Scheffer Andrew Ltd.
Planners & Engineers
Since 1976

Elinor Lake
Area Structure Plan

July 2017

File # 136701

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1 INTRODUCTION AND PURPOSE

The purpose of this Area Structure Plan is to establish a framework for the future land use, planning, and the provision of infrastructure, services and amenities in the Elinor Lake Resort. Elinor Lake Resort is converting the existing Elinor Lake camping area into a unique recreational resort development. Currently, the site is partially developed with a bareland condominium and cabin rentals with supporting infrastructure and services, and unserviced recreation lease sites. It is the intension of the intention the owners to continue the development of the property with intensive recreational uses, and add additional bareland condominium sites based on market demand. The project site is located approximately 160 km northeast of Edmonton and 45 km southeast of Lac La Biche.

The location of Elinor Lake Resort is shown on Figure 1 on the following page.

The site was originally farmland until sometime in the 1970's before it was reclaimed by Alberta Parks and Services with the intention of including it in the local parks area. In the 1990's, the site was leased to the Elinor Lake Resort group to run as a campsite. The group purchased the land in 2005 with an intention to develop portions of the site with serviced lots for recreational use, and continue to make available lease sites for either short term or long term occupation by recreational users.

The vision of the Elinor Lake Owners Group is to establish Elinor Lake Resort as a recreation destination that provides a variety of options for the vacationing public, and contributes to the growth of tourism in Lac La Biche County.

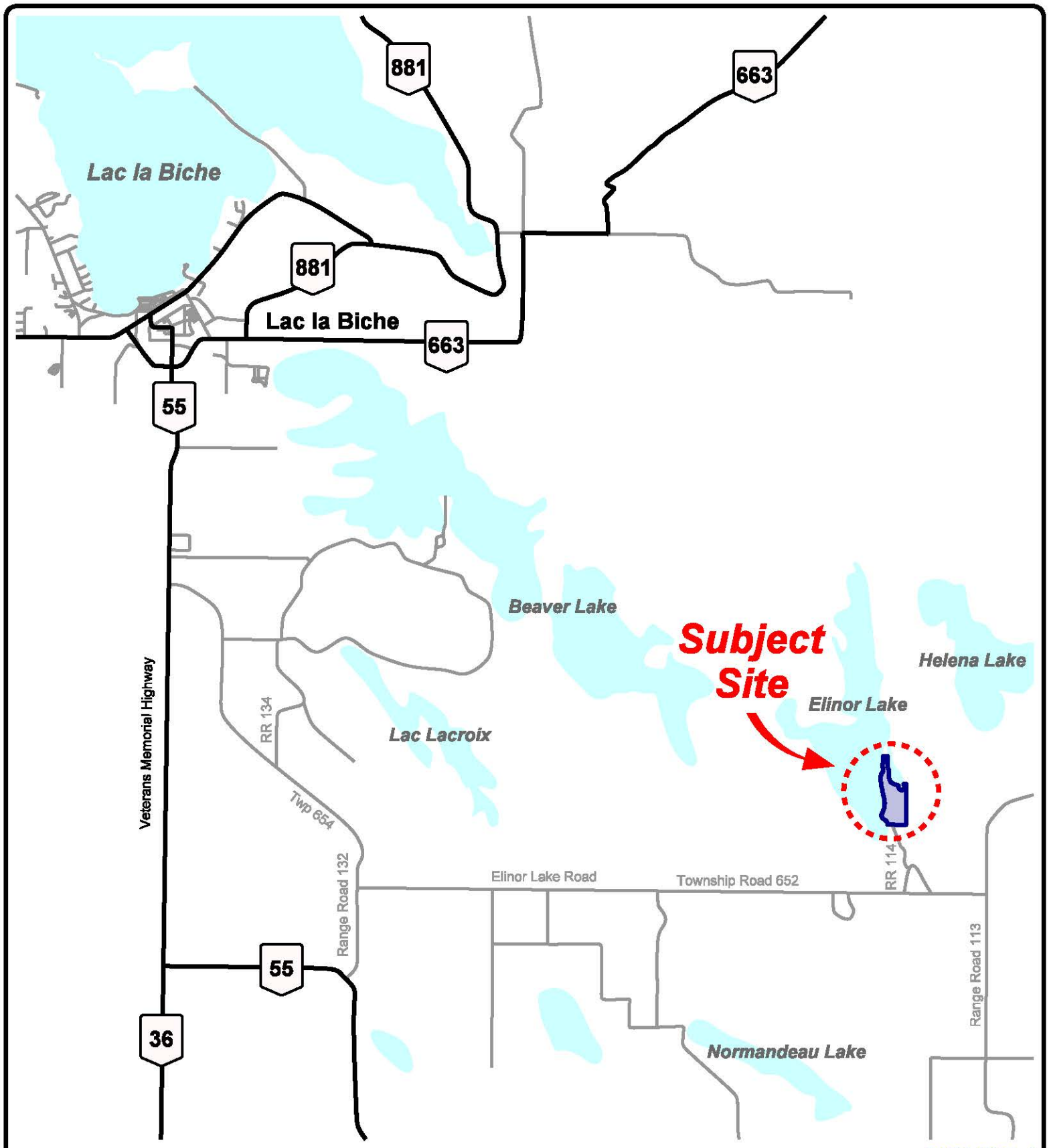

FIGURE 1
LOCATION PLAN

ELINOR LAKE RESORT AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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2 SITE CONTEXT

2.1 Plan Area

The Elinor Lake Resort has a total area of approximately 100.9 ha (249 ac). The project area includes a portion of SW29-65-11-4 (the portion between Elinor Lake and Matthews Lake), the entire NW20-65-11-4, and the northern half of SW20-65-11-4. The entire property has been zoned to a Direct Control District 3 (DC3), which is currently subdivided into 162 bareland condominium units, 10 fee simple titles, and the remaining area is partially developed with 205 recreation sites which are available to lease on a yearly basis. It is important to note that prior to the development of the bareland condominium, the primary use of this property was as a campsite, and that land use (recreation sites for lease) continues today.

An aerial photograph of the property is shown on Figure 2

Site improvements to date include a 162 lot subdivision, a water treatment/distribution system, a waste water collection/treatment system, a road network within the resort, a number of rental cabins, a utility centre, an office, a store and a maintenance shop. Additionally, walking and hiking trails and a boat launch have been added.

The site contains natural mixed wooded areas and has fairly flat topography. The subdivision design will take advantage of mixed wooded areas by leaving them somewhat intact and establishing properties that include forested land. The plan area does not contain any ecological reserves, special wildlife projects or recorded environmentally sensitive areas. An environmental buffer (30 m) has been established by legal survey and is solely the responsibility of the Province of Alberta.

The topography of the property is shown on Figure 3

The future use of land in the undeveloped portions of Elinor Lake Resort, will be consistent with the existing Direct Control District 3 (DC3), or as amended by Lac La Biche County in it's current update of the County's Land Use Bylaw.

2.2 Surrounding Land Uses

The Elinor Lake Resort development is surrounded by lakes on the west and northeast, the Elinor Lake Provincial Recreation Area to the south and Crown land to the north and east. The main uses of the adjacent lands are recreational and agriculture. Elinor Lake Resort is in close proximity to Lakeland Provincial Park and Recreation Area.

Site Boundary

Airphoto Date : Fall 2012

FIGURE 2
AIRPHOTO

ELINOR LAKE RESORT
AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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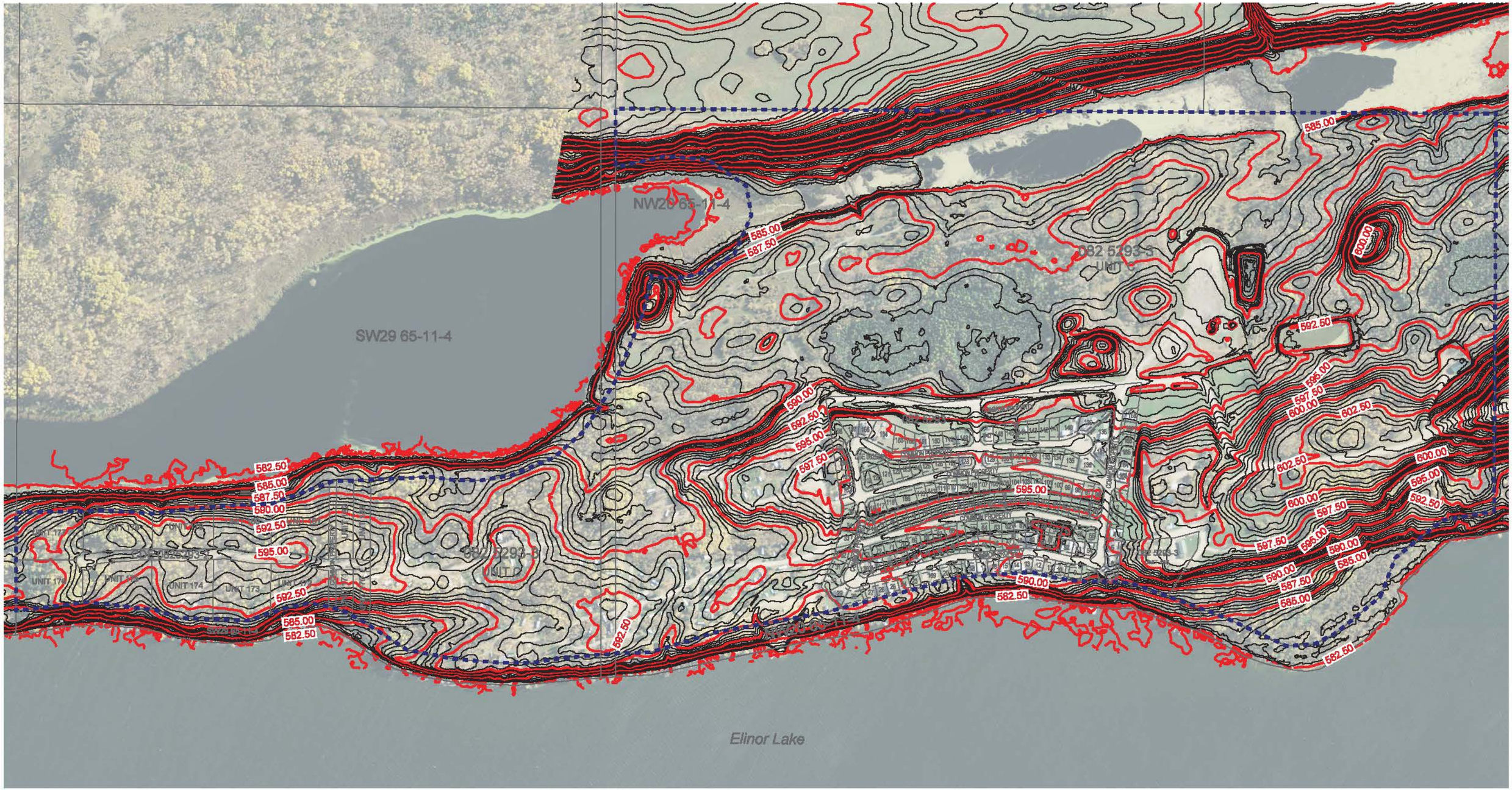

- Site Boundary
- 2.5m Contour Intervals
- 0.5m Contour Intervals

FIGURE 3
TOPOGRAPHY

ELINOR LAKE RESORT
AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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3 POLICY CONTEXT

3.1 Lower Athabasca Regional Plan (LARP)

The development plan for Elinor Lake falls in line with regional outcomes outlined in the "Lower Athabasca Regional Plan" developed by the Alberta Government. These outcomes include diversifying the region's economy, maintaining landscapes to maintain ecosystem function and biodiversity, and enhancing the quality of life of residents through opportunities for active living and recreation.

3.2 Lac La Biche County Municipal Plan (MDP)

The proposed development strategy conforms to the Lac La Biche County Municipal Development Plan adopted in September 2013. Most specifically, the Elinor Lake Resort conforms to the Lakeshore Policy Area laid out in the MDP which states "The County's objective for the Lakeshore Policy Area is to protect and enhance the environment, educate property owners, and ensure that the appropriate approvals and obtained from the various levels of government."

3.3 Lac La Biche County Land Use Bylaw (LUB)

Elinor Lake Resort will follow all applicable regulations included in the Lac La Biche Land Use Bylaw – Direct Control District 3 (DC3), or as amended by Lac La Biche County in it's current update update of the Land Use Bylaw. These uses will be consistent with uses typically found at a recreational resort and include single detached residential, convenience commercial, hotel and motel, seasonal rental sites for lease, cabins for rent, and the supporting infrastructure.

The existing land use designation of the property and the surrounding lands is shown on Figure 4

- Site Boundary
- Agricultural (AG)
- Crown Land (CL)
- Direct Control District 3 (DC3)

FIGURE 4

EXISTING LAND USE

ELINOR LAKE RESORT AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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4 DEVELOPMENT OBJECTIVES AND POLICIES

4.1 Objectives

The Elinor Lake Resort intends to protect and preserve the natural environment as much as possible, integrating it into the lifestyles of future residents. Preserving the natural environment not only promotes a healthy environment, it provides a more attractive community and enhances recreation.

4.2 Environmental Policies

4.2.1 An Environmental Protection Plan will be prepared in order to mitigate potential effects. The Environmental Protection Plan will address forestry, environmentally sensitive areas (including riparian habitats) and endangered or threatened species. The subdivision design will take advantage of the mixed wooded areas by leaving them somewhat intact and designing properties that include forested land. The design will aim to minimize surface disturbance and forest removal. Removal of natural vegetation will be timed to avoid the nesting periods of migratory birds to reduce direct mortalities. Clearance to remove any natural vegetation during the nesting period will require assessment by a qualified environmental specialist.

4.2.2 An environmental code of conduct will be developed to increase awareness for current residents and an expectation for all future residents of the area. The code will address numerous subjects, including: restrictions on the use of herbicides and pesticides, garbage disposal, erosion control, boating restrictions and regulations, control over the use of fertilizers, tree removal limitations, shoreline disturbances, fire management, temporary dock and beach development restrictions, potential environmental enhancement developments, noise control, and snow removal.

4.2.3 The Alberta Government has established angling regulations that support the effective management of fish stocks in Elinor Lake. Increased numbers of lake residents might suggest increased concerns for reduction of fish stocks, however, the carrying capacity of users is being managed by the Alberta Government and with all new residents abiding by existing regulations; fish resources should not be jeopardized. All new residents will be encouraged to support the sharing of the fish resources in the lake.

4.2.4 Elinor Lake Resort will follow the FireSmart Guidebook for Community Protection, issued by the Province of Alberta in February of 2013. The Guidebook outlines best practices and proactive measures that can be taken to reduce the risk of fire damage to settlement areas,

where there is an interface between forested natural areas, and areas that have been developed for human activity or occupation.

4.3 DEVELOPMENT OBJECTIVES

1. To develop and maintain Elinor Lake Resort in a manner that promotes a quality recreational experience, and adds to the tourism potential of Lake La Biche County.

2. To provide an adequate supply of land in the resort area to accommodate a mix of recreational options and tenures which cater to various lifestyles and budgets.

3. To incorporate public open space and trails in Elinor Lake Resort so they form an integral part of the resort development, and encourage social interaction and physical activity.

4. To provide convenience commercial services at a level that is appropriate to meet the needs of the clientele of Elinor Lake Resort.

5. To ensure that the required water, wastewater and other utility services are adequate to meet the needs of the various accommodation options offered by Elinor Lake Resort.

6. To promote responsible environmental stewardship that preserves and protects the natural environment, the riparian areas around Elinor Lake, and the Lake itself.

7. To ensure that storage of hazardous or dangerous goods is limited to domestic sized containers, and is done in a safe and secure manner to minimize the risk of spills.

8. To minimize the potential visual impact associated with large parking lots by proper design and distribution of parking for various vehicles and recreational equipment.

9. To ensure that Elinor Lake Resort is a clean, safe and comfortable place that can be enjoyed by all of the owners, patrons and guests of the Resort.

10. To create and maintain a quality recreational resort development where there is a sense of community, and that sense of community extends to people of all ages.

5 DEVELOPMENT CONCEPT

Elinor Lake Resort Ltd. is proposing to create a unique recreational resort development. A total of 600 lots with sizes ranging from approximately 4000 sq. ft. to approximately 1 acre will be developed on the site. The bareland condominium concept allows the developer to fully service each unit while keeping the sites affordable to purchasers. Each stage will be developed as they become economically viable. In the interim, the unserviced portions of Elinor Lake Resort will continue to be leased on a yearly basis as recreation sites.

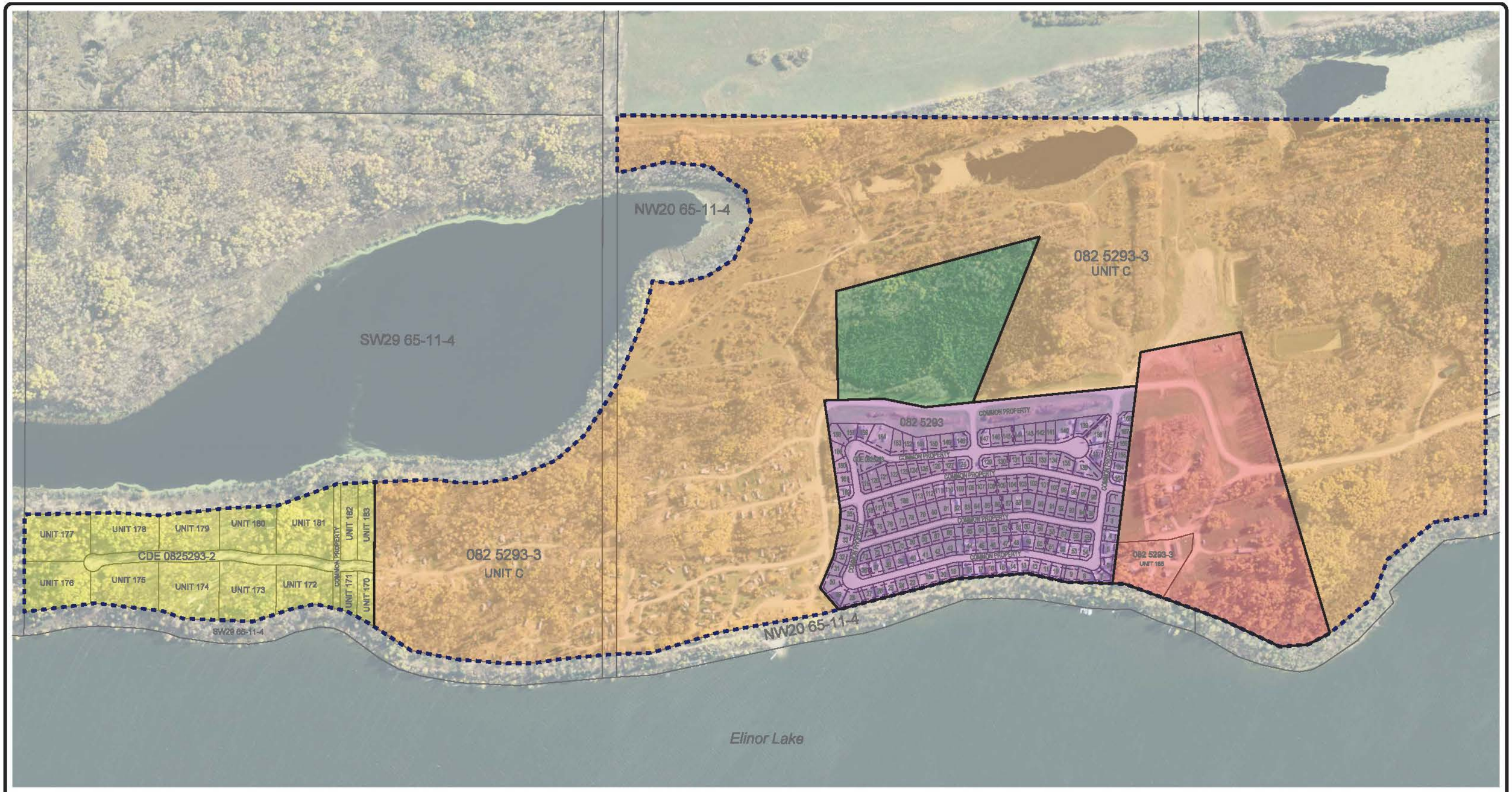
The proposed land use for the site is primarily single detached residential, with portions dedicated to public utility/services and environmental reserve. Since market demand for proposed Stages 2 through 7 does not yet make these stages economically viable, they will continue to be used for recreational vehicle sites that are leased on a yearly basis. Stage 1 has been completely developed, and has been subdivided to contain 162 lots, a water treatment/distribution system, wastewater collection/treatment system, road network, rental cabins, a utility centre, an office, a store and a maintenance shop. The lots have full services including gas, power, phone, water and wastewater. Stage 1 is currently zoned Direct Control District 3 (DC3), and contains lots with an approximate average size of 4000 sq. ft.

Stage 2 is planned to be developed with approximately 70 lots, based on market demand. The remaining 368 lots that are proposed will be developed in Stages 3 through 7 with lots sizes to be determined. These stages are also zoned Direct Control District 3 (DC3), and will be serviced utilizing trenchless technology in order to protect the existing landscape and vegetation.

The Development Concept is shown on Figure 5

The rationale behind the creation of Elinor Lake Resort stems from the quality and extent of the site, it's proximity to Elinor Lake, and it's suitability for tourism recreation facilities catering to a variety of lifestyles and budgets. The Resort provides easy access to Lakeland Provincial Park, and while it does provide some limited convenience commercial, the urban settlement of Lac La Biche is only 20 miles away, and provides a full selection of consumer goods and services, various amenities and tourist attractions, and parts and service for vehicles and recreational equipment.

Elinor Lake Resort is the premier resort destination in Lac La Biche County, and will continue to provide recreational opportunities to the local community, as well as those from other locations in north central Alberta. As the Resort grows, it will increase those opportunities, and enhance economic development and tourism in Lac La Biche County.



- Site Boundary
- Natural Open Space (NOS)
- Existing Bareland Condo
- Commercial
- Estate Lots
- Future Residential

FIGURE 5
DEVELOPMENT CONCEPT

ELINOR LAKE RESORT
AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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	Ha	% of GDA
Gross Area	100.90	
Less Environmental Reserve	11.51	
Gross Developable Area	89.39	100
Residential Uses		
Stage 1	10.57	11.8
Stage 2	5.45	6.1
Stage 3	11.15	12.5
Stage 4	5.06	5.7
Stage 5	7.26	8.1
Stage 6	8.16	9.1
Stage 7	14.52	16.2
Subtotal	62.17	69.5
Commercial Uses		
Convenience Commercial	3.48	3.9
Subtotal	3.48	3.9
Open Space		
Natural Open Space (NOS)	4.54	5.1
Local Open Space and Parks	2.10	2.4
Subtotal	6.64	7.5
Infrastructure		
Internal Roadways		
Stage 1	1.80	2.0
Stage 2	1.05	1.2
Stage 3	2.35	2.6
Stage 4	1.04	1.2
Stage 5	1.44	1.6
Stage 6	1.34	1.5
Stage 7	2.88	3.2
Public Utility / Services	5.20	5.8
Subtotal	17.10	19.1

Table 1: Area Structure Plan Land Use Statistics

	Area (Ha)	Density (Units/Ha)	Units	Persons/Unit	Population
Residential Uses					
Stage 1	12.37	13.1	162	3	486
Stage 2	6.50	10.8	70	3	210
Stage 3	13.50	6.7	90	3	270
Stage 4	6.10	11.5	70	3	210
Stage 5	8.70	4.6	40	3	140
Stage 6	9.50	6.1	58	3	174
Stage 7	17.40	6.3	110	3	330
Total	74.07	8.1	600	3	1,800

Table 2: Residential Land Use Analysis

6 TRANSPORTATION AND SERVICING

6.1 Servicing

The current servicing is shown in Figure 6 on the following page. Servicing is fully installed for Stage 1 and includes water, wastewater, power, gas and telephone.

Both a water distribution system and a wastewater collection system have been installed to service the existing lots with provision for future lots. A wastewater management plan has been prepared by DCL Siemens and is included in Appendix A.

The stormwater management report prepared by DCL Siemens proposes a drainage plan for the development that will help ensure that the storm drainage will not contribute nutrients or sediment to Elinor Lake. The stormwater management report is included in Appendix B.

6.2 Transportation Network

EXH Engineering Services Ltd. has prepared a Traffic Impact Assessment (TIA). During the detailed design of the internal road system, due care will be taken to ensure access and egress for emergency vehicles. The current transportation network is shown on Figure 7. The TIA is included in Appendix C.

6.3 Schools, Parks and Open Space

A 4.54 ha portion of the property is designated as Natural Open Space (NOS) and has the potential to be allocated as an environmental reserve. Additionally, a 30 m buffer has been created around Elinor Lake by the Alberta Government. Natural parks will be incorporated throughout the residential development and the leased recreation sites to enhance the living experience. The resort is aimed at seasonal use and will not require a school.

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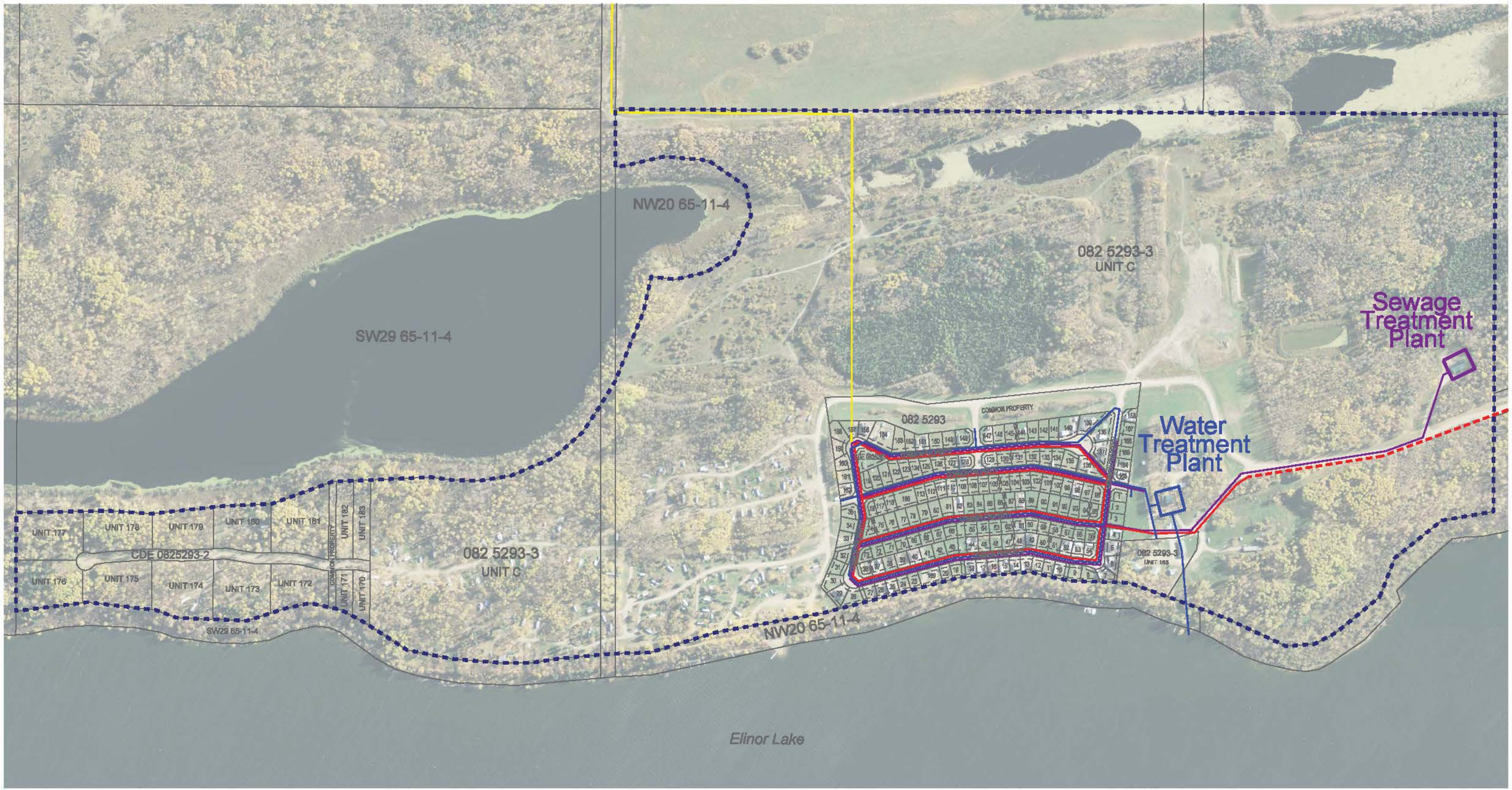

- Site Boundary
- Underground Power
- Overhead Power
- Water
- Wastewater
- Natural Gas

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FIGURE 6
EXISTING UTILITIES

ELINOR LAKE RESORT
AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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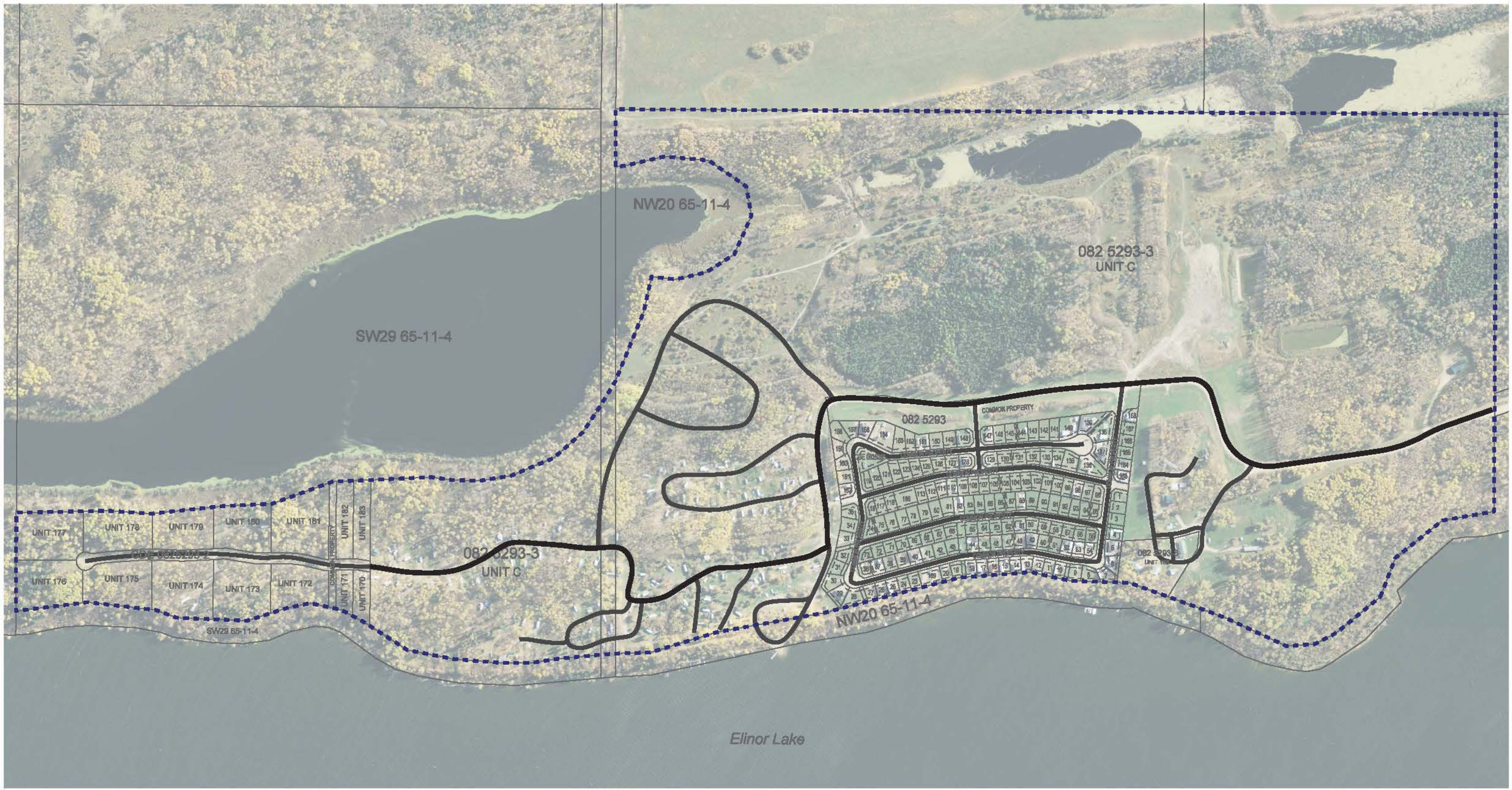

Site Boundary
Main Access Road
Local Road

FIGURE 7
TRANSPORTATION NETWORK

ELINOR LAKE RESORT
AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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7 COMMUNITY CONSULTATION

To date the following public consultation processes have been undertaken:

1. **April 28, 2013**. Presentation of the Area Structure Plan to the Elinor Lake Condo Association.

2. **May 6, 2013**. Area Structure Plan posted to geniepad so all owners had access.

3. **August 26, 2013**. County Council hearing on the Plan. Council gave first and second reading to the by-law. Council determined that Area Structure Plans required two Public meetings and instructed Elinor Lake Resort management to hold an advertised Public Open house.

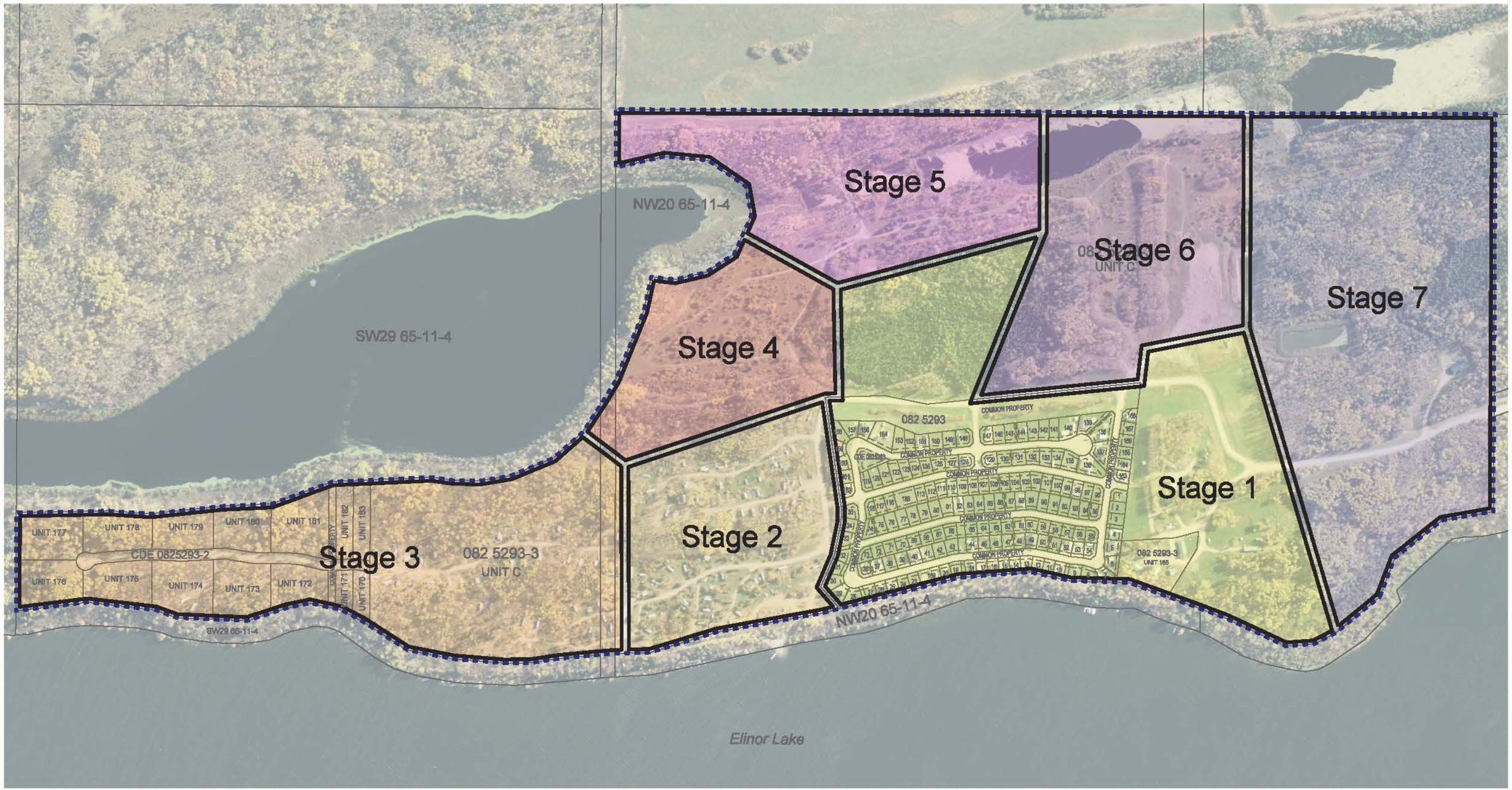
4. **August 31, 2013**. Elinor Lake Resort held an open meeting for Unit owners at 10:00 am. Seventeen owners attended and discussed the Plan. They agreed by a show of hands that they had no problems with the Plan.

5. **September 3, 2013**. Elinor lake Resort Advertised a Public Open House for Sepember13, 2013 in the Lac La Biche Post.
6. **September 13, 2013**. A Pubic Open House was held from 10:00 am to 12:00. No people attended.

8 IMPLEMENTATION AND STAGING

The site will be developed in seven (7) separate stages consisting mainly of bareland condominiums. Stage 1 has already been subdivided and contains 162 lots, walking and hiking trails, roadways, and servicing. Future phases of bareland condominiums will be staged sequentially at a pace that is dependent on the demand. Figure 8 on the following page shows the proposed stages, including the already developed Stage 1 as well as the future stages. Currently, development for Stage 2 is in the planning process. Please note that the staging sequence is conceptual, and subject to change.

Appendix C contains the Traffic impact assessment completed by EXH Engineering Services Ltd. in March 2007 and, although not complete, the work outlined on Page 17 of that report is being performed as weather permits. This work will be completed in due course.



Site Boundary
Staging Boundaries

FIGURE 8
STAGING
ELINOR LAKE RESORT AREA STRUCTURE PLAN

Portions of SW29, NW20, SW20 65-11-W4
LAC LA BICHE COUNTY

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APPENDIX A

Wastewater Management Plan

DCL SIEMENS
Engineering Ltd.

1.0 Background

The Elinor Lake subdivision in Lac La Biche County, Alberta is a country residential development located in portions of the western half of section 20-65-11-W4, as well as a portion of the SW ¼ 19-65-11-W4. This development is a recreational RV resort and as result the there will be no or only a very limited number of full time residents. The majority of the population will be seasonal, primarily on weekends, and this has been taken into account in the generation of wastewater from the Elinor Lake Resort.

This report entitled "Wastewater Management Plan" includes a compilation of information that has been gathered and presented since early 2009. Basically, this development will employ an activated sludge wastewater treatment system (Phase 1), which can be converted to a Biowheel system in Phase 2 to double the capacity of the plant. This is offered by H_2O Innovation and details on their technical proposal are contained in Appendix A.

The calculations and assumptions presented in this report are based upon averages. The concept presented is viable for this subdivision but in order to institute any wastewater management plan it will be necessary to obtain the approval from Alberta Environment.

2.0 Effluent Generation

2.1 Population

The layout of the Elinor Lake Resort is shown below and contains 168 lots.

This is a large recreational resort and as such it is anticipated that development on the lots will take place over an extended period of time. Typically, a factor of 3.5 persons per lot is used to estimate population but in this case an adjustment must be made to account for the seasonal nature of occupation. Two seasons have been considered with the Summer Season being the period between May and September (5 months) and the Winter Season being from November to April (7 months). It is assumed that lot development will take place over the next 20 years but the ultimate flows have been used for the purposes of this report.

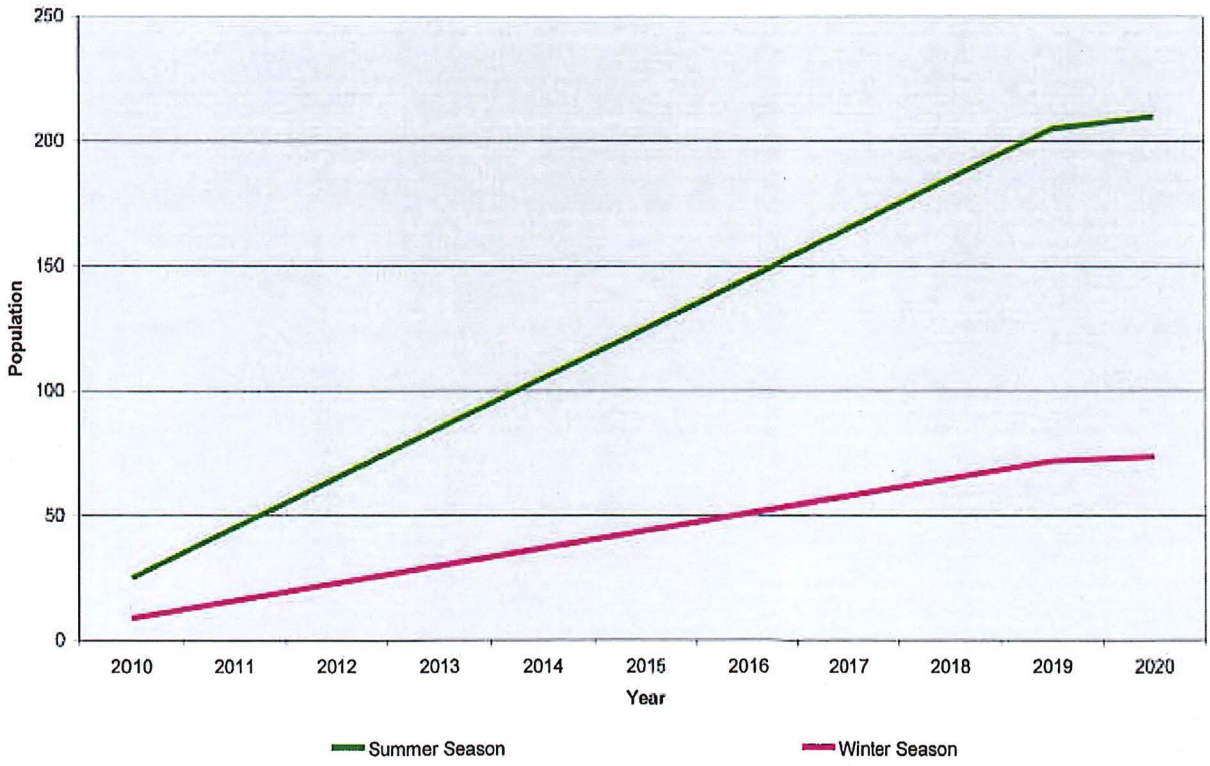
Due to the type of development, there will only be a very limited number of permanent residents and due to the seasonal nature of occupancy the following population factors (equivalent full-time residents) have been employed:

1. Summer Season — 1.25 persons per lot

2. Winter Season — 0.125 persons per lot

This reflects the facts that very few people will elect to visit and stay in this area in the winter season (estimated at 10% of that in the Summer Season) and during the Summer Season most stays at the resort will be on weekends, with some extended stays during July and August. The following graph shows population projections.

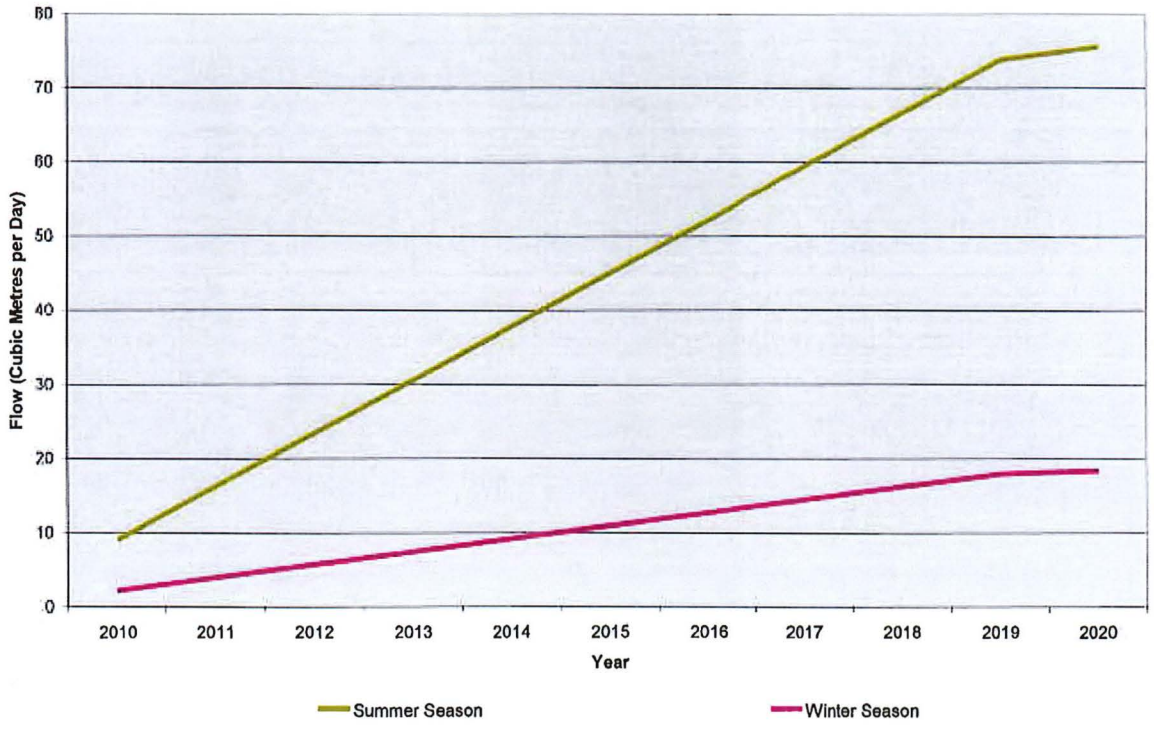
Population Projection



2.2 Wastewater Generation

A wastewater generation factor of 360 litres per day per person in the summer season and 250 litres per day person in the winter season has been used to determine the anticipated flows in the new treatment plant (see graph below).

WASTEWATER GENERATION



At the completion of the development on the lots in the Elinor Lake Resort it is estimated that the summer wastewater flows will be slightly less than 80 cubic metres per day on an average annualized basis. The Winter Season flow will be a maximum of approximately 18 cubic metres per day.

3.0 Wastewater Treatment and Discharge

3.1 Treatment

The wastewater treatment system being proposed by H_2O Innovation will be installed in two phases in accordance with the following design criteria and assumptions.

Inlet Parameters:	Flow	40,000 gpd (151 m^3/day)
	Operation	24 hours per day
	Temperature	10 to 18 degrees C
	BOD	300 mg/L
	SS	300 mg/L
	P	6 mg/L
	TKN	45 mg/L
	NH_3-N	40 mg/L
	pH	6 to 7
	Oil/Grease	<50 mg/L
Effluent Parameters: (Phase 1)	BOD	<15 mg/L
	SS	<15 mg/L
	P	<1 mg/L
	TKN	No limit specified by Client
	NH_3-N	<3 mg/L
	Fecal Coliform	<200 CFU/100 mL sample
Effluent Parameters: (Phase 2)	BOD	<10 mg/L
	SS	<10 mg/L
	P	<1 mg/L
	TKN	No limit specified by Client
	NH_3-N	<3 mg/L
	Fecal Coliform	<200 CFU/100 mL sample

The system will also include UV treatment and alum injection to control phosphorus to within approved limits.

3.2 Receiving Water Body

The configuration of the new wastewater treatment plant, existing lagoons and existing stormwater pond is shown on the plan on the following page and the proposed effluent discharge will be:

1. by forcemain from the wastewater treatment plant to the stormwater pond;
2. detention in the stormwater pond and blending with stormwater during the summer months;
3. in winter months the valve at the control manhole will be closed and the effluent will be stored from November (freeze-up) to April (thaw); and,
4. by open channel from the stormwater pond to the unnamed creek.

The unnamed creek, that flows along the west boundary of the subdivision, discharges into Matthews Lake and then into Elinor Lake. This creek drains an area of approximately 7 square kilometres (some of it farmland used for raising livestock) and the flows measured are:

- April 20, 2009 — 7.7 cubic metres per second (665,000 m^3/day)
- September 30, 2008 — 0.05 cubic metres per second (4,300 m^3/day)

The creek (see pictures in Appendix B) has 2 large beaver dams, which have been in-place for approximately 20 years and can contain a volume of approximately 16,000 cubic metres. The east creek bank rises steeply to about 7 metres above the normal water level and the west bank rises gently to about 10 metres above normal water level.

The unnamed creek flows into Matthews Lake which has a volume of approximately 30,000 cubic metres but is shallow with an average depth of only 1.5 metres. No fish have been found in the unnamed creek or Matthews Lake, primarily due to depth and the low oxygen level in the lake (on April 15, 2009 was measured at 0.18 mg/L and 1 mg/L is considered the lower limit for fish survival).

A number of rare plant surveys have been undertaken in the area and the Alberta Natural Heritage Information Centre records only one occurrence of a rare plant in the watershed. This is the Carex Backii, which was recorded along a trail that is 3 to 4 metres above the normal water level of the creek.

The pond is of sufficient size to accommodate both stormwater and effluent discharge in the summer season. In the winter season the pond has sufficient volume to retain approximately 6 month of effluent flow. When the valve at the control manhole is opened in April it will be diluted by both the spring thaw flows and the high flows in the unnamed creek.

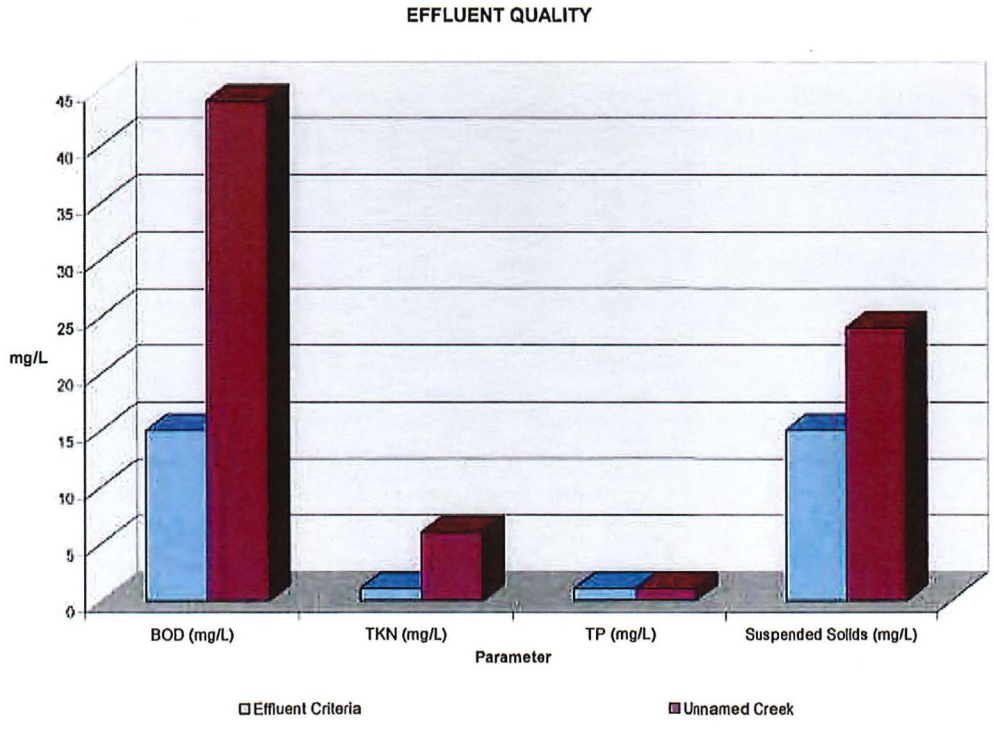
3.3 Effluent Discharge

When determining the impact of the effluent on the receiving water body two main factors must be considered, which are:

- the volume of effluent being discharged in comparison to the natural flows; and,
- the quality of the effluent compared the water quality in the creek.

During the summer season it is assumed that the beaver ponds in the unnamed creek will have a flow equal to that measured in September (approximately 4,300 m^3/day). The addition of 80 m^3/day of effluent generated by the subdivision residents would be negligible and the dilution factor would be approximately 50 to 1

In addition the quality of the effluent is superior to water in the existing creek (see water analysis performed by AGAT Labs in Appendix C) and the graphs following show a comparison between them.



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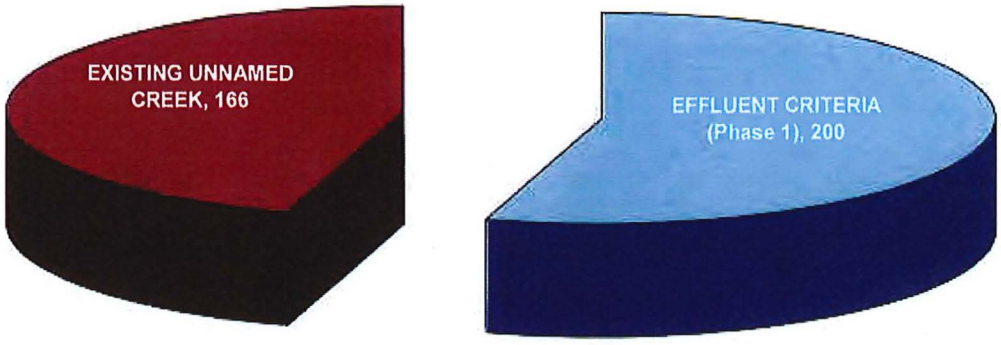
Engineering Ltd.

FECAL COLIFORM



The discharge from the proposed water treatment facility to the unnamed creek, through the existing stormwater pond, would not have any impact on the unnamed creek. In fact there may be some long-term benefit to the unnamed creek and Matthews Lake, as the effluent is of better quality then that existing naturally.

4.0 Recommendations

Based upon the information presented herein it is recommended that:

1. the wastewater treatment system proposed by H_2O Innovation be installed:

2. a discharge be through the stormwater pond to the unnamed creek; and,

3. approval be sought from Alberta Environment.

If there are any questions and more information is required please contact the undersigned.

Brian Locher, P.Eng., LL.B.

APPENDIX B

Stormwater Management Plan

DCL SIEMENS
Engineering Ltd.

1.0 Background

The Elinor Lake subdivision in Lac La Biche County, Alberta is a country residential development located in portions of the western half of section 20-65-11-W4, as well as a portion of the SW ¼ 19-65-11-W4. The "Preliminary Stormwater Management Report" was completed in May 2009 and has been reviewed with Alberta Environment and Sustainable Resource Development. This "Final Stormwater Management Plan" builds upon the concepts presented in previous submissions and provides environmentally sensitive options for the retention, treatment and disposal of the stormwater for the Elinor Lake subdivision.

This report entitled "Final Stormwater Management Plan" is the 5th submission and includes not only the west area but also the east part of the Elinor Lake subdivision and incorporates changes reflecting comments received from Alberta Environment and Alberta Sustainable Resource Development. This report is a response to Alberta Environment requirements to contain stormwater within the subdivision and discharge at an acceptable quality to the nearest bodies of water. The Elinor Lake subdivision is divided into 6 sub-catchment areas as shown in Drawing 2.0, appended to this report. The stormwater from Catchment Areas 2, 3, 5 and 6 will be stored, treated and discharged from separate stormwater management facilities as shown in Drawing 1.0. Catchment Area 1 is located immediately adjacent to the shore of Elinor Lake and due to topography it will be impossible to direct stormwater flow to a treatment facility, so this area will drain overland (through existing natural vegetation) to Elinor Lake. Catchment Area 4 contains 3.3529 hectares and due to a high point located in the southeast of the subdivision, this area has to drain northeast through an existing culvert to a low ground level, natural pond as shown in Drawing 3.0. Silt fence will be installed at the outlet of each existing culvert to filter any sediment and road pollutant. Areas 5 and 6, including effluent from the wastewater treatment plant located in far southeast will be discharged to the proposed Pond 2 located approximately 200m southeast of the subdivision (on land owned by the same company).

The calculations and assumptions presented in the first report "Preliminary Stormwater Management Report" have been checked and remain valid. The concepts presented remain viable for this subdivision but in order to institute any stormwater management plan it will be necessary to obtain the approval from Alberta Sustainable Resource Development to cross the property between the subdivision and Elinor Lake.

2.0 Stormwater Management Report

2.1 Scope

The scope of the report is as follows:

1. To provide a description of the proposed stormwater management system.

2. To address the capacity of the southwest and southeast stormwater management retention ponds based on 100 Yr- 4 hr storm event.

3. To provide information on Best Management Practices (BMP's) employed.

4. To provide information regarding the operation and maintenance of the facility.

The scope has been expanded in this final plan to provide additional information pertaining to the protection of the environment.

2.2 Stormwater Management System Description

In order to manage stormwater within the subdivision, it will be directed to retention areas to allow sediments to settle out. Two stormwater management facilities (wet ponds) are proposed to control the stormwater from Catchment Areas 2, 3, 5 and 6. To avoid water ponding, a 300 mm storm pipe is proposed to convey the stormwater from the catchment Area 2 to Pond 1 as shown in Drawing 3.0. Due to additional load on a Pond 1, volume has increased and increased storage capacity is necessary to accommodate the flow from Catchment Area 2.

Pond 2, located southeast of the subdivision will store stormwater and effluent from wastewater treatment plant, retain it for a 24 hour period to allow for settling of solids and then route it through natural channels and an unnamed creek with several beaver dams prior to discharge into Matthews Lake (neither the drainage course, unnamed creek nor the lake are fish bearing - see Drawing 01, which shows the drainage direction).

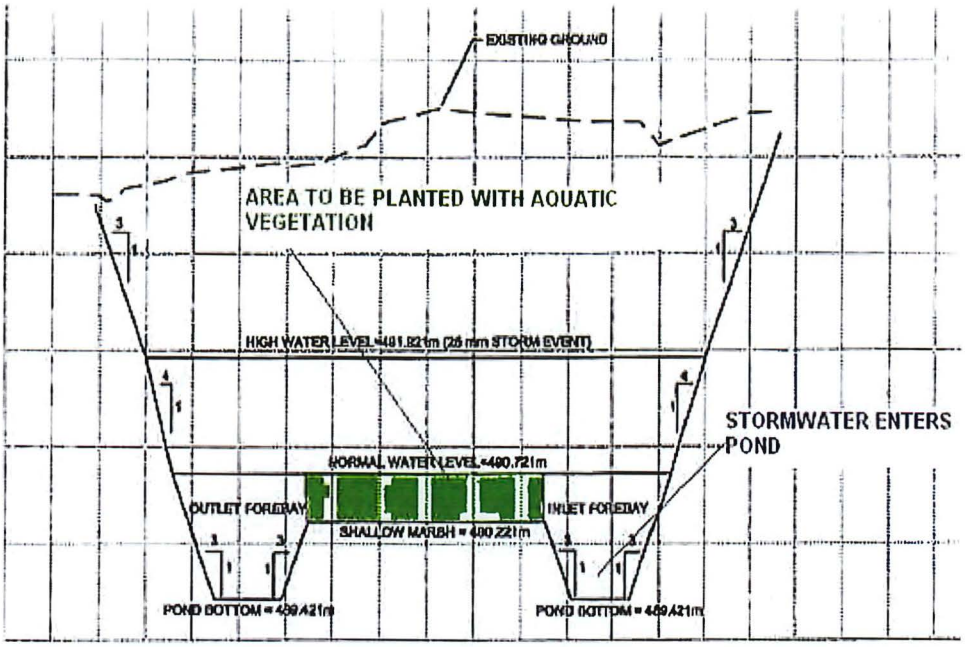
Due to topography within the subdivision, Areas 1 and 4 presented a challenge and it was necessary to:

- drain Area 1 overland and through existing natural vegetation to Elinor Lake (this area is very small and contain only approximately 0.6 hectares); and,
- drain Area 4 to the east (see Drawing 1, which shows the direction of drainage); through existing culverts and through natural drainage courses, ponds and wetlands prior to it reaching Matthews Lake (this will result in improvement of stormwater quality/quantity through infiltration, evaporation and transpiration).

All stormwater will enter the ponds via ditches or pipes to the forebay, which is deeper than the adjacent constructed marsh area, and overall sediment control is achieved through:

- first directing the stormwater to flow through grassed ditches, which will provide a primary level of control;
- the stormwater entering the forebay will be required to flow across the constructed marsh thereby providing a secondary level of control; the typical pond cross section is provided on the following page and it is to be planted with aquatic vegetation;
- stormwater will be retained in the pond for a period of 24 hours, thereby providing additional sediment control and water quality improvement; and
- the ponds will be equipped with a control manhole.

This design will ensure that the stormwater entering Elinor Lake will comply with the guidelines established by Alberta Environment.



POND CROSS-SECTION

2.3 Stormwater Modeling

An XP-SWMM 2009 computer model was run to compute the required storage volume and orifice size for each stormwater management facility, as well as to analyze the hydraulic characteristics of the system. Table 1.0 outlines the parameters used in the hydrologic and hydraulic analysis of the proposed major drainage system.

The orifice is designed to release the maximum allowable discharge rate of 2.8 litres per second per hectare. The design calculation for the orifice is done within the XP-SWMM 2009. The following is the orifice flow formula used in the model.

$Q = CA\,(2gH)^{1/2}$

H = Head, HWL – Tail Water Level (m)

Q= Discharge (m^3/s)

C= Orifice Coefficient (0.6)

2.4 Result of Analysis

The west and east retention ponds can accommodate runoff volume during 100 year – 4 hour storm event at a discharge rate of 2.8 L/s/ha. The east pond generates a runoff volume of 2,661 m^3 at a high water level of 489.647 m which is 0.353 m below the provided water level of 490.0 m. However, the west pond generates a runoff volume of 2,120 m^3 at a high water level of 491.196 m.

The simulated peak flows and runoff volumes for the 100 year – 4 hour design rainfall event are summarized in Tables 2.0 and 3.0. They also present the peak outflow and orifice size for each facility. Table 4.0 presents the configuration of the stormwater management facilities. Figures 1 and 4 present the variation of water level in each facility during 100 yr- 4 hr. and Figures 2 and 5 present the stage-discharge for each pond. Figures 3 and 6 present the stage–storage relationship for the Ponds. Both ponds are required to have a minimum of 0.3 m freeboard.

2.5 Capacity of the Stormwater Management Facilities

Both Ponds will be a small constructed wetland with the following characteristics:

1. A permanent pool depth of 1.0 m.

2. An active storage depth of approximately 2.0 m on the southwest and a proposed 1.4 m on the east retention pond.

3. Freeboard depth of approximately 0.30 m.

4. A storage capacity of 2,122 m^3 and 2661 m^3, on the west and east retention pond respectively, based the 100 Yr-4 hr. storm event.

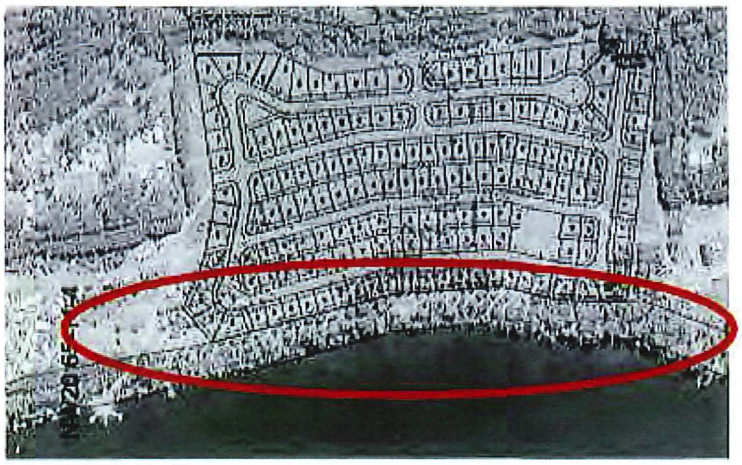
5. An outlet structure with an orifice area of 3,600 mm^2 and 5,300 mm^2, on the west and east ponds respectively, will be used to allow the stored 2,122 m^3 and 2,661 m^3 to be released over a 24 hr period to further enhance the quality of the stormwater.

The proposed facilities provide a larger volume than required based on the 100 year – 4 hour event and will conform to section 6.3.1.2 of the "**STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER, AND STORM DRAINAGE SYSTEMS**", January 2006 edition, which states that:

> *"It is considered that storing the volume from a 25 mm storm over the contributing area is appropriate for Alberta for stormwater quality control using detention devices such as dry ponds, wet ponds, and constructed wetlands."*

3.0 Discharge to Elinor Lake

One of the primary hurdles in instituting the stormwater management plan for this subdivision has been the method of crossing the public lands located between the subdivision and Elinor Lake (see plan below).

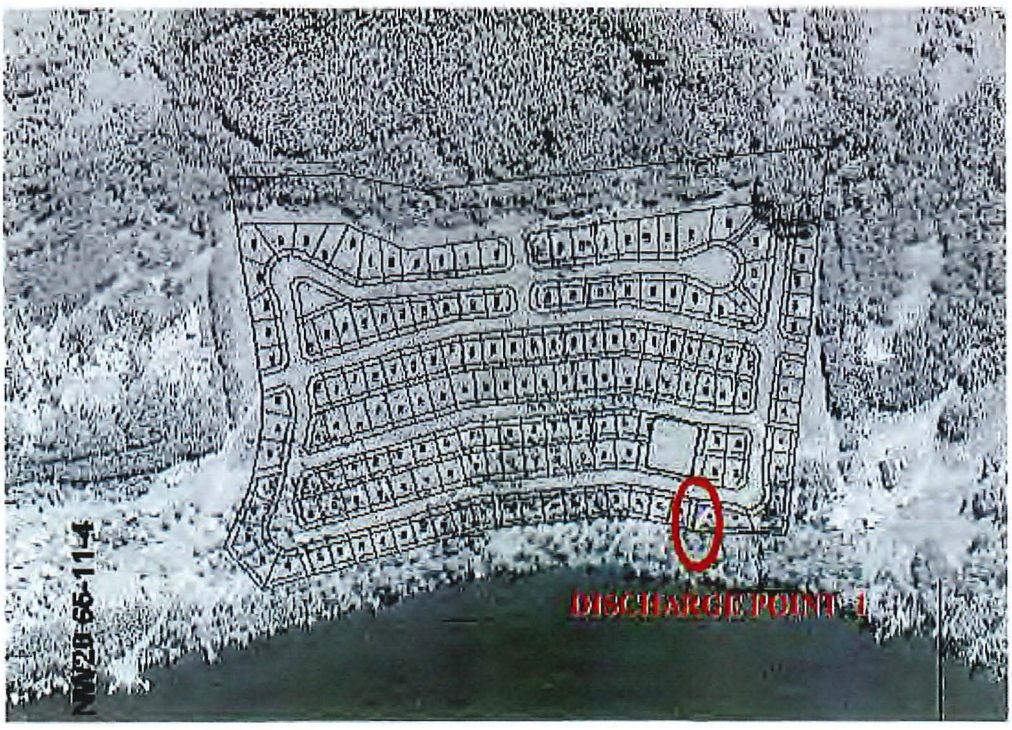


The elevation difference between the back of lots and the lake level is approximately 10 to 15 metres with slopes approaching 60%. It is a challenge to traverse these slopes without creating instability and erosion potential and this "Stormwater Management Report" proposes the installation of a pipe (approximate location shown below) by the directional drilling method. However, there are some negative aspects inherent in this proposal, including:

1. some work is still required on the lakeshore slopes in order to armour the pipe outlet location with riprap to prevent erosion, (this work will be performed during winter months to minimize the potential of having sediment entering Elinor Lake and permit proper clean-up prior to spring thaw);

2. construction problems could arise (i.e. drill head could become stuck in hole) which may necessitate excavation on the slopes; and,

3. the discharge pipe could collapse or become plugged which may require excavation.



The details of the outfall structure are shown on Drawing No. 10 and will include:

1. installation of geotextile fabric under the rock to prevent erosion;

2. installation of smaller rock over the geotextile fabric; and,

3. placement of large rock to disperse the energy in the stormwater prior to it reaching Elinor Lake.

The outfall structure will be placed above the water level of Elinor Lake and natural re-growth will be encouraged so that the area can return to its existing condition (see picture below).

4.0 Best Management Practices (BMP's)

The following Best Management Practices will be employed within the Elinor Lake Subdivision:

1. Lot Level BMP- Lots will be graded to slope to roadway ditches. Grassed swales at the backs of lots will be employed where required.

2. Conveyance System BMP - Vegetated/grassed roadway ditches will convey stormwater to the constructed wetlands (ponds), allowing for filtering of the runoff by vegetation, and infiltration of a portion of the runoff into the soil.

3. End of Pipe BMP - A constructed wetland is used to detain stormwater and allow for settling out of suspended solids. A portion of the soluble pollutants would be removed by the vegetation in the wetlands as well to further enhance the quality of runoff from the development.

5.0 Maintenance Considerations

The following activities are recommended to be performed to maintain the stormwater management facilities:

1. Routine maintenance of the wetland, inlet and outlet structures, grass swales, and road ditches would be required, which will involve the remove of accumulated sediments.

2. Regular checks at outfall locations to ensure erosion is not occurring and natural vegetation growth is established.

3. Regular checks on the sideslopes of ponds to ensure sloughing is not occurring and natural vegetation growth remains established.

6.0 Recommendations

This most recent plan will provide the required improvements to stormwater prior to discharging to Elinor Lake. It is therefore recommended that only one discharge location be provided at Elinor Lake as this will:

1. provide a more environmentally sensitive method of managing the stormwater;
2. allows a means of controlling informal access to the lakeshore; and,
3. reduce the number of crossings on SRD property.

The use of natural drainage courses and wetlands for the discharge of Pond 2 and Area 4 is considered preferable as it will:

1. improve the quality and reduce the quantity of stormwater through infiltration, evaporation and transpiration; and,
2. ensure that the existing drainage patterns are maintained thereby having minimal impact on the ecology.

Further information can be provided upon request.

Brian A. Locher, P.Eng., LL.B.

APPENDIX C

Traffic Impact Assessment

DCL SIEMENS
Engineering Ltd.

Elinor Lake Resort Development Group
Traffic Impact Assessment
Elinor Lake Resort
W 1/2 20 - 65 - 11 – W4

Prepared By:

Masrur Askar, P. Eng.

Permit

PERMIT TO PRACTICE
EXH ENGINEERING SERVICES LTD.
Signature
Date Mar. 12/07
PERMIT NUMBER: P 5347
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Janis Fong, P. Eng.

March 2007

PROJECT # 4205056

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APPENDICES

EXECUTIVE SUMMARY

EXH Engineering Services Ltd. was retained by the Elinor Lake Resort Development Group (the Developer) to carry out a traffic impact assessment for a proposed multi-lot resort development located in the W1/2 of 20–65–11–W4. The proposed Elinor Lake Resort is situated approximately 160 km northeast of Edmonton and 45 km southeast of Lac La Biche.

The developer is proposing to convert the existing Elinor Lake Recreational Area into a unique resort development. The proposed development is currently accessed from two access points along Township Road 652.

The proposed development is to consist of 145 Bareland condominium lots and 3 cabin rentals. The development locations and the concept plan are shown on the attached drawings (Appendix A).

Based on the information contained in this report, we offer the following comments, conclusions and recommendations:

- The existing Township Road 652 & West Access Road intersection will require a Type 1a configuration as a result of the site development.
- The existing Township Road 652 & East Access Road intersection will require a Type 1a configuration as a result of the site development.
- Dedicated right-hand turning lanes are not warranted due to traffic generated by the proposed site development for both of the intersections.
- Sight distances for traffic approaching the two intersections from the south and the north are estimated to be in excess of 1,000 metres and appear to be adequate.

- There is no significant pedestrian traffic in the area; therefore accommodation of pedestrian traffic is not anticipated as a requirement.

1. INTRODUCTION

EXH Engineering Services Ltd. was retained by the Elinor Lake Resort Development Group (the Developer) to carry out a traffic impact assessment for a proposed multi-lot resort development located in the W1/2 of 20–65–11–W4.

The Elinor Lake Resort is situated in Lakeland County approximately 160 km northeast of Edmonton and 45 km southeast of Lac La Biche. It is accessed by approximately 23 km of local road east from Highway 36 and approximately 18 km of local road north from Highway 55. The proposed development is currently accessed by approximately 2 km of local gravel road from two access points along Township Road 652.

The developer is proposing to convert the existing Elinor Lake Recreational Area into a unique resort development. The intention is to develop the project in separate phases with a potential for Bareland condominium lots and cabin rentals. It is expected that this development will attract seasonal traffic from Lac La Biche, Edmonton and Bonnyville.

The proposed development is to consist of 145 Bareland condominium lots and 3 cabin rentals. The development locations and the concept plan are shown on the attached drawings (Appendix A).

2. SCOPE OF WORK

This assessment is intended as a review of the following specific issues:

- The estimated traffic volume generated by the development at average and peak times.
- The estimated existing and projected (20-year horizon) background traffic, development traffic and combined background and development traffic at average and peak times on adjacent county roads.
- The estimated future left-turn and right-turn maneuvers at following the two intersections on Township Road 652:
    1. Township Road 652 & West Access Road Intersection
    2. Township Road 652 & East Access Road Intersection
- The appropriate configuration for the existing intersections to accommodate the site immediately after development and at the 20-year design horizon.
- Capacity analysis for the two intersections.
- Operational Analysis to ensure that the design vehicle is capable of safely maneuvering the intersection without interfering with other traffic movements.

This review is based on Township Road 652 traffic volume data in 2002 obtained from the County of Lakeland website. This report does not extend to a review of the geometry of the off site municipal roads and intersections and therefore does not represent a detailed design of the subject intersections.

3. METHODOLOGY

In order to address these issues and to carry out the Traffic Impact Assessment, the following methodology was used:

- Obtain traffic volumes for Township Road 652 from the County of Lakeland;
- Gather traffic volume data from the existing development that will now be utilizing the same access as the proposed development.
- Estimate the traffic generation from the proposed development based on the Institute of Transportation Engineers (ITE) Manual, 7th Edition.
- Assess the impact on existing road access points, due to site generated traffic.
- Assess the potential impact of the site traffic on the operation of the two intersections: Township Road 652 East Access Road and Township Road 652 West Access Road.
- Analyze the capacity, delay and level of service (LOS) of the intersections at AM and PM peak periods for both 2007 and 2027 using McTrans HCS+ software.

4. PROJECT INFORMATION

The proposed multi-lot resort development located in the W1/2 of 20 – 65 – 11 – W4 is situated approximately 160 km northeast of Edmonton and 45 km southeast of Lac La Biche. The developer is proposing to convert the existing Elinor Lake Recreational area into a unique resort development.

The project will be developed as separate phases with a potential of 145 condominium lots and 3 cabin rentals. Currently the site is accessed by local road from a total of two points from Township Road 652. The local roads providing access to the site also provide access to properties in the W½-20-65-W4. A municipal land fill is located 1.6 km due south of the site along Township Road 652. The Elinor Lake Subdivision is located approximately 1 km further west from the landfill along Township Road 652.

The development locations and the concept plan are shown on the attached drawings (Appendix A).

The development site, locally known as the "Elinor Lake Campground" is currently a seasonal camping area. The use of the land is not expected to change. As the developer no longer offers short term camping, the number of users of the site is expected to decrease significantly

5. ESTIMATED SITE TRAFFIC GENERATION

Estimates of development traffic volumes contained in this report are based on the Institute of Transportation Engineers (ITE) Manual, 7th Edition. Based on the type and use of rental cabins we considered the trips to be generated by the rental cabins will be equivalent to the resort hotels. For the purpose of this review, we have used the following ITE average trip-end generation categories:

- Recreational Homes (Land Use: 260)
- Resort Hotel (Land use: 330)

ITE trip generation rates are based on observed measurement and are contained in Appendix D. ITE provides a range of trip generation rates for the specific types of development, along with recommended averages. Estimates are categorized based on typical weekday and AM/PM Peak Hour traffic volumes for the adjacent roadway.

The direction distribution of traffic entering and exiting the site through the West Access Road was assumed as:

- A maximum of 90% of the development traffic will use the West Access Road & Township Road 652 intersection.

- A maximum of 25% of the development traffic will use the East Access Road & Township Road 652 intersection.

This assumed distribution is based on the proximity of the Town of Lac La Biche to the north-west, Town of Bonnyville to the south-east, The City of Edmonton to the south-west and also from some households and communities surrounding the area.

The estimated traffic volume generated by the development at average and peak times on adjacent roads are attached in Appendix C and are summarized in Table 1 and Table 2. Total trips represent two-way vehicle trips. Volumes entering and exiting the site, shown in Table 3 are based on ITE typical distribution percentages.

Table 1: Estimated Generated Traffic- Township Road 652 & West Access Road

Development Conditions							Entering from the		Exiting to the	
Average Daily	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	West	East	West	East
Recreational Homes	150	D. Units	3.16	474	237	237	213	24	213	24
Resort Hotel	3	Room	0.59	2	1	1	1	1	1	1
Total				476	238	238	214	25	214	25
AM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the site	Exiting the site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	150	D. Units	0.2	24	16	8	14	2	7	1
Resort Hotel	3	Room	0.4	2	2	1	2	1	1	1
Total				26	18	9	16	3	8	2
PM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	150	D. Units	0.26	39	16	23	14	2	21	2
Resort Hotel	3	Room	0.49	1	1	1	1	1	1	1
Total				40	17	24	15	3	22	3

Table 2: Estimated Generated Traffic- Township Road 652 & East Access Road

Development Conditions							Entering from the		Exiting to the	
Average Daily	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	West	East	West	East
Recreational Homes	150	D. Unit	3.16	474	237	237	47	59	47	59
Resort Hotel	3	Room	0.59	2	1	1	0	1	0	1
Total				476	238	238	47	60	48	60
AM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the site	Exiting the site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	150	D. Unit	0.2	24	16	8	3	4	2	2
Resort Hotel	3	Room	0.4	2	2	1	0	1	0	1
Total				26	18	9	3	5	2	3
PM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	150	D. Unit	0.26	39	16	23	3	4	5	6
Resort Hotel	3	Room	0.49	1	1	1	0	1	0	1
Total				40	17	24	3	5	5	7

Table 3: Directional Distribution percentages of generated Traffic from ITE Manual

Campground Vehicle Park				Resort Hotel				Commercial			
AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting
42%	58%	69%	31%	72%	28%	43%	57%	50%	50%	50%	50%

In summary, it is estimated that the proposed development will result in approximately 609 trips per day at full development and full occupancy, with peak-hour volumes of 42 at the AM peak and 70.

Refer to Appendix C for Traffic Volumes.

6. TRAFFIC VOLUMES

Township Road 652 is a two-lane undivided gravel road that runs east and west along the south side of the site, with an 80 km/h operating speed. The gravel surface changes to pavement (as shown on the Lakeland county Landownership map) approximately 11 km most of the West Access Road, Township Road 652 is classified as a collector in the county's Transportation Master Plan (2005-2009).

Site photographs taken by EXH in July 2006 are located in Appendix A.

The Lakeland County Transportation Master Plan (2005-2009), July 2005 indicates an Average Annual Daily Traffic (AADT) for Township Road 652 of 60 measured east of the intersection of Township Road 652 and Range Road 4113 (Appendix B). This intersection is located 1.6 km east of the East Access Road on Township Road 652.

On the other hand, AADT for Township Road 652 is 130 measured west of the intersection of Township Road 652 and Range Road 4123 (Appendix B). This intersection is located 1.6 km west of the east Access Road on Township Road 652.
For this review, we considered the traffic volume on the Township Road 652 in the vicinity of the site as130 instead of 60 to analyze the traffic impact due to the development.

Based on the assumed daily traffic of 130 vehicles per day, and a non-compounding 2.5% growth rate, the estimated average daily traffic volumes are 200 (147 plus some additional traffic for some new development near the site and summer traffic) in 2007 and 300 in 2027 at the section of the road near the site. These volumes represent the base traffic volumes along Township Road 652, with development traffic volumes assumed as being in addition to this base estimate. The AM and PM Peak Hour volumes for Highway 2 were similarly projected to be the design year.

7. LEFT-TURN MANEUVERS

Left-turn warrants are based on the level of probability that a vehicle in the advancing traffic stream in the design hour will not arrive at an intersection when another vehicle, traveling in the same direction, is stopped waiting to make a left turn. The associated hazard this represents decreases with decreased design speed. The analysis of left-turn maneuvers of Township 652 Road was conducted based on the proposed development plan.

Alberta Infrastructure and Transportation typically utilizes the 100th highest hourly volume for design functions. For a rural situation, this will tend to be in the order of 12% to 15% of the average daily traffic volume. This results in an estimated design-hour volume of 30 in 2007 and 45 in 2027 at the two intersections. These represent base volumes, prior to development.

It is also assumed that these base volumes will be evenly split between east-bound and west-bound and unchanged between the AM and PM peak.

7.1. TOWNSHIP ROAD 652 & WEST ACCESS ROAD INTERSECTION

Volumes for turning maneuvers are illustrated in Appendix C.

For the purpose of this review, it is necessary to make assumptions with respect to the direction from which the traffic is approaching the site during the design peak hour. The following assumptions were used, based on the location of likely user attractions:

- On average, during the day, the volume entering the site will be equal to the exiting volume.

- During the AM peak hour, up to 90% of the residential traffic entering the site will be from the west and 25% from the east. Similarly, during the PM peak, up to 90% will leave the site to the south and 25% to the east.

The site development and Highway 2 volumes at the 20-year design horizon, and the AM and PM peak hour estimates, are summarized in Table 4. Some numbers have been rounded.

Table 4: Peak Hour Turning Information–Township Road 562 & West Access Road

AM Peak	Eastbound	Westbound	Left turns	% Left Turn
Immediately after the Development (2007)	28	15	16	57.1
Projected Design Year (2027)	34	21	19	47.1
PM Peak				
Immediately after the Development (2007)	27	15	15	55.6
Projected Design Year (2027)	33	21	15	45.9

An analysis was conducted using the opposing and advancing traffic volumes during peak hour times. This analysis, for both the AM and PM peak and through to the design horizon, suggested that a Type 1a intersection is warranted considering travel trailer (Pt) or boat trailer (Pb) as the design vehicle.

Refer to Appendix D for the intersection analysis and Section 9.4 for Operational Analysis.

7.2 TOWNSHIP ROAD 652 & EAST ACCESS ROAD INTERSECTION

Volumes for turning maneuvers are illustrated in Appendix C.

For the purpose of this review, it is necessary to make assumptions with respect to the direction from which the traffic is approaching the site during the design

peak hour. The following assumptions were used, based on the location of likely user attractions:

- On average, during the day, the volume entering the site will be equal to the exiting volume.
- During the AM peak hour, up to 20% of the residential traffic entering the site will be from the west and 25% from the east. Similarly, during the PM peak, up to 20% will leave the site to the south and 25% to the east.

The site development and Township Road 652 volumes at the 20-year design horizon and the AM and PM peak hour estimates are summarized in Table 5. Left turns refer to the traffic on Township Road 652 west-bound turning into the Access Road. Some numbers have been rounded.

Table 5: Peak Hour Turning Information–Township Road 562 & East Access Road

AM Peak	Eastbound	Westbound	Left turns	% Left Turn
Immediately after the Development (2007)	15	17	15	20.0
Projected Design Year (2027)	21	23	3	14.3
PM Peak				
Immediately after the Development (2007)	15	17	3	20.0
Projected Design Year (2027)	21	23	3	15.9

An analysis was conducted using the opposing and advancing traffic volumes during peak hour times. This analysis, for both the AM and PM peak and through to the design horizon, suggested that a Type 1a intersection is warranted considering travel trailer (Pt) or boat trailer (Pb) as design vehicle.

Refer to Appendix D for the intersection analysis and section 9.4 Operational Analysis.

The analysis is summarized in Table 6 and Table 7 below.

Table 6: Warrants for Left Turn Treatment – Town ship Road 652 & West Access Road

Analysis Year	AM Peak				PM Peak			
	V_A	V_O	% Left-turn	Left turn Treatment	V_A	V_O	% Left-turn	Left turn Treatment
2007	28	15	57.1	Not Warranted	27	15	55.6	Not Warranted
2027	34	21	47.1	Not Warranted	33	21	45.9	Not Warranted

Table 7: Warrants for Left Turn Treatment -- Town ship Road 652 & West Access Road

Analysis Year	AM Peak				PM Peak			
	V_A	V_O	% Left-turn	Left turn Treatment	V_A	V_O	% Left-turn	Left turn Treatment
2007	15	17	20	Not Warranted	15	17	20.0	Not Warranted
2027	21	23	14.3	Not Warranted	21	23	15.9	Not Warranted

8. RIGHT-TURN MANEUVERS

The Alberta Infrastructure and Transportation warrant for a right-turn lane requires that the intersecting road have an average daily traffic volume in excess of 900 vehicles and a right-turn volume in excess of 360 vehicles. Based on the assumptions noted, the average daily right-turns onto Township Road 652 from West Access Road would be in the order of 147 after full development. Therefore, a right-turn lane is not warranted for West Access Road.

Similarly the average daily right-turns onto Township Road 652 from East Access Road would be in the order of 34 after full development. Therefore, a right-turn lane is not also warranted for East Access Road.

9. ADDITIONAL CONSIDERATIONS

This review is intended as a general overview of a number of site aspects. Some additional issues have been identified for consideration.

9.1. ILLUMINATION/PEDESTRIAN TRAFFIC

There is no pedestrian traffic in the area. Accommodation of pedestrian traffic is not anticipated as a requirement. There is no illumination along Township Road 652 in proximity to the site. A warrant for illumination was not conducted.

9.2. SIGHT DISTANCES

The sight distances with respect to the two approaches were observed by EXH to be in excess of 1,000 metres. Therefore the sight distances for the proposed development appear to be adequate.

9.3. CAPACITY

A capacity analysis of the intersection was undertaken using McTrans HCS+ software. The AM and PM peak periods for both 2007 and 2027 were analyzed for capacity, delay, and level of service (LOS). The analysis is summarized in Table 8 and 9 below.

Table 8: Intersection Capacity – Township Road 652 & West Access Road

	Eastbound				Southbound			
	2007		2027		2007		2027	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Volume (vph)	20	45	20	45	26	27	26	27
Capacity(vph)	1608	1604	1626	1622	1048	1031	1062	1047
Control Delay (s/veh)	7.3	7.3	7.2	7.3	8.5	8.6	8.5	8.5
LOS	A	A	A	A	A	A	A	A

Table 9: Intersection Capacity – Township Road 652 & East Access Road

	Eastbound				Westbound			
	2007		2027		2007		2027	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Volume (vph)	4	9	4	9	11	7	11	12
Capacity(vph)	1605	1595	1597	1587	1018	958	1005	987
Control Delay (s/veh)	7.2	7.3	7.3	7.3	8.6	8.8	8.6	8.7
LOS	A	A	A	A	A	A	A	A

The complete analysis can be found in Appendix C.

9.4. OPERATIONAL ANALYSIS

The operational analysis is required to ensure that the design vehicle is capable of safely maneuvering the intersection without interfering with other traffic movements. A design vehicle is a selected motor vehicle which is used to establish highway design controls to accommodate the weight, dimensions and operating characteristics for vehicles of a designated type.

The proposed site will used mostly by the recreational vehicles. Therefore, we consider travel trailer (Pt) or boat trailer (Pb) as design vehicle. To allow intersections to be designed to accommodate the appropriate vehicles, turning templates are used to facilitate the checking of intersection layouts.

Drawing-01 (Appendix D) illustrates how the turning templates for the design vehicles travel trailer (Pt) or boat trailer (Pb) match with both of the Township Road 652 & West Access Road and Township Road 652 & East Access Road intersection.

10. CONCLUSIONS AND RECOMMENDATIONS

Based on the information contained in this report, we offer the following comments, conclusions and recommendations:

- The existing Township Road 652 & West Access Road intersection will require a Type 1a configuration as a result of the site development.
- The existing Township Road 652 & East Access Road intersection will require a Type 1a configuration as a result of the site development.
- Dedicated right-hand turning lanes are not warranted due to proposed site development for both of the intersections.
- Sight distances for traffic approaching the site from the south and the north are estimated to be in excess of 1,000 metres and appear to be adequate.
- There is no significant pedestrian traffic in the area; therefore accommodation of pedestrian traffic is not anticipated as a requirement.

11. CLOSURE

This report has been prepared based on the best information available at the time. It is intended to provide conceptual review of the specific issues. Numbers will be updated through detailed design or with a more comprehensive site evaluation.

This report has been prepared by EXH Engineering Services Ltd. for the use of the Elinor Lake Resort Development Group. Use by third parties, without the express written permission of EXH Engineering Services Ltd., is not permitted.

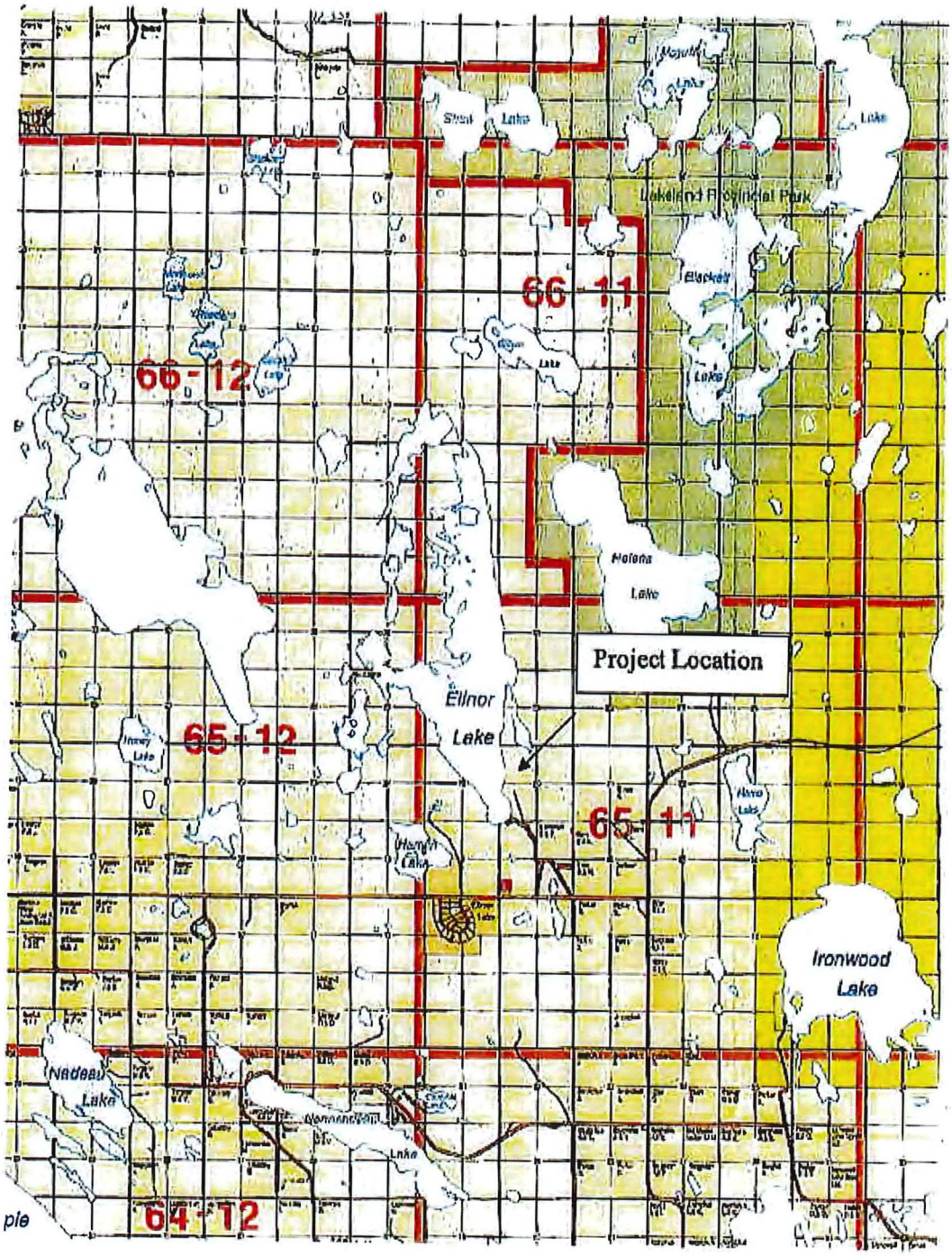
APPENDIX A

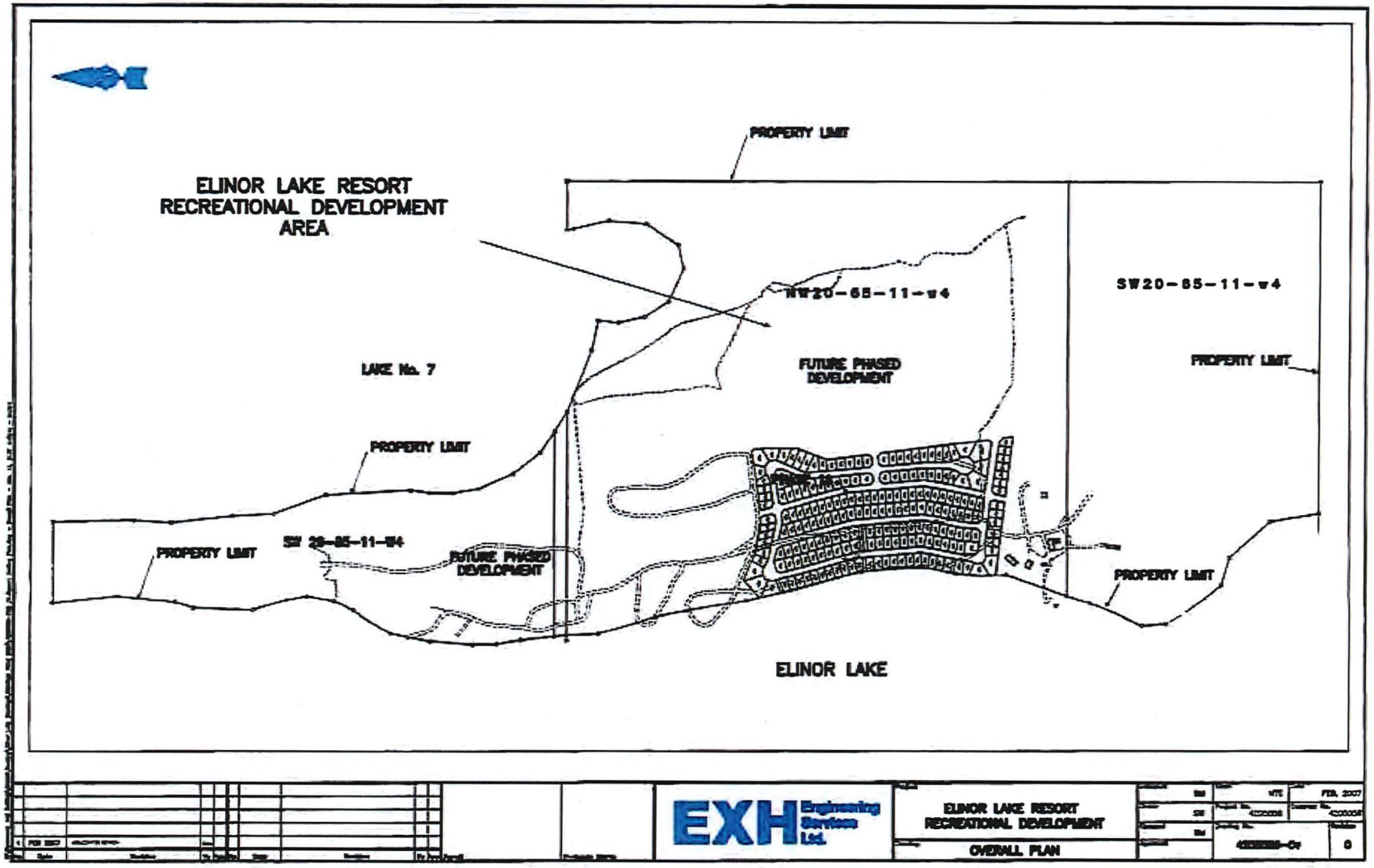
PROJECT FIGURES

Location Plan

Site Layout Plan

Figure D-7.5: Types of Intersections


Lakeland Provincial Park
66 - 11
66 - 12
Helena Lake
Project Location
Ellnor Lake
65 - 12
65 - 11
Ironwood Lake
Nadeau Lake
64 - 12



EXH Engineering Services Ltd.

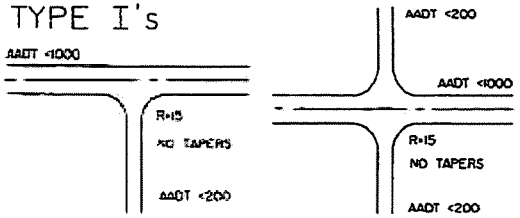
ELINOR LAKE RESORT
RECREATIONAL DEVELOPMENT

OVERALL PLAN

FEB. 2007

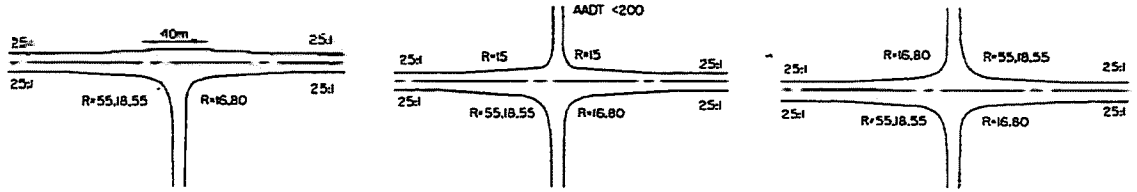
0

TYPE I's



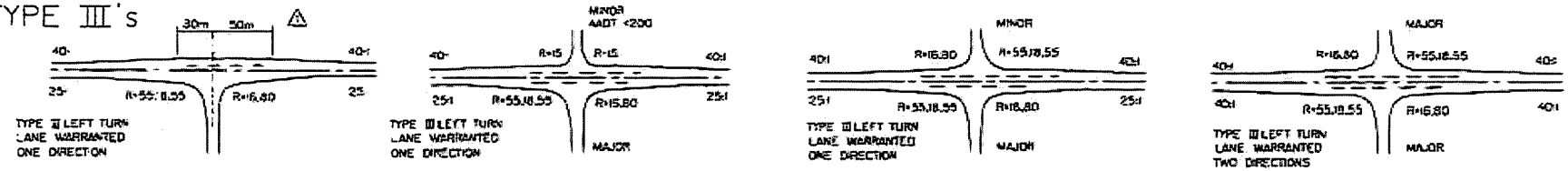
TYPE Ia TYPE Ib

TYPE II's



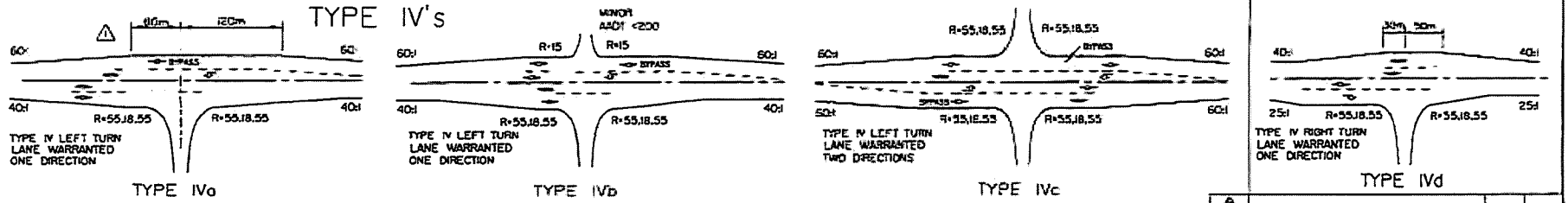
TYPE IIa TYPE IIb TYPE IIc

TYPE III's



TYPE IIIa TYPE IIIb TYPE IIIc TYPE IIId

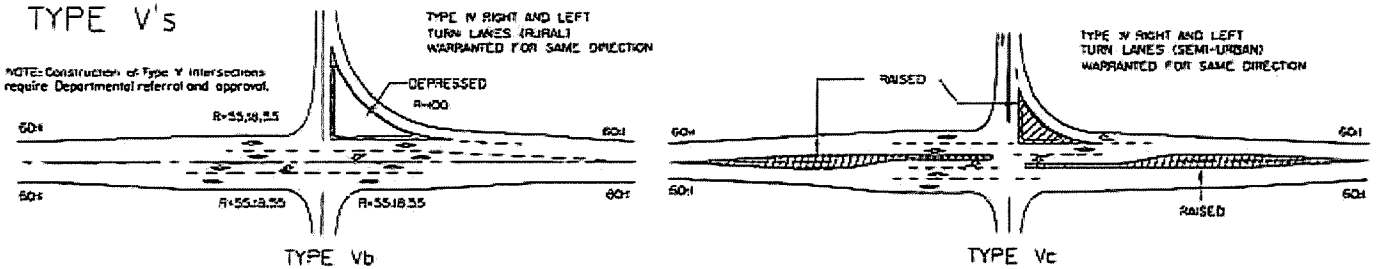
TYPE IV's



TYPE IVa TYPE IVb TYPE IVc TYPE IVd

TYPE V's

NOTE: Construction of Type V intersections require Departmental referral and approval.



TYPE Vb TYPE Vc

NOTES:
1. This is not a pavement marking drawing.
2. This figure depicts the typical layouts used for at-grade intersections. Detailed design considerations may dictate some minor alterations for particular intersections. The tapers shown here are typical for a 110 km/h design speed on the main highway.

No.	REVISIONS	BY	DATE
⚠			
⚠	REVISED LANE DIMENSIONS	TDH	08/95

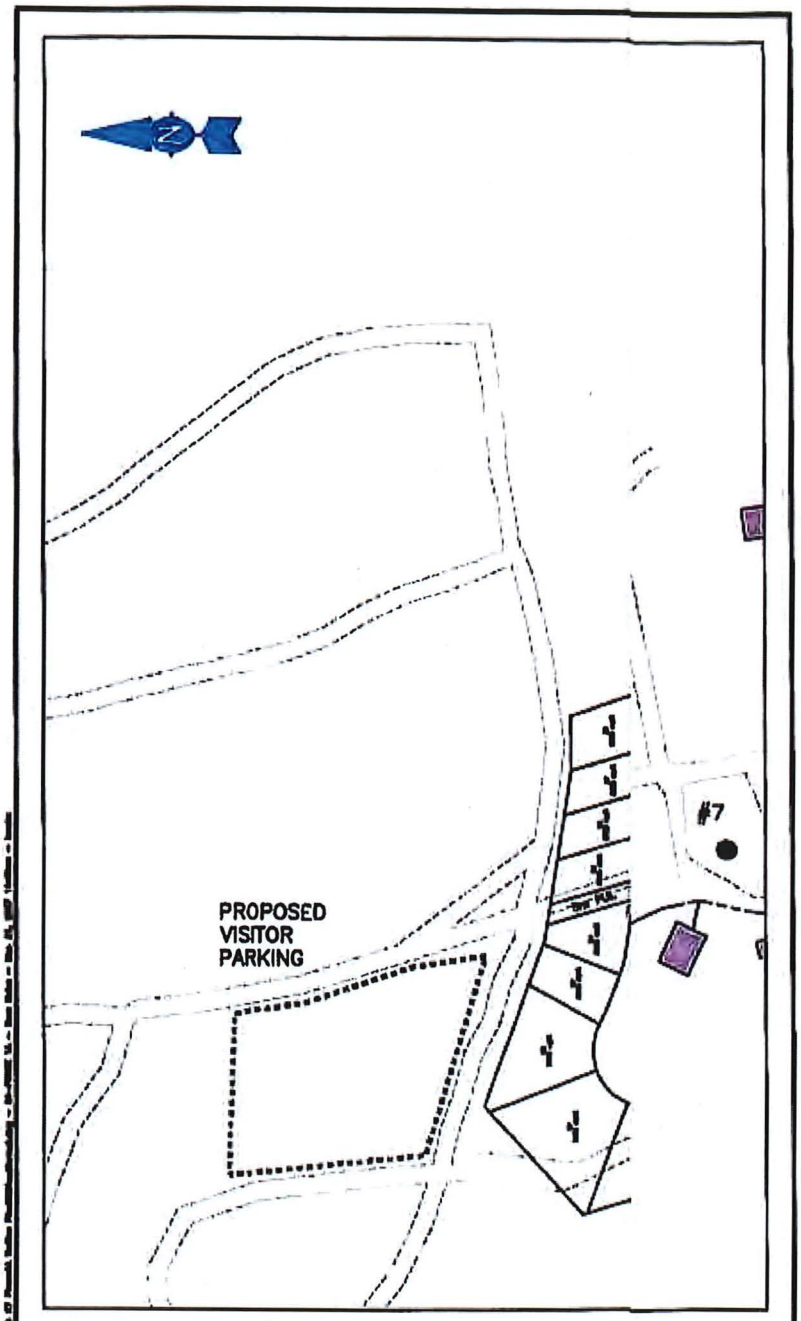
Alberta INFRASTRUCTURE

FIGURE D-7.5

Date AUG 995

STANDARD AT-GRADE INTERSECTION LAYOUTS FOR TWO-LANE HIGHWAYS

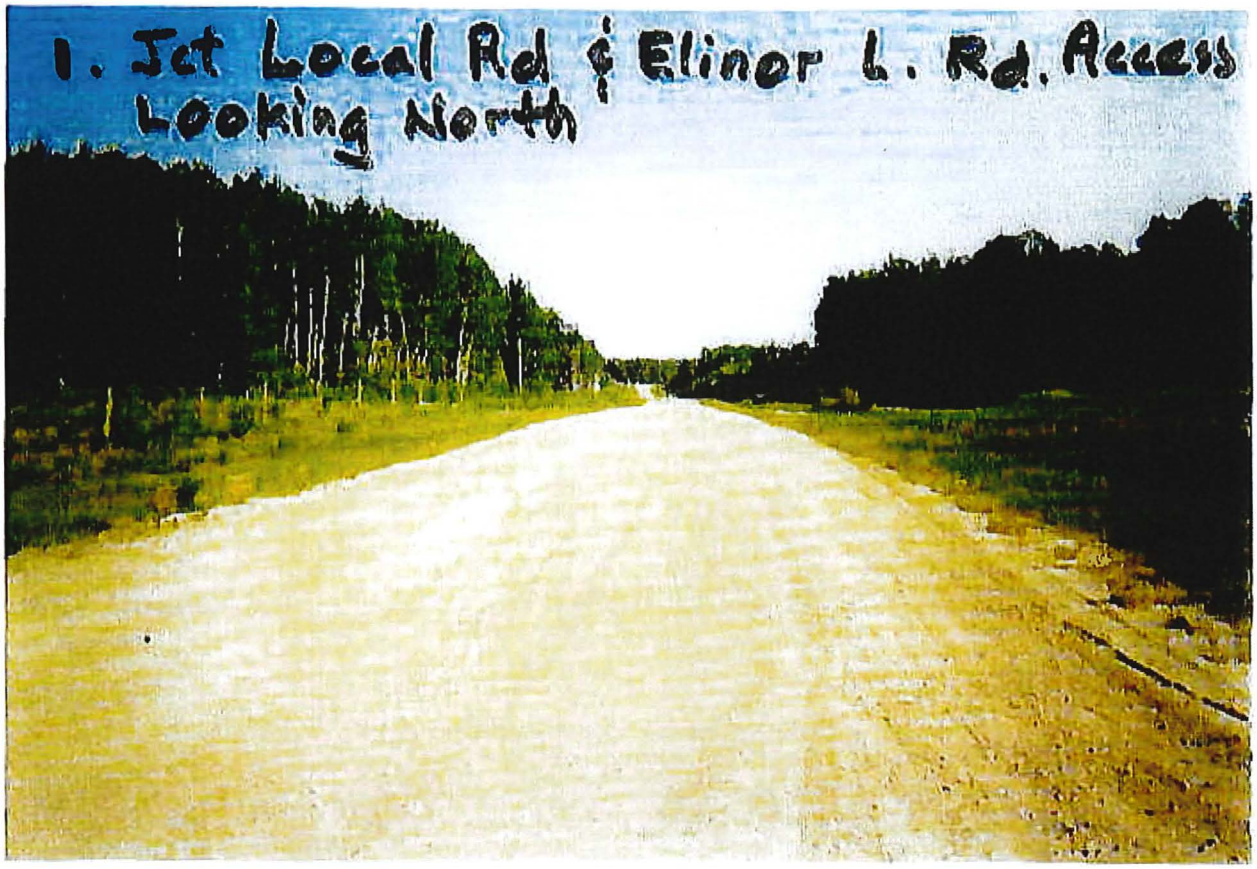
Prepared By: LT	Checked By: B.K.	Scale: N.T.S.	PAGE D-III

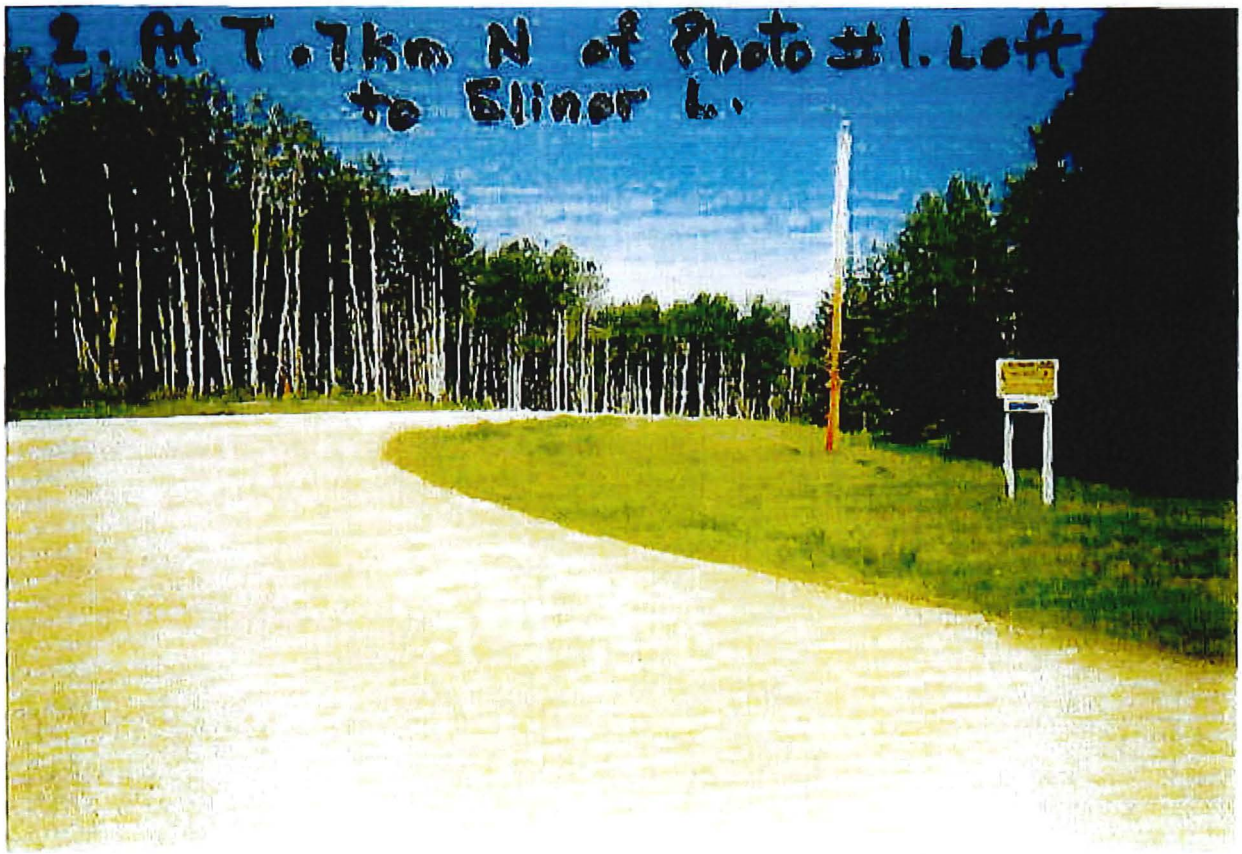


							NTS	FEB. 2007
							056	Contract No. 4206056
0	FEB 07	ISSUED FOR REVIEW	BM				S6-01	Revision 0
No.	Date	Revision	By	App'd	No.	Date	Revision	

APPENDIX B

SITE PHOTOGRAPHS


1. Jct Local Rd & Eliner L. Rd. Access
Looking North


2. At T. 1km N of Photo #1. Left
to Eliner L.

APPENDIX C

TRAFFIC VOLUMES

APPENDIX C

TRAFFIC VOLUMES

LAKELAND COUNTY

TRANSPORTATION MASTER PLAN

2005 - 2009

JULY 2005

LAKELAND COUNTY

TRANSPORTATION MASTER PLAN

2005 – 2009

Prepared by

Lakeland County
Public Works Department
Box 1679
Lac La Biche, Alberta
T0A 2C0

Phone: 780-623-1747
Fax: 780-623-2039

JULY 2005

5.2.1 Arterial Roads

Arterial roads are the main thoroughfares and generally have the highest traffic volumes within the County's subsystem of roads. They are designed to handle traffic that is going from a provincial highway to another provincial highway or going from a community, through other communities on the way to a provincial highway. They also handle traffic heading to and from numerous resources in the area. The arterial roads provide an integrated network of connections to the provincial highway system. They serve both local and through traffic. An arterial road generally meets one or more of the following criteria:

- Traffic volumes in excess of 100 vehicles per day
- Connects a town to another town
- Connects a town to a provincial highway
- Connects a town to an arterial road
- Connects one provincial highway to another provincial highway

Two arterial road standards have been employed in the County. One standard is for existing arterial roads while the other standard is for new construction. The existing arterial road standard provides an 8 meter finished paved surface width in a 40 meter right of way built to a 90 km/hr design speed. The future paved arterial road standard is similar to the existing standard but provides a 9 meter finished paved surface width. A cross-section of the future arterial standard is provided as Figure 4 and cross-section for the existing arterial road is shown in Figure 5.

For roads with traffic volumes less than 200 vehicles per day, an 8 meter finished surface width meets the Alberta Transportation design guideline. For an existing gravel road with an 8 to 9 meter surface width, the required subgrade width can be achieved by removing material from the road top and placing it on the existing sideslopes. This would usually be completed during the subgrade preparation stage of a base-paving project. A subgrade width of 10 meters is required to achieve a finished surface width of 8 meters with 3:1 sideslopes and a structure of 250mm of granular base course and 80-100mm of asphalt concrete pavement.

5.2.2 Collector Roads

Collector roads serve the purpose the name suggests. They collect local traffic and funnel it to the primary and secondary highways, arterial roads or

communities. A collector road would generally meet one or more of the following criteria:

- Traffic volumes in excess of 50 vehicles per day
- Connects an arterial road to another arterial road
- Connects multi-lot rural residential areas, hamlets or other populated areas to the provincial highway system or an arterial road
- Connects recreational sites to a provincial highway or arterial road

The proposed collector road standard provides a 9 meter finished gravel surface and should be built to a 90km/hr design speed in a 30 meter right of way. A cross-section for the Collector Road is provided in Figure 6.

5.2.3 Local Roads

Rural roads that are not included in the above classification system or the provincial highway system are considered to be local roads. Local roads meet one or more of the following criteria:

- Serves a local function and is not generally used for long distance travel
- Low volume roads that generally serve only local traffic
- May serve only one resident
- May not be a through road

Two local road standards are proposed. The proposed Local Road standard is for an 8 meter finished gravel surface built to a 90km/hr design speed in a 20 meter right of way. The proposed Access Road standard provides a 7 meter finished gravel surface in a 20 meter right of way. Figure 7 outlines the recommended cross-section for local roads and Figure 8 outlines the recommended cross-section for access roads.

The following information provides a basic guide for the selection of a roadway cross section based upon the design speeds and traffic volumes likely to be encountered on most local roads. It is recommended that the designer refer to Alberta Transportation's Design Guide to determine the appropriate alignment elements for the selected cross section and design speed.

	DATE OF COUNT	INTERSECTION	NORTH	SOUTH	EAST	WEST
	Nov 22 2002	HWY 858 & RR 4162A(Birch Grove Access)	180	320	0	200
1	Nov 26 2002	TWP 652 & RR4132A(Elnor Lake Rd)	450	190	340	120
	Nov 27 2002	HWY 55 & RR 4105(East Richlake area)	80	70	460	470
	Nov 28 2002	TWP 652(MacDonald Rd)& RR 4153	130	100	0	50
	Nov 28 2002	HWY 36 & TWP 650(Balaban Rd)	1030	990	0	80
	Nov 29 2002	TWP 640A & RR 4114(Richlake store)	70	70	70	70
	Dec 04 2002	HWY 36 & TWP 653(Christy Creek Rd)	1610	1550	90	170
	Dec 04 2002	HWY 36 & TWP 661A(Beaver Lk Rd)	2290	1670	700	0
	Dec 05 2002	HWY 663 & TWP Rd 663(Venice Rd)	980	890	60	150
	Dec 05 2002	HWY 881 & RR 4131(Golf course road)	520	60	1220	1700
	Dec 06 2002	TWP 665A & RR 4152A(Missawawi 11)	0	40	160	120
	Dec 10 2002	HWY 881 & TWP 683(Square Lake road)	910	950	100	0
	Dec 10 2002	HWY 663 & RR 4135A(Beaver hill road)	1760	0	1970	750
	Dec 12 2002	HWY 55 & RR 4142A(Sentinel Industrial pk)	840	0	4080	3540
	Dec 12 2002	TWP 680 & RR 4161(Plamondon landfill rd)	0	60	190	210
3	Dec 17 2002	TWP 652 & RR 4113(Elnor Lake Rd)	40	60	0	60
	Dec 17 2002	HWY 858 & TWP 684A(campsite road)	520	830	350	0
	Dec 18 2002	TWP 672 & RR 4125(Shaw lake road)	60	50	100	130
2	Dec 18 2002	TWP 652 & RR 4123(Elnor lake road)	0	30	120	130
	Dec 19 2002	HWY 858 & RR 4144(Poplar point rd)	60	80	100	80
	Dec 19 2002	HWY 881 & TWP 695A(Heartlake access)	380	480	140	0

APPENDIX D

TRIP GENERATION ESTIMATES

Land Use: 330
Resort Hotel

Description

Resort hotels are similar to hotels (Land Use 310) in that they provide sleeping accommodations, restaurants, cocktail lounges, retail shops and guest services. The primary difference is that resort hotels cater to the tourist and vacation industry, often providing a wide variety of recreational facilities/programs (golf courses, tennis courts, beach access, or other amenities) rather than convention and meeting business. Resort hotels are normally located in suburban or outlying locations on larger sites than conventional hotels. One site surveyed in the San Diego area is actually a "motel row" with combined facilities similar to a resort hotel. Hotel (Land Use 310), all suites hotel (Land Use 311), business hotel (Land Use 312) and motel (Land Use 320) are related uses.

Additional Data

Eleven studies provided information on occupancy rates at the time the studies were conducted. The average occupancy rate for these studies was approximately 82 percent.

Some properties contained in this land use provided guest transportation services (such as airport shuttles, limousine services, or golf course shuttle service), which may have had an impact on the overall trip generation rates.

The sites were surveyed from the 1970s to the 1990s throughout the United States.

For all lodging uses, it is important to collect data on occupied rooms as well as total rooms in order to accurately predict trip generation characteristics for the site.

Source Numbers

18, 40, 100, 270, 277, 381, 436

Land Use: 330
Resort Hotel
Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

Independent Variable	Trip Generation Rate	Size of Independent Variable	Number of Studies	Directional Distribution
Occupied Rooms				
Saturday	13.43	273	1	50% entering, 50% exiting
Saturday Peak Hour of Generator	1.23	273	1	Not Available
Sunday	10.09	273	1	50% entering, 50% exiting
Employees				
Saturday	13.58	270	1	50% entering, 50% exiting
Saturday Peak Hour of Generator	1.25	270	1	Not Available
Sunday	10.20	270	1	50% entering, 50% exiting

Resort Hotel
(330)

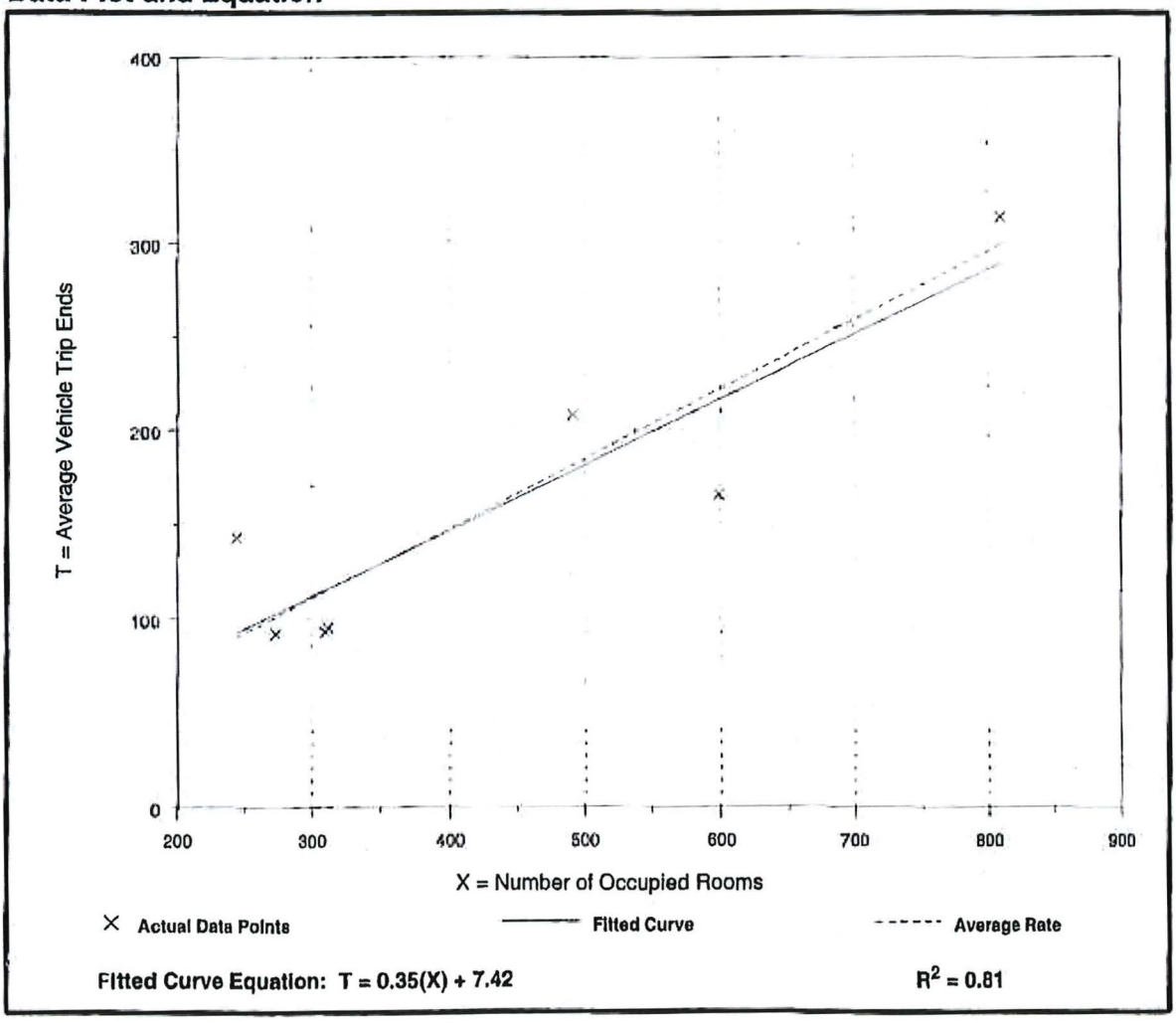
Average Vehicle Trip Ends vs: **Occupied Rooms**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 7
Average Number of Occupied Rooms: 434
Directional Distribution: 72% entering, 28% exiting

Trip Generation per Occupied Room

Average Rate	Range of Rates	Standard Deviation
0.37	0.28 - 0.59	0.61

Data Plot and Equation



Fitted Curve Equation: T = 0.35(X) + 7.42 **R^2 = 0.81**

Resort Hotel
(330)

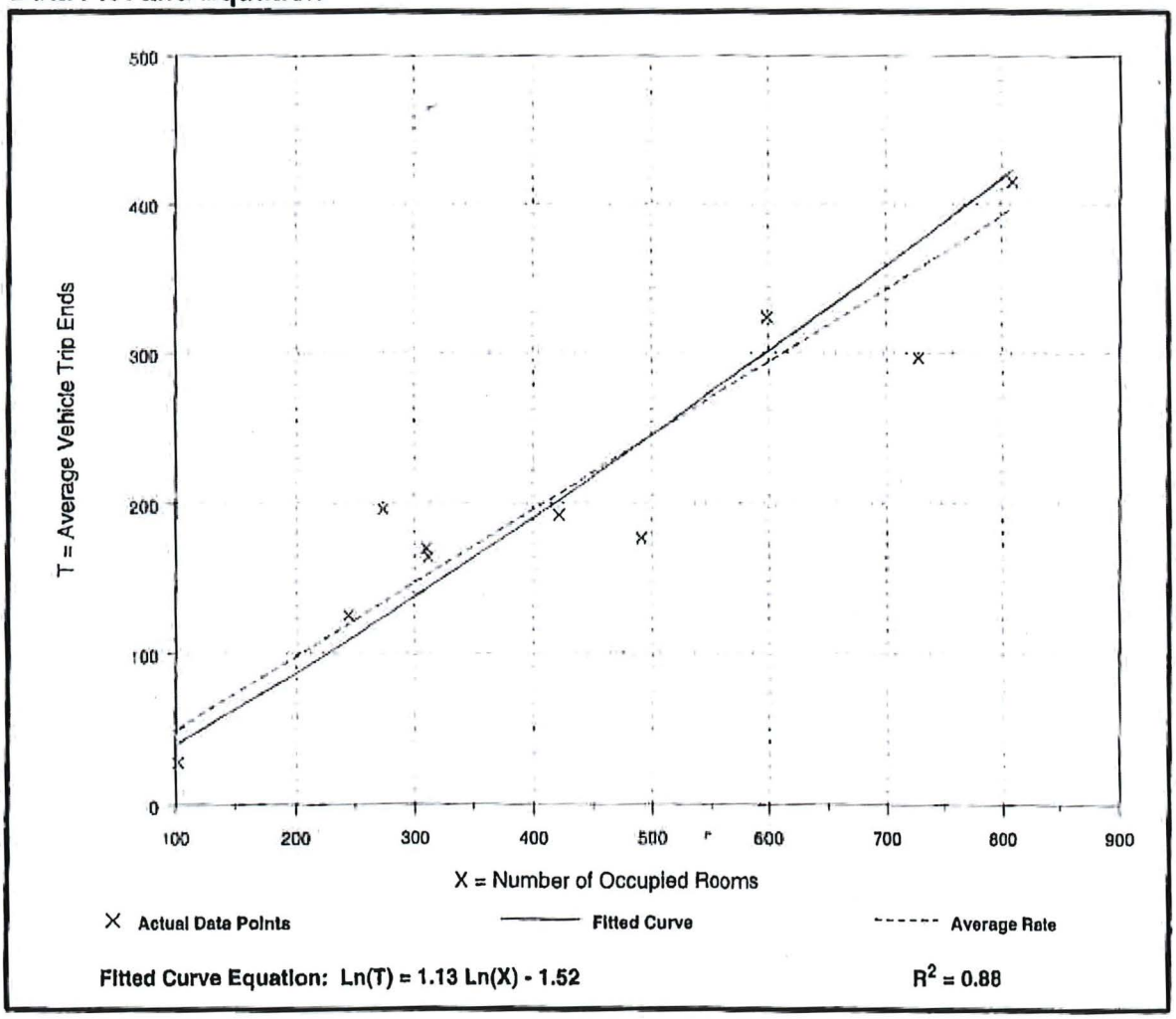
Average Vehicle Trip Ends vs: **Occupied Rooms**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 10
Average Number of Occupied Rooms: 429
Directional Distribution: 43% entering, 57% exiting

Trip Generation per Occupied Room

Average Rate	Range of Rates	Standard Deviation
0.49	0.27 - 0.72	0.70

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 1.13 Ln(X) - 1.52 $R^2 = 0.88$

Land Use: 416
Campground/Recreational Vehicle Park
Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

Independent Variable	Trip Generation Rate	Size of Independent Variable	Number of Studies	Directional Distribution
Acres				
Weekday a.m. Peak Hour of Adjacent Street Traffic	0.48	50	1	42% entering, 58% exiting
Weekday p.m. Peak Hour of Adjacent Street Traffic	0.98	50	1	69% entering, 31% exiting
Weekday a.m. Peak Hour of Generator	0.52	50	1	42% entering, 58% exiting
Weekday p.m. Peak Hour of Generator	1.06	50	1	62% entering, 38% exiting

Campground/Recreational Vehicle Park
(416)

Average Vehicle Trip Ends vs: **Occupied Camp Sites**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

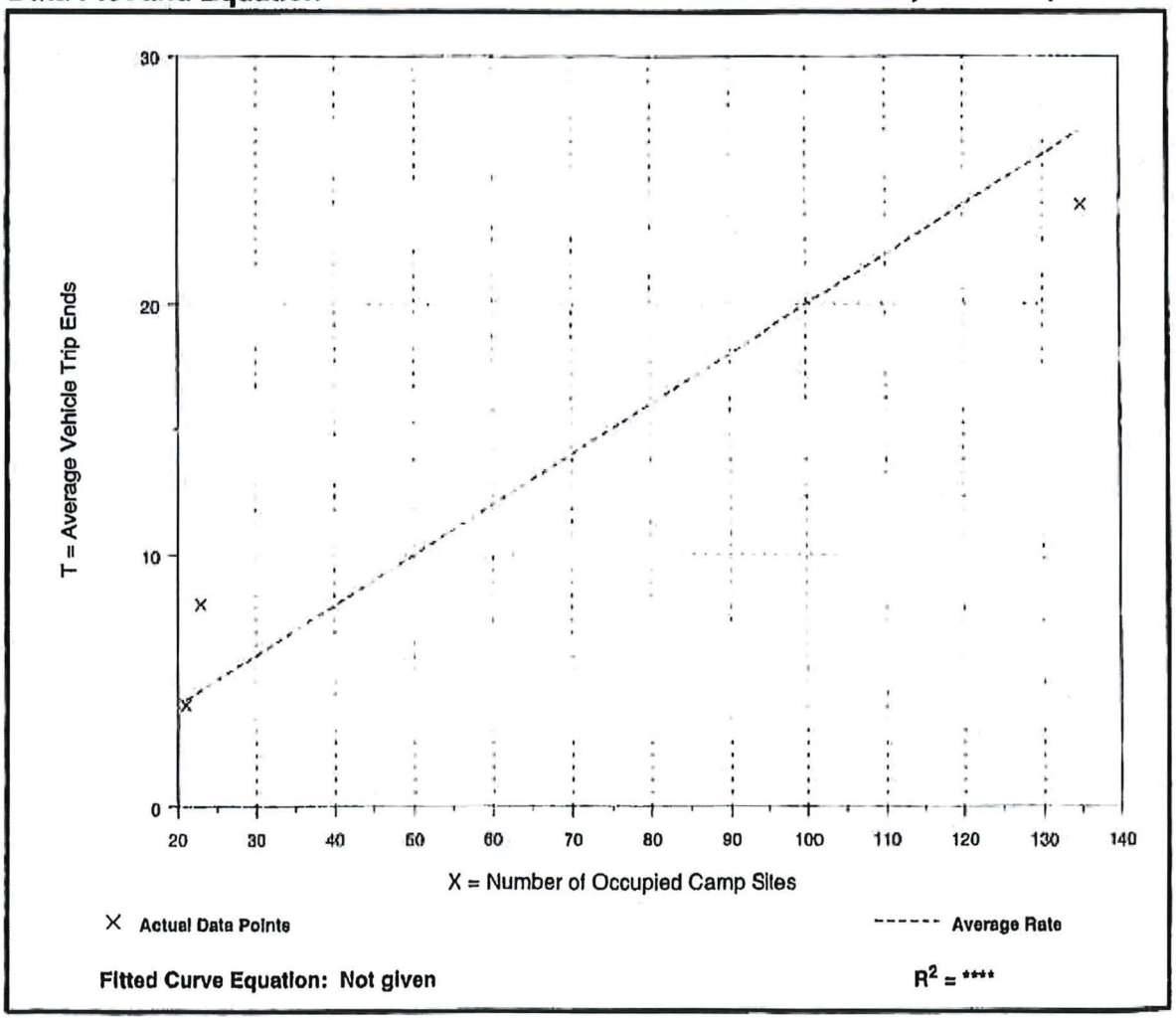
Number of Studies: 3
Average Number of Occupied Camp Sites: 60
Directional Distribution: 42% entering, 58% exiting

Trip Generation per Occupied Camp Site

Average Rate	Range of Rates	Standard Deviation
0.20	0.18 - 0.35	0.45

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Campground/Recreational Vehicle Park
(416)

Average Vehicle Trip Ends vs: **Occupied Camp Sites**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

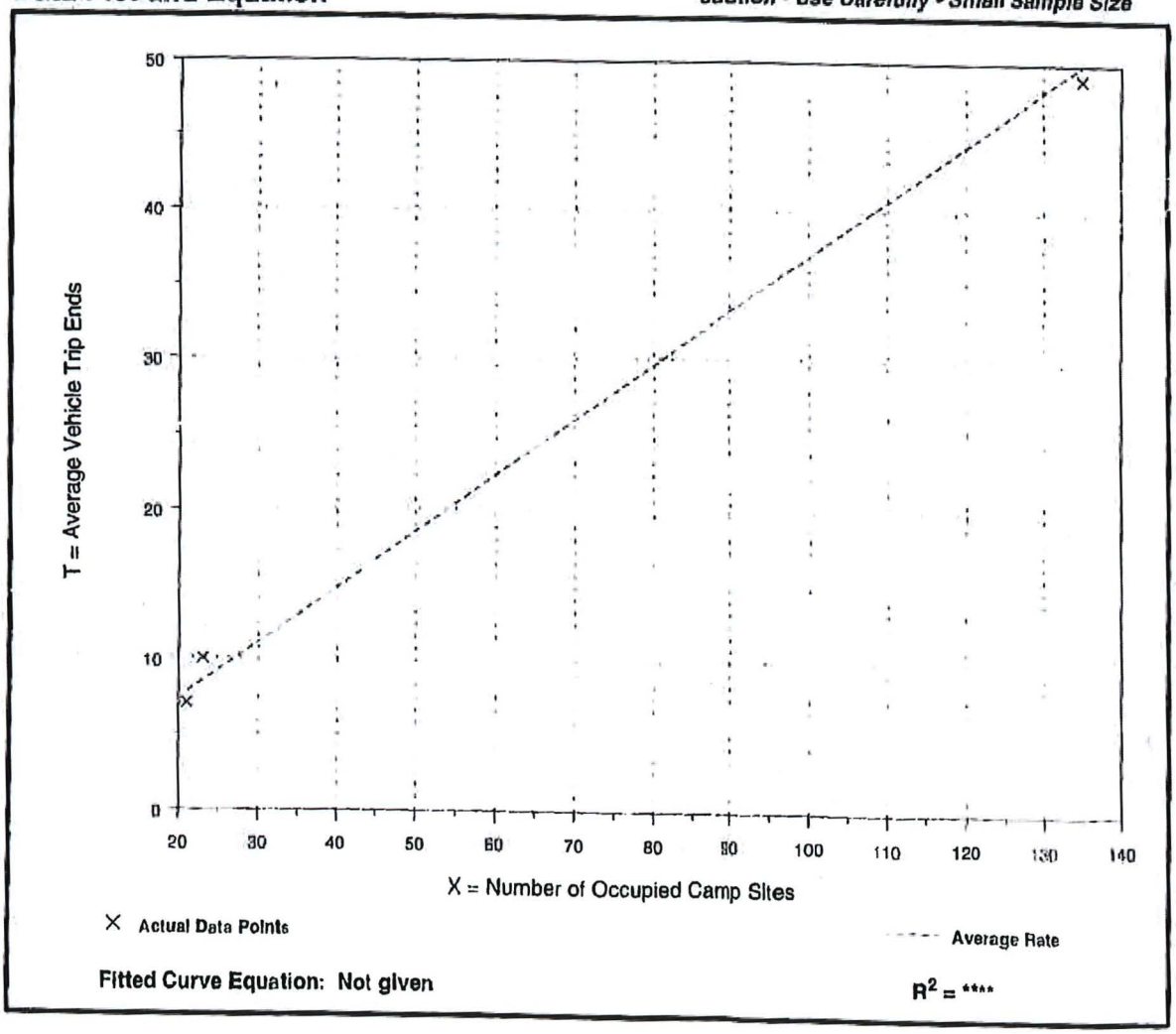
Number of Studies: 3
Average Number of Occupied Camp Sites: 60
Directional Distribution: 69% entering, 31% exiting

Trip Generation per Occupied Camp Site

Average Rate	Range of Rates	Standard Deviation
0.37	0.33 - 0.43	0.60

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Campground/Recreational Vehicle Park
(416)

Average Vehicle Trip Ends vs: **Occupied Camp Sites**
On a: **Weekday,**
A.M. Peak Hour of Generator

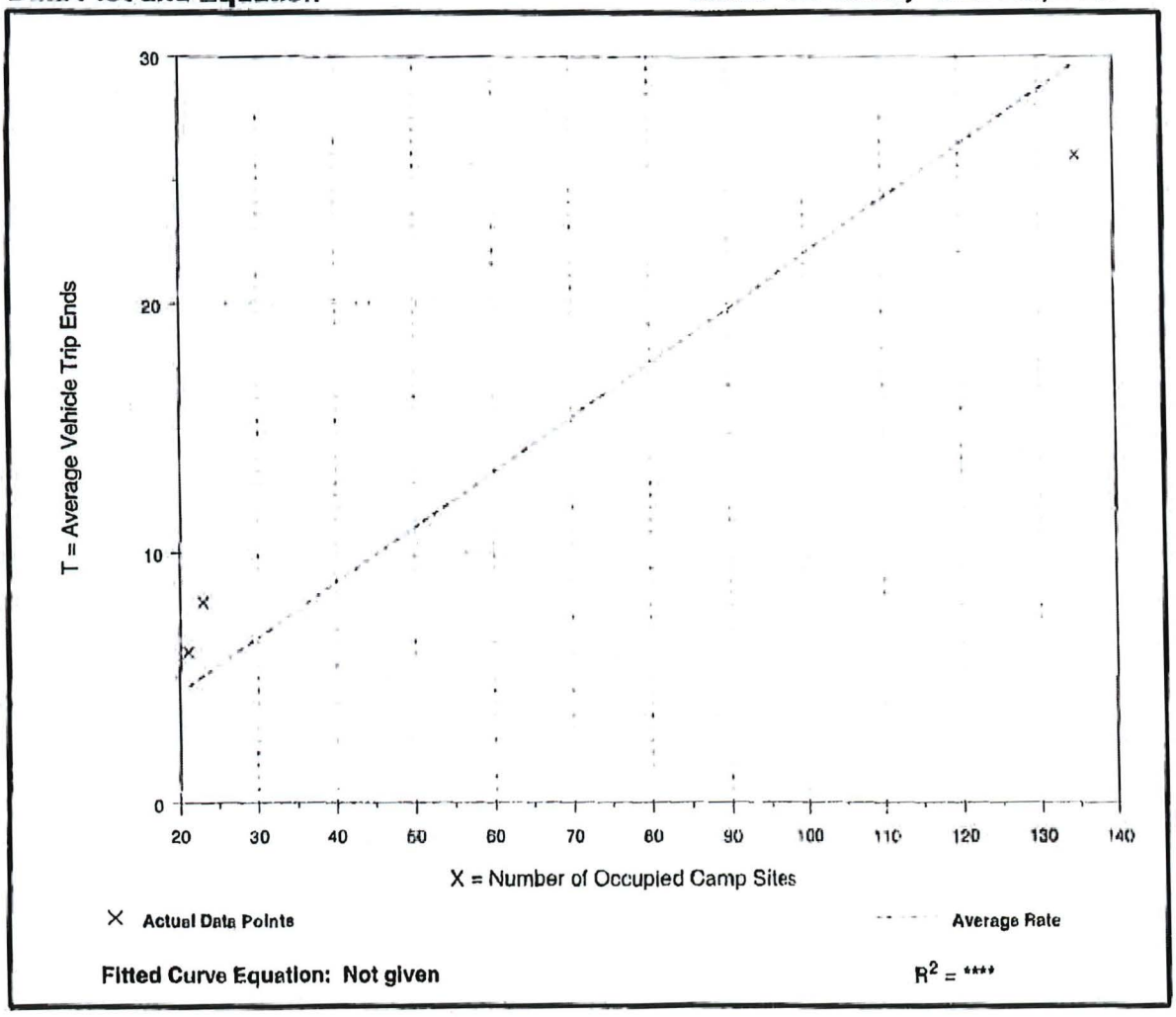
Number of Studies: 3
Average Number of Occupied Camp Sites: 60
Directional Distribution: 42% entering, 58% exiting

Trip Generation per Occupied Camp Site

Average Rate	Range of Rates	Standard Deviation
0.22	0.19 - 0.35	0.47

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Campground/Recreational Vehicle Park
(416)

Average Vehicle Trip Ends vs: **Occupied Camp Sites**
On a: **Weekday,**
P.M. Peak Hour of Generator

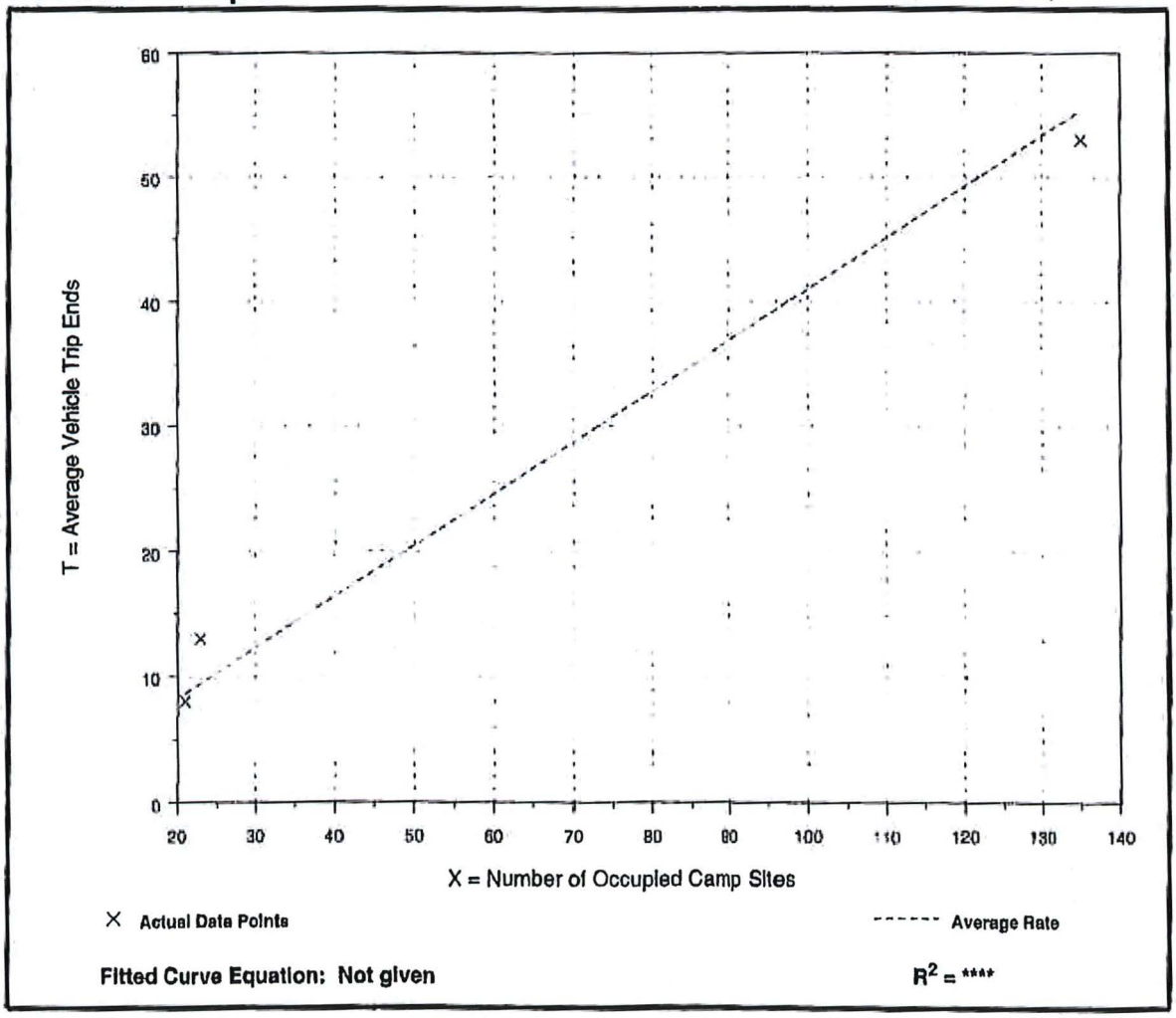
Number of Studies: 3
Average Number of Occupied Camp Sites: 60
Directional Distribution: 62% entering, 38% exiting

Trip Generation per Occupied Camp Site

Average Rate	Range of Rates	Standard Deviation
0.41	0.38 - 0.57	0.64

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 945
Gasoline/Service Station with Convenience Market

Description

This land use includes gasoline/service stations with convenience markets where the primary business is the fueling of motor vehicles. These service stations may also have ancillary facilities for servicing and repairing motor vehicles. Some commonly sold convenience items are newspapers, coffee or other beverages and snack items that are usually consumed in the car. These service stations are generally located at intersections or interchanges. This land use does not include stations with car washes. Convenience market—open 24 hours (Land Use 851), convenience market—open 15–16 hours (Land Use 852), convenience market with gasoline pumps (Land Use 853), gasoline/service station (Land Use 944) and gasoline/service station with convenience market and car wash (Land Use 946) are related uses.

Additional Data

The independent variable vehicle fueling position is defined as the maximum number of vehicles that can be fueled simultaneously.

Gasoline/service stations in this land use include "pay-at-the-pump" and traditional fueling stations.

The weekday peak hours of the generator typically coincided with the peak hours of the adjacent street traffic.

The sites were surveyed from the late 1980s to the 1990s throughout the United States, with many conducted in New England.

Source Numbers

221, 255, 288, 347, 350, 351, 355, 440

Gasoline/Service Station with Convenience Market
(945)

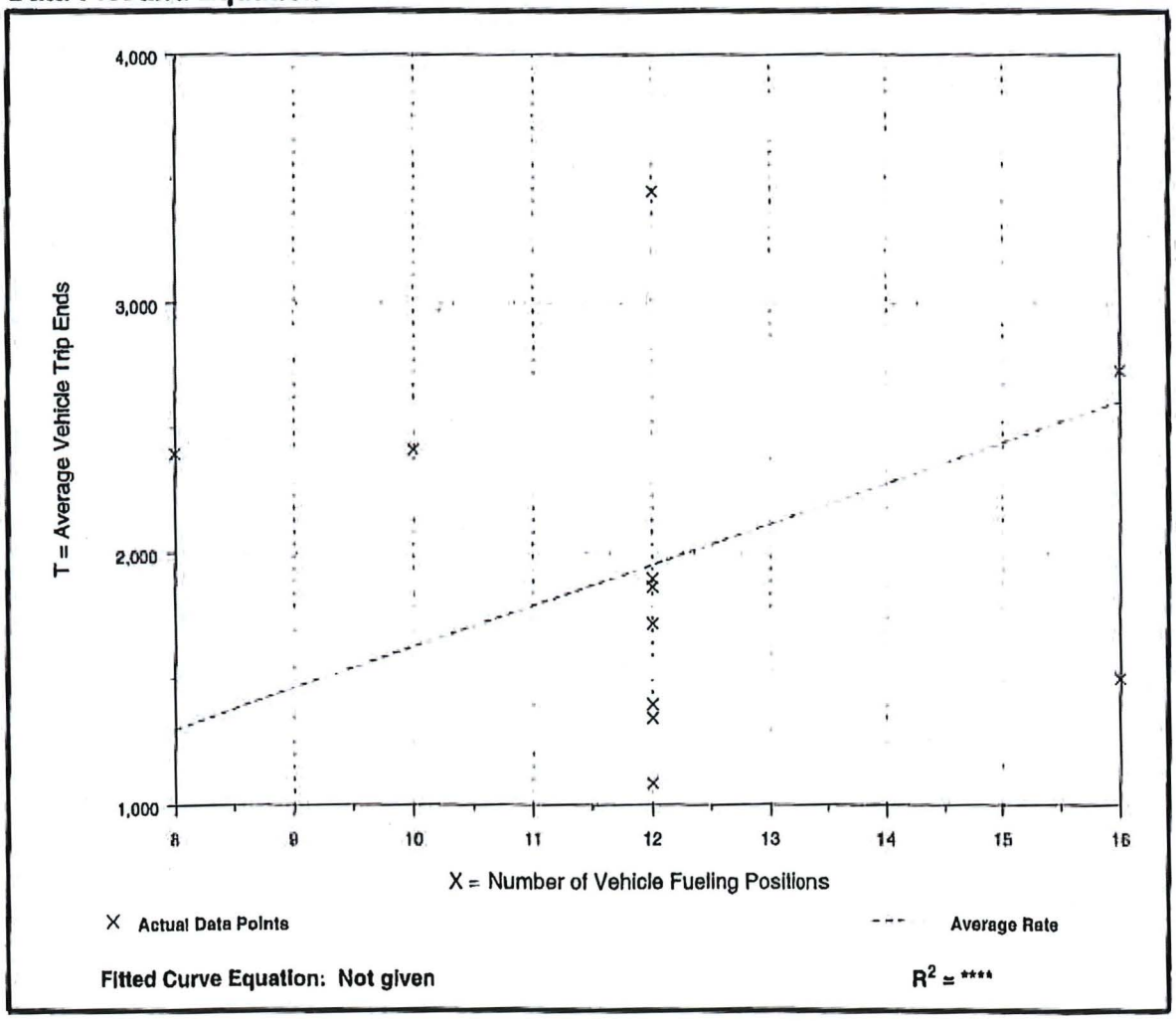
Average Vehicle Trip Ends vs: Vehicle Fueling Positions
On a: Weekday

Number of Studies: 11
Average Vehicle Fueling Positions: 12
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
162.78	90.67 - 299.50	68.16

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

Gasoline/Service Station with Convenience Market
(945)

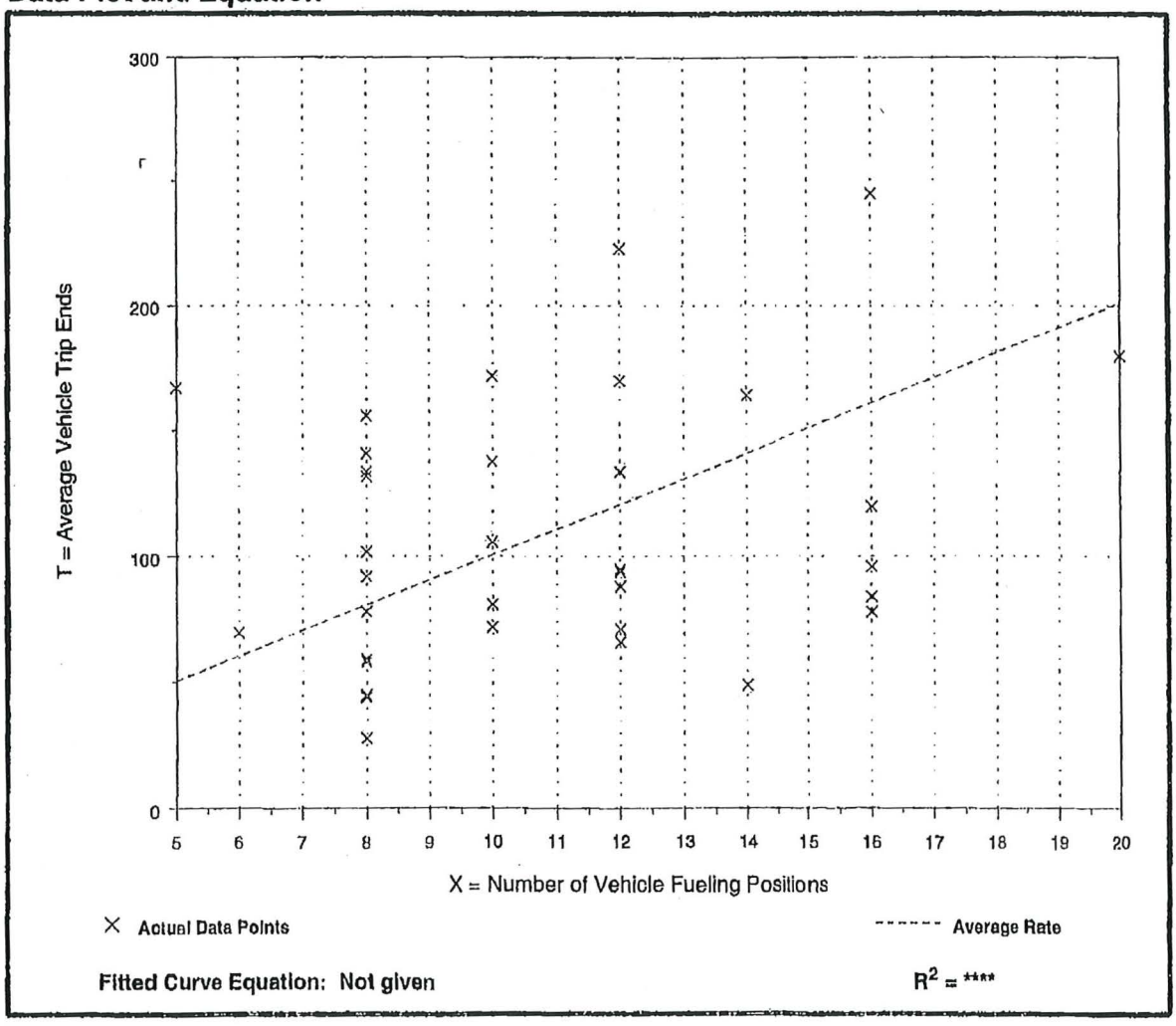
Average Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 35
Average Vehicle Fueling Positions: 11
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
10.06	3.50 - 33.40	6.01

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

Gasoline/Service Station with Convenience Market
(945)

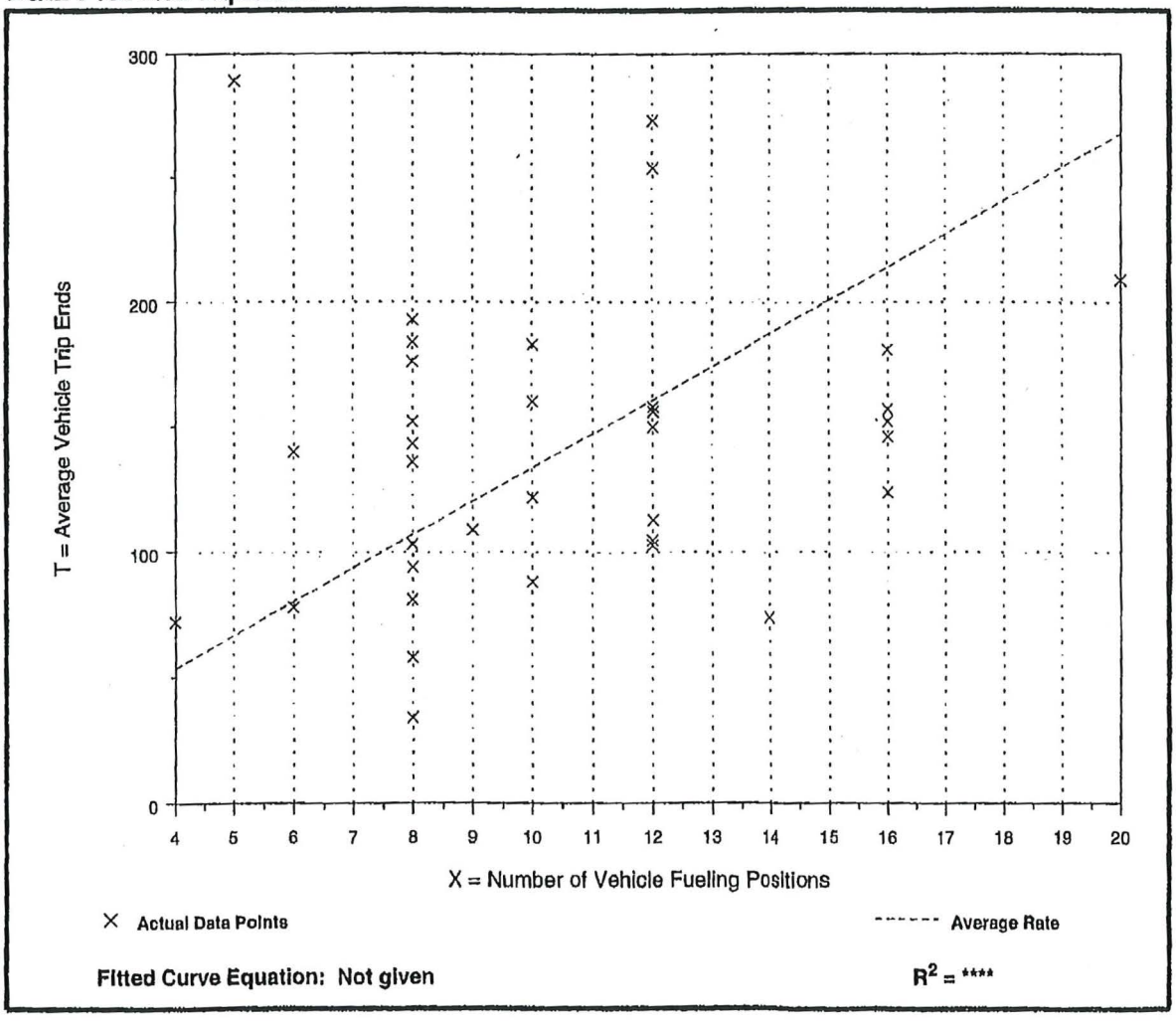
Average Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 37
Average Vehicle Fueling Positions: 10
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
13.38	4.25 - 57.80	7.98

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

APPENDIX E

INTERSECTION ANALYSIS

Table 10: Estimated Development Traffic Volumes of Township Road 652

Township Road 652 & West Access Road

Recreational Homes				Traffic Growth	Entering From		Exiting towards	
AM Peak		PM Peak			West	East	West	East
Entering	Exiting	Entering	Exiting					
67%	33%	41%	59%	2.5%	90%	10%	90%	10%

Resort Hotel			
AM Peak		PM Peak	
Entering	Exiting	Entering	Exiting
72%	28%	43%	57%

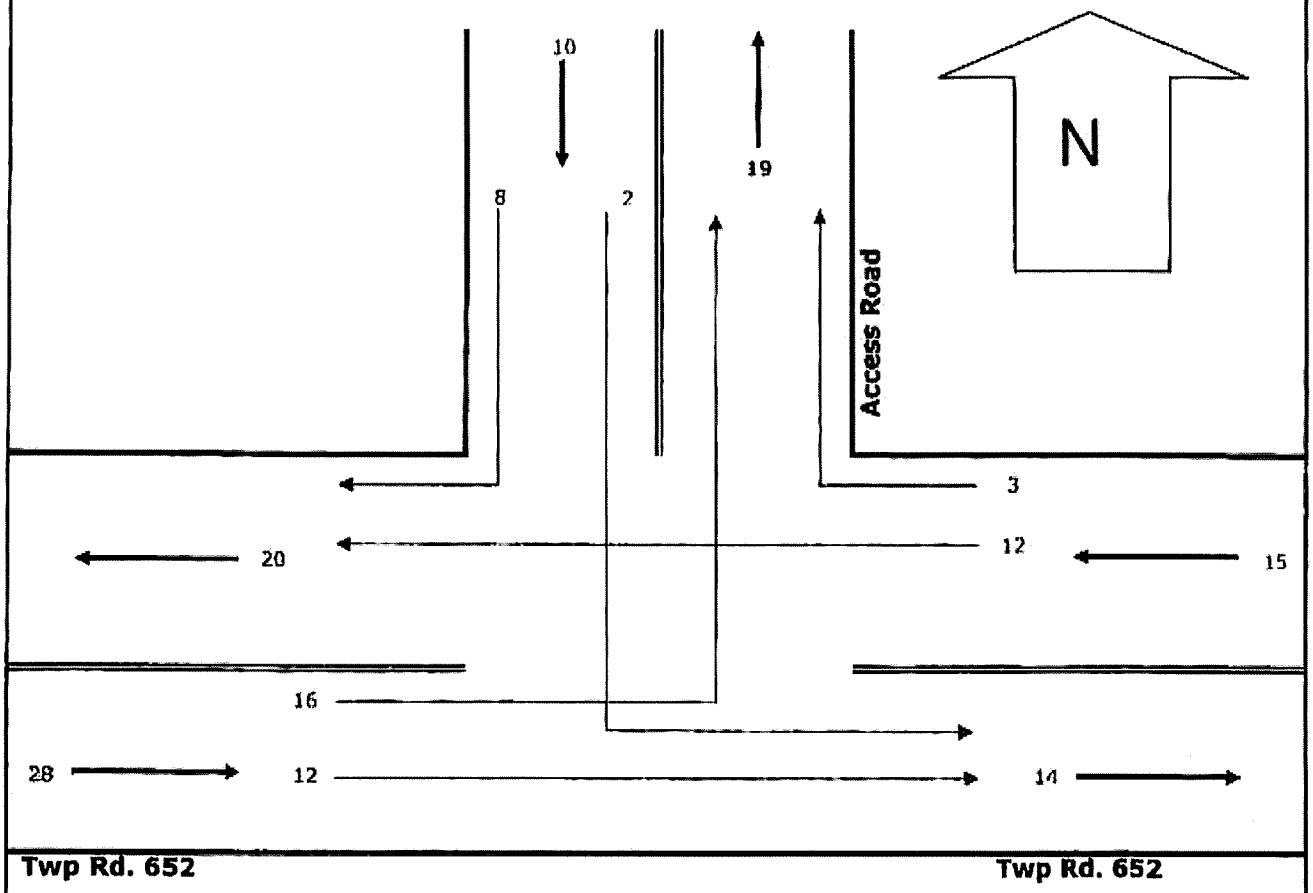
Development Conditions							Entering from the		Exiting to the	
Average Daily	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	West	East	West	East
Recreational Homes	145	D. Units	3.16	458	229	229	206	23	206	23
Resort Hotel	3	Room	0.59	2	1	1	1	1	1	1
Total				460	230	230	207	24	207	24
							WL	ER	NR	NL
AM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the site	Exiting the site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	145	D. Units	0.2	23	15	8	14	2	7	1
Resort Hotel	3	Room	0.4	2	2	1	2	1	1	1
Total				25	17	9	16	3	8	2
PM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	145	D. Units	0.26	38	16	22	14	2	20	2
Resort Hotel	3	Room	0.49	1	1	1	1	1	1	1
Total				39	17	23	15	3	21	3

	NR	NL	NT	SR	SL	ST	ER	EL	ET	WR	WL	WT
AM PEAK-2007									12			12
Generated Traffic 2007 - AM Peak	8	2					3				16	
Total	8	2					3		12		16	12
AM PEAK-2027									18			18
Generated Traffic 2027 - AM Peak	8	2					3				16	
Total	8	2					3		18		16	18
PM PEAK-2007									12			12
Generated Traffic 2007 - PM Peak	21	3					3				15	
Total	21	3					3		12		15	12
PM PEAK-2027									18			18
Generated Traffic 2027 - PM Peak	21	3					3				15	
Total	21	3					3		18		15	18

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

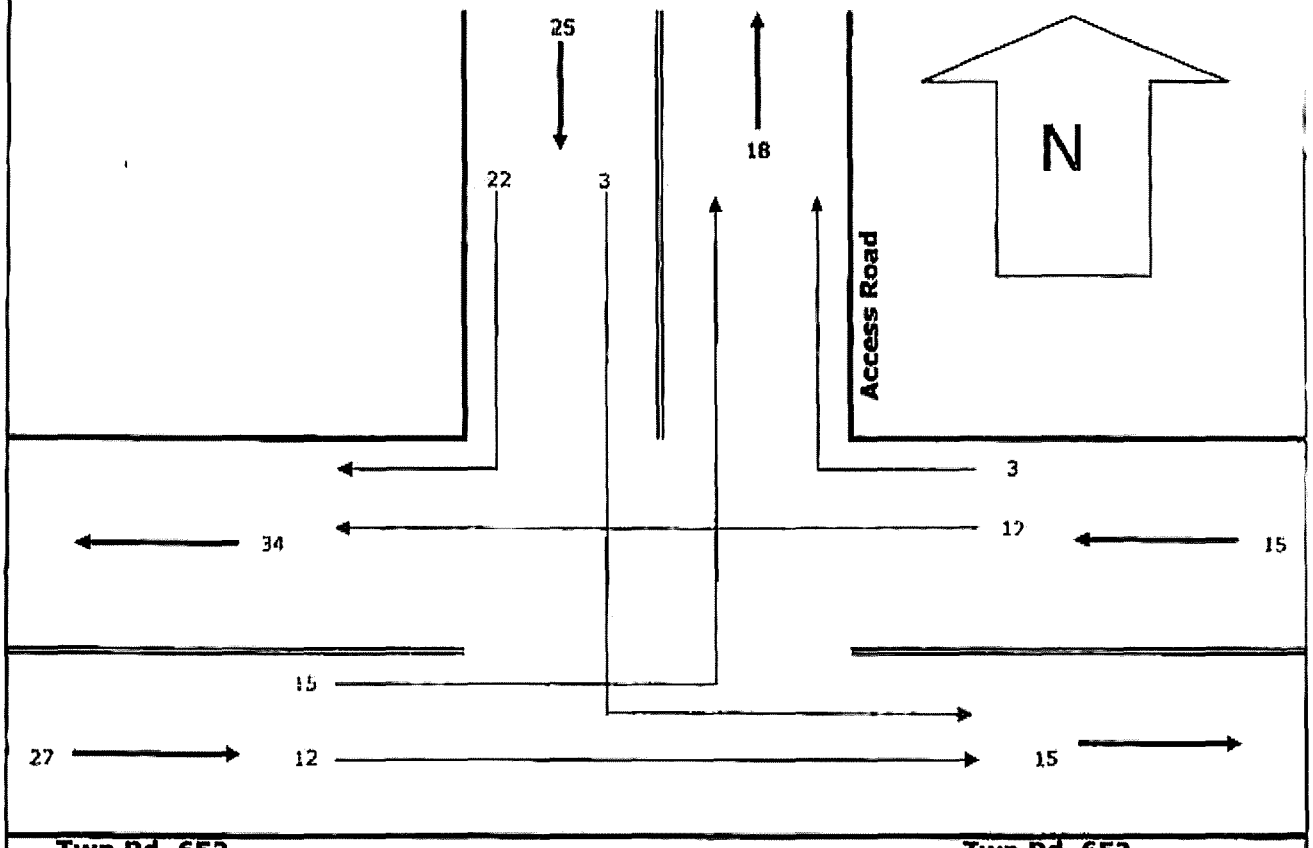
Design Hourly Traffic Volumes and Turning Movements
2007 A.M. Peak Hour
Township Road 652 and West Access Road



V_l	16
V_a	28
L	57.1%
V_o	15

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

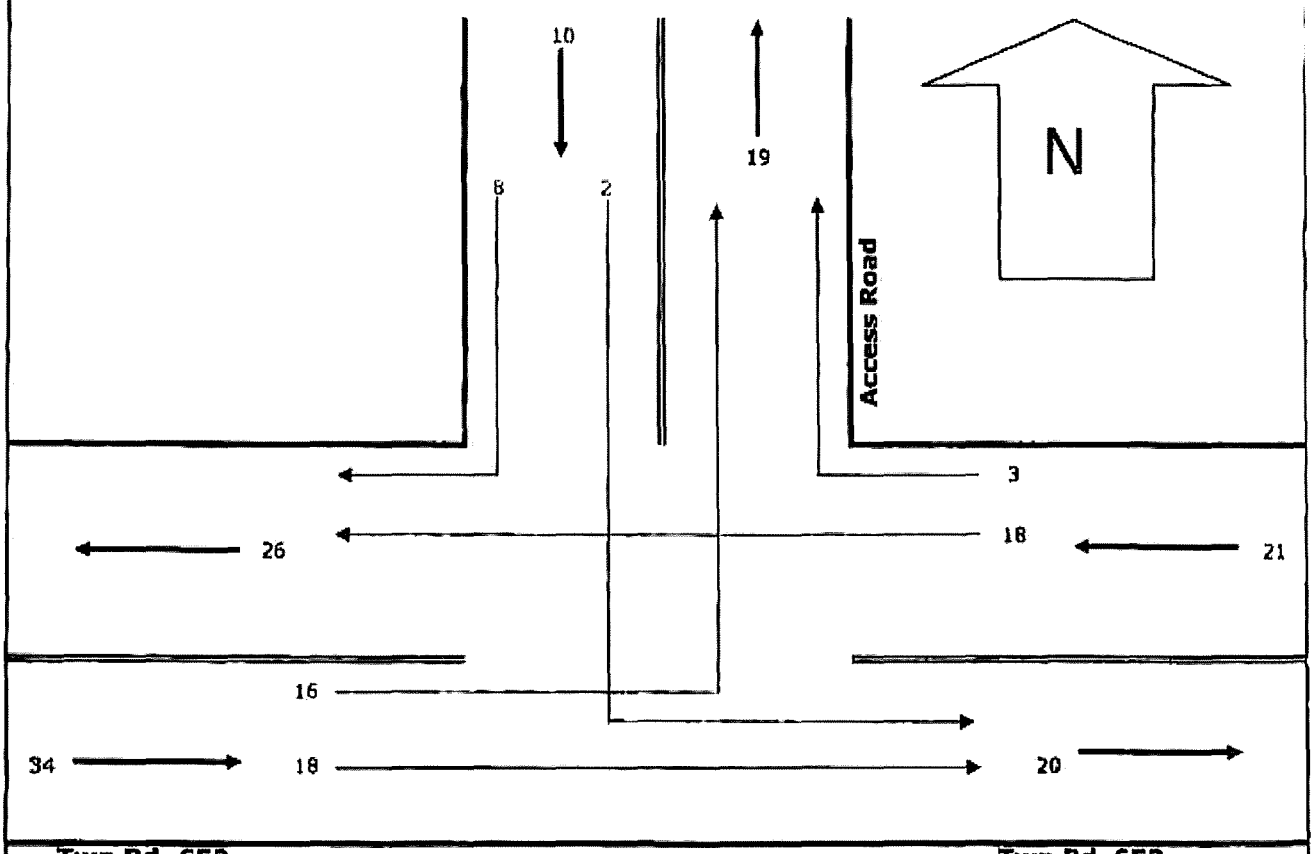
Design Hourly Traffic Volumes and Turning Movements
2007 P.M. Peak Hour
Township Road 652 and West Access Road



V_l	15
V_a	27
L	55.6%
V_o	15

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

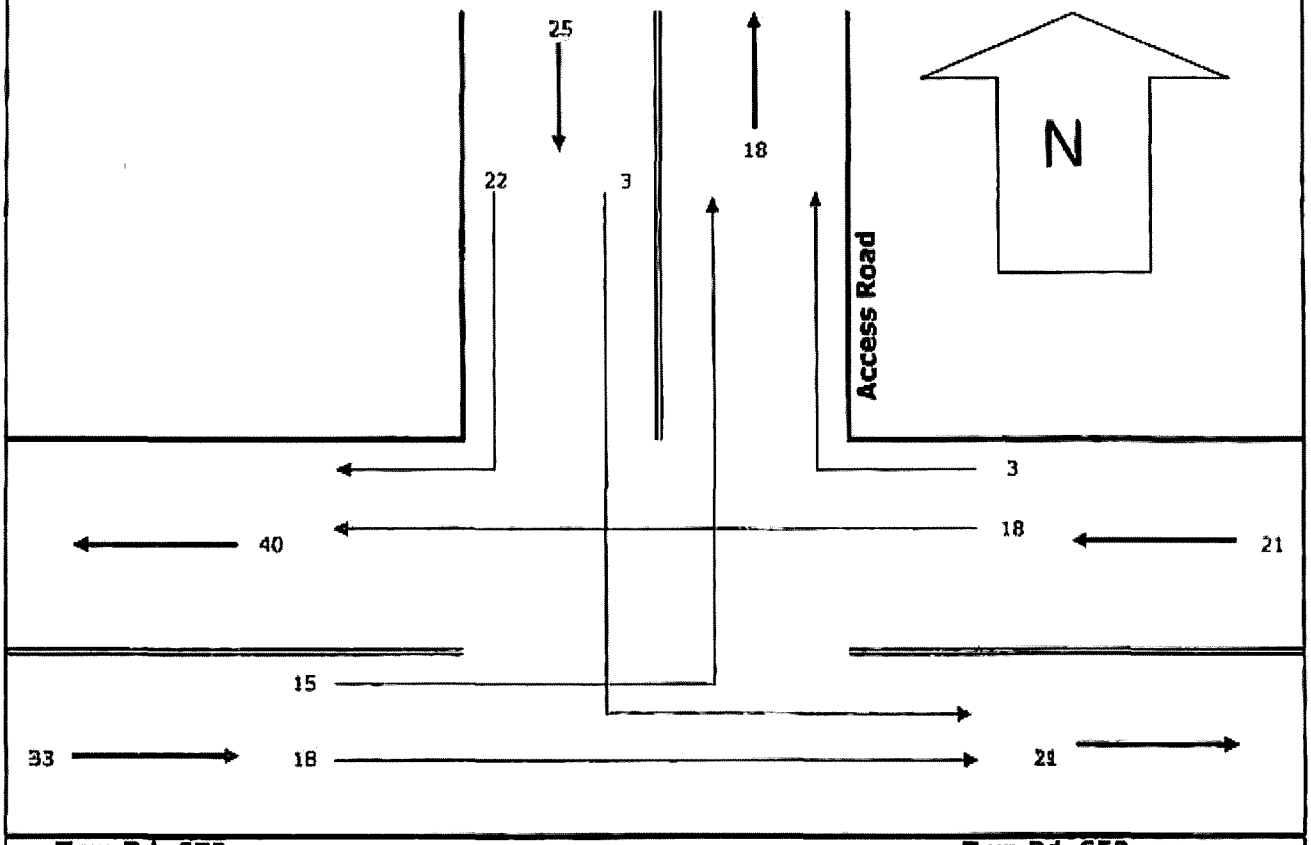
Design Hourly Traffic Volumes and Turning Movements
2027 A.M. Peak Hour
Township Road 652 and West Access Road



V_l	16
V_a	34
L	47.1%
V_o	21

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

Design Hourly Traffic Volumes and Turning Movements
2027 P.M. Peak Hour
Township Road 652 and West Access Road



V_l	15
V_a	33
L	45.9%
V_o	21

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

Table 11: Estimated Development Traffic Volumes of Township Road 652

Township Road 652 & East Access Road

Traffic Growth	Recreational Homes				Resort Hotel			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Entering	Exiting	Entering	Exiting	Entering	Exiting	Entering	Exiting
2.5%	67%	33%	41%	59%	72%	28%	43%	57%

Entering From		Exiting towards	
West	East	West	East
20%	25%	20%	25%

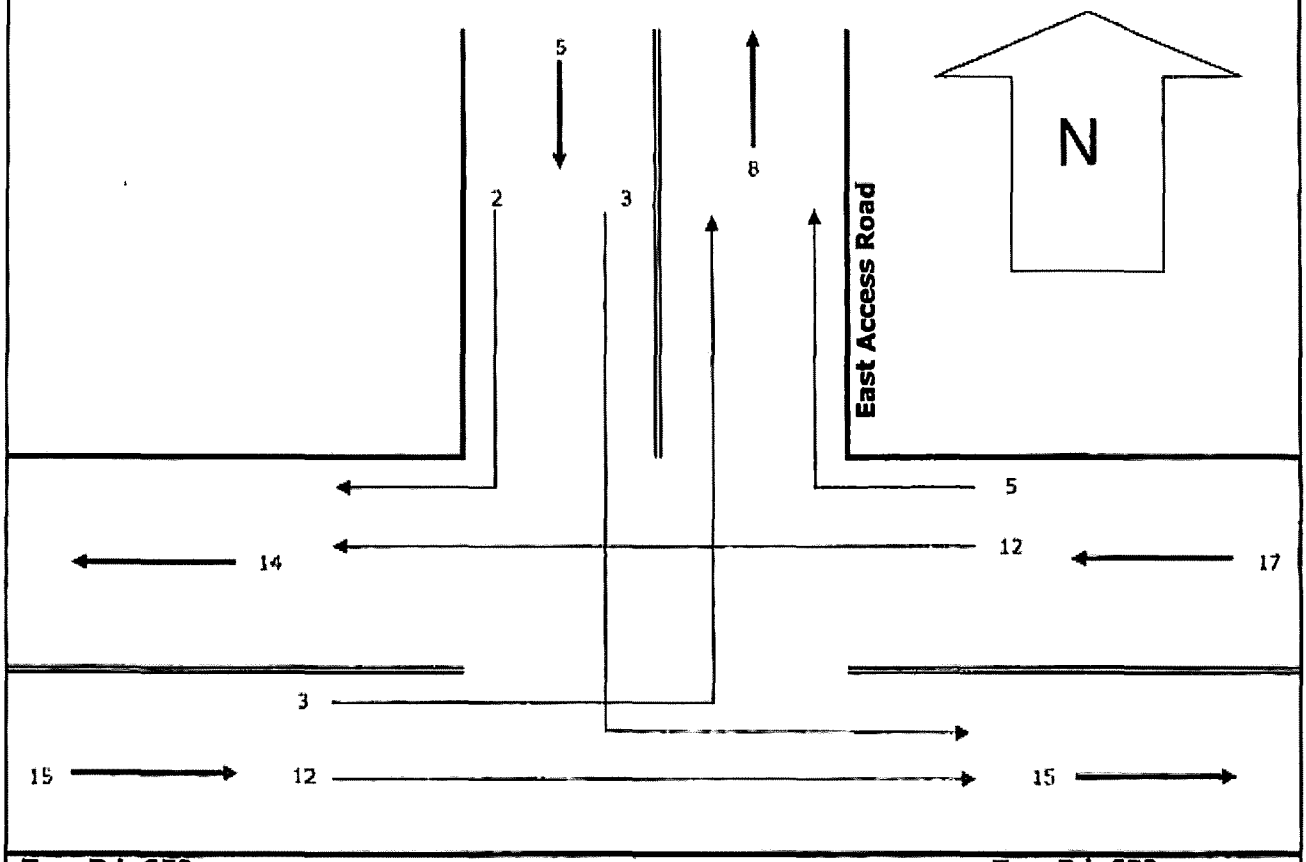
Development Conditions							Entering from the		Exiting to the	
Average Daily	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	West	East	West	East
Recreational Homes	145	D. Unit	3.16	458	229	229	46	57	46	57
Resort Hotel	3	Room	0.59	2	1	1	0	1	0	1
Total				460	230	230	46	58	46	58
							WL	ER	NR	NL
AM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the site	Exiting the site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	145	D. Unit	0.2	23	15	8	3	4	2	2
Resort Hotel	3	Room	0.4	2	2	1	0	1	0	1
Total				25	17	9	3	5	2	3
PM Peak	Amount	Unit	Trip Rate	Total Trips	Entering the Site	Exiting the Site	Entering from the		Exiting to the	
							West	East	West	East
Recreational Homes	145	D. Unit	0.26	38	16	22	3	4	4	6
Resort Hotel	3	Room	0.49	1	1	1	0	1	0	1
Total				39	17	23	3	5	5	7

	NR	NL	NT	SR	SL	ST	ER	EL	ET	WR	WL	WT
AM PEAK-2007									12			12
Generated Traffic 2007 - AM Peak	2	3					5				3	
Total	2	3					5		12		3	12
AM PEAK-2027									18			18
Generated Traffic 2027 - AM Peak	2	3					5				3	
Total	2	3					5		18		3	18
PM PEAK-2007									12			12
Generated Traffic 2007 - PM Peak	5	7					5				3	
Total	5	7					5		12		3	12
PM PEAK-2027									18			18
Generated Traffic 2027 - PM Peak	5	7					5				3	
Total	5	7					5		18		3	18

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

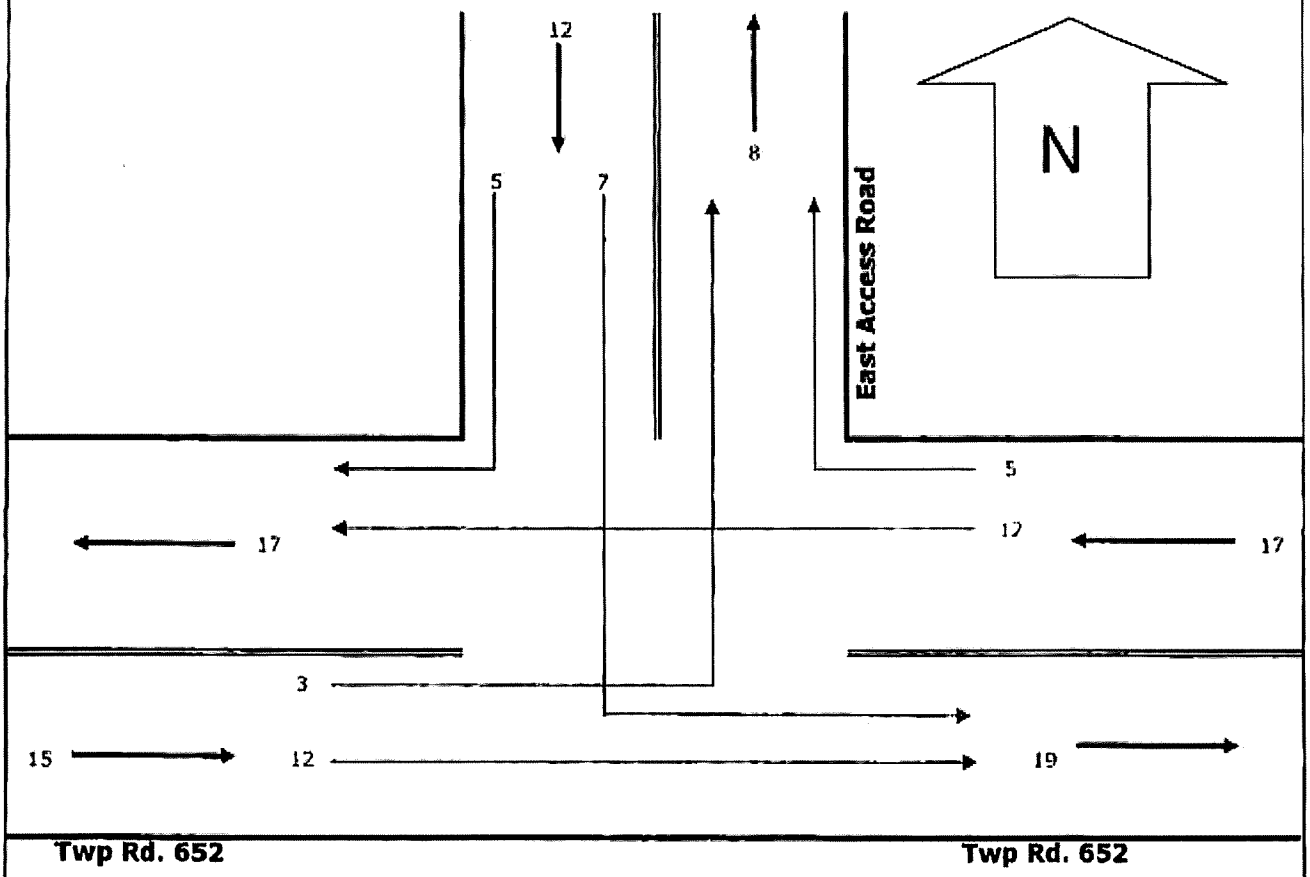
Design Hourly Traffic Volumes and Turning Movements
2007 A.M. Peak Hour
Township Road 652 and East Access Road



V_l	3
V_a	15
L	20.0%
V_o	17

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

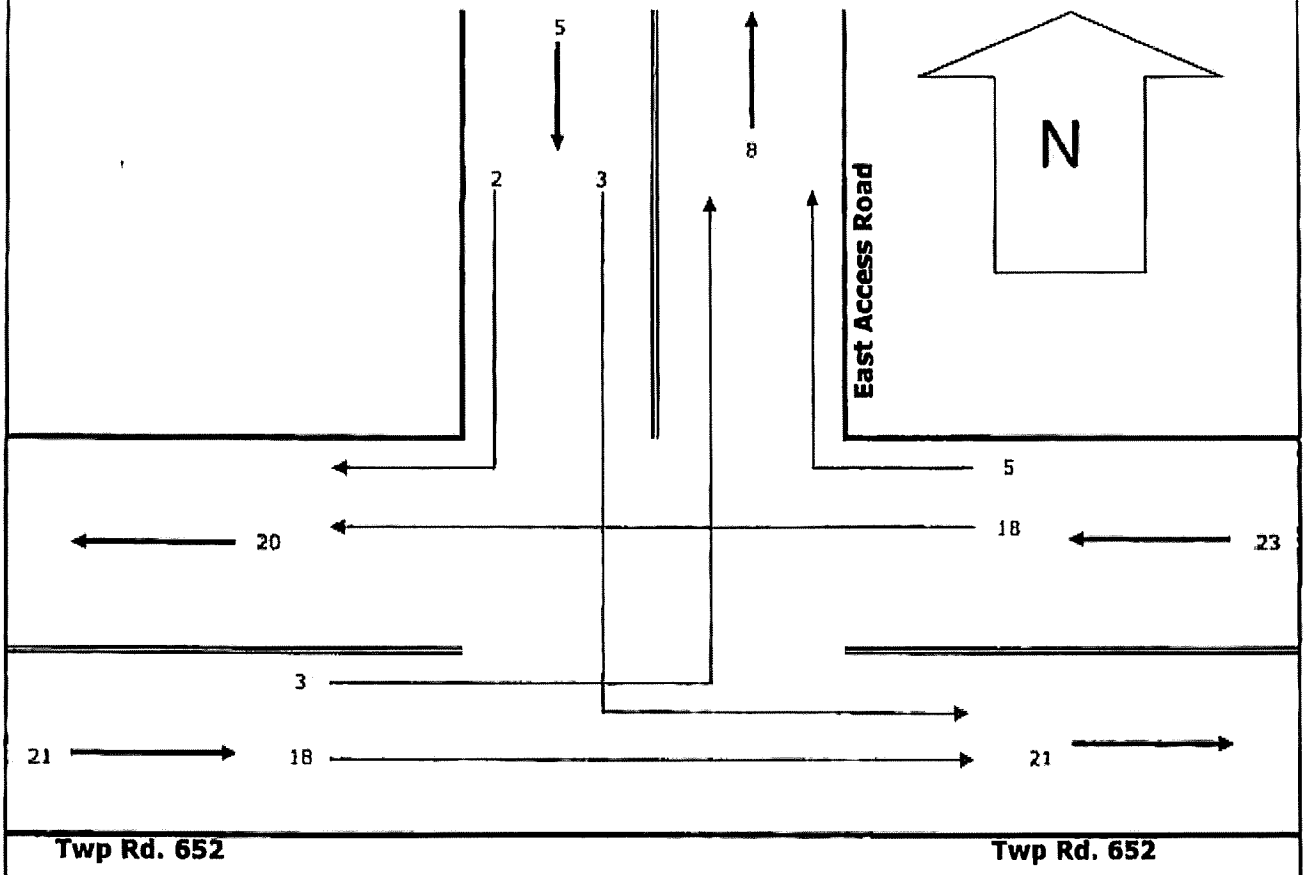
Design Hourly Traffic Volumes and Turning Movements
2007 P.M. Peak Hour
Township Road 652 and East Access Road



V_l	3
V_a	15
L	20.0%
V_o	17

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

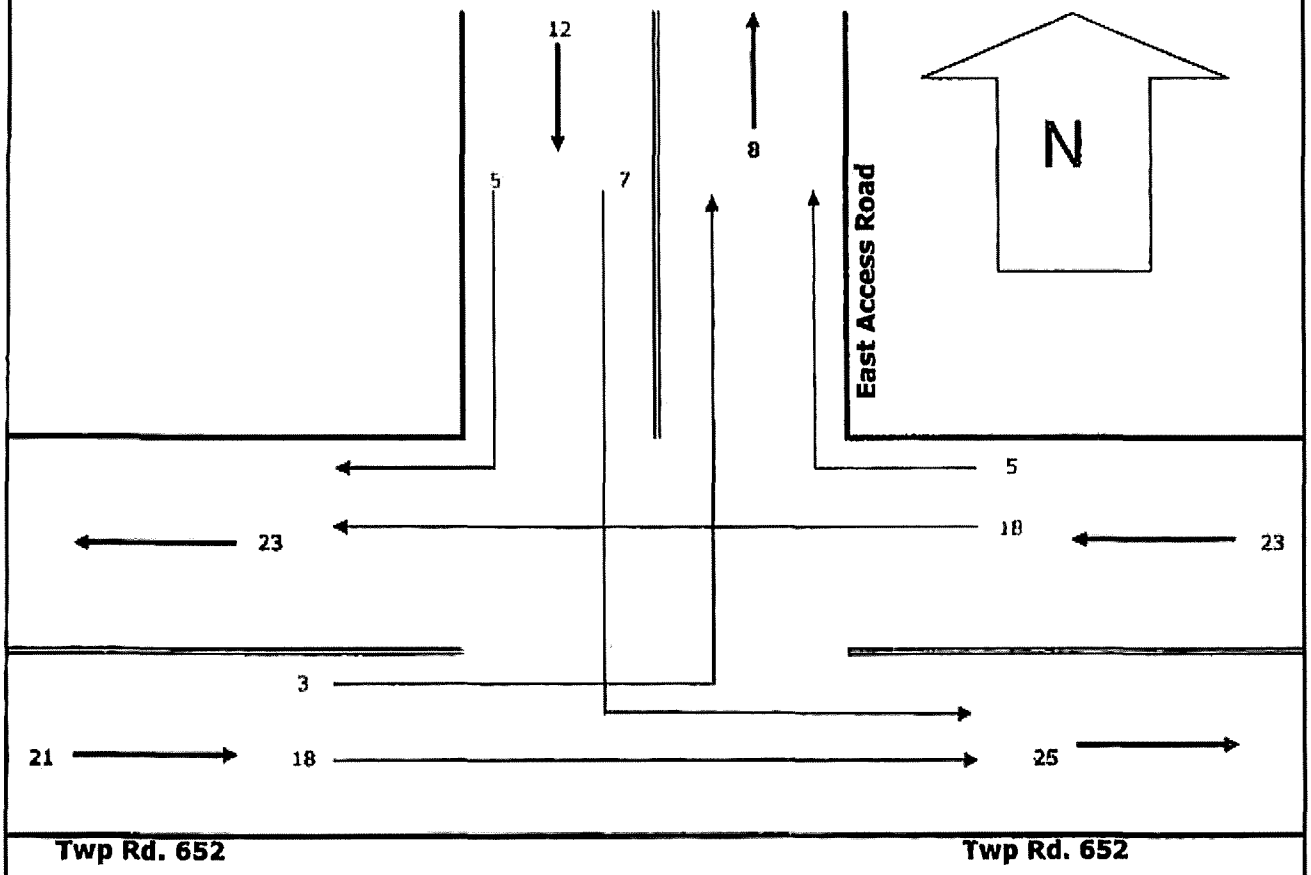
Design Hourly Traffic Volumes and Turning Movements
2027 A.M. Peak Hour
Township Road 652 and East Access Road



V_l	3
V_a	21
L	14.3%
V_o	23

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

Design Hourly Traffic Volumes and Turning Movements
2027 P.M. Peak Hour
Township Road 652 and East Access Road



V_l	3
V_a	21
L	15.9%
V_o	23

V_l = number of left turning vehicles per hour in the advancing volume
V_a = advancing volume
L = proportion of left turns in advancing volume
V_o = opposing volume

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Masrur Askar*	Intersection	*Twp Rd 652 & West Access Rd*
Agency/Co.	*EXH Engineering Services Ltd.*	Jurisdiction	*Lakeland County*
Date Performed	*2/22/2007*	Analysis Year	*2007*
Analysis Time Period	*AM Peak, 2007*		

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *West Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle,Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*19*	*12*			*12*	*3*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*20*	*13*	*0*	*0*	*13*	*3*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*4*		*21*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*4*	*0*	*22*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*20*						*26*	
C (m) (veh/h)	*1608*						*1048*	
v/c	*0.01*						*0.02*	
95% queue length	*0.04*						*0.08*	
Control Delay (s/veh)	*7.3*						*8.5*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.5
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Masrur Askar*
Agency/Co.	*EXH Engineering Services Ltd.*
Date Performed	*2/22/2007*
Analysis Time Period	*PM Peak, 2007*

Site Information

Intersection	*Twp Rd 652 & West Access Rd*
Jurisdiction	*Lakeland County*
Analysis Year	*2007*

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *West Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*42*	*12*			*12*	*6*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*45*	*13*	*0*	*0*	*13*	*6*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*4*		*22*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*4*	*0*	*23*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*45*						*27*	
C (m) (veh/h)	*1604*						*1031*	
v/c	*0.03*						*0.03*	
95% queue length	*0.09*						*0.08*	
Control Delay (s/veh)	*7.3*						*8.6*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.6
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Masrur Askar*	Intersection	*Twp Rd 652 & West Access Rd*
Agency/Co.	*EXH Engineering Services Ltd.*	Jurisdiction	*Lakeland County*
Date Performed	*2/22/2007*	Analysis Year	*2027*
Analysis Time Period	*AM Peak, 2027*		

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *West Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*19*	*18*			*0*	*3*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*20*	*19*	*0*	*0*	*0*	*3*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*4*		*21*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*4*	*0*	*22*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*20*						*26*	
C (m) (veh/h)	*1626*						*1062*	
v/c	*0.01*						*0.02*	
95% queue length	*0.04*						*0.08*	
Control Delay (s/veh)	*7.2*						*8.5*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.5
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Masrur Askar*	Intersection	*Twp Rd 652 & West Access Rd*
Agency/Co.	*EXH Engineering Services Ltd.*	Jurisdiction	*Lakeland County*
Date Performed	*2/22/2007*	Analysis Year	*2027*
Analysis Time Period	*PM Peak, 2027*		

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *West Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*42*	*18*			*0*	*6*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*45*	*19*	*0*	*0*	*0*	*6*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*4*		*22*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*4*	*0*	*23*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*45*						*27*	
C (m) (veh/h)	*1622*						*1047*	
v/c	*0.03*						*0.03*	
95% queue length	*0.09*						*0.08*	
Control Delay (s/veh)	*7.3*						*8.5*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.5
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Masrur Askar*	Intersection	*Twp Rd 652 & East Access Rd*
Agency/Co.	*EXH Engineering Services Ltd.*	Jurisdiction	*Lakeland County*
Date Performed	*2/22/2007*	Analysis Year	*2007*
Analysis Time Period	*AM Peak, 2007*		

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *East Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*4*	*12*			*12*	*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*4*	*13*	*0*	*0*	*13*	*5*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*6*		*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*6*	*0*	*5*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*4*						*11*	
C (m) (veh/h)	*1605*						*1018*	
v/c	*0.00*						*0.01*	
95% queue length	*0.01*						*0.03*	
Control Delay (s/veh)	*7.2*						*8.6*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.6
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Masrur Askar*
Agency/Co.	*EXH Engineering Services Ltd.*
Date Performed	*2/22/2007*
Analysis Time Period	*PM Peak, 2007*

Site Information

Intersection	*Twp Rd 652 & East Access Rd*
Jurisdiction	*Lakeland County*
Analysis Year	*2007*

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street: *East Access Road*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*9*	*12*			*12*	*12*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*9*	*13*	*0*	*0*	*13*	*13*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*7*		*0*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*7*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*9*						*7*	
C (m) (veh/h)	*1595*						*958*	
v/c	*0.01*						*0.01*	
95% queue length	*0.02*						*0.02*	
Control Delay (s/veh)	*7.3*						*8.8*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.8
Approach LOS	--	--		A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Masrur Askar*	Intersection	*Twp Rd 652 & East Access Rd*
Agency/Co.	*EXH Engineering Services Ltd.*	Jurisdiction	*Lakeland County*
Date Performed	*2/22/2007*	Analysis Year	*2027*
Analysis Time Period	*AM Peak, 2027*		

Project Description *4205056*

East/West Street: *Township Road 652*	North/South Street:
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*4*	*18*			*18*	*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*4*	*19*	*0*	*0*	*19*	*5*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*6*		*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*6*	*0*	*5*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*4*						*11*	
C (m) (veh/h)	*1597*						*1005*	
v/c	*0.00*						*0.01*	
95% queue length	*0.01*						*0.03*	
Control Delay (s/veh)	*7.3*						*8.6*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.6
Approach LOS	--	--		A

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Masrur Askar*
Agency/Co.	*EXH Engineering Services Ltd.*
Date Performed	*2/22/2007*
Analysis Time Period	*PM Peak, 2027*

Site Information

Intersection	*Twp Rd 652 & East Access Rd*
Jurisdiction	*Lakeland County*
Analysis Year	*2027*

Project Description *4205056*

East/West Street: *Township Road 652* | North/South Street:

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*9*	*18*			*18*	*12*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*9*	*19*	*0*	*0*	*19*	*13*
Percent Heavy Vehicles	*1*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

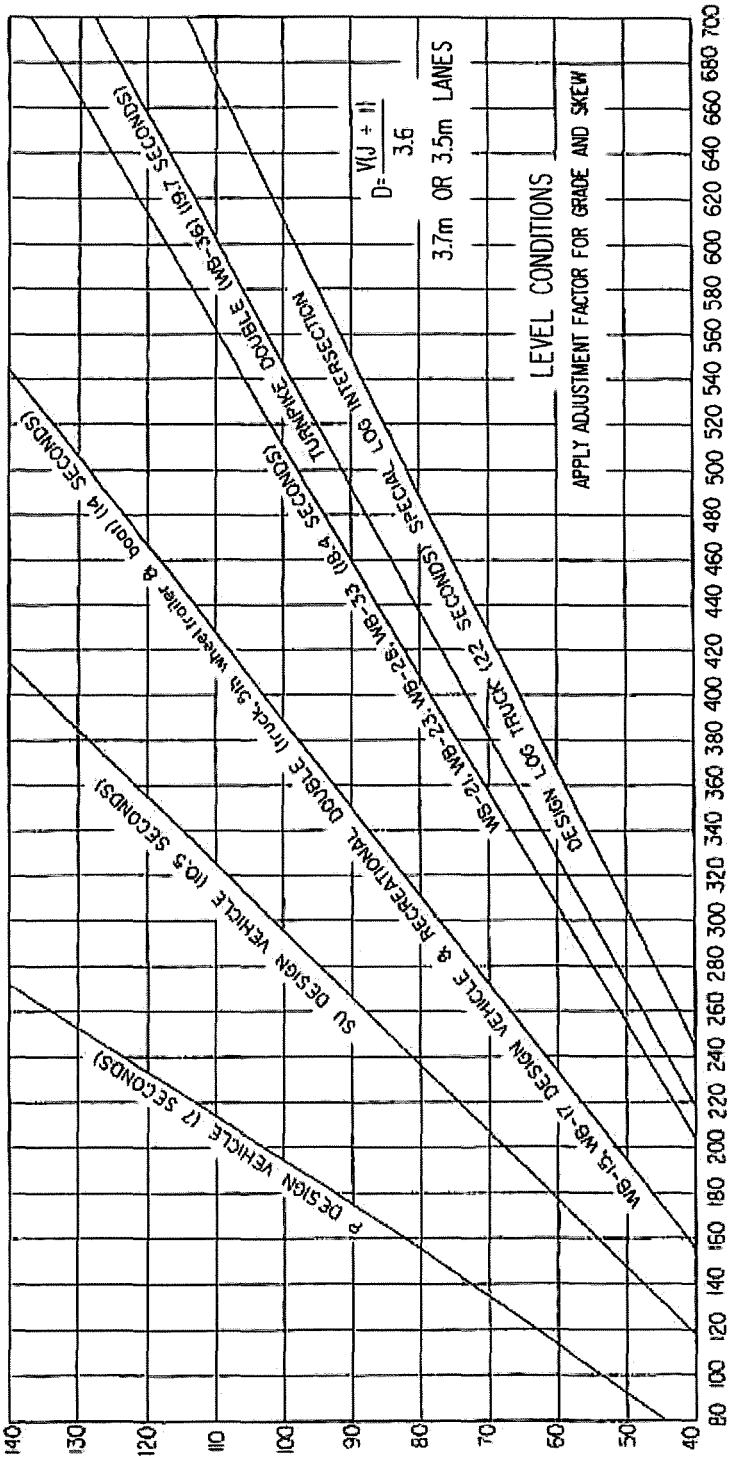
Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*7*		*5*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*7*	*0*	*5*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*9*						*12*	
C (m) (veh/h)	*1587*						*987*	
v/c	*0.01*						*0.01*	
95% queue length	*0.02*						*0.04*	
Control Delay (s/veh)	*7.3*						*8.7*	
LOS	*A*						*A*	

Approach Delay (s/veh)	--	--		8.7
Approach LOS	--	--		A

FIGURE D-4.2.2.2 SIGHT DISTANCES FOR LEFT TURN ONTO HIGHWAY*



NOTES:

1. To determine the sight distance requirements at an intersection, the designer should select the longest vehicle or vehicle with the greatest I.S.D. need, that uses the intersection on a regular basis, i.e., daily. Because of the various eye heights, the I.S.D. available for several design vehicles may have to be checked.
2. The usefulness of intersection sight distances in excess of 500m has been debated and will be the subject of future research into gap acceptance by large trucks on rural highways in Alberta. Changes to this table may be made based on that research.

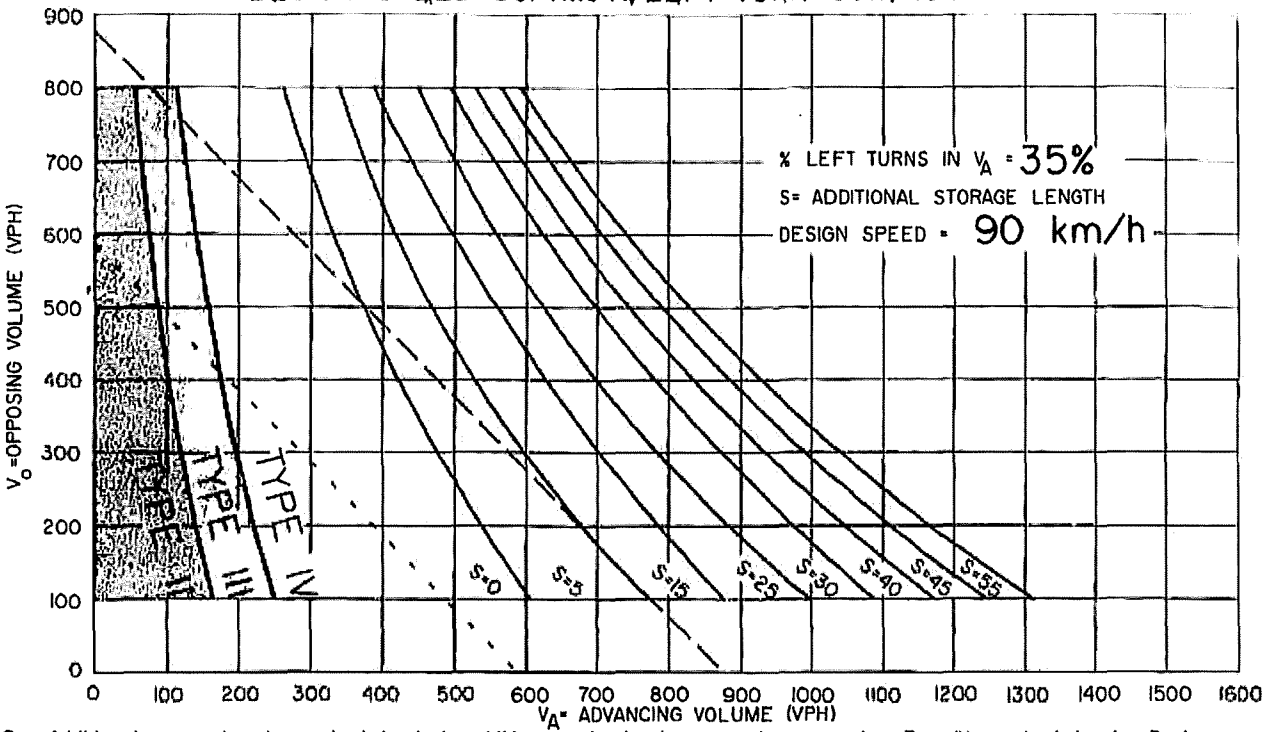
* INTERSECTION SIGHT DISTANCE (I.S.D.)

- THE I.S.D.'s SHOWN IN THIS FIGURE ARE BASED ON THE DISTANCE TRAVELLED AT DESIGN SPEED DURING A CRITICAL TIME (SHOWN ON THE FIGURE IN SECONDS). THE CRITICAL TIME INCLUDES THE TIME TAKEN FOR THE MANOEUVRE (LEFT TURN FROM THE MINOR ROAD) PLUS 2 SECONDS FOR PERCEPTION/REACTION TIME.
- THE INTERSECTION SIGHT DISTANCE AVAILABLE IS TO BE DETERMINED USING AN EYE HEIGHT (BASED ON THE DESIGN VEHICLE) LOCATED AT THE JUNCTION AND AN OBJECT HEIGHT OF 1.3m (REPRESENTING THE ROOF OF A PASSENGER VEHICLE) ON THE THROUGH ALIGNMENT. THE EYE HEIGHTS TO BE USED ARE SHOWN IN FIGURE D-5a.

* THIS CHART IS BASED ON CRITERIA USED BY AASHTO FOR "SIGHT DISTANCE" AT STOP LOCATIONS. THE SET OF CRITERIA IS DESCRIBED AS CASE IIIB IN THE AASHTO PUBLICATION "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS, 1994

REVISIONS	No.	BY		DATE
	No. 1	BY BK	ADDED NOTE	DATE AUG/99

FIGURE D-7.6-5d WARRANTS FOR LEFT TURN TREATMENT AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 90 KM/H, LEFT TURN 35%, 40%



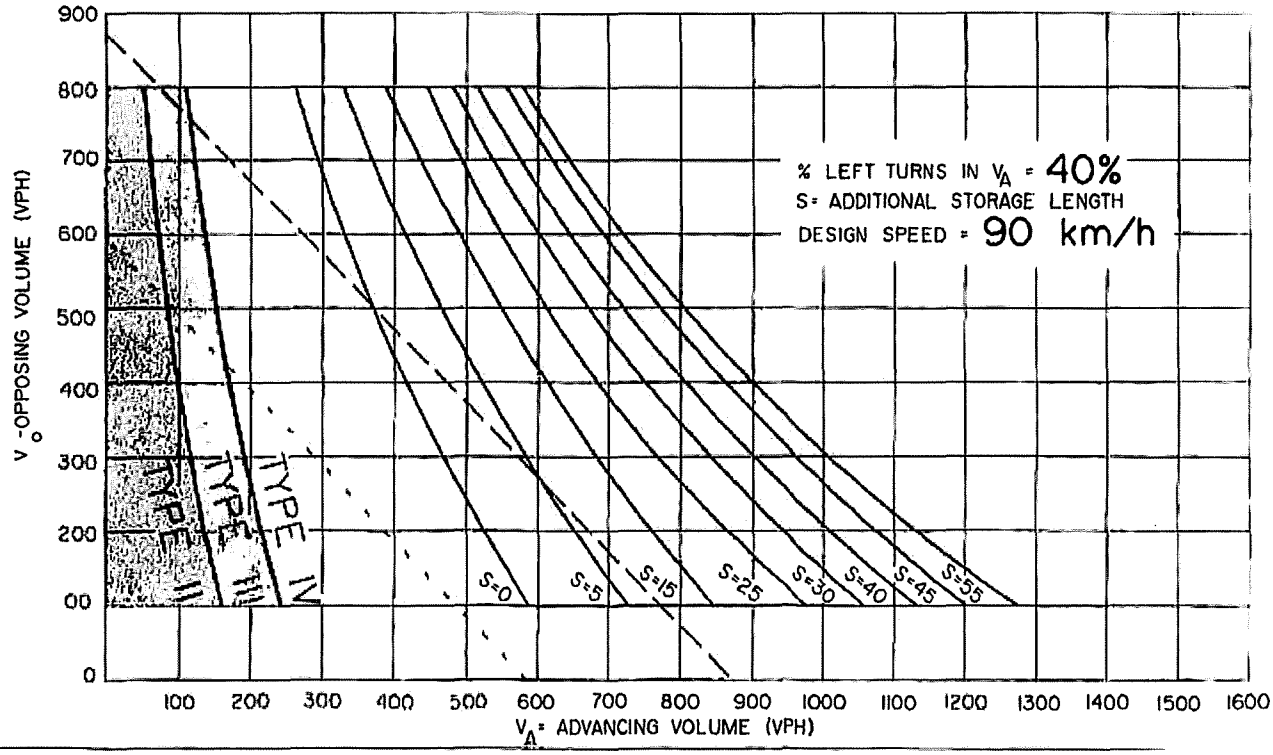
S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.

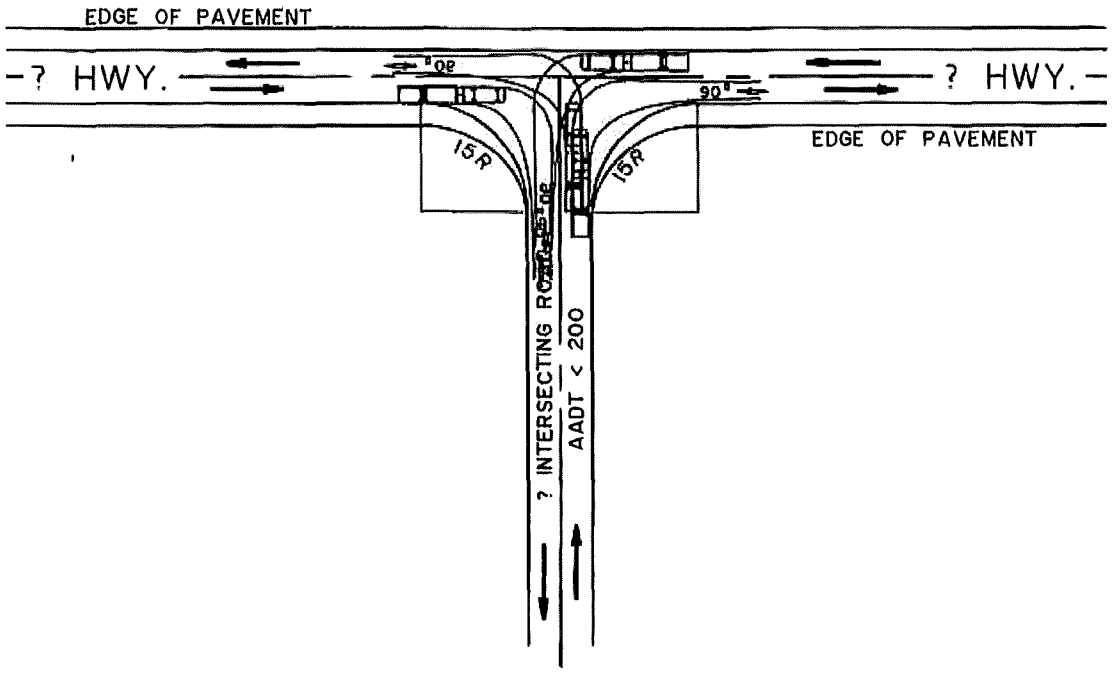
- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.

— — — — Traffic signals may be warranted in "free flow" urban areas.

Notes:

1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.





NOTE: ALL DIMENSIONS SHOWN ARE FOR FINISHED PAVEMENT SURFACES. ADDITIONAL SUBGRADE WIDTHS TO BE PROVIDED TO ALLOW FOR DEPTH OF BASE COURSE AND PAVEMENT.

No.	REVISIONS	BY	DATE
2			
1			

Approved:

ORIGINAL SIGNED
BY PETER · TAJCNER

Executive Director,
Technical Standards Branch

Date: FEBRUARY 23, 1993

Alberta
TRANSPORTATION
AND UTILITIES

T'-INTERSECTION TREATMENT
(TYPE I a)