MILLARVILLE COUNTRY ESTATES AREA STRUCTURE PLAN

Prepared for:
The Municipal District of Foothills No. 31

Landowner/Developer:

Millarville Estates Ltd. (913007 Alberta Ltd.)

Prepared by:

glb planning ltd.

November 2004

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1.0 INTRODUCTION

1.1 Purpose of the Plan

The *Millarville Country Estates* Area Structure Plan (ASP) has been prepared pursuant to the Province of Alberta's Municipal Government Act and the Municipal District of Foothills Municipal Development Plan. The purpose and intent of the ASP is to provide for the orderly development of the subject lands. The ASP is more detailed than the Municipal Development Plan (MDP) as it provides a more specific policy framework for the Municipality and will act as guide for future land use redesignation, subdivision, and development applications within the Plan Area.

1.2 Background to the ASP

The Plan Area contains 44.288 ha (109.4 acres±) of the SW ¼ Section 14, Township 21, Range 03, West of the 5th Meridian. The Plan area is located 1.5 kilometers west of Highway 22, and 3 kilometers north of the Hamlet of Millarville.

The Plan Area contains many desirable features for Country Residential development, including secluded treed home sites, gently sloping topography, and easy access to a major transportation link to Calgary and Okotoks. Close proximity to the Hamlet of Millarville further enhances the desirability of these lands for future country estate living.

1.3 The Approval Process

The M.D. of Foothills outlines in its' MDP, the requirements for an Area Structure Plan for Country Residential Development proposals in excess of 8 lots. An ASP is a statutory plan adopted by bylaw, thus requiring approval by the Municipal Council.

The ASP preparation involved initial meetings with municipal planning staff, the superintendent of Public Works, and the local Councilor to discuss design concepts and goals. Other recent ASPs were also reviewed to gain insight into current development trends within the M.D. of Foothills. Detailed technical studies were commissioned prior to proceeding with the formal design and application process, to ensure that the specific characteristics of the land and area were integrated in the design of this Country Residential proposal.

The ASP process involves public participation, which invites the neighbours and general public to provide their comments and concerns regarding the proposed development concept. Input from all key stakeholders is carefully considered prior to submitting the final version of the ASP for Council's consideration.

1.4 Plan Implementation

The *Millarville Country Estates* Area Structure Plan is adopted by bylaw only after due process, and in accordance with the Municipal Government Act. Once adopted, this statutory document becomes a key factor in subsequent Land Use Redesignation and Subdivision applications. The ASP should not contravene the objectives and policies of the Municipal Development Plan. The adoption of the ASP does not diminish, supercede, replace or repeal any part of the MDP or other statutory plans that may be in effect in the Plan Area.

The adoption of the Area Structure Plan may require incorporation into other municipal planning documents such as the Foothills MDP and Land Use Bylaw in order for its full implementation.

1.5 Plan Review and Amendment

The existing conditions that have helped form this ASP may change in the future, therefore periodic review and amendment of the ASP may be required as needed. As the approving authority, Council may initiate amendment of the ASP in accordance with the Municipal Government Act. The landowner or their agents may also make application to amend the ASP in accordance with the proper procedures and application requirements of the MGA.

1.6 Legislative Framework

Municipal Government Act

Pursuant to the Municipal Government Act, Part 633, a Municipal Council is permitted by bylaw to adopt an Area Structure Plan as a statutory document.

Section 633 of the MGA states:

1. *For the purpose of providing a framework for subsequent subdivision and development of an area of land, a council may, by bylaw, adopt an area structure plan.*

2. *An area structure plan*
    a. *must describe*
        i. *the sequence of development proposed for the area,*
        ii. *the land uses proposed for the area, either generally or with respect to specific parts of the area,*
        iii. *the density of population proposed for the area either generally or with respect to specific parts of the area, and*
        iv. *the general location of major transportation routes and public utilities,*
    b. *may contain any other matters the council considers necessary.*

The Municipal Development Plan

The M.D. of Foothills adopted the Municipal Development Plan in October 1998 to meet the requirements of the MGA and to provide an understandable guide to future development within the municipality. The MDP establishes the long-range goals and objectives of the municipality and sets policies to achieve those goals and objectives. The *Millarville Country Estates* Area Structure Plan is consistent with, and conforms to, the policies of the MDP.

The requirements of the MDP for an Area Structure Plan, when country residential development is proposed, is outlined in Section 5.3.5 of the MDP.

> *An Area Structure Plan drafted in accordance with the Guidelines adopted by the Municipality shall be required as part of a Country Residential proposal that would create 8 new lots or more and for proposals of less than 8 new lots an Area Structure Plan may be required if in the opinion of Council one is necessary, due to:*
> *a.) the impact the proposal may have on adjoining lands;*
> *b.) the need to review, in greater detail, the infrastructure requirements of this proposal;*
> *c.) the proposal being a continuation of an existing subdivision and leads to a density greater than 8 lots per quarter section;*
> *d.) the proposal, in the opinion of Council, being phase 1 of a development that will create 8 new lots or more.*

1.7 Interpretation

In this Area Structure Plan, the following interpretations shall apply:

"ASP" or **"Plan"** means the *Millarville Country Estates* Area Structure Plan.

"Council" means the Council of the Municipal District of Foothills No. 31.

"Developer" means the registered owner of the lands within the ASP area.

"Landowner" means the registered owner of the lands within the ASP boundary.

"M.D." means the Municipal District of Foothills No. 31.

"MDP" means the Municipal Development Plan for the Municipal District of Foothills No. 31.

"MGA" means the Municipal Government Act

"Qualified Professional" means a professional engineer, geologist, or geophysicist licensed to practice in the Province of Alberta.

"Subdivision Approving Authority" means the Council of the Municipal District of Foothills No. 31.

"Tentative Plan" means a detailed proposal for development of the lands or any portion thereof, which may form the basis for an application for subdivision.

2.0 THE PLAN AREA

2.1 Regional/Municipal Location

The Plan area, as illustrated in **Figure 1**, is located southwest of the City of Calgary, and 3± kms north of Millarville, in the Municipal District of Foothills. The rolling topography and wooded landscape in this region and its' proximity to highway transportation linkages and a major urban center, combine to make this area increasingly popular for country residential development.

The area surrounding the subject lands **(Figure 2)** are characterized by a mix of large Agricultural designated land parcels and clusters of Country Residential designated lots. There are currently in excess of 50 Country residential lots within a 1.6 km (1 mile) radius of Section 14-21-03-W5M.

The topography and wooded lands in this area generally are not feasible for new agricultural pursuits, as the land base is typically priced for country residential development.

The location is ideally situated for those seeking an active outdoor lifestyle in a country residential setting.

2.2 Definition of Plan Area

2.2.1 Boundaries of Plan Area

The Plan Area is bounded on the north and west by new and existing country residential development. These developments have occurred mostly within the last nine years, with subdivision plans having been registered in 1978, 1995, 1996, and 2002.

The east boundary is made up of a combination of Country Residential and mid sized (<40 acres) Agricultural designated lands which are partially treed.

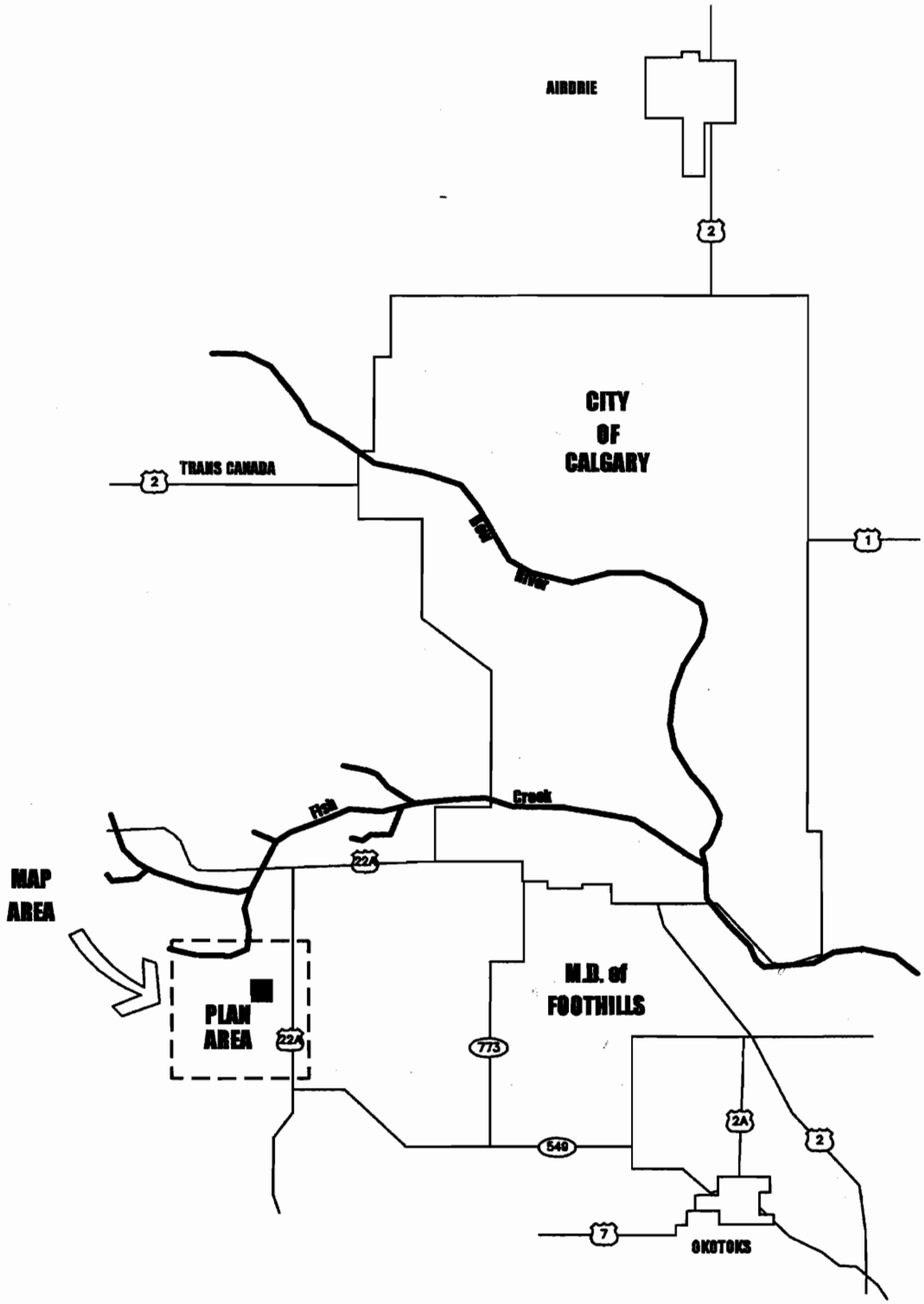
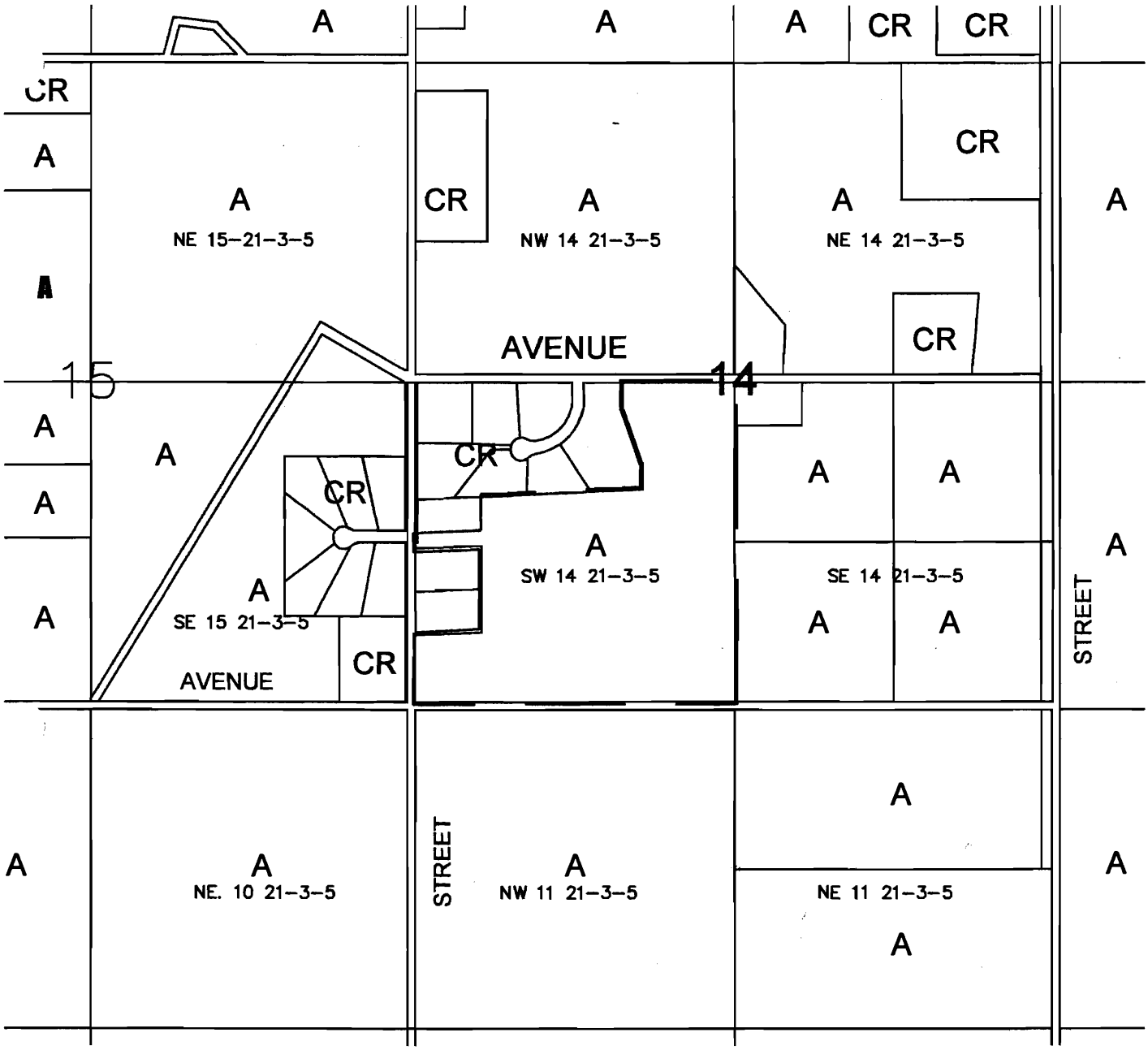


FIGURE 1:
MUNICIPAL SETTING
M.D. OF FOOTHILLS



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——— A.S.P. BOUNDARY

A AGRICULTURAL DISTRICT

CR COUNTRY RESIDENTIAL

FIGURE 2:

PLAN AREA

NOT TO SCALE

MILLARVILLE COUNTRY ESTATES

The land to the south of the subject property is designated Agricultural.

2.2.2 General Physical Description

The existing residence was completed in 2002 and is serviced by a driveway access onto 298th Avenue. Legal access exists to the west on 224th Street that is not currently utilized. There is also a cleared but undeveloped road allowance along the south boundary of the property.

Topography

The *Millarville Country Estates* parcel is 44.288 ha (109.4 acres±) of mostly wooded lands. The land slopes down from the southwest to the northeast. The lands are currently designated Agricultural but are not actively used for any agricultural purposes. Approximately 10%-15% of the land could be utilized for grazing, with the remainder of the land being heavily treed and sloped **(Fig 3).** The previous landowner had intended to utilize the subject lands for deer farming but was unsuccessful.

Natural drainage courses drain into existing low areas due to the slope of the lands. The drainage course generally separates the cleared lands from the wooded lands **(Fig 4)**.

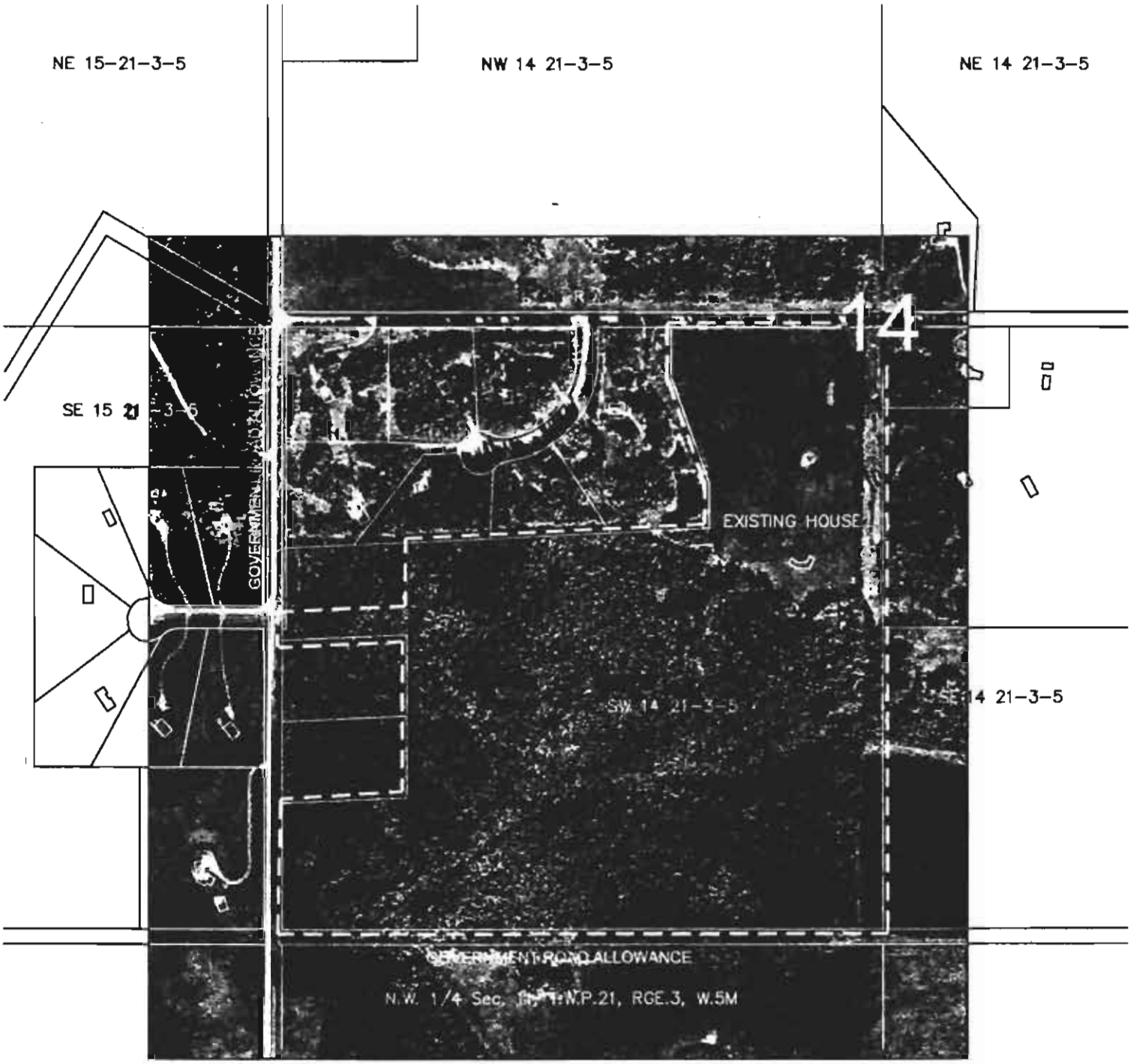

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FIGURE 3:

AIRPHOTO

NOT TO SCALE

MILLARVILLE COUNTRY ESTSTES

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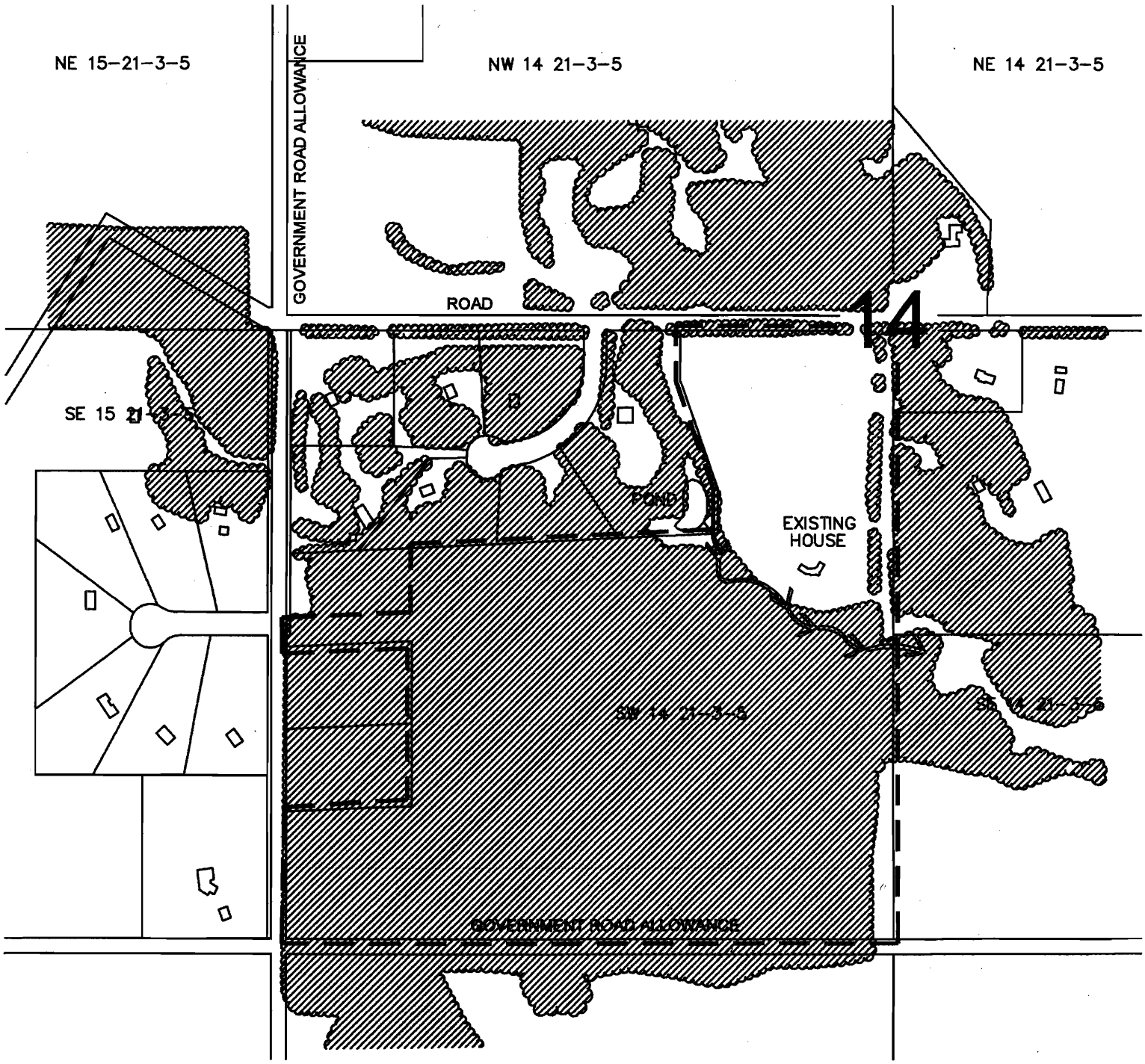

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A.S.P. BOUNDARY

EXISTING TREE COVER

SEASONAL DRAINAGE

FIGURE 4:
EXISTING SITE FEATURES

NOT TO SCALE

MILLARVILLE COUNTRY ESTSTES

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3.0 PLAN GOALS AND OBJECTIVES

3.1 Goals and Objectives of the Plan

The goal of the *Millarville Country Estates* Area Structure Plan is to provide a framework for the orderly and efficient development of a country residential subdivision that is both consistent with the environmental features of the site and compatible with the anticipated land use and transportation patterns along Highway 22.

3.2 Principles of Development

Pattern of Development

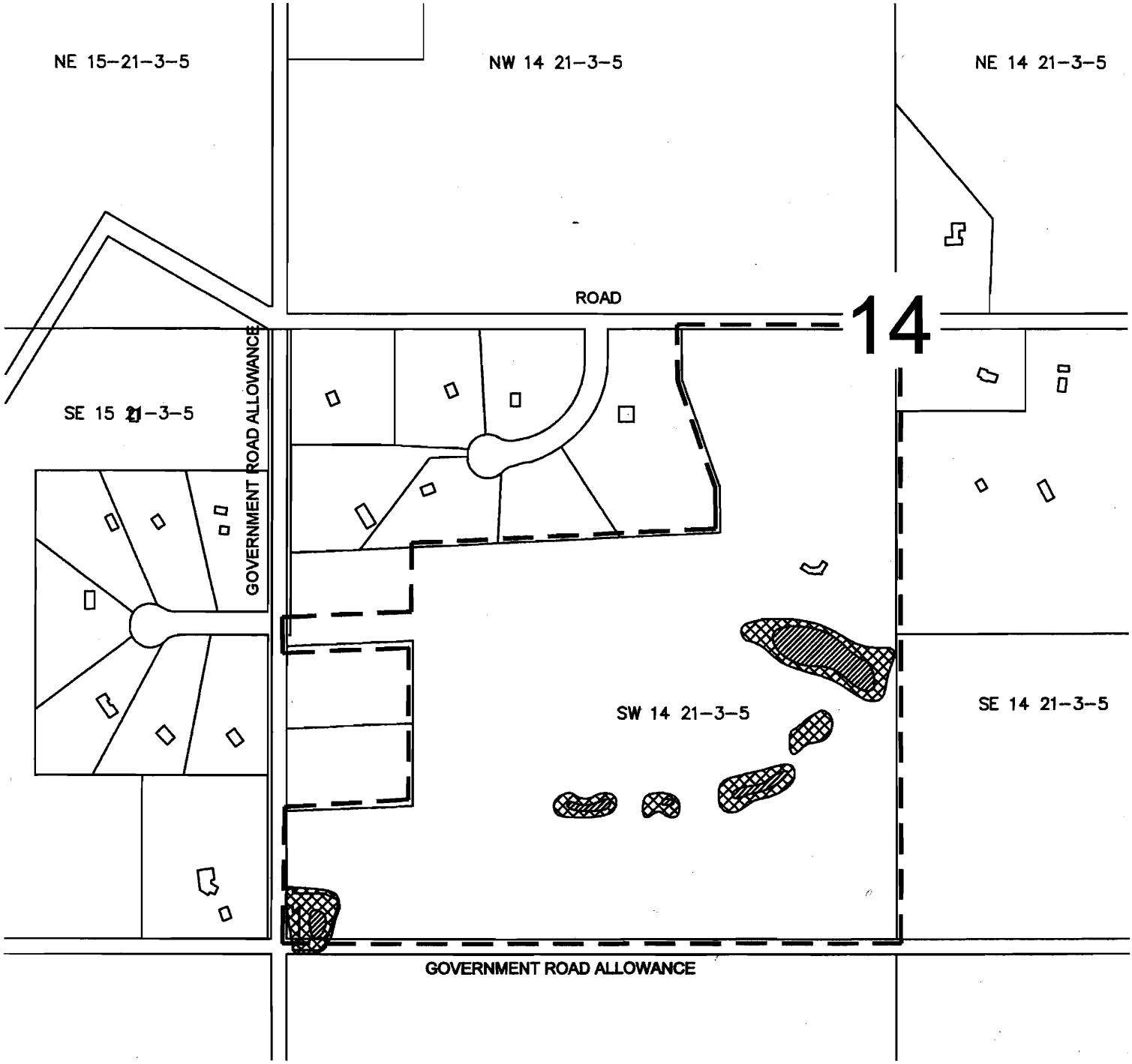
All development shall be in accordance with the statutory policies and municipal standards in effect at the time development is approved.

In order to preserve the design theme for *Millarville Country Estates*, development patterns should reflect the natural topography and character of the land. Further, where ever possible residential lots should be situated such that visual impact on adjacent landowners is minimized.

Natural Environment

The natural landform is a key component in the attractiveness of the land for residential development, and should be maintained wherever feasible. Site grading should be limited to the home building sites, utility services, and required roadways.

Distinctive natural features, including drainage courses and ponds, existing on the site shall be maintained wherever feasible and may be enhanced through incorporation into the site plans (**Figure 5**).



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A.S.P. BOUNDARY

LESS THAN 15%

15-22%

MORE THAN 22%

FIGURE 5:

SLOPE ANALYSIS

NOT TO SCALE

MILLARVILLE COUNTRY ESTATES

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Character of Development

The comprehensive design of the internal road system, open space, preservation of native trees and house design should provide a uniform high quality character that will identify *Millarville Country Estates* as a premier subdivision within this area of the M.D. of Foothills.

Development of this area should create a positive image for the community. The Country Residential lots should encourage a country residential lifestyle without permitting the keeping of intensive livestock operations.

Community Integration

Landscaping of *Millarville Country Estates* should maintain the natural vegetation through restricting the clearance of natural vegetation within each lot, thus protecting the existing landscape and minimizing the visual impact of new development.

The municipal reserve lands provide open space and a buffer between most of existing residential development and the proposed development. These public lands also provide the potential for future pathway linkages through the area utilizing the existing and proposed MR lands along with the undeveloped road right of ways.

Infrastructure

Infrastructure shall be provided according to municipal standards to ensure adequate capacity for all proposed country residential lots.

Infrastructure shall be designed to minimize impacts to the environment and to surrounding residential properties.

4.0 PLAN POLICIES

4.1 The Plan Concept

Millarville Country Estates is proposed as a comprehensively designed country residential development with the majority of the new development located within the wooded area, thus preserving much of the natural surroundings and minimizing visual impact on adjacent residential developments.

The road design and restrictive covenants should ensure that the visual impact of the home sites located within the wooded areas is minimized **(Figure 6)** as they will be visually screened by the preservation of the natural landscape. Homes shall be required through architectural controls **(Appendix 1)** to blend in with the natural landscape wherever possible through the use of natural materials and colours.

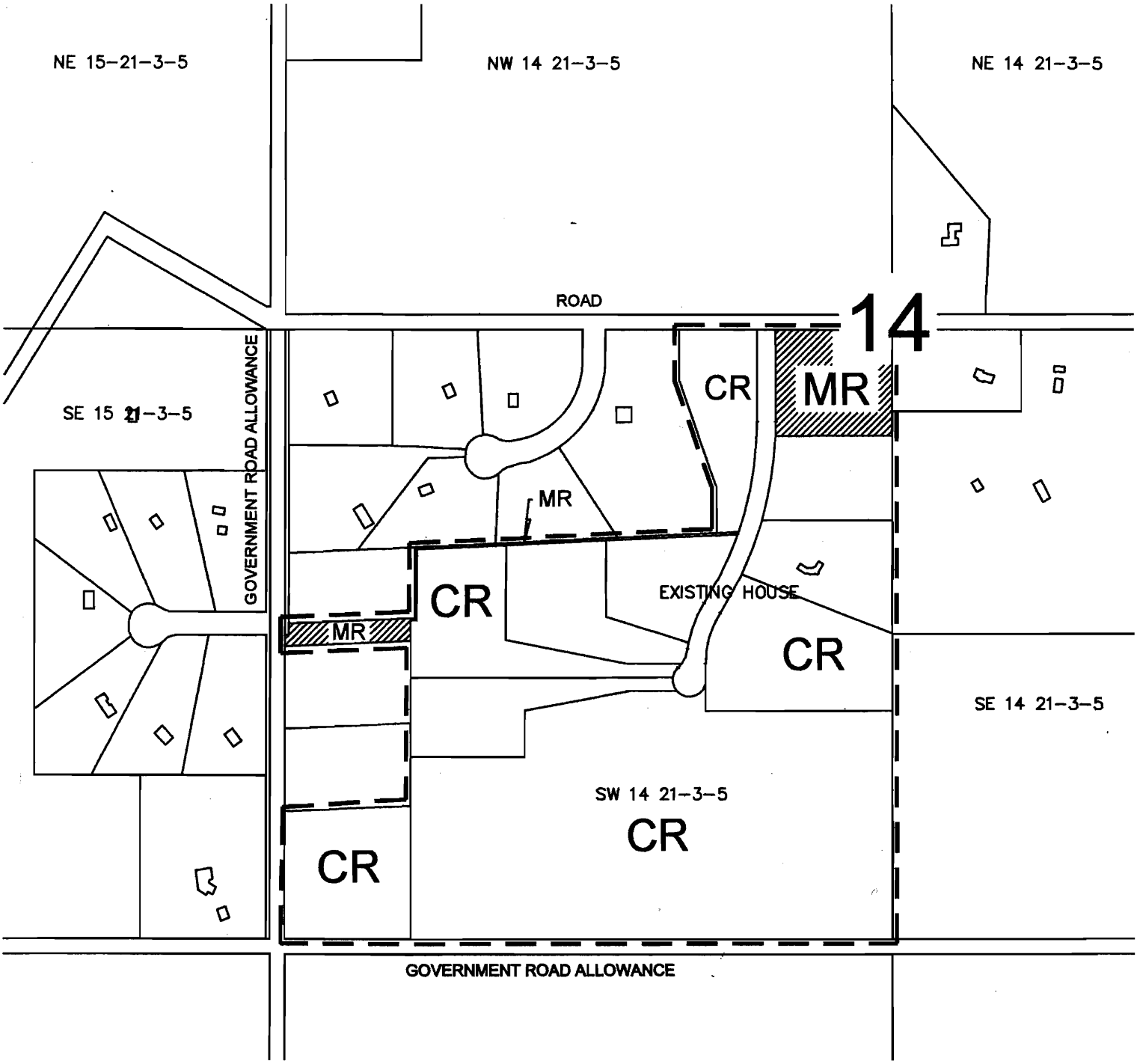
4.2 Land Use Component

The *Millarville Country Estates ASP* proposes two land uses, Country Residential (CR), and Municipal Reserve (MR). The Country Residential areas include sloping, treed lands as well as the open grass lands. The MR areas are comprised mainly of flat open grasslands with small linear connections to the existing MR lands to the west.

Table 1 outlines the areas of the proposed development.

LAND USE Redesignation	HECTARES	ACRES
A to CR	41.616	102.8
A to MR	2.670	6.6
Total Area Subdivided	25.423	62.8
Total Land Area (ASP)	44.288	109.4

Table 1.
Note: areas have been rounded up/down and may not be exact



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A.S.P. BOUNDARY

CR COUNTRY RESIDENTIAL

MR MUNICIPAL RESERVE

LAND USE REDESIGNATION

FROM A	*TO CR (Including Road)*	*41.616*
FROM A	*TO MR*	*2.670*
TOTAL AREA		*44.288*

FIGURE 6:
LAND USE PLAN

NOT TO SCALE

MILLARVILLE COUNTRY ESTATES

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The country residential areas are suitable for residential development as they have little impact on agricultural lands and the majority of lots are naturally screened by tree cover, minimizing the visual impact on existing residents.

Country Residential Areas

The proposed development of the *Millarville Country Estates ASP* lands would be no greater than 9 residential lots, resulting in 8 new single-family residential home sites with a 47± acre remainder lot. These new lots are expected to add between 21 and 28 additional residents. Municipal reserves will be provided as required by the MGA on the 62 ± acre parcel being subdivided.

In compliance with Alberta Environment guidelines and the MD of Foothills policies, each of the proposed lots has been designed to include a minimum contiguous area of one (1) acre of developable land where the slopes are not in excess of 15% slope.

Country Residential Policies

4.2.1 The average residential lot size should be no less than 4 acres in size. In order to provide a clustered development and provide larger open areas, lot sizes should be kept to 4 acres ± in size except where servicing, topography and other natural constraints make larger lot sizes necessary.

4.2.2 Residential lots are intended for single-family residences only.

4.2.3 All country residential development shall be required to conform to Restrictive Covenants to be registered on title at the subdivision stage.

4.2.4 Where possible, all lots shall have direct access onto the internal subdivision road only.

4.2.5 All lots shall conform with the requirements of the attached Transportation Impact Assessment

4.2.6 All lots shall conform with the requirements of the attached Storm Water Management study

4.2.7 All lots shall conform with the requirements of the attached Geotechnical report

4.2.8 All lots shall conform with the requirements of any additional studies or reports that may form part of the *Millarville Country Estates* Area Structure Plan

4.2.9 Individual lot grading and clearing shall be kept to a minimum in order to preserve the integrity of the natural aesthetics of the plan area, and to minimize the visual impact of development, as per the Restrictive Covenant to be registered on title.

4.3 Environmental Considerations

Pursuant to the Municipal Government Act, the subdivision authority may require the provision of Environmental Reserve land at the time of subdivision. At their discretion, the Subdivision Authority may require dedication of Environmental Reserve where the land consists of a natural drainage course.

The portions of the lands within the ASP area that contain drainage courses are very small in size and have been incorporated into the overall design scheme. The attached Stormwater Management Plan **(Appendix 2)** proposes further enhancement of the low lands as "natural" features within the larger residential lots. These areas are to be protected and maintained in compliance with restrictive covenants to be registered on title.

4.3.1 Environmentally Sensitive Areas

The subject lands do not contain any significant amount of environmentally sensitive lands. The relatively small areas containing lands with slopes in excess of 15% **(Figure 5)** are part of the natural drainage system, and have been incorporated into the overall design of the project.

4.3.2 Topographic Considerations/Constraints

The road and lot configurations follow the natural terrain, thus permitting the preservation of the natural low lying areas and developing them as part of the Storm Water Management plan (Appendix 2).

4.4 Reserve Lands

One of the main considerations in creating the design for *Millarville Country Estates* was the visual impact on the existing residents. By providing the municipal reserves owing in the existing open grasslands, the character and feel of the area is significantly preserved and keeps visual impact of development to a minimum. The total MR dedication proposed is 2.670 ha (6.6 acres) or **10.5%** of the 25.423 ha (62.8 ac±) lands being subdivided. A deferred reserve caveat shall be placed on the 18.864 ha (47 acres±) balance parcel if required.

The proposed linear MR parcel would link the existing MR parcels to the west of the proposed development area via a linear MR system to the internal road providing a future linkage. In addition to serving as a buffer between the existing residential development to the north and the ASP area, the linear MR provides an opportunity for a possible future pathway/trail system within the ASP area or in conjunction with the adjacent undeveloped road right of way to the south.

4.5 Transportation

Internal Roadway

The proposed *Millarville Country Estates* development intends to provide access to the country residential lots via an internal road. The internal road system consists of a single local road with a cul-de-sac termination.

In keeping with the overall design scheme the internal road will closely follow the original topography of the lands, while adhering to the road design standards of the M.D. of Foothills. The layout of the road facilitates the clustering of the majority of country residential lots within the treed area, thus reducing the visual impact of the proposed development.

The *Millarville Country Estates* ASP recognizes that the current M.D. of Foothills standard for minimum road width requirements is 30 meters. Notwithstanding this, it is proposed that the internal road right of way be reduced to 25 meters in width in attempt to prevent the unnecessary clearing of natural vegetation, thus further preserving the overall design concept.

External Roadways

In support of the *Millarville Country Estates* ASP a Traffic Impact Assessment (TIA) was prepared by Eagle Engineering Corp. to determine the impacts of the original 19 lot development proposal on the local transportation network.

The TIA found that Roadway Analysis indicated that the intersection of Highway 22 and 298th Avenue will accommodate the traffic from the proposed development with no noticeable difference to the existing level of service. Further, the unsignalized intersection analysis of the proposed *Millarville Country Estates* internal road with 298th Ave indicates that it will operate at a very satisfactory level of service for all movements. The TIA concluded that all study area intersections are capable of accommodating the additional traffic generated by the proposed *Millarville Country Estates* development without noticeable impact on existing levels of service.

The reduction to 9 residential lots ensures that the new development will have little or no impact on the existing level of service

Further detailed information can be found in the attached Transportation Impact Assessment (**Appendix 3).**

Transportation Policies

4.5.1 The internal road right of way shall be a width acceptable to Council

4.5.2 The internal road shall be constructed to a standard acceptable to council and that a Developers Agreement shall be entered into regarding the construction of the road.

4.5.3 Should Council deem it necessary, the Developer shall pay the required infrastructure levy towards upgrading and maintaining the external road network accessing the ASP lands.

4.6 Servicing

Millarville Country Estates is to be serviced by groundwater via individual wells and individual septic and tile fields for each of the proposed lots. Water supply and sewage disposal shall be provided with minimal impact on the natural environment or the groundwater aquifer serving the area.

Provincial and Municipal standards shall be adhered to when providing all utilities necessary to service the development.

4.6.1 Water supply

A *Ground Water Feasibility Assessment* was conducted by Groundwater Exploration & Research Ltd. as a precursor to proceeding with preliminary concept designs. The tests were supportive of the original proposed 19 lot development, however as a result of concern raised through public consultations, additional and more comprehensive studies were commissioned. A *Groundwater Supply Assessment* (Q20) was performed in December 2003. The report, in accordance with the Water Act, addresses an assessment of the groundwater supply by finding sufficient volumes of groundwater to sustain the proposed 18 additional residences. Test results indicated that the aquifer was capable of sustaining up to 24 lots on individual wells or 45 lots on a communal well system.

Further detailed information can be found in the attached *Ground Water Supply Assessment* **(Appendix 4).**

4.6.2 Sewage Disposal

The Millarville Country Estates development proposes to utilize individual septic fields for private sewage disposal. *Soil Percolation and Near Surface Water Table Testing* was conducted by McIntosh-Lalani Engineering Ltd., to determine the suitability of the on site soils to be used for septic fields. The percolation and near surface groundwater table testing was completed in accordance with the Alberta Environmental Protection (AEP) guidelines. Ten (10) test holes were dug for the soil percolation testing, with the results ranging between 3.5 and 12.9 min/cm. The Alberta Environmental Protection's (AEP) guidelines set the acceptable range for percolation rate between 2.0 to 23.6 min/cm. The results of the tests were found to be within the AEP's acceptable range **(Appendix 5).**

The Near Surface Groundwater Table Testing utilized ten (10) boreholes at depths of 3 metres. The AEP guidelines define a high groundwater table as anywhere the water table is within 1.8 metres of the ground surface during the frost free period (until the end of August) and within 2.4 metres

of the ground surface during the rest of the year. The Boreholes used for this test were all found to be dry (Appendix 5).

The tests were carried out for application purposes. Further testing on future residential lots shall be required to ensure suitability of each lot for use of individual septic fields for private sewage disposal.

4.6.3 Geotechnical Evaluation

A Geotechnical review of soils within the Plan Area was conducted by McIntosh-Lalani **(Appendix 6)** to assess the stability of slopes and the suitability of development. The objectives of their evaluation were to:

1. Present a general Geotechnical assessment of the site;
2. Assess the stability of slopes on the subject and adjacent lands which exceed a 15 percent grade; and
3. Evaluate whether past instability, subsidence erosion, seepage, and previous land uses were in evidence.

The evaluation report found that the plan area generally consists of top-soils ranging in depths from 150 mm to 250 mm, with dry to damp silty clay extending to depths in excess of 3 meters. The lands having slopes in excess of 15 percent were generally adjacent to the drainage areas and testing found that no development setback was required from the top of slope. It was concluded that, in McIntosh-Lalani Engineering Ltd.'s professional opinion, the subject lands can be classified as "lands free from geotechnical hazards" and are suitable for development from a geo-technical point of view.

4.6.4 Stormwater Management

In support of the *Millarville Country Estates* development proposal, a Storm Water Management Study was prepared by Jubilee Engineering Consultants Ltd.(Appendix 2). The purpose of the study was to review the characteristics of the catchment areas which include the proposed development, determine the potential flows draining through the area and surface runoff generated by the proposed development, and to prepare a stormwater management plan for the site. The study also addressed the

means and ways to mitigate the erosion and sedimentation control as a result of construction of the subdivision.

The following conclusions were made from the Stormwater Management Study for the *Millarville Country Estates* development:

1. The study area within the property boundaries has been divided into 3 sub-catchments at pre-development and 3 sub-catchments at post-development based on existing topography and subdivision development.

2. Best Management Practices (BMP) were used to control and properly manage the stormwater runoff conveyed via road ditches, swales, and natural drainage channels to two (2) adequately sized ponds as follows:

Catchment	Pond	Total Capacity	1:100 yr Requirement
1	1	1928 m^3	1552 m^3
2	2	4508 m^3	3285 m^3

3. The culverts and inlet and outlet structures on ponds are sized to cater for flows from the overall catchments

4. The country residential subdivision will have *insignificant* impact on the adjacent properties and catchment areas since the runoff is either contained on site or released at less than pre-development rate.

5. Erosion and sediment transfer is restricted primarily to onsite locations, thereby protecting the downstream areas.

The design of the *Millarville Country Estates* subdivision has attempted to follow the existing contours of the land in order to preserve the natural beauty that makes the location attractive for residential development. Because of this conscious effort to follow the natural topography, the majority of the post-development drainage courses flow to an existing low lying area that is to be utilized as a stormwater retention pond. This pond will be incorporated into the natural landscape with minimal alteration required and is expected to become an amenity for the lots in which is contained. A second pond will be created to service the open areas located in catchment area 1, and will also serve as an amenity area for the lots in which it is contained.

The Stormwater Management Study was submitted to the M.D. of Foothills under separate cover for review prior to the submission of the ASP (Appendix 2). The Stormwater Management Plan was revised to meet with requirements of the redesign and reduction in the number of lots.

4.7 Wildlife Habitat Assessment

In response to concerns raised during the public consultation process regarding the impact on migrating elk herds, a *Wildlife Habitat Assessment* **(Appendix 6)** was conducted by AXYS Environmental Consulting Ltd.

Biologists conducted a ground based site survey in October of 2003 as part of their study. They used Global Positioning Systems (GPS) to map any significant habitat features and/or wildlife sightings. They also recorded dominant tree and shrub species, game trails, tracks, scat and other signs of wildlife.

The information recorded in the study particular to elk is as follows:

1. There are an estimated 26,000 elk in Alberta and they "are not at risk";
2. Wildlife Management Unit 312 (includes subject lands) has an estimated resident population of 920 elk;
3. The home range for elk is made up of winter, spring calving and summer ranges, along with migration routes for travel between them;
4. The average home range for elk in Alberta vary from 5000 ha to 5500 ha;
5. Individual herds home ranges vary from 1200 ha to 5000 ha;
6. Elk generally winter in the Lower Foothills and move to higher elevations in the summer; and
7. The amount of habitat contained within the development area (36 ha treed) is a very small proportion (0.6 %) of the ranges required to sustain the regions resident elk population

The proposed development site comprises less than 1% of the required habitat for local elk. The Wildlife Habitat Assessment indicates that the regions resident elk population has a vast migration range (up to 5500 ha) that is comprised of open fields and forested areas, and that the habitat

effectiveness for elk in the area is likely already reduced due to the disturbances from the presence of Highway 22 and other existing roads, facilities and ongoing human activities. Therefore it can be concluded that the proposed development would have little or no impact on the regions elk population and their seasonal migration.

4.8 Utilities

The utilities serving the proposed development (gas, electrical and phone) shall be provided via underground services. The provision of shallow utilities shall be at the sole expense of the developer to the extent required by the Municipal Standard Development Agreement.

4.9 Protective Services

The proposed development shall demonstrate that proper emergency vehicle access is provided to MD of Foothills standards and the satisfaction of Council, prior to redesignation and subdivision approvals.

In accordance with the M.D. of Foothills policies, new country residential subdivisions are required to meet standards for on-site fire fighting measures.

5.0 IMPLEMENTATION

5.1 Approval Process

Adoption of the *Millarville Country Estates Area Structure Plan* as a Council approved bylaw is the first step towards implementation of the development within the Plan Area. The ASP provides a framework of land use policies that must be met prior to the approval of subsequent land use redesignation bylaws and more detailed subdivision plans for specific lots within the Plan Area. To be adopted by bylaw, the *Millarville Country Estates ASP* must first be approved by the M.D.'s Council after a statutory Public Hearing and appropriate consultation with key stakeholders including affected landowners and municipal staff. All development within the plan area must be consistent with the policies of the approved ASP.

At the time of land use redesignation, additional technical information may be required by staff or council to confirm the feasibility and design of the proposed land uses. Following a statutory Public Hearing of Council, the MD of Foothills Land Use Bylaw # 01-99 would be amended to reflect the land uses as proposed, and generally illustrated in this Area Structure Plan. A Development Agreement between the MD of Foothills and the landowners/developers will be a condition of land use redesignation approval to ensure the provision of roadway and utility infrastructure in accordance with municipal standards.

After the appropriate land use bylaw amendments are in place, then the legal subdivision application may be approved by the approving authority. Subdivision approval may be staged over time to ensure a logical and efficient sequencing of infrastructure and development.

Approval Process Policies

5.1.1 The policies contained within the *Millarville Country Estates ASP* shall be reviewed and implemented by the Municipal District of Foothills Council at its discretion.

6.0 APPENDICES

Appendix 1	**Restrictive Covenants- Architectural Controls**
Appendix 2	**Stormwater Management Study**
Appendix 3	**Transportation Impact Assessment**
Appendix 4	**Groundwater Supply Assessment**
Appendix 5	**Soil Percolation & Near Surface Water Table Testing**
Appendix 6	**Geotechnical Evaluation Report**
Appendix 7	**Wildlife Habitat Assessment**

Appendix 1

Restrictive Covenants- ***Architectural Controls***

RESTRICTIVE COVENANT
Pursuant to Section 48 of the *Land Titles Act* (Alberta)

Made this ____ day of _____, 200_.

RECITALS:

A. Millarville Estates Ltd. is the registered owner of estates in fee simple in possession of those lands and premises situate in the Province of Alberta described as follows:

Meridian 5 Range 3 Township 21
Section 14
Quarter South West
Containing 64.7 Hectares (160 Acres) more or less
Excepting thereout:

Plan	**Number**	**Hectares**	**(Acres)More or Less**
Road	**7810692**	**0.209**	**0.52**
Descriptive	**9210316**	**2.10**	**5.18**
Subdivision	**9612664**	**13.154**	**32.5**
Subdivision	**0210791**	**4.02**	**9.93**
Subdivision	**0212929**	**1.27**	**3.14**

Excepting thereout all mines and minerals

and which lands and premises are to be subdivided into lots (hereinafter referred to as "the Lots")

B. It is considered desirable for the greater enjoyment and proper notification of future owners of the Lots to impose certain restrictions and covenants on the Lots and to establish a building scheme on the Lots. The restrictions and covenants are for the benefit of the existing and future owners of the Lots and will protect the Lots against depreciation by preventing inharmonious use and development.

C. The covenants, conditions and restrictions are intended to be common to the Lots and bind the Lots for the benefit of the Lots.

D. Section 68 of the *Land Titles Act* (Alberta) provides that an owner may grant to itself a restrictive covenant for the benefit of the land which it owns and against the land which it owns and the restrictive covenant may be registered under the *Land Titles Act* (Alberta).

THIS RESTRICTIVE COVENANT WITNESSES:

1. The following covenants herein shall be deemed to be covenants running with the Lots and shall be binding on and enure to the benefit of the respective heirs, assigns and successors of the owners of the Lots.

2. The Lots shall be subject to the following covenants, conditions and restrictions:

    a) Land Use – The Lots are to be used solely for single family country residences and as such may not be used for the purpose of any trade or profession unless such business is conducted entirely within the home on the Lot and is approved by the Municipal District of Foothills No. 31 or its successor (hereinafter the "M.D."). No commercial dog kennels or boarding stables are permitted. Furthermore, no attached or semi-detached dwelling, apartment, or duplex, nor any house designed for more than one family may be constructed on the Lots;

    b) Storage on the Lots- No equipment, material or supplies of any kind may be stored on the Lots apart from items normally used in conjunction with a single family residence. Outside storage of recreational vehicles (boats, trailers, and motor homes) is permitted so long as such vehicles are screened inside a minimum 8 foot fence finished in complimentary materials and colours to the house and garage. No other commercial vehicles, trailers, equipment or machinery shall be allowed to be stored on the Lots on a regular basis.

    c) Buildings – Development on the Lots is restricted to one single family residence on each of the Lots. Adequate garaging for vehicles must also be constructed and may or may not be attached to the home. Accessory buildings and structures that are regularly used in country residential sites may also be permitted. Swimming pools and irrigation systems will be permitted only if they exclusively utilize off-site water sources and not local groundwater. Irrigation for personal (non-commercial) landscaping and gardening shall be permitted where the use of a moisture monitoring device is utilized.

    d) Excavation – Grading, excavation, construction or other works, carried out upon the Lots, shall not interfere with or alter in any way the natural or established drainage system thereon. No grading shall be done which would cause water retention on any of the Lots or to cause water to drain onto neighboring/adjacent lands. No excavation shall be made on the Lots except for the purpose of constructing foundations for approved and permitted buildings or improvements. No soil, sand or gravel shall be stored on the Lots nor may it be removed from the Lots except to the

extent of permanent surplus arising from approved and permitted development.

e) Construction Activities – The owner or owners of the Lots (as the case may be) under development shall ensure that reasonable precautions are taken to prevent fires and the accumulation or escape of debris and waste water and for the proper containment of construction and all other waste inside appropriate containers with lids. Proper construction insurance must be maintained for any development. The owner of any of the Lots under development shall be responsible for and shall indemnify and save harmless other owner(s) of the Lots from any and all damage to roadways, water aquifers and to structures or improvements on either of the Lots.

f) Types of Construction – All structures constructed on the Lots shall be of new construction only and built upon permanent foundations. Mobile trailers and used buildings will not be permitted to be relocated on the Lots at any time either for temporary or permanent use.

g) Commitment - the Lots may remain undeveloped indefinitely, however once construction of any structure commences on the Lots, all planned development must be completed within twelve (12) months. Prior to occupation, structures shall be finished in accordance with plans and specifications and no structure shall exist upon any of the Lots which is incomplete and which does not have the ground around the structure landscaped so as to be in keeping with the appearance of the lands as a whole, no construction of a secondary building shall be permitted until commencement of the construction of the primary residence.

h) Building Sizes – Dwelling houses to be erected on each of the Lots shall have a minimum floor area of 1400 square feet if of single storey construction and a minimum ground floor area of 1200 square feet if of two storey construction, excluding basement development. These measurements shall be taken from the exterior of the foundation. Dwellings shall be restricted to one (1) or two (2) storey developments. Walk-out basements shall be permitted.

Dimensions for any attached carports, verandas, sunrooms, garages, or other similar structures shall not be included in finished floor area calculations.

i) Exterior Finishes – All above ground structures on each of the Lots shall be finished in either brick, stone, solid wood, vinyl, metal, hardboard, or stucco. Plywood siding will not be permitted. Cedar or pine shakes, clay tiles or asphalt shingles are permitted for roofing. The design and finish of all other above ground structures on any of the Lots must match those of the home and must be completely sided and finished throughout.

Finishing cannot be confined to front or visible elevations. All exterior chimneys should be brick, stone, or to match the siding on the house. No chimneys may be finished on the exterior with concrete block.

All flashings, gutters, fascia, and rain water leads must be painted to match the trim colors or pre-finished. All roof vents and stacks must be painted in a matte finish to match roof colors.

j) Colors- Natural colors or earth tones only shall be permitted on the exterior of buildings constructed on the Lots. Extreme, bright shades and contrasts such as pink, orange or salmon will not be permitted or approved. The owner of any of the Lots shall not change the color of any above ground structure without the written consent from the owners of the other Lots. Such consent shall not be unreasonably withheld with respect to any natural colors.

k) Lighting – All exterior lighting on each of the Lots is to be directed towards the ground only. No high level mercury vapour, sodium or halogen yard lights will be permitted. No exterior lighting shall unreasonably illuminate any adjacent lands.

l) Animals – Domestic pets and livestock, except hogs, are permitted as long as they do not inconvenience or constitute a nuisance to residents of the Lots, and provided they are kept in accordance with Land Use Bylaw governing land use in the MD. In the case of horses, there shall not be more on any parcel at any time than are permitted by the MD.

m) Garbage – The Lots shall not be used to deposit, dump, burn or store any refuse or trash. All trash and garbage must be removed from the Lots and adequate lidded containers must be located on the Lots with all trash and refuse to be stored inside them at all times. Such containers must be screened or partitioned from view. No burning or incineration of garbage on the Lots is permitted.

n) Landscaping and Tree Clearing – Undeveloped areas of any of the Lots are to be either left in a natural state or landscaped in accordance with this Restrictive Covenant or the attached Architectural Guidelines. Noxious and Restricted Weeds, as defined in the *Weed Control Act* are to be actively controlled and minimized. Any tree clearing must be at a minimum and shall be in accordance with the Architectural Guidelines attached.

o) Off-Road Vehicles – Motorcycles, trail bikes, snowmobiles or such like machines may not be operated on any of the Lots except for the purposes of maintenance, landscaping, or snow plowing on the Lots.

p) Firearms – No firearms may be discharged on the Lots.

q) Radio and Television Antennas and Satellite Receivers – All radio and television antennas and receivers shall be located on the Lots at a height of no greater than four (4) feet above the residence roof line.

r) Utilities – All utilities are to be buried underground with the exception of one original power pole to be permitted on each of the Lots.

s) Water Conservation – Water use must be conserved in accordance with the Architectural Guidelines attached.

t) Fire-breaks – Each property must maintain and permit appropriate fire breaks, as may be required by the Municipal District of Foothills No. 31, and as approved by the Developer and Architectural Consultant. There shall be a minimum fire break (no trees) around dwelling or building of 3 metres.

3. Notwithstanding paragraph 2 above, this Restrictive Covenant incorporates by reference all provisions of the "Architectural Guidelines for Millarville Estates Ltd." which are attached hereto as Appendix "A".

4. The failure of any party to strictly perform any of the covenants, conditions and stipulations contained in this agreement shall not of itself constitute a waiver of or abrogate from such covenants, conditions, and stipulations except to the extent expressly provided for in such waiver and shall not constitute a waiver of or abrogate from any other covenants, conditions or stipulations in this agreement.

5. The owner or owners of the Lots may, with respect to any breach of the obligations hereby imposed on the owner or owners of the Lots who are in breach, enforce the provisions of this restrictive covenant and may apply to a Court of competent jurisdiction to restrain any breach by injunction. The owner or owners of each of the Lots agree that in the event of an breach or apprehended breach of the covenants set out herein, damages may be difficult or impossible to determine and that specific performance or injunction (mandatory or prohibitive) as appropriate shall be available as remedies to any aggrieved party in addition to any other remedies provided at law, in equity, by statute or otherwise, and each such owner waives the right to and agrees that it shall not asset or plead that a party seeking to enforce the terms of this restrictive covenant has any adequate remedy in damages or at law.

6. Where required by the context of this agreement, the singular shall include the plural and the masculine shall include the feminine as the case may be and vice versa. Should the parties to this agreement and owners of each lot comprising the Lots at any time comprise two or more persons or owners, each such person shall

be jointly and severally bound with the other or others for the due performance of the obligations contemplated herein.

7. The rights, privileges and easements granted herein shall be subject to any restrictions or other provisions contained in any grant, covenant, right-of-way or easement before or afterwards granted for the installation use or operation of any utility within, under, over, or on the Lots or any part of them.

8. If any provision of this restrictive covenant shall be determined by a court of competent jurisdiction to be invalid and unenforceable to any extent, the remainder of this covenant shall remain in force.

9. This agreement shall be registered on the certificate of title to the Lots.

IN WITNESS WHEREOF **MILLARVILLE ESTATES LTD.** has caused its corporate seal to be affixed, duly attested by the hand(s) of its proper officer(s) in that behalf, this _____ day of _____, 200_.

MILLARVILLE ESTATES LTD.

Per:_____
GORD ANDERSON c/s

APPENDIX "A"

ARCHITECTURAL GUIDELINES FOR MILLARVILLE ESTATES LTD.

1. PURPOSE AND INTENT

The purpose and intent of these Guidelines is to endeavor to ensure to the fullest extent possible that the residential community to be built in Millarville Estates is developed in a first class manner using high quality finishes and materials. Every effort is to be made at the planning and design stage to create a community which is compatible with the surrounding natural wooded environment. Certain of these Guidelines, particularly those intended to last beyond initial construction, are contained in a registered restrictive covenant agreement which in the case of conflict takes precedence over these Guidelines.

These Guidelines are not "etched in stone". Since each homeowner and builder has their own criteria of visual appeal, no specific theme, housing style or architecture will be imposed on the community by the Developer. It is not the Developer's intent to impose rigid building rules, but rather to encourage creativity and to consider requests for building approval based primarily on the merits of each individual design and its particular setting.

The Developer always reserves the right to alter any of these Architectural Guidelines if, in any particular case, a proposed design contains attractive elements which in the opinion of the Developer would enhance the quality of the community.

2. ARCHITECTURAL CONSULTANT

The Developer has retained an Architectural Consultant to assist in the administration of these Guidelines as its initial architectural consultant (the "Architectural Consultant") on behalf of the Developer. When this agreement refers to the Developer it is assumed that it is referring to the Architectural Consultant subject always to direct decisions of the Developer. Applications for Development Approval and related materials and enquiries may be directed either to the Developer or to the Architectural Consultant in place from time to time as follows:

Developer:
Millarville Estates Ltd.
c/o #1500, 736 - 6th Avenue S.W.
Calgary, Alberta T2P 3T7

3. THE APPROVAL PROCESS

The approval process will involve three steps as follows:

a) Review of Preliminary Design

Homes to be built in this community will have to be specifically designed for the particular location in order to meet the quality standards required by these Guidelines. A meeting should be arranged with the Architectural Consultant at an early stage to review preliminary design concepts and landscaping. This meeting should include your architect/designer and/or builder.

b) Application for Approval

Prior to the application to the Municipality for a Building Permit, the builder or owner must submit an Application for Development Approval to the Architectural Consultant. Such application must be on a standard form and must include:

i. Two complete sets of blue prints, including floor plans, site plans, structural plans, elevations, and sections and specifications;

ii. One plot plan at a scale of 1:200 showing foundations, sub-floor elevations, actual top of footing elevation and all grades around the house; all setbacks, cantilevers, decks, windows and door locations; and

iii. Exterior color samples.

All building designs and their locations (Clause 6) are to be reviewed and approved prior to application for Building Permit. We recommend having design concepts approved before blue prints are drawn.

c) Final Review on Completion

A final site inspection will be carried out after completion of the home. The Compliance Deposit will be released as provided for in the sale agreement and following the satisfactory completion of the final inspection and resolution of all items arising from that inspection and after the landscaping is completed.

4. COMPLIANCE DEPOSIT

An Application for Development Approval must be accompanied by payment of FIVE THOUSAND ($5,000) DOLLARS payable to the Developer as a Compliance Deposit. Such funds will be held by the Developer pending satisfactory completion

of the final inspection as described above and otherwise as provided for in the sale agreement. In the alternative, the Compliance Deposit may be secured by a Letter of Credit in an acceptable form to the Developer or other security to the Developer rather than by a cash deposit.

5. BUILDING FORM

No particular building form will be imposed. Each design will be judged on its own merits and will be approved if found to be in harmony with the country residential neighbourhood and the wooded environment.

6. HOME AND OUTBUILDING LOCATIONS

The location of the home or outbuildings on a lot is the prerogative of the Purchaser subject to all buildings being located within the building envelope and subject to the approval by the Architectural Consultant to ensure that the locations chosen are complimentary to the adjacent properties.

7. FIREPLACES

a) Exterior fireplace treatments should be of brick or stone, but the Developer may allow variation where use of an alternative material is part of a meritorious design;

b) Concrete block exterior finished fireplaces will not be approved.

8. GARAGES/OUTBUILDINGS

A similar design and the same materials must be used in the construction and finish of the garage or any outbuildings as was used in the home itself. Discretion shall allow the Architectural Consultant (or its successor as approver) to approve submissions for outbuildings which do not contemplate a similar design or materials to that of the home.

9. ROOF PITCH AND HEIGHT

All roofs on the home or any garage or other outbuildings developed on any lot shall be at least 5:12. The maximum height of any roof (including antennas and/or stacks) shall be 9.0 metres (29.53 feet) in height. Satellite receiving dishes shall be screened so that they are concealed from view from any other lot.

10. YARD/LOT LIGHTING

Normal illumination of the exterior of the home and any garages or other outbuildings will be allowed. There shall not be permitted on any lot any exterior light which unreasonably illuminates any other lot. The use of halogen or mercury vapour

fixtures on yard lights will not be permitted unless these are controlled by a switch and are not left on for extended periods on a regular basis.

11. KEEPING OF LIVESTOCK ON LOTS

The keeping of livestock is permitted as provided by the Land Use rules of the Municipal District of Foothills No. 31 but intensive agricultural use in prohibited.

12. EXCAVATION ON LOTS

No excavation shall be made on any lot except for the purpose of buildings or for the improvement of the gardens and grounds thereof. No soil, sand or gravel shall be removed from any lot except for the purpose of buildings or for the improvement of the grounds or gardens thereof.

13. WATER CONSERVATION

In recognition of the supply of ground water being a shared resource, the use of water conservation methods is strongly encouraged. These methods may include, but are not limited to, low –flow and two-stage toilets, low-flow shower heads, new water conserving front-load washing machines, water conserving dishwashers and use of cisterns. The use of irrigation systems for landscaping is discouraged, but may be permitted only where the use of a moisture monitor is employed to eliminate any unnecessary or excessive watering.

14. PACKING AND DRIVEWAYS

The Developer will pave the apron of each driveway to a maximum of 10 metres. When designing and laying out the driveway the purchaser/homeowner/designer shall ensure that a direct view of the home is not possible from the driveway entrance (this may be accomplished through curving of the driveway or the use of selective landscaping in front of the home). The Purchaser shall have the option of gravelling, or paving or treating in some other matter the balance of the driveway so that the Purchaser or any occupant of a lot will not bring mud or other materials onto the paved roads from a lot as a result of the condition of the driveway.

15. FENCING

a) All fencing adjacent to roadways will be pressure treated rail construction of a standard design (a copy of standard design to be obtained from Architectural Consultant).

b) All other fencing on the lot shall be designed by Purchaser and approved by Architectural Consultant to ensure that no fencing unreasonably

detracts from an adjacent lot. In all cases fencing height, color, quality and design must be suitable to the particular location.

16. SERVICES SUPPLIED BY DEVELOPER

The Developer shall supply the following services to the Purchaser:

(a) All corners of each lot will be marked by 4" x 4" treated posts;

(b) Individual or shared wells which have been tested by the Developer and comply with guidelines set out by Alberta Environment or other relevant agency;

(c) Underground electrical and telephone service to a designated point inside each lot. Purchaser shall be responsible for making application for service and paying cost of all connection fees;

(d) Underground gas service by Canada Western Natural Gas to designated point inside of property line. Purchaser shall be responsible for making application for service and paying cost of all connection fees;

(e) Roads within subdivision and Driveway apron to each lot;

(f) Purchaser shall be responsible for construction of septic field on the lot or an alternative method of disposing of sewage on site provided all requirements of law (including those of the Municipal District of Foothills No. 31, Alberta Environment and Alberta Labour) are observed.

17. SETBACKS

The location of each home must be approved by the Developer or the Architectural Consultant. The building envelope limit contained in the Restrictive Covenant applicable to each lot (designated in the Restrictive Covenant as the "tree line") will determine the minimum setback distances, which in all cases shall be at least 15 metres.

18. GARBAGE

Garbage storage design and location must be approved at the same time as the building design. It is of great importance in this setting that garbage storage be visually unobtrusive and bear and skunk proof.

19. LANDSCAPING and TREE CLEARING

All areas in each lot must, following building completion, either be left in a natural state or landscaped in a first class manner as may be approved by the Developer or

the Architectural Consultant. Underground irrigation shall be permitted only where the use of moisture monitors are used to eliminate any unnecessary or excessive water usage. Particular care must be given not to damage or remove trees beyond the "tree line" as shown in the Restrictive Covenant applicable to each lot without such prior approval. Except as may be reasonably necessary for access to the Lot and for construction with a reasonable landscaped yard as approved, there shall be no tree clearing on the Lot without the prior approval of the Developer or the Architectural Consultant, it being intended that the lots shall generally be left in their natural state.

20. COLORS

All colors will be considered on an individual basis it being the intent of the Developer to provide maximum freedom of choice, subject only to the need to avoid extreme shades and contrasts and, in some cases, close repetition of color among nearby homes. Any color scheme shall contain a maximum of three colors. The Purchaser or any successor or assign shall not change the color scheme of the home, garage, or any out-buildings without first obtaining the consent of the Developer.

21. ENTRIES

The Developer will discourage flat-faced entries. Since the entry to a home gives the initial and lasting impression, entries should be given detailed consideration such as roof overhangs, porches, trellises, courts, etc.

22. BUILDER'S RESPONSIBILITIES

(a) The builder will be responsible for reviewing and verifying:

i. the legal survey plan;
ii. the building grade plan, the final building grade and the actual top of footing;
iii. the location of all utility connections, transformer boxes, telephone cable and pedestals, television cables, etc.

These checks must be carried out prior to the design stage and the Developer and Architectural Consultant will assume that the appropriate checks have been made by the Builder prior to the Application for development Approval.

(b) The granting of an approval by the Developer does not, of course, release the builder/owner from the obligation to comply with all municipal bylaws, building codes, statues and regulations which are applicable to the development and are imposed by law. The Developer and Architectural Consultant will not be responsible for the legal requirements of that nature.

(c) The cost of repair due to builder damage to any underground utilities, trees, drainage or other items will be charged back and may be deducted from the Compliance Deposit. It is understood that the amount of chargebacks will not be limited to the amount of the Compliance Deposit.

23. SIGNAGE

No signs will be allowed on any lot either during or after construction without the consent of the Developer or the Architectural Consultant. This clause shall not limit the ability of the Purchaser or any successor or assign from placing personal name signage or for sale signs on the lot.

24. CONSTRUCTION ACTIVITIES

However, upon the commencement of constructions, the construction of the exterior of the home or any garage or other outbuildings and all approved landscaping must be completed within a period of 12 months (excepting only seasonal deficiencies which will be completed as soon as weather permits).

(a) Extreme precautions must be taken during the construction process to avoid damage to the natural wooded environment in which these homes are being built.

(b) Specific attention must be given to fire prevention.

(c) A suitably sized garbage container must be located at the site during construction to avoid garbage blowing into other areas of the subdivision.

(d) Excess fill arising from basement excavation, etc., must be immediately removed from the site unless it can be incorporated into the site in a manner acceptable to the Developer.

(e) Construction water must be handled with care to avoid damage to the area and must not be released into the natural drainage in the area.

25. SERVICES

All services, including electricity, telephone, cable television , etc., must be installed underground.

26. SEVERABILITY

If any provision hereof is made void or rendered invalid or unenforceable by any law from time to time in force in the Province of Alberta, and if any provision hereof is determined by any court of competent jurisdiction to not be a covenant running with

the land, the same shall not invalidate or render in any way unenforceable any of the remaining provisions of this Agreement.

27. HOMEOWNERS ASSOCIATION

It is the Developer's intention that a "Homeowners Association" shall be formed to manage the operation and maintenance of any community property and to administer the Architectural Guidelines affecting Millarville Estates after completion of the development by the Developer.

In the event the Homeowners Association shall not be set up by the Homeowners, within 6 months of completion of the project, the Developer shall form and prepare the Homeowners Association Bylaws, which shall bind each lot. The Owners of each lot in Millarville Estates will be entitled to one vote in the Homeowners Association.

Once the Homeowners Association has been established, any reference in these Architectural Guidelines to the Developer or the Architectural Consultant will refer to the Homeowners Association who will assume these responsibilities and duties.

Dated this day of 200 .

Millarville Estates Ltd.

Per: _____

DATED:_____, 200___

BETWEEN:

MILLARVILLE ESTATES LTD.,
a body corporate carrying on business
near Millarville, Alberta, as Covenantor

IN FAVOUR OF

MILLARVILLE ESTATES LTD.,
a body corporate carrying on business
near Millarville, Alberta, as Covenantee

RESTRICTIVE COVENANT

Appendix 2

Stormwater Management Study

STORMWATER MANAGEMENT STUDY

COUNTRY RESIDENTIAL SUBDIVISION

SW 1/4 SEC 14 - 21 - 3 - W5M

MUNICIPAL DISTRICT OF FOOTHILLS

October, 2004

Prepared for:

MILLARVILLE COUNTRY ESTATES

Prepared by:

JUBILEE
ENGINEERING
CONSULTANTS LTD

CONSULTING ENGINEERS • SURVEYORS • PLANNERS

911 - 32nd AVENUE N. E.
CALGARY, ALBERTA T2E 6X6
PHONE 276 - 1001

FILE 04-123

TABLE OF CONTENTS

1.0 INTRODUCTION

Jubilee Engineering Consultants Ltd. has been requested by Millarville Country Estates to prepare a stormwater management study for the proposed site in the M. D. of Foothills. The proposed development consists 44 hectares of developable land, which were initially subdivided into 19 lots and have been revised to 9 lots.

The stormwater management study will utilize sound engineering practices in accordance with the M.D. of Foothills standards and guidelines for the management of stormwater flows produced within the drainage areas, also referred to as the catchment areas, that contains the above development. It will also provide an estimate of the expected flow to be accommodated by the development and the expected flow that will be passed on to downstream areas.

1.1 Purpose and Scope

The study will review the characteristics of the catchment areas which include the proposed development, determine the potential flows draining through the area and surface runoff generated by the proposed development, and to prepare a stormwater management plan for the proposed site. It will also address the means and ways to mitigate the erosion and sedimentation control as a result of construction of the subdivision. Details of the Best Management Practices have been included to be part of the Stormwater Management Plan.

The study is an office study based on the existing data and information obtained from the client and the M. D. of Foothills. Field investigations of the site were carried out to familiarize the study team with the site. The specific work activities of the analysis were as follows:

- Collection of data pertaining to the site to define the drainage boundaries and site conditions within watershed.
- Delineate the drainage area that includes the proposed development.
- Communication with local authorities, and government agencies to determine the site constraints and stormwater management issues that will be addressed.
- Computer simulation analysis to determine the pre and post runoff generated for the 1 in 100 year return period event.
- Development of appropriate stormwater management concepts and methodologies.
- Reporting of the analysis and recommendations.
- Make changes from the February 2003 report to suit the revised subdivision plan.

2.0 SITE INFORMATION

2.1 General Location

The Country Residential Subdivision is located in the Millarville area in the M. D. of Foothills. This site is southwest of Calgary, 20 km west of the Town of Okotoks, at the intersection of 224th Street West and 306th Avenue South.

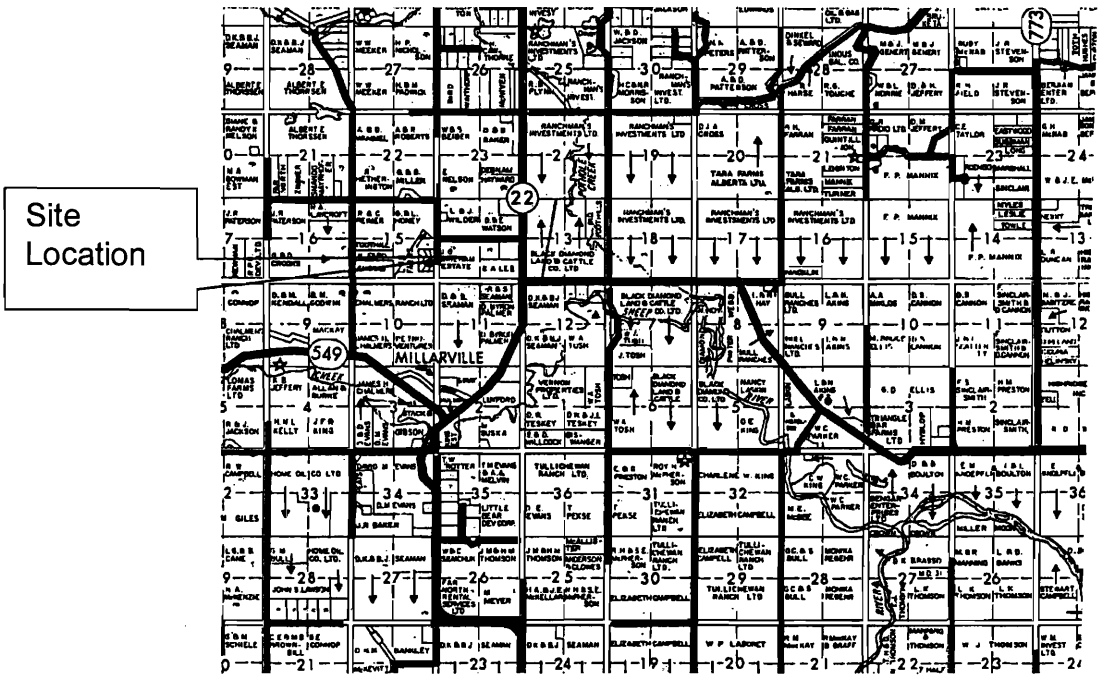


Figure 1 - Study Area

2.2 Area

The plan area comprises approximately 44 hectares.

2.3 Legal Description

The subject land is legally described as a portion of the SW ¼ Section 14, Township 21, Range 3, West of the 5th Meridian.

2.4 Physical Features

The site is presently covered with grass. The site itself does not appear to have been modified/graded significantly from its natural condition.

The land slopes towards the east property line with drainage exiting at three low points. Across the site the datum ranges from ± 1205.0 m to ± 1300.0 m. Refer to drawings SWM-1 and SWM-2.

3.0 CATCHMENT AREAS AND DRAINAGE PATTERNS

3.1 Definition and Delineation

New development boundaries seldom coincide with drainage boundaries. For this reason it is necessary to review each site to determine the affect of the new development.

Topographical data obtained from AltaLIS Ltd. was used to generate contour mapping for the site and surrounding area. This contour mapping was used to delineate the catchment basin that drains the proposed site. Refer to pullout drawing SWM-1 for a 1:5,000 topographical map showing the catchment subdivided into two catchments of approximately 132.1 ha (catchment A1) and 50.4 ha (catchment B1).

Flows generated from catchment A1 enter in the north west corner and traverse the site via a natural channel and exit on the east side. Flows from catchment B1 traverse the site from west to east via natural channels, exiting on the east side.

3.2 Pre-Development Drainage Conditions

The proposed site is bounded by roads in the north and west. Ridges and high points in the south divide the site from the adjacent lands. Along the east, low and high points divide the site from adjacent lands. Drainage is via natural channels towards low areas. Basically the site drainage can be divided into the north and south halves with drainage west to east. See drawing SWM-2.

In addition, as described previously above, the overall drainage area delineated as catchment A1 and B1 route through the site.

All the existing predevelopment site conditions and flow patterns were confirmed by Jubilee Engineering during a site visit.

3.3 Post-Development Drainage Conditions

The post-development drainage patterns will change from the pre-development drainage patterns due to the changes in catchment areas and imperviousness. The catchment areas are controlled by the lot division and the siting of the proposed ponds. See drawing SWM-3.

4.0 STORMWATER MANAGEMENT PLAN

The stormwater management plan for the proposed subdivision provides for a drainage system to control and properly manage stormwater runoff in terms of both water quality and quantity. The drainage system consists of surface run-off that drains towards the proposed ponds via road ditches and existing natural channels. Additional swales are proposed along lot lines to direct water towards the proposed ponds. See drawing SWM-3.

The site is divided into 3 catchment areas, namely 1, 2 and 3. For catchments 1 and 2, the 1:100 year runoff is contained in two wet ponds, while runoff from catchment 3 exits the site via natural channels without control. Catchment 3 is not significantly affected by the subdivision and the pre- and post-development runoff remains the same. In case the land in catchment 3 is developed (in the future) the stormwater requirements will need to be addressed at that time.

Runoff from catchments A1 and B1 are primarily used to size the culverts under the roads and the inlet and overflow structures at the ponds. The runoff does not contribute to the sizing of the storage in the ponds or any retention facility due to the proposed development and are allowed to exit the site at the predevelopment rate.

Overall, the stormwater management plan facilitates the control of post development flows only from catchments 1, 2, and 3 so as to keep them below or equal to the predevelopment flows. At the same time the plan has provision to allow flows from catchment A1 and B1 to flow through the site.

Best Management Practices are used as described hereunder.

There are four basic groups of BMP's:

- Source Control
- Lot Level
- Conveyance System
- End of Pipe

Source Control

This BMP relates to control of contaminants at the source prior to reaching the drainage system. As a general rule, good housekeeping practices should be implemented, e.g. adopt proper litter disposal, ensure street sweeping and control of spillage of chemicals and waste. Education in the importance of stormwater ponds and water quality at community and municipal level is necessary.

Lot Level

This BMP refers to reduction and treatment of runoff at lot level prior to reaching the main drainage system. Examples are rainwater collection, downspouts, disposal on grass areas and on lot filtration (where possible). Specific implementation measures can vary from site to site and these BMP's can be instituted at the design and construction of lot buildings.

Conveyance System

This BMP mainly focuses on use of grassed swales. The grass provides erosion control and the height of the grass blades can help to filter sediment particles. The swales, road ditches and all natural drainage paths within the site shall be grassed

End-of-Pipe

This BMP relates to the system where eventual discharge of the runoff occurs within the site, e.g. the retention ponds. For water quantity control, the ponds are sized to cater for the 1:100 year runoff. The discharge leaving the site is less than predevelopment rate and hence the road ditches downstream are not affected by excess flows. The ponds are designed as wet and evaporation ponds which provide the water quality control by removing the suspended solids prior to discharge. See section 6.0 for the analysis of sediment removal, which is achieved at greater than 85%.

Drainage paths and channel downstream of the site shall also not be affected since the post development flows are contained on site and flows leaving the site are no greater than the pre-development flow. Hence the natural ecological conditions, vegetation, and bodies of water have the least impact.

Breeding of mosquito larvae can also occur in the ponds, especially along the edges where the depth is not greater than 30cm. The mosquito larvae can lead to West Nile Disease.

It is important to maintain the pond areas, by observing the BMP's and removing grass clipping, leaves and debris from the ponds. The debris and pollutant runoff encourages breeding of larvae and also contaminates the water, thereby affecting water quality and health of residents and public at large.

BMP's shall be effective through a multi-disciplinary effort put in place by a joint action from the start of the development, through to the final occupants (residents) and the direction from the M. D. of Rocky View.

The above mentioned BMP's relate to the stormwater within the site. Implementation of the BMP's shall greatly enhance the water quality by preventing contamination.

5.0 EROSION AND SEDIMENTATION CONTROL

The potential of erosion and sedimentation is high during site preparation and/or construction of roads and buildings.

The storm runoff from the development area will flow overland and in the ditches and channels. The sediment from erosion needs to be contained to protect downstream areas.

Erosion and sedimentation control measures need to be put in place to contain the transport of sediment within the site boundaries.

The following measures are suggested to control the erosion, and shall be field located at time of construction to suit the topography of the site and construction activities.

These measures should be addressed by the contractors and developers at the time of construction.

Critical Areas

The land slopes are gentle with no steep slopes. Hence there are no significant critical areas.

Control Measures

A silt fence will be placed all along the east and west property lines. Extra silt fences can be installed as required during construction. The silt fences shall prevent sediment transport effected by construction activities.

Construction traffic will access the site at the designated entrance. A gravel bed shall be placed at the entrance to reduce mud and clay being transported off the site. The gravel bed, based on field experience, is usually 20 - 25m in length and 7 - 15m wide. As per City of Calgary guidelines for erosion and sediment control, the gravel is 15 - 20 cm with 20mm crushed rock or gravel composed of hard, durable cubical fragments.

To further reduce mud-tracking, a wash-down facility with high pressure hose can be provided, to wash down the truck wheels.

As work progresses:

1. The site is graded and any runoff will be directed towards the ponds, thus restricting sediment onsite. The silt fences shall also contain sediment transport and should be inspected periodically and any damage repaired.

2. Any disturbed soil surfaces shall be regularly watered to prevent dust control. Watering shall be done, if required, by having water trucks on site and carrying out frequent checks.

3. Any excess materials on site will be hauled to the contractor's location of choice. Any piles of dirt or soil stacked on site during construction for an extended period will be seeded to prevent erosion.
4. Permanent stabilization shall be done as the work is completed by the contractor. The main areas are:

- any access roads and parking areas,
- landscaping around the site will be done wherever designated,
- any open soil surface and slopes due to construction activities shall be watered and seeded immediately as required.

Maintenance

There will be a representative from the Engineering Consultants, or the developer's project manager, on site during construction and regular spot visits during rough grading. If there are any problems or repairs to erosion and sediment control devices they will be dealt with in an efficient manner. All accumulated sediments shall be promptly removed.

A maintenance and inspection log and a copy of the erosion control report will be kept on site. The maintenance and inspection log will reflect the site inspection records (inspections will be done at least once a week and after each significant rainfall event or snowmelt).

The protection and control measures shall not be removed until the FAC/Construction Completion Certificate is acquired.

6.0 ANALYSIS

6.1 Runoff Analysis

Flow analysis for the proposed development was undertaken using the SWMHYMO Computer Model. This model was used because it computes the peak discharge and the total runoff volumes during a single 1:100 year storm event. SWMHYMO requires the following site specific parameters:

- Catchment area
- Land Use
- Initial abstraction (or loss) IA

IA is 0.2S
Where S = soil storage
= 25400 / CN - 254)

Rainfall data from the M. D. of Foothills is limited and the nearest long term precipitation records are from the City of Calgary. Therefore, 1990 Intensity-Duration-Frequency information for the Calgary International Airport was used. A 100 year synthetic Chicago storm over a 24 hour period was considered in the model. See Appendix B for SWMHYMO computer runs.

Table 1 shows the 1:100 year pre-development peak discharge coming from the overall catchments A1 and B1 from the surrounding areas. As mentioned previously, these flows route through the site and are used to size the inlet and overflow on the ponds and any culverts under the roads.

Table 1

Subcatchment	Area ha	Impervious CN Factor	Runoff m^3/s
A1	132.1	72.3	1.65
B1	50.4	72.4	0.79

The 900 diameter culvert under the road can cater for the 1.65 m^3/s flow. See drawing SWM-3.

Tables 2 and 3 show the estimated 1:100 year peak discharge for the pre-development and post-development, the change in the imperviousness, and the post-development control features for the catchments within the site boundaries. See Appendix A for impervious ratio calculations.

Table 2 – Summary of Pre-Development Flow

Sub-catchment	Area ha	Impervious CN Factor	Peak Runoff m^3/s	Volume m^3	Site Discharge m^3/s
A	6.55	72	0.144	1898	0.144
B	16.65	72	0.431	4825	0.431
C	21.90	72	0.464	6112	0.464

Table 3 – Summary of Post-Development Flows

Sub-catchment	Area ha	Impervious CN Factor	Peak Runoff m^3 /s	Volume m^3	Site Discharge m^3/s	Control
1	6.55	73.20	0.160	2016	0.057	Wet Pond
2	16.65	72.8	0.516	5024	0.119	Wet Pond
3	21.09	72.02	0.464	6116	0.464	None

Catchment 1
The runoff will be contained in a wet pond at the east property line. The flow will drain through the road ditches, natural drainage paths, and through the proposed 600 mm diameter culvert under the road.

Catchment 2
The post-development runoff will be contained in a wet pond at the east property line. The flow will drain through the 900 mm diameter culvert under the road and through the natural channel running west to east.

Catchment 3
The post-development runoff will be directed to the east property line and will flow through the road ditches and natural channels running west to east. The flow will exit at the east property line and continue to flow along the natural channel.

6.2 Retention Analysis

Retention analysis for the proposed development was also undertaken using the QUALHYMO and HYDSTAT computer models. These models were used because they calculate the 1 in 100 year capacity for a specific pond design based on historical long-term continuous precipitation.

As part of the stormwater management plan, the overland drainage from the site will drain into the proposed wet ponds discharging at the controlled rates. The ponds will provide for the settlement of errodable material and improve the quality of water.

To ensure sufficient volume and appropriate disposal of surface runoff in the site, sizing of the retention facility was performed using QUALHYMO, a continuous simulation computer model. The analysis requires the input of site specific parameters, long-term continuous precipitation (1960 to 1992), and monthly average evaporation rates. The program produces an output file with the maximum and minimum annual pond volumes. Computer output files for QUALHYMO are contained in Appendix B.

Upon attaining the maximum annual storage volumes from the QUALHYMO simulation the 1 in 100 year stormwater storage requirement was determined by statistical analysis using HYDSTAT. HYDSTAT uses seven different curve-fitting methods to estimate the 1 in 100 year return period event. The predicted 1 in 100 year return period volumes of the various catchments were worked out. Computer output files for HYDSTAT are contained in Appendix B. Details for the ponds designed using the continuous simulation model are summarized below in Table 4.

Table 4 - Pond Details

Catchment	1:100 Year		Total Provided			Type of Pond
	Capacity m^3	Depth m	Pond #	Capacity m^3	Depth m	
1	1522	1.55	1	1928	1.75	Wet Pond
2	3285	1.55	2	4508	1.95	Wet Pond

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusions

The following conclusions are made from the Stormwater Management Study for the Millarville Country Residential Subdivision.

- The study area within the property boundaries has been subdivided into 3 subcatchments at pre-development and 3 at post-development based on the existing topography and subdivision development.

- Best Management Practices (BMP) have been used to control and properly manage the stormwater runoff conveyed via road ditches, swales, and natural drainage channels to adequately sized ponds as follows:

Catchment	Pond	Total Capacity m^3	1:100 year requirement m^3
1	1	1928	1522
2	2	4508	3285

- The culverts and inlet and overflow structures on ponds shall be sized to cater for flows from the overall catchments A1 and B1.

- The Country Residential Subdivision will have insignificant impact on the adjacent properties and catchment areas since the runoff is either contained on site or released at less than pre-development rate.

- Erosion and sediment transfer is restricted primarily to onsite locations, thereby protecting the downstream areas.

- Best Management Practices should be implemented and followed through from project inception to finish. A multi-disciplinary action is necessary involving owners, developers, planners, designers, contractors, and direction from the M. D. of Foothills.

7.2 Recommendations

The following recommendations are made from the Stormwater Management Study for the Country Residential Subdivision.

- Surface runoff should be conveyed towards the proposed ponds by way of overland flow in natural channels and newly constructed road ditches and swales.
- The ponds, ditches and culverts should be as per drawing SWM-3.
- Silt fences, dust control, and good housekeeping measures should be implemented to ensure erosion and sedimentation control.
- Drainage Easements should be provided as required for the ponds and the proposed flow routes.
- Best Management Practices (BMP) should be strongly emphasized and put in place.

8.0 REFERENCES

Alberta Environment, (1997). "Stormwater Management Guidelines for the Province of Alberta". Alberta Environmental Standards and Approvals Division, Municipal Engineering Branch, Edmonton, Alberta.

Guidelines for Erosion and Sediment Control, City of Calgary, Engineering and Environmental Services Department.

J. F. Sabourin and Associates Inc., (2000). "SWMHYMO; Stormwater Management Hydrologic Model, User's Manual", Ottawa, Ontario.

Charles A. Rowney and Craig R. Macrae, (1992). "Qualhymo User Manual, Release 2.1: Continuous Simulation Framework".

Stormwater Management Report - Millarville, February 2003.

9.0 CORPORATE AUTHORIZATION

This report, Country Residential Subdivision for Millarville, Stormwater Management Study was prepared by Jubilee Engineering Consultants Ltd.

PERMIT TO PRACTICE

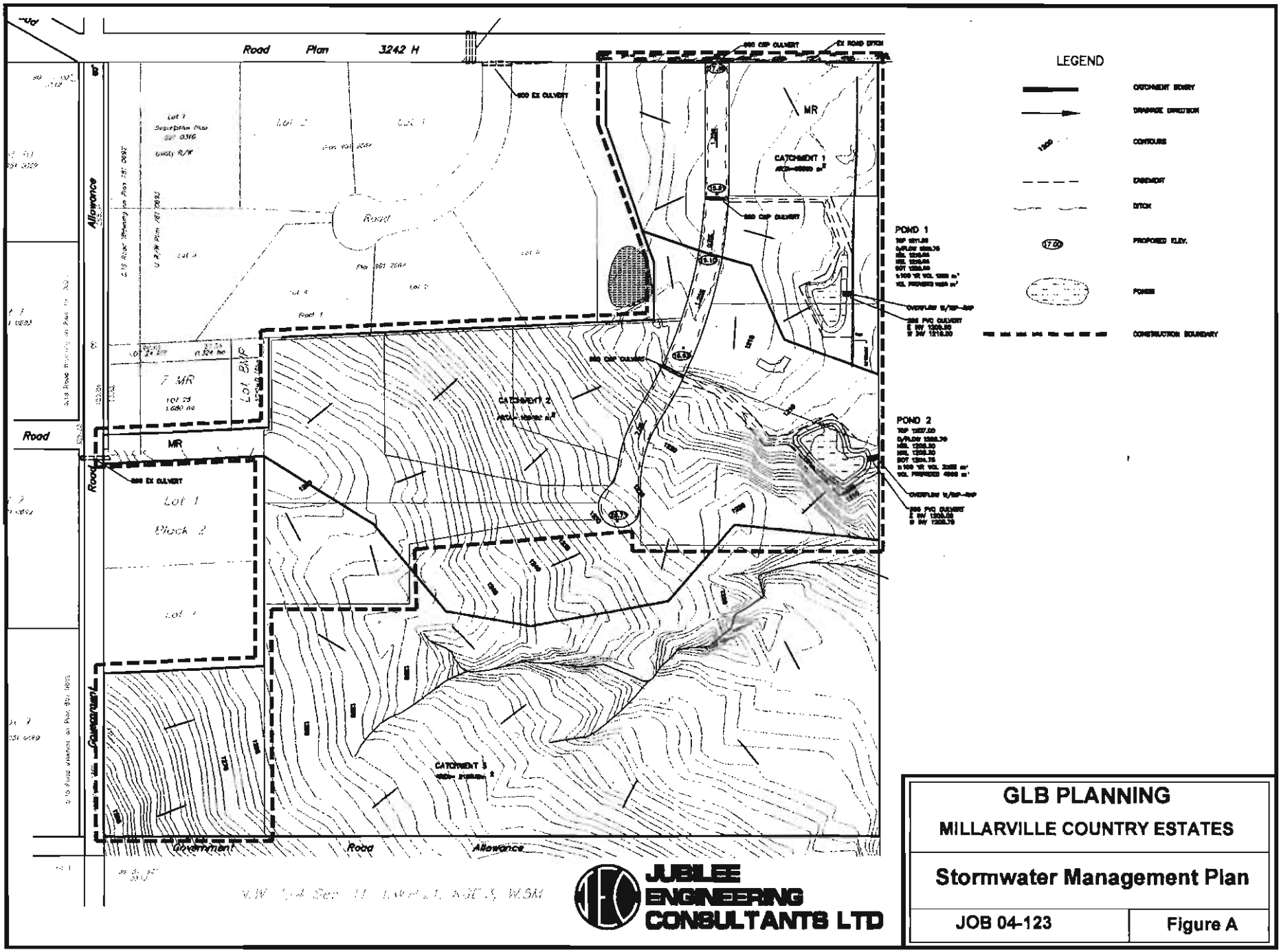
JUBILEE ENGINEERING CONSULTANTS LTD.

Signature_____

Date _____

PERMIT NUMBER P 3550

The Association of Professional Engineers, Geologists and Geophysicists of Alberta



JUBILEE ENGINEERING CONSULTANTS LTD

GLB PLANNING

MILLARVILLE COUNTRY ESTATES

Stormwater Management Plan

JOB 04-123	Figure A

Appendix 3

Transportation Impact Assessment

Based on the results of the assessment, it is concluded that Highway 22, 298th Avenue, the Millarville Country Estates subdivision road, and all study area intersections are capable of accommodating the additional traffic generated by the proposed Millarville Country Estates development without noticeable impact on existing levels of service.

Specific transportation related recommendations for the Millarville Country Estates development have been included in Section 7 of this report.

Table of Contents

List of Exhibits & Photographs

1.0 INTRODUCTION

1.1 Millarville Country Estates Development Description

The proposed Millarville Country Estates development site is a 108-acre parcel located in the S.W.1/4 Sec. 14-21-3-W5M approximately 3.5 kilometres north of Millarville in the Municipal District of Foothills. There is an existing single-family dwelling on the development land and there are nine other country residential lots, seven of which are developed, in the remaining portion of the quarter section.

The proposed development will be constructed in two phases with eight single-family homes in Phase 1 and 11 in Phase 2. Construction on the Phase 1 homes is tentatively expected to commence in 2003 and be completed by 2004. Construction on the Phase 2 homes is tentatively expected to commence in 2004 and be completed by 2005.

The development site is primarily accessed from 298th Avenue with one of the proposed lots, on the west side of the development, to be accessed directly from 224 Street. The majority of the site traffic is expected to use Highway 22 to access the property though it is also possible to access the site from the west and from the north via 224 Street (Priddis Valley Road).

1.2 Study Objectives

The Municipal District of Foothills requires that a Traffic Impact Assessment be completed as part of the subdivision and development approval process for the proposed Millarville Country Estates development. Eagle Engineering Corp. was retained by GLB Planning Ltd. to prepare the assessment.

The purpose of this study is to:

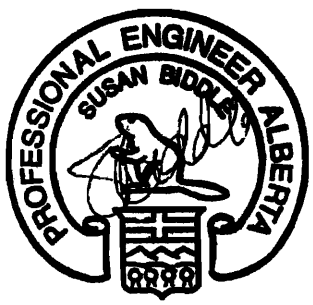
MILLARVILLE COUNTRY ESTATES

TRAFFIC IMPACT ASSESSMENT

February 18, 2003

Prepared for:

GLB Planning Ltd.
Unit 113, 2060 Pegasus Road N.E.
Calgary, Alberta
T2E 8G8



Prepared by:

EAGLE ENGINEERING CORP
TRAFFIC, TRANSPORTATION and HIGHWAYS
#2, 2616 - 16 Street NE
Calgary, Alberta
T2E 7J8

- Assess the traffic impacts from the proposed development on the intersection operations at Highway 22/298th Avenue and 298th Avenue/Millarville Country Estates subdivision road;
- Assess the impact of the proposed development traffic on the roadway operation of Highway 22 and the operation of 298th Avenue;
- Determine appropriate intersection configuration recommendations, based on Municipal District of Foothills design standards, to accommodate all turning movements into and out of the Millarville Country Estates development.

Exhibit 1.1 Site Plan

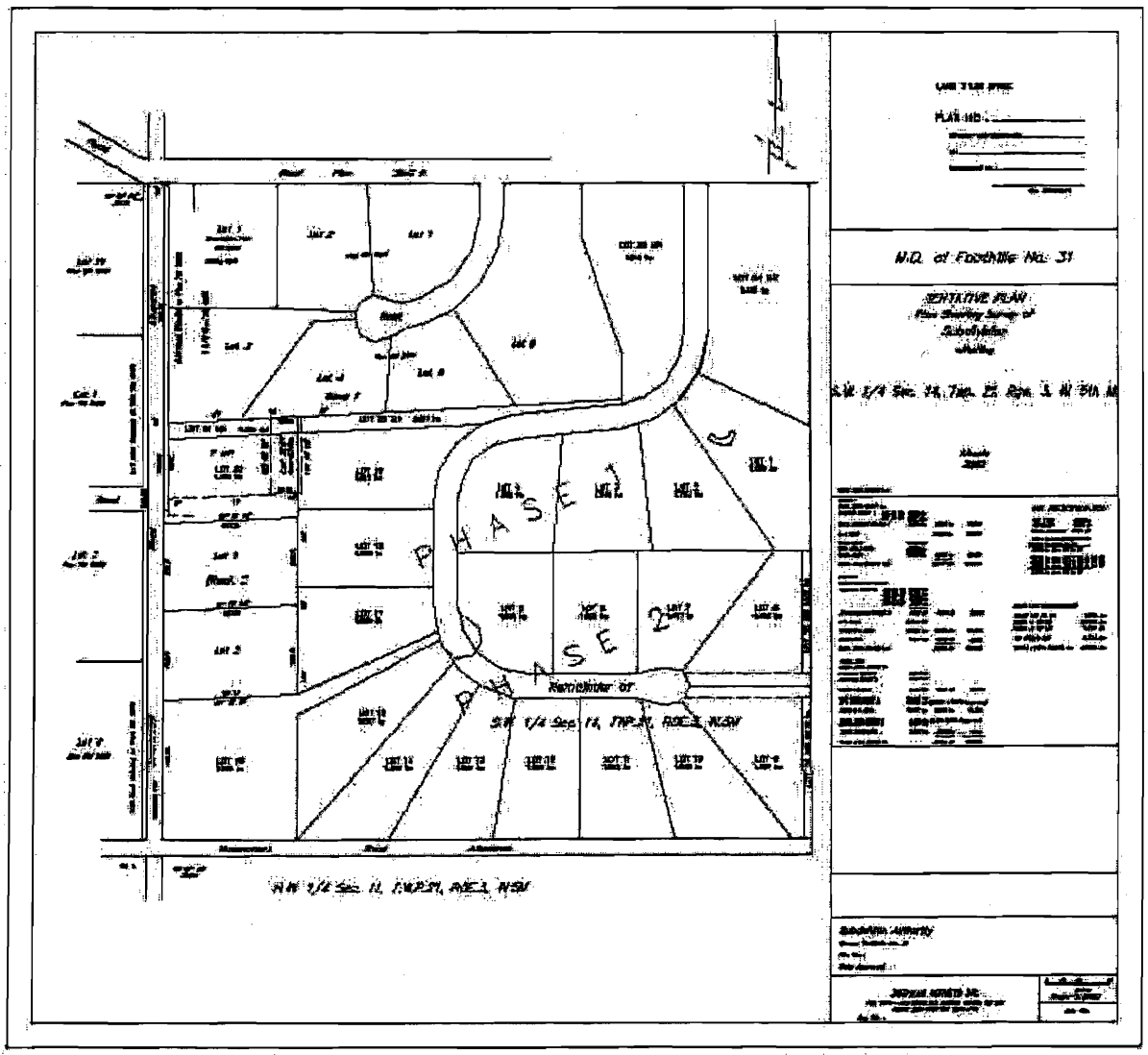
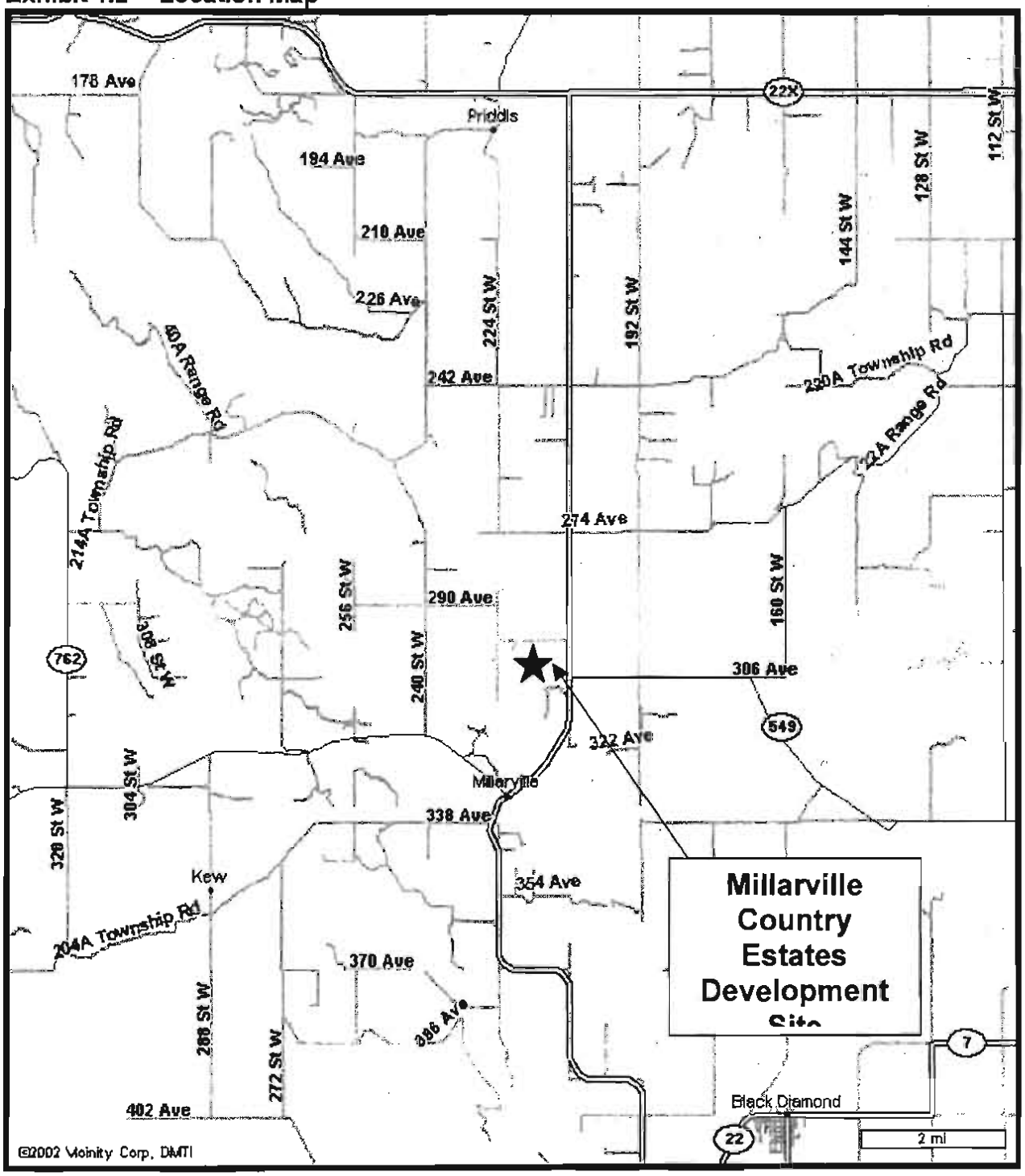


Exhibit 1.2 Location Map



2.0 EXISTING AND ANTICIPATED AREA DEVELOPMENT

2.1 Existing Area Development

There is one single-family residence located on the 108-acre proposed development site. The quarter-section of land that contains the development site also includes nine, previously subdivided, residential lots that are not part of the proposed development. On the west side of 244 Street, opposite the west edge of the Millarville Country Estates subdivision, there is a residential subdivision consisting of seven country residential acreages. The remaining properties surrounding the development site are farms and agricultural lands.

2.2 Anticipated Area Development

There are no pending development applications for the area surrounding the Millarville Country Estates site though it is reasonable to assume that infill construction and new residential developments throughout this area will continue to occur as long as land is available and the consumer demand persists.

3.0 ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 Highway 22

Highway 22 is categorized by Alberta Transportation as being a Class 1B provincial highway. The section from the north junction of Highway 549 to just south of the junction with Highway 22X has a RAU-213.4-110 design designation, which describes a roadway with two 3.7-metre travel lanes, 3.0-metre paved shoulders, and a 110 km/h design speed. The vertical profile is rolling and there are no horizontal curves in the study area. The highway was reconstructed and paved to current standards in 1997 and the surface and structure appear to be in very good condition. The posted speed limit on the highway is 100 km/h.

The 2001 AADT (average annual daily traffic) volume on Highway 22 past the intersection of 298th Avenue was approximately 3,100 vehicles per day. During the summer months, the 2001 ASDT (average seasonal daily traffic) volume increased by 25% to approximately 3,860. The traffic composition on Highway 22 was reported to be 85% passenger cars, 7% RV's, 6% single-unit trucks and 2% tractor-trailers. Trips made by pedestrians, cyclists and transit vehicles in this area were considered insignificant from a traffic impact perspective due to the rural nature of the surroundings.

3.2 298th Avenue

The municipality road, 298th Avenue, is 1.6-kilometre long east/west local road that connects 224 Street to Highway 22. It serves as an access for approximately 20 farm sites and country residential homes. The oiled road surface is approximately 7.2 metres wide with no pavement centerline or shoulder line markings and appears to be in fair to good condition. There are no speed limit signs. The vertical alignment is rolling and the horizontal alignment is tangential.

The November 2002 traffic counts on 298th Avenue measured an average of 191 vehicles per day during weekdays and 165 vehicles per day on weekend days. The traffic is comprised of approximately 93% passenger vehicles, 5% RV's and single-unit trucks, and 2% tractor-trailers.

3.3 Future Traffic Considerations

There are no immediate or long-term plans for upgrading Highway 22 or 298th Avenue at this time.

4.0 SITE TRAFFIC PROJECTIONS

4.1 Trip Generation and Distribution

Trip rates for the Millarville Country Estates development were based on rates recommended by the Institute of Transportation Engineers for single-family dwellings. All trip generation rates and volumes are documented in Exhibit 4.1.

Exhibit 4.1: Trip Generation and Distribution

Trip Generation	No. of Units	a.m. Peak Hour				p.m. Peak Hour				Daily	
		Inbound		Outbound		Inbound		Outbound		24 Hour	
		trips/hr/unit	veh/hr	trips/hr/unit	veh/hr	trips/hr/unit	veh/hr	trips/hr/unit	veh/hr	trips/hr/unit	veh/hr
Millarville Country Estates (new homes)											
Phase 1	8	0.19	2	0.56	4	0.65	5	0.36	3	9.57	77
Phase 2	11	0.19	2	0.56	6	0.65	7	0.36	4	9.57	105
Total	**19**		**4**		**10**		**12**		**7**		**182**

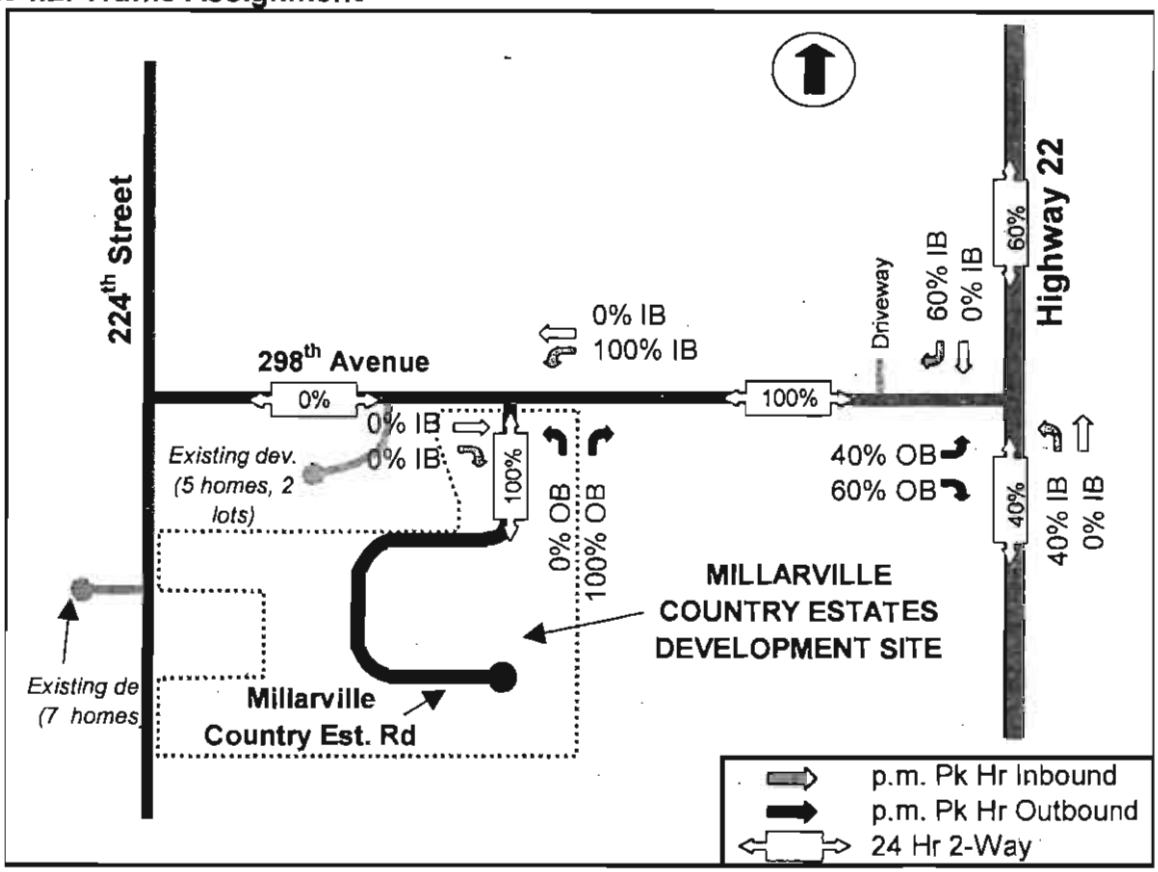
4.2 Traffic Assignment

It is possible to access the Millarville Country Estates subdivision from Highway 22 north of Priddis or from Highway 762 via 224 Street. However, there are no large employment centers, commercial developments, or institutions in the west and Highway 22 is a preferable travel route to most destinations in the north. Accordingly, for the purpose of this assessment, all Millarville Country Estates traffic was assumed to go to and come from the east via Highway 22.

One of the lots on the west side of the development site may be accessed directly from 224 Street. For the purpose of the assessment, all Millarville Country Estates lots were assumed to be accessed via 298th Avenue.

The traffic assignment from Millarville Country Estates to Highway 22 was based on a review of Alberta Transportation's turn movement volumes at the intersections of Highway 22 and Plummer Road and Highway 22 and Highway 549 North Junction. Exhibit 4.2 is a diagram showing the assignment for the proposed development. Trip assignment tables have been included in Appendix A.

Exhibit 4.2: Traffic Assignment



4.3 Background Traffic Growth

The 5% non-linear annual growth rate assumed for Highway 22 was estimated based on a review of Alberta Transportation's Traffic Volume History for the section of Highway 22 near the development site. The growth rate on 298th Avenue was assumed to be 2.5%, which is consistent with typical rural growth rates. The Millarville Country Estates subdivision road was assumed to be stable (0% growth rate) as all traffic increases would be as a direct result of new local development, not background growth.

4.4 Traffic Volumes

The horizon years selected for this assessment include 2003 to examine the pre-development conditions and the conditions at the completion of Phase 1, 2005 to examine the conditions with Phase 2 built-out, and 2010 to predict the traffic conditions five years after the development is built-out.

The 2003 24-hour traffic volumes for Highway 22 and 298th Avenue were estimated by factoring the 2001 volumes for Highway 22 and the 2002 volumes for 298th Avenue. The a.m. peak-hour, and p.m. peak-hour turn movements at the Highway 22 and 298th Avenue intersection were estimated by assuming the turn volume proportions were consistent with those estimated by Alberta Transportation for the intersection at Highway 22 and Plummers Road. The 2003, 2005, and 2010 daily and peak-hour background traffic volumes were projected using the growth rates described in the previous section.

Exhibits 4.3 to 4.8 at the end of this section are traffic volume diagrams for the background traffic volumes, site traffic volumes and total volumes at each assessment horizon. Tables summarizing the 24-hour volumes and the peak-hour turning movement volumes are included in Appendix A.

Exhibit: 4.3 - 2003 Background Traffic Volumes

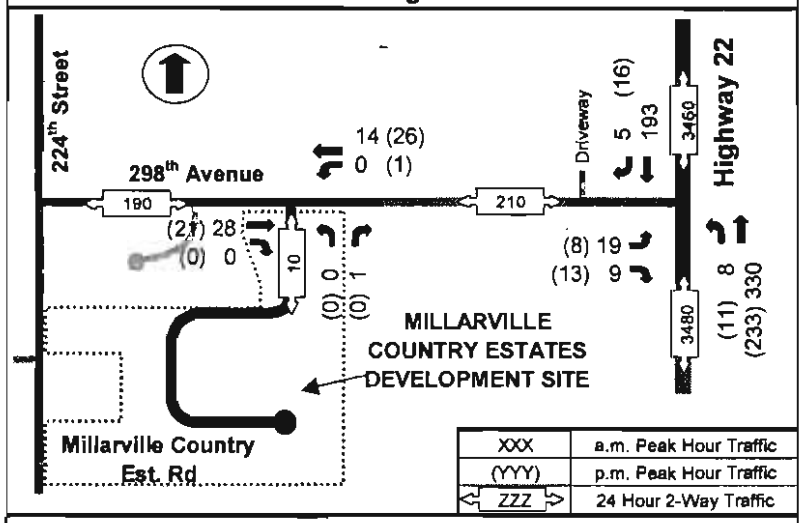


Exhibit 4.4: 2003 Site Traffic - Phase 1 Build-out

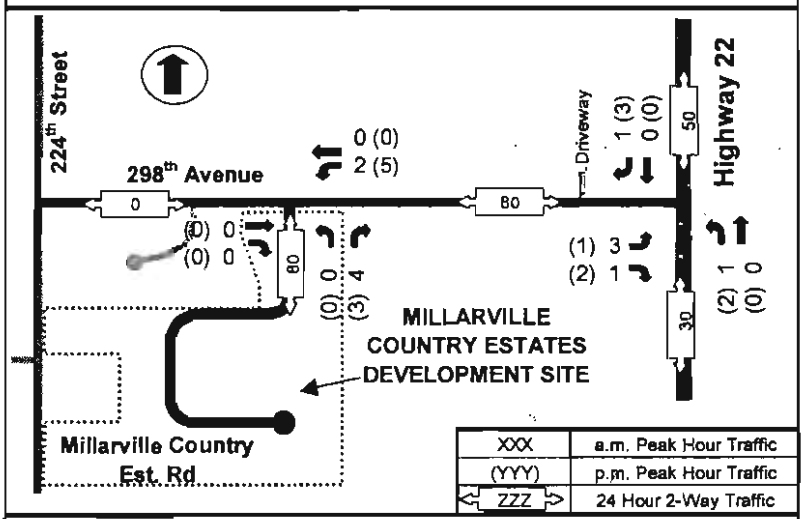


Exhibit: 4.5 - 2005 Site Traffic - Phase 2 Build-out

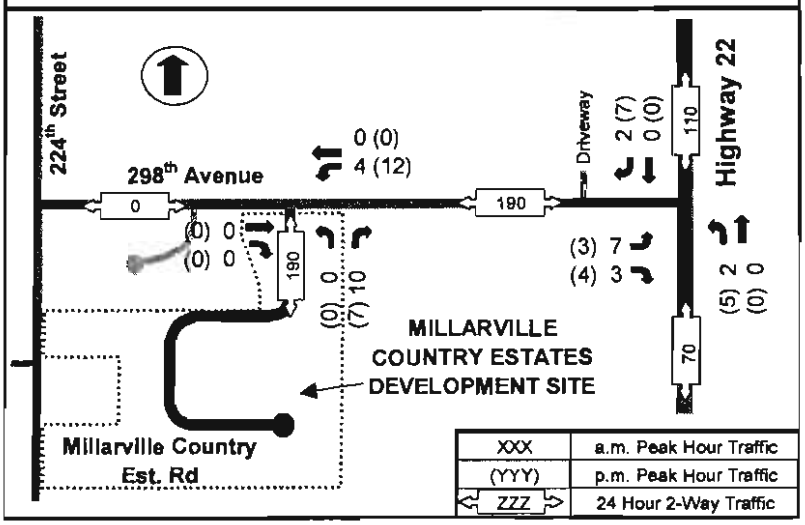


Exhibit 4.6: 2003 Total Traffic Volumes

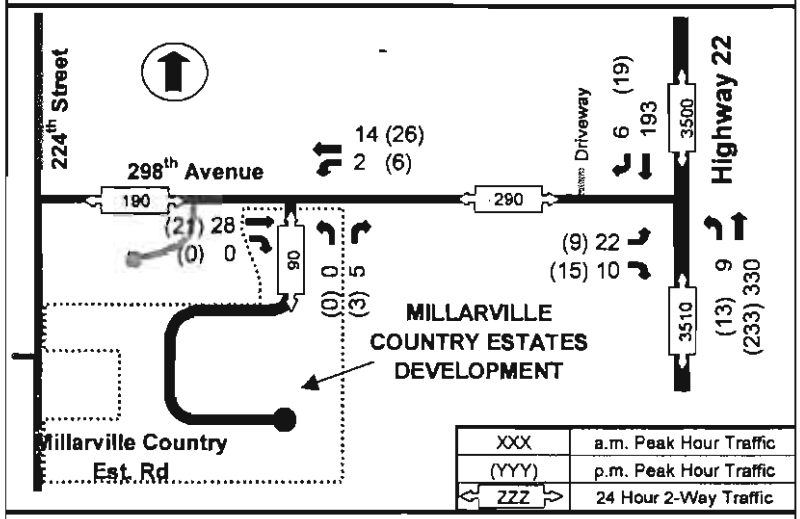


Exhibit 4.7: 2005 Total Traffic Volumes

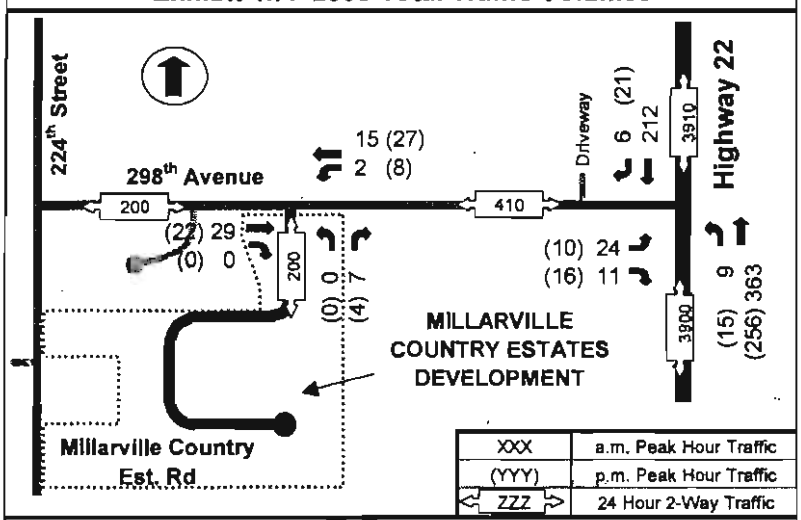
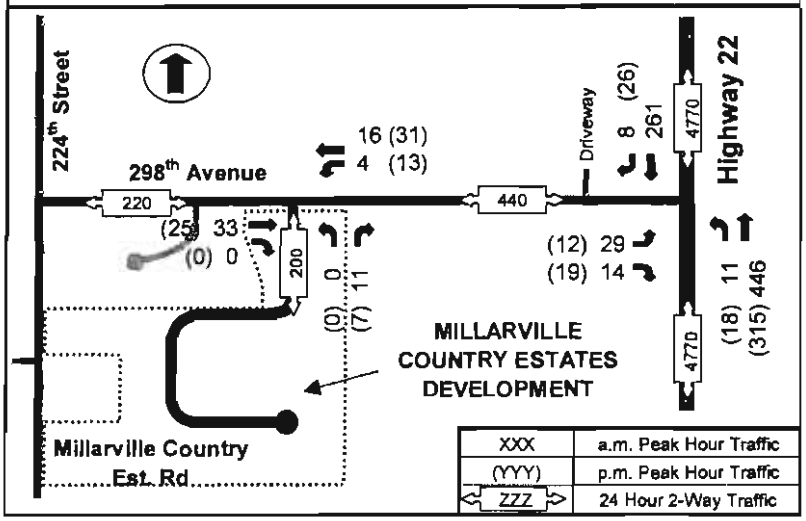


Exhibit 4.8: 2010 Total Traffic Volumes



5.0 TRAFFIC ASSESSMENT PROCEDURE

5.1 Analysis Components and Methodology

The capacity analysis component of this study included two-lane highway analyses and unsignalized intersection analyses. The horizon years chosen for the assessment include 2003, to represent pre-development conditions and conditions with Phase 1 built-out, 2005 to represent conditions with Millarville Country Estates built-out, and 2010 to represent conditions five years after build-out.

All analyses were performed using the Highway Capacity Software developed by the Transportation Research Board and based on the methods documented in the Highway Capacity Manual.

5.2 Two-lane Highway Analysis

The two-lane highway analysis was completed for the section of Highway 22 south of 298th Avenue. The analysis determined the 2003 pre-development level of service, the expected level of service in 2005 after adding traffic from the proposed development, and the 2010 conditions at the five-year post-development horizon.

The design hour volumes used for all two-lane highway analyses were calculated using a 'K' factor of 0.15 as is typical for roads in rural areas.

5.3 Unsignalized Intersection Analysis

Unsignalized intersection analyses were completed for the intersection of Highway 22 and 298th Avenue. The operation of the Millarville Country Estates subdivision road and 298th Avenue intersection was also analysed. The analyses focussed on p.m. peak-hour impacts as the traffic volumes are greater in the p.m. than in the a.m.

5.4 Geometric and Operational Assessment

Geometric evaluations of Highway 22 and 298th Avenue were completed to identify any safety or operational concerns that may impair the roadway's ability to accommodate background and site traffic.

6.0 TRAFFIC ASSESSMENT RESULTS

6.1 Two-lane Highway Analysis Results

In 2003, the section of Highway 22 south of 298th Avenue will be functioning at LOS C during peak periods with and without traffic from the proposed Millarville Country Estates development. By 2010, with traffic from the Millarville Country Estates development and increases in background traffic, Highway 22 will continue to operate at LOS C or better.

In 2010, with traffic from the proposed development, 298th Avenue will be functioning at LOS A.

Exhibit 6.1 below summarizes the two-lane highway analyses and the complete capacity analysis output data has been included in Appendix B.

Exhibit 6.1: Highway Performance Summary

MILLARVILLE COUNTRY EST. Two-Lane Roadway Analysis Summary	Horizon Year	Run Id.	Daily Volume (veh/day)	Design Hour Vol. (veh/hr)	Level of Service	
					V/C Ratio	(LOS)
Highway 22 - South of 298th Avenue				K = .15		
Background Traffic	2003	H22-03B	3,480	522	0.21	C
Total - Millarville Est. Ph. 1	2003	H22-03T	3,510	527	0.21	C
Total - Millarville Est. Ph.1&2	2005	H22-05T	3,900	585	0.24	C
Total - 5 Yrs after M.E. Build-out	2010	H22-10T	4,770	716	0.29	C
298th Avenue - West of Highway 22						
Total - 5 Yrs after M.E. Build-out	2010	298Av-10T	440	66	0.04	A

6.2 Unsignalized Intersection Analysis Results

Highway 22 & 298th Avenue: In 2003, prior to adding traffic from the proposed development, the northbound and southbound movements at this intersection will function at LOS A and the eastbound movements will function at LOS B with a delay of 11.4 seconds per vehicle. When traffic from Phase 1 of Millarville Country Estates is added, the delay for the eastbound movements will increase by 0.1 seconds during the p.m. peak periods. By 2010, with Millarville Country Estates built-out and with background traffic increases on Highway 22, the LOS

for northbound and southbound movements will continue to operate at LOS A and the eastbound movements will continue to operate at LOS B.

298th Avenue & Millarville Country Estates Subdivision Road: All movements at this intersection will operate at LOS A until and beyond the 2010 five-year development horizon.

Exhibit 6.2 below summarizes the unsignalized intersection analysis results for both intersections and the unsignalized analysis output data has been included in Appendix B.

Exhibit 6.2: Unsignalized Intersection Analysis Results

Millarville Country Est. Unsignalized Intersection Analysis Results	Horizon Year	Run Id.	Northbound		Southbound		Eastbound		Westbound	
			Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Highway 22 & 298th Avenue										
p.m. Peak Hour Analysis			*left turn*		*uninterrupted*		*left/right*		*undeveloped*	
Background Traffic	2003	H22&298-03B-P	8.0	A	-	A	11.4	B		
Total - M. Est. Ph. 1	2003	H22&298-03T-P	8.0	A	-	A	11.5	B		
Total - M. Est. Ph1&2	2005	H22&298-05T-P	8.1	A	-	A	12.0	B		
Total - M.E. Build-out + 5 Yrs	2010	H22&298-10T-P	8.4	A	-	A	13.4	B		
298th Avenue & Millarville Country Estates Subdivision Road										
p.m. Peak Hour Analysis			*left/right*		*undeveloped*		*uninterrupted*		*left turn*	
Total - M.E. Build-out + 5 Yrs	2010	298&MER-10T-P	8.5	A			-	A	8.4	A

6.3 Geometric Review Results

Highway 22: The pavement and structure of Highway 22 north and south of the 298th Avenue intersection appear to be in fair condition. The cross-section consists of a 13.4-metre surface with two 3.7-metre driving lanes and 3.0-metre shoulders. The vertical profile is essentially level for several hundred metres north and south of the 298th Avenue intersection and there are no horizontal curves. The sideslopes are approximately 4:1 and the drainage appears to be satisfactory.

298th Avenue: The section of 298th Avenue Highway 22 between 224 Street and Highway 22 has a 7.2-metre oiled surface with no centerline or shoulder line markings. The roadway right-of-way is approximately 20 metres. The vertical profile is rolling and the horizontal alignment is straight.

Highway 22 & 298th Avenue Intersection: The intersection design is a typical Type IIa configuration with a southbound right turn taper, an eastbound right turn acceleration lane and a northbound bypass lane. The southbound right turn radius is a three-centered curve (55m-18m-55m) and the eastbound right turn radius is a two-centered curve (16m-80m). The width of 298th Avenue has been increased to approximately 10 metres at the intersection. The Type IIa design is appropriate for accommodating existing and projected volumes at the intersection.

There is a 60 cm Stop sign and a 'Stop Ahead' warning sign for eastbound traffic on 298th Avenue and delineator posts have been appropriately installed at the corners of the intersection.

Sight Distance from 298th Avenue along Highway 22: The sight distance from 298th Avenue along the north and south legs of Highway 22 is greater than one kilometre and comfortably exceeds the minimum sight distance requirement for all design vehicles.

298th Avenue & Millarville Country Estates Subdivision Road: The existing residential driveway will be upgraded to meet the Municipal District of Foothills requirements for a subdivision road with 200 vehicles per day. The upgrading will include installation of a stop sign for northbound traffic, road name signs, and delineator guideposts. The sight distances from the proposed subdivision road intersection to the east and west along 298th Avenue exceeds the 175-metre minimum sight distance requirement for a road with a 90-km/h design speed. There are no existing or anticipated concerns with the operation of this intersection.

Photo 1: 298th Avenue WB – Past Millarville Country Estates Site

Photo 2: 298th Avenue EB – Past Millarville Country Estates Site

Photo 3: from 298th Avenue SB to Millarville Country Estates Site

Photo 4: 298th Av EB

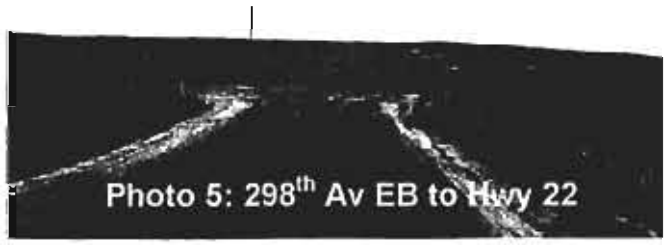


Photo 5: 298th Av EB to Hwy 22

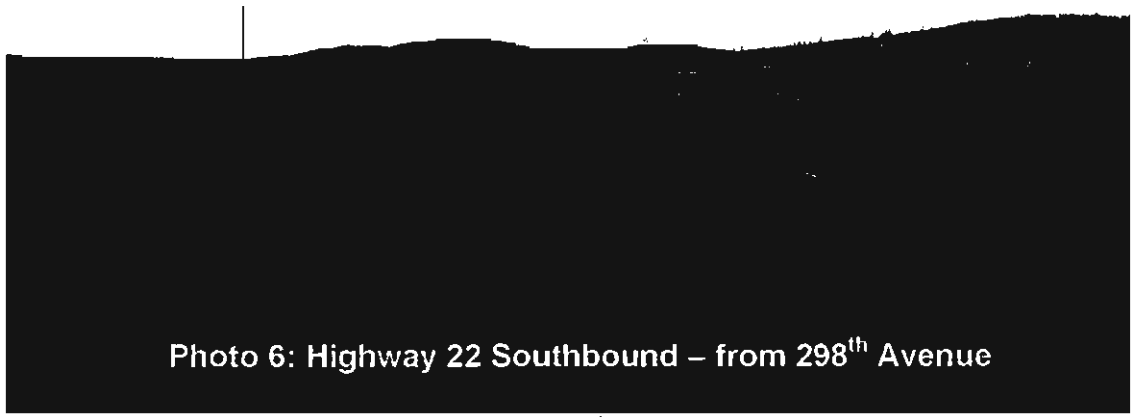


Photo 6: Highway 22 Southbound – from 298th Avenue

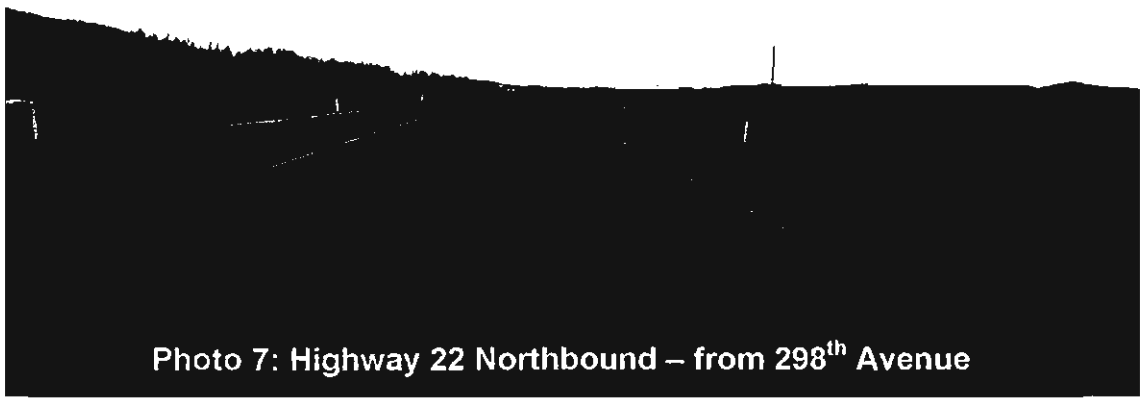


Photo 7: Highway 22 Northbound – from 298th Avenue

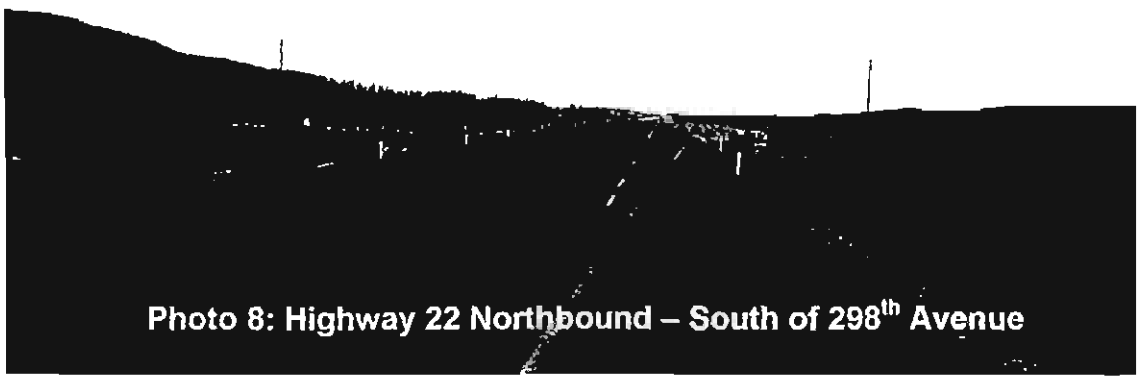


Photo 8: Highway 22 Northbound – South of 298th Avenue

7.0 CONCLUSIONS & RECOMMENDATIONS

The traffic analysis indicates that Highway 22 and 298th Avenue will be very capable of accommodating all traffic generated by the proposed Millarville Country Estates subdivision. The roads will incur very little impact as a result of the proposed development and will continue to function at acceptable levels of service until and beyond the five-year post-development horizon in 2010. The existing Highway 22 and 298th Avenue intersection currently functions with all movements at LOS B or better and will continue to function at the same levels of service with traffic from the proposed development until and beyond 2010.

7.1 Recommendations For Millarville Country Estates

No geometric improvements or pavement marking revisions to the Highway 22 and 298th Avenue intersection are required or recommended to accommodate the traffic from the Millarville Country Estates subdivision. Other recommendations to ensure the internal subdivision network is suitable for accommodating projected traffic flows are:

- Construct the Millarville Country Estates subdivision road in accordance with Municipal District of Foothill's Road Construction Standards for a paved internal subdivision roadway with a 7.0-metre paved surface.
- Install northbound Stop sign and street name sign at the north end of the Millarville Country Estates subdivision road.
- If there is to be direct access from 224 Street to a lot on the west side of the development site, the driveway should be located opposite the existing subdivision road on the west side of 224 Street if possible and practical.

7.2 Suggestions for Off-site Signage Improvement

The Municipal District of Foothills may wish to consider the following suggestions to address off-site signage deficiencies in the vicinity of the proposed subdivision:

- Install a checkerboard warning sign on the east side of Highway 22 opposite the 298th Avenue approach.
- Install a northbound and southbound 100 km/h maximum speed signs on Highway 22 and a westbound speed limit sign (80 km/h or less) on 298th Avenue west of Highway22.

7.3 Future Upgrading of 298th Avenue

The Municipal District of Foothills may also consider evaluating the section of 298th Avenue between 224 Street and Highway 22 for eventual widening and paving. The Municipal District Road Construction Standards do not specify a volume level at which paving is normally required, however, Alberta Transportation typically considers a road exceeding 200 vehicles per day as a potential candidate for asphalt paving. The existing right-of-way on 298th Avenue is 20 metres. Upgrading, in accordance with the Municipal District of Foothills requirements for an 8.0-metre wide paved road allowance, will involve right-of-way acquisition to satisfy the 30-metre right-of-way requirement. The Municipal District of Foothills should ensure a strategy for protecting the necessary right-of-way lands is developed and implemented.

If and when 298th Avenue is upgraded, the municipality might also consider constructing a small pull-off for the mailboxes on the south side of 298th Avenue.

APPENDIX A

24 Hour Two-way Weekday Traffic Volumes Table

Peak Hour Turn Movement Volumes

Intersection Turning Movement Diagrams

- Highway 22 & Plummer's Road
- Highway 22 & Highway 549 North Junction

Traffic Volume History Report (1992-2001)

MILLARVILLE ESTATES 24 HOUR TRAFFIC VOLUMES	24 Hour Trips	Highway 22		298th Avenue		Millarville Est. Rd.
		S. of 298th Ave	N. of 298th Ave	W. of Hwy 22	W. of M.E. Rd.	S. of 298th Ave
Growth Rate		5.0%	5.0%	2.5%	2.5%	0.0%
Background Traffic						
2001		3160	3140	200	180	10
2003		3480	3450	210	190	10
2005		3830	3800	220	200	10
2010		4700	4660	250	220	10
Millarville Estates Site Traffic						
Trip Asst.		40%	60%	100%	0%	100%
Phase 1	77	30	50	80	0	80
Phase 2	105	40	60	110	0	110
Total Site Traffic		70	110	190	0	190
Total Traffic (Background + Site Traffic)						
2003 - Phase 1 Build-out		3510	3500	290	190	90
2005 - Phase 2 Build-out		3900	3910	410	200	200
2010 - 5 Years after Build-out		4770	4770	440	220	200

MILLARVILLE ESTATES	IB	OB	Highway 22 & 298th Avenue						298th Ave & Millarville Est Ent.					
			EBL	EBR	NBL	NBT	SBT	SBR	EBT	EBR	WBL	WBT	NBL	NBR
a.m. Peak Hour														
Growth Rate			2.5%	2.5%	2.5%	5.0%	5.0%	2.5%	2.5%	0.0%	0.0%	2.5%	0.0%	0.0%
BACKGROUND TRAFFIC														
2001			18	9	8	300	175	5	27	0	0	13	0	1
2003			19	9	8	330	193	5	28	0	0	14	0	1
2005			20	9	8	363	212	5	29	0	0	15	0	1
2010			22	11	9	446	261	6	33	0	0	16	0	1
DEVELOPMENT SITE TRAFFIC														
Trip Asst. - inbound			0%	0%	65%	0%	0%	35%	0%	0%	100%	0%	0%	0%
Trip Asst. - outbound			70%	30%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Millarville Est. - Phase 1	2	4	3	1	1	0	0	1	0	0	2	0	0	4
Millarville Est. - Phase 2	2	6	4	2	1	0	0	1	0	0	2	0	0	6
Total Site Traffic			7	3	2	0	0	2	0	0	4	0	0	10
TOTAL TRAFFIC (Background + Site Traffic)														
2003 - Phase 1 Build-out			22	10	9	330	193	6	28	0	2	14	0	5
2005 - Phase 2 Build-out			24	11	9	363	212	6	29	0	2	15	0	7
2010 - 5-Years after Build-out			29	14	11	446	261	8	33	0	4	16	0	11

MILLARVILLE ESTATES	IB	OB	Highway 22 & 298th Avenue						298th Ave & Millarville Est Ent.					
			EBL	EBR	NBL	NBT	SBT	SBR	EBT	EBR	WBL	WBT	NBL	NBR
p.m. Peak Hour														
Growth Rate			2.5%	2.5%	2.5%	5.0%	5.0%	2.5%	2.5%	0.0%	0.0%	2.5%	0.0%	0.0%
BACKGROUND TRAFFIC														
2001			8	12	10	212	275	15	20	0	1	25	0	0
2003			8	13	11	233	303	16	21	0	1	26	0	0
2005			8	14	12	256	333	17	22	0	1	27	0	0
2010			9	15	13	315	409	19	25	0	1	31	0	0
DEVELOPMENT SITE TRAFFIC														
Trip Asst. - inbound			0%	0%	40%	0%	0%	60%	0%	0%	100%	0%	0%	0%
Trip Asst. - outbound			40%	60%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Millarville Est. - Phase 1	5	3	1	2	2	0	0	3	0	0	5	0	0	3
Millarville Est. - Phase 2	7	4	2	2	3	0	0	4	0	0	7	0	0	4
Total Site Traffic			3	4	5	0	0	7	0	0	12	0	0	7
TOTAL TRAFFIC (Background + Site Traffic)														
2003 - Phase 1 Build-out			9	15	13	233	303	19	21	0	6	26	0	3
2005 - Phase 2 Build-out			10	16	15	256	333	21	22	0	8	27	0	4
2010 - 5-Years after Build-out			12	19	18	315	409	26	25	0	13	31	0	7

TRAFFIC COUNT FOR 298 ave. W, at 216 st.

(IDC14-21-3-5)

		THEORETICAL AADT
W.day	191	**183**
W.end	165	

SOURCE DATA:

DATE	TIME	RAW COUNT	3AX	4AX	5AX+	Trucks (3AX+)	Trucks (4AX+)	NOTE	DATA USE:	AADT	W.DAY	W.END
Fri Nov.22/02	*08:06-24:00*	179	5	6	0	11	6	*partial*	w/ Nov. 29			
Sat Nov.23/02	*00:01-24:00*	185	4	10	0	14	10	*wk.end*		185		185
Sun Nov.24/02	*00:01-24:00*	145	5	2	0	7	2	*wk.end*		145		145
Mon Nov.25/02	*00:01-24:00*	197	10	2	3	15	5			197	197	
Tue Nov.26/02	*00:01-24:00*	180	0	2	1	3	3			180	180	
Wed Nov.27/02	*00:01-24:00*	185	0	4	0	4	4			185	185	
Thu Nov.28/02	*00:01-24:00*	188	2	2	0	4	2			188	188	
Fri Nov.29/02	*00:01-08:06*	25	0	0	0	0	0	*partial*	incl. Nov. 22	204	204	
						0	0					
						0	0					
						0	0					
						0	0					
						0	0					
						0	0					
						0	0					
						0	0					
						0	0					
		1284	26	28	4	58	32			1284	954	330
									Days:	7	5	2
									Average:	183	191	165

Truck %: 4.52%

Semi/trn: 2.49%

Avg trucks per day: 8

Avg semi/train per: 5

Note: truck traffic will include holiday trailers, motorhomes, farm machinery, and horsetrailers.

17.3% of traffic exceeds the speed limit: an average of 32 vehicles a day.

1.8% exceeds the limit by over 20KPH: an average of 3 vehicles a day.

554 330

Theoretical Averages: 183

(trucks): 8

(semi/tn): 5

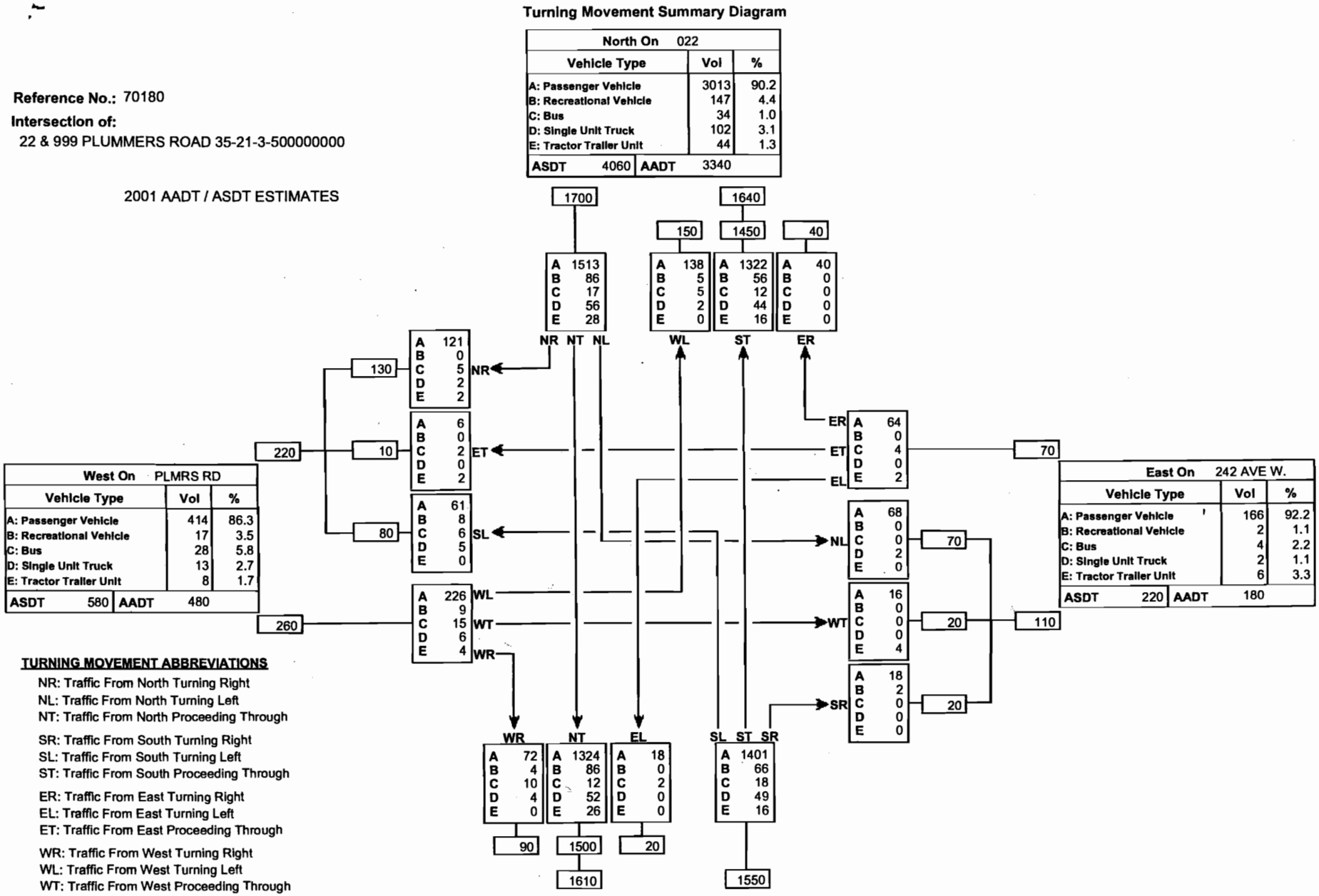
Reference No.: 70180

Intersection of:

22 & 999 PLUMMERS ROAD 35-21-3-500000000

2001 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.: 70180

Intersection of:
22 & 999 PLUMMERS ROAD 35-21-3-500000000

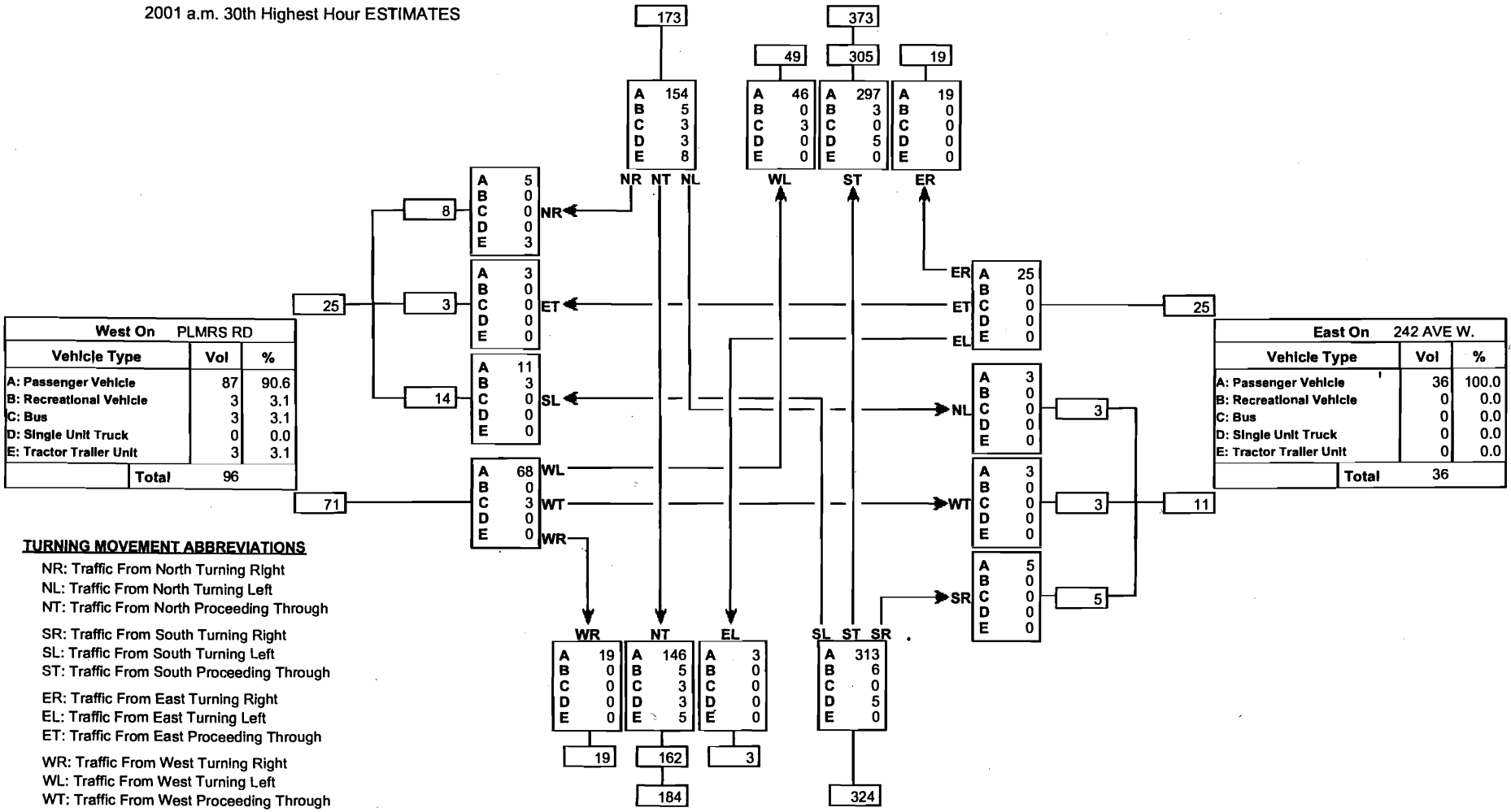
2001 a.m. 30th Highest Hour ESTIMATES

North On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	516	94.5
B: Recreational Vehicle	8	1.5
C: Bus	6	1.1
D: Single Unit Truck	8	1.5
E: Tractor Trailer Unit	8	1.5
Total	546	

West On PLMRS RD		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	87	90.6
B: Recreational Vehicle	3	3.1
C: Bus	3	3.1
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	3	3.1
Total	96	

East On 242 AVE W.		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	36	100.0
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	36	

South On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	481	94.7
B: Recreational Vehicle	11	2.2
C: Bus	3	0.6
D: Single Unit Truck	8	1.6
E: Tractor Trailer Unit	5	1.0
Total	508	



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WT: Traffic From West Proceeding Through

Reference No.: 70180

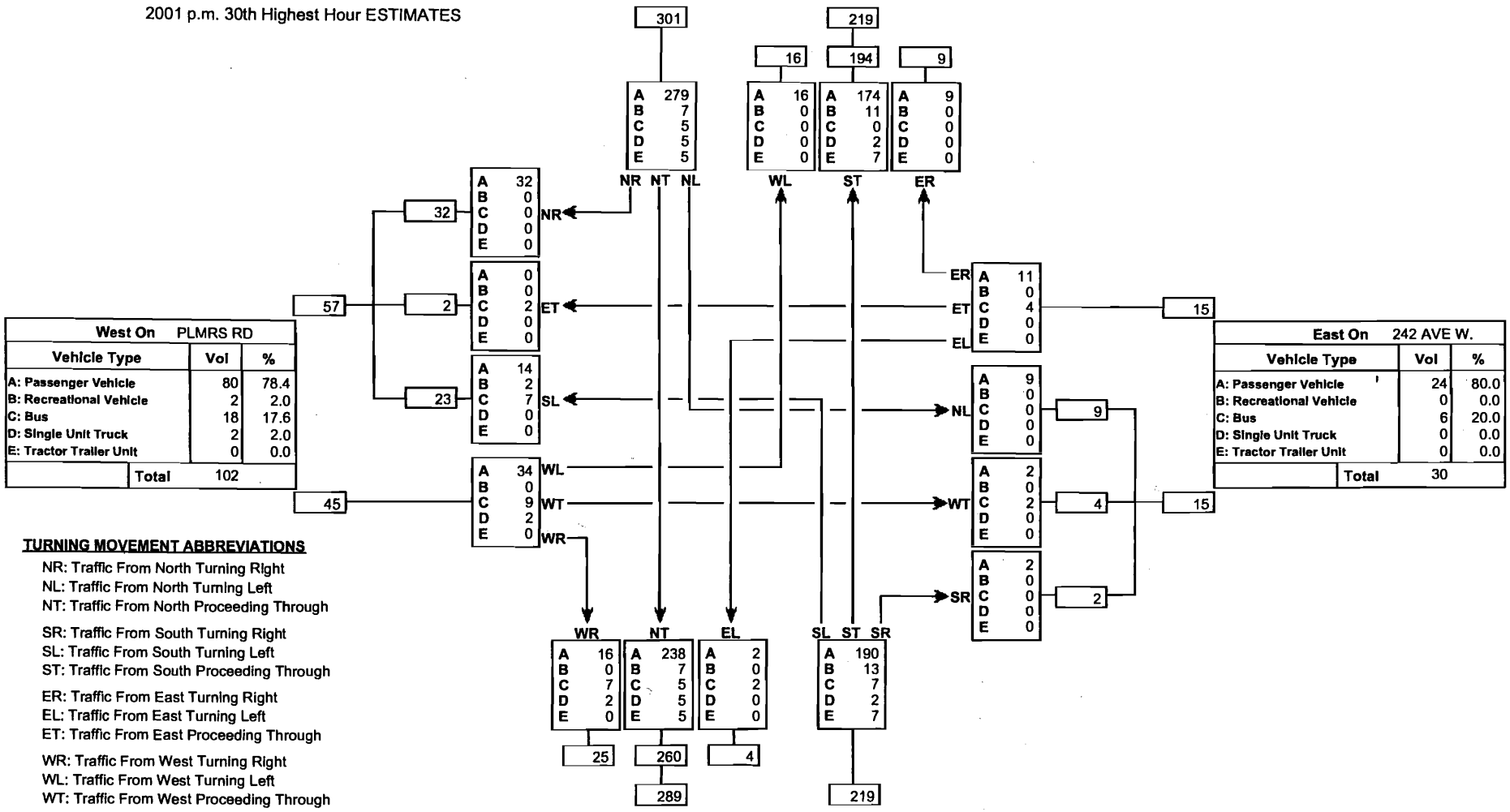
Intersection of:

22 & 999 PLUMMERS ROAD 35-21-3-500000000

2001 p.m. 30th Highest Hour ESTIMATES

Turning Movement Summary Diagram

North On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	478	91.9
B: Recreational Vehicle	18	3.5
C: Bus	5	1.0
D: Single Unit Truck	7	1.3
E: Tractor Trailer Unit	12	2.3
Total	520	



West On PLMRS RD		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	80	78.4
B: Recreational Vehicle	2	2.0
C: Bus	18	17.6
D: Single Unit Truck	2	2.0
E: Tractor Trailer Unit	0	0.0
Total	102	

East On 242 AVE W.		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	24	80.0
B: Recreational Vehicle	0	0.0
C: Bus	6	20.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	30	

South On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	446	87.8
B: Recreational Vehicle	20	3.9
C: Bus	21	4.1
D: Single Unit Truck	9	1.8
E: Tractor Trailer Unit	12	2.4
Total	508	

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ET: Traffic From East Proceeding Through

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

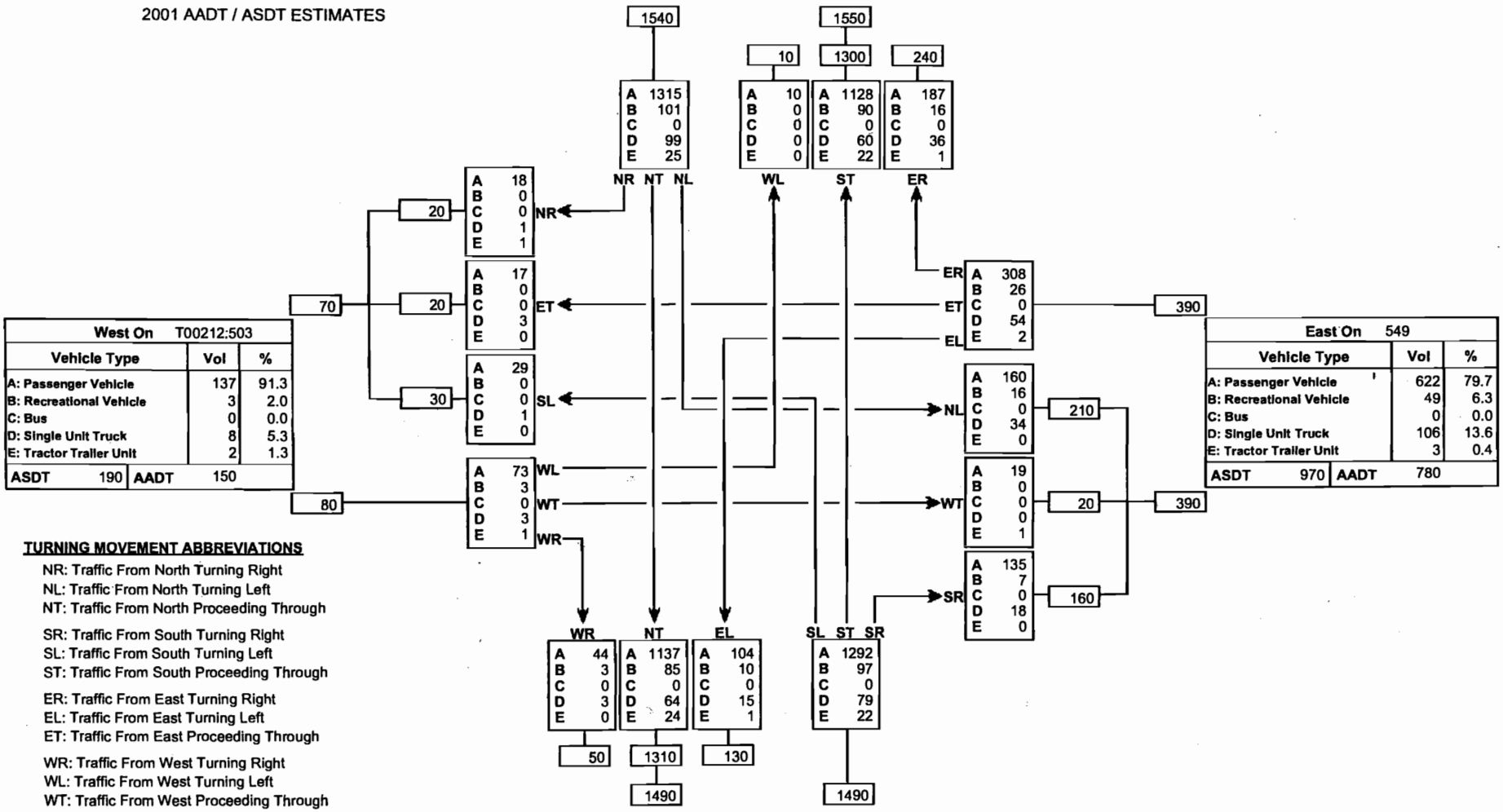
Turning Movement Summary Diagram

Reference No.: 68180

Intersection of:
22 & 549 NE OF MILLARVILLE NJ

2001 AADT / ASDT ESTIMATES

North On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2640	85.4
B: Recreational Vehicle	207	6.7
C: Bus	0	0.0
D: Single Unit Truck	195	6.3
E: Tractor Trailer Unit	48	1.6
ASDT 3860	AADT 3090	



West On T00212:503		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	137	91.3
B: Recreational Vehicle	3	2.0
C: Bus	0	0.0
D: Single Unit Truck	8	5.3
E: Tractor Trailer Unit	2	1.3
ASDT 190	AADT 150	

East On 549		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	622	79.7
B: Recreational Vehicle	49	6.3
C: Bus	0	0.0
D: Single Unit Truck	106	13.6
E: Tractor Trailer Unit	3	0.4
ASDT 970	AADT 780	

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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)

South On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2577	86.5
B: Recreational Vehicle	195	6.5
C: Bus	0	0.0
D: Single Unit Truck	161	5.4
E: Tractor Trailer Unit	47	1.6
ASDT 3720	AADT 2980	

Turning Movement Summary Diagram

Reference No.: 68180

Intersection of:
22 & 549 NE OF MILLARVILLE NJ

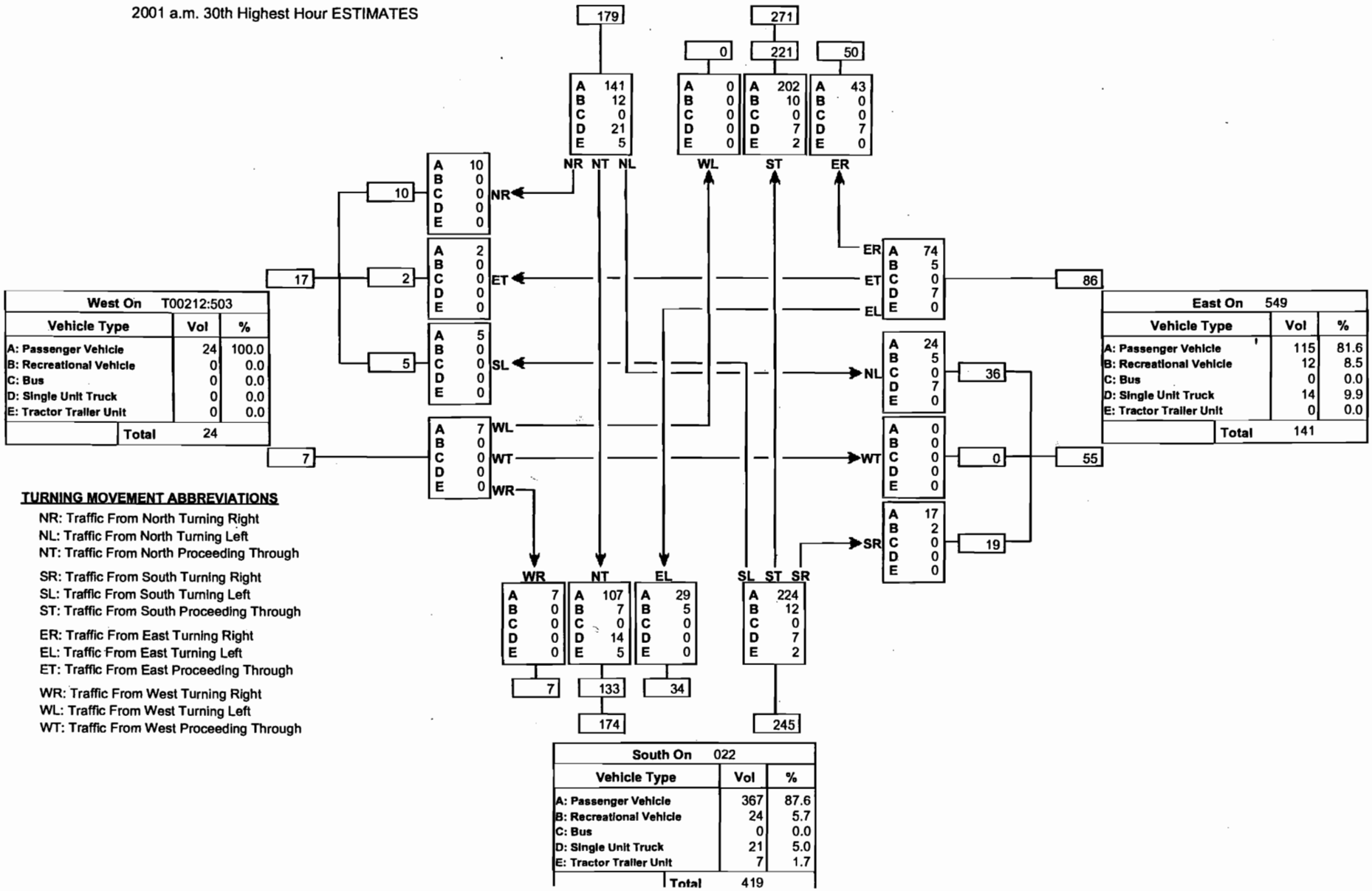
2001 a.m. 30th Highest Hour ESTIMATES

North On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	386	85.8
B: Recreational Vehicle	22	4.9
C: Bus	0	0.0
D: Single Unit Truck	35	7.8
E: Tractor Trailer Unit	7	1.6
Total	450	

West On T00212:503		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	24	100.0
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	24	

East On 549		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	115	81.6
B: Recreational Vehicle	12	8.5
C: Bus	0	0.0
D: Single Unit Truck	14	9.9
E: Tractor Trailer Unit	0	0.0
Total	141	

South On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	367	87.6
B: Recreational Vehicle	24	5.7
C: Bus	0	0.0
D: Single Unit Truck	21	5.0
E: Tractor Trailer Unit	7	1.7
Total	419	



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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 Summary Diagram

Reference No.: 68180

Intersection of:
22 & 549 NE OF MILLARVILLE NJ

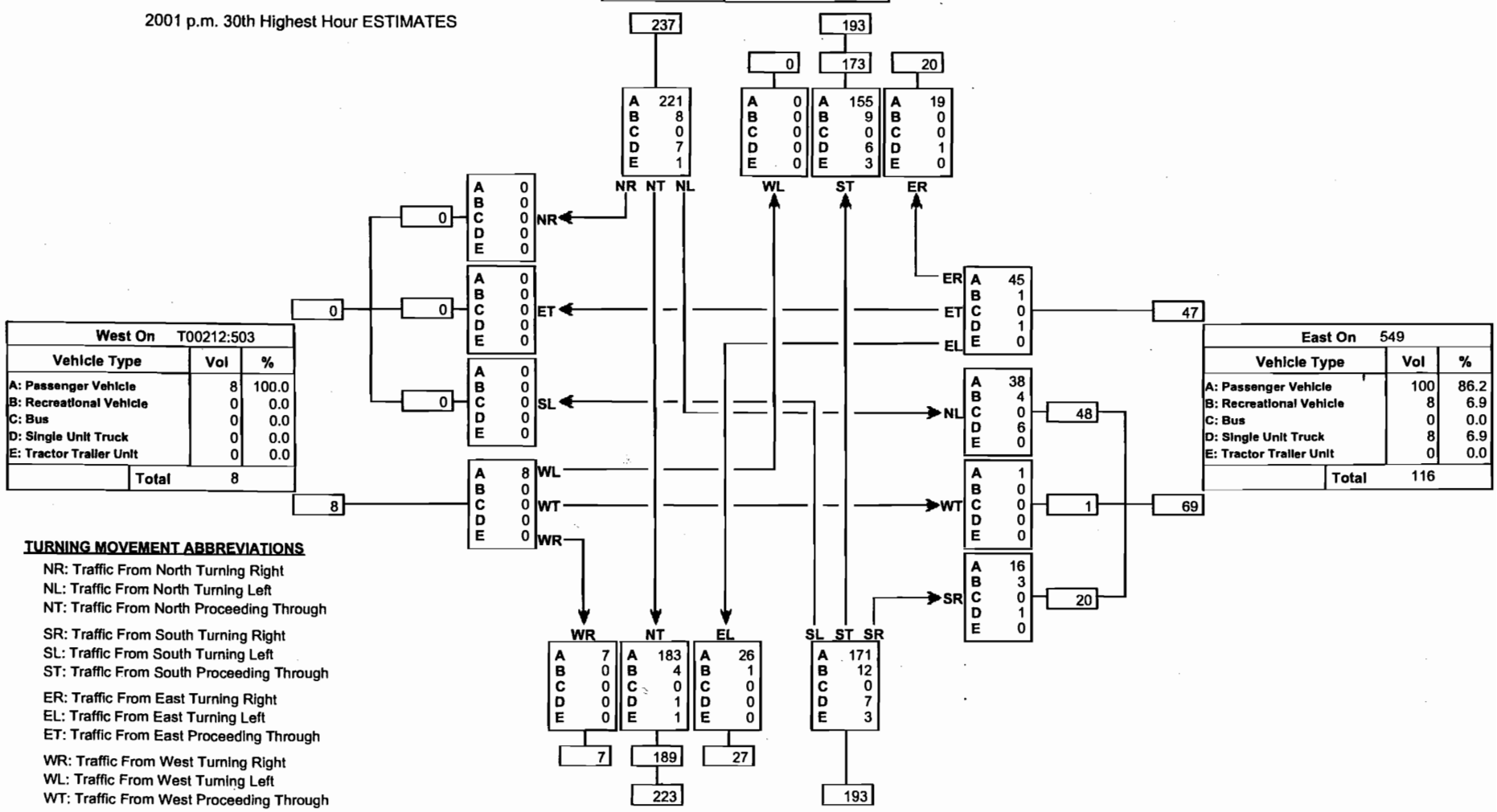
2001 p.m. 30th Highest Hour ESTIMATES

North On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	395	91.9
B: Recreational Vehicle	17	4.0
C: Bus	0	0.0
D: Single Unit Truck	14	3.3
E: Tractor Trailer Unit	4	0.9
Total	430	

West On T00212:503		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	8	100.0
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	8	

East On 549		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	100	86.2
B: Recreational Vehicle	8	6.9
C: Bus	0	0.0
D: Single Unit Truck	8	6.9
E: Tractor Trailer Unit	0	0.0
Total	116	

South On 022		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	387	93.0
B: Recreational Vehicle	17	4.1
C: Bus	0	0.0
D: Single Unit Truck	8	1.9
E: Tractor Trailer Unit	4	1.0
Total	416	



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

ALBERTA HIGHWAYS 1 TO 216
TRAFFIC VOLUME HISTORY 1992-2001

Alberta Transportation
Program Management Branch
Highway Asset Management Section

Produced: 1-APR-2002 McElhanney Consulting Services Ltd.

Hwy	CS	TCS	Muni	Location Description	1992 AADT	1993 AADT	1994 AADT	1995 AADT	1996 AADT	1997 AADT	1998 AADT	1999 AADT	2000 AADT	2001 AADT	2001 ASDT
022	12	24	Fthl	N OF 549 SE OF MILLARVILLE SJ	2110	2300	2210	2340	2310	2190	3030	3360	3480	2980	3620
022	12	24	Fthl	S OF 549 NE OF MILLARVILLE NJ	2110	2340	2250	2320	2310	2190	3030	3350	3470	2980	3720
022	12	28	Fthl	N OF 549 NE OF MILLARVILLE NJ	2130	2360	2270	2340	2220	2100	2900	3210	3330	3090	3860
022	12	28	Fthl	S OF PLUMMERS RD 35-21-3-500000000		2180	2090	2150	2030	1930	2750	3040	3140	3160	3840
022	12	28	Fthl	N OF PLUMMERS RD 35-21-3-500000000		2570	2470	2520	2380	2260	2910	3210	3320	3340	4060
022	12	28	Fthl	0.9 KM S OF 22 & 22X PRIDDIS	2480	2750	2640	2680	2540	2500	2850	3160	3270	3320	4150
022	12	28	Fthl	S OF 22X NE OF PRIDDIS	2480	2750	2640	2680	2540	2500	2850	3160	3270	3320	4150
022	14	04	Fthl	W OF 22X NE OF PRIDDIS	3220	3290	3550	3520	3580	3830	4170	4620	4600	4580	5720
022	14	04	Fthl	0.9 KM W OF 22 & 22X PRIDDIS EJ	3220	3290	3550	3520	3580	3830	4040	4470	4450	4570	5710
022	14	04	Fthl	E OF PRIDDIS ACC 22-22-3-500000000		3290	3550	3520	3580	3830	4400	4860	4840	4970	6210
022	14	04	Fthl	W OF PRIDDIS ACC 22-22-3-500000000		2940	3170	3140	3200	3420	3920	4330	4310	4440	5550
022	14	04	Fthl	E OF LOCAL RD 25-22-4-500000000	2190	2240	2420	2410	2460	2250	2380	2430	2410	2490	3110
022	14	04	Fthl	W OF LOCAL RD 25-22-4-500000000	2110	2160	2330	2340	2390	2140	2260	2310	2290	2370	2960
022	14	04	Fthl	E OF 336 ST, FOOTHILLS 33-22-4-500001400		1810	1720	1900	1940	2080	2200	2250	2230	2290	2860
022	14	04	Fthl	W OF 336 ST, FOOTHILLS 33-22-4-500001400		1810	1720	1900	1940	2080	2200	2250	2230	2290	2860
022	14	04	Fthl	E OF 352 ST, FOOTHILLS 32-22-4-500001150		1860	1770	1960	2010	2150	2270	2690	2670	2740	3420
022	14	04	Fthl	W OF 352 ST, FOOTHILLS 32-22-4-500001150		1880	1790	1980	2030	2170	2290	2710	2690	2760	3450
022	14	04	Fthl	0.9 KM E OF 22 & 762 BRAGG CREEK	1730	1830	1740	1930	1960	2100	2160	2430	2410	2720	3400
022	14	04	Fthl	E OF 762 SE OF BRAGG CREEK	1730	1830	1740	1930	1960	2100	2160	2430	2410	2730	3410
022	14	08	Fthl	W OF 762 SE OF BRAGG CREEK	2410	2320	2350	2600	2620	2810	2890	3230	3210	3640	4550
022	14	08	Rkyv	E OF 66 SE OF BRAGG CREEK	2410	2640	2350	2600	2620	2810	2890	3200	3180	3630	5740
022	14	10	Rkyv	N OF 66 SE OF BRAGG CREEK	2770	3030	2690	2980	2170	2330	2410	2700	2690	3800	6000
022	14	10	Rkyv	S OF LOCAL RD 18-23-4-515391339	2140	2340	2120	2360		5010		5340	5240	5400	6480
022	14	10	Rkyv	N OF LOCAL RD 18-23-4-515391339	4000	4370	4440	4940		5170		5520	5420	5580	6700
022	14	10	Rkyv	S OF 758 AT BRAGG CREEK							3490	4260	4180	4260	5110
022	14	10	Rkyv	E OF 758 AT BRAGG CREEK							2590	3160	3100	3160	3790
022	14	10	Rkyv	0.8 KM S OF 8 & 22 BRAGG CREEK	4910	5370	5450	6670	6670	6930	6480	6910	6910	6980	8000
022	14	10	Rkyv	S OF 8 NE OF BRAGG CREEK	4910	5370	5450	6670	6670	6930	6480	6910	6910	6980	8000
022	14	12	Rkyv	N OF 8 NE OF BRAGG CREEK	3860	4600	5130	5150	5160	5420	6610	7060	7060	7120	8160
022	14	12	Rkyv	1.4 KM S OF 1 & 22 COCHRANE	3900	4650	5190	5160	5160	5420	7000	7480	7110	7170	8830
022	14	12	Rkyv	S OF 1 S OF COCHRANE	3900	4670	5210	5180	5190	5450	7400	7670	7210	7280	8950
022	16	04	Rkyv	N OF 1 S OF COCHRANE	4800	5440	5700	6260	6370	6680	7560	7830	7400	7470	9190
022	16	04	Rkyv	2.8 KM N OF 1 & 22 COCHRANE	4860	5290	5540	6080	6190	6490	7350	7920	7500	7570	8730
022	16	08	Rkyv	S OF GLENBOW DR, COCHRANE 3-26-4-513820533						5670	6560	8220	8820	8860	9530
022	16	08	Rkyv	N OF GLENBOW DR, COCHRANE 3-26-4-513820533						6010	6960	8730	9360	9400	10110
022	16	08	Rkyv	S OF 1A AT COCHRANE	3580	4190	4390	4610	4550	6010	8280	8720	9360	9400	10110
022	16	08	Rkyv	N OF 1A AT COCHRANE	4680	4960	5310	5460	5400	5830	5470	5760	6400	6440	6930
022	16	08	Rkyv	S OF GAS PLANT ACC COCHRANE 10-26-4-509501000				5460	5400	5830	5470	5760	6430	6470	6960

APPENDIX B

I.T.E. Trip Generation Rates

Two-lane Highway Analysis

- Highway 22 – South of 298 Avenue
- 298th Avenue – West of Highway 22

Unsignalized Intersection Analysis

- Highway 22 & 298th Avenue
- 298th Avenue & Millarville Estates Road

Millarville Estates
SUMMARY OF TRIP GENERATION CALCULATION
FOR 19 DWELLING UNITS OF SINGLE FAMILY DWELLINGS
02/06/03

	AVERAGE RATE	STANDARD DEVIATION	ADJUSTMENT FACTOR	DRIVE WAY VOLUME
AVG WKDY 2-WAY VOL	9.57	3.69	1.00	182
7-9 AM PK HR ENTER	0.19	0.00	1.00	4
7-9 AM PK HR EXIT	0.56	0.00	1.00	11
7-9 AM PK HR TOTAL	0.75	0.90	1.00	14
4-6 PM PK HR ENTER	0.65	0.00	1.00	12
4-6 PM PK HR EXIT	0.36	0.00	1.00	7
4-6 PM PK HR TOTAL	1.01	1.05	1.00	19
SATURDAY 2-WAY VOL	10.09	3.67	1.00	192
PK HR ENTER	0.51	0.00	1.00	10
PK HR EXIT	0.43	0.00	1.00	8
PK HR TOTAL	0.94	0.99	1.00	18
SUNDAY 2-WAY VOL	8.78	3.33	1.00	167
PK HR ENTER	0.46	0.00	1.00	9
PK HR EXIT	0.40	0.00	1.00	8
PK HR TOTAL	0.86	0.95	1.00	16

Note: A zero rate indicates no rate data available
Source: Institute of Transportation Engineers
Trip Generation, 6th Edition, 1997.

Two-lane Highway Analysis

- **Highway 22 – South of 298th Avenue**
  - 2003 Background
  - 2003 Background + Millarville Est. Phase 1
  - 2005 Total (Back ground + M.E. Ph 1&2)
  - 2010 Total (5 Years after Build-out)

- **298th Avenue – West of Highway 22**
  - 2010 Total (5 Years after Build-out)

HCS2000: Two-Lane Highways Release 4.1b

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Two-Way Two-Lane Highway Segment Analysis

Analyst	SB
Agency/Co.	Eagle Engineering Corp.
Date Performed	2/7/2003
Analysis Time Period	DHV with K=0.15
Highway	Highway 22:12
From/To	S. of 298th Ave
Jurisdiction	Alberta Transportation
Analysis Year	2003 Background
Description	Millarville Estates

Input Data

Highway class	Class 1				
Shoulder width	3.0	m	Peak-hour factor, PHF	0.88	
Lane width	3.7	m	% Trucks and buses	6	%
Segment length	0.2	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	25	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 522 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.944	
Two-way flow rate,(note-1) vp	675	pc/h
Highest directional split proportion (note-2)	405	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	0.0	km/h
Adj. for access points, fA	1.3	km/h
Free-flow speed, FFS	98.7	km/h
Adjustment for no-passing zones, fnp	2.7	km/h
Average travel speed, ATS	87.6	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.971	
Two-way flow rate,(note-1) vp	650	pc/h
Highest directional split proportion (note-2)	390	
Base percent time-spent-following, BPTSF	43.5	%
Adj.for directional distribution and no-passing zones, fd/np	11.4	
Percent time-spent-following, PTSF	54.9	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-kilometers of travel, VkmT15	30	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	104	veh-km
Peak 15-min total travel time, TT15	0.3	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1b

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Two-Way Two-Lane Highway Segment Analysis

Analyst	SB
Agency/Co.	Eagle Engineering Corp.
Date Performed	2/7/2003
Analysis Time Period	DHV with K=0.15
Highway	Highway 22:12
From/To	S. of 298th Ave
Jurisdiction	Alberta Transportation
Analysis Year	2003 w/ Phase 1
Description	Millarville Estates

Input Data

Highway class	Class 1				
Shoulder width	3.0	m	Peak-hour factor, PHF	0.88	
Lane width	3.7	m	% Trucks and buses	6	%
Segment length	0.2	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	25	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 526 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.944	
Two-way flow rate,(note-1) vp	681	pc/h
Highest directional split proportion (note-2)	409	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	0.0	km/h
Adj. for access points, fA	1.3	km/h
Free-flow speed, FFS	98.7	km/h
Adjustment for no-passing zones, fnp	2.7	km/h
Average travel speed, ATS	87.5	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.971	
Two-way flow rate,(note-1) vp	655	pc/h
Highest directional split proportion (note-2)	393	
Base percent time-spent-following, BPTSF	43.8	%
Adj.for directional distribution and no-passing zones, fd/np	11.3	
Percent time-spent-following, PTSF	55.1	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.21	
Peak 15-min vehicle-kilometers of travel, VkmT15	30	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	105	veh-km
Peak 15-min total travel time, TT15	0.3	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1b

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Two-Way Two-Lane Highway Segment Analysis

Analyst	SB
Agency/Co.	Eagle Engineering Corp.
Date Performed	2/7/2003
Analysis Time Period	DHV with K=0.15
Highway	Highway 22:12
From/To	S. of 298th Ave
Jurisdiction	Alberta Transportation
Analysis Year	2005 Total
Description	Millarville Estates

Input Data

Highway class	Class 1				
Shoulder width	3.0	m	Peak-hour factor, PHF	0.88	
Lane width	3.7	m	% Trucks and buses	6	%
Segment length	0.2	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	25	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 585 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.944	
Two-way flow rate,(note-1) vp	757	pc/h
Highest directional split proportion (note-2)	454	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	0.0	km/h
Adj. for access points, fA	1.3	km/h
Free-flow speed, FFS	98.7	km/h
Adjustment for no-passing zones, fnp	2.5	km/h
Average travel speed, ATS	86.7	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.971	
Two-way flow rate,(note-1) vp	728	pc/h
Highest directional split proportion (note-2)	437	
Base percent time-spent-following, BPTSF	47.3	%
Adj.for directional distribution and no-passing zones, fd/np	9.8	
Percent time-spent-following, PTSF	57.0	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.24	
Peak 15-min vehicle-kilometers of travel, VkmT15	33	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	117	veh-km
Peak 15-min total travel time, TT15	0.4	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1b

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Two-Way Two-Lane Highway Segment Analysis

Analyst	SB
Agency/Co.	Eagle Engineering Corp.
Date Performed	2/7/2003
Analysis Time Period	DHV with K=0.15
Highway	Highway 22:12
From/To	S. of 298th Ave
Jurisdiction	Alberta Transportation
Analysis Year	2010 Total
Description	Millarville Estates

Input Data

Highway class	Class 1				
Shoulder width	3.0	m	Peak-hour factor, PHF	0.88	
Lane width	3.7	m	% Trucks and buses	6	%
Segment length	0.2	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	25	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V	716	veh/h	
Directional split	60 / 40	%	

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.944	
Two-way flow rate,(note-1) vp	926	pc/h
Highest directional split proportion (note-2)	556	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	0.0	km/h
Adj. for access points, fA	1.3	km/h
Free-flow speed, FFS	98.7	km/h
Adjustment for no-passing zones, fnp	2.1	km/h
Average travel speed, ATS	85.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.971	
Two-way flow rate,(note-1) vp	892	pc/h
Highest directional split proportion (note-2)	535	
Base percent time-spent-following, BPTSF	54.3	%
Adj.for directional distribution and no-passing zones, fd/np	7.6	
Percent time-spent-following, PTSF	62.0	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.29	
Peak 15-min vehicle-kilometers of travel, VkmT15	41	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	143	veh-km
Peak 15-min total travel time, TT15	0.5	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Two-Lane Highways Release 4.1b

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Two-Way Two-Lane Highway Segment Analysis

Analyst	SB
Agency/Co.	Eagle Engineering Corp.
Date Performed	2/7/2003
Analysis Time Period	DHV with K=0.15
Highway	298th Avenue
From/To	E. of Highway 22
Jurisdiction	Alberta Transportation
Analysis Year	2010 Total
Description	Millarville Estates

Input Data

Highway class	Class 2				
Shoulder width	0.1	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	6	%
Segment length	3.2	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	50	%
Grade: Length		km	Access points/km	4	/km
Up/down		%			

Two-way hourly volume, V	66	veh/h	
Directional split	65 / 35	%	

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.913	
Two-way flow rate,(note-1) vp	116	pc/h
Highest directional split proportion (note-2)	75	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	7.5	km/h
Adj. for access points, fA	2.7	km/h
Free-flow speed, FFS	89.8	km/h
Adjustment for no-passing zones, fnp	1.8	km/h
Average travel speed, ATS	86.6	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.954	
Two-way flow rate,(note-1) vp	102	pc/h
Highest directional split proportion (note-2)	66	
Base percent time-spent-following, BPTSF	8.6	%
Adj.for directional distribution and no-passing zones, fd/np	18.2	
Percent time-spent-following, PTSF	26.7	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.04	
Peak 15-min vehicle-kilometers of travel, VkmT15	60	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	211	veh-km
Peak 15-min total travel time, TT15	0.7	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS2000: Unsignalized Intersections Release 4.1b

TWO-WAY STOP CONTROL SUMMARY

Analyst: SB
Agency/Co.: Eagle Engineering Corp.
Date Performed: 2/6/2003
Analysis Time Period: p.m. Peak Hour
Intersection: Highway 22 & 298th Ave
Jurisdiction: MD of Foothills
Units: U. S. Metric
Analysis Year: 2003 BG
Project ID: Millarville Estates
East/West Street: 298th Avenue
North/South Street: Highway 22
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	11	233			303	16
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	12	258			336	17
Percent Heavy Vehicles	0	--	--		--	--
Median Type	Undivided					
RT Channelized?						No
Lanes	1	1			1	1
Configuration	L	T			T	R
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				8		13
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				8		14
Percent Heavy Vehicles				0		0
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?					No	
Storage						
RT Channelized?						
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	12						22	
C(m) (vph)	1217						588	
v/c	0.01						0.04	
95% queue length	0.03						0.12	
Control Delay	8.0						11.4	
LOS	A						B	
Approach Delay							11.4	
Approach LOS							B	

Unsignalized Intersection Analysis

Highway 22 & 298thAvenue

- 2003 Background (a.m. & p.m. Peak Hour)
- 2003 Total (a.m. & p.m. Peak Hour)
- 2008 Total (a.m. & p.m. Peak Hour)

298th Avenue & Millarville Estates Subdivision Road

- 2008 Total (p.m. Peak Hour)

HCS2000: Unsignalized Intersections Release 4.1b

TWO-WAY STOP CONTROL SUMMARY

Analyst: SB
Agency/Co.: Eagle Engineering Corp.
Date Performed: 2/6/2003
Analysis Time Period: p.m. Peak Hour
Intersection: Highway 22 & 298th Ave
Jurisdiction: MD of Foothills
Units: U. S. Metric
Analysis Year: 2003 Ph1
Project ID: Millarville Estates
East/West Street: 298th Avenue
North/South Street: Highway 22
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	13	233			303	19
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	14	258			336	21
Percent Heavy Vehicles	0	--	--		--	--
Median Type	Undivided					
RT Channelized?						No
Lanes	1	1			1	1
Configuration	L	T			T	R
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				9		15
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				10		16
Percent Heavy Vehicles				0		0
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?					No	
Storage						
RT Channelized?						
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	14						26	
C(m) (vph)	1213						581	
v/c	0.01						0.04	
95% queue length	0.04						0.14	
Control Delay	8.0						11.5	
LOS	A						B	
Approach Delay							11.5	
Approach LOS							B	

HCS2000: Unsignalized Intersections Release 4.1b

TWO-WAY STOP CONTROL SUMMARY

Analyst: SB
Agency/Co.: Eagle Engineering Corp.
Date Performed: 2/6/2003
Analysis Time Period: p.m. Peak Hour
Intersection: Highway 22 & 298th Ave
Jurisdiction: MD of Foothills
Units: U. S. Metric
Analysis Year: 2005 Ph1&2
Project ID: Millarville Estates
East/West Street: 298th Avenue
North/South Street: Highway 22
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	15	256			333	21
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	16	284			370	23
Percent Heavy Vehicles	0	--	--		--	--
Median Type	Undivided					
RT Channelized?						No
Lanes	1	1			1	1
Configuration	L	T			T	R
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		16
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				11		17
Percent Heavy Vehicles				0		0
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?					No	
Storage						
RT Channelized?						
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	16						28	
C(m) (vph)	1177						540	
v/c	0.01						0.05	
95% queue length	0.04						0.16	
Control Delay	8.1						12.0	
LOS	A						B	
Approach Delay							12.0	
Approach LOS							B	

HCS2000: Unsignalized Intersections Release 4.1b

TWO-WAY STOP CONTROL SUMMARY

Analyst: SB
Agency/Co.: Eagle Engineering Corp.
Date Performed: 2/6/2003
Analysis Time Period: p.m. Peak Hour
Intersection: Highway 22 & 298th Ave
Jurisdiction: MD of Foothills
Units: U. S. Metric
Analysis Year: 2010 Ph1&2
Project ID: Millarville Estates
East/West Street: 298th Avenue
North/South Street: Highway 22
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	18	315			409	26
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	20	350			454	28
Percent Heavy Vehicles	0	--	--		--	--
Median Type	Undivided					
RT Channelized?						No
Lanes	1	1			1	1
Configuration	L	T			T	R
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				12		19
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				13		21
Percent Heavy Vehicles				0		0
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?					No	
Storage						
RT Channelized?						
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	20						34	
C(m) (vph)	1091						461	
v/c	0.02						0.07	
95% queue length	0.06						0.24	
Control Delay	8.4						13.4	
LOS	A						B	
Approach Delay							13.4	
Approach LOS							B	

HCS2000: Unsignalized Intersections Release 4.1b

TWO-WAY STOP CONTROL SUMMARY

Analyst: SB
Agency/Co.: Eagle Engineering Corp.
Date Performed: 2/6/2003
Analysis Time Period: p.m. Peak Hour
Intersection: 298th Av & Millarville Est. Rd
Jurisdiction: MD of Foothills
Units: U. S. Metric
Analysis Year: 2010 Ph1&2
Project ID: Millarville Estates
East/West Street: 298th Avenue
North/South Street: Millarville Est. Road
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		25	1	13	31	
Peak-Hour Factor, PHF		0.90	0.90	0.90	0.90	
Hourly Flow Rate, HFR		27	1	14	34	
Percent Heavy Vehicles		--	--	0	--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR		LT	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	1		7			
Peak Hour Factor, PHF	0.90		0.90			
Hourly Flow Rate, HFR	1		7			
Percent Heavy Vehicles	0		0			
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?		No				
Storage						
RT Channelized?						
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		14		8				
C(m) (vph)		1599		1032				
v/c		0.01		0.01				
95% queue length		0.03		0.02				
Control Delay		7.3		8.5				
LOS		A		A				
Approach Delay				8.5				
Approach LOS				A				

APPENDIX C

Glossary

Level of Service Descriptions

Technical References

GLOSSARY

Definitions & Acronyms

AADT: Average Annual Daily Traffic, the total number of vehicles passing a given point in a year divided by the number of days in the year.

ASDT: Average Seasonal Daily Traffic (usually summer).

Channelization: The separation or regulation of conflicting traffic movement into definite paths of travel by the use of pavement markings, raised islands, or other suitable means, to facilitate the safe and orderly movement of both vehicles and pedestrians.

Chevron signs: A chevron symbol (sideways "V") in black, against standard yellow background, on a vertical rectangle. Used as an alternate or supplement to standard delineators and to large arrow signs.

Clear distance: The distance between the edge of a travel way and a fixed object.

Complete interchange lighting: Includes lighting in the interchange area on both the acceleration and deceleration areas plus the ramps through the terminus.

Delineator/guidepost: A reflecting device installed at the side of a roadway, in series, to indicate changes in roadway alignment, including work zones, curves and corners, for drivers, especially at night. This can be accomplished through a variety of traffic control devices, including post-mounted delineators, pavement markings (both in the centre and at the edge of roadways), chevron alignment and other signs, lighted guidance tubes, and reflective devices placed on barriers and guardrails.

Delineation lighting: one or two luminaires placed at an intersection to assist motorists in identifying its location.

Divided highway: Roadway that is separated by a median

Full illumination: the illumination of all legs of an intersection.

Grade: A measure of the steepness of a roadway, bikeway or walkway, expressed in a ratio of vertical rise per horizontal distance, usually in percent; e.g. a 5% grade equals 5 m of rise over a 100 m horizontal distance.

HGDG: Highway Geometric Design Guide (Alberta Infrastructure, 1999)

Luminaire: complete lighting unit consisting of a lamp or lamps, the optical system for the control of light distribution, and components for light positioning and power supply.

MUTCD: The "Manual on Uniform Traffic Control Devices," approved by the Federal Highway Administration as a national standard for placement and selection of all traffic control devices on or adjacent to all highways open to public travel.

Partial illumination: the illumination of the major legs of an intersection.

Partial interchange lighting: Lighting on an interchange that consists of a few luminaires located in the general areas where entrance and exit ramps connect with the through traffic lanes of a freeway (between the entry gore and the end of the acceleration ramp or exit gore and the beginning of the deceleration ramp).

Pavement markings: Painted or applied lines or legends placed on a roadway surface for regulating, guiding or warning traffic.

Pedestrian: A person on foot, in a wheelchair or walking a bicycle.

Retroreflection: occurs when surfaces return a large portion of an incoming light beam to its source. This is why retroreflective materials appear brightest to observers located near the light source - for example, a driver and the vehicle headlights. Retroreflective surfaces are excellent for use on devices to improve nighttime visibility for drivers.

Sight distance: is the distance that a driver needs to react appropriately to a situation. Three types are commonly used in traffic engineering: stopping sight distance, passing sight distance, and intersection sight distance. A fourth - decision sight distance is often used to provide added distance in potentially hazardous or confusing situations.

Skew angle: The angle formed between a roadway, bikeway or walkway and an intersecting roadway, bikeway, walkway or railway, measured away from the perpendicular.

TAC: Transportation Association of Canada

Traffic control devices (TCD): are all signs, signals, pavement markings, and devices placed on, over, or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn or guide traffic.

LEVEL-OF-SERVICE DESCRIPTIONS

A qualitative measure describing traffic operational conditions and their perception by drivers is needed to assess the degree of congestion on a highway facility. Such a measure is referred to as a *level of service* and is intended to capture factors such as speed and travel time, freedom to manoeuvre, and safety. Current practice designates level of service ranging from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst. The *Highway Capacity Manual* [Transportation Research Board 1985] defines level of service for freeways (LOS) as follows:

Level-of-Service A LOS A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist or passenger is excellent.

Level-of-Service B LOS B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to manoeuvre within the traffic stream form LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behaviour.

Level-of-Service C LOS C is in the range of stable flow but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by the interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and manoeuvring within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeable at this level.

Level-of-Service D LOS D represents high density, but stable, flow. Speed and freedom to manoeuvre are severely restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-Service E LOS E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform, value. Freedom to manoeuvre within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle to "give way" to accommodate such manoeuvres. Comfort and convenience levels are extremely poor, and driver frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns in flow.

Level-of-Service F LOS F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go traffic *waves,* and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in cyclic fashion. LOS F is used to describe the operating conditions within the queue, as well as the point of traffic flow breakdown. It should be noted, however, that in many cases operating conditions of vehicles discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge (or service flow) that causes the queue to form; LOS F is an appropriate designation for such points.

TECHNICAL REFERENCES

Alberta Transportation, *Highway Geometric Design Guide*, Departmental Geometric Design Standards Advisory Committee, Alberta Transportation and Utilities, Edmonton, Alberta, Canada, 1999

Transportation Association of Canada, *Manual of Uniform Traffic Control Devices For Canada, Fourth Edition*, Committee on Uniform Traffic Control, Transportation Association of Canada, Ottawa, Ontario, Canada, 1998

Transportation Research Board, *Highway Capacity Manual*, Special Report 209 Third Edition, National Research Council, Washington D.C., 1998

Municipal District of Foothills, *Road Construction Standards*, December 31, 1993

Appendix 4

Groundwater Supply Assessment

#03-107

Groundwater Supply Assessment
Millarville Country Estates
SW-14-21-03-W5M

Submitted to:

glb planning ltd and
Millarville Estates Ltd

Prepared by:

Groundwater Exploration & Research Ltd.
December 2003

Groundwater
Exploration & Research

Groundwater Exploration & Research LTD

Box 15
Balzac, AB. CANADA T0M 0E0
Phone (403) 226-0330: Fax (403) 226-6593: Email: nowakb@telus.net

December 22, 2003
File No: 03-107

glb planning ltd
610 5 Avenue NE
Calgary, AB.
T2E 0L2

Attention: Patrick Burke

RE: Proposed subdivision of the Millarville Estates Ltd property at SW-14-21-03-W5M: Municipal District of Foothills

Enclosed find our letter report which summarizes well completion details; includes a table of pump test data; a graph of the drawdown and recovery data from a field test conducted on the well; and makes a recommendation with respect to the calculated Q_{20} for a well at the above captioned location.

1.0 Background Information

The subject property is located approximately 0.8 km north of the Hamlet of Millarville. There are currently 9 parcels in the SW-14 quarter section, 6 of which are associated with the Lineham Estates subdivision in the northwest corner of the quarter section. The parent parcel is a +/-44.284 hectares [109.43 acres] with the intent to create up to 18 additional lots varying in size from +/-1.62 to 3.24 hectares (4 to 8 acres). A well test was conducted on an existing well. The development is expected to be completed in two phases, with Phase 1 consisting of 8 lots plus the existing parcel [Lot 1]; and Phase 2 consisting of 10 lots.

It is intended that the proposed subdivision be supplied by a groundwater source. Two options are possible – individual wells or a licensed communal well. For a concept of individual wells the water requirement is 61.56 m^3/day [9.4 Cgpm]. For a licensed communal well, the water requirement is 32.72 m^3/day [5.0 Cgpm].

2.0 Well Completion Details

Total Depth:		35.06 meters
Non-Pumping Water Level:		5.21 meters below top of casing
Surface Casing:		168 mm set to 10.98 meters
Liner:		127 mm PVC set from 4.57 to 35.06 meters; perforated from 28.96 to 35.06 meters
Drilling Contractor:		Blackwood Drilling Ltd.
Pump Test Contractor:		Blackwood Drilling Ltd
Date Drilled:		July 23, 2001
Lithology:	00.00 - 4.88	clay & rocks
	4.88 - 7.32	sandy clay & rocks
	7.32 - 8.54	gravel
	8.54 - 10.98	sandy clay & rocks
	10.98 - 17.68	shale
	17.68 - 19.51	sandstone
	19.51 - 20.73	shale
	20.73 - 21.04	sandstone
	21.04 - 22.56	shale
	22.56 - 23.17	sandstone
	23.17 - 24.70	shale
	24.70 - 28.66	sandstone
	28.66 - 31.10	shale
	31.10 - 32.62	sandstone
	32.62 - 35.06	shale

3.0 Well Test Results

The existing well was flow tested by Blackwood Drilling on November 7-8, 2003. The well was pumped at a rate of 81.82 m^3/day [12.5 Cgpm] for 720 minutes followed by 720 minutes of recovery. Water level measurements were recorded automatically using a pressure transducer and data logger supplied and installed by Blackwood Drilling Ltd.

The maximum drawdown was observed to be 10.18 meters during the 720 minute test at a pumping rate of 81.82 m^3/day [12.5 Cgpm]. After 720 minutes of termination of pumping, the water level in the well had recovered 93.6 percent.

The maximum available drawdown, measured from the non-pumping water level of 5.21 meters, and the top of the perforated interval at 28.96 meters is 23.75 meters.

Transmissive capacity has been determined graphically using the Cooper and Jacob semilog plot method, with transmissive capacity based usually on the final limb of the curve according to:

$$T = 2.3Q/4*pi*delta\ s$$

where: T = transmissive capacity, in m^2/day
Q = pump rate, in m^3/day
s = drawdown over one log cycle

and by the non-graphical Sheahan Z(u) and Kasenow-SAM methods.

Transmissive capacity, determined from the above methods is summarized as follows:

Stage	Delta s	Transmissivity
drawdown	1.64	9.14
residual drawdown	1.13	13.26
Sheahan Z(u)		7.13
Kasenow SAM		8.81

Based on the above methods of analysis, the geometric mean transmissive capacity is 9.34 m^2/day. It should be noted that the calculated transmissive capacity value is time dependent, flow rate dependent [particularly for fractured or stratified heterogeneous media] and reflects the response of an aquifer for the particular time of the year during which the test was conducted. Transmissive capacity is not a constant everywhere in an aquifer and is generally characterized by a log-normal distribution.

The 20 year, long term safe yield index (Q_{20}), neglecting well loss, is determined from the equation:

$$\mathbf{Q_{20} = 0.683TH}$$

where: Q20 = 20 year, long term safe yield, in m^3/day

T = effective transmissive capacity, in m^2/day

H = available drawdown, in meters

The calculation of the 20 year safe yield index for an aquifer, assuming isotropic, homogeneous conditions is derived by extrapolating a downward trend so that the available drawdown lasts for 20 years. This approach neglects the effects of recharge, and is, therefore, a conservative approach.

It is common practice to adjust the Q_{20} by a safety factor to account for unknown boundary conditions due to test duration, well deterioration, well inefficiency, seasonal variability in non-pumping water level and errors associated with assuming isotropic, homogeneous aquifer conditions.

Based on a factor of safety of 1.5 the calculated Q_{20} is 101.0 m^3/day (15.4 Cgpm). When the calculated Q_{20} exceeds the pump test rate, it is common practice to conservatively consider the Q_{20} as equal to the pump test rate, in this case 81.82 m^3/day [12.5 Cgpm].

In accordance with the Water Act, every household user is entitled to divert up to a maximum of 1250 cubic meters per year or 3.42 m^3/day. The test well indicates that the local aquifer is capable of supporting up to 24 lots on individual wells or 45 lots on a communal well scheme. The proposed subdivision is for 18 lots over two phases.

4.0 Pertinent Regulations

Country residential subdivision and groundwater supply is regulated by Section 21(2) and Section 23(3) of the Water Act and the Water Regulation stated as follows:

Section 21(2):

Subject to subsection (3) and section 23 and any exemptions specified in the regulations, a person who owns or occupies land under which groundwater exists

- **(a) has the right to commence and continue the diversion of the groundwater for household purposes, and**
- **(b) may not obtain a license for the diversion of the groundwater for household purposes.**

[note: As defined in the Water Act, "household purposes" means the use of a maximum of 1250 cubic meters of water per year per household for the purposes of human consumption, sanitation, fire protection and watering animals, gardens, lawns and trees].

Section 23(3):

If after this Act comes into force, a subdivision of land of a type or class of subdivision specified in the regulations is approved under the Municipal Government Act, a person residing within that subdivision on a parcel of land that adjoins or is above a source of water described in section 21 has the right to commence and continue the diversion of water under section 21 only if

(a) a report certified by a professional engineer, professional geologist, or professional geophysicist, as defined in the Engineering, Geological and Geophysical Professions Act, was submitted to the subdivision authority as part of the application for the subdivision under the Municipal Government Act, and the report states that the diversion of 1250 cubic meters of water per year for household purposes under section 21 for each of the households within the subdivision will not interfere with any household users, licensees, or traditional agriculture users who exist when subdivision is approved, and

(b) the diversion of water for each household within the subdivision under section 21 is not inconsistent with an applicable approved water management plan

Water Regulation [AR 205/98]:

9(1) Subject to subsection (2), a type of subdivision of land for the purposes of section 23(3) of the Act is a subdivision that results in 6 or more parcels in a quarter section or in a river lot.

5.0 Summary of Findings

Based on the results of the flow test and information from the drill log, the following conclusions have been drawn:

[1] The local aquifer has a transmissive capacity of 9.34 m^2/day.

[2] The calculated Q_{20} sustainable yield, determined from a 720 minute flow test was 101.0 m^3/day [15.4 Cgpm]. The calculated Q_{20} exceeded the flow test rate of 81.82 m^3/day [12.5 Cgpm]. The aquifer has a conservative flow capacity of 81.82 m^3/day which is equal to the flow test rate.

[3] The well and local aquifer is capable of supporting up to 24 lots in accordance with the Water Act allocation of 1250 m^3/year per parcel for household purposes; or 45 lots for a licensed communal well concept.

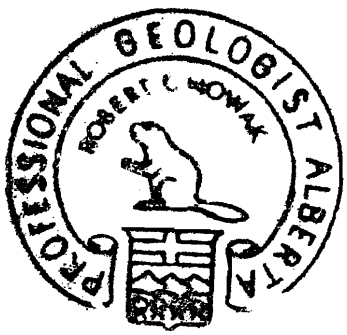
[4] Once subdivision is approved, it will be necessary to drill and flow test a well on each of the proposed lots, to confirm water availability in accordance with the Water Act.

[5] It is suggested that one well be drilled on one of the Phase 2 lots and maintained as an observation well until after completion of Phase 1. This will provide a means of determining if regional groundwater impact is occurring as a result of increased country residential development.

6.0 Closure

A chemical analysis of the well water was not undertaken at the time of the flow test. In accordance with Alberta Environment document Interim Guidelines For The Evaluation of Groundwater Supply For Unserviced Residential Subdivisions Using Privately Owned Domestic Water Wells (June 27, 1994) chemical and bacteriological analysis of the well water should be undertaken to ensure that the proposed water supply meets Health Canada guidelines.

If you have any questions or comments regarding the conclusions drawn in this groundwater supply assessment, contact the undersigned at your convenience.



Respectfully yours,
Groundwater Exploration & Research Ltd.

Bob Nowak

Bob Nowak: Ph.D., P.Geol.
Groundwater Geologist

PERMIT TO PRACTICE
Groundwater Exploration & Research Ltd.
Signature B. Nowak
Date Dec 31/03
PERMIT NUMBER: P 3471
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

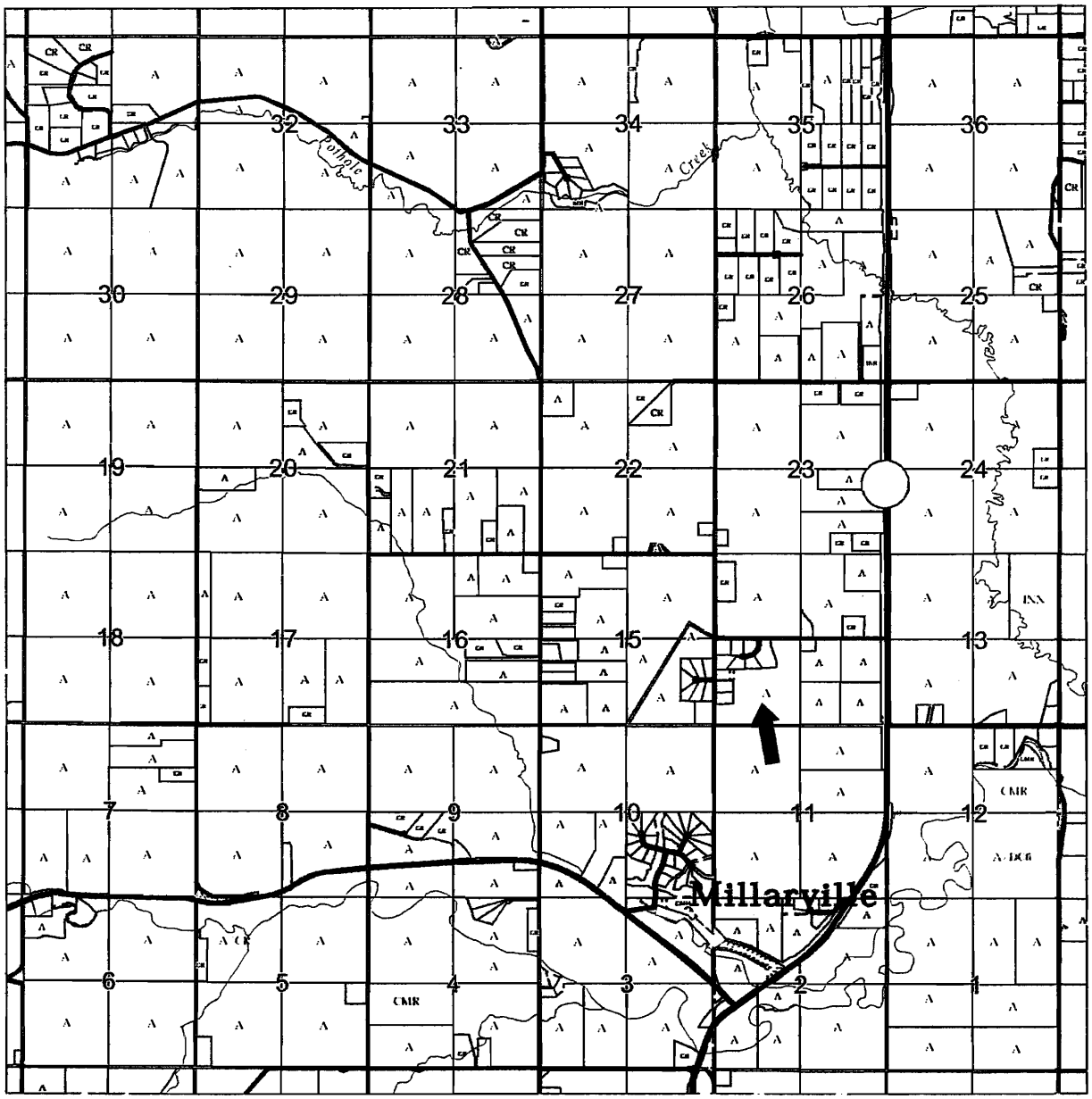
Appendix

Groundwater

Exploration & Research

LAND USE MAP No. 2103

(21-03-W5)

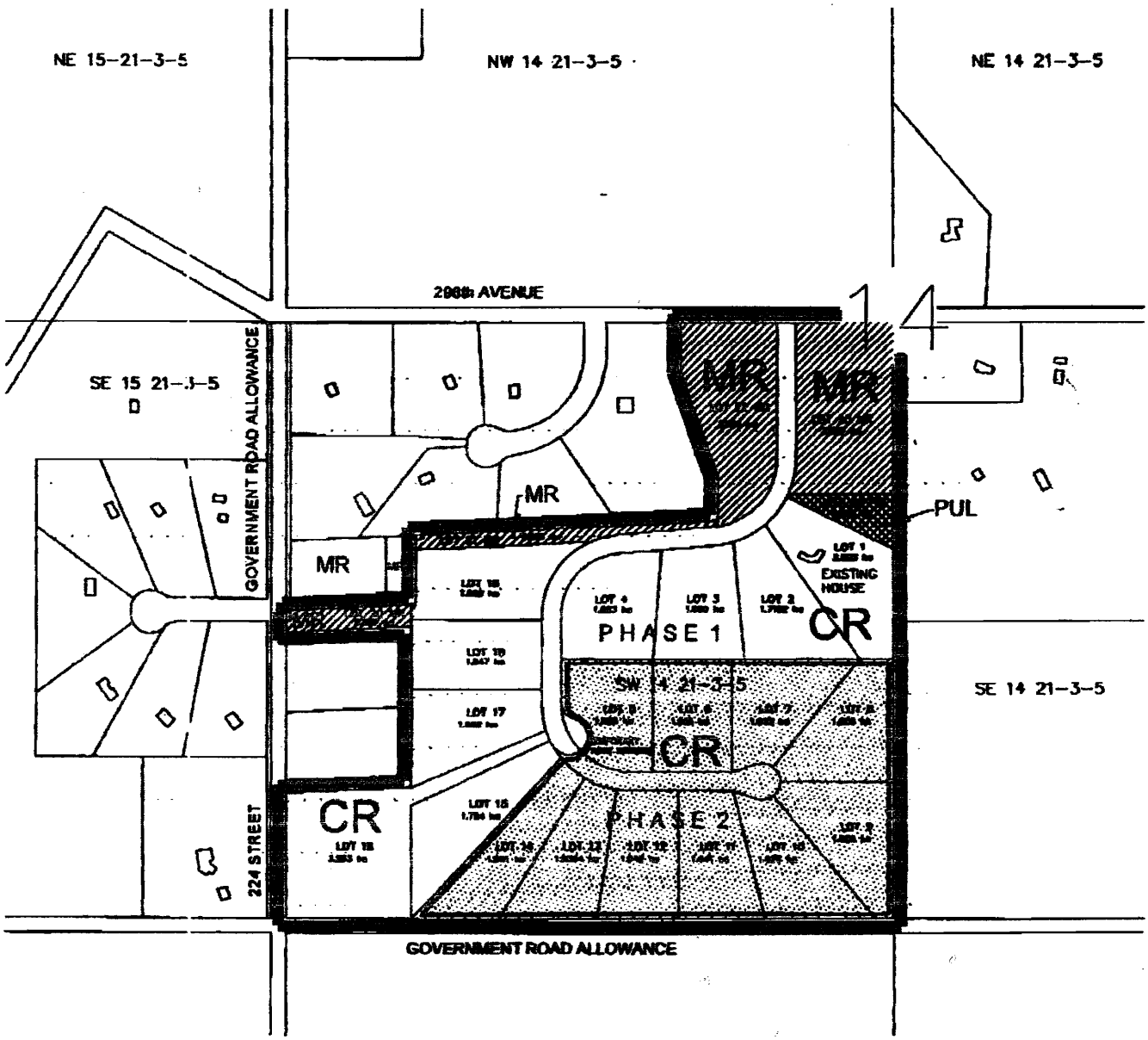


Scale 1:60,000

LEGEND

A	Agricultural
CMH	Commercial Hamlet
CMY	Commercial Highway
CMP	Commercial Park
CMR	Commercial Rural
CR	Country Residential
CRA	Country Residential- Subdistrict A
DC1	Direct Control - Spruce Meadows
DC2	Direct Control - Aldersyde Industrial
DC3	Direct Control - Smed
DC4	Direct Control - Private Airport
DC5	Direct Control - Airport
DC6	Direct Control - Gravel Pit
DC7	Direct Control - Silver Tip Ranch Commercial
DC8	Direct Control - Telecommunications Tower
DC9	Direct Control - Nature's Hideaway Campground
DC10	Direct Control - Paradise Ranch Resort
EP	Environmental Protection
ER	Environmental Reserve
INH	Industrial - Hamlet
INN	Industrial - Natural Resources
INP	Industrial - Park
INR	Industrial - Rural
MR	Municipal Reserve
R	Residential
RA	Residential- Subdistrict A
REC	Recreation
	Multiple Land Use (ie. A/CR)

Map Date: Nov 26, 2003



A.S.P. BOUNDARY

PHASE 2 BOUNDARY

CR COUNTRY RESIDENTIAL

MR MUNICIPAL RESERVE

PUBLIC UTILITY LOT

N

LAND USE REDESIGNATION

FROM A TO CR	*36.919 ha*
FROM A TO MR	*6.829 ha*
FROM A TO PUL	*0.536 ha*
	44.284 ha

FIGURE 6:

LAND USE PLAN

NOT TO SCALE

MILLARVILLE COUNTRY ESTATES

DECEMBER 2003

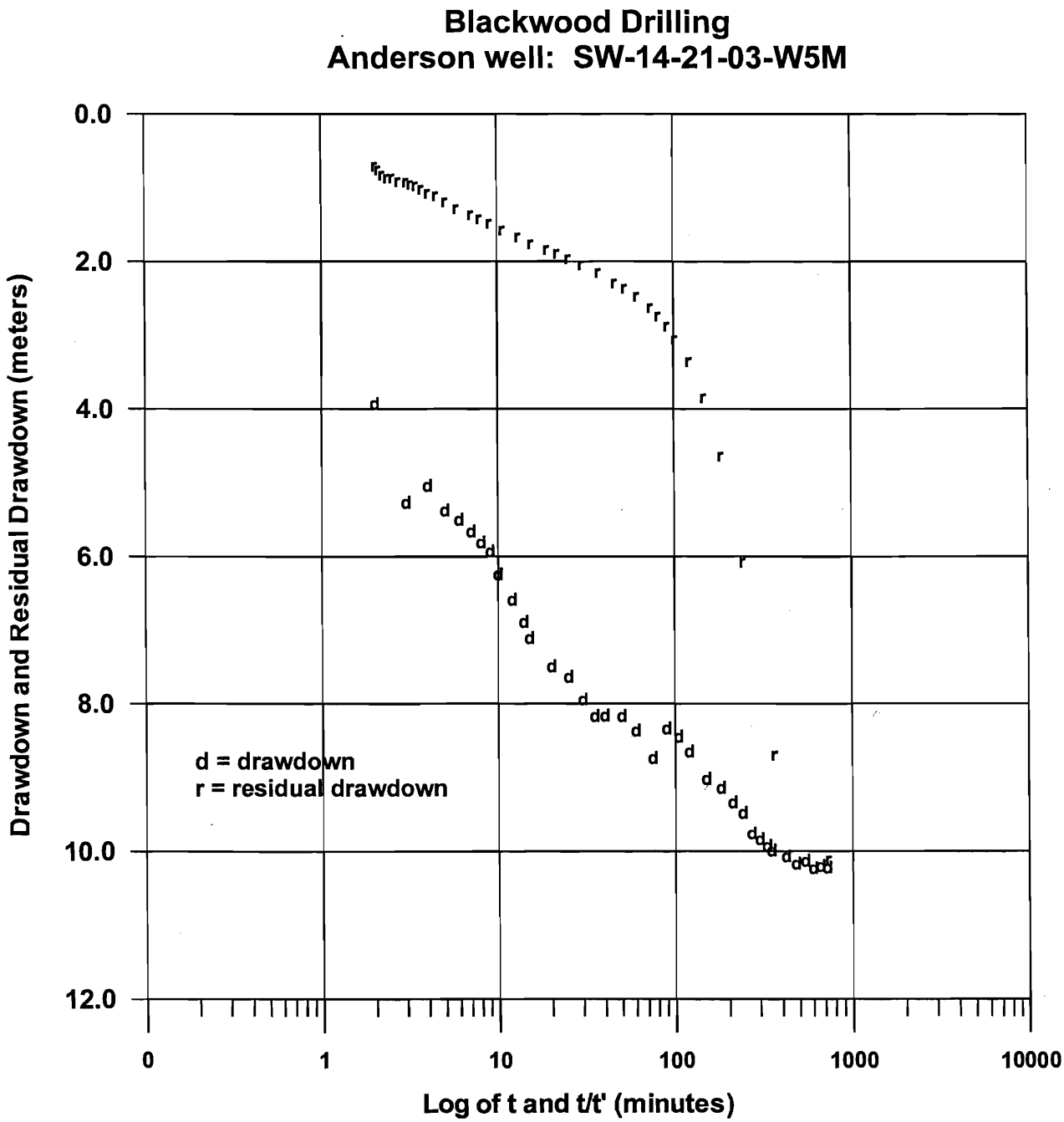
Pump Test Data
SW-14-21-03-W5M

Project: Millarville Estates Ltd well
Date: November 7-8, 2003 ,
Non-Pumping Water Level: 5.21 meters, below top of casing
Pump Test Rate: 81.82 m^3/day (12.5 Cgpm)
Test Duration: 720 + 720 minutes

Elapsed Time t (min)	Drawdown (m)	Elapsed Time t/t' (min)	Residual Drawdown (m)
1		721	10.06
2	3.88	361	8.64
3	5.22	241	6.02
4	5.00	181	4.59
5	5.33	145	3.79
6	5.46	121	3.30
7	5.61	103.9	3.00
8	5.76	91	2.82
9	5.88	81	2.68
10	6.19	73	2.57
12	6.54	61	2.42
14	6.84	52.4	2.31
16	7.06	46	2.24
20	7.44	37	2.10
25	7.59	29.8	1.99
30	7.90	25	1.91
35	8.12	21.6	1.84
40	8.12	19	1.78
50	8.12	15.4	1.71
60	8.32	13	1.62
75	8.69	10.6	1.52
90	8.29	9	1.43
105	8.40	7.9	1.37
120	8.60	7	1.31
150	8.97	5.8	1.23
180	9.09	5	1.14
210	9.29	4.4	1.05
240	9.43	4	1.02
270	9.71	3.7	0.96

Pump Test Data (continued)
SW-14-21-03-W5M

Elapsed Time t (min)	Drawdown (m)	Elapsed Time t/t' (min)	Residual Drawdown (m)
300	9.79	3.4	0.92
330	9.88	3.2	0.90
360	9.94	3	0.87
420	10.02	2.71	0.86
480	10.12	2.5	0.81
540	10.08	2.33	0.81
600	10.18	2.2	0.77
660	10.15	2.09	0.70
720	10.17	2	0.65


Blackwood Drilling
Anderson well: SW-14-21-03-W5M
Drawdown and Residual Drawdown (meters)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
d = drawdown
r = residual drawdown
0
1
10
100
1000
10000
Log of t and t/t' (minutes)

BLACKWOOD DRILLING
P.O. BOX 53
De WINTON, ALBERTA
TOL OXO (403) 938-7582

PUMPING TEST REPORT

Owner: Millerville Estates

Date: nov7/03 **Type of Test:** 12+12 hour **Location:** Jerry Kenny HouseWell

Duration of Test: 24 hr. **Static Level:** 5.21m **Draw Down:** 10.169m

Start of Test: 0 **End of Test:** 26.036m

TIME	LEVEL	CHANGE	RECOVERY	CHANGE	TIME	LEVEL	CHANGE	RECOVERY	CHANGE
1	26.6822	#VALUE!	16.6247	0	450	16.6086	-0.059	25.8722	0.0429
2	22.804	-3.8782	18.0408	1.4161	480	16.5657	-0.0429	25.8722	0
3	21.4576	-1.3464	20.6638	2.623	510	16.6086	0.0429	25.8722	0
4	21.6883	0.2307	22.096	1.4322	540	16.6086	0	25.8722	0
5	21.3557	-0.3326	22.8952	0.7992	570	16.5389	-0.0697	25.8722	0
6	21.2216	-0.1341	23.3833	0.4881	600	16.5013	-0.0376	25.9151	0.0429
7	21.0714	-0.1502	23.6891	0.3058	630	16.7212	0.2199	25.955	0.0399
8	20.9212	-0.1502	23.8607	0.1716	660	16.5389	-0.1823	25.987	0.032
9	20.8032	-0.118	24.0056	0.1449	690	16.5228	-0.0161	26.013	0.026
10	20.4921	-0.3111	24.1182	0.1126	720	16.5132	-0.0096	26.036	0.023
12	20.1488	-0.3433	24.2684	0.1502	750	0	-16.5132	0	-26.036
14	19.8484	-0.3004	24.3757	0.1073	780	0	0	0	0
16	19.6285	-0.2199	24.4454	0.0697	810	0	0	0	0
20	19.2423	-0.3862	24.5849	0.1395	840	0	0	0	0
25	19.0921	-0.1502	24.6921	0.1072	870	0	0	0	0
30	18.781	-0.3111	24.7726	0.0805	900	0	0	0	0
35	18.5611	-0.2199	24.8423	0.0697	930	0	0	0	0
40	18.5611	0	24.9013	0.059	960	0	0	0	0
50	18.5611	0	24.9764	0.0751	990	0	0	0	0
60	18.368	-0.1931	25.0623	0.0859	1020	0	0	0	0
75	17.9979	-0.3701	25.1642	0.1019	1050	0	0	0	0
90	18.3894	0.3915	25.25	0.0858	1080	0	0	0	0
105	18.2875	-0.1019	25.3197	0.0697	1110	0	0	0	0
120	18.089	-0.1985	25.3787	0.059	1140	0	0	0	0
150	17.7189	-0.3701	25.4592	0.0805	1170	0	0	0	0
180	17.5956	-0.1233	25.545	0.0858	1200	0	0	0	0
210	17.3971	-0.1985	25.6308	0.0858	1230	0	0	0	0
240	17.2523	-0.1448	25.663	0.0322	1260	0	0	0	0
270	16.9733	-0.279	25.722	0.059	1290	0	0	0	0
300	16.8962	-0.0751	25.7649	0.0429	1320	0	0	0	0
330	16.8017	-0.0965	25.7864	0.0215	1350	0	0	0	0
360	16.7427	-0.059	25.8132	0.0268	1380	0	0	0	0
390	16.7105	-0.0322	25.8293	0.0161	1410	0	0	0	0
420	16.6676	-0.0429	25.8293	0	1440	0	0	0	0

Comments: This well was pumped at thr Rate of 12.5 gpm, This Data logger measore Water Coloum. Static was measured by Tape.

Alberta Water Well Drilling Report

ENVIRONMENTAL PROTECTION

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:
Map verified:
Date report received:

Contractor and Well Owner Information

Company Name: Blackwood Drilling LTD
Licence No.: 82348-A
Address: PO Box 53
City or Town: DeWinton AB
Postal Code: T0L 0X0
Owner's Name: ULLYSSES GROUP LTD c/o Jerry Kenny
Well Owner has a copy of this report: Yes / No
Address: 306 SUNVISTA ... SE CALGARY AB
Postal Code: T2X3G6

Well Location

1/4 or LSD	Sec	Twp	Rge
SW	19	21	3

Well Information

Type of Work: Testhole / [X] New Well / Reconditioned / Deepened / Reclaimed well / Date reclaimed
Materials Used: Cement / Bentonite Product / Other
Proposed well use: [X] Domestic / Non-Domestic / Specify
Method of Drilling: Auger / Boring / Cable tool / [X] Rotary / Combination / Backhoe / Other
Anticipated water requirements per day: 750 gallons

Formation Log

Depth from ground level (ft)	Lithology Description
1	Top Soil
16	Clay + Rocks
24	Silty Clay + Rocks
28	Gravel
36	Sandy Clay + Rocks
58	SH
61	SS
66	SH
69	SS
74	SH
76	SS
81	SH
94	SS
101	SH
107	SS
115	SH

Geophysical Log taken: Electric / Gamma
Did you encounter: Mineralized water more than 4000 ppm TDS / Gas
Depth:
Remedial action taken:

Well Completion

Date Started: 01 7 20
Date Completion: 01 7 23
Are measurements in metric or imperial
Well depth: 115'
Borehole diameter: 8 3/4
Casing type: Steel
Liner type: PVC
Size OD: 6 5/8
Size OD: 5"
Wall thickness: .188
Wall thickness: .255
Bottom at: 38'
Top: 15 Bottom: 115
Perforations from: 95' to: 115
from: to:
Perforation size: 1/8 x 6"
Perforated by: [X] Saw / Torch / Machine / Other
Seal: Bentonite product / [X] Driven / Cement / Grout / Other
Sealed interval from: 28' to: 38'
Screen type: Size OD:
Intervals from: to: slot size:
from: to: slot size:
Installation: Attached to casing / Telescoped
Fittings: Top: Packer / [X] Coupler Bottom: Wash-down / Bail / Plug
Pack: Artificial/Mechanical / [X] Natural
Grain size: Amount:

Contractor Certification

Driller's Name: Scott Blackwood
Certification No.: 37697A

This well was constructed in accordance with the Water Well Regulation of the Alberta Environmental Protection and Enhancement Act. All information in this report is true.

Signature: [signature] Date: 10/..

Well Yield

Test Date: 01 8 ..
Test method: [X] Pump / Bailer / Air
Are measurements in metric or imperial
Non pumping static water level: 4.55
Rate of water removal: 10 gpm
Depth of pump intake: 110'
Water level at end of test: 18...
Distance from top of casing to ground level: 1.5

Depth to water level

Pumping	Elapsed Time minutes	Recovery
	0	
8.06	1	[illegible]
9.87	2	[illegible]
11.17	3	[illegible]
12.10	4	[illegible]
12.71	5	[illegible]
13.17	6	[illegible]
13.56	7	[illegible]
13.68	8	
13.91	9	
14.10	10	
14.33	12	
14.53	14	[illegible]
14.70	16	
14.88	20	
15.04	25	
15.16	30	
15.28	35	
15.40	40	
15.59	50	
15.65	60	
16.03	75	
17.01	90	
17.22	105	
17.40	120	

Total Drawdown: 12.85
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 10
Recommended pump intake: 110
Pump installed: Yes Depth:
Type:
Any further pumptest information?

White copy - Environmental Protection; Yellow copy - Well Owner; Pink copy - Contractor

Appendix 5

Soil Percolation & Near Surface Water Table Testing

McINTOSH • LALANI ENGINEERING LTD.

December 4, 2002

glb Planning Ltd.
Unit 113, 2860 Pegasus Road N.E.
Calgary, Alberta
T2E 3G8

M•L 1668

Attention: Mr. Patrick Burke

Dear Sir:

Subject: Soil Percolation and Near Surface Water Table Testing
Millarville Country Residential Subdivisions - S.W. ¼ 14-21-3-W5M
M.D. of Foothills

This letter serves to present the results of the percolation testing and near surface groundwater testing completed by McIntosh•Lalani Engineering Ltd. (M•L) at the above noted site. The site is approximately 110 acres of land situated within the S.W. 14-21-3-W5M within the M.D. of Foothills. The property is proposed to be subdivided into approximately 21 lots. This property is situated just north of the Town of Millarville ½ mile to the west of Highway 22 on the south side of 298th Avenue.

The percolation testing was completed on December 3 and 4th, 2002, to determine the suitability of the in situ site soils to be used for a septic fields. As well, adjacent to the percolation testholes locations, at a minimum distance of 3.0 m, a near surface groundwater well was installed to a depth of 3.0 m below the existing ground surface to determine if shallow groundwater exists. The locations of the percolation testholes and near surface groundwater wells were selected by representatives of M•L and are presented on the attached Figure No. 1. The percolation and near surface groundwater testing was completed in accordance with the Alberta Environmental Protection guidelines.

Soil Stratigraphy

The soils encountered in the percolation testholes and near surface groundwater testholes were consistent. A surficial layer of topsoil with an approximate average thickness of 200 mm was encountered which is underlain by silty clay to 3.0 metre depth. One location, Borehole No. 1 encountered a siltstone bedrock at a depth of 1.5 metres depth.

Percolation Test Method

The percolation rates test method was carried as per the test procedures outlines in the Alberta Environmental Protection (AEP) guidelines and are briefly summarized herein:

- A 200 mm (8 inch) diameter hole is augered to a depth of 900 mm (35 inches).
- The bottom and sides of the testholes are scarified to provide a natural soil interface into which the water may percolate.
- All loose material is removed from the hole.
- Placement of approximately 25 mm of gravel in the bottom to protect against the scouring action of added water.
- Initial soaking is undertaken by pouring clear water into the hole to the halfway mark (450 mm below ground surface) and maintained for a least 4 hours before conducting the percolation test.
- The percolation test is performed as follows:
  - water is added until the 450 mm refill mark is reached.
  - the drop in water is measured and recorded after an interval of a least 30 minutes and the percolation rate is calculated.
  - the procedures are repeated until the percolation rates of three consecutive measurements are within 10 percent pf each other.

Percolation Testing

The average percolation test results range between 3.5 and 12.9 min/cm within the percolation testhole. The Alberta Environmental Protection's (AEP) guidelines for the acceptable range for percolation rate is 2.0 to 23.6 min/cm. The results of the testing completed by M•L within the percolation testhole indicates the percolation rates are within the AEP's acceptable range. The attached Table No. 1 presented the results of the percolation testing.

Near Surface Groundwater Table Testing

The AEP guidelines define a high groundwater table as any where the water table is within 1.8 metres of the ground surface during the frost free period up until the end of August, and within 2.4 metres of the ground surface during the remainder of the year.

Water levels were recorded on December 4, 2002 and were dry to a depth of the borehole at 3.0 m below the existing ground elevation. Table No. 2 presents the water level readings. These water levels should however be maintained is approximately 1 week time to allow adequate time for the potential groundwater to stabilize. These results will be forwarded.

We trust the enclosed meets with your present requirements. Should you have questions please contact our office.

Respectfully submitted,

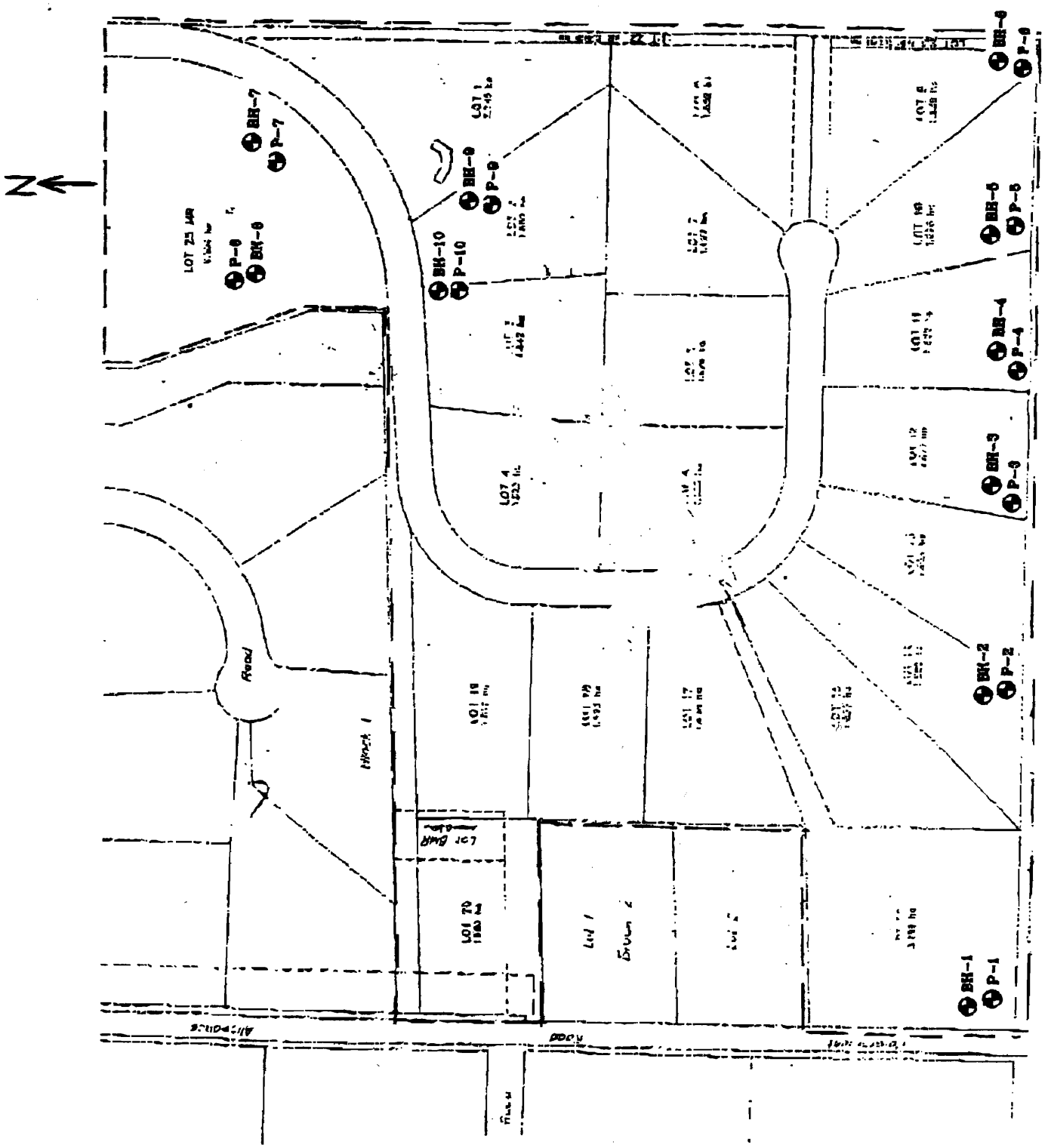
McIntosh•Lalani Engineering Ltd.

PROFESSIONAL ENGINEER ALBERTA NAZIM S. LALANI

Marty D. Ward, P.Eng.
Project Engineer
/clc

Nazim S. Lalani, P.Eng.
Senior Project Engineer

PERMIT TO PRACTICE
McINTOSH LALANI ENGINEERING LTD.
Signature
Date
PERMIT NUMBER: P 6482
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



glb Planning Ltd.	McIntosh Lalani Engineering Ltd.			
Millerville Country Residential – SW14-21-3-W5M				
Borehole and Percolation Test Locations	Scale: N.T.S.	Date: Dec 5, 2002	Job: ML-1668	Figure: Figure No. 1

TABLE NO. 1

PERCOLATION TEST RESULTS

Testhole No.	Trial No. 1 (min/cm)	Trial No. 2 (min/cm)	Trial No. 3 (min/cm)	Average (min/cm)
P-1	9.2	9.3	8.8	9.1
P-2	3.5	3.7	4.0	3.7
P-3	8.0	7.8	7.8	7.9
P-4	4.8	4.7	4.8	4.8
P-5	13.4	12.3	12.9	12.9
P-6	9.0	9.2	10.0	9.4
P-7	3.7	3.6	3.2	3.5
P-8	10.0	9.6	9.0	9.5
P-9	8.2	8.0	7.5	7.9
P-10	10.0	9.4	10.2	9.9

TABLE NO. 2

GROUNDWATER LEVELS

Borehole No.	Water Level on December 4, 2002
BH-1	Dry to 3.0 m
BH-2	Dry to 3.0 m
BH-3	Dry to 3.0 m
BH-4	Dry to 3.0 m
BH-5	Dry to 3.0 m
BH-6	Dry to 3.0 m
BH-7	Dry to 3.0 m
BH-8	Dry to 3.0 m
BH-9	Dry to 3.0 m
BH-10	Dry to 3.0 m

Appendix 6

Geotechnical Evaluation Report

McINTOSH • LALANI ENGINEERING LTD.

December 4, 2002

glb Planning Ltd.
Unit 113, 2860 Pegasus Road N.E.
Calgary, Alberta
T2G 3G8

M•L 1668

Attention: Mr. Patrick Burke

Dear Sir:

Subject: Geotechnical Evaluation Report
S.W. ¼ 14-21-3-W5M - North of Millarville

1.0 INTRODUCTION

McIntosh-Lalani Engineering Ltd. (M•L) is presenting this letter to address the Geotechnical Evaluation Report requirements as outlined in the City of Calgary's "Geotechnical Report Requirements for Development" documented dated January 10, 1992. These guidelines were used, however the subject land is within the M.D. of Foothills. It is M•L's understanding that the property is to be developed primarily for country residential properties. The objectives of this evaluation was to:

- present a general geotechnical assessment of the site.
- assess the stability of slopes on the subject and adjacent lands which exceed a 15 percent grade, and,
- evaluate whether past instability, subsidence erosion, seepage and previous land uses are in evidence.

Based on the evaluation summarized below, it is M•L's opinion that the project area is geotechnically suitable for development.

2.0 SITE LOCATION

The subject property consists of approximately 110 acres of land. This is situated entirely within the S.W. ¼ 14-21-3-W5M. This property is located north of the Town of Millarville. The land is approximately ½ mile west of Highway 22 and on the south side of 298 Avenue.

3.0 SITE REVIEW

M•L has conducted a preliminary site reconnaissance (walkover) of the subject lands and reviewed the pertinent geotechnical information.

The northwest portion of this quarter section of land consists of seven existing country residential lots. In addition there is an existing new home constructed near the east side of the quarter section, within the subject lands. The south boundary of the property is 298th Avenue. There is also a gravel road on the west side of the property. The majority of the property is covered with a dense deciduous trees and some coniferous trees. The lands slope from the southwest corner, down to the north and east. There is a cut line through the trees along the south property line. The northeast portion of the quarter section is also within this property. This area is flat in topography and covered in a prairie grass vegetation. There is a small drainage ravine which traverses through the site. This drainage is fed from a impoundment of water which is on the adjacent property. A small 3.0 metre tall embankment was created on this adjacent property parallel to the subject properties land, which impounds this small water body.

4.0 SUBSURFACE CONDITIONS

M•L has completed some shallow boreholes within the property to monitor any presence of shallow groundwater for septic field installations. During this drilling, the soils were logged by a M•L representative. Ten boreholes were drilled to depths of 3.0 metres depth. The borehole locations are as illustrated in Figure No. 1. The following soils were encountered.

A topsoil thickness ranging from 150 to 250 mm was encountered. Beneath the topsoil is a silty clay till. The silty clay is generally dry to damp, low to medium plastic, stiff to very stiff in consistency and consists of a trace of gravel. The silty clay extends to the 3.0 metre depth in each borehole with the exception of Borehole No. 1. Bedrock was encountered at 1.5 metre depth in Borehole 1 location. The bedrock is a dry strong siltstone bedrock. The borehole logs 1 to 10 are attached.

5.0 SLOPE STABILITY REVIEW

Much of the south and west portion of the site is sloping. However, the slope gradients are a maximum of 4H:1V. This steeper portion of the slope is within the extreme southwest corner of the

site and adjacent to a few drainage ravines. However, these slopes gradients will likely meet a F.O.S. of 1.50 against slope instability and no development setbacks will be required. Upon completion of final design grades, M•L should review the layout and any potential cuts or fills within the site to confirm the slope stability at that time.

6.0 GEOTECHNICAL EVALUATION

Based on the above, M•L's evaluation of the site concludes the following.

- The boreholes completed did not encounter any unusual subsurface conditions which may be detrimental to site developments. However, due to poor site access presently from the heavy tree coverage, the soil conditions should be confirmed prior to site development in the areas of the ravine and treed areas.

- M•L should review the final site layout and potential impacts which the small embankment, which creates the pond on the adjacent property, may have.

- There are slopes which exceed a 15 percent gradient. However, from a cursory review, none that would require any slope stability setbacks. M•L should confirm this when site access is feasible.

- Aside from the above noted points, subject lands can be classified as "lands free from geotechnical hazards".

It is M•L's opinion, that, the subject lands are suitable for development from a geotechnical point of view.

We trust the enclosed meets with your present requirements. Should you have questions please contact our office.

Respectfully submitted,

McIntosh•Lalani Engineering Ltd.

Marty D. Ward, P.Eng.
Project Engineer
/clc

PERMIT TO PRACTICE
McINTOSH LALANI ENGINEERING LTD.
Signature _____
Date 2002/12/06
PERMIT NUMBER: P 6482
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

PROFESSIONAL ENGINEER ALBERTA
NAZIM S. LALANI

Nazim S. Lalani, P.Eng.
Senior Project Engineer

Appendix 7

Wildlife Habitat Assessment

Wildlife Habitat Assessment Millarville Rural Development

Field Survey Report

Prepared by:
AXYS Environmental Consulting Ltd.
Calgary, Alberta

October 2003
FINAL REPORT

Prepared for:
GLB Planning Ltd.
Calgary, Alberta

Table of Contents

Introduction

GLB Planning Ltd. is currently in the early stages of developing the Millarville Country Estates, a small rural housing development located approximately 2 km north of Millarville, Alberta. The area proposed for development is located at SW1/4 14-21-3-W5, which is situated within the M.D of Foothills. Local residents have raised concerns that the planned development may impact on a number of resident elk that occur in the region and local area. AXYS Environmental Consulting Ltd. was retained by GLB Planning Ltd. to conduct a wildlife assessment in the development area and to provide a qualitative, professional estimation of habitat value, particularly with respect to elk.

Methods

Biologists conducted a ground based site survey of the development area on October 7th 2003, beginning at 10:00, and finishing at approximately 14:00. The weather was sunny with 20% cloud cover, a temperature of 21 degrees Celsius by the end of the survey, with a wind speed of approximately 20km/hr from the west. Access to the site was gained at the southwest corner. The government road allowance was followed along the entire width of the site, followed by a series of random transects in a general east-west pattern. The wildlife assessment was aided by the availability of development renderings (Slope Analysis and Existing Site Features) and a 1:50,000 topographic map-sheet (82J/16 – Priddis) depicting aspect, elevation, coarse scale vegetative cover and human residences and transportation infrastructure in the area.

A Global Positioning System (GPS) was used to plot travel through the development area, as well as to map any significant habitat features and/or wildlife sightings and sign. Dominant tree and shrub species were recorded, as was evidence of game trails, tracks, scat, or other signs of wildlife.

Background – Elk Population Status and Habitat Requirements

Historically, elk were widely distributed in North America. European settlement and land development led to decreased continental ranges with current distribution in more secure, larger tracts of land in the western part of the continent. In Alberta, elk are distributed primarily in the Foothills, Mountains and Parkland Natural Regions. There are an estimated 26,000 elk in the province and the species is considered to be *not at risk* by provincial wildlife managers (ASRD 2000). In Wildlife Management Unit (WMU) 312, which encompasses the development area, there is an estimated resident population of 920 elk (Pat Young, ASRD, personal communication).

The home range of elk is made up of winter, spring calving and summer ranges, along with migration routes for travel between them. The sizes of seasonal ranges for an elk herd vary depending on the quality of habitat; averages in the province have ranged between 5000 and 5500 ha. Individual home ranges have been known to vary from 1200

to over 5000ha (Jones 1997). In the Rocky Mountains and Foothills, elk generally over-winter in the Lower Foothills and Montane Natural Sub-regions and move west to higher elevations during the summer. Within WMU 312, both high quality wintering and spring calving habitat for elk exists (Pat Young, ASRD, personal communication).

During the spring and summer, elk are primarily grazers, feeding on numerous species of grasses and forbs. During fall and winter, elk consume greater amounts of forbs and shrubs, but prefer grass when available. Grassy meadows, willow flats and south facing slopes are key winter habitats. Elk are also typically associated with forest edges and foraging often occurs within 200m of cover. Cover habitat, including both security and thermal cover, is also an integral habitat requirement for elk. Elk will take refuge in forests when temperatures drop and wind-chill increases. Many studies have shown that mature mixed-wood stands provide the best hiding and thermal cover, as long as they are 4 ha or bigger in size (Wisdom *et. al.* 1986).

Habitat *effectiveness*, defined as the ability for an animal to utilize otherwise useful habitat, is often reduced near open roads used by motorized vehicles, and in proximity to various development and human activity. Roads through forage areas can reduce elk use by up to 90% for 500m when hiding cover is unavailable (Lyon 1980). When roadside-hiding cover is present, the zone of influence may be reduced to approximately 100m. In areas where hiding cover is not limited, sensory disturbances will not significantly alter cow elk home range, as they return quickly once the direct disturbance is removed (Edge and Marcum 1985).

Results and Discussion

Elk

The Rocky Mountain foothills, which encompass the development area, are characterized by linear ridges and hills of sediment that bridge the prairies in the east and and the Rocky Mountains to the west. The development area is situated on forested hillside, approximately 1210 to 1290 m asl., that slopes to northeast. Immediately west of the development area is are open grassed, southwest facing slopes. The forest is mainly comprised of trembling aspen (*Populus tremuloides)*, with occasional balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*). Shrub components included serviceberries (Saskatoon berry) (*Amelanchier alnifolia*), a number of different willow species (*Salix spp*), red osier dogwood (*Cornus stolonifera*), snowberry (*Symphocarpos albus)*, wild current (*Ribes spp*) and bract honey-suckle (*Lonicera involucrata).* There was approximately 60-70% canopy closure in the southern portion of the site, with moss and various forest herbs growing at ground level, while the northern portion was more open (30-40% canopy closure) and blanketed with different species of tall grass, and a high concentration of cow parsnip (*Heracleum lanatum).*

During the site assessment, tracks of both elk (*Cervus elaphus*) and white-tailed (*Odocoileus virginianus*) or mule (*Odocoileus hemionus*) deer were observed along and crossing the government right of way (RoW) in the southern portion of the site. A number of game trails were observed, most heading in a north-south direction. Two elk

pellet groups were observed; this low number was likely partially attributable to the abundance of fallen leaves that obscured visibility of objects on the forest floor. A large number of serviceberry, dogwood, and willow shrubs showed signs of mild to extreme browsing by elk in previous years, particularly along the forest edge; sign of very recent browsing was not apparent. Sign of bark browsing by elk was also observed on several mature aspen trees (see Appendix A).

Overall, the juxtaposition of the forested development area with open ridges and south facing slopes are suitable conditions for wintering elk. Elk will bed and browse on woody shrubs in the forested edges while foraging on open exposed grassed habitats on south-facing slopes and ridges. The overall effectiveness of winter and potential calving habitat in and around the development area may be somewhat reduced due to the presence of Highway 22, secondary and other rural access roads and human activity and facilities that are present in the area. Nonetheless, like much of the rolling foothills in the WMU, the development site and nearby areas provide the necessary juxtaposition of suitable topography and both foraging and cover habitats that are of value to some portion of the region's resident elk herd.

Other Wildlife and Wildlife Sign

There area many species of wildlife that may use habitat in and around the development area as residents, seasonal occupants or as transients. In terms of mammals, other species recorded during the survey, in addition to sign of elk and deer activity, included red squirrel (*Tamiasciurus douglasi*) and evidence of deer mice (*Peromyscus maniculatis*).

Few bird species were recorded, reflecting the autumn season when most bird species have long since migrated to wintering grounds in the southern and western United States through South America. Species observed included Black-capped chickadees (*Poecile africapillus*), boreal chickadees (*Poecile hudsonicus*), white-breasted nuthatches (*Sitta carolinensis*), dark-eyed junkos (*Junco hymenalis*) and a single brown thrasher (*Toxostoma rufrum*) in the southeast corner of the development area. No stick nests were observed in or around the development area, indicating a lack of nesting corvids, hawks, eagles, or owls. Several species may, however, utilize habitats in or around the development area as foraging habitat.

An ephemeral pond and drainage channel occurs in the northeastern portion of the development area, which may provide breeding, foraging and/or overwintering habitat for one or more of the amphibian and reptile species that occur in the region. While no amphibian and reptile species were observed during the survey, the overlap between the mid-autumn survey and the early part of most species' hibernation periods likely precluded the potential for any observations.

Conclusion

On a landscape level, the Rocky Mountain Foothills provide essential year-round habitats for elk as well as migration corridors between seasonal ranges. The mainly forested development area and adjacent open grassed slopes and ridges are reflective of topographic features and juxtaposition of forest and open habitats that are favourable to

elk. The amount of habitat contained within the development area is a very small proportion of the extents required to sustain the regions resident elk population. Habitat effectiveness for elk immediately in and near the development area may be somewhat reduced due to disturbances from the presence of existing roads, facilities and ongoing human activities. While several other species of wildlife occur or may occur in and around the development area on a seasonal or year-round basis, few were recorded. This is party attributed to the autumn timing of the site assessment that follows after the migratory period for most bird species and that overlaps the hibernation period for most amphibian and reptile species.

Appendix A

Photograph 1

The serviceberry shrubs show evidence of heavy browsing, however no recent activity suggesting that elk have not used the site extensively for some time. This level of browsing was typical of many of the palatable shrubs along the edges of the forested habitat patch.

Photograph 2

The trembling aspen (*Populus tremuloides*) shows evidence of elk feeding on the outer bark and cambium layers of the tree. The scar has dried and begun to heal, suggesting the feeding activity occurred at least 1 year ago. No fresh scars were observed in the study area.

Photograph 3

The northern portion of the forested habitat patch was more open and covered with various species of grass, and is more suitable for elk than the southern portions of the site. There is evidence of older feeding activity on the trembling aspen (*Populus tremuloides*) by elk.

Photograph 4

These aspen (*Populus tremuloides*), show evidence of much older feeding scars, suggesting the area is no longer used extensively by elk.

References

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