 0.8 hectare to slightly over 1.1 hectares.

.2 Roadways and Utility Lots

To provide for the appropriate access to each lot and to ensure that public utilities can be installed properly, roadways and utility right-of-ways will be dedicated (see plan).

3.2 Population and Housing Densities

The area of the site amounts to approximately 17 acres.

If the average household size is 4 persons then approximately 32 people would inhabit the completed subdivision. The density of the site would then be in the neighbourhood of 1.8 persons per acre.

With possibly 8 homes situated on 17 acres, the housing density would be approximately 0.5 unit per acre.

All lots are to be for single-family residential dwellings. Setback of all permanent structures shall be a minimum of 20 metres from front, and 2 metres from side and rear property boundaries.

3.3 Municipal Reserve

The developer will meet the 10% municipal reserve (MR) requirement of the subdivision process.

4. PROPOSED ROADWAYS AND SERVICING

4.1 Roadways

.1 Site Access

The proposed subdivision would derive access from a road built along north edge of the property from the County road allowance between Sections 28 and 29. This road right-of-way would be 20 metres in width with a gravel road constructed

The widening of an existing approach will be required at the north end of the property in the west ditch with the extension of an existing culvert to be added at the time of construction. The road and approach shall be built to a standard acceptable to the County of Lethbridge.

.2 Road Dimensions

The proposed 20 metre wide road would extend into the development area as indicated on the area structure map.

.3 Construction and Surfacing

The proposed roadways within the site would be constructed according to a rural residential cross section utilizing a minimal ditch on either side. Driveway approaches would be constructed over appropriately sized culverts. In addition, the roads would be gravel surfaced.

.4 Off-Site Roadways and Traffic

The external roadway system is already in place adjacent to the site. A gravel-surfaced roadway is adjacent to the east boundary of the site.

.5 Drainage

Drainage swales will be constructed as part of the roadway cross-section throughout the future subdivision. This may entail culverts and approaches being also constructed for each lot. The design in intended to be compatible with the pre-development flow rate study and is shown in detail on the proposed subdivision plan.

The natural slope of the parcel in question is from north to south and west to east. See plot plan for spot elevations. The new road constructed to the north shall stop any infiltration of water onto this property. The north ditch shall carry waters to the road allowance ditch at the east side of the property. Grading shall be done on property so as to facilitate all waters on the property to move to southerly portion of the property where a ± 6 metre wide swale will carry waters through a newly

constructed retention pond to the road allowance ditch at the east side off the property. Water presently runs in this fashion but has a ponding area on Lot 19. Lot 19 shall be stripped of topsoil and filled with clean fill to an elevation that shall force all water to flow to the road allowance west ditch. Please see plan for location of dugout to be filled. New dugout to be created for fire protection. The building, now located on the proposed roadway, to be relocated to facilitate road construction.

.6 Road Maintenance

Because the on-site roadway is a private road, construction and maintenance are the responsibility of the developer and the future residents. This will include snow plowing and repairs as required. When the road is turned over to the Country, it will become their responsibility.

.7 Fire Protection

A new dugout will be created for fire protection water storage. This dugout shall have a dry hydrant installed at the time of construction. Please see the tentative plan for the location of this dugout and the access that will be created to service it. We have also incorporated the drainage system of the site to run through this dugout. This will supply additional holding area for storm drain waters over and above the design specifications set out by EBA Engineering Ltd. This will also minimize the distance storm waters will travel to the pond thus reducing any possibility of erosion.

4.2 Servicing

.1 Water

Owner, Glenn Plowman, has purchased one unit from the Rural Water Association Water Co-op. This will service Lot 18 with potable water. A turnout has been placed at the east property boundary. Until all units have been sold at the Co-op, purchase of potable water service is still available to other lots. If this option is not exercised, future owners will haul potable water to installed cisterns.

Rural Water Association Water Co-op
Contact: Walter Vandenbrook
Phone: 403-320-1600

SMRID will supply water to all properties once the following terms have been met:

i) The 15 irrigation acres have been removed and replaced with a Household Purposes Agreement for all lots. Water services will be supplied by an underground pipeline ran as shown on the plan from the existing turnout. The gas company has said water pipeline can run inside their easement as long

as P/L is placed 2 metres off property line leaving them 4.1 metres for their main line installation.

ii) No trees are to be placed within 5 metres of water pipeline and no permanent surface installations are allowed that may hinder service of pipelines.

iii) A 6.0 metre access easement is provided to allow access to the turnout situated in Lot 12. See plan for location.

SMRID
Contact: *Derik Jaffray*
Phone: *403-328-4401*

.2 Sewage Disposal

Each proposed lot exceeds the minimum 1/2 acre requirement for a private sewage disposal system. The normal septic tank and disposal field system is proposed for the development. Alternatively, a pump-out tank could be provided if a suitable location in the P2 test area could not be found. See EBA Engineering Consultants Ltd. Report dated November 8, 2001, (see 5.0 Closure).

Supplier: *C&V Excavating*

Septic tank and field systems to be used for sewage disposal. C&V Excavating has installed several systems in the area and has confirmed soils conditions have been receptive to this installation.

C&V Excavating
Contact: *Vic Giesbrech*
Phone: *403-327-3555*

.3 Storm Water and Drainage

.1 *Individual Site Considerations*

Increased development activity on the site will have a corresponding impact on surface runoff. Roof areas, sidewalks, driveways and paved roadways will all speed up the rate at which storm water will leave an individual site and combine with runoff from adjacent sites. Owners will be encouraged to employ on-site storm water detention in their site development and landscaping design.

.2 *Communal Drainage Considerations*

Through the site grading plan and road construction, the developer will ensure that appropriate means to detain surface runoff are employed. See EBA Engineering Consultants Ltd. report dated December 17, 2001 for particulars.

.3 Energy Supply

.1 *Electricity*

Electrical power to and through the site is available through Utilicorp. It is proposed that an underground line in the utility right-of-way at the front of the property will be utilized.

Lots 18 and 19 shall have electrical service supplied by existing overhead power line system. Lots 12, 13, 14 and 15 shall be serviced by underground lines in 8.0 metre utility right-of-way at front of property. Lots 16 and 17 shall be serviced at a later date. Provisions for this future service shall be allowed for during initial construction. See plan for utility right-of-way location. Power and Telus cables would be run in same trench. George Plaksey to make appropriate applications to Utilicorp and coordinate contractors during construction.

UMA Group
Contact: *George Plaksey*
Phone: *403-329-4822*

.2 *Natural Gas*

Supplier: *ATCO Gas*

ATCO Gas will install main line so lots shall be pre-serviced with natural gas main. Each new lot landowner shall be responsible for their individual service line. ATCO Gas has agreed to allow construction of water line in their 6.1 metre utility right-of-way. See plan for location and offsets.

Contact: *Rick Cicon*
Phone: *403-380-5421*

.4 Communications

.1 *Telephone*

Telephone service may be provided through the Telus network. The cable would be sited within the utility right-of-way.

Supplier: *Telus*

Line will be installed at same time as electricity in same trench. Line will be run to pedestal at property line. Each new landowner will pay for service from pedestal to house.

Contact: *Jose Wojfzel*
Phone: *403-382-2575*

.2 *Television*

It is not intended to provide a cable service to the site.

4.3 Staging of Development

The only staging to be done is with the electrical services. Lots 15 and 16 will not be serviced with electricity at this time.

5. ARCHITECTURAL CONTROL AND DEVELOPMENT STANDARDS

5.1 Housing Form

.1 House Style

Mobile homes and relocated homes on new foundations would not be permitted in the subdivision. A caveat shall be placed on the title thus ensuring the construction of a new home.

.2 House Size

Houses within the subdivision will be required to be a minimum of 1200 square feet in area.

5.2 Housing Placement and Design

.1 House Design

Residents will be encouraged to work with a designer in the planning and design of their home to ensure that a consistent level of development is achieved.

.2 House Placement

Placement is optional as long as minimum setbacks of the Country are observed.

.3 Accessory Buildings

Out buildings will be allowed but will also be subject to minimum setback requirements.

5.3 Fencing

Uniform fencing is encouraged.

5.4 Vehicle Storage

Residents would be encouraged to store recreational vehicles within an off-site storage compound or alternatively on their own sites in a manner which does not obstruct neighbouring views.

5.5 Animals

Residents would be allowed to keep the normal range of pets. Horses, cattle, pigs, chickens and other animals raised for commercial purposes, not conducive to a residential environment or the size of the lot would not be allowed.

Original Government Road Allowance

Plan GL 27

N.E.1/4 SEC. 28 – 9 – 21 – 4

N.W.1/4 SEC. 28 – 9 – 21 – 4

Canal R/W Plan 771 1144

Plan Irr. 68

3.84 AC.
2.02 AC.
2.56 AC.
2.02 AC.
2.11 AC.
2.57 AC.
2.01 AC.
2.08 AC.
2.56 AC.
2.01 AC.
2.56 AC.
2.82 AC.
2.33 AC.
2.35 AC.
2.35 AC.
2.58 AC.
3.00 AC.
2.00 AC.
2.35 AC.
2.48 AC.
2.39 AC.
3.31 AC.
2.61 AC.
2.82 AC.
2.54 AC.
2.27 AC.
2.08 AC.
2.06 AC.
2.06 AC.

Plan GL 95

P/L R/W

Road

Utility R/W

12	13	14	15	16	17	18	19
2.81 AC.	2.33 AC.	2.00 AC.	2.00 AC.	2.00 AC.	2.00 AC.	2.00 AC.	2.14 AC.

Block 1

Plan 781 0309

Utility R/W Plan 981 2456

Lot 11	Lot 10	Lot 9	Lot 8	Lot 7	Lot 6
1.86 AC.	2.07 AC.	2.07 AC.	2.07 AC.	2.07 AC.	2.07 AC.

Plan 981 2455

Lot 5
Block 1
Plan 971 2241
4.88 AC.

20.12m WIDE ROAD

Road on Plan 981 2455

Lot 3
Block 2
Descriptive
Plan 001 0027

Original Government Road Allowance

Road Widening Plan 871 0562

N.W.1/4 SEC. 29 – 9 – 21 – 4

S.W.1/4 SEC. 29 – 9 – 21 – 4

S.W.1/4 SEC. 28 – 9 – 21 – 4

N

County of Lethbridge No. 26
AREA STRUCTURE PLAN
Surrounding
Lot 3, Block 1, Plan 927 LK
Within
SEC. 28, TWP. 9, RGE. 21, W. 4M.

50 0 50 100 150 200
Scale = 1 : 2000 Metres

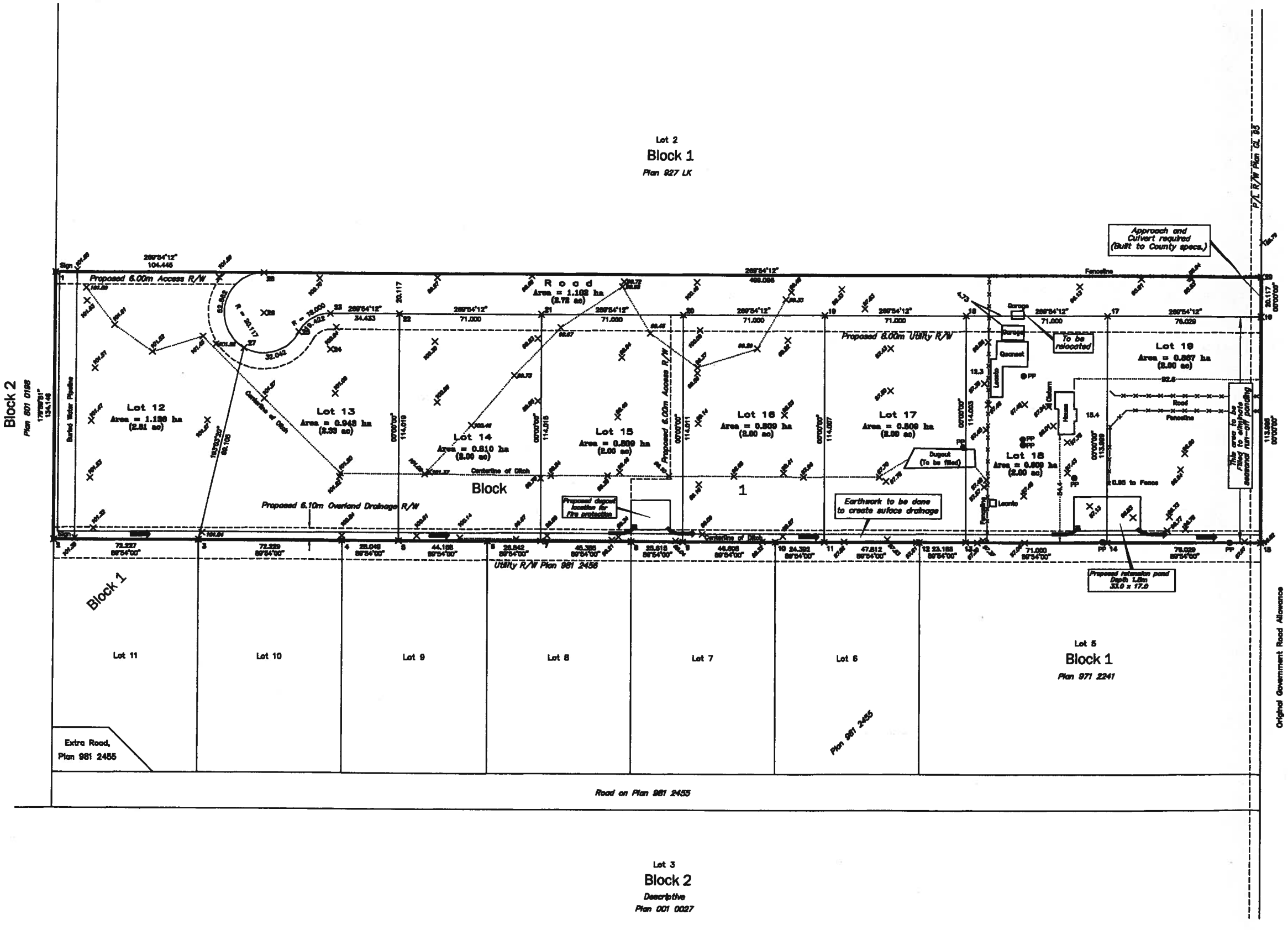
Legend:

Distances shown are in metres and decimals thereof
Portion to be registered is outlined thus ═══

Abbreviations:

'AC' denotes acres	'Pl.' denotes placed
'E.' denotes East	'PP.' denotes power poles
'Fd.' denotes Found	'Rge.' denotes Range
'ha' denotes hectares	'Re-est.' denotes Re-established
'I.' denotes Statutory Iron Post	'Ref.' denotes Reference
'Mer.' denotes Meridian	'Sec.' denotes Section
'Mk' denotes Mark	'S.' denotes South
'Mkd.' denotes Marked	'Twp.' denotes Township
'N.' denotes North	'W.' denotes West

??? Surveys Ltd. ???, CALGARY, ALBERTA



N

REGISTRAR
LAND TITLES OFFICE

PLAN NO. _____

ENTERED AND REGISTERED

ON _____

INSTRUMENT NO: _____

_____
A.D. REGISTRAR

N.W.1/4 SEC. 29 – 9 – 21 – 4

S.W.1/4 SEC. 29 – 9 – 21 – 4

County of Lethbridge No. 26

TENTATIVE PLAN SHOWING SURVEY OF

PROPOSED SUBDIVISION

Affecting

Lot 3, Block 1, Plan 927 LK

Within

E.1/2 SEC. 28, TWP. 9, RGE. 21, W. 4M.

BY ??? , A.L.S., 2000

25 0 25 50 75 100
Scale = 1 : 1000 Metres

Legend:

Statutory Iron Survey Post found shown thus _____ ●
Statutory Iron Survey Post placed shown thus _____ ○ *marked ' P ??? '*
Drainage arrows shown thus _____ ⟹
Distances shown are in metres and decimals thereof
Bearings are assumed and are derived from Plan 981 2455
Parties to be registered is outlined thus ———————

Abbreviations:

'E.' denotes East
'Fd.' denotes Found
'Iss' denotes Isolcore
'I.' denotes Statutory Iron Post
'Mon.' denotes Monitor
'Mk' denotes Mark
'Mnd.' denotes Mound
'N.' denotes North
'Pl.' denotes placed
'PP.' denotes power pole
'Rge.' denotes Range
'Re-est.' denotes Re-established
'Ref.' denotes Reference
'Sec.' denotes Section
'S.' denotes South
'Twp.' denotes Township
'W.' denotes West

SURVEYOR:
NAME: ??? , A.L.S.
SURVEY DATES:
January 5, 2001

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT HOLDER
P ???
??? ??? ???

REGISTERED OWNER:
???
C. of T. No.: ???

SUBDIVISION AUTHORITY:
NAME: COUNTY OF LETHBRIDGE NO. 26
FILE NO:
DATE APPROVED:

??? Surveys Ltd. ???, CALGARY, ALBERTA

November 8, 2001

Mr. Lorne Schmid
623 – 94 Avenue SW
Calgary AB T2V 0X8

EBA File: 0404-01-42863

Dear Sir:

Subject: Proposed Subdivision Development
SEC. 28, TWP. 9, RGE. 21, W4M

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by EBA Engineering Consultants Ltd. (EBA) for the proposed subdivision of a parcel of land located in Section 28-9-21-W4M. The object of the evaluation was to provide a site specific preliminary assessment for septic disposal fields for the proposed subdivision development. In addition to the septic disposal field evaluation, EBA was also requested to comment on any potential slope stability concerns for the site, which may be applicable to the proposed development.

EBA's scope of services for this evaluation included the following.

- Site reconnaissance and review of surface topography
- Installation of five (5) percolation boreholes
- Installation of three (3) groundwater monitoring wells
- Septic disposal field analysis with regards to geotechnical issues (percolation rates and groundwater levels)
- Preparation of a report to include a general assessment for the feasibility of septic disposal fields

Authorization to proceed with this evaluation was received verbally from Mr. Lorne Schmid on October 23, 2001.

2.0 PROJECT DETAILS

The proposed development is understood to comprise the design and construction of eight (8) residential acreages (designated as Lot 12 through Lot 19). The precise location of each residence (and subsequently each septic disposal field) for the lots has yet to be determined. Figure 2 presents a conceptual layout of the proposed subdivision. An access roadway is to be constructed along the north perimeter of the development. In addition, it is understood that a surface water dugout is to be constructed in the southwest corner of Lot 19 to provide fire protection for the development as currently conceived.

3.0 SITE DESCRIPTION

3.1 Location

The project site is located approximately 1.5 km north of Lethbridge, Alberta within the County of Lethbridge. Specifically, the site is located west of a county rural roadway which extends north of 43 Street in Lethbridge. The legal description of the site is the central portion (parts of NE, NW, SE, and SW Quarters) of Section 28, Township 9, Range 21, West of the 4 Meridian. Figure 1 presents a general site location plan.

3.2 Surface Conditions

Generally the site topography is slightly undulating, sloping eastward towards the rural county road adjacent to the east property line. The drop in elevation from the west property line to the east property line is approximately 5.0 m, as derived from a topographic map of the proposed site development produced by Mr. Lorne Schmid. The majority of the elevation relief occurs in the center of the site.

The site is generally covered with grasses. An irrigation ditch exists on the site, extending from the northwest corner to an 'outlet dugout', presently located in the east third of the property (designated as Lot 17). It is understood that the form of irrigation for the property is flood irrigation.

3.3 Site Reconnaissance

As part of this assessment, EBA personnel (Sabourin) conducted a site reconnaissance of this site on October 23, 2001. The reconnaissance included a visual review of the existing condition of the property, with specific regard to any potential site development restrictions due to slope instability. The topography of the site is 'relatively flat' with respect to the slope instability (refer Section 3.2). Therefore, in EBA's opinion there are no development restrictions with regards to present or future slope instability, given the anticipated rural development.

4.0 SEPTIC DISPOSAL FIELD EVALUATION

This section presents the results of an evaluation conducted by EBA Engineering Consultants Ltd. (EBA) for septic disposal fields for the proposed development.

4.1 Fieldwork

Site work was carried out on October 30, 2001 utilizing a bobcat excavator with a drill attachment supplied by Ace Bobcat, of Lethbridge, Alberta. The drill set-up was equipped with 200 mm diameter solid stem continuous flight augers for the drilling of the percolation boreholes and groundwater monitoring wells. EBA's field representative was Mr. George Hiraga, C.E.T.

Five percolation tests within the surficial soils were conducted within the proposed development. The following table provides the results of the field program and percolation test results. A graphic summary of the percolation test results is provided in Appendix B.

Percolation Test	Location	Subsurface Stratigraphy (m)	Percolation Test Result (min/cm)
P1	Lot 19	0-0.1 Topsoil – clay, silty, sandy, damp, brown, some organics 0.1-1.0 Clay – silty, some sand to sandy, moist, medium plastic, olive brown	10.0
P2	Lot 17	0-0.1 Topsoil – clay, silty, sandy, damp, brown, some organics 0.1-1.0 Clay – silty, trace to some sand, moist, medium plastic, olive brown	30.0
P3	Lot 15	0-0.1 Topsoil – clay, silty, sandy, damp, brown, some organics 0.1-0.9 Clay – silty, some sand to sandy, moist, medium plastic, olive brown	10.0
P4	Lot 13	0-0.1 Topsoil – clay, silty, sandy, moist, brown, some organics 0.1-0.9 Clay – silty, sandy, damp, medium plastic, light brown	4.0
P5	Lot 12	0-0.1 Topsoil – clay, silty, sandy, damp, brown, some organics 0.1-0.9 Clay – silty, some sand to sandy, moist, medium plastic, olive brown	7.8

The percolation boreholes were 200 mm in diameter and drilled to depths of approximately 0.9 m. The percolation borehole sidewalls were scraped in order to provide a natural soil interface, half filled with water and allowed to saturate overnight. On October 31, 2001 the percolation holes were refilled with water to approximately 0.45 m below existing ground surface and the subsidence of the water measured versus time in conformance with, 'Percolation Test Procedure', as outlined in the Alberta Private Sewage Systems Standard of Practice 1999, in particular Item A.6 to be used with subsection 7.1.5. Generally, the test procedure consisted of:

- Following initial soaking the percolation boreholes were refilled with 450 mm depth of water and maintained at this depth for 4 hours.

- Immediately following the final adjustment to 450 mm of water, the drop in water level was measured at 30 minute intervals.

- After each measurement the water level was readjusted to 450 mm and the test continued until two successive water level drops did not vary by more than 3.2 mm (minimum of 3 measurements made).

As part of this evaluation, three groundwater monitoring wells were also installed to determine the presence of groundwater within approximately 3.0 m of the existing ground surface. The Groundwater Monitoring (GW) wells were installed in Lots 19 (GW1), 16 (GW2) and 13 (GW3), as shown in Figure 2. Generally the subsurface stratigraphy at the monitoring well locations consisted of a lacustrine clay layer underlying a relatively thin layer of topsoil, in turn, overlying a deposit of glacial clay till. Groundwater levels were also monitored on October 31, 2001 in the monitoring wells. At that time groundwater was measured at 1.80 m and 1.83 m below ground level in GW1 and GW3 respectively. GW2 was monitored dry. Monitoring well logs are presented in Appendix C.

4.2 Septic Disposal Fields

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)

- not slower than 60 minutes per 2.5 cm (24 minutes / cm)

as determined by a percolation test. The Standard of Practice also references the requirement to have a layer of 300 mm minimum thickness of soil material having a percolation rate slower than 5 minutes per 25 mm between the disposal field and water table. It is also recognized that the natural separation between the point of effluent infiltration into the soil and the groundwater should be a minimum of 1.5 m (The Plumbing and Drainage Act Regulations).

The conditions encountered during the fieldwork generally indicate similar soil conditions across the proposed subdivision with respect to suitability for septic disposal fields. At the ground elevation tested, the soils generally consist of a surficial layer of topsoil underlain by a lacustrine medium plastic clay deposit. The percolation test results were 10.0, 10.0, 4.0 and 7.8 minutes/cm, respectively for P1, P3, P4 and P5, meeting the requirements of the Safety Codes Council's guidelines. For P2 the percolation test result was faster than 24 minutes/cm (30.0), which did not meet the criteria.

Groundwater was not encountered in GW2 and at approximately 1.8 m below existing ground level in GW1 and GW2, satisfying the requirements of the applicable regulations/guidelines.

The information provided herein is intended to provide preliminary data for consideration in the design of septic disposal fields as per the provincial regulations.

5.0 CLOSURE

The conditions encountered during the fieldwork indicate generally similar soil conditions with respect to suitability for septic disposal fields for the percolation tests conducted except for P2. Additional tests may be required to find a suitable location for the septic disposal field for this lot or other methods for waste disposal, such as construction of a 'septic mound' (in accordance with the regulations) or an enclosed septic tank, may be required.

Regardless, as per the Alberta Environmental Protection Guidelines and The Plumbing and Drainage Act Regulations (Alberta Labour), additional tests are required once site specific locations are finalized and final grades for the septic disposal fields are established (if different from that encountered at the borehole locations). EBA should be given the opportunity to review details of the design and construction of the septic disposal fields related to geotechnical aspects of the project.

The recommendations in this report were prepared in accordance with generally accepted engineering principles and practice. The recommendations were based on observations made during EBA's site inspection and the fieldwork conducted as reported herein. For further limitations, reference should be made to the Geotechnical Report - General Conditions in Appendix A.

We trust this report satisfies your present requirements. Should you require additional information, please contact our office.

Respectfully submitted,
EBA Engineering Consultants Ltd.

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date Nov 8, 01
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Marc J. Sabourin, P.Eng.
Project Director

MJS:nme

FIGURES

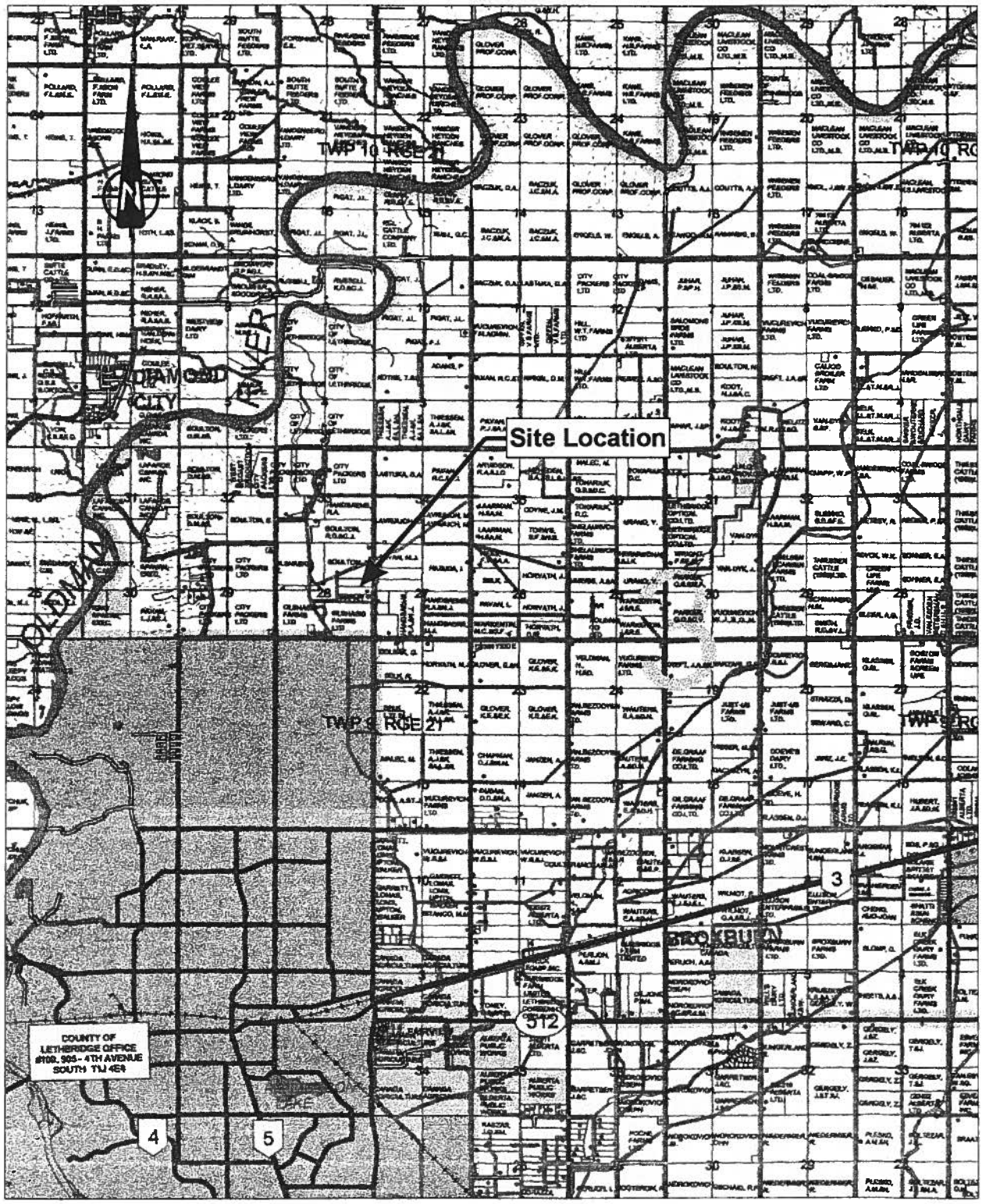


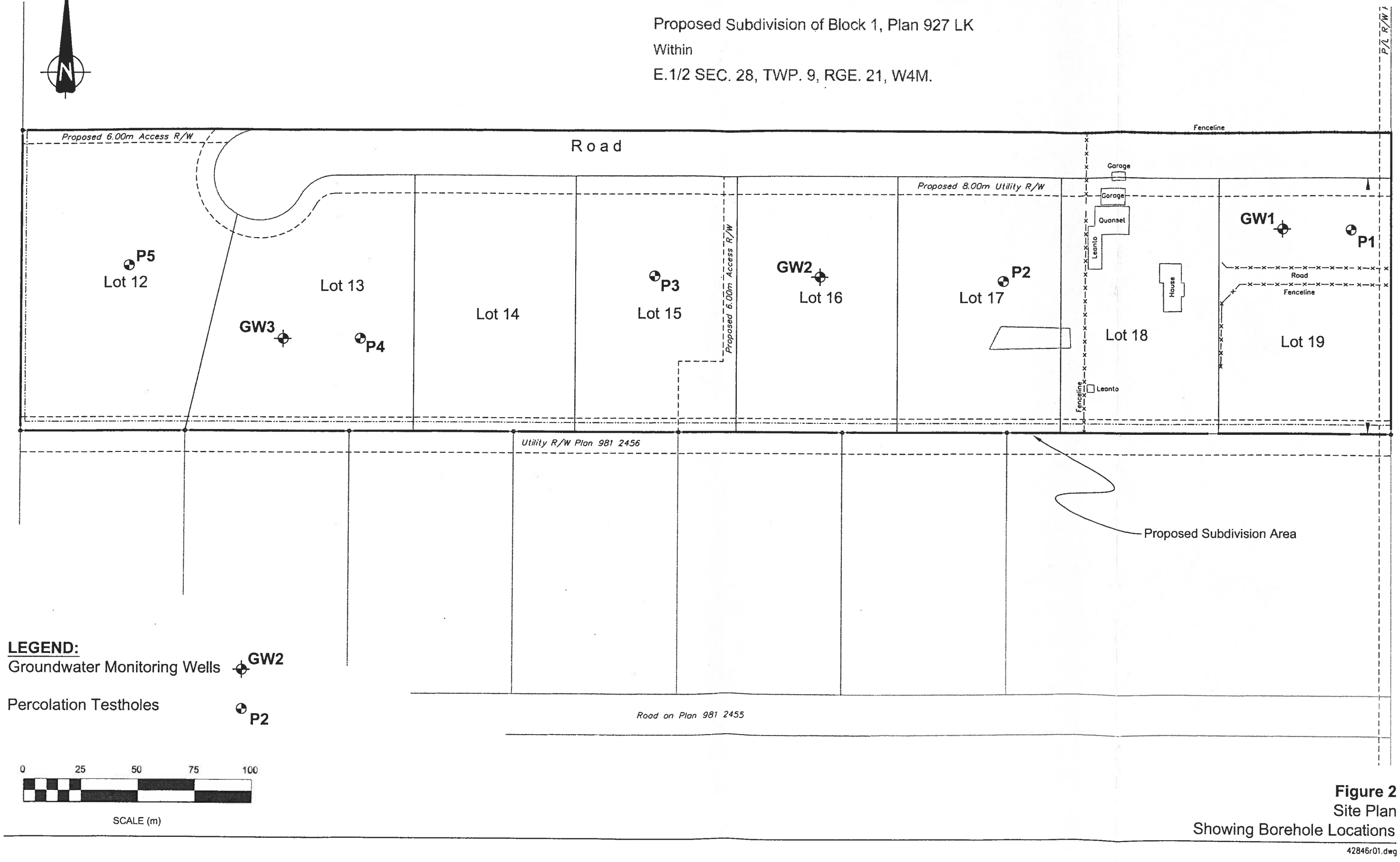
Figure 1

Location Plan

42863r01.cdr

eba

Proposed Subdivision of Block 1, Plan 927 LK
Within
E.1/2 SEC. 28, TWP. 9, RGE. 21, W4M.



LEGEND:

Groundwater Monitoring Wells GW2

Percolation Testholes P2

0 25 50 75 100

SCALE (m)

Figure 2
Site Plan
Showing Borehole Locations

APPENDIX A

GEOTECHNICAL REPORT – GENERAL CONDITIONS

EBA Engineering Consultants Ltd. (EBA)
GEOTECHNICAL REPORT – GENERAL CONDITIONS

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

A.1 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.

A.2 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.

A.3 LOGS OF TEST HOLES

The test hole 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.

A.4 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.

A.5 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.

A.6 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.

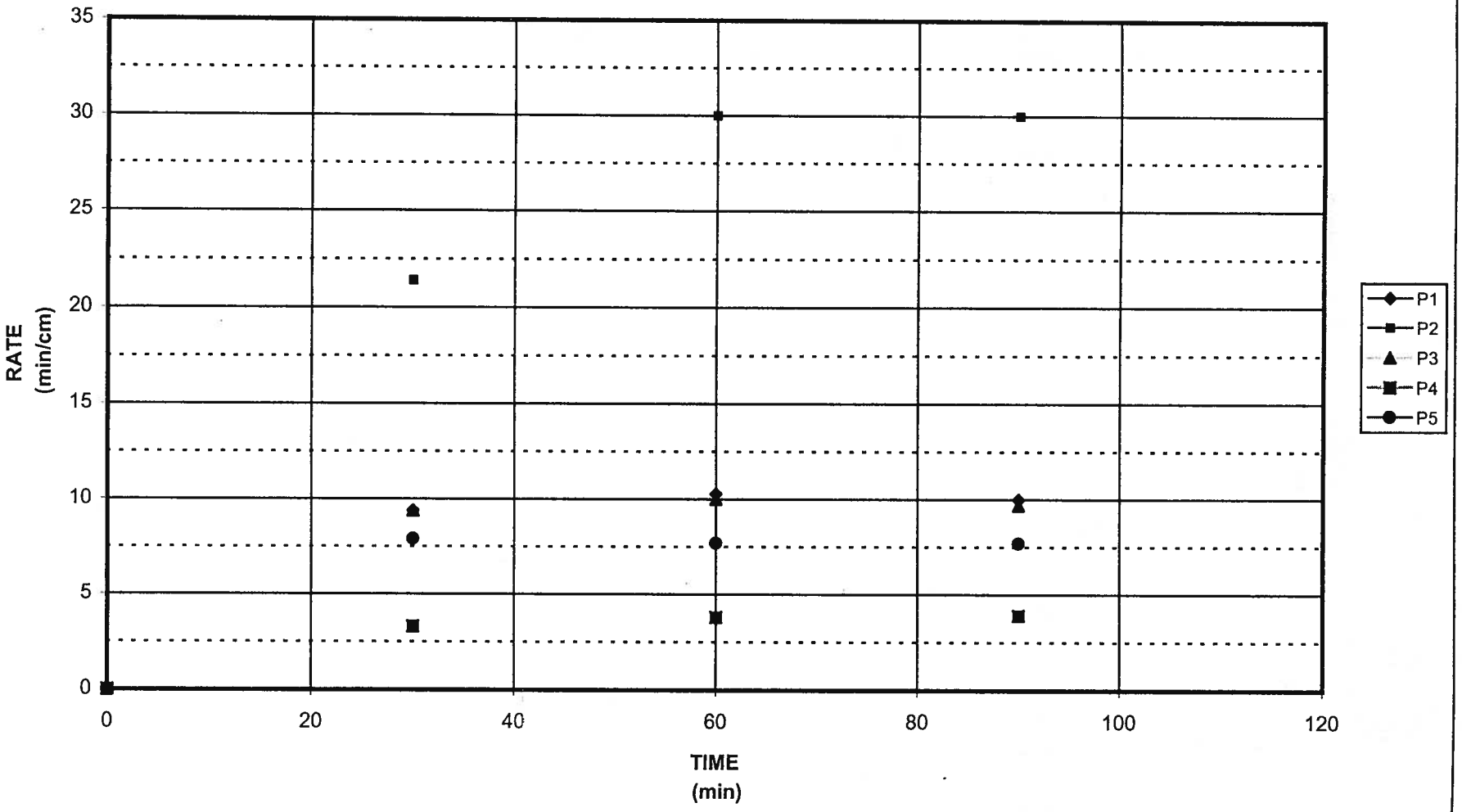
A.7 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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.

APPENDIX B

PERCOLATION TEST RESULTS

PERCOLATION TEST RESULTS
0404-01-42863
CHART 1



APPENDIX C

GROUNDWATER MONITORING LOGS

PROJECT: Septic Field Evaluation	LOCATION: Section 28-9-21-W4M	BOREHOLE NO: 001
CLIENT: Mr. Lorne Shmidt	Contractor: Ace Bobcat	PROJECT NO: 0404-01-42863
PROJECT ENGINEER: MJS	Drill Method; Solid Stem Auger	ELEVATION: 96.2 m

SAMPLE TYPE ■ DISTURBED ⊘ NO RECOVERY ⊠ SPT ☰ A-CASING ▯ SHELBY TUBE ▮ CORE

Symbols for SOILS

Depth(m)		SAMPLE TYPE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80	■ Standard Penetration (N) ■ 20 40 60 80	ELEVATION(m)
0.0	TOPSOIL – clay, silty, some sand, some organics, moist, brown					96.0
1.0	CLAY – silty, some sand, stiff, moist, brown, medium plastic					95.0
2.0	CLAY (TILL) – silty, some sand, trace gravel, stiff, moist, olive brown, coal specks, oxide stains, white precipitates ...very moist					94.0
3.0	End of Borehole at 3.0m No seepage or soloughing on completion 25mm PVC standpipe installed to 3.0m depth Groundwater level monitored on 31/10/01					93.0
4.0						92.0
5.0						91.0
6.0						90.0
7.0						89.0

EBA Engineering Consultants Ltd.

LOGGED BY: GH	COMPLETION DEPTH: 3 m
REVIEWED BY: MJS	COMPLETE: 01/10/30
Fig. No: B1	Page 1 of 1

01/11/05 11:40AM (NORMAL)

PROJECT: Septic Field Evaluation	LOCATION: Section 28-9-21-W4M	BOREHOLE NO: 002
CLIENT: Mr. Lorne Shmidt	Contractor: Ace Bobcat	PROJECT NO: 0404-01-42863
PROJECT ENGINEER: MJS	Drill Method; Solid Stem Auger	ELEVATION: 98.8 m

SAMPLE TYPE ■ DISTURBED ⊘ NO RECOVERY ⊠ SPT ☰ A-CASING ▯ SHELBY TUBE ▮ CORE

Depth(m)	Symbols for SOILS	SAMPLE TYPE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80	■ Standard Penetration (N) ■ 20 40 60 80	ELEVATION(m)
0.0	TOPSOIL – clay, silty, some sand, some organics, moist, brown					98.8
	CLAY – silty, some sand, stiff, moist, brown, medium plastic					
1.0	CLAY (TILL) – silty, some sand, trace gravel, stiff, moist, olive brown, coal specks, oxide stains, white precipitates					98.0
2.0						97.0
3.0	End of Borehole at 3.0m No seepage or soloughing on completion 25mm PVC standpipe installed to 3.0m depth Monitoring Well dry on 31/10/01					96.0
4.0						95.0
5.0						94.0
6.0						93.0
7.0						92.0

EBA Engineering Consultants Ltd.

LOGGED BY: GH	COMPLETION DEPTH: 3 m
REVIEWED BY: MJS	COMPLETE: 01/10/30
Fig. No: B2	Page 1 of 1

01/11/05 11:40AM (NORMAL)

PROJECT: Septic Field Evaluation	LOCATION: Section 28-9-21-W4M	BOREHOLE NO: 003
CLIENT: Mr. Lorne Shmidt	Contractor: Ace Bobcat	PROJECT NO: 0404-01-42863
PROJECT ENGINEER: MJS	Drill Method; Solid Stem Auger	ELEVATION: 101.1 m

SAMPLE TYPE ■ DISTURBED ⊘ NO RECOVERY ⊠ SPT ☰ A-CASING ▯ SHELBY TUBE ▮ CORE

Depth(m)	Symbols for SOILS	SAMPLE TYPE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80	■ Standard Penetration (N) ■ 20 40 60 80	ELEVATION(m)
0.0	TOPSOIL – clay, silty, some sand, some organics, moist, brown					101.0
	CLAY – silty, some sand, stiff, moist, brown, medium plastic					
1.0	...very moist, firm					100.0
▼	...wet, some sloughing					▼
2.0	CLAY (TILL) – silty, some sand, trace gravel, stiff, moist, olive brown, coal specks, oxide stains, white precipitates					99.0
3.0	End of Borehole at 3.0m					98.0
	Sloughing and seepage on completion from 1.8m					
	25mm PVC standpipe installed to 3.0m depth					
4.0	Groundwater level monitored on 31/10/01					97.0
5.0						96.0
6.0						95.0
7.0						94.0

EBA Engineering Consultants Ltd.

LOGGED BY: GH	COMPLETION DEPTH: 3 m
REVIEWED BY: MJS	COMPLETE: 01/10/30
Fig. No: B3	Page 1 of 1

01/11/05 11:40AM (NORMAL)

December 17, 2001

EBA File: 0404-01-42863

Mr. Lorne Schmid
623 - 94 Avenue SW
Calgary, Alberta
T2V 0X8

Subject: **Hydrological Analysis**
Proposed Subdivision Development
Section 28, Township 9, Range 21, W4M
County of Lethbridge, Alberta

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained by Mr. Lorne Schmid to conduct hydrological analysis of a proposed eight-lot residential subdivision located at Section 28, Township 9, Range 21, W4M. The development of a new subdivision will increase the peak flow and surface runoff volume to a minor degree. The purpose of this analysis is to size a surface water detention pond for 1:100 year rainfall event that would accommodate the additional runoff volume while maintaining the pre-development flow rate.

The objective of the analysis is to conduct hydrological modelling to evaluate the change in surface runoff response during a 1:100 year rainfall before and after the development, as per discussions with County of Lethbridge personnel. This will eliminate possible concerns for increased flooding and erosion downstream of the subject property. The results will be used to determine a minimum storage capacity of the pond and the size of outlet culverts to accommodate the flow.

2.0 SITE DESCRIPTION

The project site is located approximately 1.5 km north of Lethbridge, Alberta within the County of Lethbridge. The land use in the area is mainly agriculture, and irrigation is commonly practiced. There is an irrigation canal located to the immediate west of the site. The site

14535 - 118 Avenue, Edmonton, Alberta T5L 2M7 - Tel: (780) 451-2121 - Fax: (780) 454-5688
Internet: edmonton@eba.ca - Web Site: http//www.eba.ca

topography is slightly undulating, and sloping eastward towards the rural county road adjacent to the east property line. The general geology of the site is a thin layer of topsoil (silty clay and some sand) overlying lacustrine clay, which overlies glacial clay till.

A farm resident currently occupies the site. There are a few buildings and a dugout located at the east end of the property near the county road. The survey plan provided to EBA shows that there is a small on-site ditch that runs from the northwest portion of the site to the dugout.

The subject site drains easterly to the county road and then northerly to an irrigation canal. From there, runoff is either stored and used for irrigation, or directed to the Oldman River via a coulee system.

3.0 HYDROLOGICAL ANALYSIS

EBA used a computer model, VisualOTTHYMO, version 1.0.21, to determine the change in runoff response caused by the new development. The model uses a mathematical relationship of physical and empirical parameters representing the hydrologic interactions that result in surface runoff. The physical parameters include a design rainfall event, drainage area, surficial soil type, and site topography. The empirical parameters numerically describe the surficial conditions, infiltration, and overland flow response.

The analysis was conducted in two stages: pre-development and post-development to determine the change in surface runoff response peak flow. The following sections describe the analysis in detail.

3.1 Pre-development Analysis

The 1:100 year rainfall data was obtained from the intensity, duration and frequency (IDF) curve generated from the rainfall data collected at the Lethbridge Airport. Based on the site description and the current site conditions, the following parameters were used in the computer model.

Table 1
Pre-development Hydrological Parameters

Parameters	Value
Drainage Area	8.1 ha
Hydrologic Soil Group	Class C
Runoff Curve Number (CN)	71
Unit Hydrograph Time to Peak (T_p)	0.4 hour
Surface Grade	1%
Time Step	5 min
Duration of Storm	4 hours

The modelling results show that during the 1:100 year design event, the surface runoff would take about 1.8 hours to reach a peak flow of 0.52 m^3/s at the outflow. The total rainfall was estimated at 75 mm and the percent runoff (ratio of runoff depth and total rainfall depth) was about 38%.

3.2 Post-Development Analysis

2.3.1 Proposed Site Development Plan

The proposed site development plan includes eight lots with areas ranging from 0.8 ha to 1.1 ha, a residential road along the north end of the property, and a drainage swale that will run along the east and south of the property boundary. The preliminary survey plan showed that the current site is sloping at approximately 1% grade towards the east.

2.3.2 Hydrological Model

The VisualOTTHYMO computer model was used to determine the runoff response for post-development of the site. Similarly, the 1:100 year rainfall event obtained from Lethbridge Airport was used in the model.

The following assumptions were made for the analysis, and Figure 1 illustrates the proposed drainage pattern based on these assumptions:

- The general site topography during post-development will be sloping eastward towards the county road.
- There are three on-site drainage swales:
  1. Along the west boundary of Lot 12
  2. Along the south boundary of the property
  3. Between lot 18 and 19
- Each lot will be graded so that the surface water will drain away from the house; the house on each lot is assumed to be constructed near the middle of the lot. Surface water from the front yard will be draining into the residential road ditch, and water from the back yard will be draining into the proposed swale along western and southern boundary.
- The drainage ditch at the residential road will run parallel along with the proposed utility right-of-way. Surface runoff from the road and the front yards of each lot will drain eastward towards a proposed swale between Lots 18 and 19.
- Each lot is assumed to have a house with a 190 m^2 (2000 ft^2) footprint, a long driveway (6 m x 20 m), and a garage area of 50 m^2.
- The front and back yards will be sodded and landscaped.
- The surface water from Lot 19 will be draining directly into the adjacent county road (bypassing the detention pond).

Based on the above assumptions and the proposed preliminary site development plan, the site was divided into two drainage areas as shown on Figure 1. The following parameters were entered into the model:

Table 2
Post-Development Hydrological Development

Parameters	Area 1	Area 2
Drainage Area	7.1 ha	1.0 ha
Hydrologic Soil Group	Class C	Class C
Runoff Curve Number (CN)	78	78
Unit Hydrograph Time to Peak (T_p)	0.44 hour	0.12 hour
Surface Grade	0.9%	0.8%
Time Step	5 min.	5 min.
Duration of Storm	4 hours	4 hours

The modelling results showed that the peak flows would increase in the order of 2 to 3% if detention storage pond is not included. The total minimum storage capacity of 300 m^3 is required to maintain a pre-development outflow rate of 0.52 m^3/s as per County of Lethbridge requirements. The modelling results are contained in Appendix A. Table 3 shows a comparison table of 1:100 year peak flow rate for pre-development, post-development without on-site surface water control, and post-development with on-site surface water control. The recommended location of the detention pond is near the county road at the southwest corner of Lot 19. This location maximizes the surface area from which the runoff will be collected.

Table 3
1:100 Year Peak Flow Comparison for Pre- and Post-Development

Pre-development	Post-Development (Without On-site Surface Water Control)	Post-Development (With On-site Surface Water Control)	Minimum Detention Pond Capacity
0.52 m^3/s	0.53 m^3/s	0.52 m^3/s	300 m^3

4.0 SURFACE WATER RETENTION POND

Based on the hydrological analysis, a surface retention pond having a capacity of 300 m^3 will meet the 1:100 year rainfall detention volume and an outflow rate of 0.52 m^3/s. The recommended pond dimension is 17 m x 33 m x 1.5 m with a 4:1(H:V) side slopes and a freeboard of 0.3 m. The recommended location of the pond is shown on Figure 1. The detention pond could be split between two locations but any storage site should be located on the east half of the property.

The recommended pond size does not include water storage for fire protection, potable water, or any other water usage. Any additional storage capacity will be added to the recommended minimum storage capacity of 300 m^3. It is assumed that additional storage capacity for other usage will be confirmed during final design stage.

It is recommended that the perimeter of the pond be fenced and appropriate signage be used for residential safety. The pond shall only be accessible to authorized personnel.

4.1 Downstream Capacity

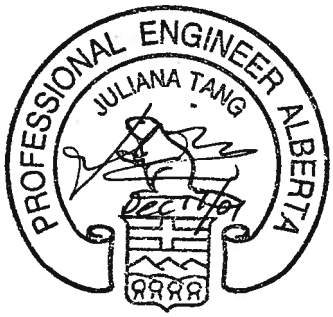
EBA inspected the existing culverts approximately 1km north and south of the east county road. The surface water flows northwards along the road from the subject site and there are six driveway access culverts of 400 mm in diameter spaced approximately 200 m apart. These are not sized for a 1:100 year flows but will not be adversely impacted, as the subject site flows will be maintained at the pre-development levels.

The recommended culvert size for the detention pond is two 400 mm diameter. The locations of the outlet culverts are shown on Figure 1. Metal screens or mesh over the culvert openings may also be used to prevent material or debris from clogging the culvert openings. Regular inspection of the culverts should be conducted as part of the culvert maintenance program.

5.0 CLOSURE

We trust that the information provided meets your present requirement. Should you have any questions or comments, please contact the undersigned.

EBA Engineering Consultants Ltd.



Juliana Tang, M.Sc., P.Eng.
Project Engineer
Environmental Services
(Direct Line: (780) 451-2130, ext. 483)

reviewed by:

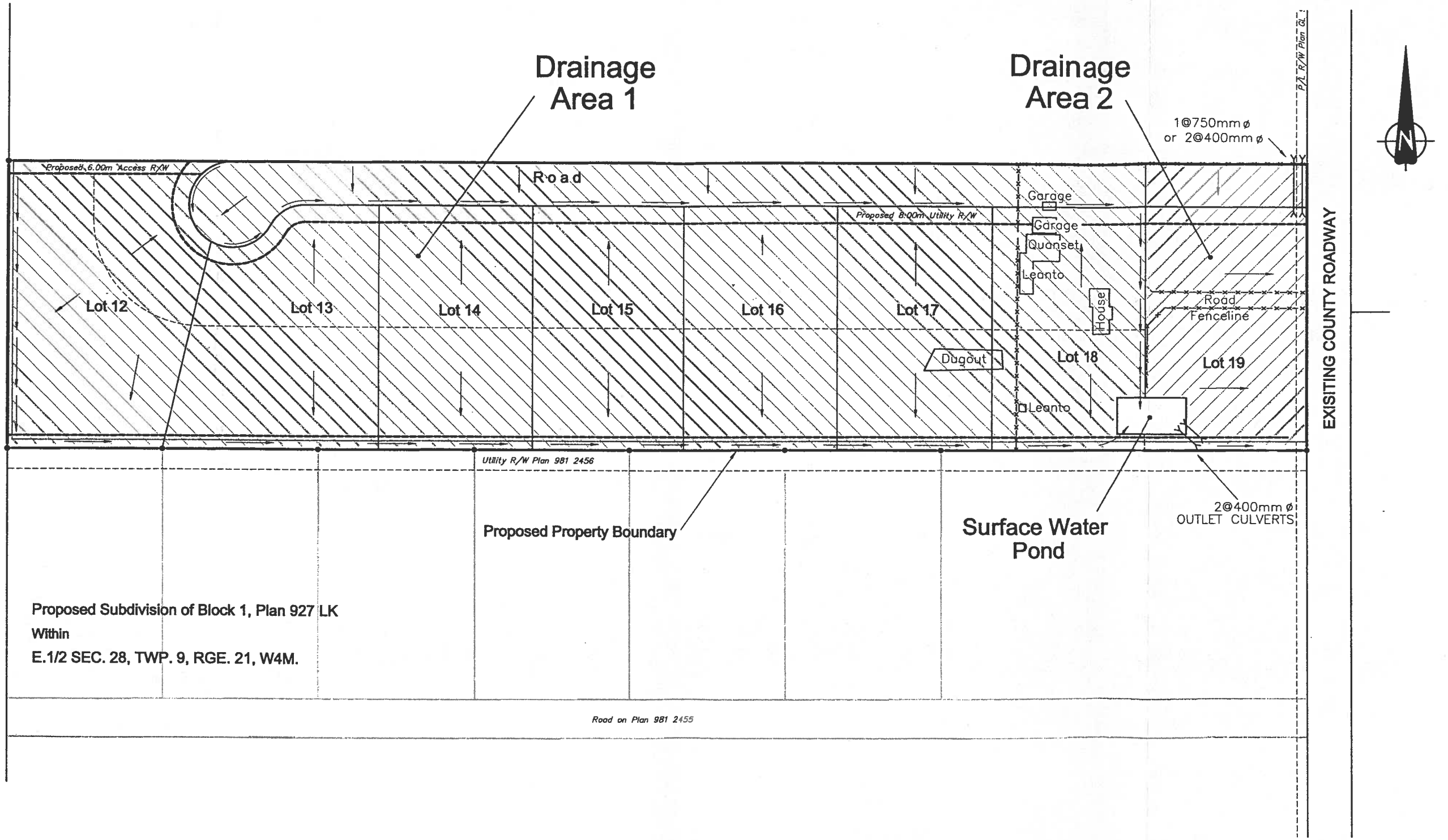
Brian C. Adeney, P.Eng.
Project Director
Environmental Services
(Direct Line: (780) 451-2130, ext. 258)

/wdr

Attachments

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature _____
Date Dec 17/01
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

FIGURE



LEGEND

drainage direction

culvert

0 100

metres

Figure 1
Drainage Pattern and
Location of Surface Rention Pond
For New Development

42863M01C.dwg

eba

APPENDIX A

MODELLING RESULTS

```
==========================================================================================================================

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM, Version 1.0
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    HHHHH    Y    M M M  O   O   Licensed To:
      O   O    T      T    H   H    Y    M   M  O   O   EBA Engineering
       OOO     T      T    H   H    Y    M   M   OOO    V0101-0060-1

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                  *****  D E T A I L E D   O U T P U T  *****


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DATE: 14/12/2001                          TIME: 11:37:19 AM

USER:

COMMENTS: PRE - DEVELOPMENT

--------------------------------------------------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=2193.958
| Ptotal= 74.80 mm |                           B=   6.792
--------------------                           C=    .865
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                    The CORRELATION coefficient is =  .9990

                     TIME       INPUT INT.          TAB. INT.
                    (min)        (mm/hr)             (mm/hr)
                       5.         250.10              259.60
                      10.         191.80              191.21
                      15.         158.80              152.62
                      30.         105.70               97.02
                      60.          57.60               57.92
                     120.          31.30               33.27
                     360.          11.80               13.27
                     720.           7.40                7.35
                    1440.           4.40                4.05

  TIME    RAIN  | TIME    RAIN  | TIME    RAIN  | TIME    RAIN
   hrs   mm/hr  |  hrs   mm/hr  |  hrs   mm/hr  |  hrs   mm/hr
   .08    3.20  | 1.08   19.38  | 2.08   11.10  | 3.08    4.51
   .17    3.43  | 1.17   32.53  | 2.17    9.89  | 3.17    4.30
   .25    3.70  | 1.25   83.62  | 2.25    8.91  | 3.25    4.11
   .33    4.02  | 1.33  259.60  | 2.33    8.11  | 3.33    3.94
   .42    4.40  | 1.42  109.59  | 2.42    7.44  | 3.42    3.78
   .50    4.86  | 1.50   57.77  | 2.50    6.88  | 3.50    3.63
   .58    5.44  | 1.58   37.69  | 2.58    6.39  | 3.58    3.50
   .67    6.17  | 1.67   27.45  | 2.67    5.97  | 3.67    3.37
   .75    7.15  | 1.75   21.39  | 2.75    5.61  | 3.75    3.26
   .83    8.50  | 1.83   17.43  | 2.83    5.28  | 3.83    3.15
   .92   10.48  | 1.92   14.67  | 2.92    4.99  | 3.92    3.05
  1.00   13.64  | 2.00   12.64  | 3.00    4.74  | 4.00    2.96

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (0001)  |   Area     (ha)=   8.10   Curve Number    (CN)= 71.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   4.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .40
```

```
    Unit Hyd Qpeak   (cms)=     .773

    PEAK FLOW        (cms)=     .522 (i)
    TIME TO PEAK     (hrs)=    1.833
    RUNOFF VOLUME     (mm)=   28.262
    TOTAL RAINFALL    (mm)=   74.799
    RUNOFF COEFFICIENT    =     .378

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------

 FINISH
===========================================================================================================
```

```
 V    V   I    SSSSS  U   U    A    L
 V    V   I    SS     U   U   A A   L
  V  V    I     SS    U   U  AAAAA  L
  V  V    I      SS   U   U  A   A  L
   VV     I    SSSSS  UUUUU  A   A  LLLLL

  OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM, Version 1.0
 O   O    T      T    H   H   Y Y   MM MM  O   O
 O   O    T      T    HHHHH    Y    M M M  O   O   Licensed To:
 O   O    T      T    H   H    Y    M   M  O   O   EBA Engineering
  OOO     T      T    H   H    Y    M   M   OOO    V0101-0060-1
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***** D E T A I L E D O U T P U T *****

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Summary filename: C:\Visual OTTHYMO v1.01\Lethbridge\Post-Development-1summary.txt

DATE: 14/12/2001 TIME: 11:32:38 AM

USER:

<=== comment ===>1:100 Year Rainstorm Event POST - DEVELOPMENT

****
** SIMULATION NUMBER: 1 **
****

| CHICAGO STORM |
| Ptotal= 74.78 mm |

IDF curve parameters: A=2193.958
B= 6.792
C= .865
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = .33

The CORRELATION coefficient is = .9990

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	250.10	259.60
10.	191.80	191.21
15.	158.80	152.62
30.	105.70	97.02
60.	57.60	57.92
120.	31.30	33.27
360.	11.80	13.27
720.	7.40	7.35
1440.	4.40	4.05

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.48	1.17	41.31	2.17	9.74	3.17	4.27
.33	4.08	1.33	191.21	2.33	8.01	3.33	3.91
.50	4.96	1.50	56.01	2.50	6.80	3.50	3.61
.67	6.35	1.67	26.67	2.67	5.91	3.67	3.35
.83	8.86	1.83	17.04	2.83	5.24	3.83	3.13
1.00	14.71	2.00	12.41	3.00	4.70	4.00	2.94

| CALIB |
| NASHYD (0001) |
| ID= 1 DT= 5.0 min |

Area (ha)= 7.08 Curve Number (CN)= 78.0
Ia (mm)= 4.70 # of Linear Res. (N)= 3.00
U.H. Tp(hrs)= .44

Unit Hyd Qpeak (cms)= .615

PEAK FLOW (cms)= .530 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 34.653
TOTAL RAINFALL (mm)= 74.783

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0003)		OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2---> OUT= 1					
DT= 5.0 min		.000	.000	.500	.030

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0001)	7.08	.53	1.83	34.65
OUTFLOW: ID= 1 (0003)	7.08	.49	2.00	34.65

PEAK FLOW REDUCTION [Qout/Qin](%)= 92.42
TIME SHIFT OF PEAK FLOW (min)= 10.00
MAXIMUM STORAGE USED (ha.m.)= .03

CALIB NASHYD (0002) ID= 1 DT= 5.0 min					
	Area	(ha)=	1.05	Curve Number (CN)=	78.0
	Ia	(mm)=	4.70	# of Linear Res.(N)=	3.00
	U.H. Tp	(hrs)=	.12		

Unit Hyd Qpeak (cms)= .334

PEAK FLOW (cms)= .170 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 34.193
TOTAL RAINFALL (mm)= 74.783
RUNOFF COEFFICIENT = .457

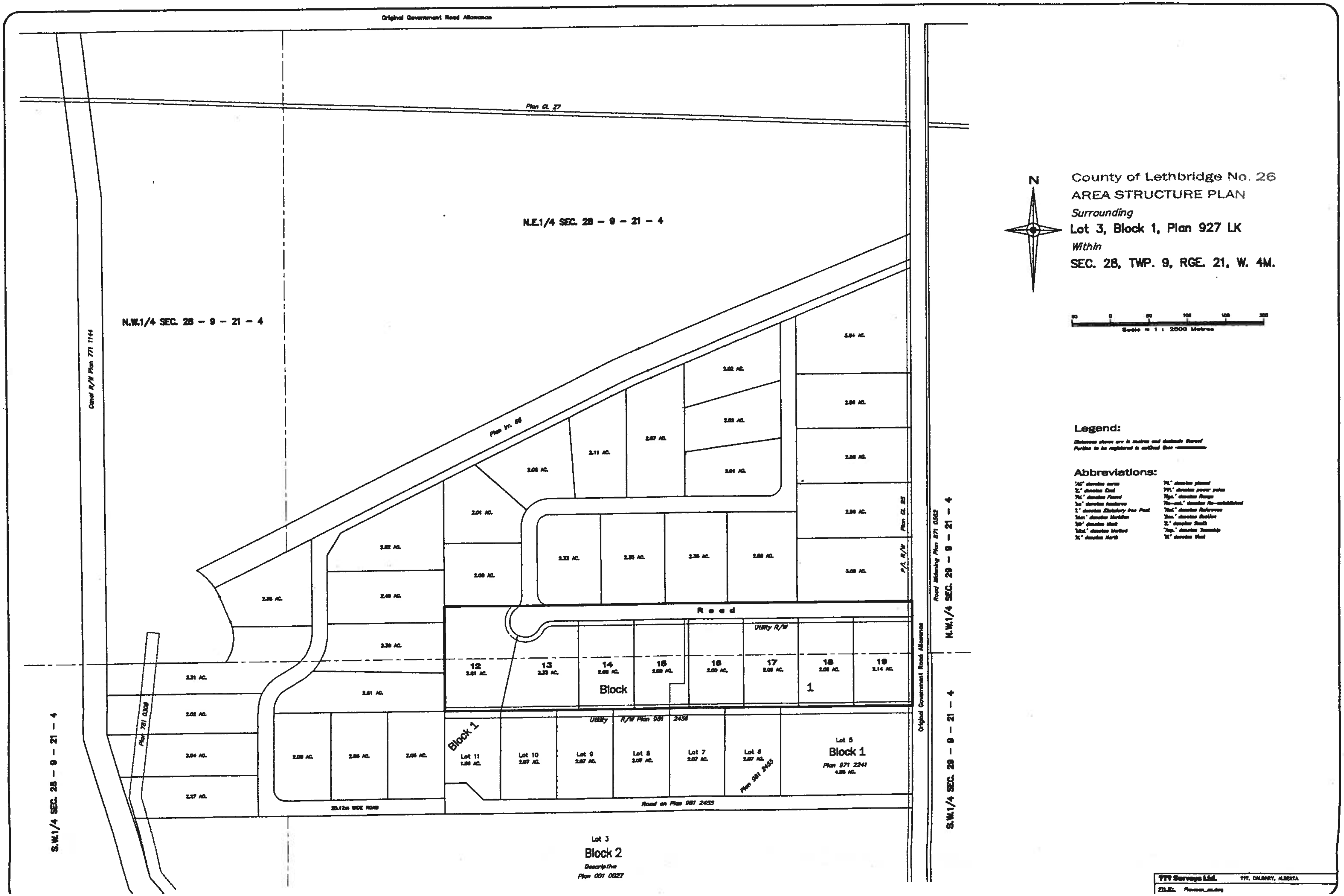
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0004)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0003):	7.08	.490	2.00	34.65
+ ID2= 2 (0002):	1.05	.170	1.42	34.19
ID = 3 (0004):	8.13	.519	1.92	34.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH


County of Lethbridge No. 26
AREA STRUCTURE PLAN
Surrounding
Lot 3, Block 1, Plan 927 LK
Within
SEC. 28, TWP. 9, RGE. 21, W. 4M.
N
Legend:
Abbreviations:
Original Government Road Allowance
Plan GL 27
N.E.1/4 SEC. 28 - 9 - 21 - 4
N.W.1/4 SEC. 28 - 9 - 21 - 4
S.W.1/4 SEC. 28 - 9 - 21 - 4
N.W.1/4 SEC. 29 - 9 - 21 - 4
S.W.1/4 SEC. 29 - 9 - 21 - 4
Canal R/W Plan 771 1144
Plan Irr. 86
Road
Utility R/W
Block 1
Lot 5
Block 1
Plan 971 2241
Lot 3
Block 2
Descriptive
Plan 001 0027
Road on Plan 981 2455
Plan 781 0308
20.12m WIDE ROAD