LAC STE. ANNE COUNTY
PROVINCE OF ALBERTA
BYLAW #16-2014

A BYLAW TO CONTROL LAND USE.

WHEREAS, under the provisions of the Municipal Government Act, being Chapter M-26.1, Division 5, Sections 633 and 692 of the Revised Statutes of Alberta 2000 R.S.A., a municipality may adopt an Area Structure Plan.

AND WHEREAS the Council of Lac Ste. Anne County has decided to amend the Waters Edge Resort Area Structure Plan as a means to better facilitate growth within Waters Edge.

NOW THEREFORE the Council duly assembled hereby enacts as follows:

1) Lac Ste. Anne County Bylaw No. 16-2014, known as the Waters Edge Resort Area Structure plan, is hereby adopted.

2) That this Bylaw comes into full force and effect upon third reading of this Bylaw

First Reading carried the 6th day of August, A.D. 2014.

Reeve (Seal)

County Manager (Seal)

Read a second time this 3rd day of September, A.D. 2014.

Reeve (Seal)

County Manager (Seal)

Read a third and final time this 3rd day of September, A.D. 2014.

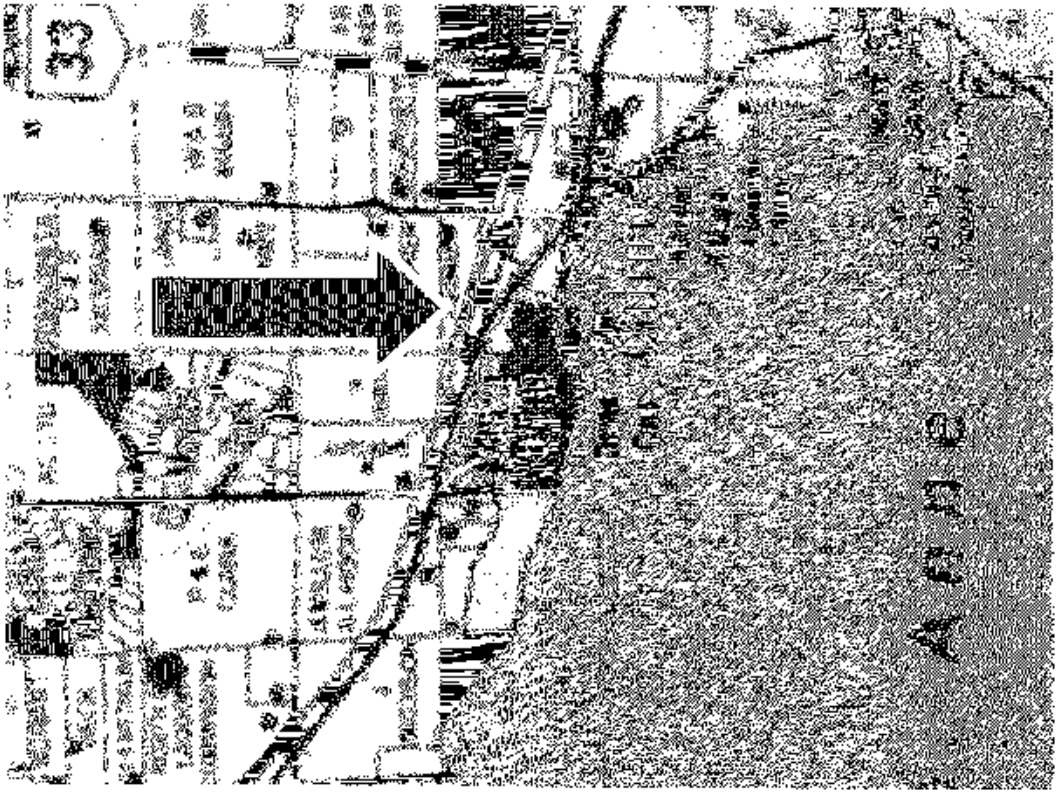
Reeve (Seal)

County Manager (Seal)

SCHEDULE "A"

BYLAW NO. 16-2014

A BYLAW TO ADOPT THE WATERS EDGE RESORT AREA STRUCTURE PLAN



SCHEDULE "B"

BYLAW NO. 16-2014

A BYLAW TO ADOPT THE WATERS EDGE RESORT AREA STRUCTURE PLAN

LAC STE. ANNE COUNTY

WATERS EDGE RESORT AREA STRUCTURE PLAN

NORTH SHORE LAC STE. ANNE AT GUNN, ALBERTA

REVISED JULY 2014

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- Appendix 2 – Transportation Impact Assessment /D&A Paulichuk Consulting Ltd. (Spring 2014).
- Appendix 3 – On Site Assessment and Feasibility Study for On Site Waste Water Treatment System / EBA Engineering Consultants Ltd.

1.0 SITE LOCATION, BACKGROUND & HISTORY

Waters Edge R.V. Resort started as Arndt Acres Holiday Trailer Resort and is located on the north Shore of Lac Ste. Anne at Gunn and consists of approximately 49.3 acres of land with 1/2 mile of Lakeshore. It was originally developed by Herb and Kathleen Arndt after the property was purchased in its "natural state" in the early 1950's. The property started as a public-access campground and then transitioned into a seasonal holiday trailer resort with full time mobile home residents in the late 60's.

The Property is an existing development and operates as a seasonal R.V. Resort and Mobile Home Community that offers lots of varying sizes (minimum length 80 feet; widths vary between 30 feet and 50 feet) to renters with holiday trailers, R.V.'s, mobile homes and cabins. The rental agreement is for a 12 month time frame and is classified as seasonal or full-time. The Resort is a gated community and has a private entrance, with an electronic gate which can be opened from your vehicle by means of an access card.

Approximately 32.5 acres of the property area is currently developed. There are 196 existing prepared lots of varying sizes, which are serviced with metered power, holding tank and water line. Of these lots, 32 are for full-time residents. The northwest corner of the property, approximately 16.8 acres, consists of undeveloped land. This area is envisioned to become part of the development as future lots with open space.

The Resort amenities include a Clubhouse for individual and group gatherings, Boat Launch, Common Washroom and Shower Facilities for Residents' use, Secure Storage Compound, Common Piers with Boat Slips, a Walking Trail System and green Common Recreation Space, including Common Beach Access and a Playground.

The property's existing use as a Seasonal R.V. Resort and Mobile Home Community has basically not changed in over 40 years with the Resort continually being maintained and upgraded. The County recognizes this use under the current Agricultural District "B" and the property is also recognized as a Manufactured / Mobile Home Community / Park (Bylaw 05-2000).

2.0 APPLICATION INTENT & PURPOSE

The intention of this Area Structure Plan is to redevelop the existing resort area into a bare land condominium residential community that will consist of fully serviced single detached homes with ancillary uses including parks, lake access and a common storage area. Waters Edge will be developed in a single phase that includes multiple subdivision applications, each creating lots for individual ownership through condominium title.

This Area Structure Plan also includes one direct control district to allow for architecturally designed single detached homes and basic development regulations to ensure compliance with the overall theme and purpose of this Plan.

The goal is to continue the existing development, enhancing it to create a First Class, Environmentally Sensitive Lakefront Development, allowing for individual lot ownership under a Bare Land Condominium ownership plan that will be an asset to the County.

3.0 SITE CONTEXT AND ADJACENT LAND USES

The site consists of some 49.31 acres of land. It is located on the north shore of Lac Ste. Anne at Gunn, with access to the property at its eastern edge from Lac Ste. Anne Trail (Range Road 33).

The site is bounded to the south by the waters of Lac Ste Anne, to the west by the Corsair Cove Development, to the north by the Canadian Northern Western Railway right-of-way, and to the east by the Hamlet of Gunn. (See Figure 1 – Location Map).

The site southern boundary fronts totally on the lakeshore of Lac Ste. Anne with the property's legal description including the Riparian Rights to these waters, which is defined "as where the land meets the water".

The existing and adjacent land uses are long established and well defined. The development does not propose to change the existing use of the lands or its relationship to the existing adjacent land uses. (See Figure 2 – Existing Development Plan and Figure 3 – Aerial Photograph of Existing Development.)

4.0 EXISTING LAND USE AND COUNTY BYLAWS

The existing property has been in use as a campground, transitioned into an R.V. and Mobile / Modular Home Community / Park since its original development in the early 1960's. Previous zoning of the property was Commercial Recreation, and currently the property is zoned Agricultural District "B" with the existing uses permitted and / or discretionary.

The County has also designated this property as a Manufactured / Mobile Home Community / Park (Bylaw 05-2000).

The uses envisioned meet the existing Agricultural District "B" and the County's designation of the property as a Manufactured / Mobile Home Community / Park. However, to properly clarify all uses, the intent is to rezone the property to a Direct Control, laying out all Development Guidelines specific to this Plan Area. (See Appendix 1).

Since the initial re-development, the overall theme of Waters Edge changed from a mixed R.V. and residential development to a community that would consist solely of single detached residential development. A 2014 amendment to this Plan removed the R.V. area of Waters Edge and made the single detached residential community the primary land use throughout the parcel.

5.0 DEVELOPMENT CONCEPT

The original development concept was to continue to operate the property as a seasonal R.V. Resort and Mobile / Modular Home Community / Park within a Bare Land Condominium, allowing for the R.V. Park to continue and to allow the individual ownership of lots. In 2014, an amendment to this Plan removed the R.V. Park component to Waters Edge and planned for the entire parcel to be a primarily residential community comprised of single detached homes.

The existing (2006) development consisted of 196 lots in which renovation and upgrades have occurred over the years with extensive upgrades over the last year. This work has included:

- Working within the existing layout, upgrading and completing work to provide for a consistent lot width: Increasing lot widths from 30' as a minimum, to a minimum of 35' to an average of 50' in width by a minimum average depth of 90'. Upgrades over the last year have reduced the number of lots from 210 to provide for 160 seasonal R.V. lots, 32 full-time mobile home lots and 4 service lots (Club House, Shower/Washroom, Shop and Storage Yard); for a total of 196 lots.

- To provide upgraded and / or new services to all the sites; Water, Sanitary and Power.

- Discontinue the existing private pier usage of over 25 piers on the property into the lake by providing for five to six common piers with individual slips for boats, evenly distributed across the lake frontage of the property.

- Renovating the existing Pavilion Storage Building into a Common Amenity Clubhouse Building for group gatherings, resident meetings, etc.

- Enhancement of the existing Boat / Trailer / Boat Hoist Storage Compound, re-grading, gravelling and security fencing this area.

- Providing a future fitness building, outdoor pool and sundeck with washrooms and shower facilities.

- Enhancing the walking trail system on the property and the green common recreation space, including Common Beach Access and a Playground.

- Construction of Boat Launch.

The intent of the Bare Land Strata Condominium Subdivision is to provide for a planned community allowing individual ownership of lots under a Bare Land Condominium Title.

The original development concept subdivided the property into 2 Condominium Unit Parcels (Unit 1 and Unit 2) in which phased development of individual lots can occur through the existing development and enhancements to the existing development and development of new Bare Land Condominium Lots within the created Unit Parcels. The common areas such as roadways, green space and lakefront access will be held as Common Property within the Bare Land Condominium plan. (See Figure 4 – Subdivision Plan; Figure 5 – Proposed Development Plan and Figure 6 – Common Property Plan.).

A 2014 amendment to this Plan removed the land originally planned for R.V. development and revised the Development Plan to be a residential community to include the entire parcel and reduced the total number of lots from a maximum of 229 to 133 residential lots planned for the community.

The Development Plan is to redevelop the existing west end of the site (Unit 1), increasing the size of the lots to minimum (50 ft. x 150 ft.; 7500 ft^2) as Bare Land Condominium Lots. On-going development will allow for the remainder of the property (Unit 2) to be subdivided into Bare Land Condominium lots of similar size (detailed specifications are included in the attached Land Use District Schedules).

Development will continue to progress under the current Direct Control Zoning, which provides specific guidelines for buildings and use within the Plan Area and guides the transition from the former Commercial Recreation development to the development concept described in this Area Structure Plan.

6.0 TRANSPORTATION

Access to the plan area remains as exists from the southeast corner of the lands from Lac Ste. Anne Trail (Range Road 33). This existing access meets all County Requirements.

It is proposed that emergency access to both Corsair Cove and the Plan Area to be enhanced through a joint emergency access at the west property line joining up to the MR Lands at Corsair Cove to allow for emergency vehicles to access Corsair Cove from the east through the Plan Area, and from Corsair Cove on the west to the Plan Area. This enhancement will provide emergency access from two directions for both Corsair Cove and the Plan Area. The emergency access has been constructed in accordance with County's standards and approvals.

The internal roadway system, road width is to be a minimum of 7.2 meters wide and be hard surfaced with an environmentally friendly compacted road milling surface. A walkway of 2 meters is to be provided adjacent to one side of the roadways and be grassed. The roadways within the Plan Area under a Bare Land Strata Condominium Plan will be held as Common Property and continue to remain private and therefore do not provide any burden on the County for maintenance.

Attached as Appendix 1 is a Traffic Impact Assessment, prepared by D&A Paulichuk Consulting Ltd. in the spring of 2014. The TIA concludes that the proposed development, in its final Completed Development State, won't create any additional impact on the adjoining County or Provincial roadway systems. Further, the TIA recommends that no improvements to adjoining roadways are required now and into the 20 year horizon.

7.0 UTILITY SERVICING CONCEPTS

Servicing Overview

Waters Edge shall be serviced as follows:

- Water: New lots to be serviced via a low pressure looped water system. The System will be developed in compliance with Alberta Environment Standards. An Engineering study has been completed to verify the Plan Area can be serviced through aquifer. All required Provincial Approvals have been applied for, approved, and remain in place.

- Sewage collection is to utilize a communal low pressure waste water collection system. The on-site system is designed to be connected to the proposed North 43 Lagoon Regional Wastewater Collection and Transmission System ; or connected to an on-site secondary treatment system.

  With regard to the North 43 Lagoon System, Waters Edge on-site system and main line is approved and designed to be part of the North 43 Lagoon Regional Wastewater Collection and Transmission System. The development will allow the main line to go through Waters Edge.

  Sewage collection for individual condominium lots is provided through the installation of common holding tanks (a minimum of 1 tank per two lots/units). A low pressure pump system is designed to transfer the sewage into the development's main and on through to the main that is part of the regional system.

  In the interim, the low pressure system collects the waste water on site to sewage holding tanks and vacuum trucks it to the North 43 Lagoon.

  In the event that the North 43 Regional Wastewater Collection and Transmission System is not developed the on-site low pressure system main will connect to an on-site secondary treatment and subsurface disposal system (See appendix 3 - On-Site Assessment and Feasibility Study for on-site water treatment system, completed by EBA Engineering consultants Ltd.)

- Franchise utilities, i.e. power, gas, telephone, will be provided by the respective utility companies in the area. Electrical and Telephone to be provided to all lots via a combination of overhead and underground service.

- Engineering details of all servicing has been reviewed and approved by all Provincial Authorities and Lac Ste. Anne County. All municipal and provincial approvals or licenses are in place.

8.0 STREET LIGHTING

Street lighting is to be provided along internal roadways; poles with lights approximately 450 feet on centre to be provided.

9.0 FIRE FIGHTING

The Plan Area falls within the Alberta Beach and Onoway Emergency Fire Fighting Services area. A Fire Truck Fill Hydrant has been constructed at the Boat Launch Area approximately in the centre of the site for refilling Fire Fighting Equipment.

10.0 SITE TOPOGRAPHY AND STORM WATER DRAINAGE

The topography of the Plan Area rises away from the lake, providing for four natural "tiers" or "benches". The property naturally drains south towards Lac Ste. Anne. The natural drainage within the existing Plan Area and the Proposed Development retains all sediment through natural on site percolation, absorption and filtration before draining into Lac Ste. Anne. Detailed Engineering at all stages will ensure all sediment is properly retained and filtered and meets all Engineering Standards and County Approvals. Roadway design will provide a 2% crossfall to match the topography to allow for the natural percolation and absorption of storm water. Lot drainage design will

- Provisions shall be made to provide for 1 guest parking stall for every 6 lots, to be evenly distributed in the new Development Plan Areas as developed.

- Detailed development standards for the Plan Area are provided for in the (CR1) and (CR2)Direct Control Land Use District that was created for Waters Edge and as attached as Appendix 1 to this Area Structure Plan.

- Unit 1 of the Condominium Plan will create a maximum of 79 residential lots.

- Unit 2 of the Condominium Plan will create a maximum of 54 residential lots.

14.0 COMMON AREAS

With the proposed Bare Land Condominium Subdivision, the following provides for the calculations of reserve dedication based upon Lac Ste. Anne County Policy 601-4,

- Parkland: 7.0 Acres per 160 Acres (Pro Rated)
  Plan Area Minimum Requirement Calculation; 2.16 Acres.

- Infrastructure improvements in one or more park lots (i.e. play equipment, swings, volleyball, etc.) Area: 2.5 acres per 160 acres (Pro Rated).
  Plan Area Minimum Requirement Calculation; 0.77 Acre.

- The value of a maximum of 1.25 acres per 160 acres (Pro Rated) in money in lieu of reserves may be allocated against lands, which is dedicated for walkway purposed as part of an internal road structure.
  Plan Area Minimum Requirement Calculation; .386 Acre.

- With above the Plan Area Minimum Requirements Total 3.316 Acres.

- The Property has Riparian Rights along the south property line, which is the north shore of Lac Ste. Anne. A minimum lakefront common property area access of 6 m (20 ft) is provided for the whole south property line along the lake shore of Lac Ste. Anne for all Residents' enjoyment and access to the lakefront / lakeshore.

The Plan Area Development Concept exceeds providing for the above Requirements (Requirement: 3.316 Acres), providing a total of 9.88 acres of "green space" parks, walkways and lakefront access, which totals over 18% of the parcel area. (See Proposed Development Plan Figure 5 c/w data.) The Development provides for these as Common Property Areas under the Plan Area's Bare Land Condominium Title (See Figure 6 – Common Property Plan).

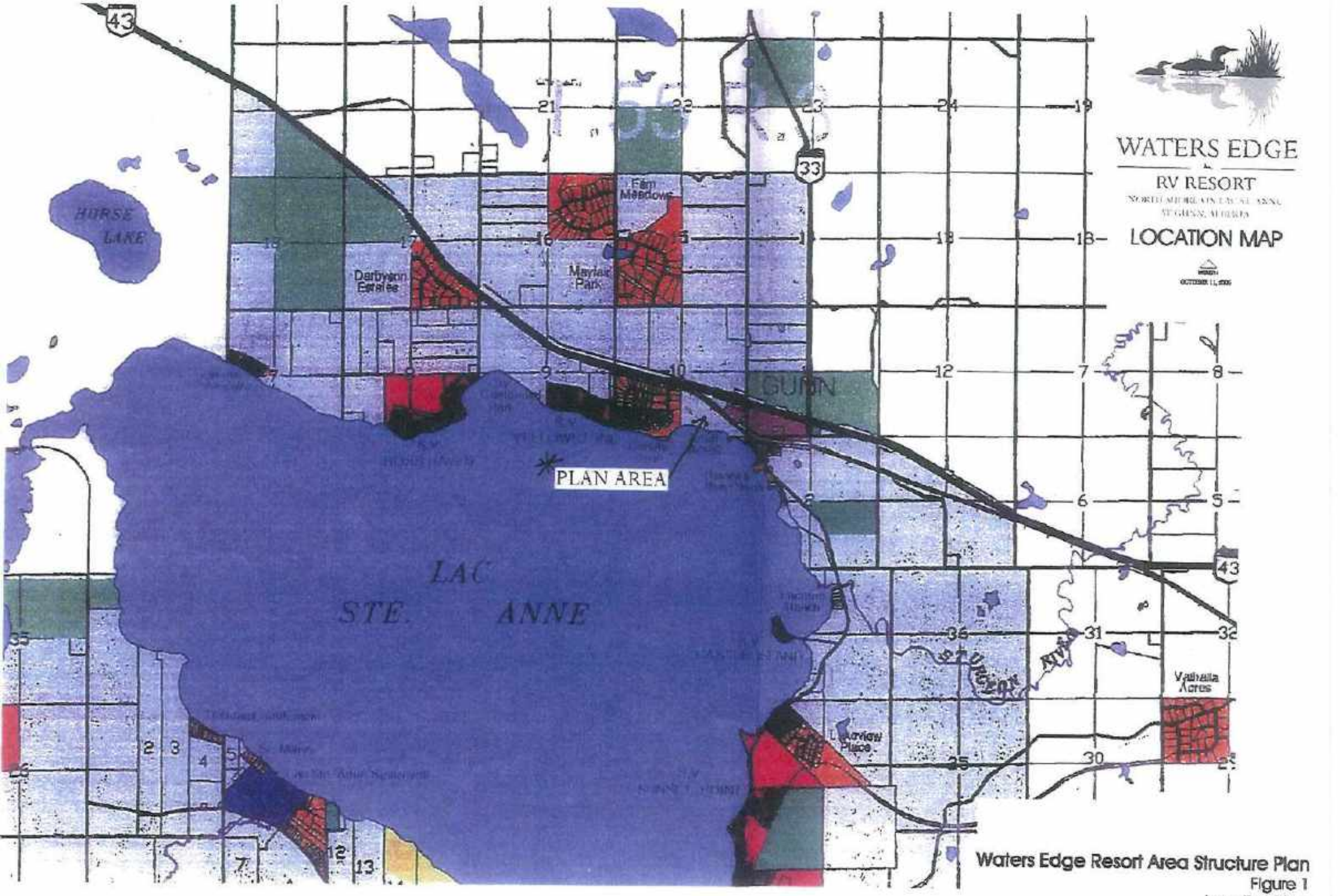
15.0 CONCLUSIONS

a) The subject lands are situated within a well defined planning area bounded by established land uses.

b) This Area Structure Plan Bylaw is consistent with the purposes and intent of the County's Plans Bylaws in place.

c) This Area Structure Plan Bylaw incorporates the existing uses of the Plan Area providing development controls through Direct Control Zoning specific for this Plan Area for both units created that establishes a comprehensive framework for all future development.

d) Access and transportation considerations, environmental concerns, servicing concepts and detailed development guidelines have all been addressed.



Waters Edge Resort Area Structure Plan
Figure 1
Location Map

Waters Edge Resort Area Structure Plan
Figure 2
Existing Development Plan

WATERS EDGE

RV RESORT

NORTH SHORE ON LAC ST. ANNE

AT GUNN, ALBERTA

AERIAL PHOTOGRAPH

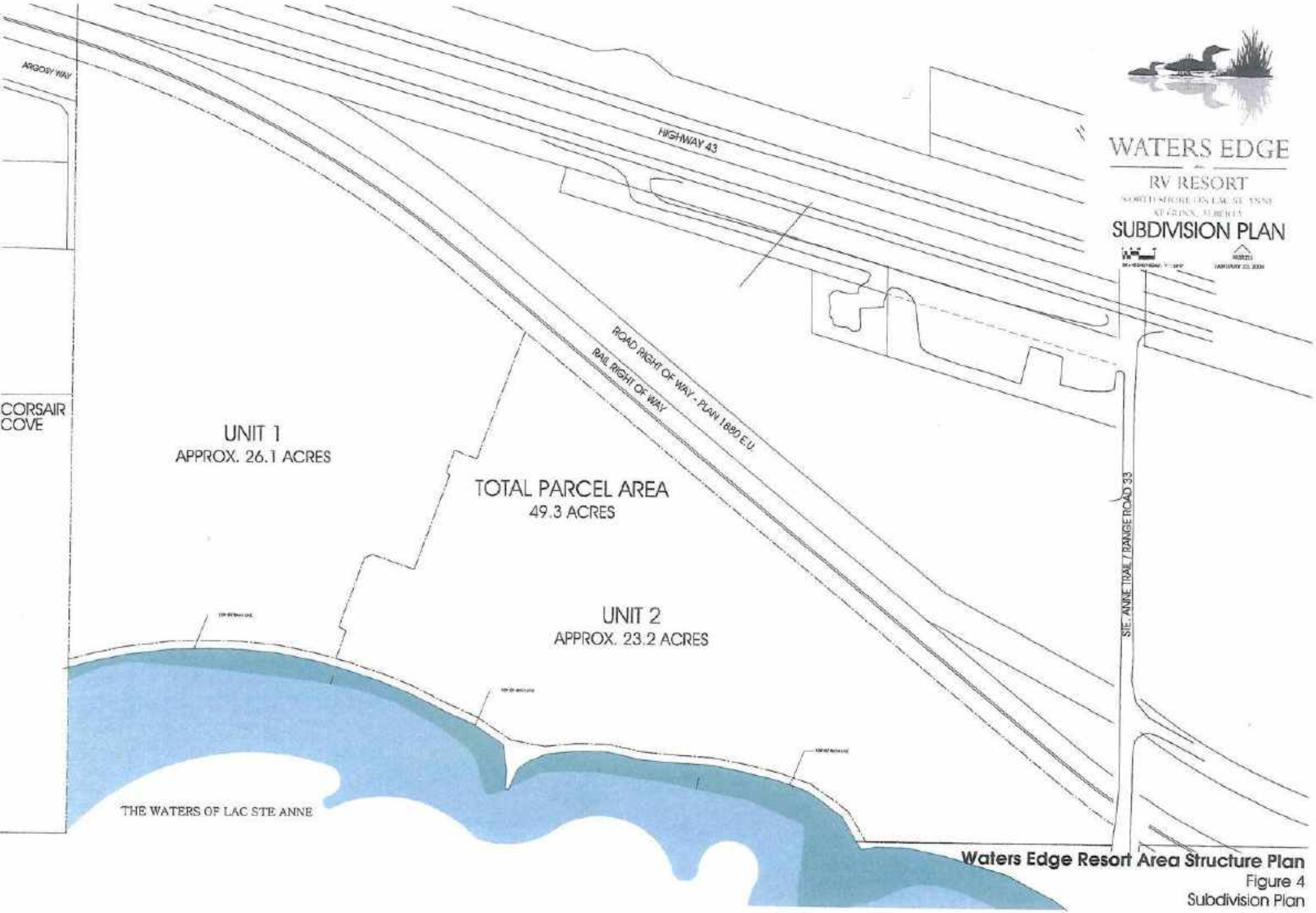
NORTH

SEPTEMBER 11, 2008

Waters Edge Resort Area Structure Plan

Figure 3

Aerial Photograph of Existing Development

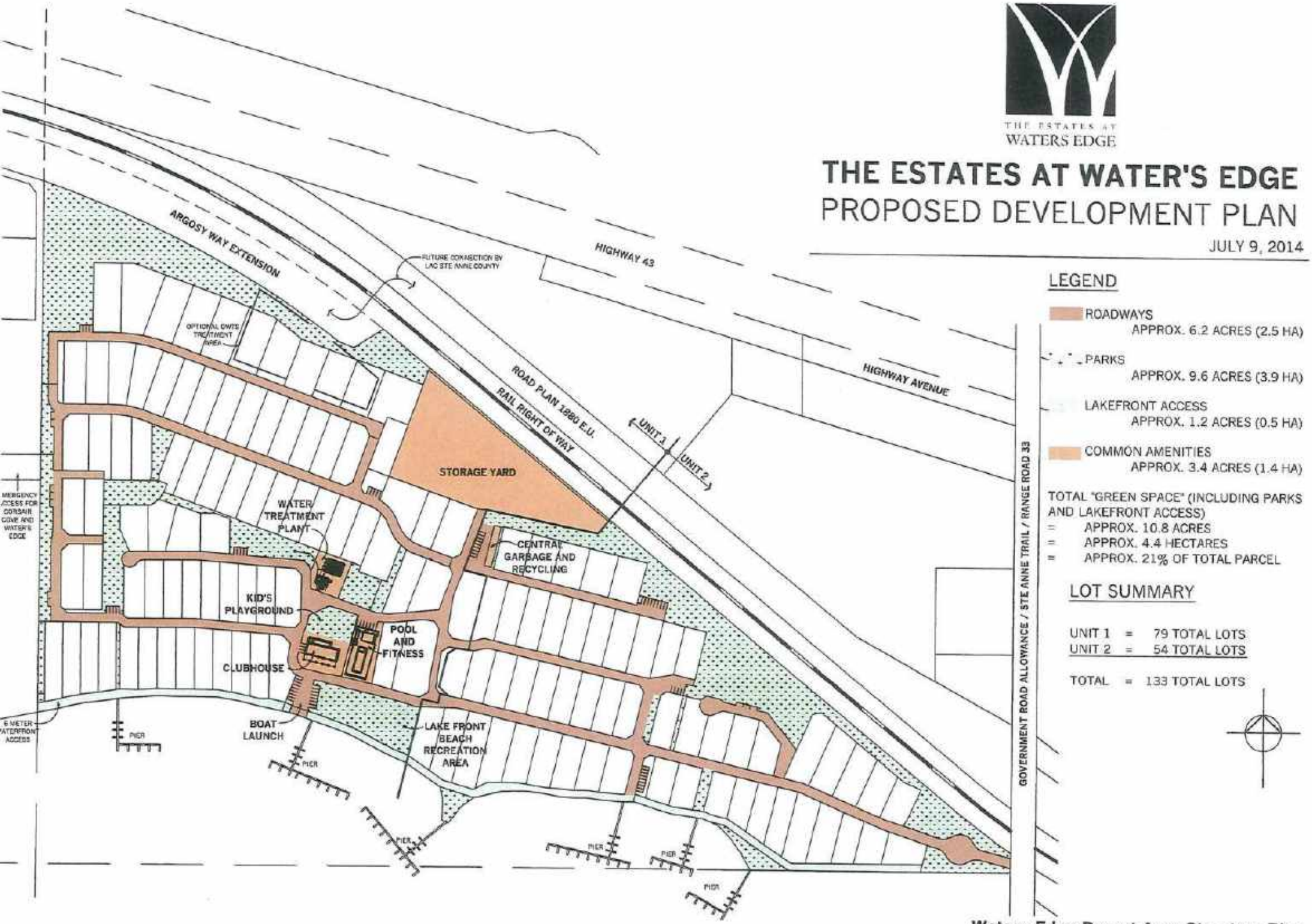


Waters Edge Resort Area Structure Plan
Figure 4
Subdivision Plan

THE ESTATES AT WATERS EDGE

THE ESTATES AT WATER'S EDGE
PROPOSED DEVELOPMENT PLAN

JULY 9, 2014



LEGEND

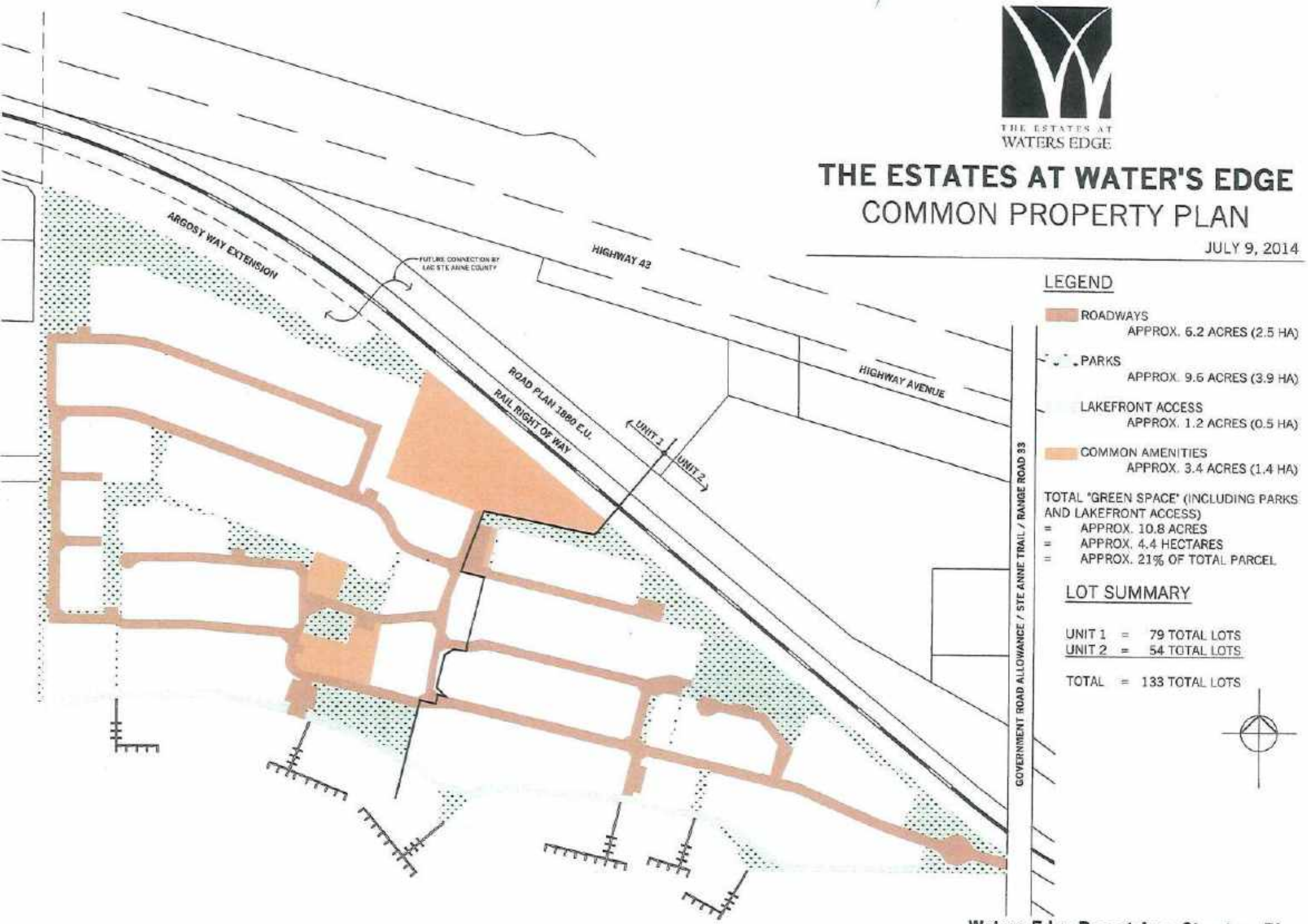
- ROADWAYS — APPROX. 6.2 ACRES (2.5 HA)
- PARKS — APPROX. 9.6 ACRES (3.9 HA)
- LAKEFRONT ACCESS — APPROX. 1.2 ACRES (0.5 HA)
- COMMON AMENITIES — APPROX. 3.4 ACRES (1.4 HA)

TOTAL "GREEN SPACE" (INCLUDING PARKS AND LAKEFRONT ACCESS)
= APPROX. 10.8 ACRES
= APPROX. 4.4 HECTARES
= APPROX. 21% OF TOTAL PARCEL

LOT SUMMARY

UNIT 1	=	79 TOTAL LOTS
UNIT 2	=	54 TOTAL LOTS
TOTAL	=	133 TOTAL LOTS

Waters Edge Resort Area Structure Plan
Figure 5
Proposed Development Plan



THE ESTATES AT WATERS EDGE

THE ESTATES AT WATER'S EDGE
COMMON PROPERTY PLAN

JULY 9, 2014

LEGEND

- ROADWAYS APPROX. 6.2 ACRES (2.5 HA)
- PARKS APPROX. 9.6 ACRES (3.9 HA)
- LAKEFRONT ACCESS APPROX. 1.2 ACRES (0.5 HA)
- COMMON AMENITIES APPROX. 3.4 ACRES (1.4 HA)

TOTAL "GREEN SPACE" (INCLUDING PARKS AND LAKEFRONT ACCESS)
= APPROX. 10.8 ACRES
= APPROX. 4.4 HECTARES
= APPROX. 21% OF TOTAL PARCEL

LOT SUMMARY

UNIT 1	=	79 TOTAL LOTS
UNIT 2	=	54 TOTAL LOTS
TOTAL	=	133 TOTAL LOTS

Waters Edge Resort Area Structure Plan
Figure 6
Common Property Plan

Waters Edge Resort Area Structure Plan
North Shore Lac Ste. Anne at Gunn, Alberta

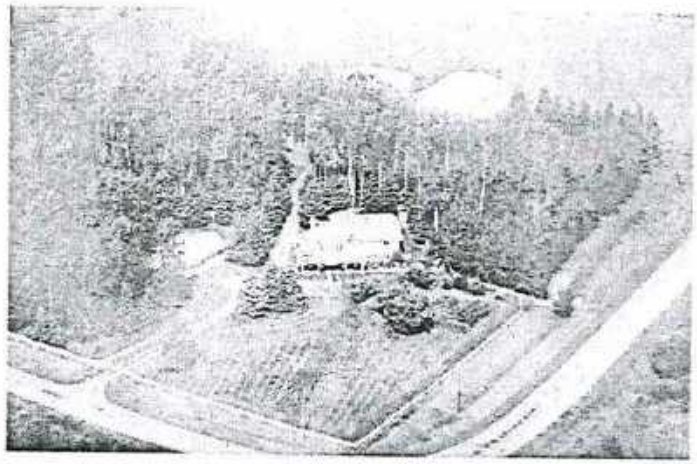
Appendix 1

Proposed Direct Control

Waters Edge Resort (CRR)

Purpose

The purpose of this District is to accommodate the development of an adult and family oriented Bare Land Condominium Subdivision which will provide a wide selection of lot sizes, common property for access, park area and lakefront access, and a picturesque view of Lac Ste. Anne under Bare Land Condominium Ownership.



Regulations

Permitted and Discretionary uses within the CRR district are outlined in Figure 8.13.1.

Development Regulations for CRR are outlined in Figure 8.13.2

Figure 8.13.1 - Permitted and Discretionary Uses

Uses	Permitted	Discretionary
Accessory Building or Use	P	
Communication Tower		D
Garage	P	
Guest House		D
Home Based Business (minor)	P	
Marina or Boat Rental Facility	P	
Modular Dwelling	P	
Park, playground and open space inc. trails	P	
Retail Store		D
Single Detached Dwelling/Modular Home	P	
Storage Yard	P	

Figure 8.13.2 – Development Regulations

Regulation	Standard
Parcel Areas	Area "A" Lots Min 929 m² (10,000 ft²) Other Lot Min: 696.75 m² (7500 ft²)
Density	Max. 1 dwelling per parcel* *More than 1 dwelling may be permitted subject to the conditions set out in Section 9.2
Floor Area	Min: 55.7 m² (640 ft²)
Dwelling Height	Area "B" Lots: 1 storey Other: 1.5 to 2.0 storey
Min. Setbacks	Rear: 6.0 m (19.7 ft) Side: 2.43 m (8 ft) Front: 9.0 m (29.5 ft) Lake View (Front Yard): 9.0 m (30 ft)
Min Lot Width	Area "A" Lots: 18.28 m (60 ft) Other: 15.24 m (50 ft)
Min Lot Depth	45.75 m (150 ft)
Lot Coverage	Maximum 40%
Parking	Min 2 passenger vehicles per parcel

Additional Regulations

1.1.1 In addition to the regulations listed above, other regulations in this bylaw also apply. These include:

- General Development Regulations of Sections 9;
- Specific Use Regulations of Section 10;
- Parking and Loading Standards of Section 11;
- Landscaping Standards of Section 12;
- Sign Regulations of Section 13

1.1.2 Setbacks are measured as the distance from the building foundation to the property line.

1.1.3 A maximum raised deck of 408 sq. ft (37.9 m²), shall be allowed per lot. Decks that are not 600 mm (2 feet) above grade shall not require a Building Permit. Decks that are above 600 mm (2 feet) shall require a Building Permit

1.1.4 A maximum of 79 residential parcels to be developed within Bare Land Condominium Plan No 072-6914, Unit 1.

1.1.5 A maximum of 54 residential parcels to be developed within Bare Land Condominium Plan No. 072-6942, Unit 2.

1.1.6 A retail store shall only be developed within Bare Land Condominium Plan No. 072-6942, Unit 2.

1.1.7 A maximum of 1 storage shed shall be allowed per lot, only if storage is not part of the garage or car port. Maximum size is 3.0 m (10 ft) x 3.0 m (10 ft) x 2.13 m (7 ft).

1.1.8 Uncovered Entrance Porches and Steps can be located in Sideyards to a maximum of 2.7 m (9 ft.) in width.

1.1.9 All finishes of dwelling/modular home, attached/detached garage or car port, guest house, or shed shall be compatible finishes, colour coordinated and follow the Architectural Guidelines and Controls of the Bare Land Condominium Association.

1.1.10 The improvements on each lot shall follow the Architectural Controls and Landscape Standards of the Bare Land Condominium Association and have the approval of the Association. Homes with less than the standard roof pitch may be allowed subject to obtaining engineering approval in accordance with the standards of the Safety Codes Act.

1.1.11 Each side yard shall be landscaped with shrubs and trees to provide natural vegetation screening between lots and follow the Landscape Controls and Guidelines of the Bare Land Condominium Association.

1.1.12 A fence shall not exceed 1.8 m (5.9 ft) in height and shall require the approval of the Bare Land Condominium Association.

1.1.13 The keeping of animals is limited to a maximum of 2 domestic pets.

1.1.14 No residential lot may be re-subdivided to create a larger number of residential lots in this District without a formal bylaw amendment of this District and the applicable Area Structure Plan.

1.1.15 All development permit applications shall have the written approval of Waters Edge Resort Bareland Condominium Association prior to submission to Lac Ste. Anne County.

1.1.16 Lac Ste. Anne County Council delegates the approving authority for all residential development and uses related to a residential development as described in this District to the Development Officer. All other development and uses shall be determined by the Municipal Planning Commission.

1.1.17 Development decisions and stop orders are eligible for appeal to the Subdivision and Development Appeal Board pursuant to Sections 685 and 645 of the Municipal Government Act.

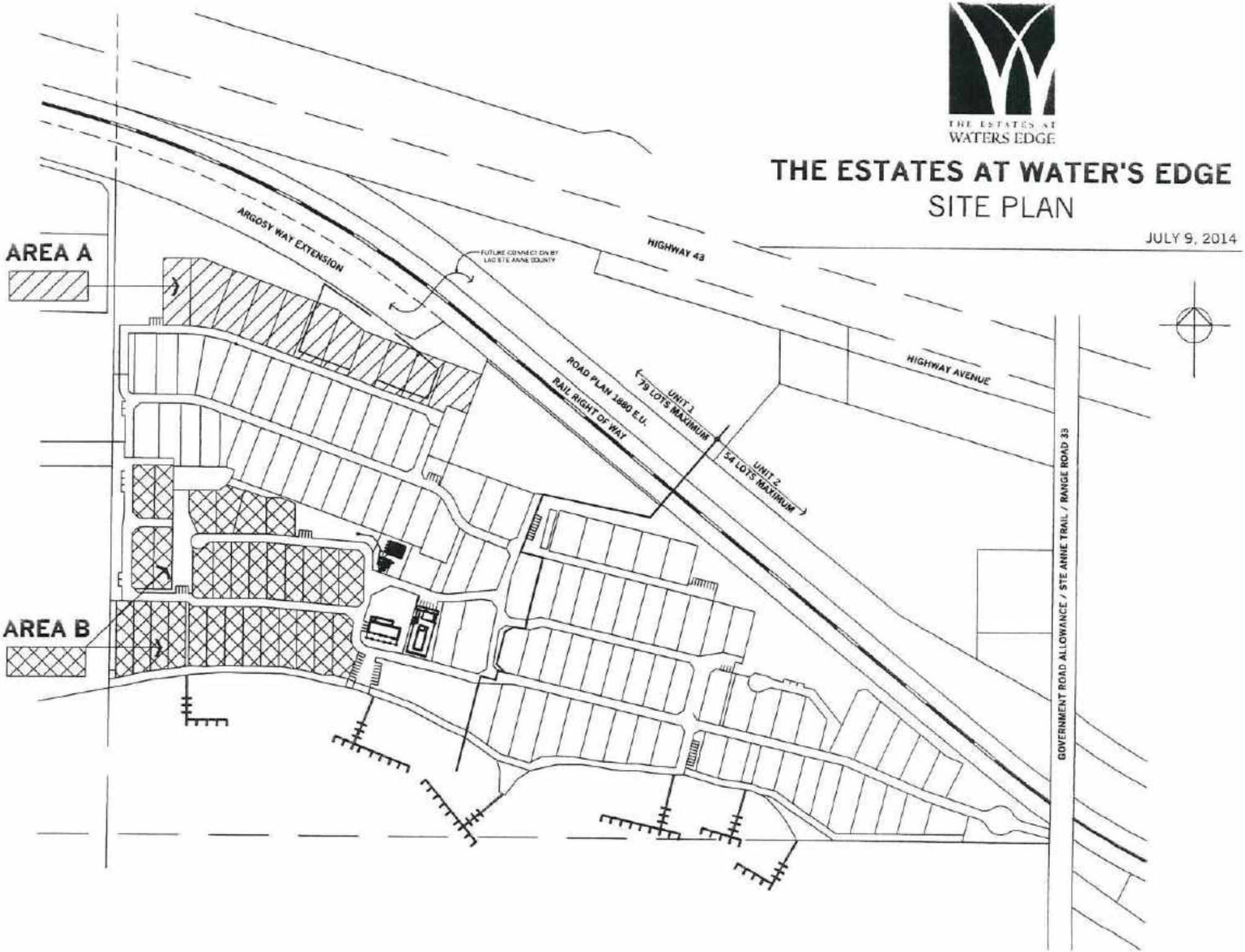
1.1.18 A landscaped buffer within each side yard shall be a minimum of 0.9 m (3.0 feet) in width.

THE ESTATES AT
WATERS EDGE

THE ESTATES AT WATER'S EDGE

SITE PLAN

JULY 9, 2014



Waters Edge Resort Area Structure Plan
North Shore Lac Ste. Anne at Gunn, Alberta

Appendix 2
Transportation Report

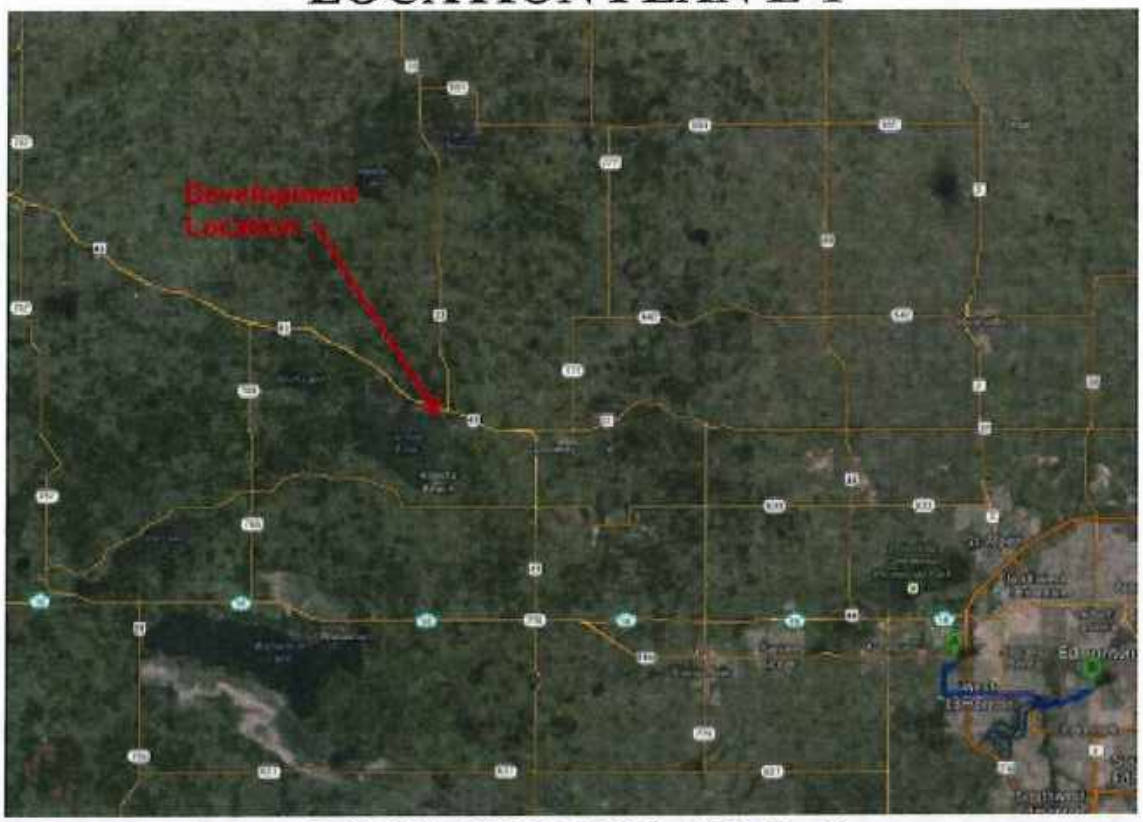
TRAFFIC IMPACT ASSESSMENT

THE ESTATES AT WATERS EDGE
Lot 1, Block 1, Plan 072 0068
Subdivision in SE 10-55-3-W5M
Highway 43:20 & Range Road 32/Gunn Access

D&A PAULICHUK CONSULTING LTD.

June 10, 2014

LOCATION PLAN L-1



LOCATION PLAN L-2

LOCATION PLAN L-3

INTERSECTION VIEW 1

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APPENDIX A - ALBERTA HIGHWAYS TRAFFIC VOLUME HISTORY
TRAFFIC DATA – TURNING MOVEMENT DIAGRAMS

APPENDIX B - TRAFFIC VOLUME HISTORY & GROWTH RATES
2013 – 2034 TURNING MOVEMENT DIAGRAMS
MAJOR - MINOR ROAD INTERSECTION FOUR-LANE DIVIDED HIGHWAY
INTERSECTION TREATMENT

APPENDIX C - SYNCHRO ANALYSIS SHEETS

1. INTRODUCTION

This report is a Traffic Impact Assessment (TIA) report for a residential subdivision development of 135 lots in SE quarter section of Section 10, Township 55, Range 3, West of 5th Meridian. See Location Plans before this report.

This report has been prepared to determine the impact of the proposed development on traffic using Highway 43:20 and the intersecting Range Road 32, which provides access to the Hamlet of Gunn. The scope of work in this case, is to assess the required intersection treatment as a result of the increased traffic volumes and turning movements attributed to the development. This document will address the following:

- Retrieve 2013 traffic volume data.
- Determine present traffic volumes for 2014.
- Determine projected traffic volumes to 2014, 2019, 2024 and 2034.
- Determine traffic volumes generated from the development.
- Determine combined traffic volumes for 2014, 2019, 2024 and 2034.
- Complete intersectional analysis of the Highway 43:20 & Rge. Rd. 32.
- Identifies geometric deficiencies based on current 3R/4R guidelines.
- Review sight distance requirements.
- Complete illumination and signalization warrant analysis, if required.
- Provides a preliminary engineering cost estimate for recommended improvements.

This report is based on information provided by Mr. Rick Arndt, of Waters Edge Land Inc., site observations from Mr. Darcy Paulichuk, P. Eng., traffic volume data from Alberta Transportation, intersectional analysis procedures and standards documented in Alberta Infrastructure and Transportation's "Highway Geometric Design Guide", 1999, and Alberta Infrastructure and Transportation's "Traffic Impact Assessment Guideline", 2005.

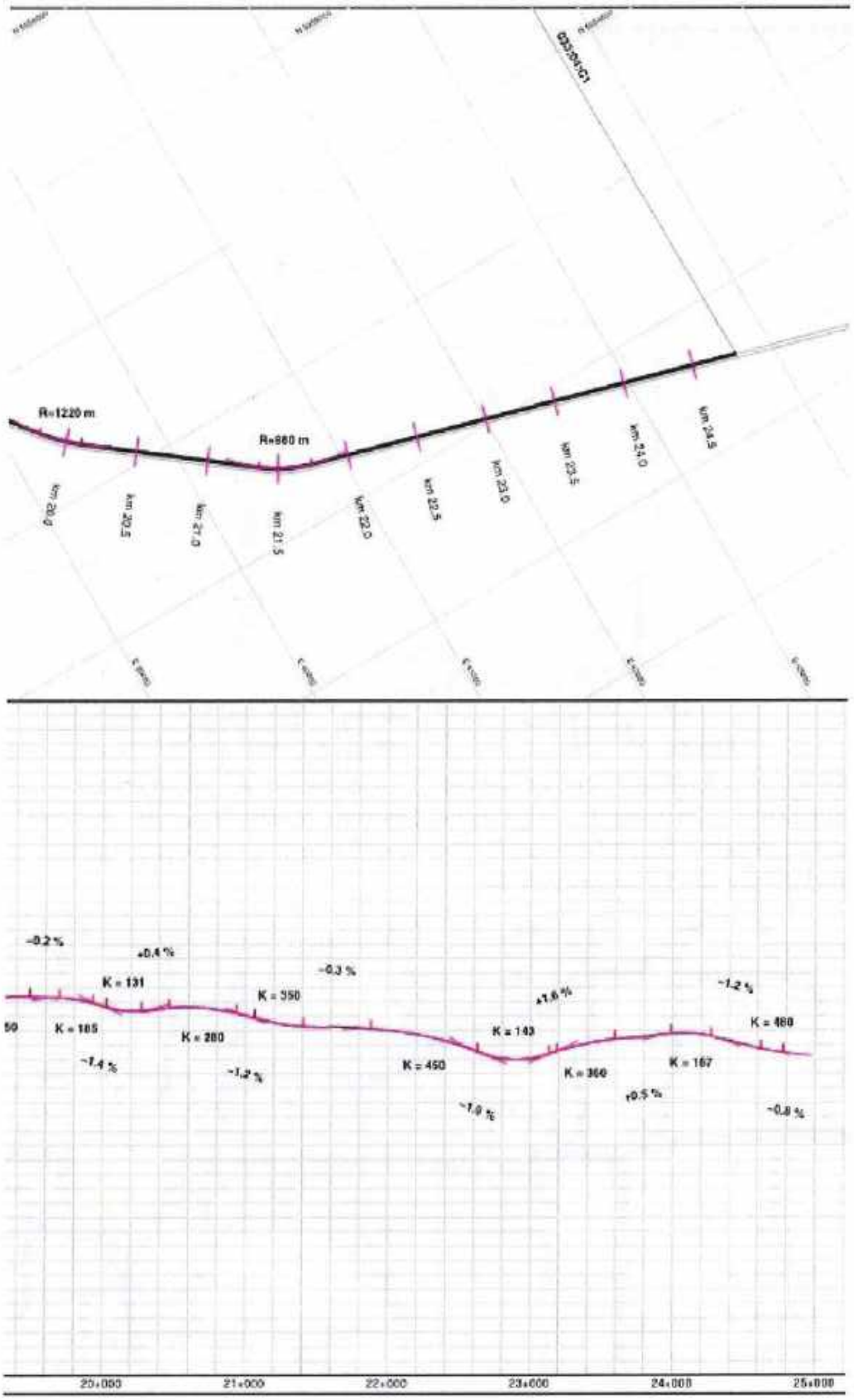
This report has been prepared for Waters Edge Land Inc. for the purposes of gaining approval from municipal and provincial governments for the development of this site.

2. EXISTING CONDITIONS

2.1 Physical Properties

Highway 43:20 traverses between Grande Prairie and Highway 16, west of Edmonton.

Hwy. 43:20 is classified as a Level 1 roadway in accordance with Alberta Transportation's "Provincial Highway Service Classification System". Level 1 roadways typically accommodate the movement of people, goods and services inter provincially and internationally.


R=1220 m
R=880 m
km 20.0
km 20.5
km 21.0
km 21.5
km 22.0
km 22.5
km 23.0
km 23.5
km 24.0
km 24.5
-0.2 %
+0.4 %
K = 131
K = 185
-7.4 %
K = 280
-1.2 %
K = 350
-0.3 %
K = 450
-7.0 %
+1.6 %
K = 143
K = 360
+0.5 %
K = 167
-1.2 %
K = 480
-0.8 %
20+000
21+000
22+000
23+000
24+000
25+000

The intersection of Hwy. 43:20 and Range Road 32 exists approximately at km 24.07. The intersection is on a horizontal tangent. The intersection is on top of a vertical crest curve with a k value of 167. The grade to the west is +0.5% and -1.2% to the east. The sight distance is excess of 800m in both directions.

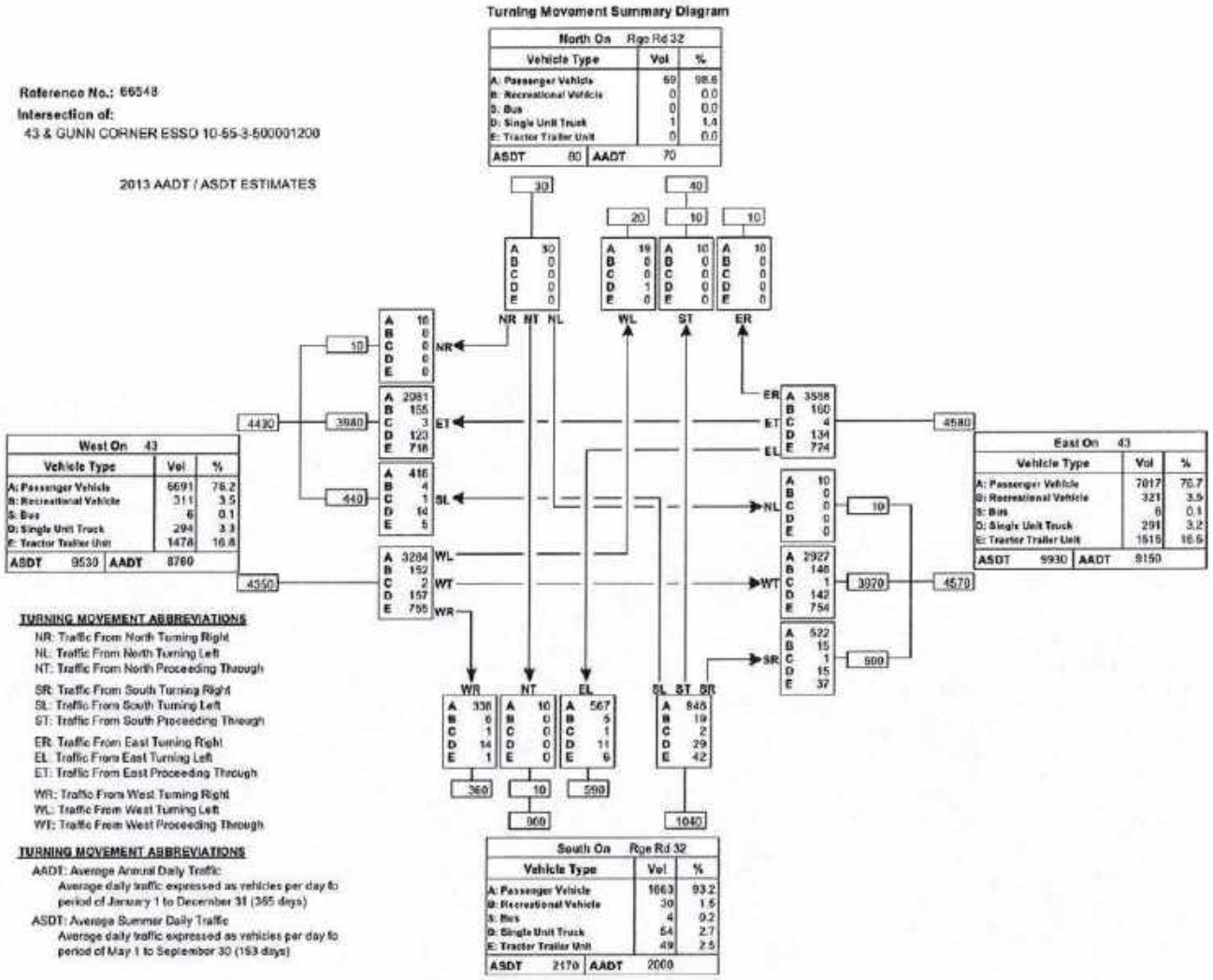
2.2 Traffic Properties

Existing Alberta Transportation intersectional traffic count locations are shown in the map below:

The AT website http://www.transportation.alberta.ca/3460.htm has traffic counts available that are relevant for comparison purposes for this assessment. There is a specific traffic count available for the intersection of Hwy. 43:20 and Rge. Rd. 32. See below.

Table-2.2a: 2013 AADT and ASDT from Alberta Highways Traffic Volume History

Intersection Leg	2013 AADT	2013 ASDT	2013 % Trucks
43 & Gunn Corner Esso (66548)	9150	9930	19.8%



2.2 Site Observations

The details of the intersection site are as follows:

- Highway 43:20 is four-laned and is paved.
- The intersection has an existing treatment as follows:
  - EBL's
    - A service road entrance exists approximately 400m west of the intersection. This service road provides access to a Veterinarian Clinic and the Alaska Hy-Way Esso, and connects to Range Road 32. The entrance has a short deceleration taper on the outside shoulder, approximately 80m long.
    - The Range Road 32 intersection contains only a short 60 – 80m taper for right turn deceleration and acceleration. A short left turn taper

exists for traffic turning from EB to NB.

- WBL's
  - There is a long deceleration lane and taper for WB to SB left turning traffic. There does not appear to be any right turn lane treatment for deceleration or acceleration.

- The width on north leg of Range Road 32 is approximately 8 metres.
- Centerline WB to Centerline EB spacing is approximately 36m.
- The Intersectional Site Distances (ISD) appeared adequate in all directions >800m.
- Vehicles on Highway 43 appeared to be traveling at the posted speed limit of 110 km/hr.
- The side slopes seem to be 5:1 or better throughout.
- There is existing illumination (5 lights) but no signalization.
- In 2002, the area was overlaid with pavement. No modifications to the existing intersection were made at that time.

Viewing west in EBL's, just east of the Intersection.
A partially painted taper exists for right turn acceleration.

Viewing east in EBL's, just west of the Intersection
A partially painted taper exists for right turn deceleration.

Some photos from the site are shown below:

Viewing east from the WBL's, just west of the intersection.

Viewing east in EBL's, west of the intersection. There is an intersection 400m west of the RR 32 intersection that connects to a service road that accesses RR 32.

Viewing east in EBL's, just west of the intersection.
Access to the Development is to the right.

3. SITE TRAFFIC CHARACTERISTICS

3.1 Highway Traffic Projections

The following historical traffic data for Highway 43:20 is available from the Alberta Transportation's website, which indicates a growth of approximately 4.58% growth for east leg of Hwy. 43:20, from 1997 to 2013 (16 years).

Historical Traffic Volumes – Hwy. 43:20

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AADT	6070	6350	6830	7080	7800	7960	7900	7690	8080	8440	9020	9150

Year	1997	1998	1999	2000	2001
AADT	5280	5450	5490	5770	6050

Projected AADT values for Hwy. 43:20 are presented in the table below for key times:

Existing Highway Traffic Forecast, Daily Volumes

Year	**Hwy. 43:20 East Leg**	**Rge. Rd. 32 South Leg**
2014	9569	2092
2019 (5 Year)	11664	2550
2024 (10 Year)	13760	3008
2034 (20 Year)	17950	3924

Peak hour traffic loading (100th highest hour) is shown below for am/pm volumes:

Existing Highway Traffic Forecast, Peak Hour Volumes

Year	**Hwy. 43:20 East Leg** a.m. & p.m.	**Rge. Rd. 32 South Leg** a.m. & p.m.
2014	981 / 980	214 / 198
2019 (5 Year)	1196 / 1194	261 / 241
2024 (10 Year)	1411 / 1409	308 / 284
2034 (20 Year)	1840 / 1838	402 / 371

3.2 Development Traffic Projections

The proposed development is for 135 residential single family dwellings located along the north shore of Lac Ste Anne.

Presently, there are already 45 units developed that are already contributing traffic to the existing transportation system.

The traffic volume calculations for purposes of the analysis are as follows:

Daily Volumes: 135 - 45 single family dwellings x10 trips/day = 900 trips per day

AM Peak Hour: 10.25% x 900 trips = 92 trips per hour

PM Peak Hour: 9.45% x 900 trips = 85 trips per hour

*Note: AM and PM factors taken from AT 2013 traffic count ratios between AADT and AM & PM 100th High Hour Estimates for the RR 32 south leg.

It is assumed that the development traffic will split 80% to the north and 20% to the south from the development access to Ste Anne Trail. The 80% of traffic to the

north, is assumed to split 70% to the east on Highway 43 and 30% to the west on Highway 43.

3.3 Combined Traffic Projections

The following tables show the estimated combined traffic volumes at the intersection.

Combined Traffic Forecast, Daily Volumes

Year	Hwy. 43 East Leg Combined	Range Road 32 South Leg Combined
2014	10062	2790
2019	12094	3147
2024	14131	3509
2034	18195	4220

Projected peak hour traffic loading (100th highest hour) is shown below for am/pm:

Combined Traffic Forecast, Peak Hour Volumes

Year	Hwy. 16 East Leg Combined am/pm	Range Road 32 South Leg Combined am/pm
2014	1032 / 1026	286 / 263
2019	1242 / 1231	327 / 295
2024	1451 / 1443	362 / 331
2034	1870 / 1854	439 / 397

4. TRAFFIC ANALYSIS

4.1 Design Speed

The posted speed on Highway 43:20 at this location is 110 km/hr. It is therefore reasonable to conclude that a design speed of 120 km/h is suitable.

4.2 Detailed Analysis

4.2.1 Right Turn Taper

In accordance with Section D.8.1, "Right Turn Taper", the following is apparent:

- Range Road 32 is considered a MAJOR ROAD, since the access is to the Hamlet of Gunn. The minimum requirement for a MAJOR ROAD is a 40:1 taper with a length of 120 to 140m (depending on the lane width).

- Presently, there are 60 – 80m right turn tapers for the east bound traffic. There is also a service road intersection 400m west of the RR 32 intersection that is available for right turns and accesses RR 32. This intersection contains a 25:1 taper.

4.2.2 Right Turn Lane

In accordance with Section D.8.7, "Warrants for Right Turn Lanes on Four-Lane Divided Highways", the following is apparent:

- The Right Turn Lane Volume must be at least 360 vehicles per day to warrant a Right Turn Lane. This is summarized in the following Table:

Table: Right Turn Lane Warrant

Condition	Base Year (2014)	5 Year (2019)	10 Year (2024)	20 Year (2034)
RR 32	(Condition Met)	(Condition Met)	(Condition Met)	(Condition Met)
Right turn daily traffic ≥ 360	476	522	567	657
For movement in question	(Yes)	(Yes)	(Yes)	(Yes)

Based on the projected volumes, a Right Turn Lane is warranted for the next 20 years.

Presently, there is no deceleration lane or acceleration lane for east bound traffic.

4.2.3 Left Turn Taper

In accordance with Section D.8.3, "Left Turn Taper", the following is apparent:

- Range Road 32 is considered a MAJOR ROAD, since the access is to the Hamlet of Gunn. The minimum requirement for a MAJOR ROAD is a 40:1 taper with a length of 120 to 140m (depending on the lane width).
- Presently, the left turn tapers are approximately 40:1.

4.2.4 Left Turn Lane

The Highway Geometric Design Guide Section D.8.6, "Warrants for Left Turn Lanes on Four-Lane Divided Highways" gives graphical guidelines for determining left turn warrant. The graphs use peak (100th highest) hour volumes and factor in percent turning and design speed to identify the required treatment for the intersection.

The following table shows the treatments needed for current and projected traffic volumes.

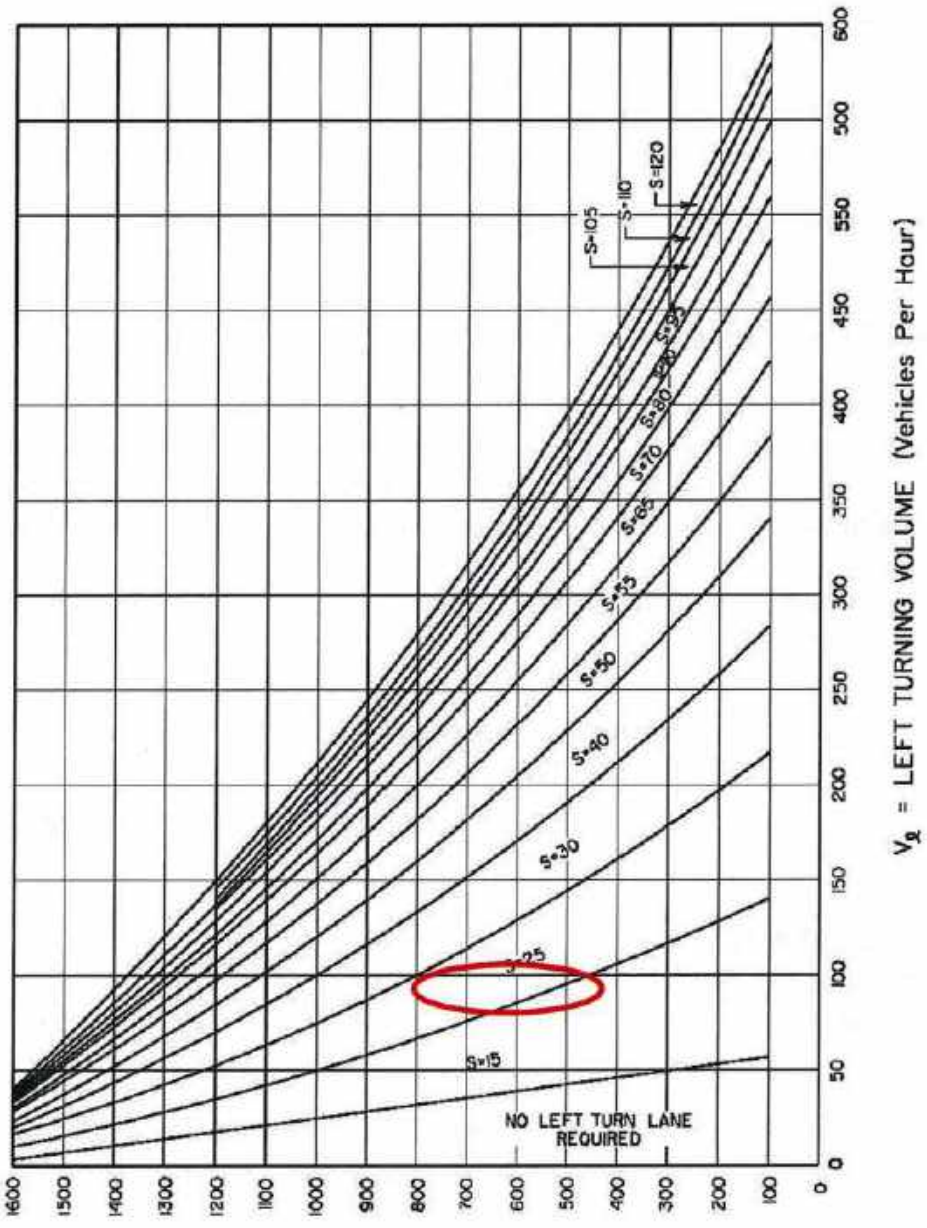
Table: Required Treatment Type

	Base Year (2014)	5 Year (2019)	10 Year (2024)	20 Year (2034)
Range Road 32				
Peak AM 100th Hour				
V_l = Turning Volume (VPH)	78	85	91	104
V_o = Opposing Volume (VPH)	436	527	614	793
Treatment Required	**Yes**	**Yes**	**Yes**	**Yes**

The above values are then used on Figure D-8.6c, "Warrants for Left Turn Lanes and Storage Requirements for Four-Lane Divided Highways", shown below.

Based on the projected volumes, a Left Turn Lane is warranted for the next 20 years for the WB to SB left turning movement. Since the existing intersection contains a left turn taper and 100m parallel lane, the existing intersection treatment appears to be sufficient.

FIGURE D-8.6c WARRANTS FOR LEFT TURN LANES AND STORAGE REQUIREMENTS FOR FOUR-LANE DIVIDED HIGHWAYS



4.2.5 Length Adjustments due to Grade on Deceleration Lanes

In accordance with Section D.6.2.6, "Effect of Grade on Parallel Deceleration Lanes", the following is apparent:

- The grade approaching the Range Road 32 entrance is approximately +0.5% and is less than 2%. No adjustment is required.

4.2.6 Length Adjustments due to Grade on Acceleration Lanes

In accordance with Table 2 of Figure D-6.3.4, "Acceleration Lengths on Turning Roadways", the following is apparent:

- The grade leaving the Range Road 32 entrance is approximately -1.2% and is less than 2%. No adjustment is required.

D.6.2.6 Effect of Grade on Parallel Deceleration Lanes

Lengths of deceleration lanes are affected by grade. That is, deceleration distances are longer on downgrades and shorter on upgrades. For highway grades greater than two percent, the length of the deceleration lane should be multiplied by one of the factors shown in Table D.6.2.6 below:

Table D.6.2.6 Ratio of Length on Grade to Length on Level

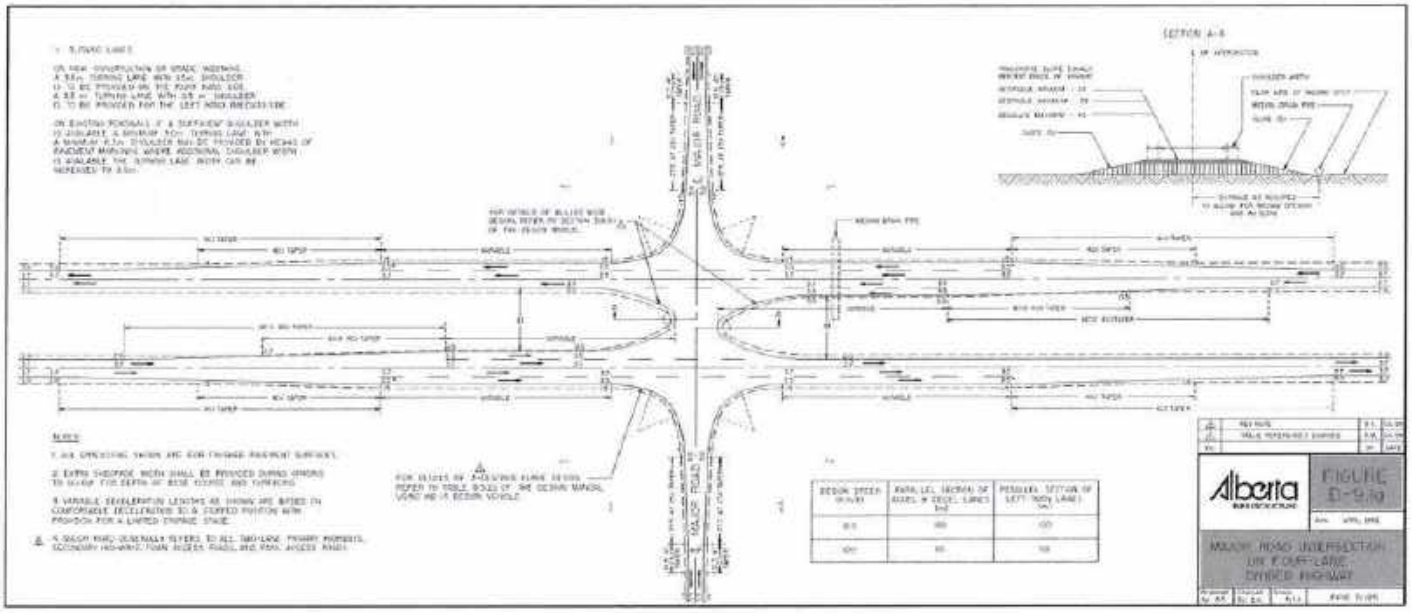
Speed (km/h)	Grade (%)	Upgrade Ratio	Downgrade Ratio
all speeds	2 to 3	0.95	1.10
	3 to 4	0.90	1.20
	4 to 5	0.85	1.30
	5 to 6	0.80	1.35

HIGHWAY DESIGN SPEED (km/h)	†RATIO OF LENGTH ON GRADE TO LENGTH ON LEVEL				
	DESIGN SPEED OF TURNING ROADWAY CURVE (km/h)				
	30	40	50	60	ALL SPEEDS
2% TO 2.99% UPGRADE					2% TO 2.99% DOWNGRADE
50	1.20	1.20	-	-	0.75
60	1.20	1.20	1.20	-	0.75
70	1.20	1.20	1.25	1.25	0.75
80	1.20	1.25	1.25	1.25	0.75
90	1.20	1.25	1.25	1.25	0.75
100	1.25	1.25	1.25	1.25	0.75
110	1.25	1.20	1.25	1.25	0.75
120	1.25	1.30	1.30	1.30	0.75
130	1.25	1.30	1.30	1.30	0.75
3% TO 3.99% UPGRADE					3% TO 3.99% DOWNGRADE
50	1.30	1.30	-	-	0.70
60	1.30	1.30	1.30	-	0.70
70	1.30	1.30	1.40	1.40	0.70
80	1.40	1.40	1.40	1.40	0.70
90	1.40	1.40	1.50	1.50	0.70
100	1.40	1.50	1.50	1.50	0.60
110	1.50	1.50	1.60	1.60	0.60
120	1.50	1.60	1.60	1.70	0.60
130	1.50	1.60	1.60	1.70	0.60
4% TO 4.99% UPGRADE					4% TO 4.99% DOWNGRADE
50	1.40	1.40	-	-	0.65
60	1.40	1.40	1.40	-	0.65
70	1.45	1.45	1.55	1.55	0.65
80	1.55	1.55	1.60	1.65	0.65
90	1.60	1.65	1.75	1.80	0.65
100	1.60	1.75	1.80	1.90	0.55
110	1.70	1.80	1.95	2.00	0.55
120	1.75	1.90	2.00	2.15	0.55
130	1.75	1.90	2.00	2.15	0.55
5% TO 5.99% UPGRADE					5% TO 5.99% DOWNGRADE
50	1.50	1.50	-	-	0.60
60	1.50	1.50	1.50	-	0.60
70	1.60	1.60	1.70	1.70	0.60
80	1.70	1.70	1.80	1.90	0.60
90	1.80	1.90	2.00	2.10	0.60
100	1.80	2.00	2.10	2.30	0.50
110	1.90	2.10	2.30	2.40	0.50
120	2.00	2.20	2.40	2.60	0.50
130	2.00	2.30	2.40	2.60	0.50

TABLE No. 2

4.2.7 Overall Intersection Treatment

The Range Road 32 Entrance is considered a **MAJOR ROAD** as reviewed above. Therefore, a "Major Road Intersection on Four-Lane Divided Highway" intersection treatment is warranted for Years 2014 to 2034 as shown below.



SUMMARY:

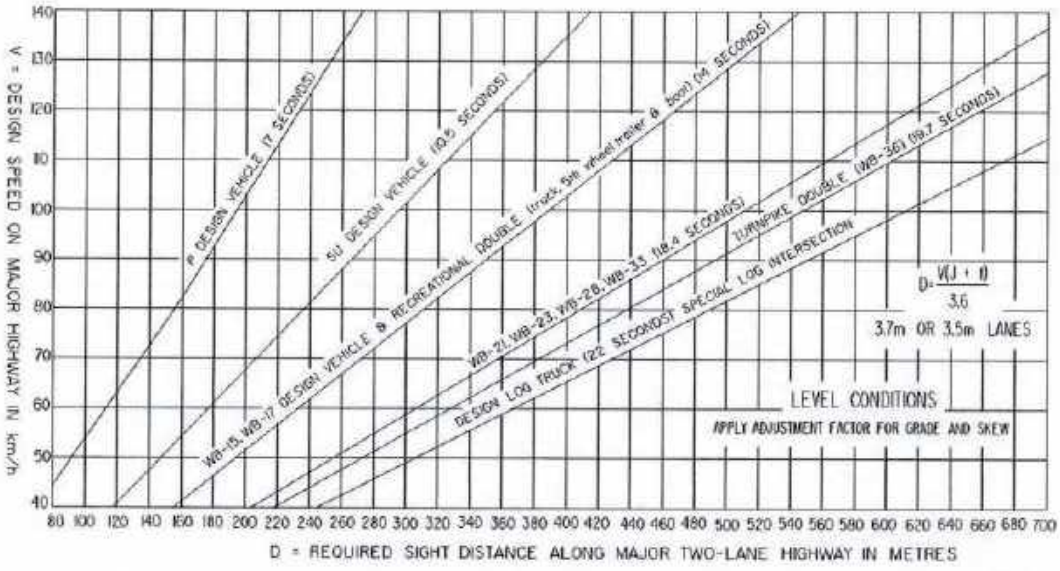
1. LEFT TURN: A left turn lane and taper exist in west bound direction and appears to meet the above drawing standard.
2. RIGHT TURN EBLs: **There are approximately 25:1 right turn tapers at the intersection that are partially painted. There are no right turn lanes existing for both deceleration and acceleration movements. There is a service road intersection 400m west of the RR 32 intersection that also provides right turn access and connects to R 32. This intersection contains a 25:1 taper.**

Presently, the intersection does not meet the required standard for right turns. Further review is required by highway capacity analysis to determine if this affects the operation of the intersection.

4.3 Intersectional Sight Distance

In accordance with section D.4, "Sight Distances at Intersections", the sight distance for left turning vehicles from the approach, without interfering with vehicles nearing the intersection, is used for determination of minimum sight distance requirements. Using Fig. D-4.2.2.2, shown in Appendix C, the required sight distances for various vehicle types with a 120 km/hr design speed are as follows:

Vehicle Type	Required Sight Distance – 120 km/hr.
Passenger Vehicle (P)	233 m
Single Unit or Bus (SU)	355 m
Semi-Trailer Combination (WB15)	470 m
Semi-Trailer Combination (WB21, WB23, WB28, WB33)	613 m



As indicated in the site inspection notes, the site distance is greater than 800 metres in both directions on Hwy. 43 at the intersection of Highway 764 & Range Road 53.

5. ILLUMINATION & SIGNALIZATION WARRANTS

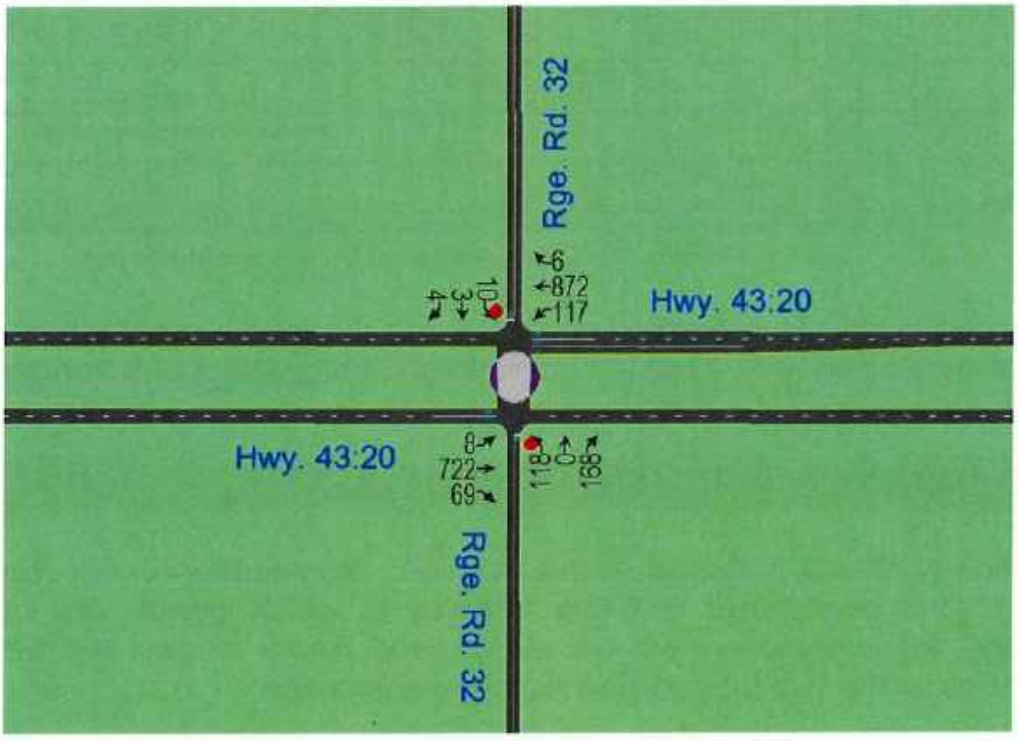
Illumination is already installed at this location. Signalization in not required since Highway 43 is considered a future freeway in which signals are not allowed. Ultimately, this intersection will be closed and future access will be made by interchange at the Highway 43 and Highway 33 junction.

6. CAPACITY ANALYSIS

A capacity analysis was performed for the intersection for the 100th highest hour for the AM Peak for Years 2014, 2019, 2024 and 2034. The traffic analysis was completed using Synchro 8 software based on HCM 2010 methodology. A saturation flow of 1700 vpl was used in this analysis. See the tables below for the results.

WITH DEVELOPMENT – No Improvements

YEAR			Highway 43:18/20		Highway 43:18/20	Rge. Rd. 32	Rge Rd. 32
	TIME PERIOD	PARAMETERS	EB Left Turn	EB Th. & Rt.Turn	WB Left turn	NB All Turns	SB All Turns
Year 2014	AM Peak	LOS	A	A	A	B	B
		Delay (s)	0.1	0.1	9.1	13.6	14.2
Year 2019	AM Peak	LOS	A	A	A	C	C
		Delay (s)	0.1	0.2	9.5	16.3	16.1
Year 2024	AM Peak	LOS	A	A	A	C	C
		Delay (s)	0.1	0.2	10.0	20.1	18.8
Year 2034	AM Peak	LOS	A	A	B	E	D
		Delay (s)	0.2	0.2	11.4	43.6	26.5



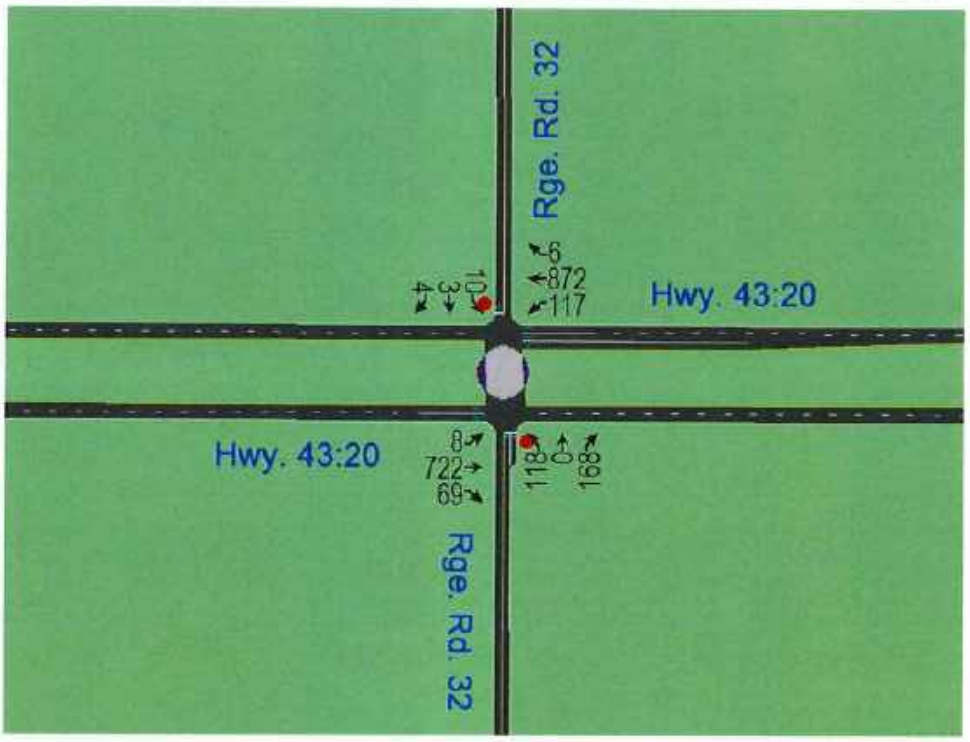
The AM Peak Hour traffic volume were chosen for this analysis, since the PM Peak Hour traffic are slightly lower.

The analysis indicates that there is no delay caused by the lack of turn lanes for the EBL's.

For the AM Peak Hour, the analysis illustrates that the existing intersection has sufficient capacity for the added development traffic for the next 16 – 20 years. In approximately 16 – 20 years, the south approach starts to fail due to a lack of a right turn lane. By adding a 15m right turn lane on the south leg, the following results in Years 2024 and 2034 are projected.

WITH DEVELOPMENT – Improvements Only on RR32 South Leg

YEAR			Highway 43:18/20		Highway 43:18/20	Rge. Rd. 32	Rge Rd. 32
	TIME PERIOD	PARAMETERS	EB Left Turn	EB Th. & Rt.Turn	WB Left turn	NB All Turns	SB All Turns
Year 2024	AM Peak	LOS	A	A	A	C	C
		Delay (s)	0.1	0.2	10.0	15.3	18.5
Year 2034	AM Peak	LOS	A	A	B	C	D
		Delay (s)	0.2	0.2	11.4	22.0	25.6



LEVEL OF SERVICE (LOS) CRITERIA

Control Delay Per Vehicle (s)	LOS by Volume to Capacity Ratio	
	≤1	>1
≤10	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F

Level of Service "A"

Level of Service "B"

Level of Service "C"

Level of Service "D"

Level of Service "E"

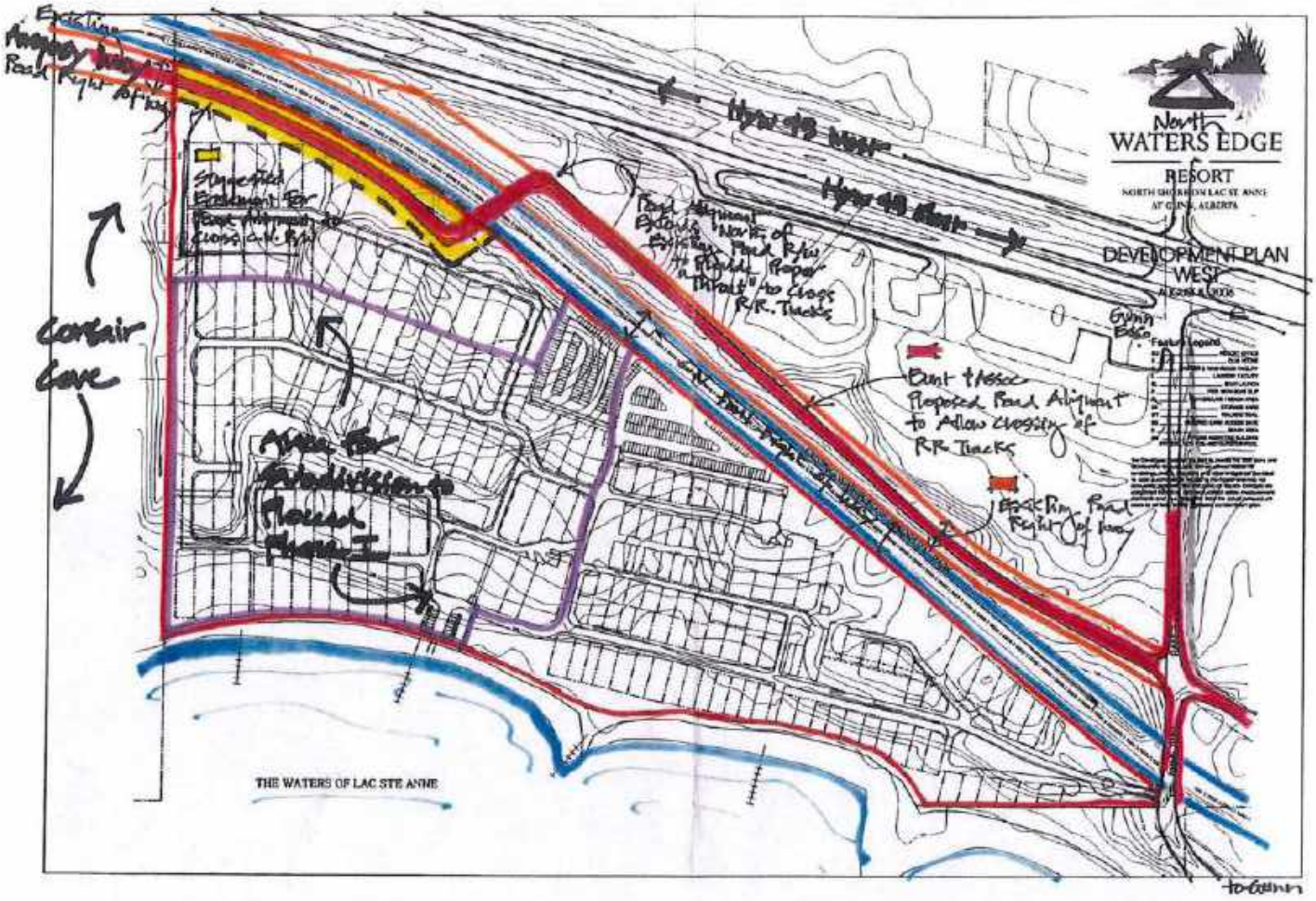
Level of Service "F"

7. FUTURE FREEWAY PLANNING

It is important to complete a review on the how the proposed development will be integrated into the future freeway system. Highway 43 is designated as a future freeway in Alberta. Access to this future freeway will only be made via a grade separation or interchange. Presently, Alberta Transportation's long range plan is too construct an interchange at the Highway 43 and Highway 33 junction. Since all other accesses to Highway 43 near this interchange will need to be closed, an alternate plan of access for all local roads needs to be considered. This includes the Range Road 32 intersection.

A schematic of this future access is shown below:

As part of this access plan, The Estates at Waters Edge development has provided right-of-way along its north boundary to allow for an east – west connection of traffic. See sketch below:



In summary, the proposed development has allowed a plan of access to accommodate the implementation of Highway 43 operating as a future freeway.

8. CONCLUSIONS & RECOMMENDATIONS

8.1 Conclusions & Recommendations

The proposed development is 135 lot single family dwelling residential development in the SE quarter section of Section 10, Township 55, Range 3, West of 5th Meridian, at Gunn, Alberta. It is anticipated that the development will generate 900 new trips per day. This assessment has determined that a "Major Road Intersection on Four-Lane Divided Highway" intersection treatment is warranted for the intersections of Highway 43:20 and Range Road 32. This treatment is warranted for Years 2014 to 2034.

The existing intersection treatment on Highway 43:20 and Range Road 32 partially meets the warranted intersection treatment. Presently, the east bound lanes only have approximately 25:1 tapers for deceleration and acceleration. The warranted standard requires 40:1 tapers with 100m lanes. This is offset partially by the presence of a service road intersection 400m west of the Range Road 32 intersection, where traffic can also make a right turn and access Range Road 32. The intersection also contains existing illumination. Signalization is not an option as Highway 43 is classified as a future freeway which disallows signalization. In the future, this intersection will be closed and the traffic re-directed to a future interchange located at the junction of Highway 43 and Highway 33. This development has provided service road/local road right-of-way on its north end to accommodate east west connectivity of traffic to this future interchange.

Completion of a Highway Capacity Analysis has revealed that the projected highway traffic volumes with the addition of the development traffic reach a Level of Service (LOS) of C in the next 10 – 16 years, and the existing intersection will have sufficient capacity for this proposed development. In approximately 16 – 20 years, the south leg of Range Road 32 (Ste Anne Trail) begins to fail due to a lack of right turn lane. Further analysis indicates that the addition of a 15m right turn lane on the south leg of Range Road 32 provides acceptable levels of operations past 20 years.

Presently, there are no improvements recommended. Since the capacity analysis has indicated that the intersection will operate within acceptable levels on Highway 43, it is recommended that longer right turn tapers and addition of lanes in the east bound lanes of Highway 43 provide no added benefit. In approximately 16 – 20 years, the intersection should be reviewed for the operation of the south leg of Range Road 32 in order to determine if the delay times are getting substantially long. If so, the addition of a right turn lane of approximately 15m on the south leg

could be considered. Since growth rates are projected using linear growth rates, there is a possibility that no improvements are required for the next 20 years.

8.2 Closure

We trust the information provided meets your present requirements. Should any questions arise, please contact our office at your convenience.

Darcy O. Paulichuk, P. Eng.

June 10, 2014
APEGGA Permit to Practice Number: P12132
D&A Paulichuk Consulting Ltd.

APPENDIX A

ALBERTA HIGHWAYS TRAFFIC VOLUME HISTORY
TRAFFIC DATA – TURNING MOVEMENT DIAGRAMS

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME HISTORY 2003 - 2012

Alberta Transportation
Planning Branch
Strategic and Network Planning

Produced: 18-Feb-2013 By CornerStone Solutions Inc.

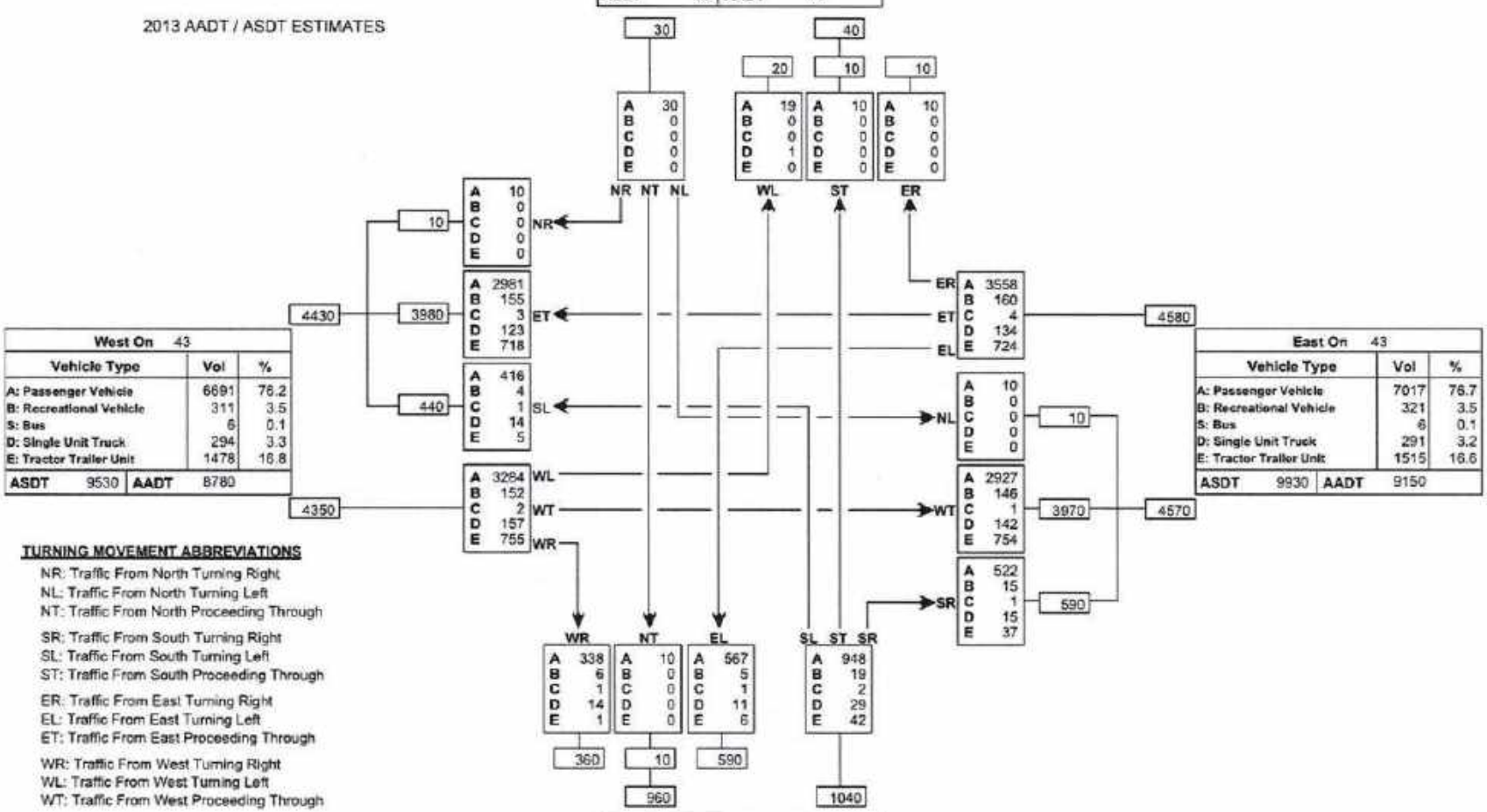
Hwy	CS	TCS	Muni	Location Description	2003 AADT	2004 AADT	2005 AADT	2006 AADT	2007 AADT	2008 AADT	2009 AADT	2010 AADT	2011 AADT	2012 AADT
43	16	10	LSAn	N OF 18 W OF GREEN COURT	6300	6710	7300	8030	8070	8010	7690	7890	8210	8540
43	16	12	LSAn	S OF 18 W OF GREEN COURT	5800	6200	6700	7500	7500	7420	7140	7340	7640	7900
43	16	14	LSAn	W OF 22 AT MAYERTHORPE	5710	6110	6590	7270	7270	7020	6780	6970	7280	7700
43	18	04	LSAn	E OF 22 AT MAYERTHORPE	5310	5680	6070	6570	6570	6760	6520	6700	6990	7510
43	18	04	LSAn	1.4 KM E OF 22 & 43 MAYERTHORPE	5390	5810				6740	6490	6740	7070	7470
43	18	04	LSAn	W OF RGE RD 80 (ROCHFORT BRIDGE ACC) 12-57-8-50000087				6440	6480	6600	6380	6630	6880	7380
43	18	04	LSAn	E OF RGE RD 80 (ROCHFORT BRIDGE ACC) 12-57-8-50000087				6420	6460	6560	6340	6590	6780	7280
43	18	04	LSAn	W OF RGE RD 75 8-57-7-515401150	5020	5370	5840	6420	6480	6580	6360	6610	6730	7230
43	18	04	LSAn	E OF RGE RD 75 8-57-7-515401150	5000	5350	5820	6400	6460	6560	6340	6560	6680	7180
43	18	04	LSAn	W OF 757 AT SANGUDO WJ	5300	5680	5980	6580	6640	6700	6460	6640	6840	7350
43	18	08	LSAn	E OF 757 AT SANGUDO WJ	5600	6000	6380	7010	7090	7030	6780	6860	7100	7590
43	18	08	LSAn	W OF 757 E OF SANGUDO EJ	5030	5410	5780	6770	6830	6770	6570	6860	7100	7590
43	18	12	LSAn	E OF 757 E OF SANGUDO EJ	4930	5310	5680	6320	6420	6360	6160	6420	6690	7160
43	18	12	LSAn	W OF LISBURN RD 23-56-6-512900785	4770	5130	5470	6080	6210	6150	6030	6270	6510	6950
43	18	12	LSAn	E OF LISBURN RD 23-56-6-512900785	4770	5130	5470	6080	6210	6150	5970	6210	6450	6890
43	18	12	LSAn	W OF 764 AT CHERHILL	4790	5150	5500	6130	6260	6200	6020	6260	6500	6950
43	20	04	LSAn	E OF 764 AT CHERHILL	5020	5400	5780	6290	6420	6360	6180	6420	6620	7100
43	20	04	LSAn	W OF 765 SE OF CHERHILL	4950	5330	5710	6210	6330	6270	6090	6340	6760	7230
43	20	08	LSAn	E OF 765 SE OF CHERHILL	4860	5220	5580	6100	6220	6160	5980	6220	6700	7160
43	20	08	LSAn	W OF RGE RD 42A NIKOODI RD 34-55-4-507251230						6480	6280	6540	6820	7300
43	20	08	LSAn	E OF RGE RD 42A NIKOODI RD 34-55-4-507251230						6600	6400	6660	6940	7440
43	20	08	LSAn	7.2 KM W OF 33 & 43 GUNN	5290	5670	5940	6600	6670	6620	6410	6750	7070	7450
43	20	08	LSAn	W OF GUNN CORNER ESSO 10-55-3-500001200	5980	6430	6730	7430	7590	7530	7310	7750	8100	8650
43	20	08	LSAn	E OF GUNN CORNER ESSO 10-55-3-500001200	6350	6830	7080	7800	7960	7900	7680	8080	8440	9020
43	20	08	LSAn	W OF 33 NE OF GUNN	6360	6840	7090	7810	7970	7910	7690	8080	8440	9020
43	22	04	LSAn	E OF 33 NE OF GUNN	7670	8170	8550	9370	9550	9470	9210	9440	9810	10480
43	22	04	LSAn	W OF 37 NW OF ONOWAY	8330	8630	9220	9950	10170	10010	9830	10050	10080	10600
43	22	08	LSAn	E OF 37 NW OF ONOWAY	7350	7590	8080	8710	8890	8800	8660	8740	8720	9200
43	22	08	LSAn	N OF ONOWAY NORTH ACC 33-54-2-500000805	7340	7580	8070	8690	8870	8780	8660	8740	8720	9200
43	22	08	LSAn	S OF ONOWAY NORTH ACC 33-54-2-500000805	7660	7920	8340	8980	9220	9020	9030	8990	8970	9440
43	22	08	LSAn	N OF ONOWAY SOUTH ACC 28-54-2-500000000	7660	7920	8340	8980	9220	9020	9030	8990	8970	9440
43	22	08	LSAn	S OF ONOWAY SOUTH ACC 28-54-2-500000000	8630	8910	9140	9850	10320	10020	10000	10320	10300	10790
43	22	08	LSAn	N OF 633 E OF ALBERTA BEACH	8470	8740	8980	9680	10240	9930	9890	10120	10100	10600
43	22	12	LSAn	S OF 633 E OF ALBERTA BEACH	9600	9910	10230	11030	11770	11320	11280	11530	11510	12050
43	22	12	LSAn	0.8 KM N OF 16 & 43 CARVEL CORNER	9900	10180	10450	11410	12010	11920	11860	12210	12220	12670
43	22	12	LSAn	N OF 16 AT MANLY CORNER	9800	10120	10450	11270	12030	11930	11880	12160	12140	12710
43 X	03	04	CoGP	W OF 116 ST, GRANDE PRAIRIE 16-72-6-600000000									940	940
43 X	03	04	CoGP	E OF 116 ST, GRANDE PRAIRIE 16-72-6-600000000									3240	3300
43 X	03	04	GrPr	W OF 2 & 43 N OF GRANDE PR	740	980	1140	1230	1340	1140	1240	1300	3240	3300
44	00	04	Park	N OF 16 W OF EDMONTON	6400	6670	7230	8470	9210	8110	8050	8530	8660	8240

Turning Movement Summary Diagram

Reference No.: 66548

Intersection of:
43 & GUNN CORNER ESSO 10-55-3-500001200

2013 AADT / ASDT ESTIMATES



TURNING MOVEMENT ABBREVIATIONS

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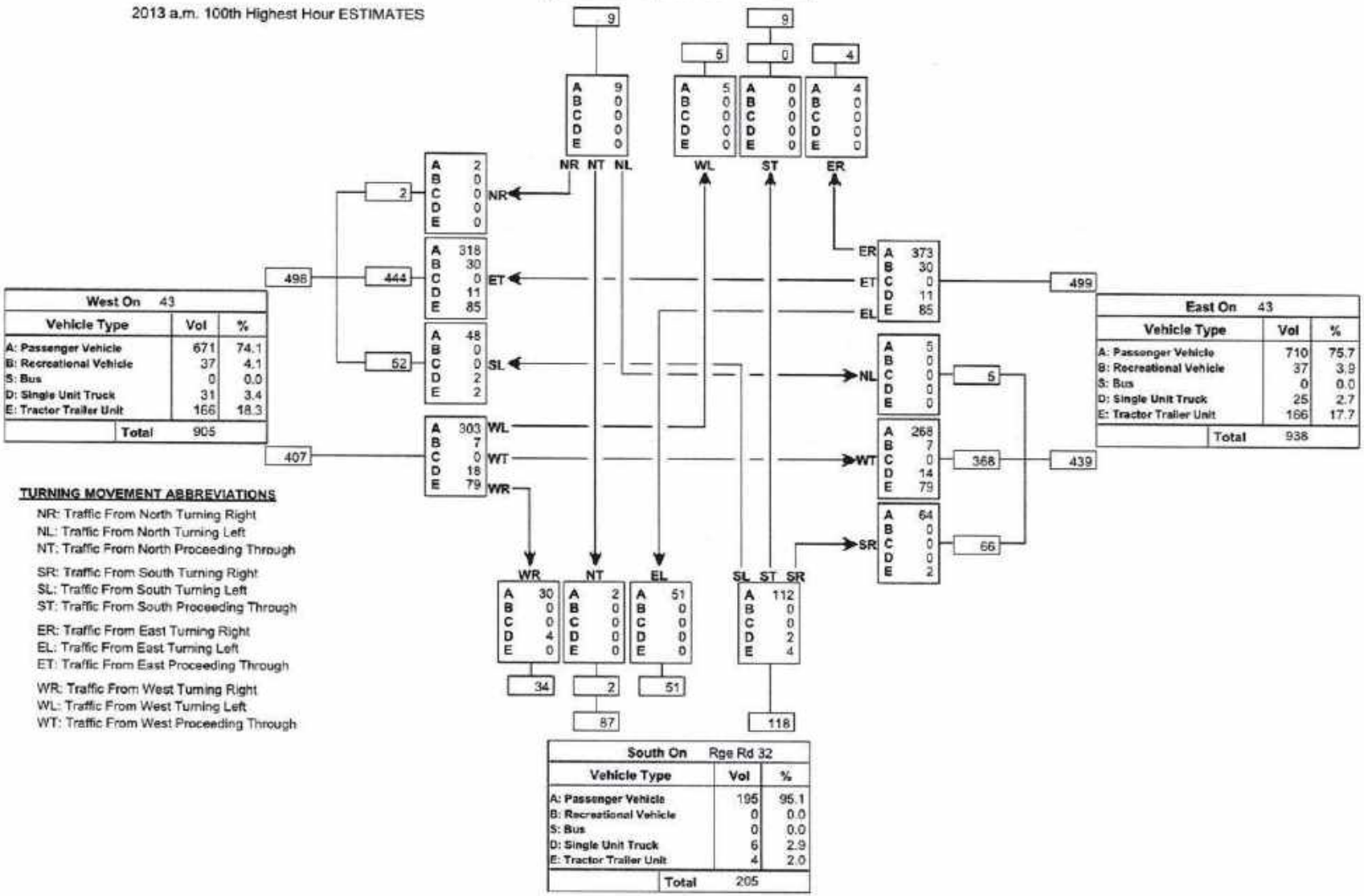
Turning Movement Summary Diagram

Reference No.: 66548

Intersection of:
43 & GUNN CORNER ESSO 10-55-3-500001200

2013 a.m. 100th Highest Hour ESTIMATES



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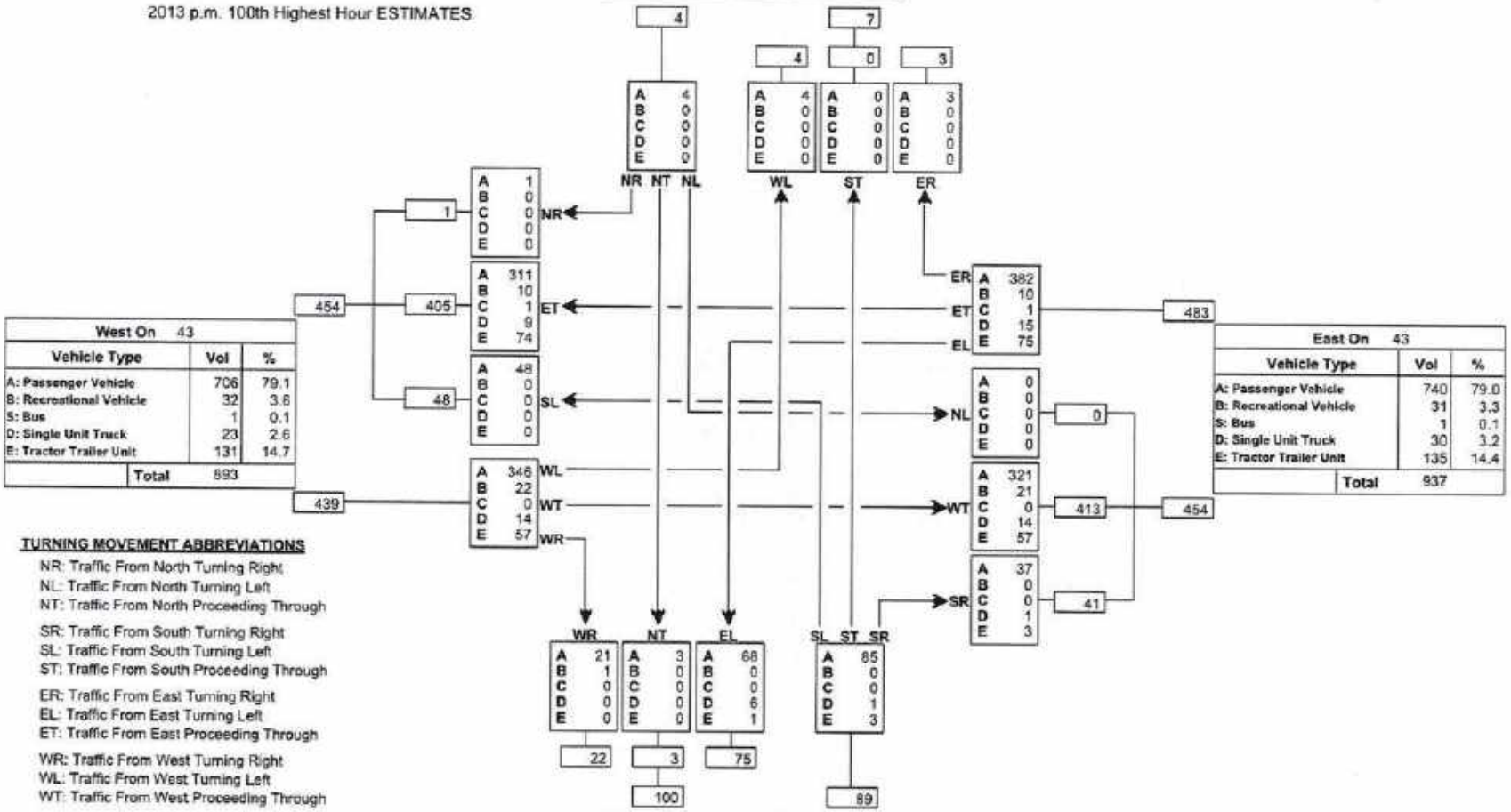
Turning Movement Summary Diagram

Reference No.: 66548

Intersection of:
43 & GUNN CORNER ESSO 10-55-3-500001200

2013 p.m. 100th Highest Hour ESTIMATES

North On Rge Rd 32		
Vehicle Type	Vol	%
A: Passenger Vehicle	11	100.0
B: Recreational Vehicle	0	0.0
S: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	11	



West On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	706	79.1
B: Recreational Vehicle	32	3.6
S: Bus	1	0.1
D: Single Unit Truck	23	2.6
E: Tractor Trailer Unit	131	14.7
Total	893	

East On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	740	79.0
B: Recreational Vehicle	31	3.3
S: Bus	1	0.1
D: Single Unit Truck	30	3.2
E: Tractor Trailer Unit	135	14.4
Total	937	

South On Rge Rd 32		
Vehicle Type	Vol	%
A: Passenger Vehicle	177	93.7
B: Recreational Vehicle	1	0.5
S: Bus	0	0.0
D: Single Unit Truck	7	3.7
E: Tractor Trailer Unit	4	2.1
Total	189	

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

APPENDIX B

TRAFFIC VOLUME HISTORY & GROWTH RATES
2013 – 2034 TURNING MOVEMENT DIAGRAMS
MAJOR ROAD INTERSECTION FOUR-LANE DIVIDED HIGHWAY
INTERSECTION TREATMENT

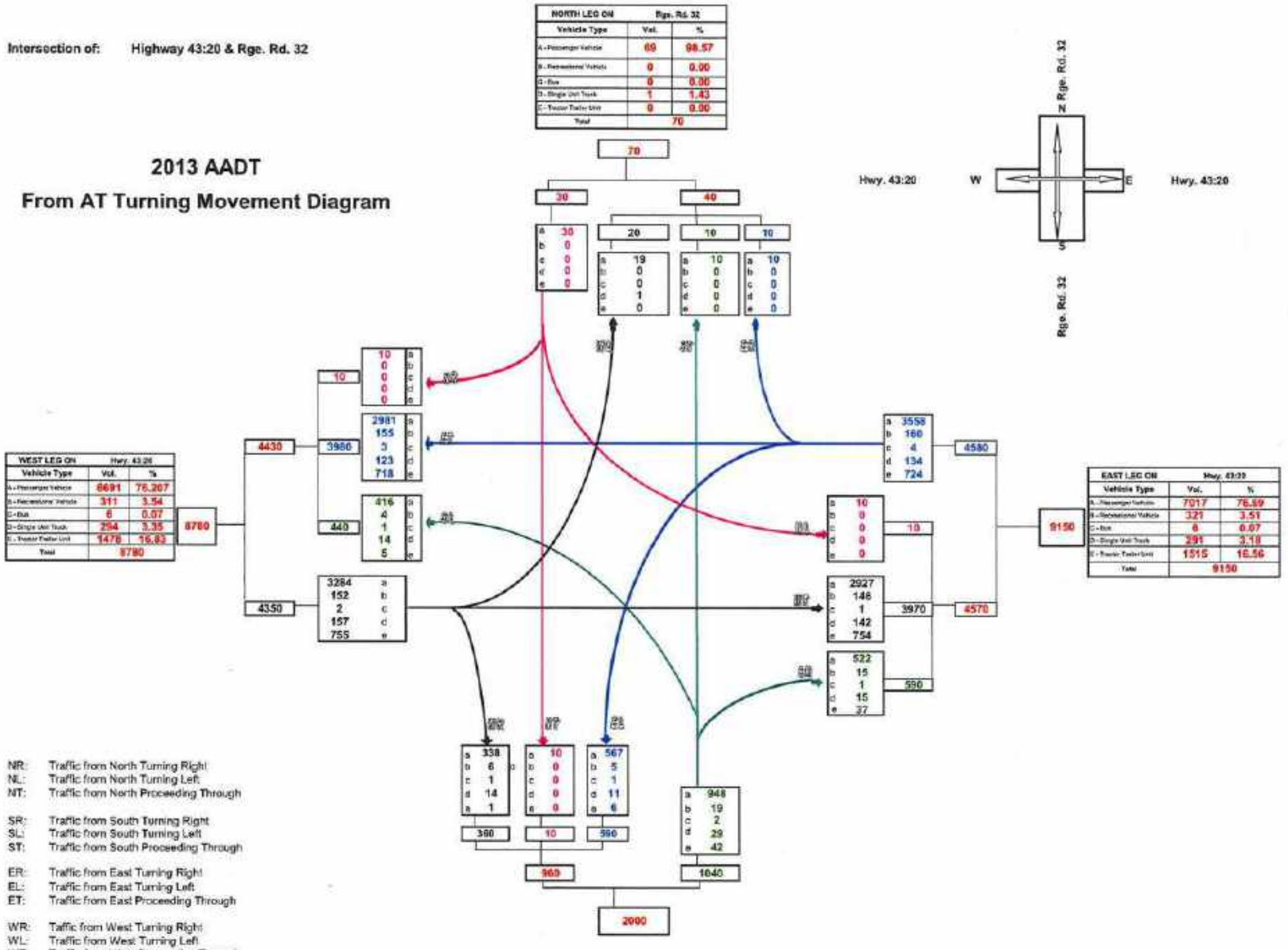
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

Intersection of: Highway 43:20 & Rge. Rd. 32

2013 AADT

From AT Turning Movement Diagram



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TURNING MOVEMENT ABBREVIATIONS

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

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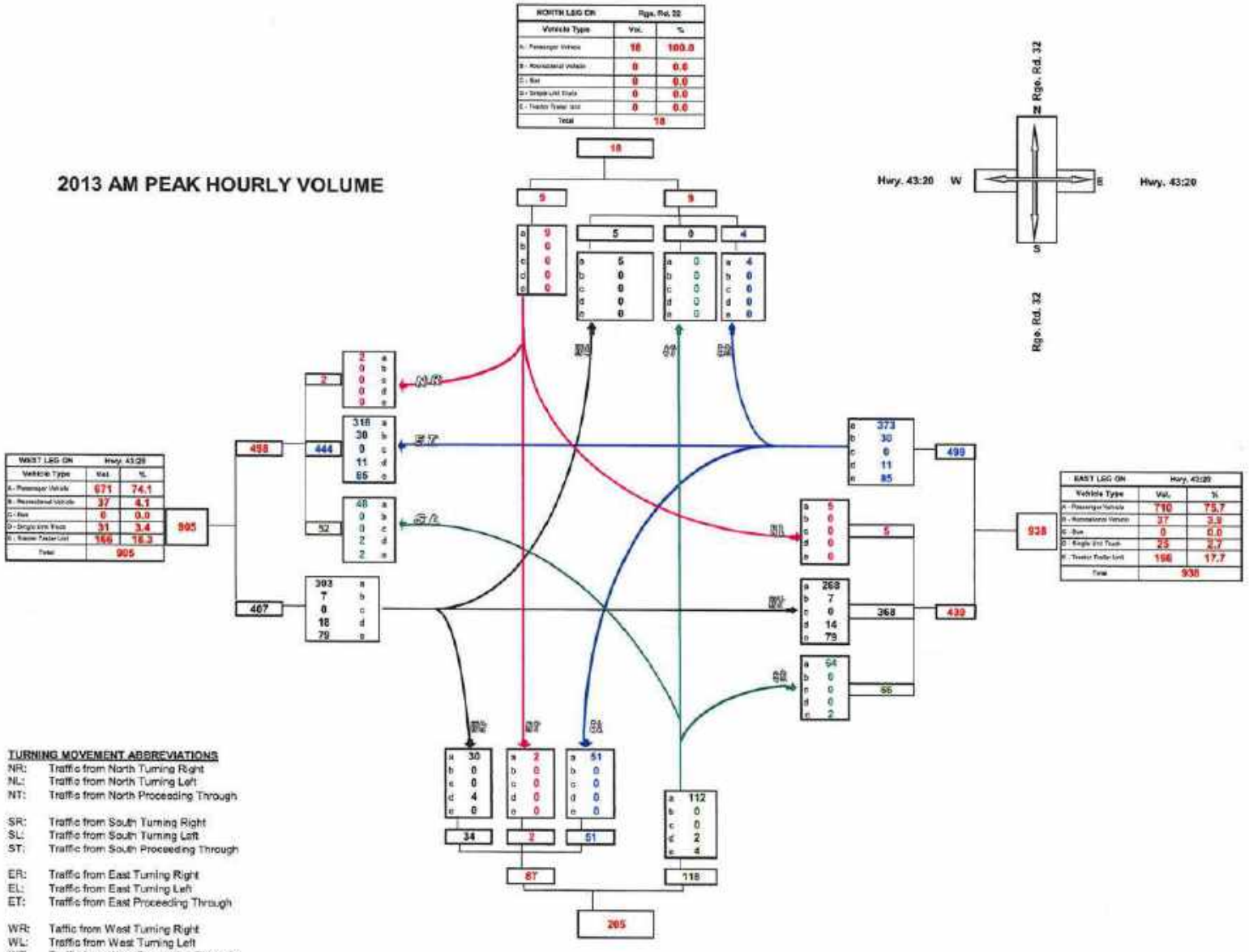
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

AADT Conversion Factor
1

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2013 AM PEAK HOURLY VOLUME



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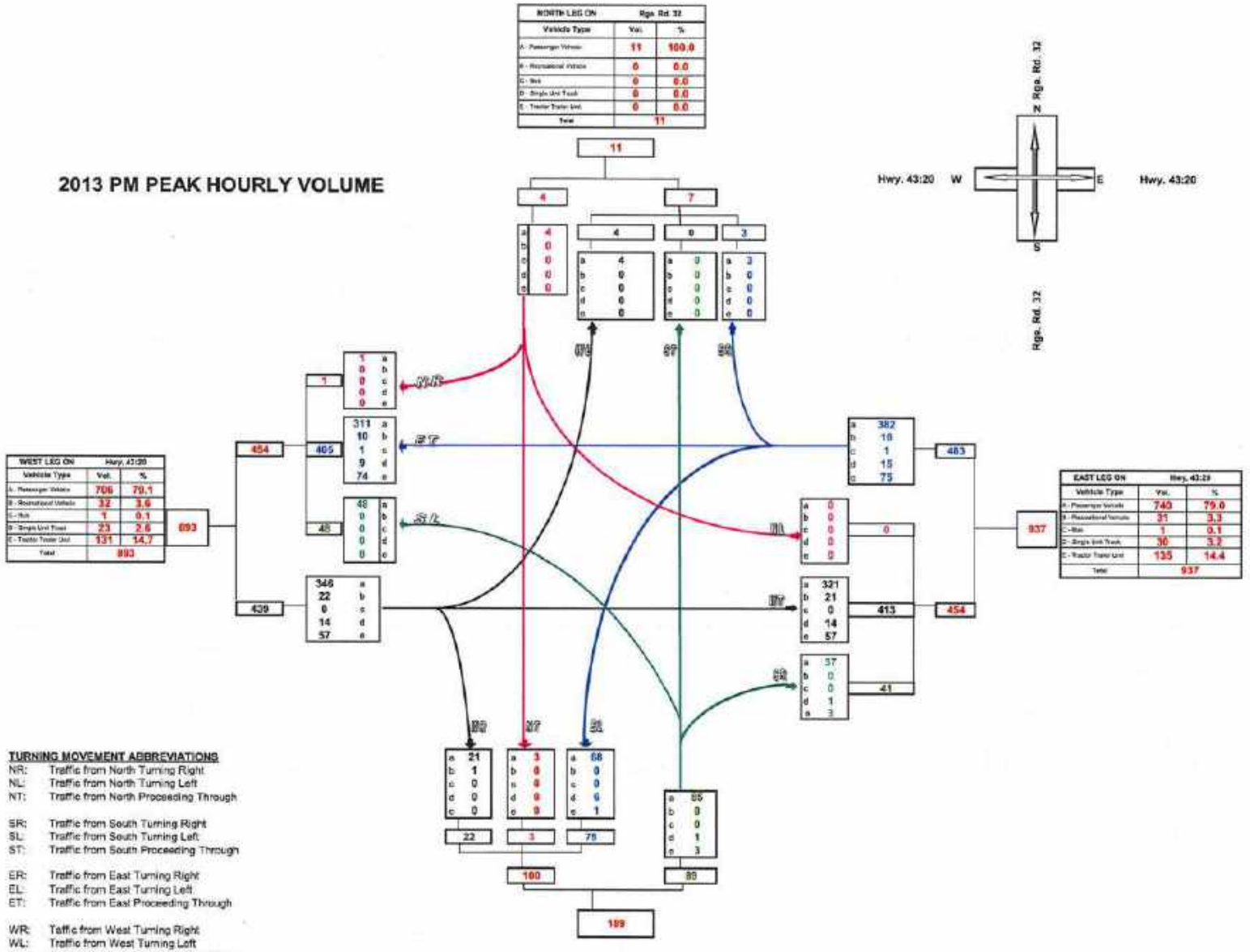
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2013 PM PEAK HOURLY VOLUME



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AM Peak	0.11825
PM Peak	0.10625

D&A PAULICHUK CONSULTING LTD.

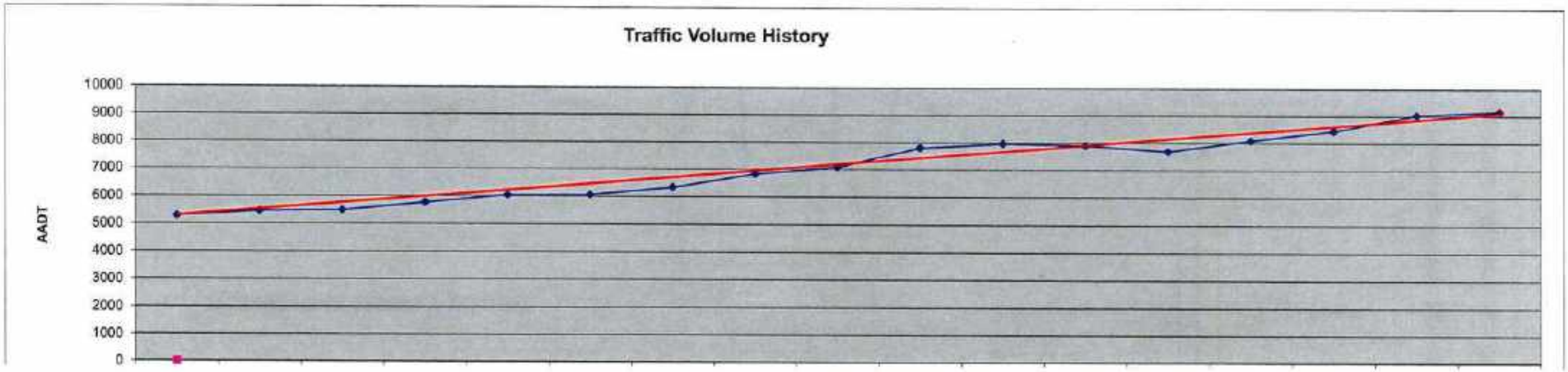
TRAFFIC VOLUME HISTORY & GROWTH RATES

Highway: Hwy. 43:20
RR 32

TRAFFIC VOLUME HISTORY

Location	AADT 1997	AADT 1998	AADT 1999	AADT 2000	AADT 2001	AADT 2002	AADT 2003	AADT 2004	AADT 2005	AADT 2006	AADT 2007	AADT 2008	AADT 2009	AADT 2010	AADT 2011	AADT 2012	AADT 2013	Growth Rate
Hwy. 43:20, E. of Gunn Corner Esso	5280	5450	5490	5770	6050	6070	6350	6830	7080	7800	7960	7900	7690	8080	8440	9020	9150	4.58%
Rge Rd. 32								Assuming same growth rate as Hwy. 43							**Use Growth Rate:**			2.50%
Hwy. 43:20															**Use Growth Rate:**			4.58%

Note: Data obtained from Alberta Transportation at http://www.transportation.alberta.ca/2639.htm



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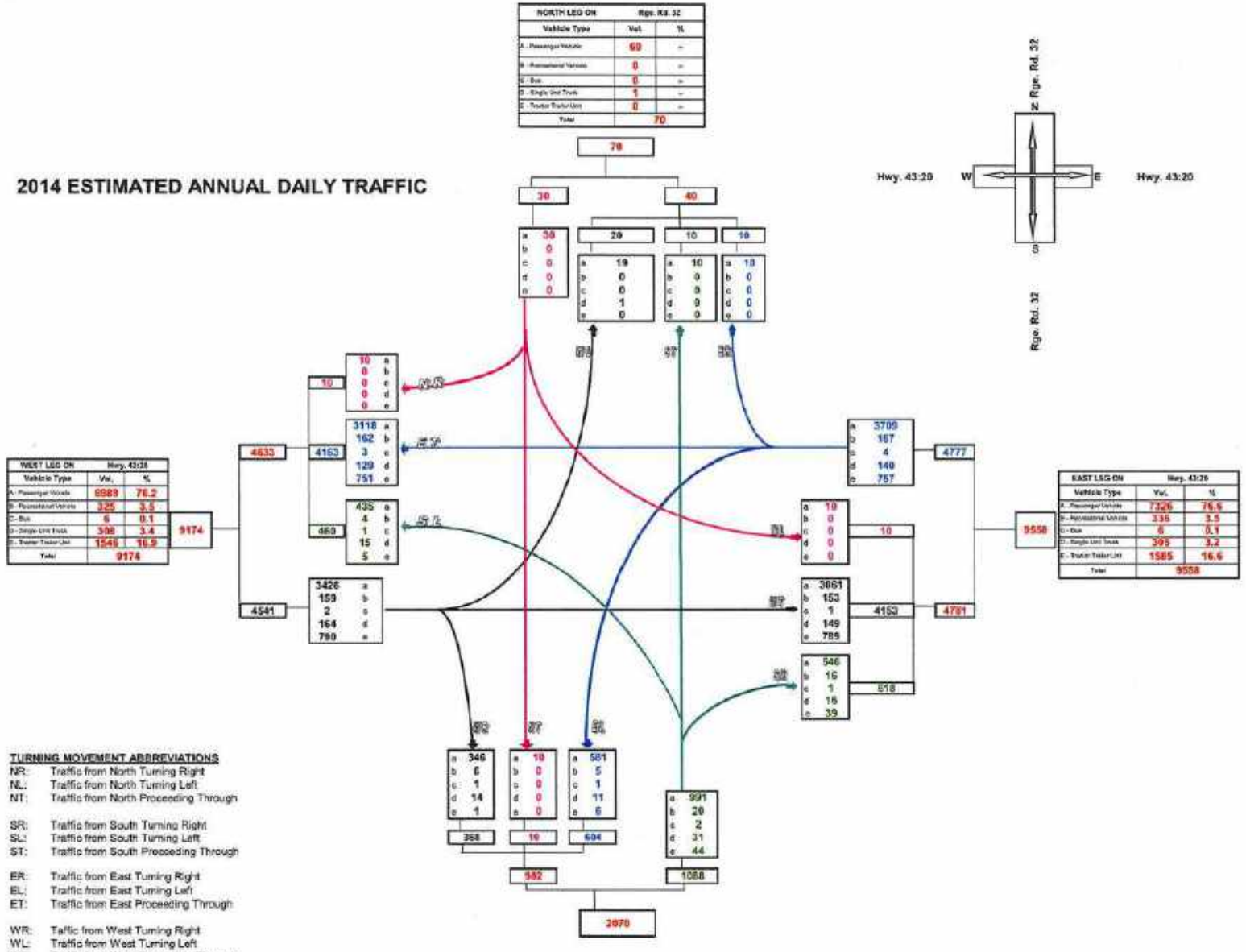
Turning Movement Summary Diagram

2014 ESTIMATED ANNUAL DAILY TRAFFIC



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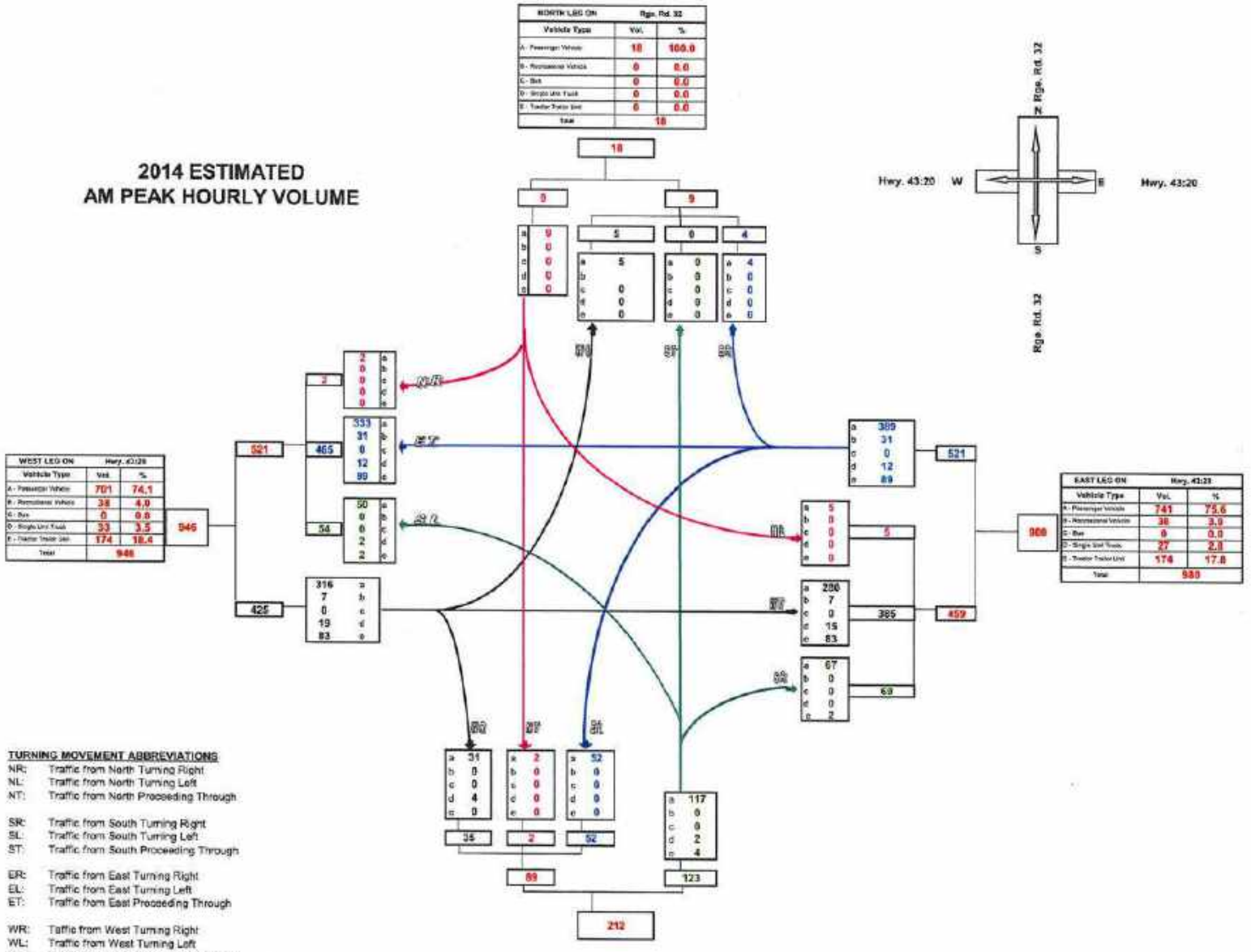
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2014 ESTIMATED AM PEAK HOURLY VOLUME



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2014
2014
1

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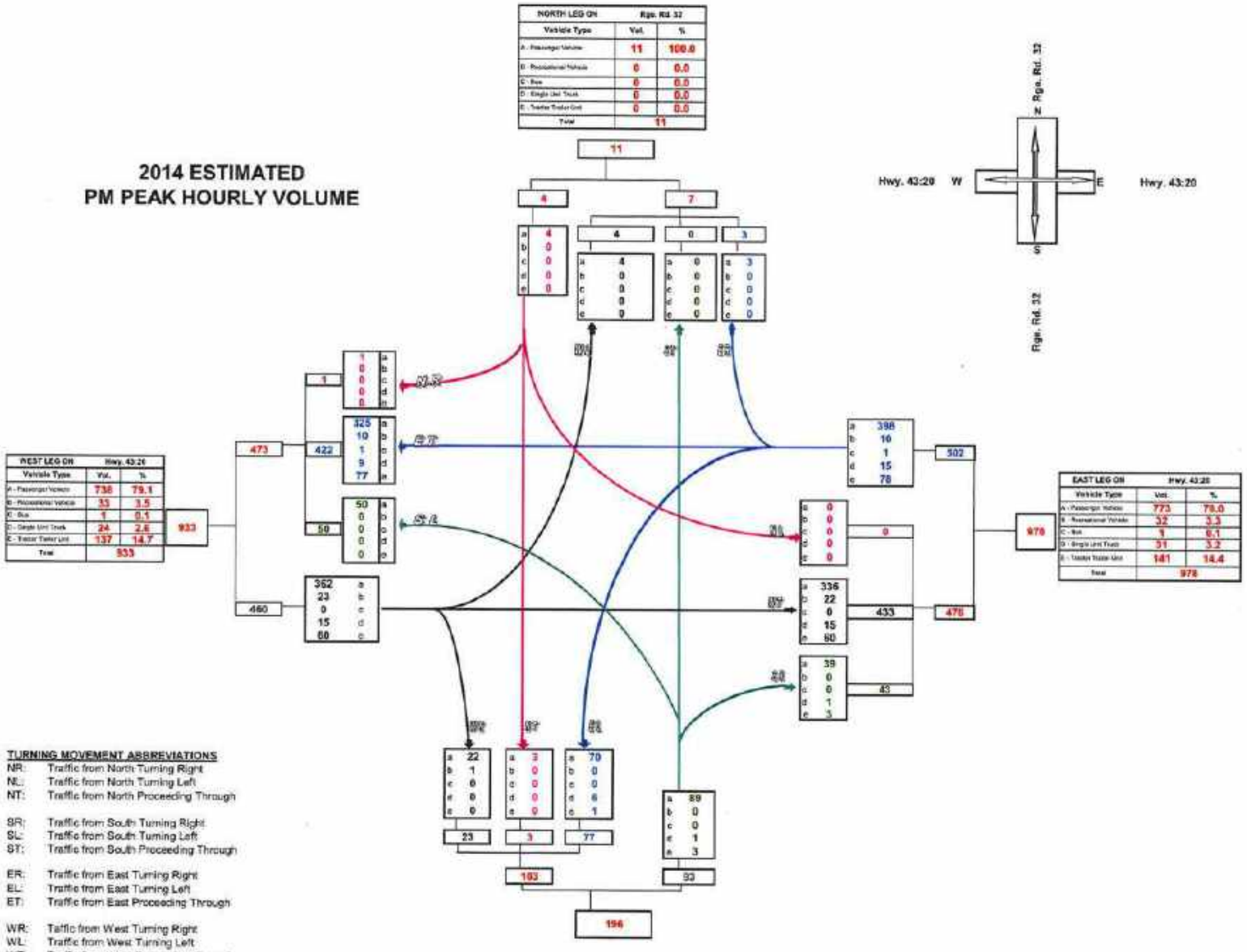
Turning Movement Summary Diagram

2014 ESTIMATED PM PEAK HOURLY VOLUME



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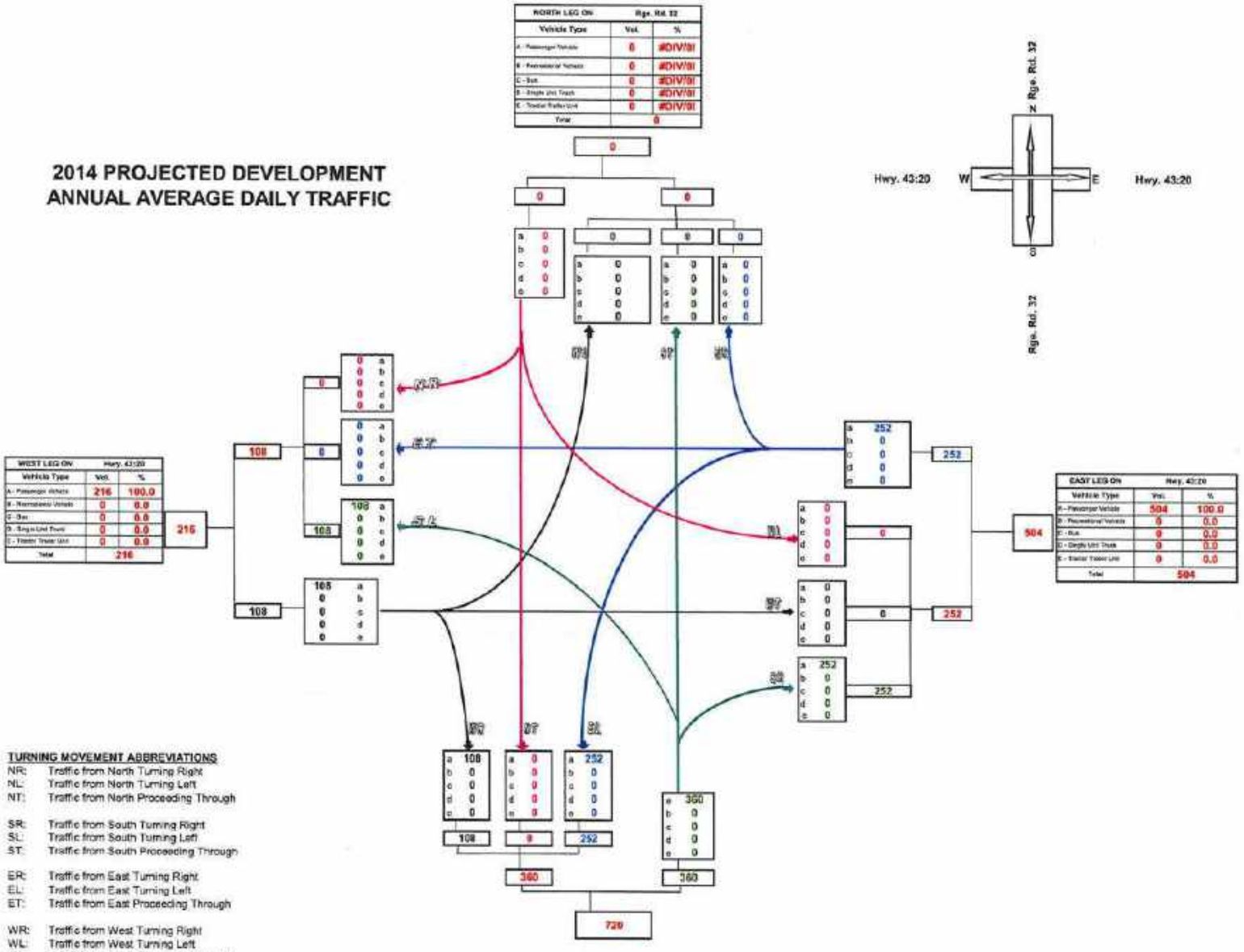
2014
2013
1

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2014 PROJECTED DEVELOPMENT
ANNUAL AVERAGE DAILY TRAFFIC



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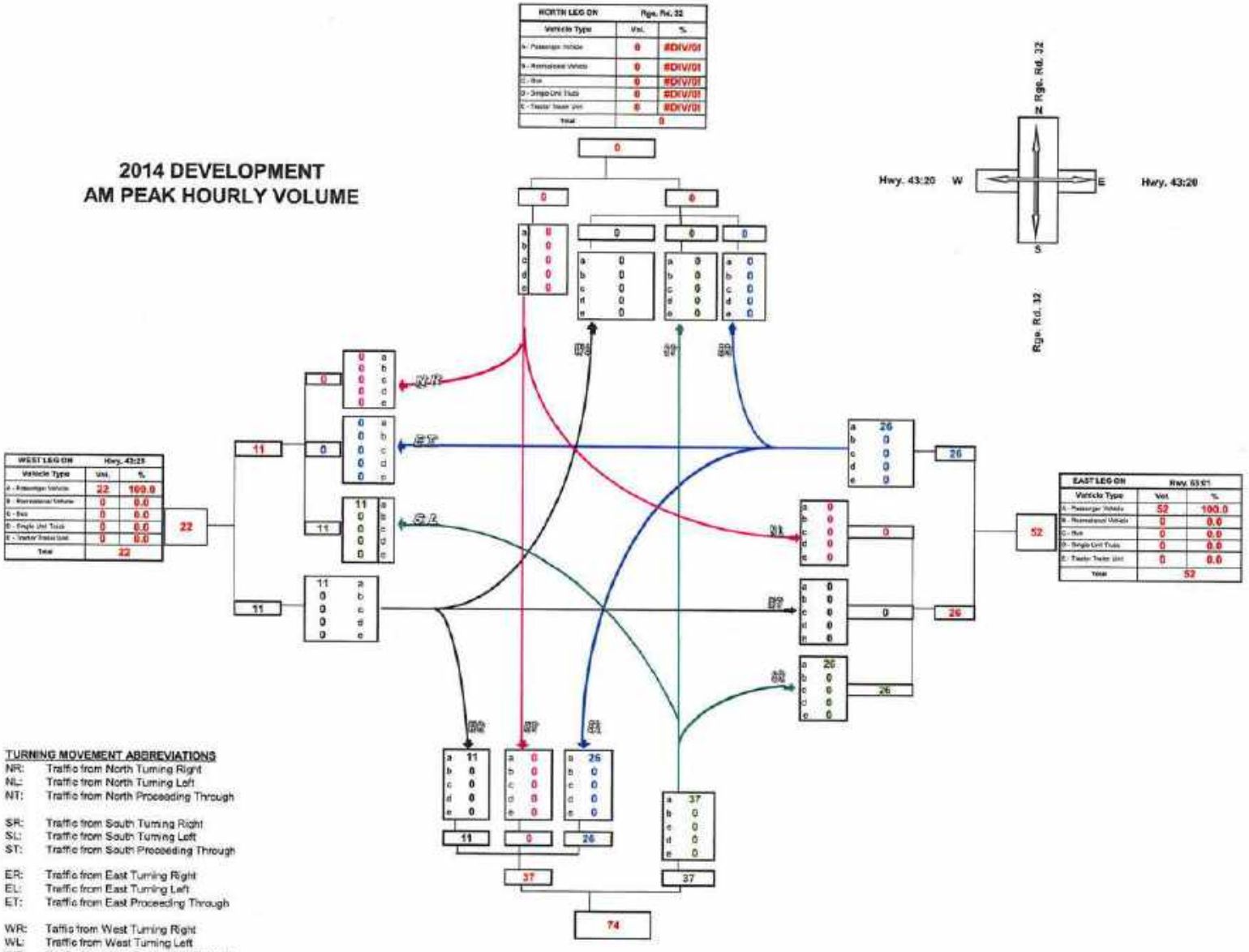
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2014 DEVELOPMENT
AM PEAK HOURLY VOLUME



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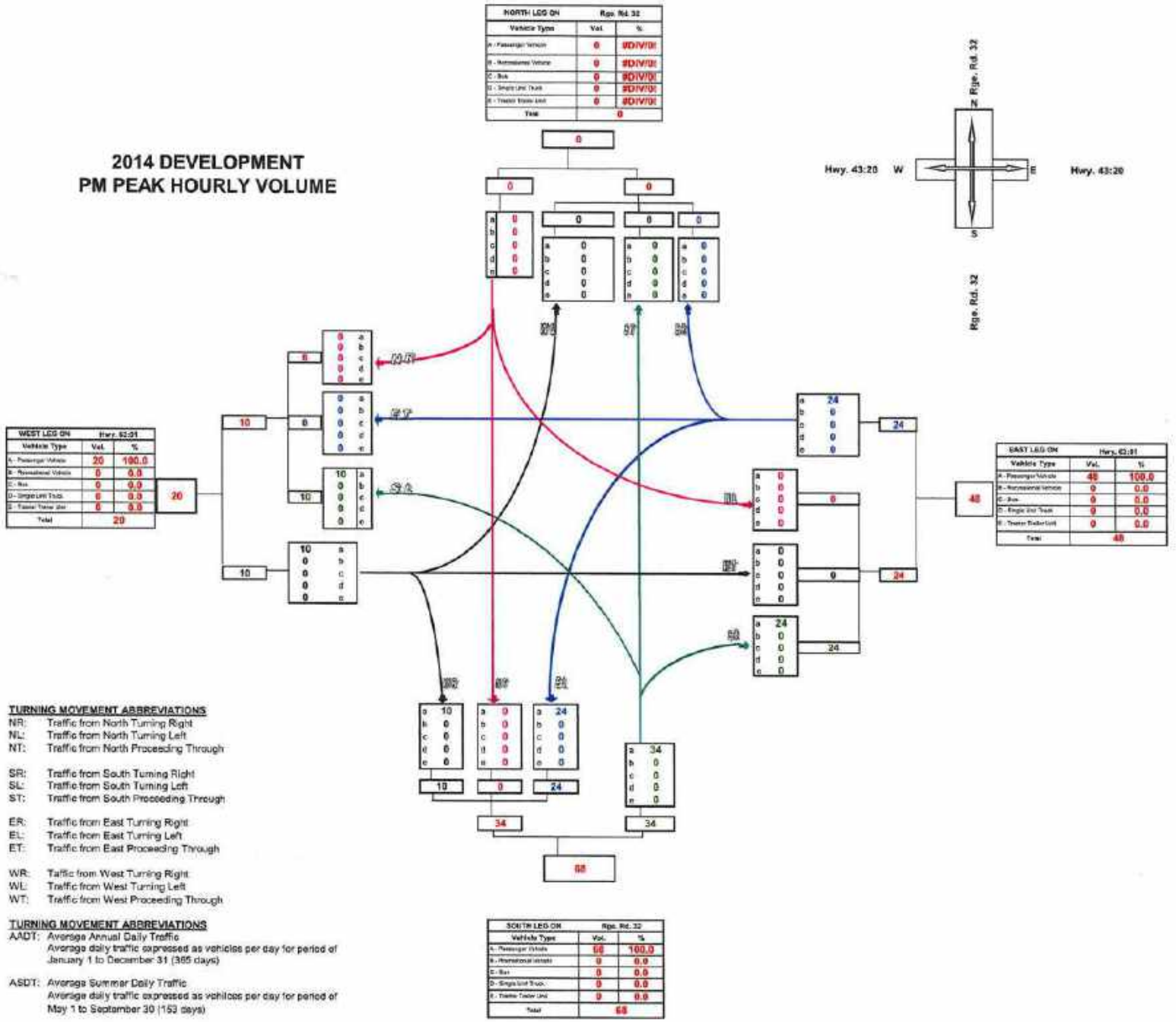
Turning Movement Summary Diagram

2014 DEVELOPMENT
PM PEAK HOURLY VOLUME



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HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	554	54	91	668	5	89	0	125	8	3	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	602	59	99	726	5	97	0	136	9	3	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	732			661			1210	1574	330	1309	1601	366
vC1, stage 1 conf vol							645	645		927	927	
vC2, stage 2 conf vol							566	929		382	674	
vCu, unblocked vol	732			661			1210	1574	330	1309	1601	366
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			88			71	100	79	96	99	99
cM capacity (veh/h)	760			812			333	272	657	239	265	634

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	308	360	99	484	247	233	15
Volume Left	7	0	99	0	0	97	9
Volume Right	0	59	0	0	5	136	3
cSH	760	1700	812	1700	1700	801	282
Volume to Capacity	0.01	0.21	0.12	0.28	0.15	0.29	0.05
Queue Length 95th (m)	0.2	0.0	3.3	0.0	0.0	9.7	1.4
Control Delay (s)	0.3	0.0	10.0	0.0	0.0	15.3	18.5
Lane LOS	A		B			C	C
Approach Delay (s)	0.1		1.2			15.3	18.5
Approach LOS						C	C

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	66.6%	ICU Level of Service	C	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	722	63	104	872	6	113	0	156	10	3	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	785	68	113	948	7	123	0	170	11	3	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	954			853			1542	2017	427	1757	2048	477
vC1, stage 1 conf vol							836	836		1177	1177	
vC2, stage 2 conf vol							706	1180		579	871	
vCu, unblocked vol	954			853			1542	2017	427	1757	2048	477
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			83			50	100	70	93	98	99
cM capacity (veh/h)	615			677			248	193	568	147	186	537

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	401	461	113	632	322	292	18
Volume Left	9	0	113	0	0	123	11
Volume Right	0	68	0	0	7	170	4
cSH	615	1700	677	1700	1700	368	186
Volume to Capacity	0.01	0.27	0.17	0.37	0.19	0.79	0.10
Queue Length 95th (m)	0.3	0.0	4.8	0.0	0.0	54.1	2.6
Control Delay (s)	0.4	0.0	11.4	0.0	0.0	43.6	26.5
Lane LOS	A		B			E	D
Approach Delay (s)	0.2		1.2			43.6	26.5
Approach LOS						E	D

Intersection Summary				
Average Delay	6.6			
Intersection Capacity Utilization	89.3%	ICU Level of Service	E	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	554	54	91	668	5	89	0	125	8	3	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	602	59	99	726	5	97	0	136	9	3	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	732			661			1210	1574	330	1377	1601	366
vC1, stage 1 conf vol							645	645		927	927	
vC2, stage 2 conf vol							566	929		450	674	
vCu, unblocked vol	732			661			1210	1574	330	1377	1601	366
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			88			71	100	79	96	99	99
cM capacity (veh/h)	760			812			333	272	657	231	265	634

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	308	360	99	484	247	233	15
Volume Left	7	0	99	0	0	97	9
Volume Right	0	59	0	0	5	136	3
cSH	760	1700	812	1700	1700	468	276
Volume to Capacity	0.01	0.21	0.12	0.28	0.15	0.50	0.06
Queue Length 95th (m)	0.2	0.0	3.3	0.0	0.0	21.7	1.4
Control Delay (s)	0.3	0.0	10.0	0.0	0.0	20.1	18.8
Lane LOS	A		B			C	C
Approach Delay (s)	0.1		1.2			20.1	18.8
Approach LOS						C	C

Intersection Summary				
Average Delay	3.5			
Intersection Capacity Utilization	71.9%	ICU Level of Service	C	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	470	51	85	585	5	78	0	111	6	2	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	511	55	92	636	5	85	0	121	7	2	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	641			566			1059	1378	283	1212	1403	321
vC1, stage 1 conf vol							552	552		823	823	
vC2, stage 2 conf vol							507	826		389	579	
vCu, unblocked vol	641			566			1059	1378	283	1212	1403	321
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			90			78	100	83	98	99	100
cM capacity (veh/h)	827			887			381	313	705	277	307	678

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	262	311	92	424	217	205	12
Volume Left	7	0	92	0	0	85	7
Volume Right	0	55	0	0	5	121	3
cSH	827	1700	887	1700	1700	522	337
Volume to Capacity	0.01	0.18	0.10	0.25	0.13	0.39	0.04
Queue Length 95th (m)	0.2	0.0	2.8	0.0	0.0	14.9	0.9
Control Delay (s)	0.3	0.0	9.5	0.0	0.0	16.3	16.1
Lane LOS	A		A			C	C
Approach Delay (s)	0.1		1.2			16.3	16.1
Approach LOS						C	C

Intersection Summary				
Average Delay	3.0			
Intersection Capacity Utilization	64.3%	ICU Level of Service	C	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	385	46	78	465	4	65	0	95	5	2	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	418	50	85	505	4	71	0	103	5	2	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	510			468			880	1134	234	1001	1157	255
vC1, stage 1 conf vol							454	454		677	677	
vC2, stage 2 conf vol							426	679		323	479	
vCu, unblocked vol	510			468			880	1134	234	1001	1157	255
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			91			84	100	86	98	99	100
cM capacity (veh/h)	936			972			446	375	758	347	369	747

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	215	259	85	337	173	174	10
Volume Left	5	0	85	0	0	71	5
Volume Right	0	50	0	0	4	103	2
cSH	936	1700	972	1700	1700	590	400
Volume to Capacity	0.01	0.15	0.09	0.20	0.10	0.29	0.02
Queue Length 95th (m)	0.1	0.0	2.3	0.0	0.0	9.8	0.6
Control Delay (s)	0.3	0.0	9.1	0.0	0.0	13.6	14.2
Lane LOS	A		A			B	B
Approach Delay (s)	0.1		1.3			13.6	14.2
Approach LOS						B	B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

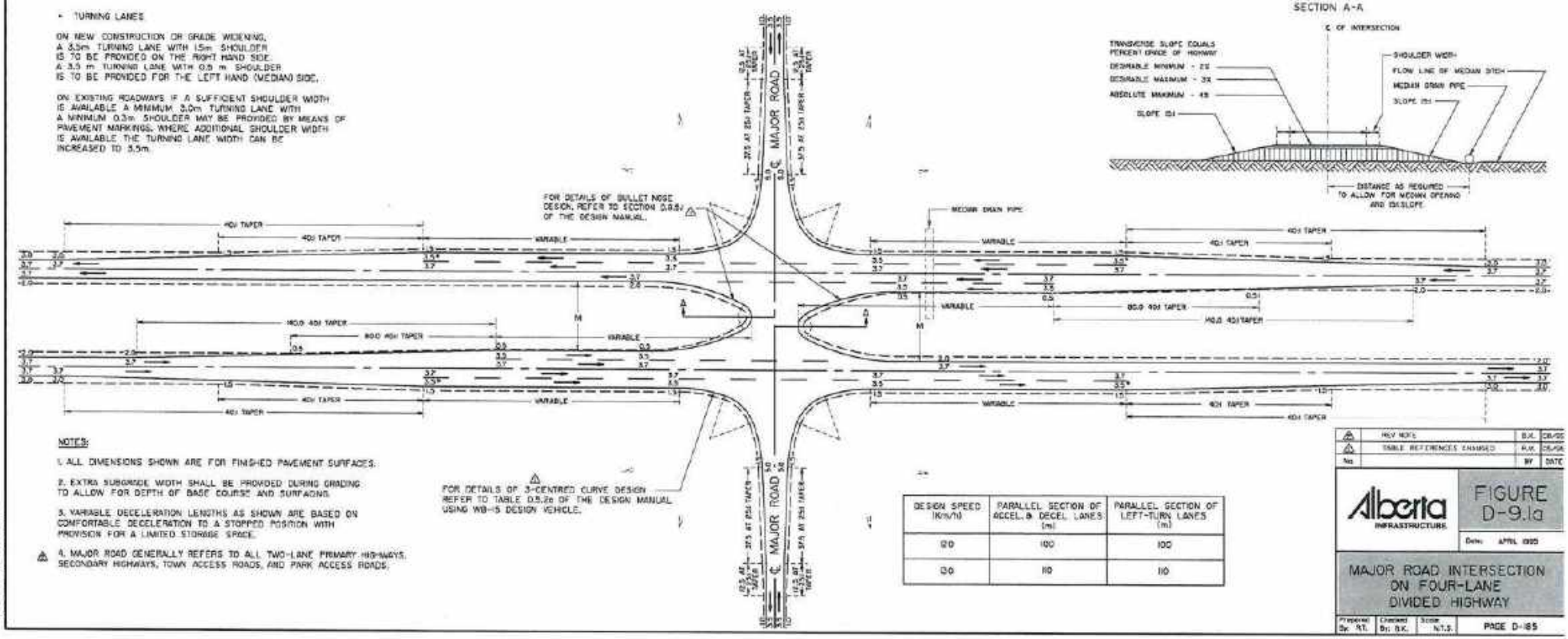
SYNCHRO ANALYSIS

- TURNING LANES

ON NEW CONSTRUCTION OR GRADE WIDENING,
A 3.5m TURNING LANE WITH 1.5m SHOULDER
IS TO BE PROVIDED ON THE RIGHT HAND SIDE.
A 3.5 m TURNING LANE WITH 0.5 m SHOULDER
IS TO BE PROVIDED FOR THE LEFT HAND (MEDIAN) SIDE.

ON EXISTING ROADWAYS IF A SUFFICIENT SHOULDER WIDTH IS AVAILABLE A MINIMUM 3.0m TURNING LANE WITH A MINIMUM 0.3m SHOULDER MAY BE PROVIDED BY MEANS OF PAVEMENT MARKINGS. WHERE ADDITIONAL SHOULDER WIDTH IS AVAILABLE THE TURNING LANE WIDTH CAN BE INCREASED TO 3.5m.

SECTION A-A



FOR DETAILS OF BULLET NOSE DESIGN, REFER TO SECTION D.9.5.1 OF THE DESIGN MANUAL.

FOR DETAILS OF 3-CENTRED CURVE DESIGN REFER TO TABLE D.5.2e OF THE DESIGN MANUAL USING WB-15 DESIGN VEHICLE.

NOTES:

1. ALL DIMENSIONS SHOWN ARE FOR FINISHED PAVEMENT SURFACES.

2. EXTRA SUBGRADE WIDTH SHALL BE PROVIDED DURING GRADING TO ALLOW FOR DEPTH OF BASE COURSE AND SURFACING.

3. VARIABLE DECELERATION LENGTHS AS SHOWN ARE BASED ON COMFORTABLE DECELERATION TO A STOPPED POSITION WITH PROVISION FOR A LIMITED STORAGE SPACE.

4. MAJOR ROAD GENERALLY REFERS TO ALL TWO-LANE PRIMARY HIGHWAYS, SECONDARY HIGHWAYS, TOWN ACCESS ROADS, AND PARK ACCESS ROADS.

DESIGN SPEED (km/h)	PARALLEL SECTION OF ACCEL. & DECEL. LANES (m)	PARALLEL SECTION OF LEFT-TURN LANES (m)
90	100	100
80	80	80

No.		BY	DATE
2	HEV NOTE	B.K.	08/05
1	TABLE REFERENCES CHANGED	B.K.	05/04

Alberta INFRASTRUCTURE

FIGURE D-9.1a

Date: APRIL 1995

MAJOR ROAD INTERSECTION ON FOUR-LANE DIVIDED HIGHWAY

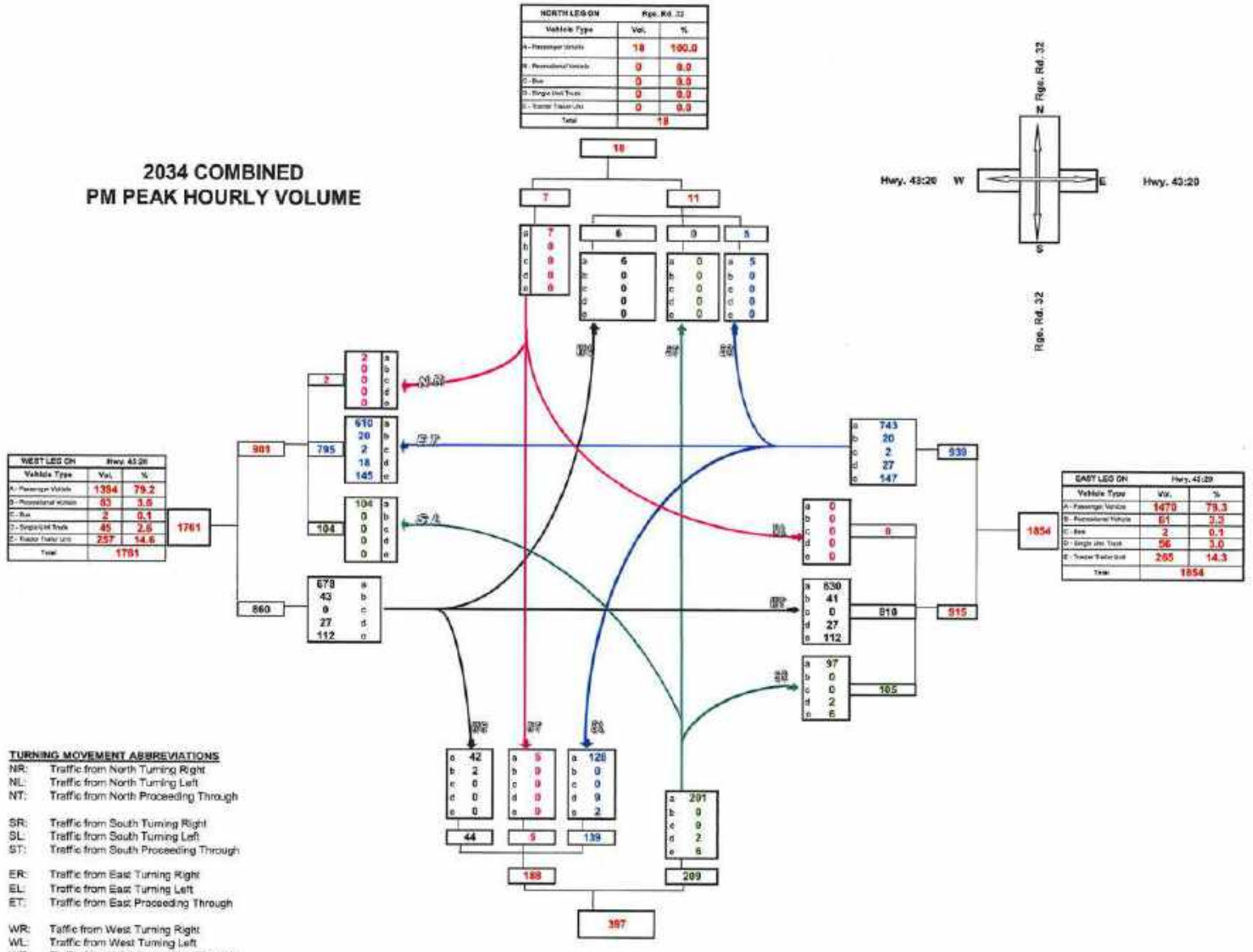
Prepared By: R.T. | Checked By: B.K. | Scale: N.T.S.

Graphics File: d9d9la.mas

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 COMBINED
PM PEAK HOURLY VOLUME



TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

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

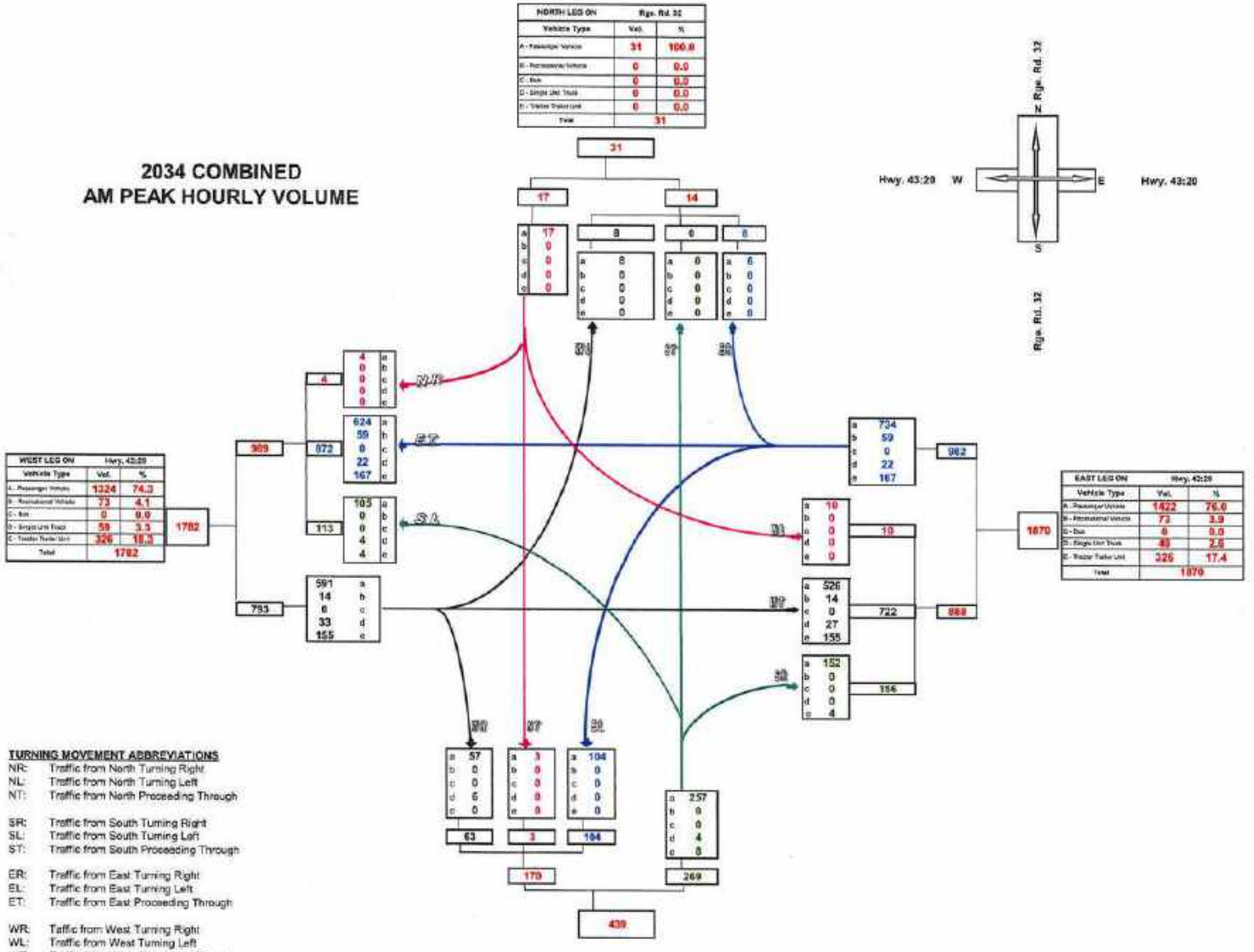
SOUTH LEG ON Rge. Rd. 32
Vehicle Type | Vol. | %
A - Passenger Vehicle | 376 | 94.7
B - Recreational Vehicle | 2 | 0.5
C - Bus | 0 | 0.0
D - Single Unit Truck | 11 | 2.8
E - Tractor Trailer Unit | 8 | 2.0
Total | 397

2034
2019
21

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 COMBINED
AM PEAK HOURLY VOLUME



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

TURNING MOVEMENT ABBREVIATIONS

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Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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

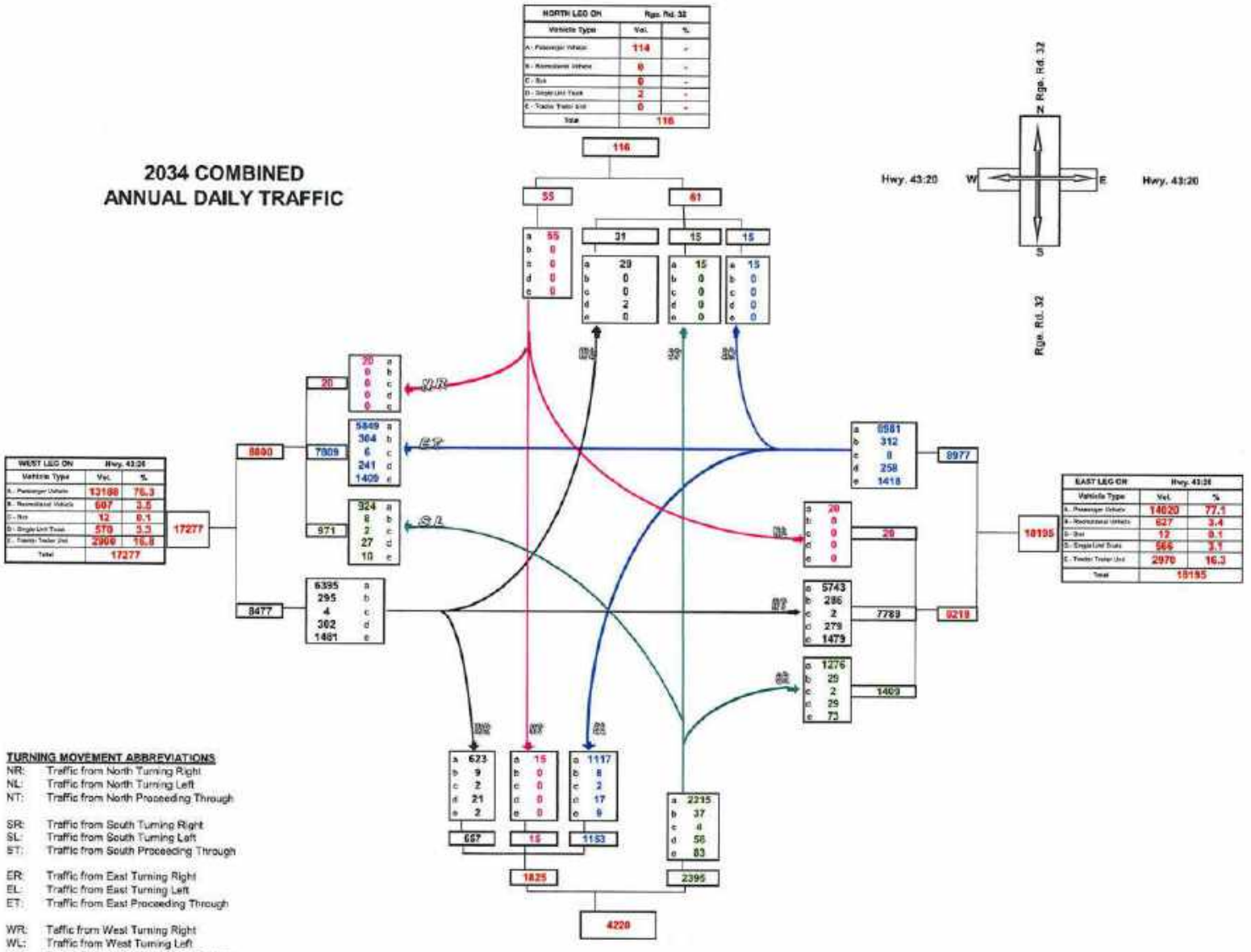
SOUTH LEG ON	Rge. Rd. 32	
Vehicle Type	Vol.	%
A - Passenger Vehicle	421	95.9
B - Recreational Vehicle	0	0.0
C - Bus	8	0.0
D - Single Unit Truck	10	2.3
E - Tractor Trailer Unit	8	1.8
Total	439	

2034
2013
21

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 COMBINED ANNUAL DAILY TRAFFIC



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

TURNING MOVEMENT ABBREVIATIONS

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Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

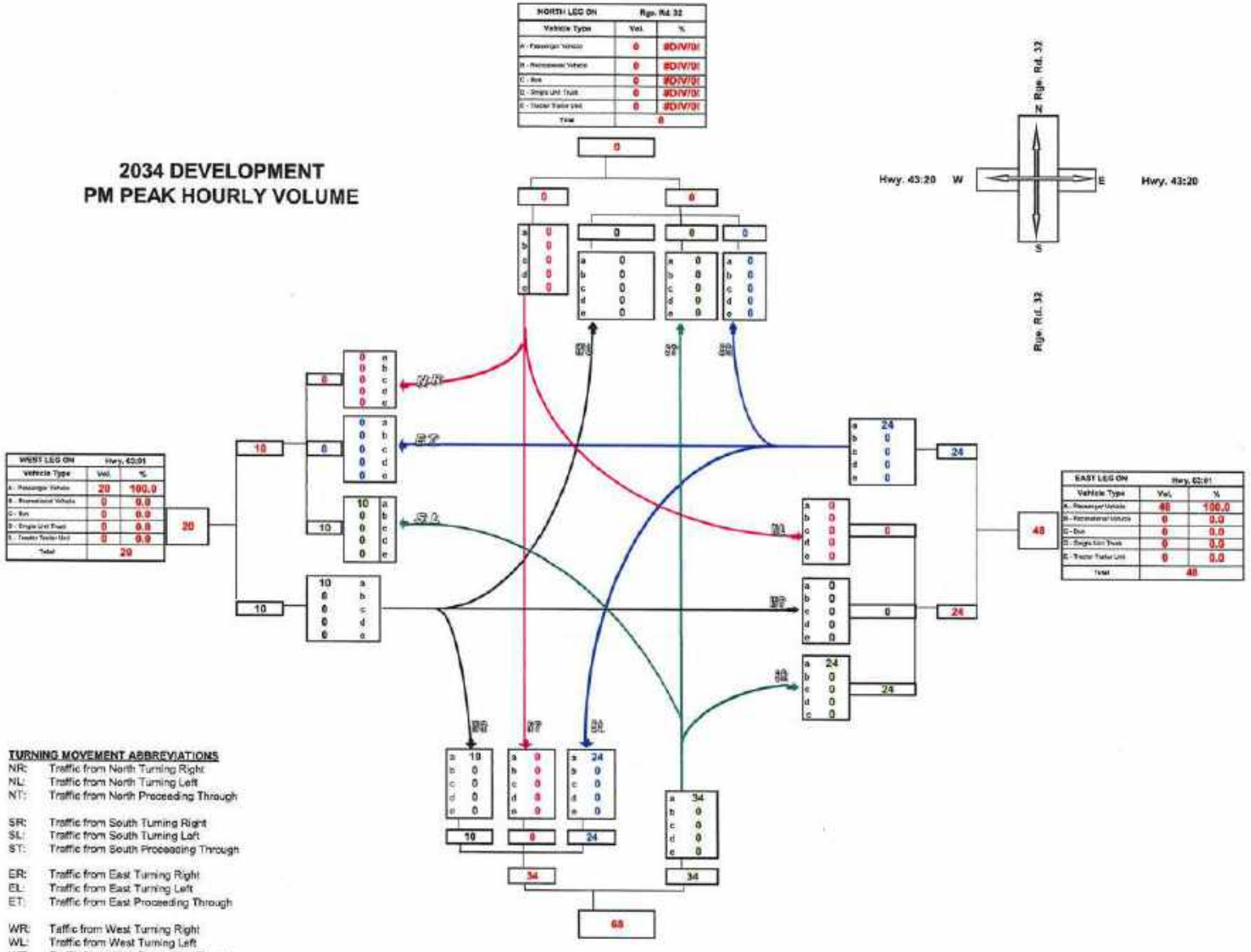
SOUTH LEG ON	Rge. Rd. 32	
Vehicle Type	Vol.	%
A - Passenger Vehicle	3970	94.1
B - Recreational Vehicle	54	1.3
C - Bus	8	0.2
D - Single Unit Truck	94	2.2
E - Tractor Trailer Unit	94	2.2
Total	4220	

2034
2013
31

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 DEVELOPMENT
PM PEAK HOURLY VOLUME



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ET: Traffic from East Proceeding Through

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

TURNING MOVEMENT ABBREVIATIONS

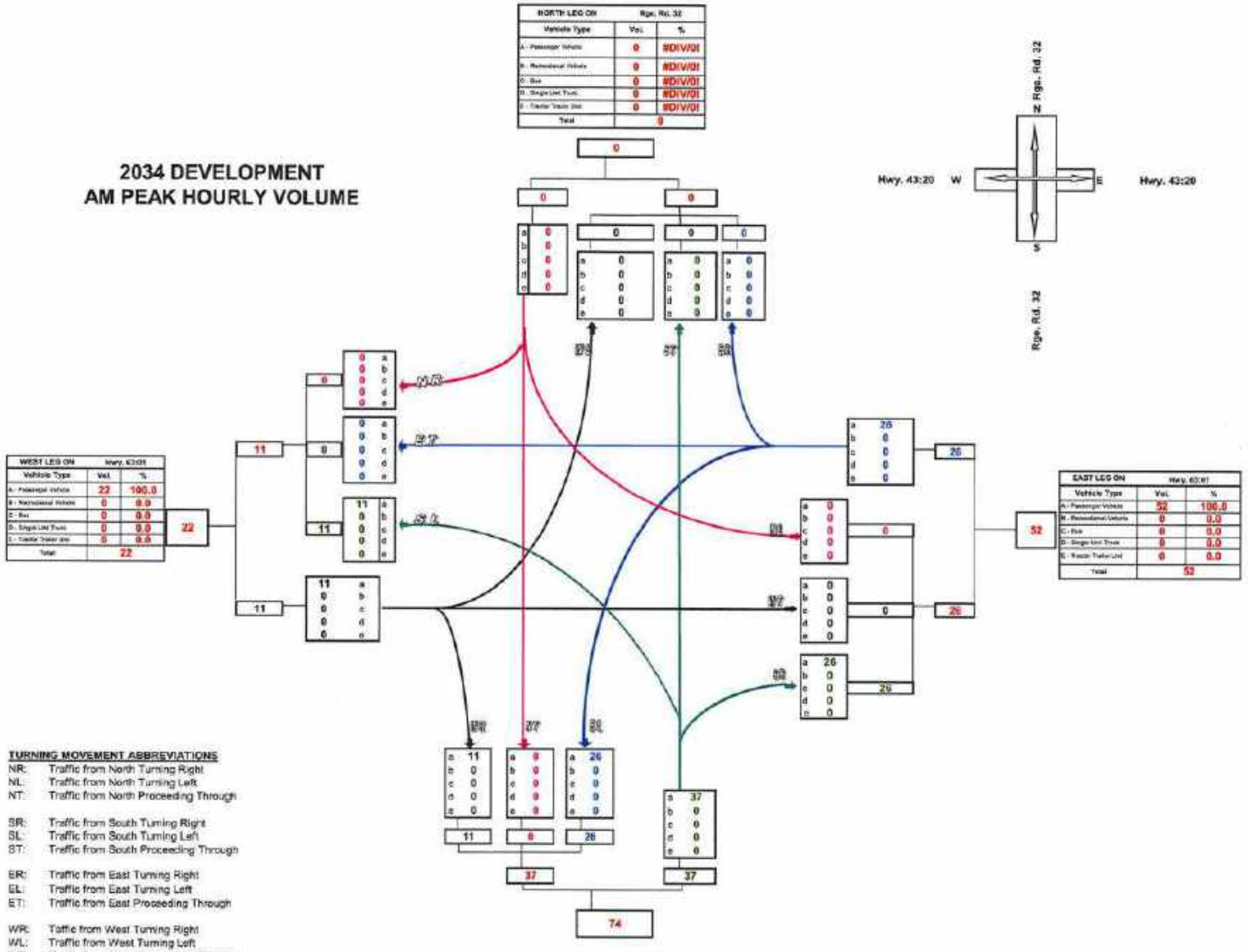
AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 DEVELOPMENT
AM PEAK HOURLY VOLUME



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

TURNING MOVEMENT ABBREVIATIONS

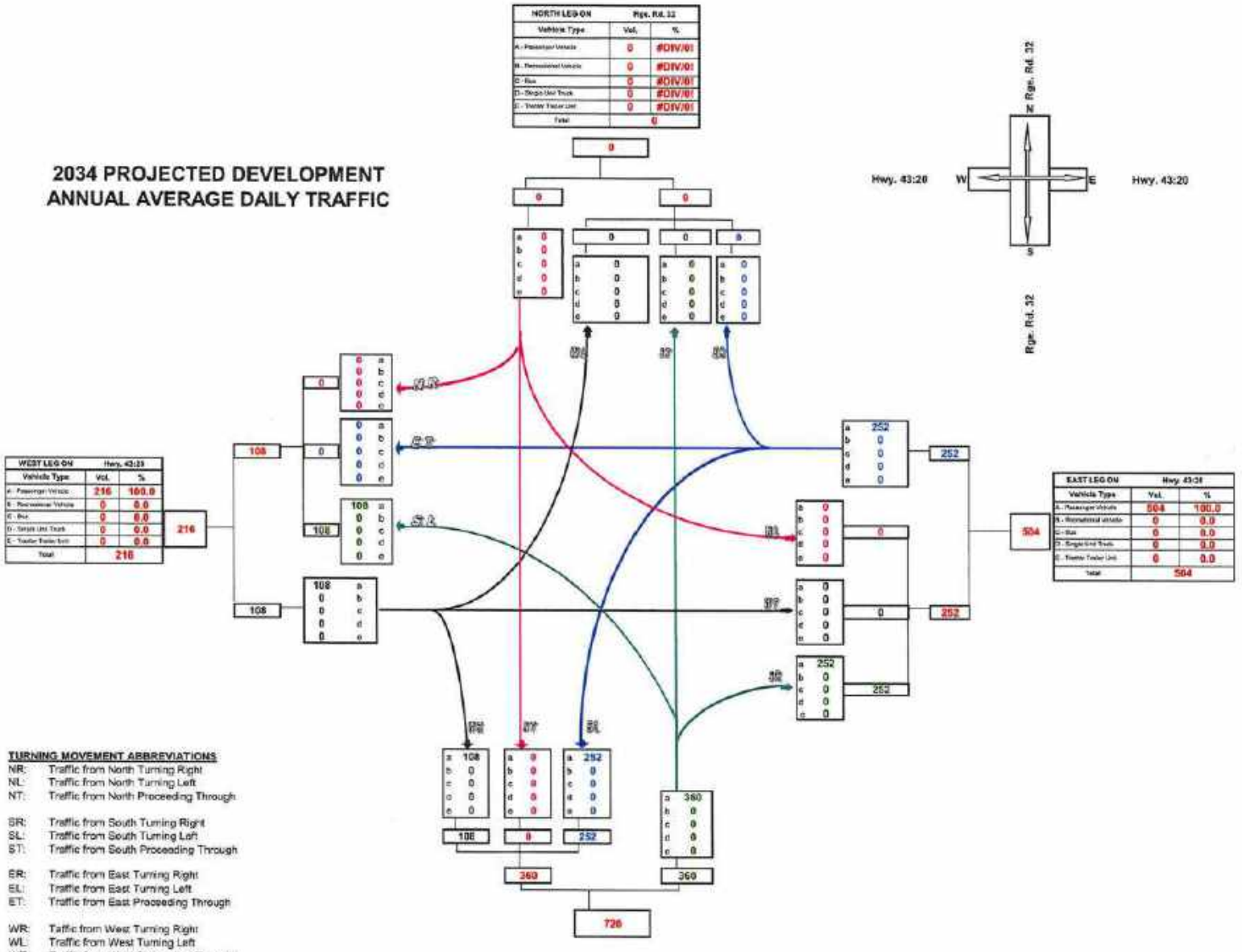
AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2034 PROJECTED DEVELOPMENT
ANNUAL AVERAGE DAILY TRAFFIC



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ET: Traffic from East Proceeding Through

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

TURNING MOVEMENT ABBREVIATIONS

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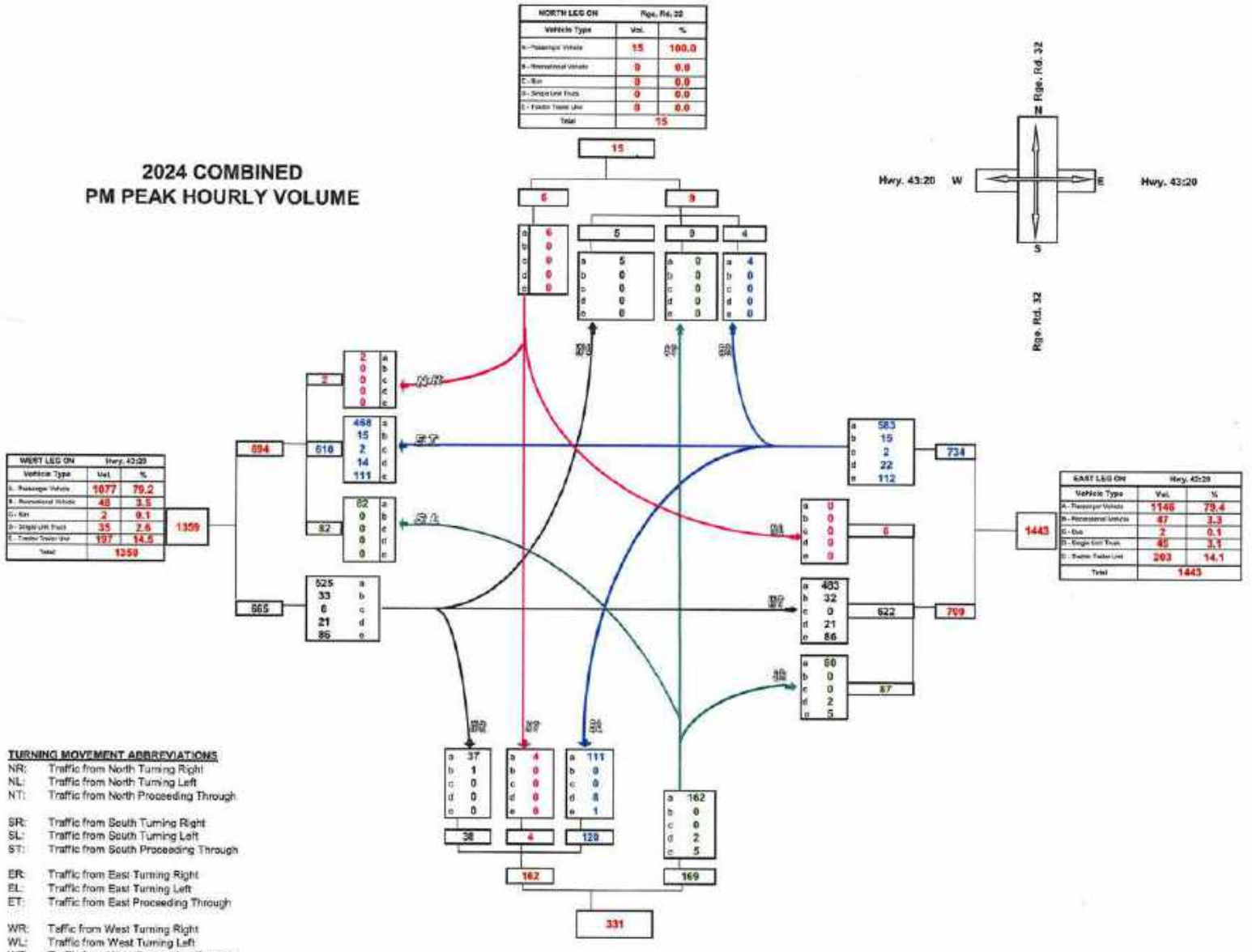
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2024 COMBINED
PM PEAK HOURLY VOLUME



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NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

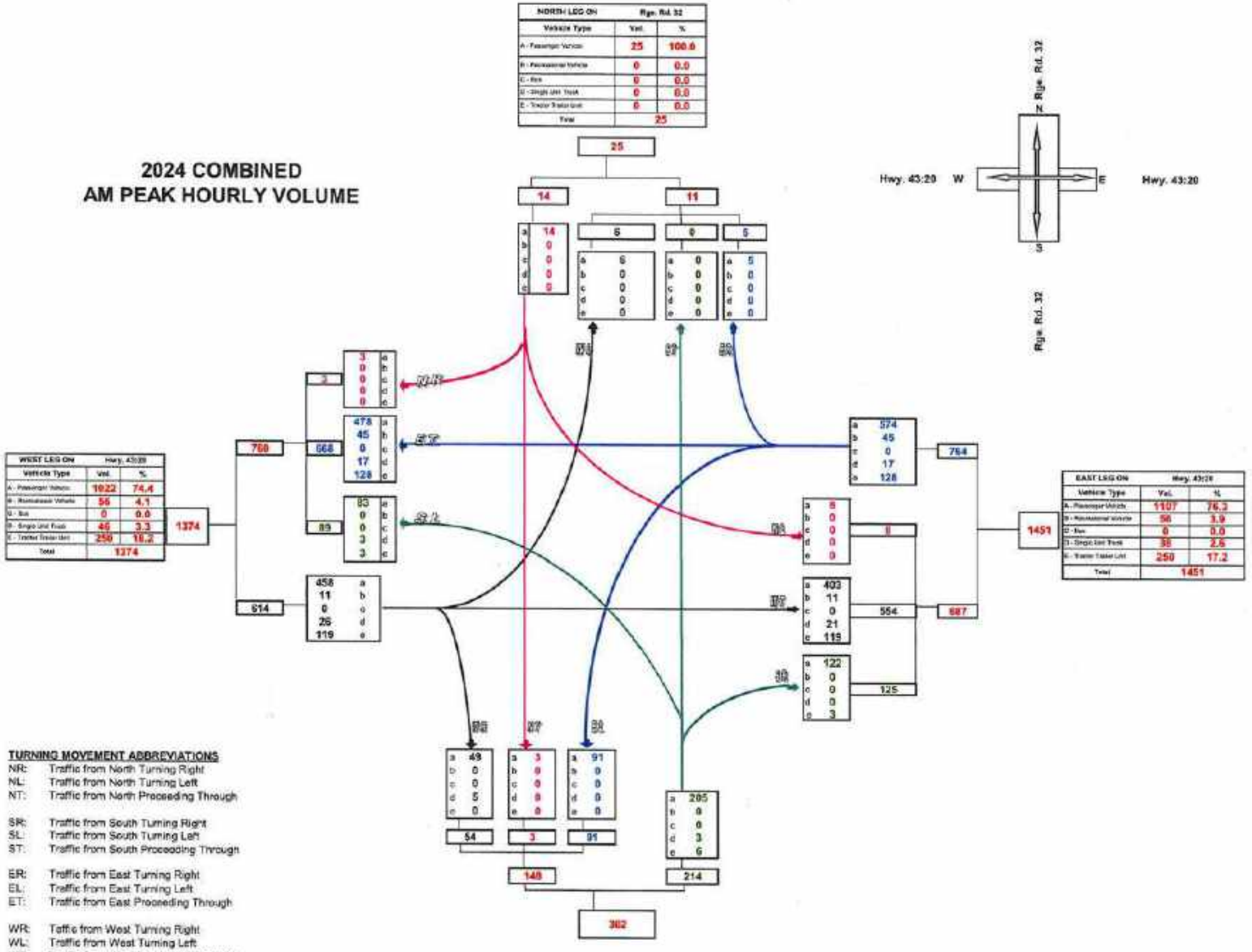
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

2024
2013
11

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2024 COMBINED AM PEAK HOURLY VOLUME



TURNING MOVEMENT ABBREVIATIONS

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

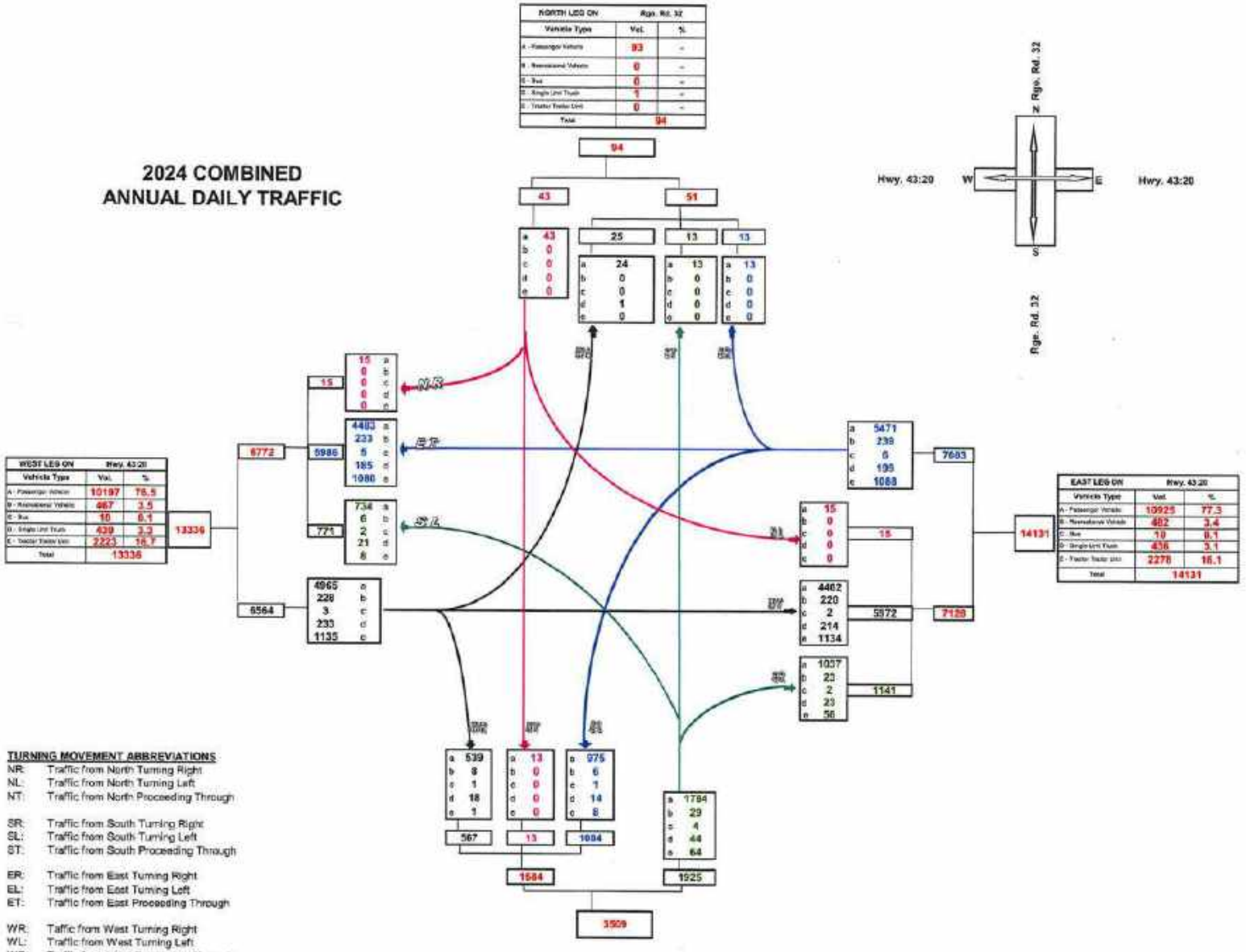
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

2024
2013
11

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2024 COMBINED ANNUAL DAILY TRAFFIC



TURNING MOVEMENT ABBREVIATIONS

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

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

SOUTH LEG ON Rge. Rd. 32

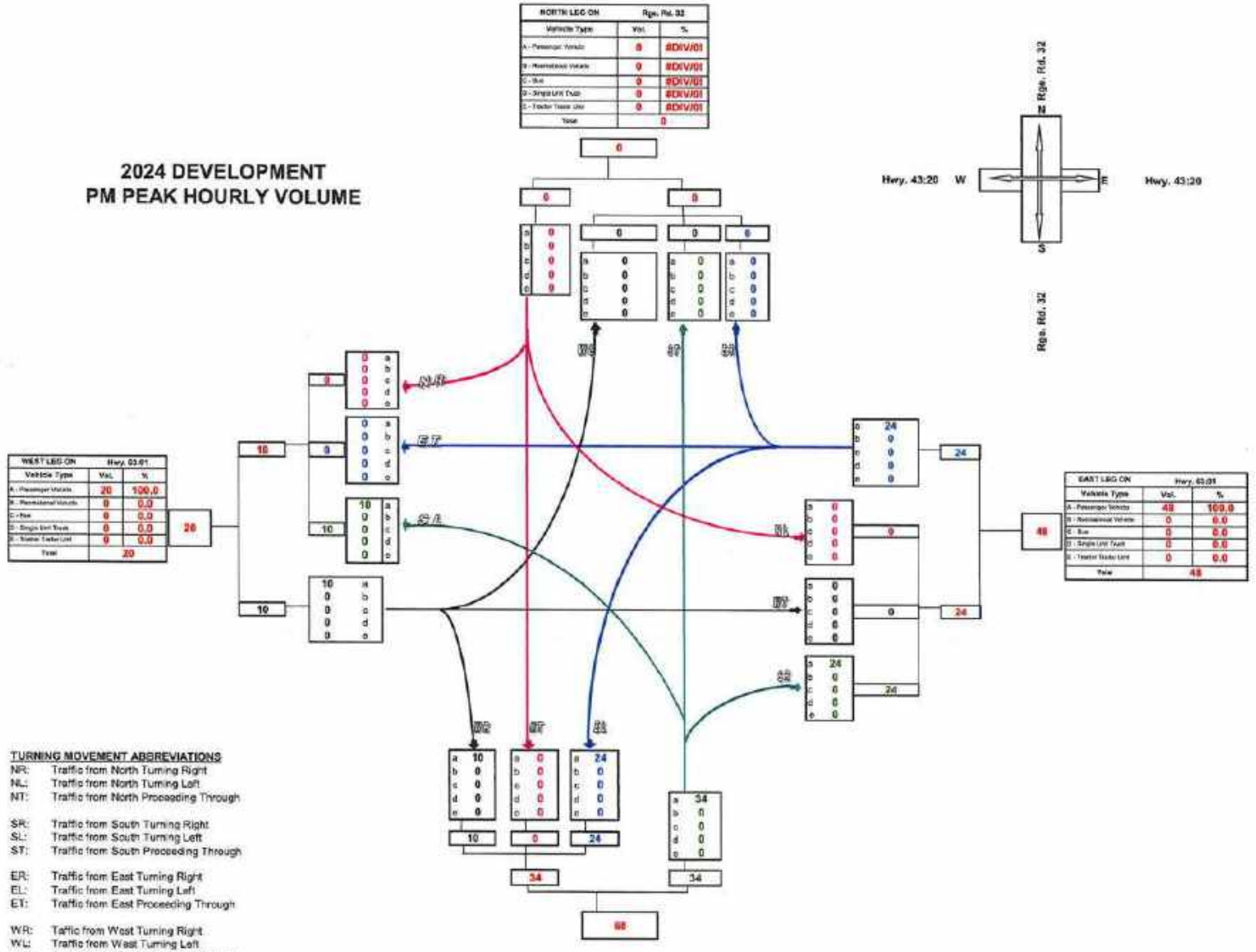
Vehicle Type	Vol.	%
A - Passenger Vehicle	3311	94.4
B - Recreational Vehicle	43	1.2
C - Bus	6	0.2
D - Single Unit Truck	76	2.2
E - Tractor Trailer Unit	73	2.1
Total	3509	

2024
2013

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2024 DEVELOPMENT
PM PEAK HOURLY VOLUME



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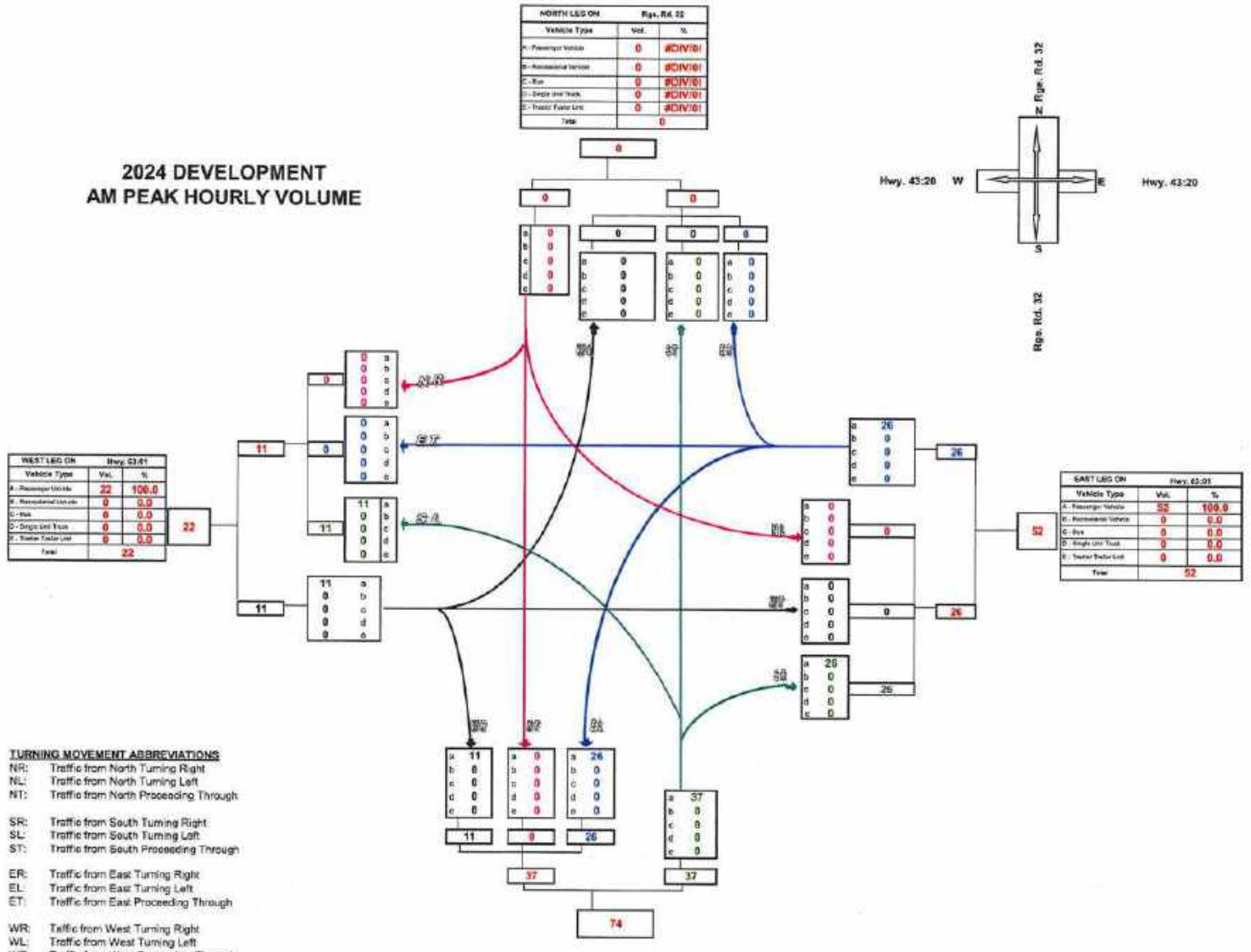
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2024 DEVELOPMENT
AM PEAK HOURLY VOLUME



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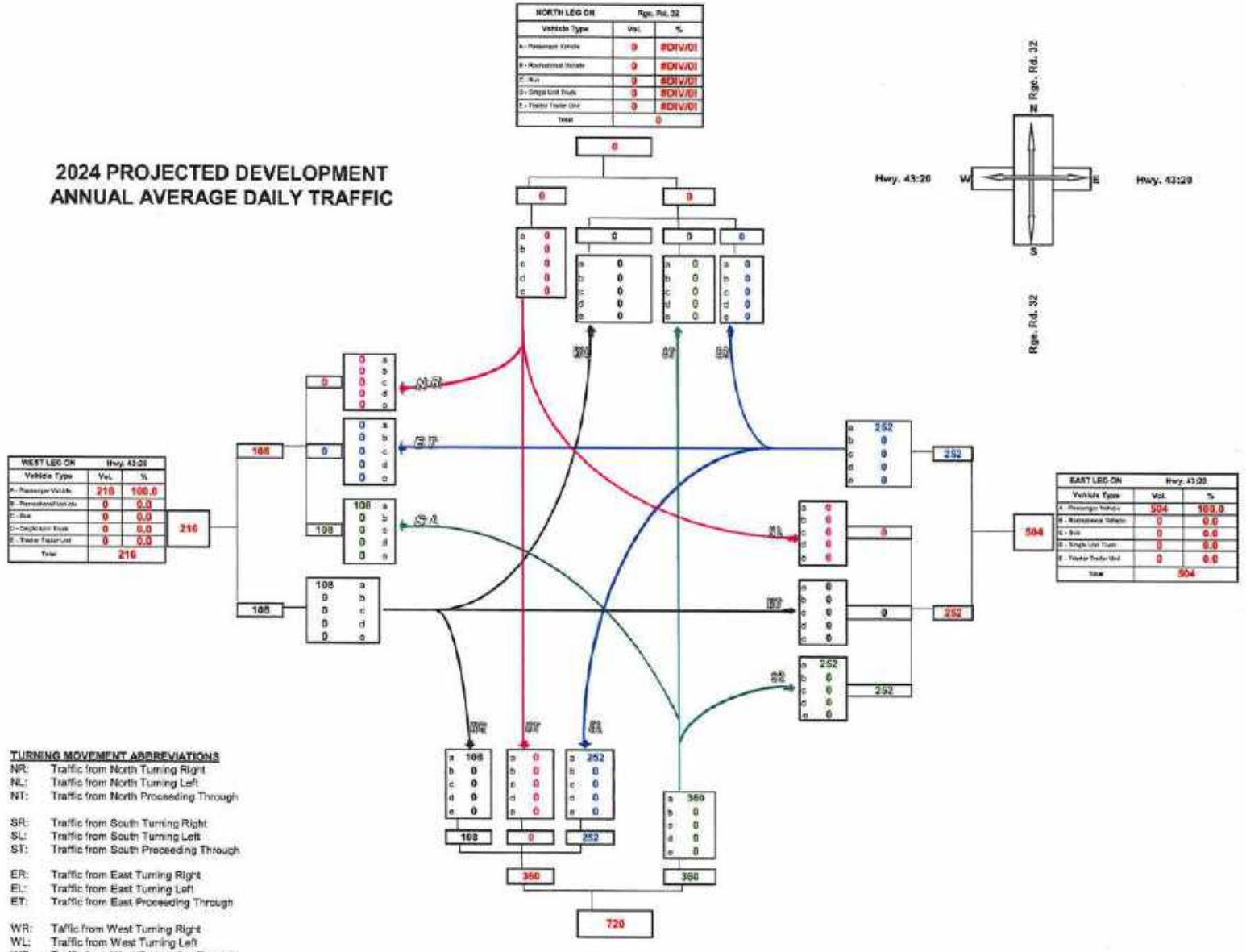
Turning Movement Summary Diagram

2024 PROJECTED DEVELOPMENT
ANNUAL AVERAGE DAILY TRAFFIC



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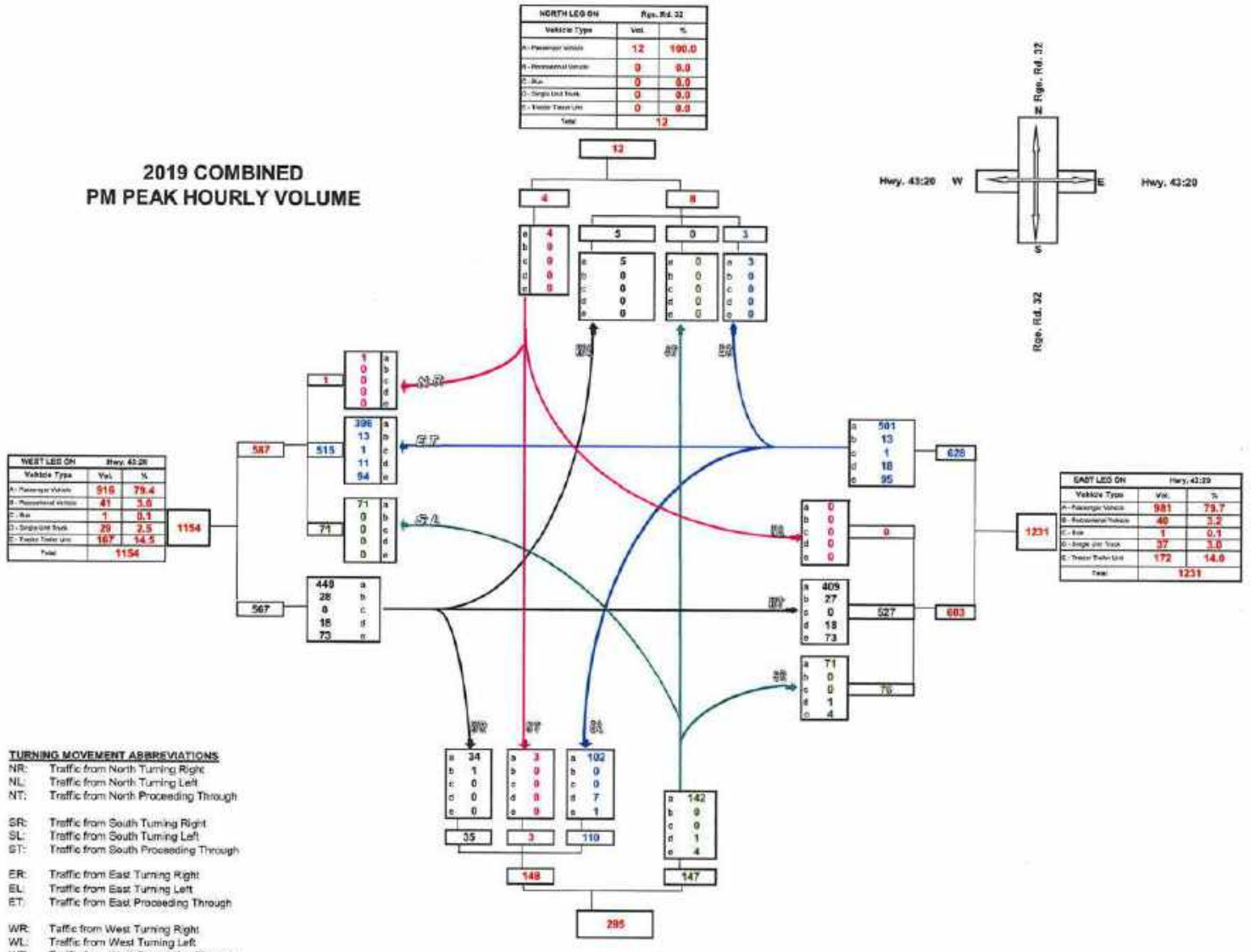
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2019 COMBINED PM PEAK HOURLY VOLUME



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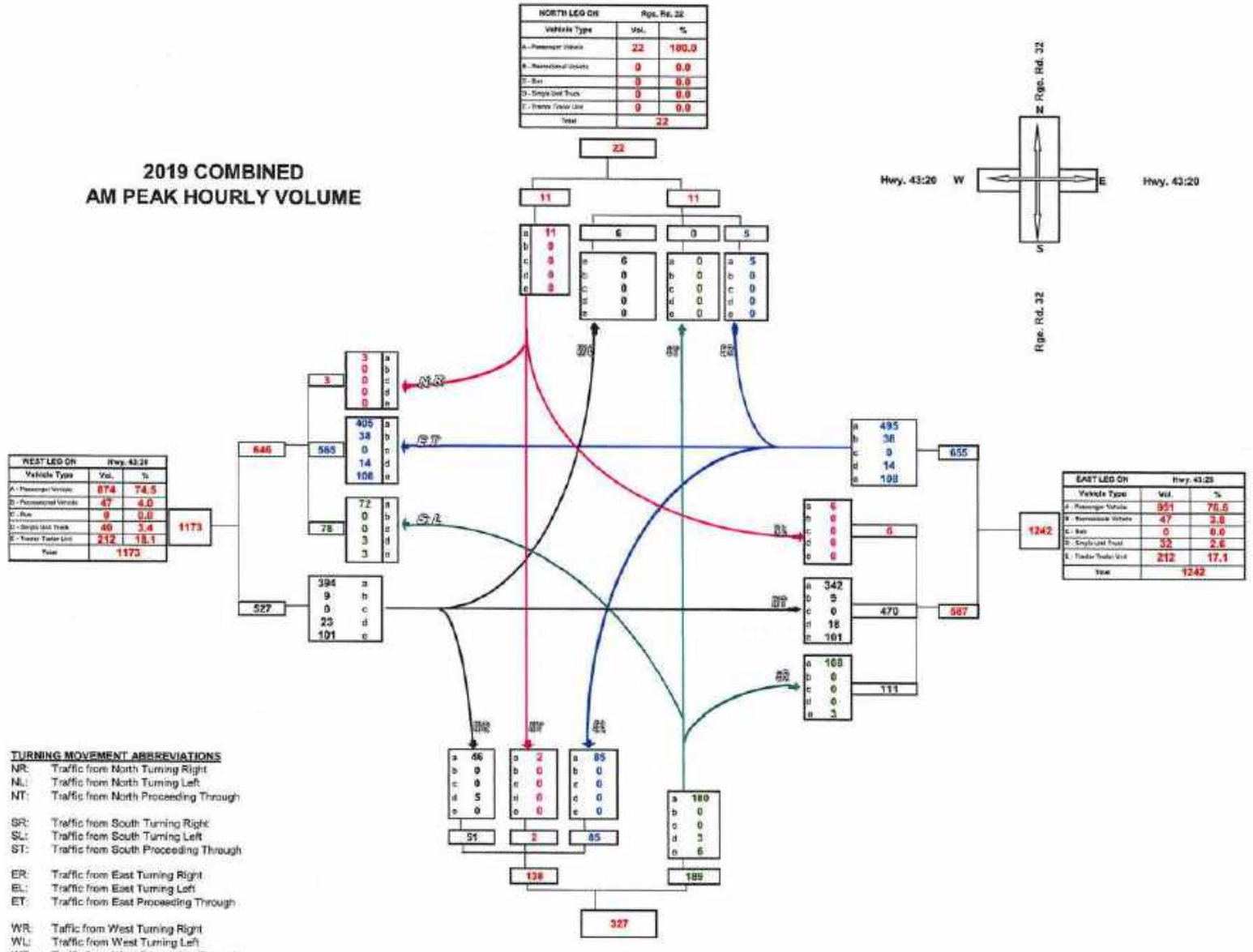
Turning Movement Summary Diagram

2019 COMBINED AM PEAK HOURLY VOLUME



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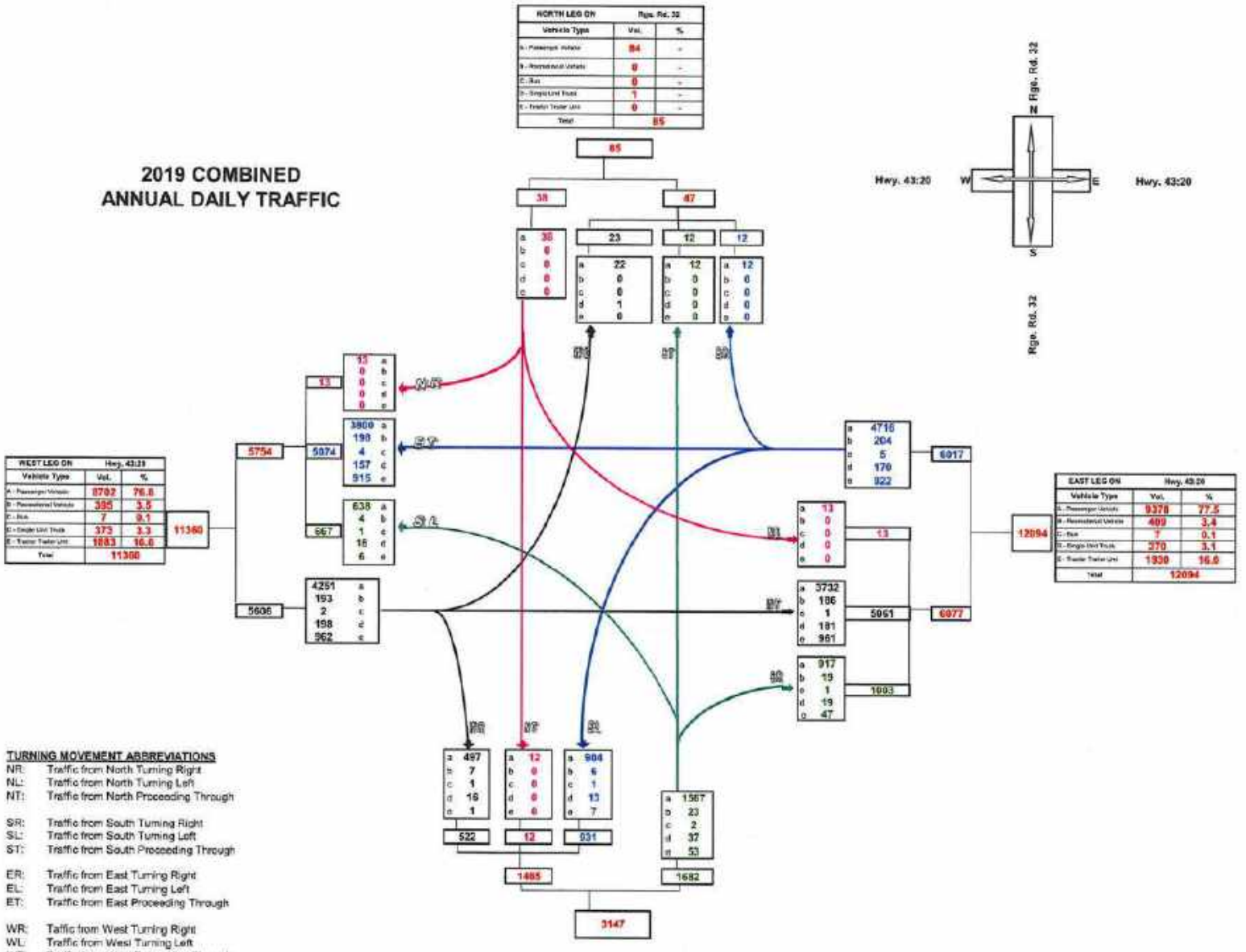
Turning Movement Summary Diagram

2019 COMBINED ANNUAL DAILY TRAFFIC



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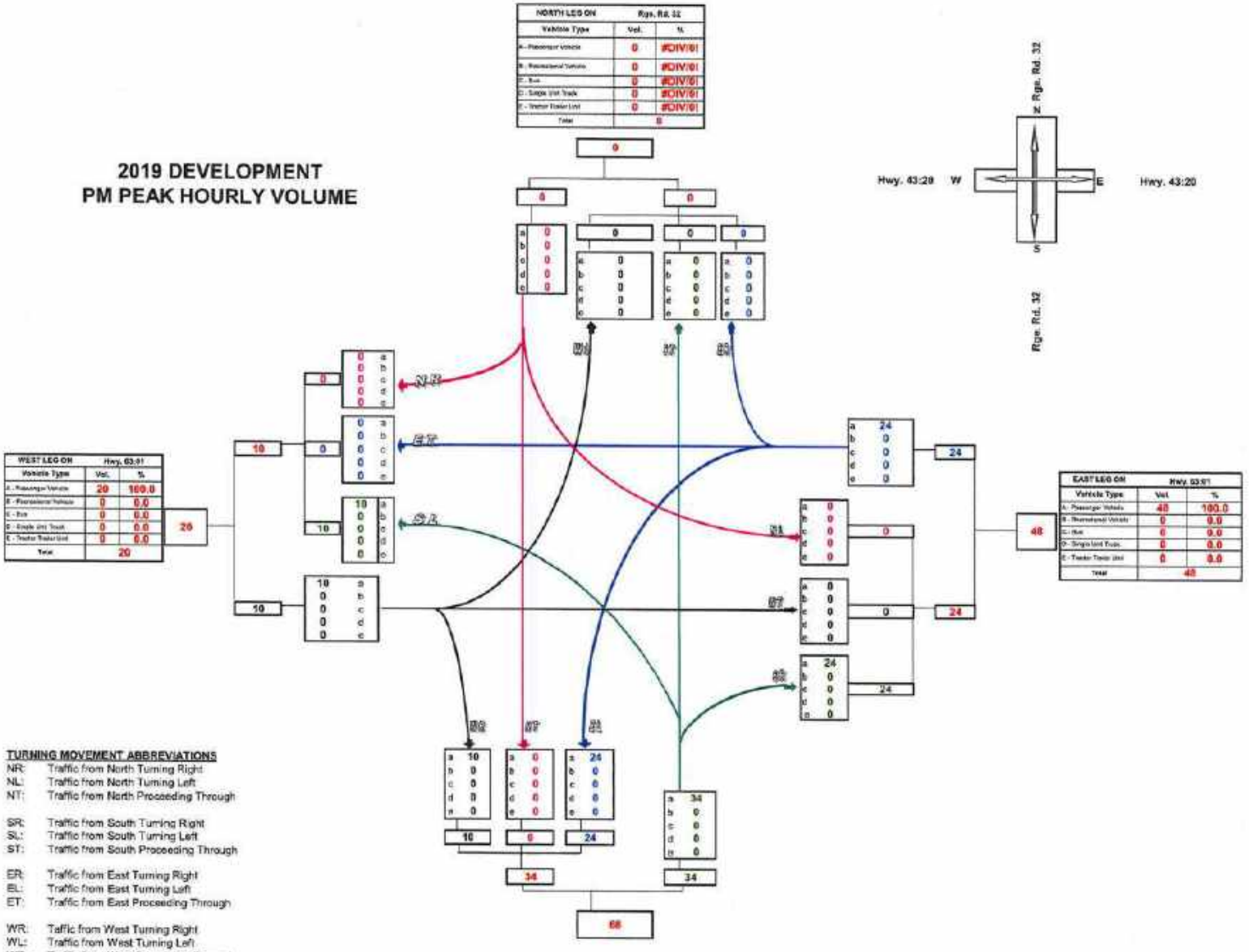
SOUTH LEG ON	Rge. Rd. 32	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2980	94.7
B - Recreational Vehicle	36	1.1
C - Bus	4	0.1
D - Single Unit Truck	66	2.1
E - Tractor Trailer Unit	61	1.9
Total	3147	

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2019 DEVELOPMENT
PM PEAK HOURLY VOLUME



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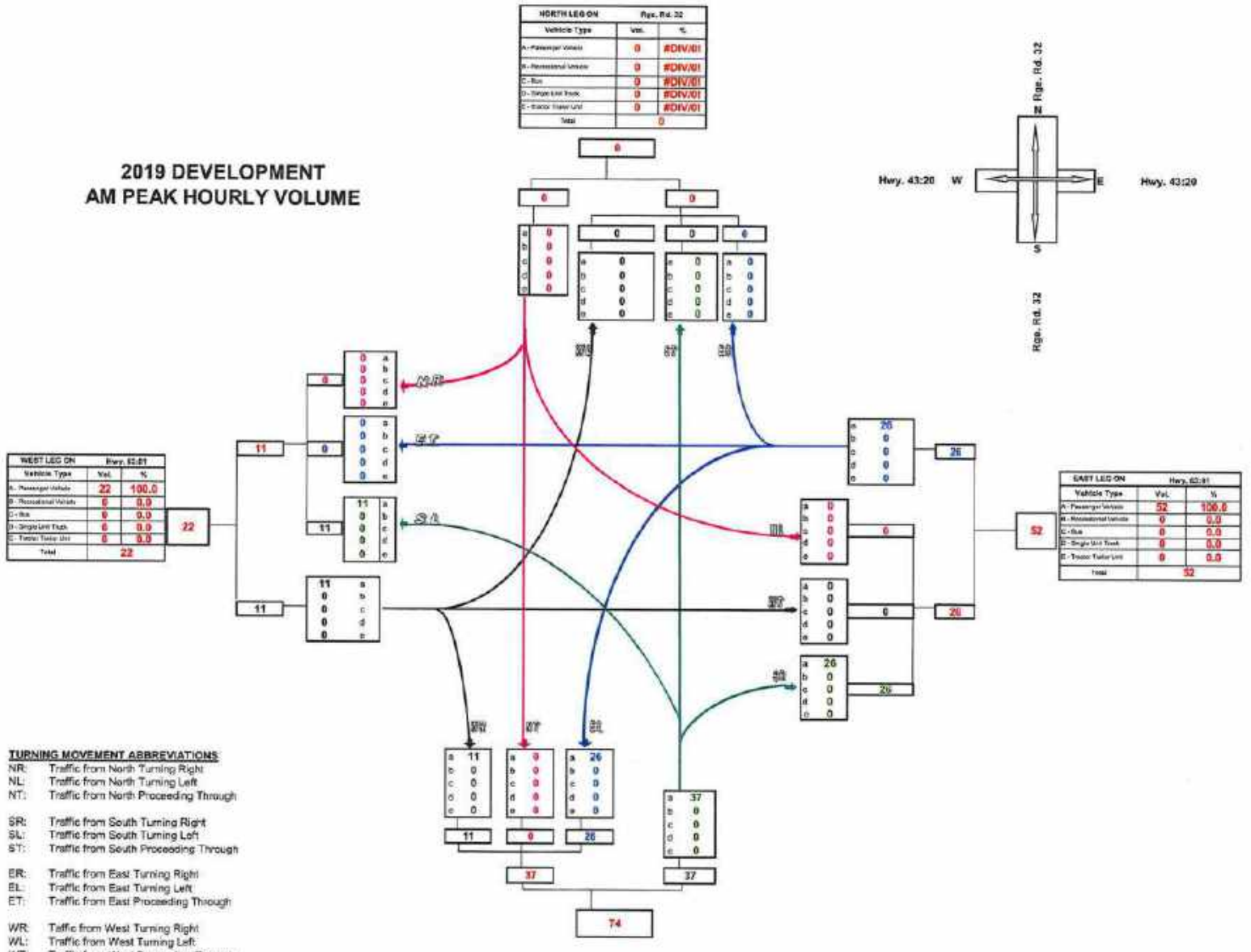
Turning Movement Summary Diagram

2019 DEVELOPMENT
AM PEAK HOURLY VOLUME



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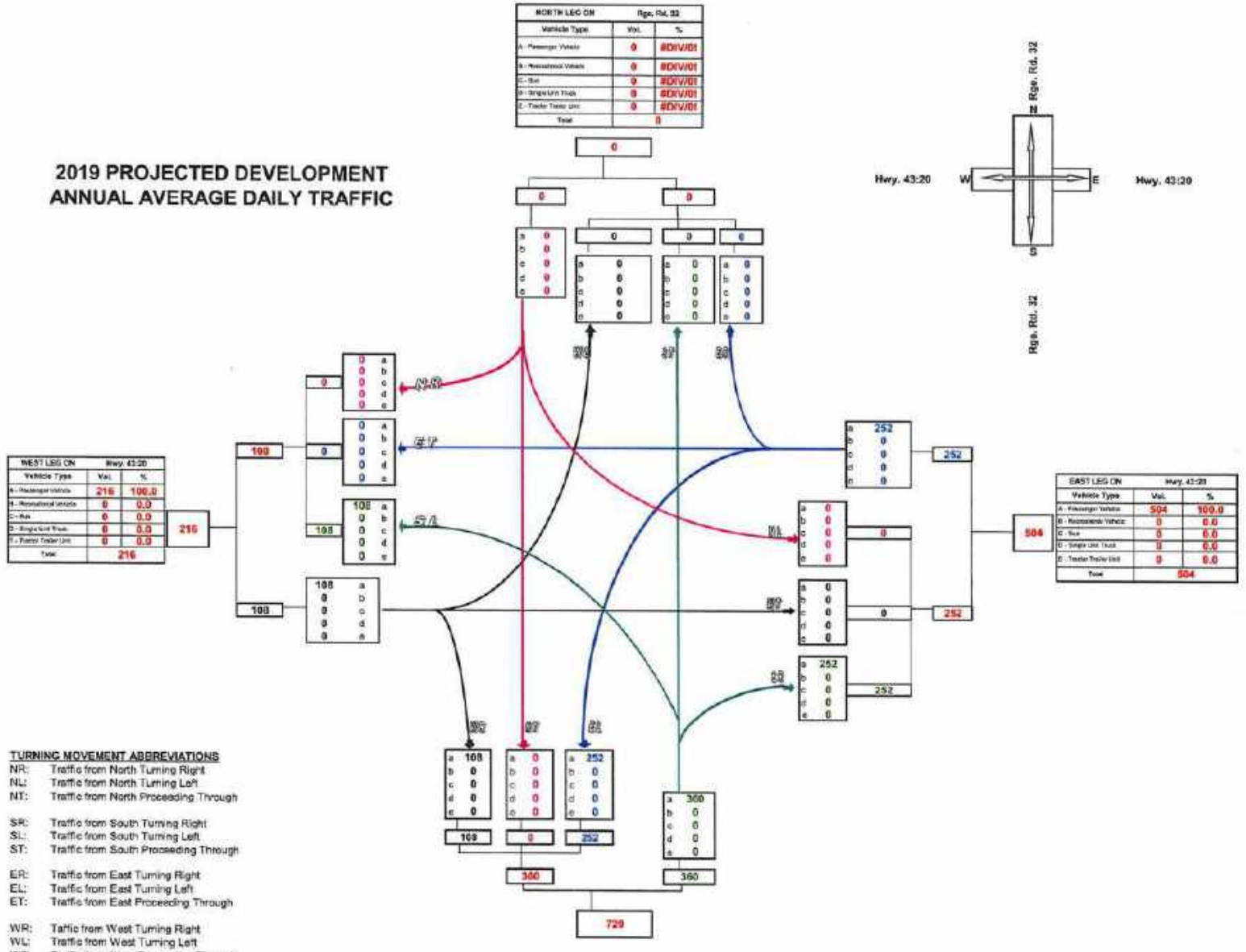
Turning Movement Summary Diagram

2019 PROJECTED DEVELOPMENT
ANNUAL AVERAGE DAILY TRAFFIC



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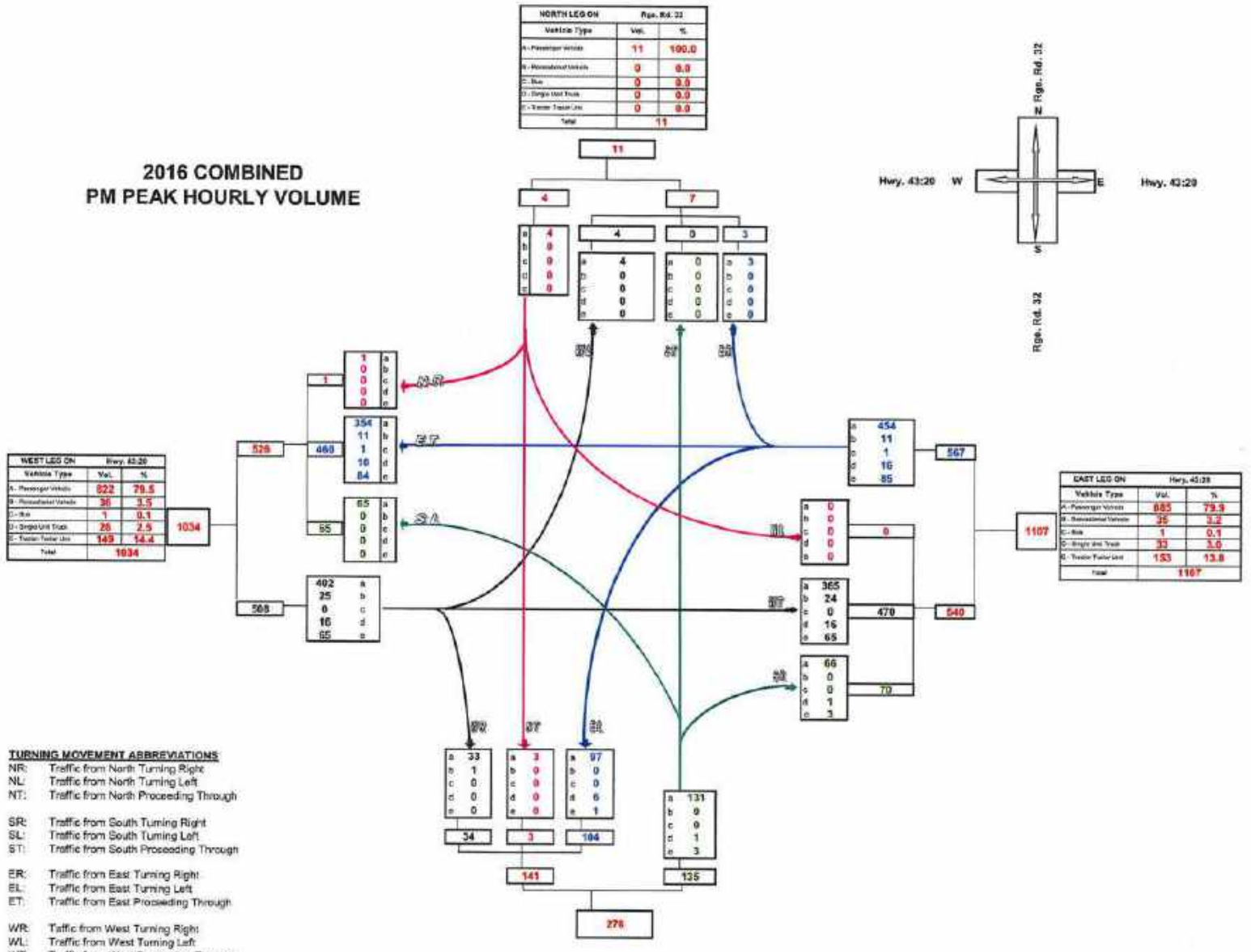
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2016 COMBINED
PM PEAK HOURLY VOLUME



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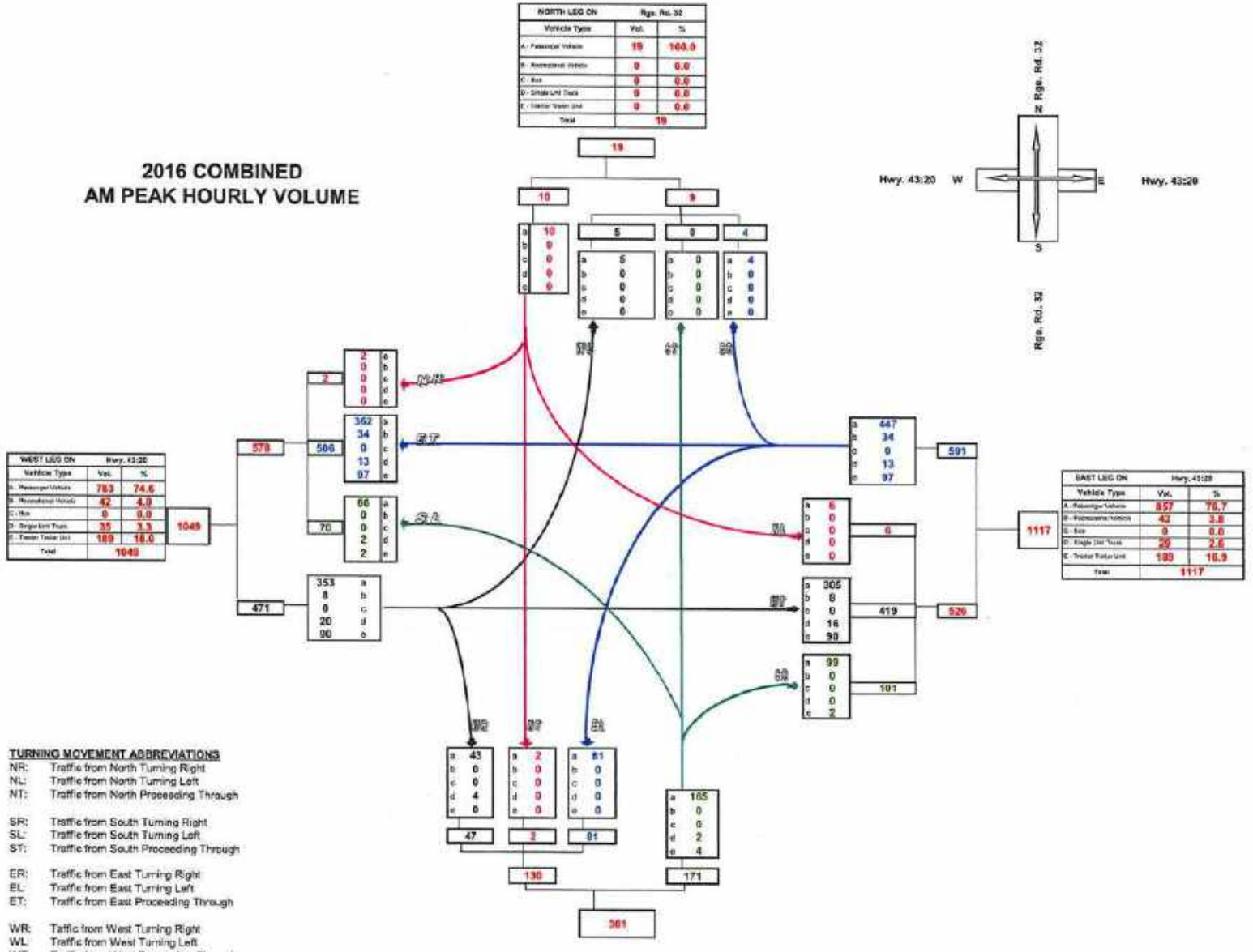
2016
2013
3

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2016 COMBINED AM PEAK HOURLY VOLUME



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SOUTH LEG ON Rge. Rd. 32

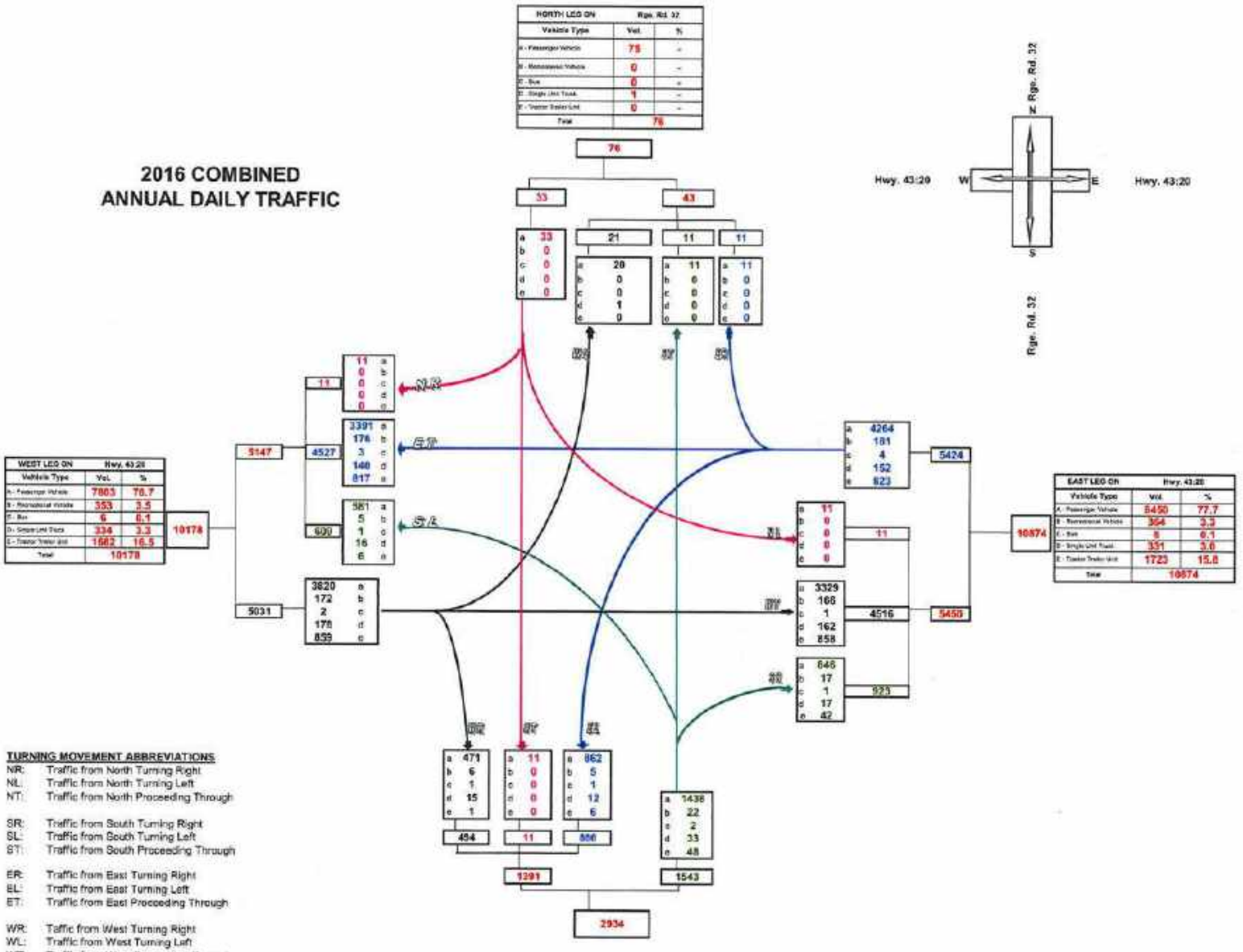
Vehicle Type	Vol.	%
A - Passenger Vehicle	291	96.7
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	6	2.0
E - Tractor Trailer Unit	4	1.3
Total	301	

2016
2013
0

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2016 COMBINED ANNUAL DAILY TRAFFIC



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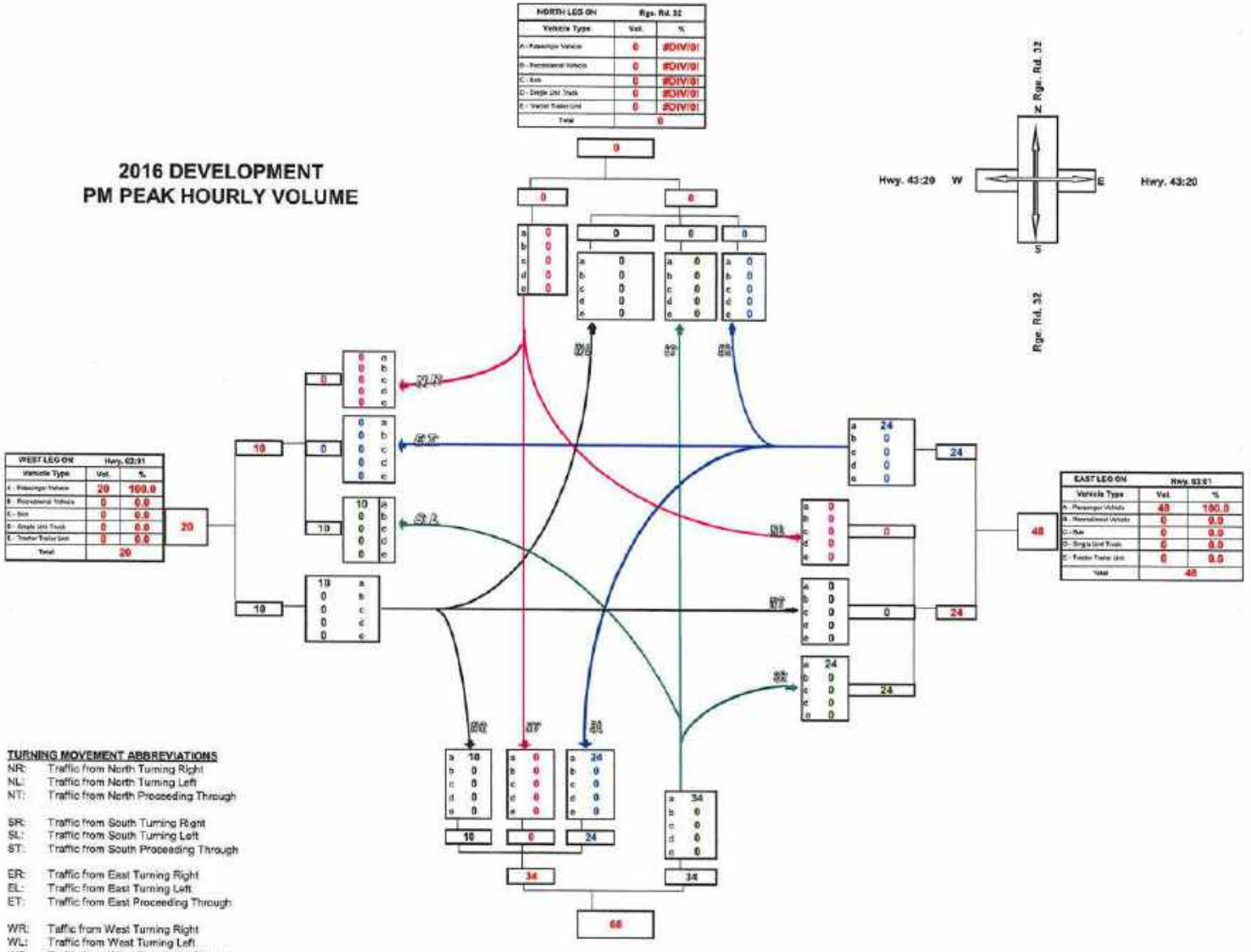
SOUTH LEG ON	Rge. Rd. 32	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2782	94.8
B - Recreational Vehicle	33	1.1
C - Bus	4	0.1
D - Single Unit Truck	60	2.0
E - Tractor Trailer Unit	55	1.9
Total	2934	

2016
2013
3

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2016 DEVELOPMENT
PM PEAK HOURLY VOLUME



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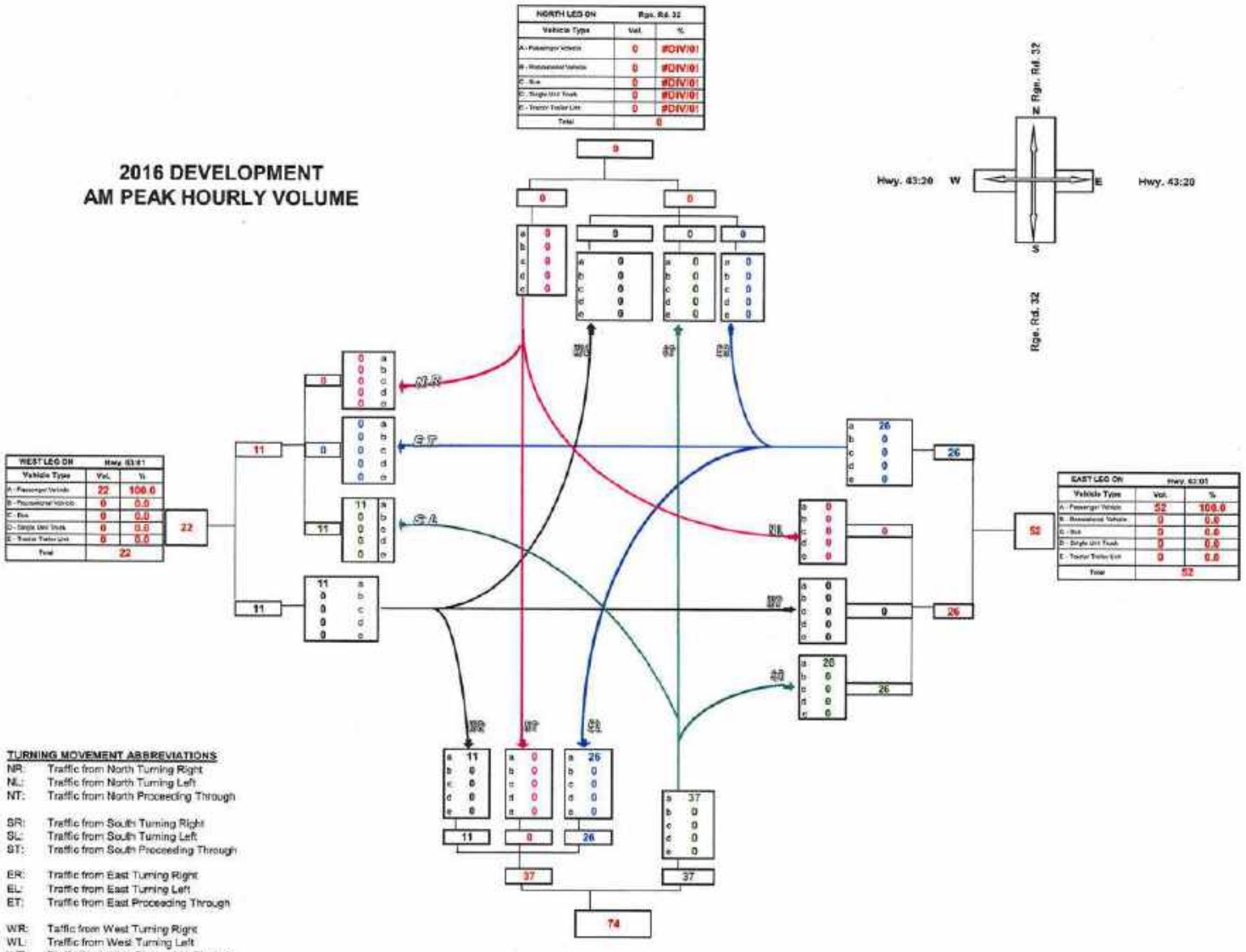

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Turning Movement Summary Diagram

2016 PROJECTED DEVELOPMENT
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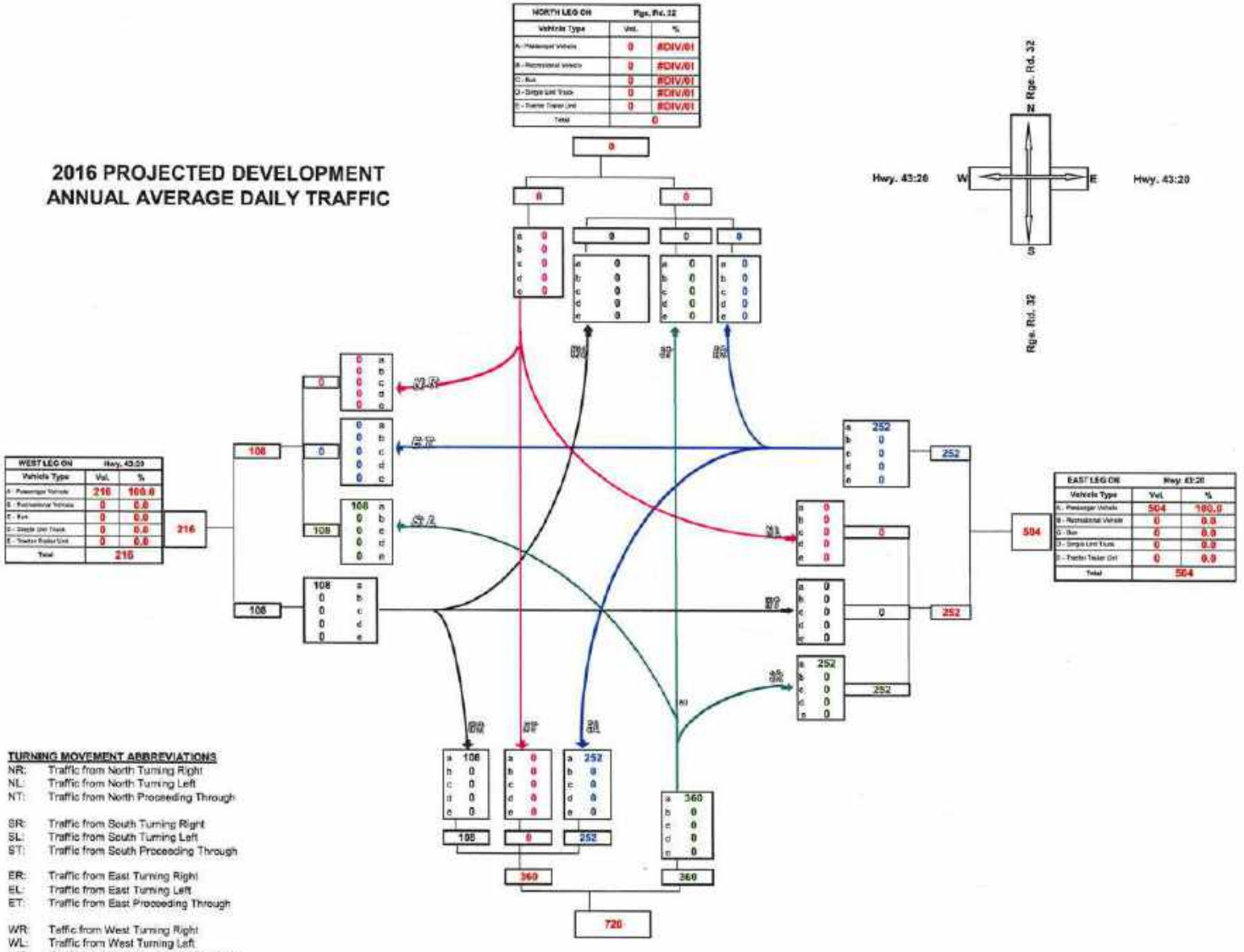

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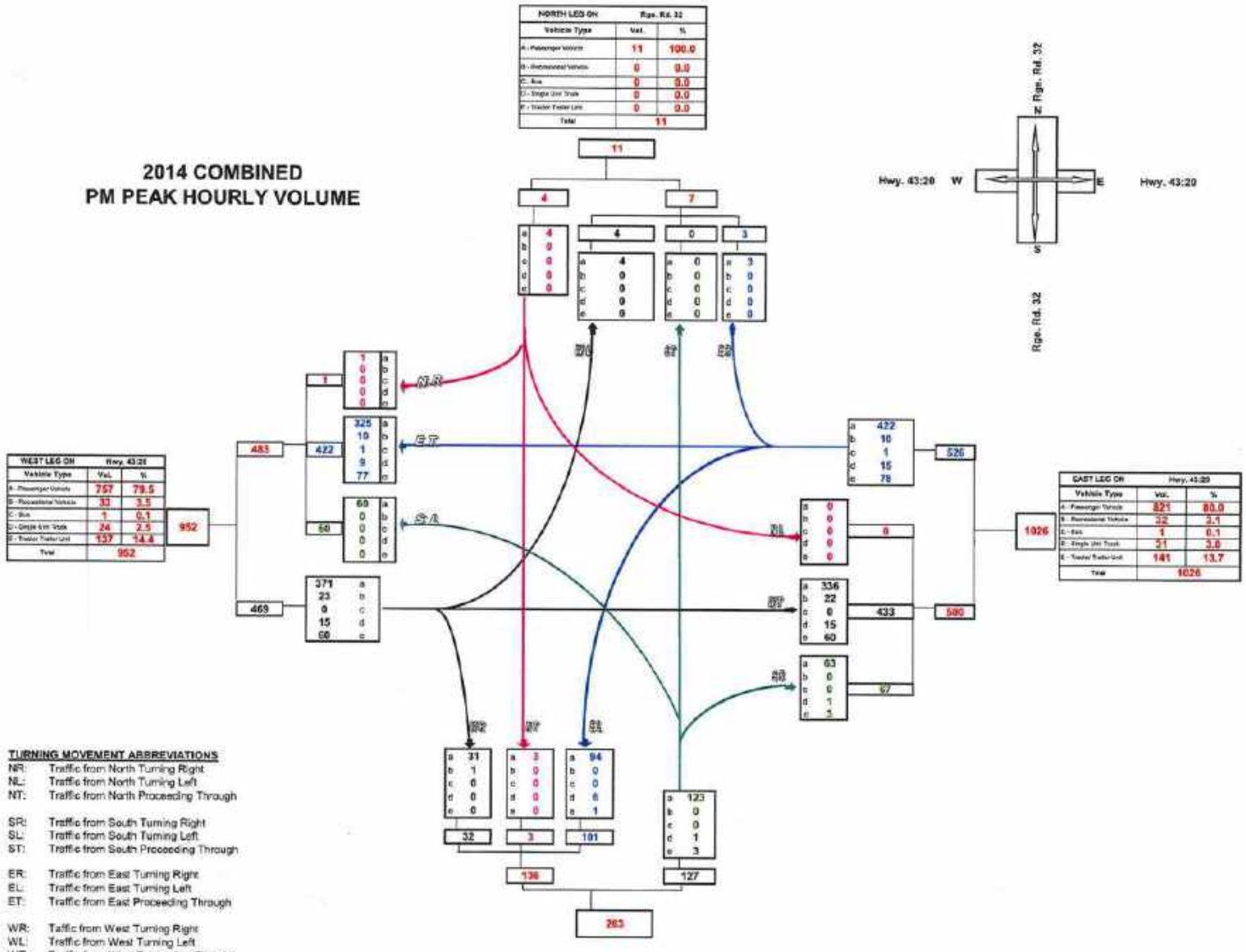
Turning Movement Summary Diagram

2014 COMBINED
PM PEAK HOURLY VOLUME



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2014
2013
1

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Turning Movement Summary Diagram

2014 COMBINED
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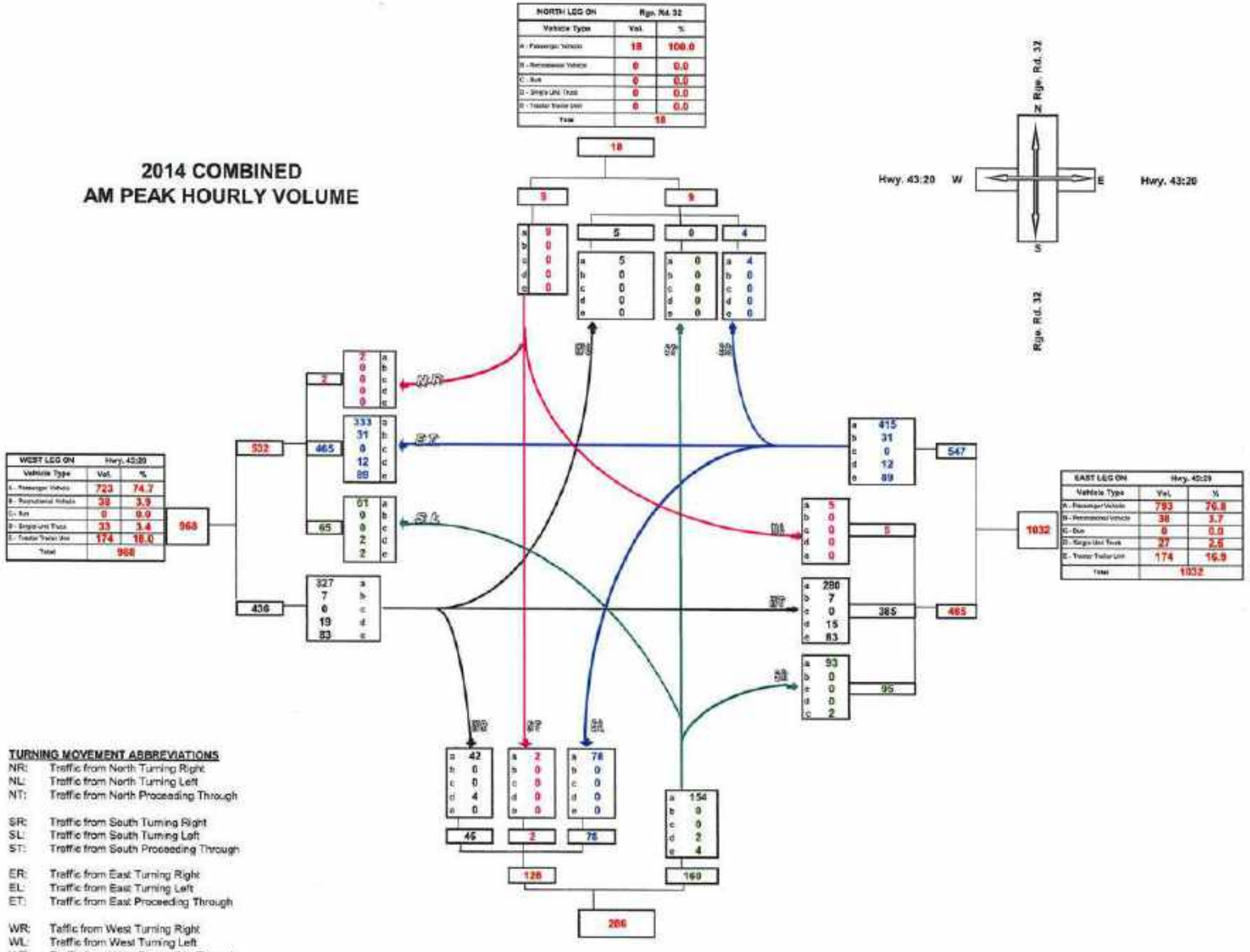

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2014
2013

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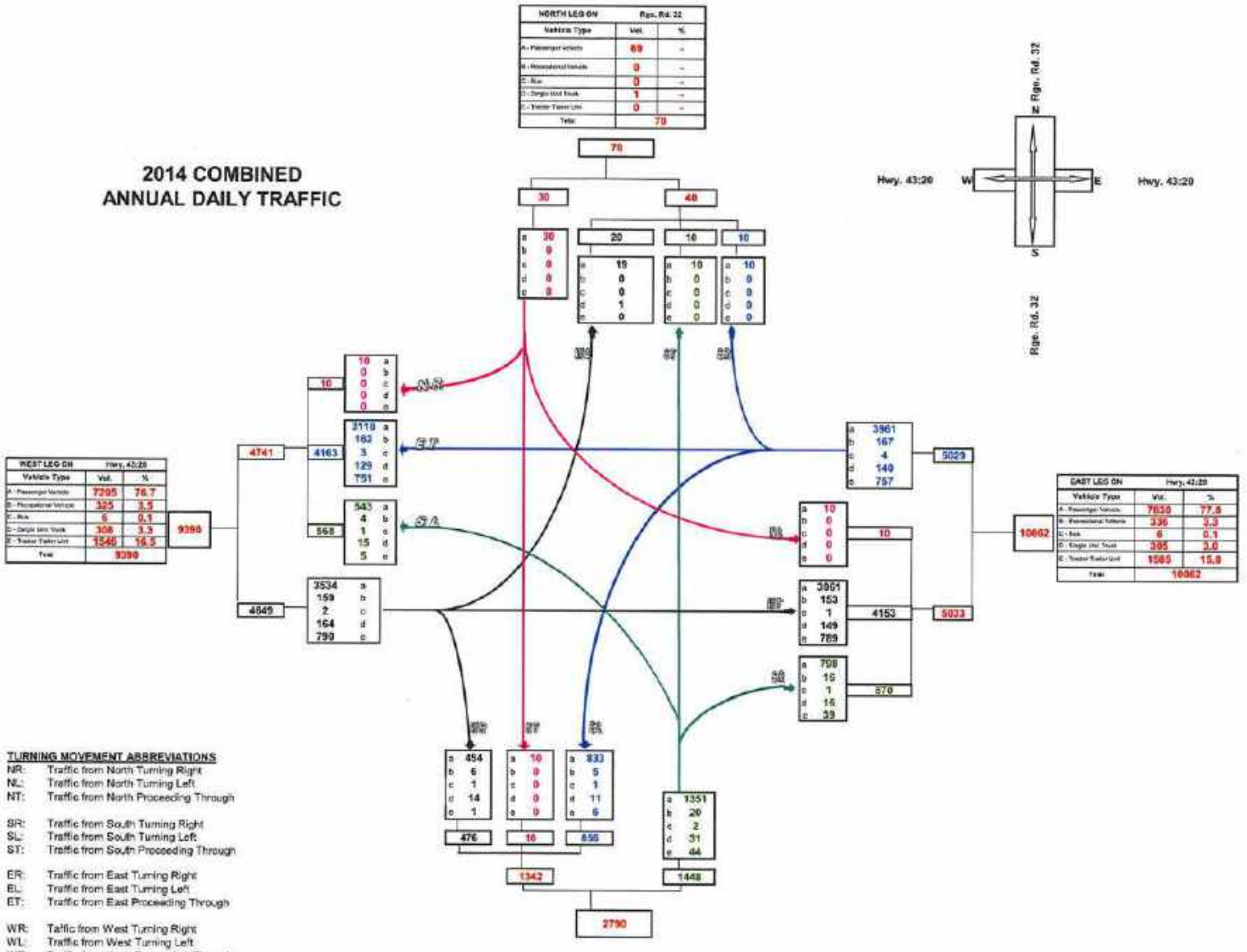

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2014
2013
1

HCM Unsignalized Intersection Capacity Analysis
3: Rge. Rd. 32 & Hwy. 43:20

09/06/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	722	63	104	872	6	113	0	156	10	3	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	785	68	113	948	7	123	0	170	11	3	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		Raised			Raised							
Median storage veh)		3			3							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	954			853			1542	2017	427	1672	2048	477
vC1, stage 1 conf vol							836	836		1177	1177	
vC2, stage 2 conf vol							706	1180		495	871	
vCu, unblocked vol	954			853			1542	2017	427	1672	2048	477
tC, single (s)	4.5			4.5			7.6	6.6	7.0	7.5	6.5	6.9
tC, 2 stage (s)							6.6	5.6		6.5	5.5	
tF (s)	2.4			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			83			50	100	70	93	98	99
cM capacity (veh/h)	615			677			248	193	568	155	186	537

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	401	461	113	632	322	292	18
Volume Left	9	0	113	0	0	123	11
Volume Right	0	68	0	0	7	170	4
cSH	615	1700	677	1700	1700	589	193
Volume to Capacity	0.01	0.27	0.17	0.37	0.19	0.50	0.10
Queue Length 95th (m)	0.3	0.0	4.8	0.0	0.0	22.0	2.5
Control Delay (s)	0.4	0.0	11.4	0.0	0.0	22.0	25.6
Lane LOS	A		B			C	D
Approach Delay (s)	0.2		1.2			22.0	25.6
Approach LOS						C	D

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

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North Central Region
Stony Plain Office

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Provincial Building
Stony Plain, Alberta
Canada T7Z 1N4

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Fax 780/963-7420

Toll-Free connection outside Edmonton – Dial 310-0000

March 8, 2007

File: 2512/SE 10-55-3-5
LSA File: 10SUB2007

Lac Ste. Anne County
Box 219, 4928 Langston Street
Sangudo, AB, T0E 2A0

Attention Geraldine Berg:

RE: Proposed Subdivision in SE 10-55-3-W5M, Adjacent to Highway 43, Lac Ste. Anne County (Revised Comments)

This will acknowledge receipt of your circulation memorandum regarding the above noted proposal, which must meet the requirements of Section 14 of the Subdivision and Development Regulation, due to the proximity of Highway 43. This proposal to create 40 additional undeveloped country residential parcels from a previously subdivided quarter sections, does not meet the requirements of Section 14 of the Regulation.

Highway 43 is being protected to a freeway standard at this location. Further to our correspondence with Bunt & Associates regarding the need to obtain a board order for the future local road crossing, the department acknowledges that this will be handled by either Lac Ste. Anne County or the department at the time of construction of the future interchange at Highway 33 and 43. It may also be required should further development pressures at the Range Road 33 intersection require closure of that intersection. Therefore, conditional on the applicant dedicating the local road system connecting his subdivision to Range Road 32 by plan of survey, the department hereby grants variance to Section 14 for this application.

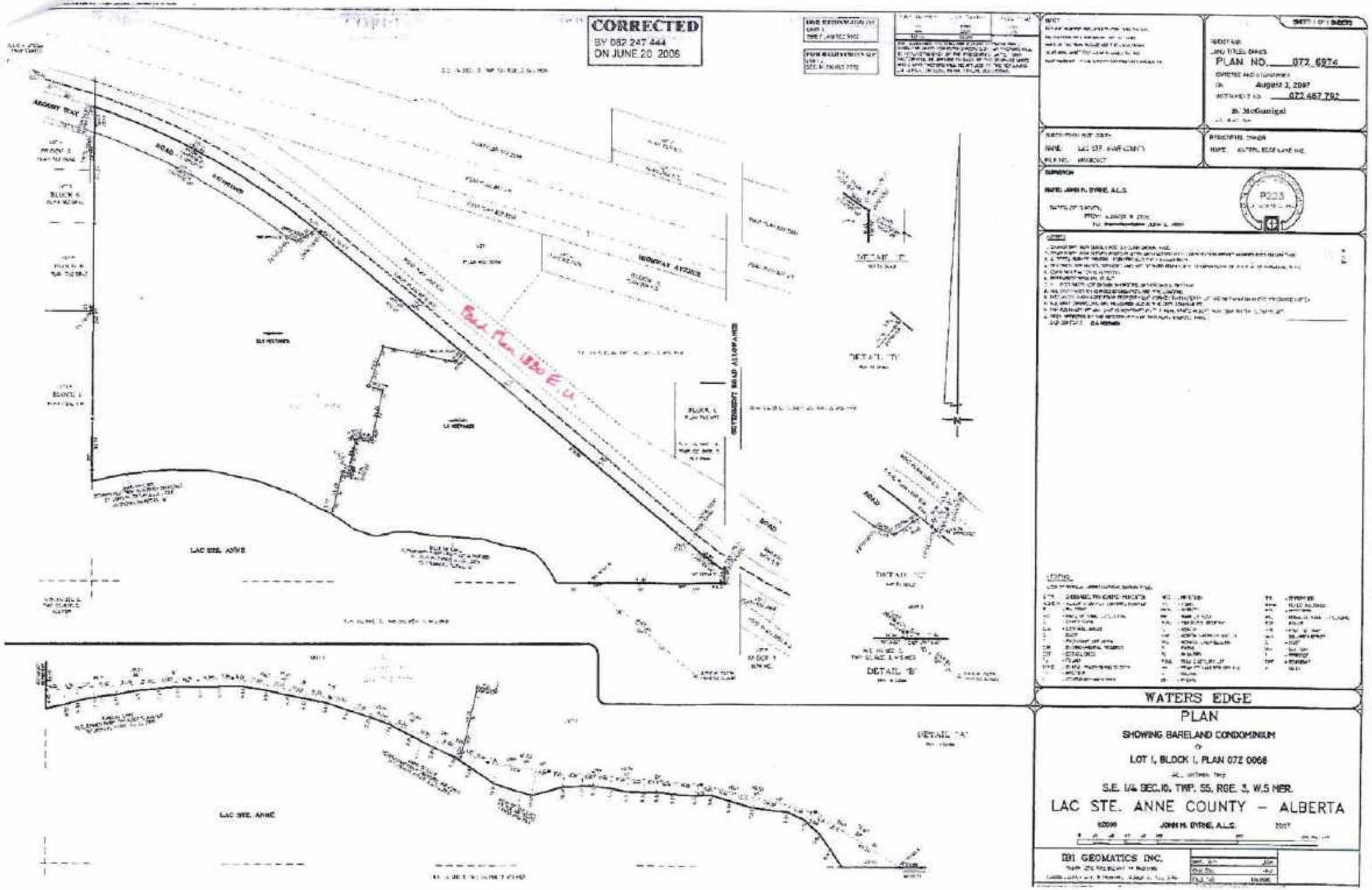
If you have any questions, please contact this office.

Yours truly,

Murray Armitage
Development and Planning Technologist

MA/

cc: Glen Tjostheim, Roadside Planning Specialist
Ray Davis, Bunt & Associates, Ste. 504, 10339 – 124 St., Edmonton, AB T5N 3W1


CORRECTED
BY 062 247 444
ON JUNE 20 2006
ROAD PLAN 982 E.U.
HIGHWAY AVENUE
RETENTION ROAD ALLOWANCE
LAC STE. ANNE
DETAIL 'A'
DETAIL 'B'
DETAIL 'C'
DETAIL 'D'
WATERS EDGE
PLAN
SHOWING BARELAND CONDOMINIUM
LOT 1, BLOCK 1, PLAN 072 0068
S.E. 1/4 SEC.10, TWP. 55, RGE. 3, W.5 MER.
LAC STE. ANNE COUNTY - ALBERTA
JOHN H. DYRE, A.L.S.
PLAN NO. 072 6974
August 3, 2007
072 487 792
B. McGonigal
P223
ISL GEOMATICS INC.

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Fax 780/963-7420
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June 18, 2009

File: 2512/SE 10-55-3-5
LSA File: 025SUB2009

Lac Ste. Anne County
Box 219, 4928 Langston Street
Sangudo, AB, T0E 2A0

ENTERED
Jun 23 2009

Attention Judy Lesko:

RE: Proposed Multi-parcel Country Residential Subdivision in SE 10-55-3-W5M, Adjacent to Highway 43, Lac Ste. Anne County

Reference your circulation regarding the above noted proposal, referred to this office in accordance with Section 5 of the Subdivision and Development Regulation, due to the proximity of Highway 43. Highway 43 is being protected to a freeway standard at this location.

This application to create 42 additional country residential parcels from a previously subdivided quarter section with no direct highway access does not meet the requirements of Section 14 of the Regulation. As the lands affected by this application are far enough removed from Highway 43, Alberta Transportation hereby grants unconditional variance to Section 14 of the Regulation. Further, the department grants variance to the distance further to Section 678 (2.1) of the Municipal Government Act and under Section 5 (5) (d) of the Subdivision and Development Regulation. As far as Alberta Transportation is concerned the appeal may be heard at the local appeal board, contingent on involvement by other provincial agencies. The department expects that the municipality will ensure that any negative impacts caused by traffic generated by this subdivision on Highway 43 intersections will be mitigated further to the Provincial Land Use Bylaws, including closure when warranted.

Should you have any questions, please contact me at 968-4217.

Yours truly,

Murray Armitage
Development and Planning Technologist

MA/

cc: Cathy Maniego, Acting Roadside Planning Specialist

REC'D - LSAC
JUN 24 2009

B U N T
& ASSOCIATES

September 26, 2005

#3054.04

Waters Edge R.V. Resort
c/o Arndt Tkalcic Architecture
10315 – 109 Street
Edmonton, AB T5J 1N3

Attn: Mr. Rick Arndt

Re: **Waters Edge R.V. Resort**
Arndt Acres Ltd.
North Shore of Lac St. Anne at Gunn, Alberta

Transportation Planners and Engineers

Bunt & Associates Engineering Ltd

Suite 706, Princeton Place
10339 - 124 Street
Edmonton, AB
T5N 3W1 Canada

Tel. 780-732-5373
Fax. 780-732-7806
Email office@buntleng.com

We have undertaken a review of the traffic generation for the addition to the existing RV Resort. The addition for the purpose of this review is envisioned to consist of approximately 80 additional sites. On this basis we offer the following information.

Site Traffic

Trip generation rates for the resort are based on ITE land use code #416 – Campground/RV Park as published in the ITE Trip Generation 7th Edition. The trips generated by the resort are estimated at 0.20 trips/occupied site in the AM peak hour and 0.37 trips/occupied site in the PM peak hour. For the purpose of the assessment it was assumed that all of the sites were occupied. In the AM peak hour the rate of 0.20 trips/occupied site identifies that approximately 20% of the sites would be generating traffic between 7:00 AM and 8:00 AM. It is assumed that only 40% of the trips generated in the AM peak hour would be inbound trips and the remaining 60% would be outbound trips.

In the PM peak hour the trip rate shows that approximately 40% of the sites were generating traffic between 4:30 PM and 5:30 PM. In the PM peak hour it was estimated that 69% of the trips generated by the campground would be inbound trips and 31% would be outbound trips.

Table 1 summarizes the AM and PM peak hour trips generated by the proposed development.

Table 1: New Site Generated Traffic

Land Use	Size	Rate	Inbound	Outbound	Total
AM Peak Hour					
Campground (416)	80 new sites	0.20 trips/site	6	10	16
PM Peak Hour					
Campground (416)	80 new sites	0.37 trips/site	21	9	30

The traffic generated by the proposed development was all assigned to Highway 43 via the Gunn access Range Road 33 (Lac Ste. Anne Trail) and assumed that the majority would be heading to the greater Edmonton area. Therefore, it is assumed that 80% of the traffic would be generated from the south and 20% would be generated from the north.

Alberta Infrastructure and Transportation Highway Volumes

A review of AIT databases identified on Highway 43 W of 33 NE of Gunn volumes of 6840 AADT in 2004 and on Highway 43 E of 33 NE of Gunn volumes of 8170 AADT. Intersection turning movement volumes were also available from AIT for the intersection of Hwy 43 & Gunn Corner ESSO.

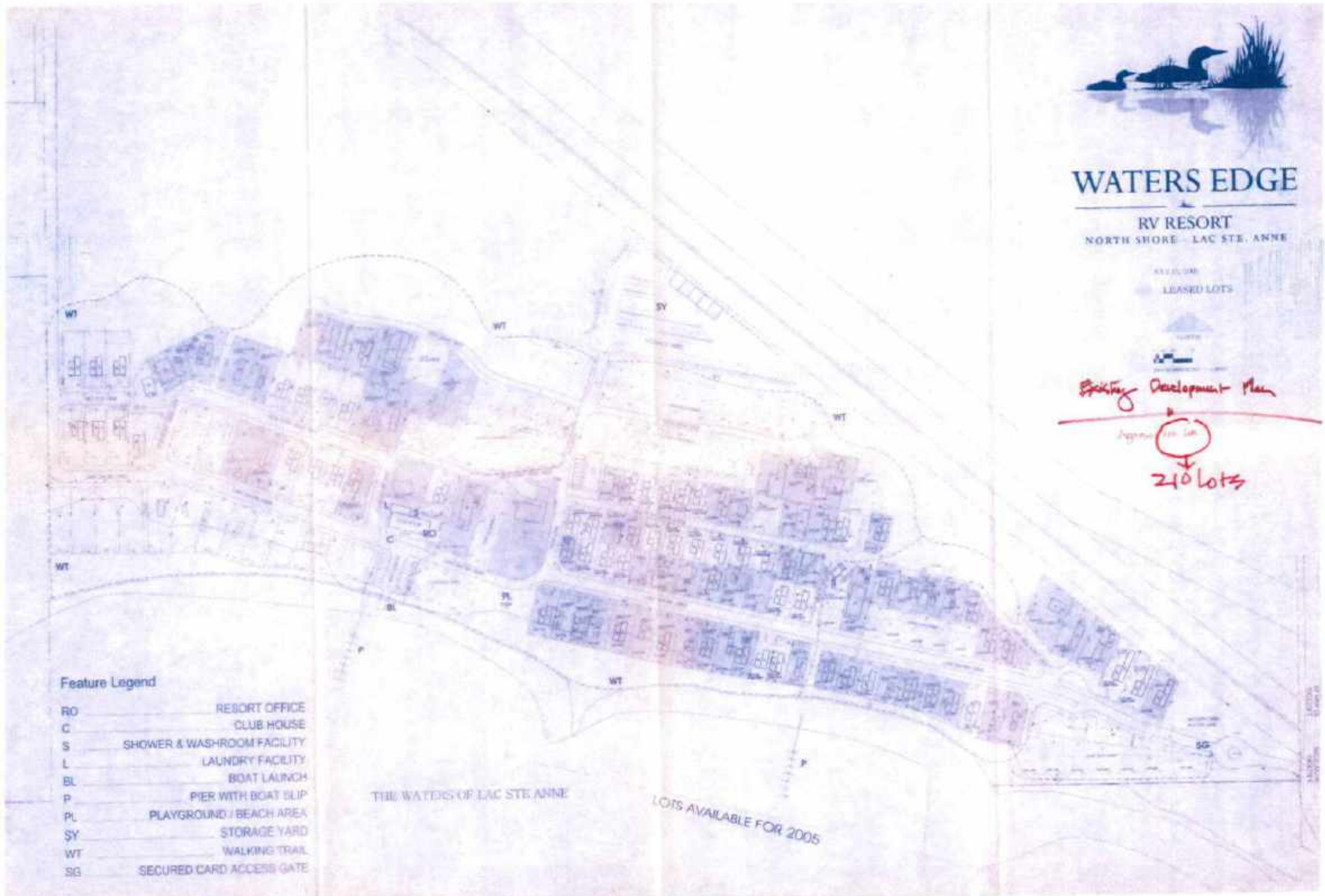
It was assumed that in conjunction with the upgrades for the North/South Trade Corridor the existing intersection of Highway 43 and the Gunn turn-off at Lac St. Anne Trail was designed to meet the Highway Geometric Design Guide. The anticipated change in volume does not change the category of geometric requirements according to Figure D-7.4 of the manual. Westbound to southbound left turns on Highway 43 increase by 5(AM) and 17(PM) vehicles in the peak hours if the new development is operating at full capacity. This being the most critical movement. Volumes for the right turn from Highway 43 is estimated at 1(AM) and 4(PM); right turn from Lac St.Anne Trail to Highway 43 is 8(AM) and 7(PM), while the left turn volumes to Hwy 43 from Lac Ste. Anne Trail is estimated at 2 for both AM and PM periods.

This preliminary review would indicate that the addition of 80 units to the Waters Edge R.V. Resort will not unduly affect the operations of the adjacent Provincial Highway 43.

We trust this provides you with the information you require for review with the County for the addition of the lots to the R.V. Resort. If you or the County have any questions please call me at 732-5373.

Sincerely
Bunt & Associates

Ray Davis
Senior Associate



WATERS EDGE

RV RESORT

NORTH SHORE - LAC STE. ANNE

LEASED LOTS

Existing Development Plan

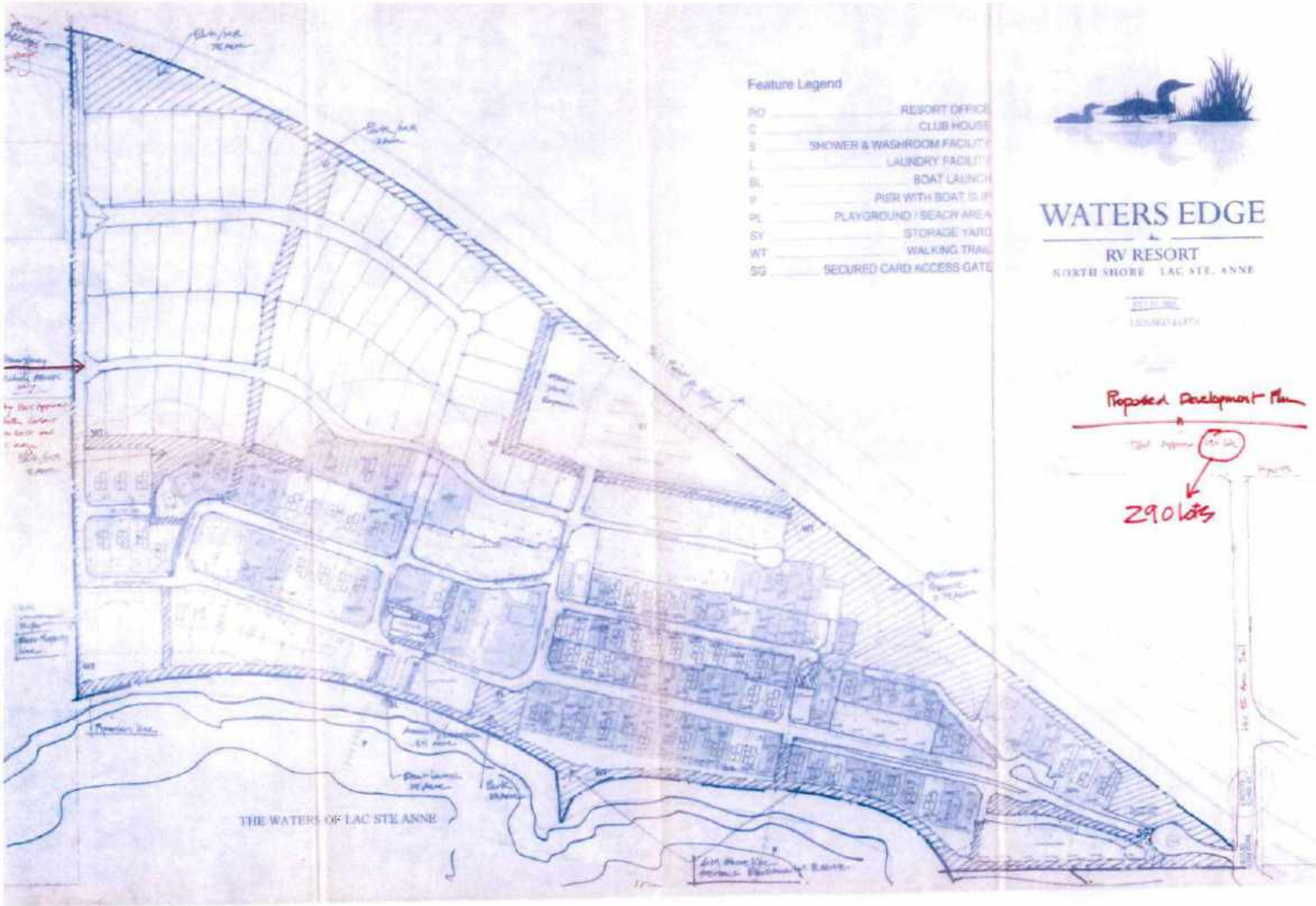
Approx. 210 Lots

Feature Legend

RO	RESORT OFFICE
C	CLUB HOUSE
S	SHOWER & WASHROOM FACILITY
L	LAUNDRY FACILITY
BL	BOAT LAUNCH
P	PIER WITH BOAT SLIP
PL	PLAYGROUND / BEACH AREA
SY	STORAGE YARD
WT	WALKING TRAIL
SG	SECURED CARD ACCESS GATE

THE WATERS OF LAC STE ANNE

LOTS AVAILABLE FOR 2005


Feature Legend
RO RESORT OFFICE
C CLUB HOUSE
S SHOWER & WASHROOM FACILITY
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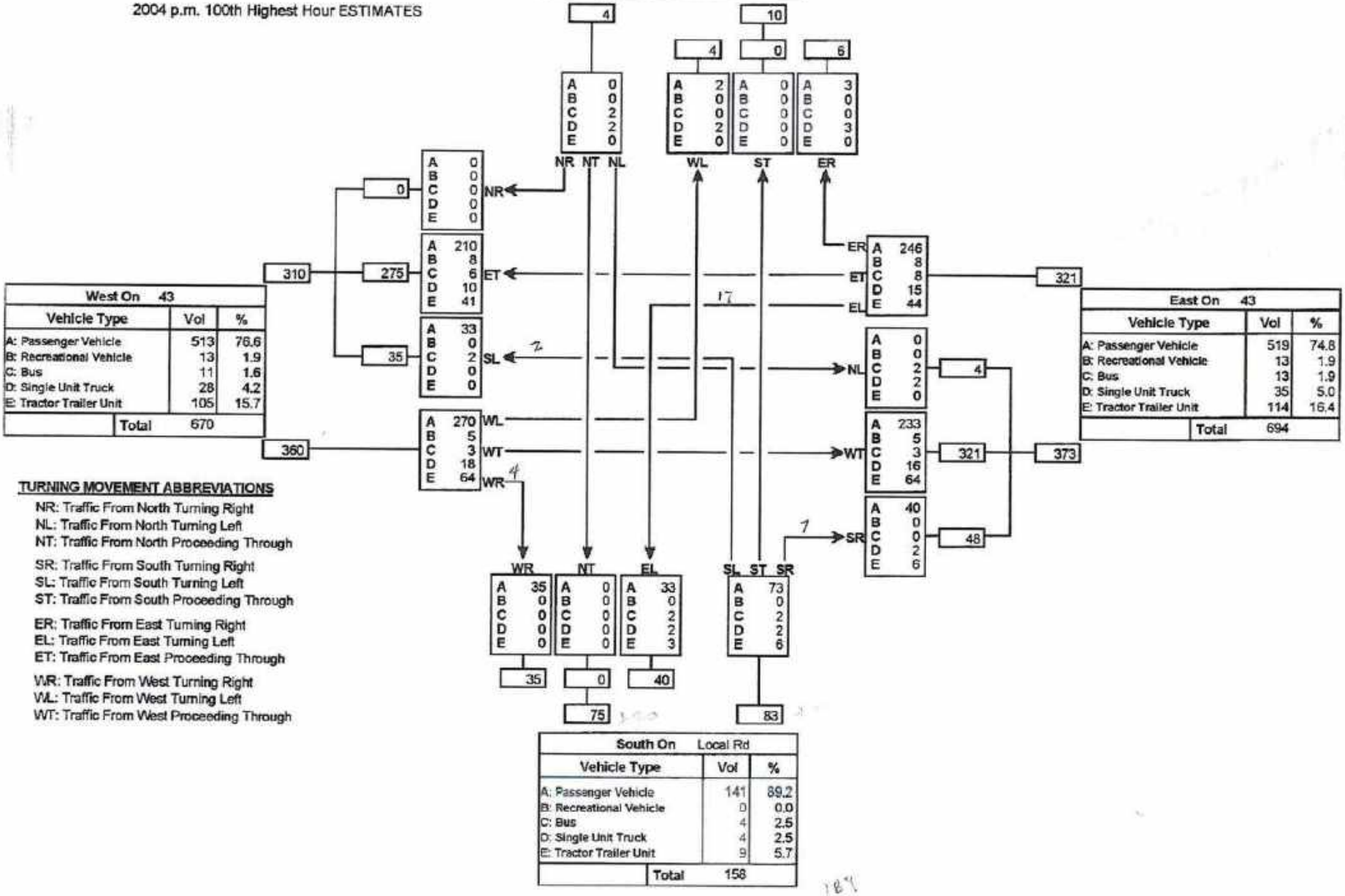
BL BOAT LAUNCH
P PIER WITH BOAT SLIP
PL PLAYGROUND / BEACH AREA
SY STORAGE YARD
WT WALKING TRAIL
SG SECURED CARD ACCESS GATE
WATERS EDGE
RV RESORT
NORTH SHORE LAC STE. ANNE
Proposed Development Plan
290 lots
THE WATERS OF LAC STE ANNE

Turning Movement Summary Diagram

Reference No.: 000440

Intersection of:
43 & GUNN CORNER ESSO 10-55-3-500001200

2004 p.m. 100th Highest Hour ESTIMATES



North On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	5	35.7
B: Recreational Vehicle	0	0.0
C: Bus	2	14.3
D: Single Unit Truck	7	50.0
E: Tractor Trailer Unit	0	0.0
Total	14	

West On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	513	76.6
B: Recreational Vehicle	13	1.9
C: Bus	11	1.6
D: Single Unit Truck	28	4.2
E: Tractor Trailer Unit	105	15.7
Total	670	

East On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	519	74.8
B: Recreational Vehicle	13	1.9
C: Bus	13	1.9
D: Single Unit Truck	35	5.0
E: Tractor Trailer Unit	114	16.4
Total	694	

South On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	141	89.2
B: Recreational Vehicle	0	0.0
C: Bus	4	2.5
D: Single Unit Truck	4	2.5
E: Tractor Trailer Unit	9	5.7
Total	158	

TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

Turning Movement Summary Diagram

Reference No.: 66548

Intersection of:

43 & OUNN CORNER ESSO 10-55-3-000001200

2004 a.m. 100th Highest Hour ESTIMATES

North On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	18	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	18	

West On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	486	74.9
B: Recreational Vehicle	34	5.2
C: Bus	4	0.6
D: Single Unit Truck	23	3.5
E: Tractor Trailer Unit	102	15.7
Total	649	

East On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	521	74.9
B: Recreational Vehicle	30	4.3
C: Bus	4	0.6
D: Single Unit Truck	29	4.2
E: Tractor Trailer Unit	112	16.1
Total	696	

South On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	149	86.1
B: Recreational Vehicle	4	2.3
C: Bus	0	0.0
D: Single Unit Truck	10	5.8
E: Tractor Trailer Unit	10	5.8
Total	173	

TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

Reference No.: 66548

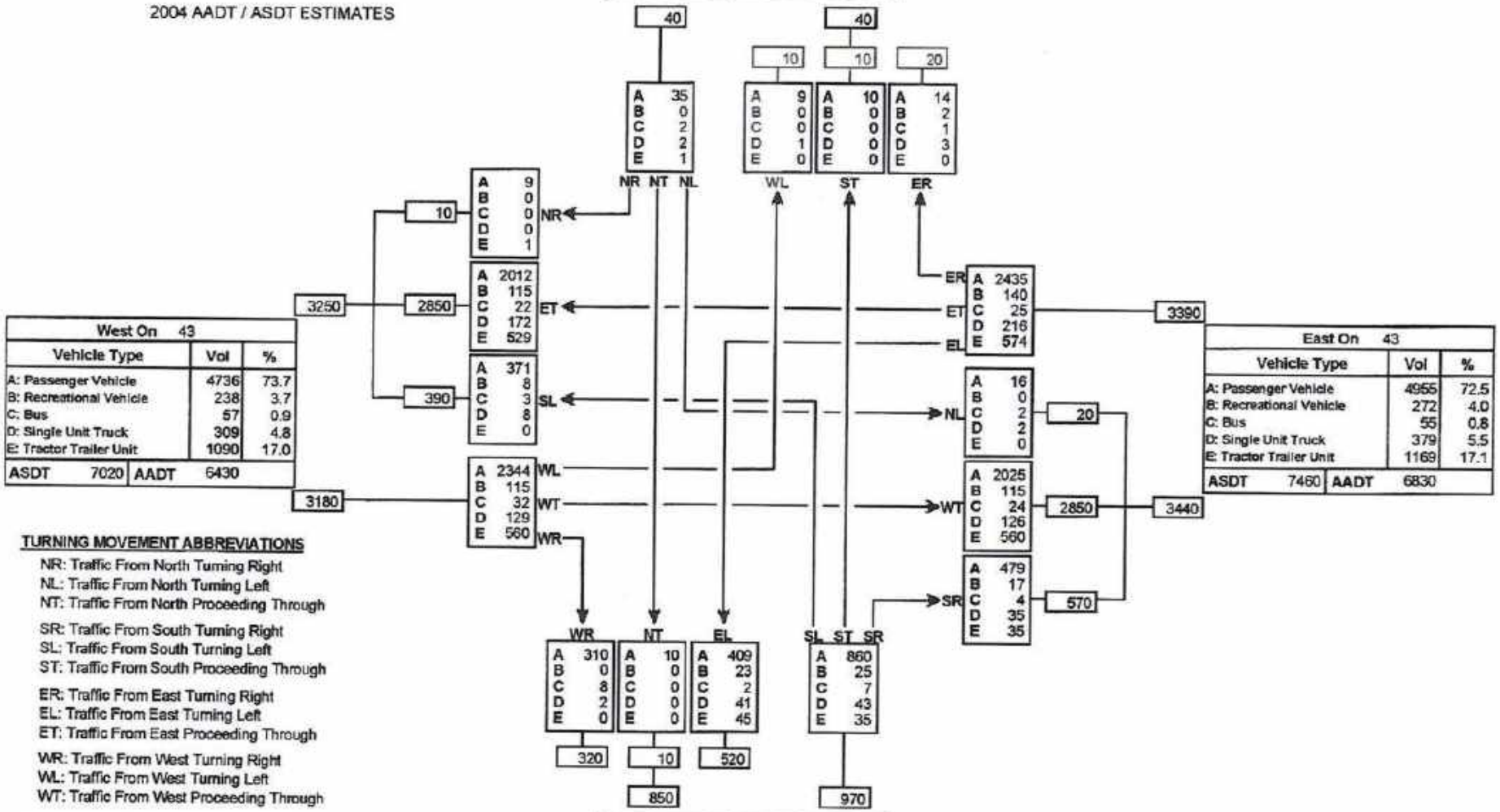
Intersection of:

43 & GUNN CORNER ESSO 10-55-3-500001200

2004 AADT / ASDT ESTIMATES

Turning Movement Summary Diagram

North On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	68	85.0
B: Recreational Vehicle	2	2.5
C: Bus	3	3.8
D: Single Unit Truck	6	7.5
E: Tractor Trailer Unit	1	1.3
ASDT 90	AADT 80	



West On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	4736	73.7
B: Recreational Vehicle	238	3.7
C: Bus	57	0.9
D: Single Unit Truck	309	4.8
E: Tractor Trailer Unit	1090	17.0
ASDT 7020	AADT 6430	

East On 43		
Vehicle Type	Vol	%
A: Passenger Vehicle	4955	72.5
B: Recreational Vehicle	272	4.0
C: Bus	55	0.8
D: Single Unit Truck	379	5.5
E: Tractor Trailer Unit	1169	17.1
ASDT 7460	AADT 6830	

South On Local Rd		
Vehicle Type	Vol	%
A: Passenger Vehicle	1589	87.3
B: Recreational Vehicle	48	2.6
C: Bus	17	0.9
D: Single Unit Truck	86	4.7
E: Tractor Trailer Unit	80	4.4
ASDT 1990	AADT 1820	

TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

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

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME HISTORY 1995 - 2004

Alberta Infrastructure and Transportation
Program Management Branch
Highway Asset Management Section

Produced: 15-Feb-2005 By CornerStone Solutions Inc.

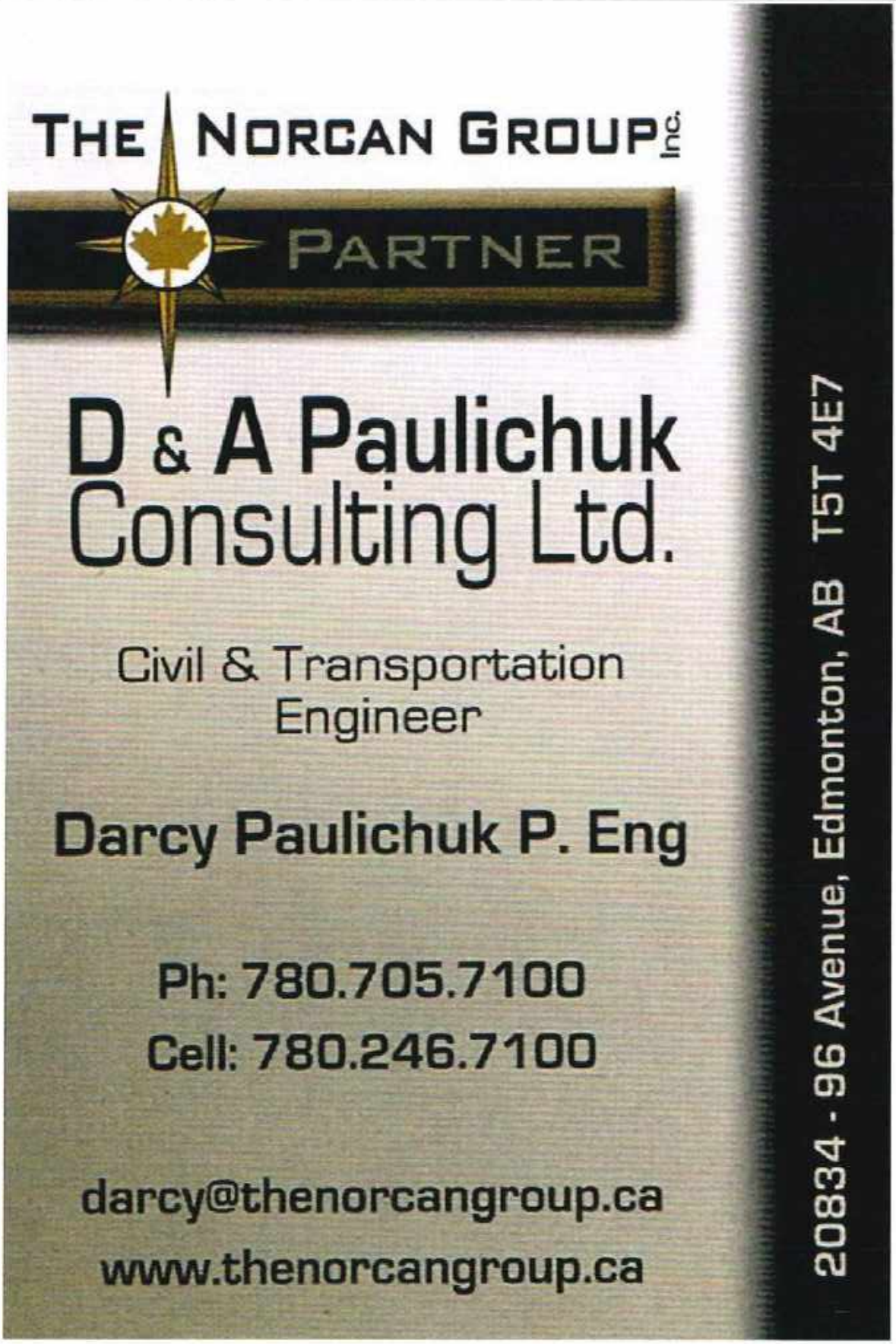
Hwy	CS	TCS	Muni	From	1995 AADT	1996 AADT	1997 AADT	1998 AADT	1999 AADT	2000 AADT	2001 AADT	2002 AADT	2003 AADT	2004 AADT	2004 ASDT
43	18	12	LSAn	E OF 757 E OF SANGUDO EJ	4470	4310	4570	4700	4740	4860	4750	4760	4930	5310	5800
43	18	12	LSAn	W OF LISBURN RD 22-56-6-500000500	4200	4080	4340	4420	4460	4580	4640	4660	4770	5130	5600
43	18	12	LSAn	E OF LISBURN RD 22-56-6-500000500	4120	4000	4260	4330	4370	4490	4550	4570	4770	5130	5600
43	18	12	LSAn	W OF 764 AT CHERHILL	4050	3810	4070	4200	4230	4340	4560	4580	4790	5150	5620
43	20	4	LSAn	E OF 764 AT CHERHILL	4370	4000	4260	4390	4420	4540	4790	4800	5020	5400	5900
43	20	4	LSAn	W OF 765 SE OF CHERHILL	4130	4010	4300	4430	4470	4590	4720	4730	4950	5330	5820
43	20	8	LSAn	E OF 765 SE OF CHERHILL	4060	3970	4240	4370	4410	4530	4630	4640	4860	5220	5700
43	20	8	LSAn	7.2 KM W OF 33 & 43 GUNN	4230	4110	4390	4530	4560	4690	4920	5030	5290	5670	6070
43	20	8	LSAn	W OF GUNN CORNER ESSO 10-55-3-500001200	4710	4570	4890	5050	5090	5420	5690	5710	5980	6430	7020
43	20	8	LSAn	E OF GUNN CORNER ESSO 10-55-3-500001200	5080	4940	5280	5450	5490	5770	6050	6070	6350	6830	7460
43	20	8	LSAn	W OF 33 NE OF GUNN	5110	4990	5330	5500	5540	5790	6070	6080	6360	6840	7470
43	22	4	LSAn	E OF 33 NE OF GUNN	6230	6110	6480	6810	6840	7080	7400	7410	7670	8170	8920
43	22	4	LSAn	W OF 37 NW OF ONOWAY	6770	6740	7150	7570	7630	7650	8010	8030	8330	8630	9420
43	22	8	LSAn	E OF 37 NW OF ONOWAY	5970	5930	6260	6580	6640	6680	6990	7100	7350	7590	8390
43	22	8	LSAn	N OF ONOWAY NORTH ACC 33-54-2-500000805	5960	5920	6250	6550	6630	6590	6890	7090	7340	7580	8370
43	22	8	LSAn	S OF ONOWAY NORTH ACC 33-54-2-500000805	6240	6200	6470	6790	6870	6870	7190	7370	7660	7920	8750
43	22	8	LSAn	N OF ONOWAY SOUTH ACC 28-54-2-500000000	6240	6200	6470	6770	6850	6870	7180	7370	7660	7920	8750
43	22	8	LSAn	S OF ONOWAY SOUTH ACC 28-54-2-500000000	7100	7050	7350	7690	7770	7820	8180	8330	8630	8910	9840
43	22	8	LSAn	N OF 633 E OF ALBERTA BEACH	6920	6880	7110	7460	7460	7680	8040	8170	8470	8740	9660
43	22	12	LSAn	S OF 633 E OF ALBERTA BEACH	7700	7650	7910	8290	8290	8530	8920	9250	9600	9910	10950
43	22	12	LSAn	0.8 KM N OF 16 & 43 CARVEL CORNER	7910	7850	8190	8580	8640	8890	9300	9590	9900	10180	11180
43	22	12	LSAn	N OF 16 AT MANLY CORNER	7910	7850	8190	8580	8640	8890	9300	9450	9800	10120	11180
44	0	4	Park	N OF 16 W OF EDMONTON	4370	4460	4840	5080	4960	5200	5760	6020	6400	6670	7610
44	0	4	Stur	S OF MEADOW VIEW DR 19-53-26-402750000			4350	4620	4570	4800	5500	5750	6220	6480	7390
44	0	4	Stur	N OF MEADOW VIEW DR 19-53-26-402750000			4010	4260	4220	4450	5100	5330	5760	6000	6840
44	0	4	Stur	3.4 KM S OF 44 & 633 VILLENUEVE	3670	3730	4050				5070	5410	5800	6040	6810
44	0	4	Stur	S OF TWP RD 540 31-53-26-400000000			4100	4350	4310	4550	5080	5310	5740	5980	6820
44	0	4	Stur	N OF TWP RD 540 31-53-26-400000000			4070	4330	4270	4510	5050	5280	5700	5940	6780
44	0	4	Stur	S OF 633 E OF VILLENEUVE			3990	4250	4240	4480	4810	5020	5400	5640	6430
44	0	8	Stur	N OF 633 E OF VILLENEUVE			4030	4290	3850	4090	4380	4570	4840	5040	5750
44	0	8	Stur	S OF 37 N OF VILLENEUVE	3400	3160	3450	3520	3620	3920	4030	4210	4510	4700	5360
44	0	12	Stur	N OF 37 N OF VILLENEUVE	3120	2890	3100	3150	3230	3500	3620	3660	3870	4040	4420
44	0	12	Stur	S OF 642 W OF MORINVILLE			2590	2710	2610	2790	2830	2860	3100	3250	3560
44	0	16	Stur	N OF 642 W OF MORINVILLE			2470	2570	2540	2720	2760	2790	2960	3090	3380
44	0	16	Stur	S OF TWP RD 570 31-56-26-400000000			2260	2330	2320	2450	2470	2500	2640	2750	3010
44	0	16	Stur	N OF TWP RD 570 31-56-26-400000000			2130	2200	2180	2310	2290	2320	2460	2570	2810
44	0	16	Stur	S OF 651 E OF BUSBY			2230	2310	2050	2160	2180	2200	2630	2750	3010
44	0	20	Stur	N OF 651 E OF BUSBY			2270	2370	2120	2230	2250	2270	2640	2750	3010
44	0	20	Wstl	S OF TWP RD 590 31-58-26-400000000			2470	2570	2560	2690	2800	2840	2970	3100	3390
44	0	20	Wstl	N OF TWP RD 590 31-58-26-400000000			2510	2610	2600	2730	2850	2890	3020	3150	3450
44	0	20	Wstl	2.6 KM S OF 18 & 44 WESTLOCK	2570	2800	2890	3010	3000	3100	3280	3360	3530	3640	3970

D&A PAULICHUK CONSULTING LTD.

DARCY PAULICHUK, P. ENG.
Senior Project Engineer

darcy.paulichuk@shaw.ca
Phone: (780) 705-7100
Cell: (780) 246-7100

20834 - 96A Avenue
Edmonton, AB
T5T 4E7


THE NORCAN GROUP Inc.
PARTNER
D & A Paulichuk
Consulting Ltd.
Civil & Transportation
Engineer
Darcy Paulichuk P. Eng
Ph: 780.705.7100
Cell: 780.246.7100
darcy@thenorcangroup.ca
www.thenorcangroup.ca
20834 - 96 Avenue, Edmonton, AB T5T 4E7

Waters Edge Resort Area Structure Plan
North Shore Lac Ste. Anne at Gunn, Alberta

Appendix 3
On-Site Assessment and Feasibility Study
For On-Site Waste Water Treatment System

Waters Edge Resort Area Structure Plan
North Shore Lac Ste. Anne at Gunn, Alberta

Appendix 3
On-Site Assessment and Feasibility Study
For On-Site Waste Water Treatment System

Water's Edge Resort Incorporated

SITE ASSESSMENT AND FEASIBILITY STUDY FOR ON-SITE WASTEWATER TREATMENT SYSTEM WATER'S EDGE RESORT, GUNN, ALBERTA

5101408

January 2006

EBA Engineering Consultants Ltd.
p. 780.451.2121 • f. 780.454.5688
14940 - 123 Avenue • Edmonton, Alberta T5V 1B4 • CANADA

EXECUTIVE SUMMARY

Foreword

This site assessment and feasibility study for an on-site wastewater treatment system (OWTS) was completed by EBA Engineering Consultants Ltd. (EBA) at the request of Mr. Rick Arndt of Water's Edge Resort Incorporated. The subject site is composed of Phases 1 to 3 of the re-development at Water's Edge Resort. The proposed development consists of 100 lots, all of which will be upscale, environmentally conscious cabins. Water's Edge Resort is located on the shores of Lac Ste. Anne at Gunn, Alberta at SE-10-055-03 W5M, in Lac Ste. Anne County. Water and wastewater services to these units will be communal and a low-pressure system is the proposed method of wastewater effluent collection to a central location. The proposed location of the final treatment component meets or exceeds the requirements for clearance from property lines, water sources, water courses, basements, cellars or crawl spaces, buildings, permanent waterbodies. There were no water wells identified within the required setback distances from any of the proposed OWTS components.

Conclusions and Recommendations

The site assessment indicates that the soil, groundwater, vegetation, and landscape conditions in the area of the proposed final treatment system are very conducive to a successful OWTS. A shallow bury trench style septic field is well suited for the soils and constraints presented by this site. The most appropriate loading rate for a shallow bury trench system at this site is 0.56 gallons/sq. ft./day. There is enough suitable land available to accommodate a shallow bury trench system for 42,872 gallons/day at a loading rate 0.56 gallons/sq. ft./day if secondary treatment and pressure distribution are used.

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1.0 INTRODUCTION

This site assessment and feasibility study for on-site wastewater treatment system (OWTS) for Water's Edge Resort Incorporated, located on the shores of Lac Ste. Anne at Gunn, Alberta, was completed by EBA Engineering Consultants Ltd. (EBA) at the request of Mr. Rick Arndt of Water's Edge Resort Incorporated in accordance with EBA's standard terms and conditions (see Appendix A).

2.0 BACKGROUND

The subject site is composed of Phases 1 to 3 of the re-development at Water's Edge Resort. The proposed development consists of 100 lots, all of which will be upscale, environmentally conscious cabins. Water and wastewater services to these units will be communal and a low-pressure system is the proposed method of wastewater effluent collection to a central location for either: (a) secondary treatment and subsurface dispersal; or (b) collection by vacuum truck and transport to the municipal lagoon. Water's Edge Resort is located on the shores of Lac Ste. Anne near Gunn, Alberta in SE-10-055-03 W5M, in Lac Ste. Anne County. The subject site is bordered to the north and east by the railway and to the south by Lac Ste. Anne. Hayfields and stands of aspen and balsam poplar lie west of the subject site. The potential treatment system area is currently undeveloped with balsam poplar, aspen and birch forested areas and native grass areas where the forest was previously cleared. The subject site is accessed via paved driveway off Range Road 33 (Lac St. Anne Trail), which borders the southeastern tip of the property.

3.0 SCOPE OF WORK

The scope of work was presented in a work plan dated October 27, 2005 to Mr. Rick Arndt (EBA File: P5100710). This site assessment for OWTS feasibility incorporates assessment of soil, groundwater, vegetation and landscape to make recommendations for suitability for shallow bury trench OWTS.

4.0 SAFETY

Standard personal protective equipment (hard hat, reflective vest, steel-toed boots) was worn by EBA personnel while on site. For personal protection, nitrile gloves were worn when handling soil and groundwater. EBA personnel had appropriate safety certification and documentation (Ground Disturbance Level II, Transportation of Dangerous Goods, Workplace Hazardous Material Information System and Standard Level First Aid). Alberta One-Call and line locates were completed by the client prior to EBA's representative arriving on site. Mr Cam Mathewson of Water's Edge Resort was present during the assessment and approved the location of each borehole for ground disturbance purposes.

5.0 METHODS

Aerial photographs were reviewed to identify historical vegetation types and areas that experience historical or seasonal flooding or high water table. Historical development was also reviewed for its potential impact on site suitability of OWTS.

Soil maps and classification for the area were reviewed to identify potential areas of suitability and unsuitability for OWTS and provide direction for the field assessment. Watershed information was reviewed to determine distances to surface waterbodies to ensure proper sighting of the OWTS. Nearby water wells were identified, particularly shallow wells that may be impacted by failed OWTS systems.

An interview with client representatives was conducted, providing information on the size and type of buildings, number of occupants, appliances and plans for future development that would affect the OWTS.

A truck-mounted drill rig was used for the site investigation. A Shelby tube was used to investigate the first 1.50 m, after which a solid stem auger was used. Soil boreholes were located in the proposed location of the OWTS final treatment component as determined by EBA and the client after reviewing all available locations.

Five boreholes were completed for soil assessment purposes in the proposed OWTS final treatment component, as shown in Figures 1 and 2. Three of these boreholes were developed into monitoring wells. Ms. Stephanie Morin of EBA and Mr. Rick Arndt of Water's Edge Resort identified the proposed OWTS final treatment area during their meeting on October 21, 2005.

The Canadian System of Soil Classification[1] was used to describe the soil profile with additional comments on limiting layers, permeable layers and seasonally saturated soil. Soil samples were collected for laboratory analysis based on location, depth, and field observations. Soil data was interpreted with respect to OWTS. Samples collected for analysis were placed in plastic bags and transported to Norwest Labs in Edmonton where the samples were analyzed to determine the soil texture to determine appropriate loading rates.

Soil samples were collected from the treatment area and down slope of the treatment area and analysed for soil salinity and nutrients. This analysis was used to assess the current soil condition and provide baseline data for future assessment, allowing Water's Edge Resort to determine if they are having an impact on the soil over time.

Seven monitoring wells were installed by EBA to assess groundwater depth, direction and rate of flow within Water's Edge Resort (see Figure 1). Three wells were installed within the proposed dispersal field area and four wells were installed downgradient of the dispersal

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1 Agriculture Canada Expert Committee on Soil Survey. 1987. The Canadian System of Soil Classification. 2nd ed. Agric. Can. Publ. 1646. 164 pp.

field in the resort area. Standard two-inch wells were installed with lock-boxes to protect the wells and prevent tampering. Keys for the lock boxes were provided to Mr. Cam Mathewson.

Two wells within the dispersal field (MW01 and MW02) and one downgradient (MW09) were sampled for routine water analysis, biological oxygen demand (BOD), total suspended solids (TSS), total and fecal coliforms, ammonia, total Kjeldahl nitrogen and total phosphorous. The data was used to assess the current groundwater condition and to provide baseline data for future assessment, allowing Water's Edge Resort to determine if they are having an impact on the groundwater over time.

Four wells (MW01, MW02, MW04 and MW09) were tested for hydraulic conductivity (speed of water movement) using a slug test. Water levels were measured in all seven wells installed by EBA and three well installed by others (MWX-01, MWX-02, MWX-03) to determine depth to groundwater and groundwater flow direction.

Vegetation was assessed and mapped in order to identify areas of poor drainage, seasonally saturated soils, high groundwater table and periodic flooding. Vegetation was also used to identify areas of good drainage.

Site topography and landscape features were assessed and mapped, including those features that are particularly important for OWTS sighting such as surface drainage, unstable slopes and areas that are prone to erosion.

6.0 SUBJECT SITE DESCRIPTION

6.1 HISTORICAL DEVELOPMENT

Aerial photographs from 1969, 1971, 1978 and 1992 were reviewed to determine any historical development or flooding within the proposed location of the final treatment system. The area around the proposed location for the final treatment system was cleared prior to 1969 and has been kept clear throughout the years by cattle grazing. There has been no further development of the area. The area of the proposed treatment system is on high ground, with no historical evidence of flooding or surface water ponding.

6.2 SURFACE WATER AND DRAINAGE

The subject site is shown in Figure 1 and the proposed location for the OWTS is shown in a detailed site plan in Figure 2. Lac Ste. Anne is 250 m south of the proposed final treatment component. There is an unnamed creek in the Corsair Cove Subdivision that runs into Lac Ste. Anne from the north. This creek lies 245 m west of the proposed final treatment component. A dry, low-lying area (that may serve as a drainage channel in the spring), which does not connect to the lake or creek, lies 50 m west of the proposed final treatment component. The elevation of the proposed location of the OWTS final treatment component is 9.5 m above Lac Ste. Anne. All permanent waterbodies are more than 100 m away from the proposed location of the OWTS final treatment component as

required by the Standard of Practice[4]. As the OWTS final treatment component is situated on high ground more than 245 m from a waterbody, it is unlikely that the OWTS final treatment component would be impacted by rising water levels in Lac Ste. Anne or the unnamed creek.

6.3 DENSITY

Lac Ste. Anne lies to the south. To the north and northwest there is approximately one home per quarter section, each having an OWTS and water well. To the west, the subdivision of Corsair Cove (SE 10-055-03 W5M) is adjacent to Water's Edge Resort. The subdivision currently has approximately 83 lots, not all currently have homes. The subdivision of Hansen and Moyer Beach lies to the southeast (NW 02-055-03 W5M). The subdivision currently has eight lots, not all currently have homes. To the east lies the Village of Gunn. There are 14 lots in Gunn, not all currently have homes. Although not all of the lots in the surrounding subdivisions are currently occupied, it is reasonable to expect that all the lots will eventually have homes, each with an OWTS and water well.

Suitability: Water's Edge Resort is located in a high density development area and a secondary treatment system with appropriate and integrated safety factors should be incorporated in the OWTS design to safeguard groundwater supplies in the area.

6.4 VEGETATION

The area where the proposed final treatment component is located is in a natural area along the northern edge of the property bordered by the railway to the north and a treed area to the east and west, as shown in Figure 2. The trees are a mixture of aspen, birch and balsam poplar with understory vegetation consisting of grasses, rose, and buckbrush. This vegetation indicates well-drained site conditions throughout the year.

6.5 TOPOGRAPHY

The area is undulating with gentle slopes, generally less than 20%. Surface drainage is north towards the railway. The area of lower elevation near the northern property line (next to the railway) is dry at the surface, with drainage to both the east and west (on property). The proposed location of the final treatment component is situated within the gently sloping landscape near the maximum elevation of the subject site. The proposed location of the final treatment component does not have surface drainage limitations and has a low risk of erosion.

6.6 ENCUMBRANCES

The proposed location of the final treatment component, as shown in Figure 2, meets or exceeds the requirements for clearance from property lines, water sources, water courses, basements, cellars or crawl spaces, buildings, permanent waterbodies.

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[4] Alberta Private Sewage Systems Standard of Practice. 1999 Handbook. 1st Edition. July 2000.

6.7 RECONNAISSANCE GROUNDWATER

Based on a review of hydrogeological maps, regional groundwater flow is inferred to be north-northeast towards the Pembina River[2] (24 km away). EBA completed a desktop investigation of the number and location of water wells and identified 88 water wells within one kilometre of the subject site. The depth of the water wells ranged from 4.5 to 91 metres. Although static water level was not reported for all wells, of those reported, the depth of the static water level ranged from 11 to 35 metres below ground surface. Eighty-five wells were for domestic use with one well each for industrial, stock watering or unknown use, respectively. The relatively shallow depth from which some of these wells are collecting water indicates that there is a possibility that these shallow wells are accessing groundwater under the direct influence of surface water. There were no wells identified within the Alberta Standard of Practice required setback distances from any of the proposed OWTS components.

6.8 GROUNDWATER ON SITE

Site features and monitoring well locations are shown in Figures 1 and 2. Groundwater contours have been plotted in Figure 3. Borehole logs with monitoring well installation details are provided in Appendix B. Groundwater elevations are summarized in Table 1. Laboratory results are summarized in Table 2 and original laboratory data is provided in Appendix C. Slug test results are summarized in Table 3 and provided in detail in Appendix D.

6.8.1 Groundwater Flow Direction and Elevation

MW01 is located in the northwest corner of the subject site, in the additional final treatment area (see Figure 2) for the OWTS final treatment component. The soil was a moderately well-drained Dark Grey Luvisol developed in moderately fine till. Weak gleying was encountered at a depth of 2.0 m. Strong gleying was encountered at 4.0 m. Bedrock was not encountered. Groundwater was located at a depth of 3.888 m below ground level on November 16, 2005.

MW02 is located in the northern portion of Water's Edge property, immediately west of the proposed location for the OWTS final treatment component. The soil was a moderately well-drained Dark Grey Luvisol developed in moderately fine till. Weak gleying was encountered at a depth of 1.0 m. Bedrock was not encountered. Groundwater was located at a depth of 2.346 m below ground level on November 16, 2005. The high seasonal groundwater table (indicated by gleyed soils at a depth of 1.0 m) makes this location unsuitable for subsurface OWTS.

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[2] G.F. Ozoray. 1972. Hydrogeological Map Wabamun Lake Alberta NTS 83G. Research Council of Alberta, Edmonton, Alberta, Canada.

MW04 is located in the northern portion of Water's Edge property, within the proposed location for the OWTS final treatment component. The soil was a moderately well-drained Dark Grey Luvisol developed in moderately fine till. Weak gleying was encountered at a depth of 4.5 m. Bedrock was not encountered. Groundwater was located at a depth of 4.665 m below ground level on November 16, 2005.

MW06 is located within the proposed Phase 1 of development for Water's Edge Resort. The soil was disturbed fill over undisturbed moderately fine till. Free water and saturated soils were encountered at 4.0 m. Strong gleying was encountered at a depth of 4.2 m. Bedrock was not encountered. Groundwater was located at a depth of 3.035 m below ground level on November 16, 2005.

MW07 is located within the proposed Phase 2 of development for Water's Edge Resort. The soil was a moderately well-drained Dark Grey Luvisol developed in moderately fine till. Weak gleying was encountered at a depth of 1.5 m. Strong gleying was encountered at a depth of 3.0 m. Bedrock was not encountered. Groundwater was located at a depth of 1.562 m below ground level on November 16, 2005.

MW08 is located within the existing development in the eastern half of Water's Edge Resort. The soil was a poorly-drained Orthic Humic Gleysol developed in moderately fine till. Weak gleying was encountered at a depth of 0.3 m. Strong gleying was encountered at a depth of 0.6 m. Free water and saturated soils were encountered at 3.2 m. Bedrock was not encountered. Groundwater was located at a depth of 0.883 m below ground level on November 16, 2005.

MW09 is located within the proposed Phase 2 of development for Water's Edge Resort. The soil was a moderately well-drained Dark Grey Luvisol developed in moderately fine till. Strong gleying was encountered at a depth of 3.0 m. Bedrock was not encountered. Groundwater was located at a depth of 3.609 m below ground level on November 16, 2005.

Based on the data collected, local groundwater within Water's Edge Resort is flowing southwest, towards Lac Ste. Anne. Groundwater contours and flow direction are illustrated in Figure 3.

Suitability: MW04 is best suited to OWTS, as there is no indication of the seasonal groundwater table to a depth of 4.5 m. The area around MW01 is also suitable for shallow bury trench OWTS. MW02 is unsuitable for subsurface final treatment systems due to the presence of the seasonal groundwater table at 1.0 m.

TABLE 1: GROUNDWATER ELEVATION - NOVEMBER 16, 2005		
Location	Elevation (m) **	Water Elevation (m) ** November 16, 2005
MW01	734.97	731.082
MW02	732.86	730.514
MW04	736.62	731.955
MW06	726.66	723.625
MW07	727.44	725.878
MW08	725.86	724.977
MW09	731.51	727.901
MWX-01	729.61	729.172
MWX-02	729.60	728.297
MWX-03	729.24	728.082
Lac Ste. Anne	722.4	722.4
** Elevations are in metres above sea level		

6.8.2 Groundwater Chemistry

Water samples were collected on November 16, 2005 for laboratory analysis. All samples were handled using nitrile gloves, sealed, labelled, and documented on a chain-of-custody form. The samples were delivered to Norwest Laboratories (NWL) in a cooler with ice on November 17, 2005. Details of analytical methods used are provided by NWL with the laboratory results.

Samples were collected to provide baseline data for comparison with future analysis after the new OWTS begins operating. Results are compared to the Potable Water Guidelines, which have both aesthetic and pass/fail criteria. MW01 and MW02 fail the Potable Water Guidelines for Total Coliforms, with coliform levels at 100 CFU/100 mL and 2 CFU/100 mL, respectively. Both wells pass for Fecal Coliforms. However, both MW01 and MW02 are within the Recreational Water Quality Guidelines for both Total and Fecal Coliforms. The Recreational Water Quality Guidelines would apply to the waters of Lac Ste. Anne. Total Coliforms are naturally present in the soil and are not an indication of impacts from animal or human sources. It should be noted that only Fecal Coliforms are considered indicative of impacts from human sources (i.e., failed septic systems). All other samples meet pass/fail criteria.

Monitoring wells should be monitored bi-annually, in the spring and fall, once the system is operational to determine if groundwater chemistry is being affected by the operation of the OWTS. However, if the system is installed, operated, and maintained in accordance with

the engineered design, the risk of the OWTS impacting groundwater and Lac Ste. Anne is minimal.

TABLE 2: GROUNDWATER LABORATORY ANALYSIS RESULTS - NOVEMBER 16, 2005

Parameter	Units	MW01	MW02	MW09	Recreational Water Quality Guideline[6]	Potable Water Guideline [λ]
Nutrients						
Ammonium-N	mg/L	0.14	<0.05	0.16	-	N/A
Total Kjeldahl Nitrogen	mg/L	0.82	1.11	0.72	-	N/A
Nitrate-N	mg/L	0.08	0.03	0.03	-	10 Pass
Nitrite-N	mg/L	0.008	<0.005	<0.005	-	1 Pass
Nitrate+Nitrite-N	mg/L	0.09	0.03	0.03	-	10 Pass
Sulfate (SO4)	mg/L	56.7	38.3	28	-	500 Aesthetic
Phosphorus, Total	mg/L	0.4	0.5	0.1	-	N/A
Microbiological Analysis						
Total Coliforms	CFU/100 mL	100	2	<1	1000	<1 Pass
Fecal Coliforms	CFU/100 mL	<1	<1	<1	200	<1 Pass
Physical and Aggregate Properties						
Colour	Colour Units	-	-	-	-	15 Aesthetic
Turbidity	NTU	-	-	-	-	5 Aesthetic
Total Suspended Solids	mg/L	-	-	-	-	N/A
Aggregate Organic Constituents						
BOD	mg/L	<4	<4	<4	-	N/A

[6] Alberta Environment. 1999. Surface Water Quality Guidelines for Use in Alberta.

[λ] Canadian Council of Ministers of the Environment (CCME). 2003. Canadian Environmental Quality Guidelines: 2003 Update, Summary Table (for drinking water quality guidelines). Website: http://www.ccme.ca/assets/pdf/e1_162.pdf.

TABLE 2: GROUNDWATER LABORATORY ANALYSIS RESULTS - NOVEMBER 16, 2005						
Parameter	Units	MW01	MW02	MW09	Recreational Water Quality Guideline[δ]	Potable Water Guideline [λ]
Routine						
pH	pH	7.59	7.48	7.55	5.0 – 9.0	6.5 - 8.5 Normal
Conductivity (EC)	uS/cm	882	1180	1060	-	N/A
Calcium (Ca)	mg/L	130	164	146	-	N/A
Magnesium (Mg)	mg/L	32.4	45.8	45.4	-	N/A
Sodium (Na)	mg/L	14.5	9.3	12.4	-	200 Aesthetic
Potassium (K)	mg/L	4.9	2.2	4.1	-	N/A
Iron (Fe)	mg/L	<0.01	0.02	<0.01	-	0.3 Aesthetic
Manganese (Mg)	mg/L	0.062	0.265	0.662	-	0.05 Aesthetic
Chloride (Cl)	mg/L	6.2	99.6	25.2		250 Pass
Fluoride	mg/L	-	-	-		1.5 Pass
Hydroxide	mg/L	<5	<5	<5		N/A
Carbonate (CO3)	mg/L	<6	<6	<6		N/A
Bicarbonate	mg/L	536	568	670		N/A
P-Alkalinity (as CaCO3)	mg/L	<5	<5	<5		N/A
T-Alkalinity (as CaCO3)	mg/L	440	466	549		N/A
Total Dissolved Solids	mg/L	508	639	591		500 Aesthetic
Hardness (as CaCO3)	mg/L	458	598	551		N/A
Ionic Balance	%	98	96	95		N/A

Suitability: The groundwater chemistry is suitable for OWTS. However, groundwater chemistry should be monitored bi-annually to ensure that the groundwater is not being impacted by OWTS operation.

6.8.3 Slug Tests

Falling head slug tests were conducted on MW01, MW02, MW04 and MW09 on November 16, 2005. Field measurements for the slug tests are presented in Table 3. The data (Table 3) and analysis (Appendix D) of the slug test results indicates that the groundwater is moving very slowly (3.43×10^{-4} m/s to 1.55×10^{-7} m/s).

TABLE 3: FIELD MEASUREMENTS FOR SLUG TEST RESULTS - NOVEMBER 16, 2005

MW01		MW02		MW04		MW09	
Time (min)	Water Level (m)	Time (min)	Water Level (m)	Time (min)	Water Level (m)	Time (min)	Water Level (m)
0.0	4.540	0.0	3.038	0.0	5.174	0.0	4.221
0.5	4.540	0.5	3.051	0.5	5.168	0.5	4.224
1.0	4.540	1.0	3.062	1.0	5.164	1.0	4.225
1.5	4.540	1.5	3.065	1.5	5.163	1.5	4.229
2.0	4.540	2.0	3.074	2.0	5.163	2.0	4.231
3.0	4.540	3.0	3.084	3.0	5.162	3.0	4.233
4.0	4.540	4.0	3.094	4.0	5.164	4.0	4.233
5.0	4.541	5.0	3.098	5.0	5.165	5.0	4.235
6.0	4.541	6.0	3.101	6.0	5.165	6.0	4.236
7.0	4.541	7.0	3.104	7.0	5.165	7.0	4.239
8.0	4.542	8.0	3.109	8.0	5.168	8.0	4.241
9.0	4.542	9.0	3.111	9.0	5.170	9.0	4.242
10.0	4.542	10.0	3.114	10.0	5.170	10.0	4.243
15.0	4.542	15.0	3.124	15.0	5.172	15.0	4.248
20.0	4.543	20.0	3.133	20.0	5.174	20.0	4.254
25.0	4.543	25.0	3.138	25.0	5.174	25.0	4.256

TABLE 4: ANALYSIS RESULTS FOR SLUG TESTS

Method	MW01	MW02	MW04	MW09
Hvorslev	3.53×10^{-9} m/s	1.77×10^{-7} m/s	1.08×10^{-8} m/s	3.94×10^{-8} m/s
Bouwer & Rice	3.43×10^{-9} m/s	1.55×10^{-7} m/s	1.06×10^{-8} m/s	3.83×10^{-8} m/s

Using the most conservative conductivity value (MW02 Bower & Rice analysis method = 1.55×10^{-7} m/s), and assuming saturated soil conditions (i.e., greatest head difference between the infiltration area and the lake of 10.46 m), the seepage velocity would be 0.1 cm per day. At a distance of 250 m, it would take approximately 500 years for water to move through the groundwater from the depth of the water table in the treatment area to reach

the lake. This is a worst-case scenario as this time frame is for water moving through the water table. Effluent applied to the treatment area must first migrate down though 3.888 m (using MW01 as a conservative reference point) of soil to reach the water table. Calculations are included in Appendix D for reference.

Application of wastewater to the soil will eventually create some amount of groundwater mounding. A properly designed and well-managed system will have less mounding than an overloaded and poorly maintained systems, but all systems have mounding. Mounding increases head and seepage velocity and will decrease the time required for groundwater to reach Lac Ste. Anne.

The minimum time for water to move from the final treatment area to the lake is approximately 500 years based on the pore water velocity. Even conservative solutes, such as Cl, have been shown to move at rates slower than pore water velocity[3]. Potential contaminants (nitrates, phosphates and biological contaminants) from the infiltration area will likely move at slower rates than average pore water velocity and take longer than 500 years to reach the lake. Nitrates from the effluent, for instance, would act as a conservative solute. Phosphorus will likely be absorbed and take much longer to reach the lake.

Suitability: The rate of groundwater flow is suitable for successful OWTS, as it will take approximately 500 years for groundwater to move from the final treatment area to the lake.

6.9 RECONNAISSANCE SOILS DATA

The subject site is located in the Dark Grey to Grey Soil Zone of Central Alberta (Soil Correlation Area 11) in the Low Boreal Mixedwood Ecoregion[4]. The area has an agroclimate rating of 2H to 3H (slight to moderate heat limitation) and receives average annual precipitation of 525 to 550 mm. Snow cover is generally persistent throughout the winter as chinooks are rare.

Based on the soils information available from AGRASID[5], there are several different soil series present in the area of the subject site:

- Uncas - Dark Grey Luvisol
- Cooking Lake - Orthic Grey Luvisol
- Hoadley - Orthic Grey Luvisol
- Westerose - Orthic Grey Luvisol

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[3] Rovey and Niemann. 2005. Do Conservative Solutes Migrate at Average Pore Water Velocity. Groundwater Volume 43, No. 1. pp. 52 to 62.

[4] Pedocan Land Evaluation Ltd., 1993. Soil Series Information for Reclamation Planning in Alberta. Alberta Conservation and Reclamation Council Report No. RRTAC 93-7. ISBN 0-7732-6041-2.

[5] CAESA Soil Inventory Project Working Group. 1998. AGRASID: Agricultural Region of Alberta Soil Inventory Database (Version 1.0). Edited by: J.A. Brierley, B.D. Walker, P.E. Smith, and W.L. Nikiforuk. Alberta Agriculture Food and Rural Development, Publications. CD-ROM.

- Onoway - Orthic Humic Gleysol
- Golden Spike - Typic Mesisol

Published soil profile information[4] was reviewed to determine the suitability of each soil series for OWTS. Please note that the depths provided below are based on the published[4] data.

6.9.1 Uncas

Uncas soil series is defined as a Dark Grey Luvisolic soil developed in moderately fine textured till. They are moderately well drained soils found in undulating, rolling and hummocky landforms. The soil texture varies from loam to silt loam, clay loam and sandy clay loam and is generally conducive to a successful OWTS. The Ahe and Ae horizons have platy structure and together are 0.13 m thick. These horizons may act as limiting layers. At 1.07 m, there is a change in structure from subangular blocky to massive (no structure). This may act as a limiting layer and may cause lateral flow if the OWTS were situated on a slope.

6.9.2 Cooking Lake

Cooking Lake soil series is defined as an Orthic Grey Luvisolic soil developed in moderately fine textured till. They are moderately well drained soils found in undulating and hummocky landforms. The soil texture is loam to clay loam and is generally conducive to a successful OWTS. The Ae horizon has platy structure and is typically 0.10 m thick. This horizon may act as a limiting layer. Soil structure in the B and C horizon is consistently subangular blocky to a depth of 2.00 m and is conducive to a successful OWTS.

6.9.3 Hoadley

Hoadley soil series is defined as an Orthic Grey Luvisolic soil developed in moderately coarse textured glaciofluvial veneers overlying till. They are moderately well drained soils found in undulating landforms. The soil texture is fine sandy loam to clay loam and is generally conducive to a successful OWTS. The Ae horizon has platy structure and is typically 0.20 m thick. This horizon may act as a limiting layer. At 1.00 m, there is a change in structure from subangular blocky to massive. This may act as a limiting layer and may cause lateral flow if the OWTS were situated on a slope.

6.9.4 Westerose

Westerose soil series is defined as an Orthic Grey Luvisolic soil developed in moderately fine textured fluvial or lacustrine materials. They are moderately well drained soils found in undulating landforms. The soil texture varies from loam to silty clay loam and silt loam. Silty clay loam is not conducive to a successful OWTS. The Ae horizon has platy structure and is typically 0.14 m thick. This horizon may act as a limiting layer. At 0.28 m, there is a change in structure from a subangular blocky B horizon to a stratified C horizon. This would act as limiting layer. Because of the unsuitable texture and structure of this soil, it is not suitable for OWTS.

6.9.5 Onoway

Onoway soil series is defined as an Orthic Humic Gleysolic soil developed in moderately fine textured till. These soils are poorly drained and are found in level and depressional landforms. The soil texture is loam to clay loam. These soils are gleyed beginning in the Bg horizon at a depth of 0.30 m, indicating saturated conditions throughout the year and a seasonal high water table. At 0.75 m, there is a change in structure to massive. The near surface seasonal water table is not conducive to a successful OWTS.

6.9.6 Golden Spike

Golden Spike soil series is defined as a Typic Mesisolic soil developed in moderately well decomposed organic material. These soils are poorly drained and are found in level, depressional and fen landforms. This soil is characterized by an accumulation of sedge fen peat greater than 1.00 m in depth. These soils are typical of locations where the water table is located just below the surface of the soil. The extremely high seasonal water table would not be conducive to a successful OWTS.

6.10 SOILS ON SITE

Detailed soil profile descriptions are available in Appendix B. Soil inspection locations are detailed in Figures 1 and 2.

6.10.1 Soils in the Proposed Final Treatment Component Area

Soils within the proposed final treatment component area (Figure 2), as determined by Mr. Rick Arndt and Ms. Stephanie Morin during their meeting on October 21, 2005, are described with respect to suitability for OWTS.

6.10.1.1 Monitoring Well 1

Soils found at MW01 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam and would be conducive to a successful OWTS. At 2.0 m there is a structure change from strong subangular blocky to massive. The massive structure of the Ckg horizon may act as a limiting layer. MW01 was weakly gleyed at a depth of 2.0 m.

Suitability: MW01 has suitable texture, structure and depth to seasonal water table for shallow bury trench OWTS.

6.10.1.2 Monitoring Well 2

Soils found at MW02 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam. At 1.0 m there is a structure change from weak blocky to massive. The massive structure of the Ckg horizon may act as a limiting layer. MW02 was weakly gleyed at a depth of 1.0 m. The relatively high seasonal water table (indicated by gleying) at this location makes it unsuitable for subsurface OWTS.

6.10.1.3 Borehole 3

Soils found at BH03 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam. At 1.0 m there is a structure change from weak blocky to massive. The massive structure of the Ckg horizon may act as a limiting layer. BH03 was weakly gleyed at a depth of 1.0 m. The relatively high seasonal water table (indicated by gleying) at this location makes it unsuitable for subsurface OWTS.

6.10.1.4 Monitoring Well 4

Soils found at MW04 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam and would be conducive to a successful OWTS. At 1.0 m there is a structure change from weak blocky to massive. The massive structure of the Ck horizon may act as a limiting layer. MW04 was strongly gleyed at a depth of 4.5 m.

Suitability: MW04 has suitable texture, structure and depth to seasonal water table for shallow bury trench OWTS.

6.10.1.5 Borehole 5

Soils found at BH05 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam and would be conducive to a successful OWTS. At 1.0 m there is a structure change from weak blocky to massive. The massive structure of the Ck horizon may act as a limiting layer. BH05 was completed to a depth of 3.0 m, no evidence of mottling or gleying was noted.

Suitability: BH05 has suitable texture, structure and depth to seasonal water table for shallow bury trench OWTS.

6.10.2 Soils Within the Proposed and Existing Water's Edge Resort Development

Monitoring wells were installed within the proposed and existing Water's Edge Resort development for the purposes of groundwater assessment. The soils are described here for informative purposes only and are not considered with respect to suitability for OWTS.

6.10.2.1 Monitoring Well 6

Soils found at MW06 were moderately well-drained disturbed fill over moderately fine till. The soil texture was sandy clay loam, clay loam and loamy sand. Due to the disturbed nature of the profile, there was no structure present and the entire profile was massive. A water-bearing loamy sand layer was located at a depth of 4.0 to 4.2 m. MW06 was strongly gleyed at a depth of 4.2 m.

6.10.2.2 Monitoring Well 7

Soils found at MW07 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was sandy loam, loam and sandy clay loam. At 1.0 m

there is a structure change from weak blocky to massive. Weak gleying was observed at a depth of 1.5 m.

6.10.2.3 Monitoring Well 8

Soils found at MW08 were poorly drained Orthic Humic Gleysols developed in moderately fine till. The soil texture was loam to clay loam. At 0.6 m there is a structure change from weak subangular blocky to massive. Moderate gleying was observed at a depth of 0.3 m.

6.10.2.4 Monitoring Well 9

Soils found at MW09 were moderately well-drained Dark Grey Luvisols developed in moderately fine till. The soil texture was loam and sandy clay loam. At 1.0 m there is a structure change from weak blocky to massive. Strong gleying was observed at a depth of 3.0 m.

6.11 LABORATORY ANALYSIS OF SOILS ON SITE

6.11.1 Texture

Original laboratory data is attached in Appendix C. Soil texture and horizon classification are detailed in Table 5. Only samples from MW04 were submitted for analysis due to the uniformity of the soil profile throughout the proposed treatment area.

TABLE 5: SOIL TEXTURE

Location	Horizon	Depth (m)	Texture
MW04	Ah	0.00 – 0.10 m	Sandy Loam
	Ae	0.10 – 0.20 m	Loam
	Bt	0.20 – 0.40 m	Loam
	Ck1	0.40 – 1.00 m	Loam
	Ck2	1.00 – 1.50 m	Sandy Clay Loam
	Ck3	1.50 – 3.00 m	Sandy Clay Loam

Suitability: MW04 is conducive to successful OWTS. Due to the uniformity of the profile throughout the proposed treatment area, it is unlikely that texture will be a limiting factor for any of the boreholes or monitoring wells advanced within the proposed treatment area.

6.11.2 Chemistry

Composite soil samples were collected from the proposed treatment area and the area downslope of the proposed treatment area. Samples were collected from the A horizon, B horizon and 50 cm below the B horizon. Soil samples collected were analysed for detailed salinity and available nutrients to provide baseline data. This data identifies the

soil's natural state before the implementation of OWTS and can be used to determine if the OWTS is affecting soil salinity or soil nutrient levels over time.

The relatively the low pH of the area downslope of the treatment area and the lower pH of 50 cm below the B horizon in the treatment area are well within the range of published data for Luvisolic soils in this area[5] and are considered natural. The results for both EC and SAR indicate that this is good quality soil. Therefore, no problems associated with wastewater infiltration are anticipated based on the soil chemistry as indicated in Table 6.

It is interesting to note that many of the soil salinity and nutrients parameters for all three depths are significantly higher in the proposed treatment area than they are in the area downslope of the proposed treatment area. This may be due to historical cattle grazing and pasturing activities in this area, as cattle would have preferred the cleared area (proposed treatment area) over the treed area (downslope area) and spent more time there, fertilizing the soil.

Available nitrogen in the soil is very low and is the limiting factor to plant growth at this location. Phosphorous is the next most limiting nutrient and is also present in very low quantities. Potassium is moderately abundant. This situation is likely the result of many years of grazing pressure, in combination with the natural forested state, which is typically low in available nutrients. Secondary treated effluent typically contains nitrogen and phosphorous, although nitrogen levels will have been greatly reduced by the secondary treatment process. Adding wastewater to this soil may provide the nutrients that are limiting to plant growth and allow plants to flourish on this site. It is recommended that the site be mowed on a regular basis to prevent the site from becoming overgrown and to retain access to the site for maintenance purposes.

It is recommended that, as the OWTS is operated, composite soil samples be collected from the treatment area and the area downslope (northeast) of the treatment area every five years, analysed for detailed soil salinity and available nutrients (nitrate, phosphorous, potassium, sulfate) and compared to the baseline data presented here. If there is a significant increase in soil salinity or nutrient levels over time, or if vegetation appears to be adversely affected, the secondary treatment plant should be assessed for effectiveness and/or the treatment capacity may need to be increased. An increase in soil salinity or nutrient levels in the area downslope of the treatment area may indicate lateral flow of the wastewater within the soil horizons and may require a reduced loading rate. These situations must be assessed on a case-by-case basis to determine if an adverse effect is present and the appropriate course of action to remedy it.

TABLE 6: SOIL CHEMISTRY

Parameters	Units	Downslope of Treatment Area			Treatment Area		
		A Horizon	B Horizon	50 cm Below B Horizon	A Horizon	B Horizon	50 cm Below B Horizon
Routine							
pH	pH-unit	5.4	5.2	5.2	6.1	6.9	5.9
Electrical Conductivity (EC)	dS/m	0.39	0.24	0.20	0.66	0.77	0.14
Sodium Adsorption Ratio (SAR)	Ratio	0.30	1.00	0.50	0.20	0.20	0.40
Saturation	%	49	31	37	59	64	27
Soluble Salts							
Calcium (Ca)	mg/kg	28.6	7.7	9.5	58.3	78.4	4.6
Magnesium (Mg)	mg/kg	7.2	2.0	2.9	13.8	21.5	1.2
Sodium (Na)	mg/kg	5	7	4	4	6	2
Potassium (K)	mg/kg	10	2	2	28	4	1
Chloride (Cl)[4]	mg/kg	16	14	4	31	46	4
Sulphate (SO_4)	mg/kg	9.9	3.8	4.9	7.8	6	2
Nitrate+Nitrite-N	mg/kg	<0.2	<0.2	<0.2	<0.3	<0.3	<0.1
TGR	T/ac	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Available Nutrients							
Nitrate-N (Available)	mg/kg	<1	<1	<1	<1	<1	<1
Phosphorus-P (Available)	mg/kg	37	15	12	40	34	9
Potassium-K (Available)	mg/kg	190	70	100	330	100	130
Sulfate-S (Available)	mg/kg	13	3	9	10	3	1

Suitability: Soils encountered in the proposed treatment area have suitable chemistry for the final treatment component if the soils are loaded at the appropriate rate.

7.0 RECOMMENDED SYSTEM LOCATION

Based on the results of the site assessment, the most suitable location for the final treatment component is in the area of MW04 and BH05. The area around MW01 could also be used if additional space is required. The area around MW02 and BH03 is less suitable and should be avoided if at all possible, as it is not suitable for subsurface final treatment systems due to high groundwater table. Figure 2 details the available treatment areas.

8.0 SUITABILITY FOR SHALLOW BURY TRENCH OWTS

Based on the site assessment, there are no impervious layers within the proposed treatment area. The main design constraints are the potentially limiting layer created by the massive structure of the Ck2 horizon at 1.0 m.

A shallow bury trench style septic field is well suited for the soils and constraints presented by this site. The point of effluent infiltration in the trench is below-grade; therefore, reducing the risk of effluent contact with residents and their children and pets. The point of effluent application is at 0.60 m (two feet) below grade, which would be into the loam textured Ck1 horizon with weak blocky structure. Oxygen supply to the field trench bottom would not be limited in these soils as they have sufficient structure. The predicted long-term success of a shallow bury trench style septic field is very good. Adequate separation distance (0.4 m) to the potentially limiting layer is present and effluent ponding at the limiting layer is unlikely if the limiting layer is used as the design factor for determining the loading rate. Groundwater mounding may occur, but depth to groundwater (4.5 m) is not currently a problem and mounding will likely be minimal at the design flow volumes. A shallow bury trench is preferable to maximize the use of soil with structure.

The shallow bury trench takes advantage of the multitude of soil flora and fauna in the upper horizons in order to maximize treatment of the effluent. In order to increase the long-term viability of these systems, the soil based treatment component should be long and narrow (rather than square) as this configuration allow water to move away from the infiltration area more effectively. This decreases the possibility for groundwater mounding and saturated horizontal flow while increasing the life of the system. Long narrow systems also blend into the landscape more easily, satisfying the landowner's desire for a natural looking landscape.

9.0 SYSTEM CONSIDERATIONS

Due to the volume of water to be treated and the available area for final treatment, it is highly recommended that secondary treatment and pressure distribution be utilized to reduce the required area for the final treatment component by 50% as permitted by the Alberta Municipal Affairs Standard of Practice for Onsite Wastewater Treatment Systems.

10.0 RECOMMENDED LOADING RATE

Please note that imperial units of measure will be used, as they are the industry standard.

From the Tyler Table,[6] the appropriate loading rate for a loam textured soil with weak blocky structure such as found at the infiltration depth at this site is 0.50 gallons/sq. ft./day for effluent where the BOD is expected to be less than 30 mg/L as is typical of secondary treated effluent.

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[6] E. Jerry Tyler. 2000. Infiltration rate table.

The loading rate suggested by the Standard of Practice[7] (SOP) for loam soils is 0.35 gallons/sq. ft./day. This loading rate is based on the biological loading of effluent from a septic tank. The SOP allows the loading rate to be effectively doubled to 0.70 gallons/sq. ft./day when secondary treatment and pressure distribution is used and does not consider the grade of structure.

From the Tyler Table, the appropriate loading rate for a sandy clay loam textured soil with massive structure such as found in the limiting layer at this site is 0.0 gallons/sq. ft./day and as such is not considered suitable.

The loading rate suggested by the SOP for a sandy clay loam textured soil is 0.28 gallons/sq. ft./day. As this loading rate is based on the biological loading of effluent from a septic tank it can be effectively doubled to 0.56 gallons/sq. ft./day when secondary treatment and pressure distribution is used.

Based on the soils at this site, research on suitable loading rates and the SOP, the most appropriate loading rate for a shallow bury trench final treatment system utilizing secondary treatment and pressure distribution is 0.56 gallons/sq. ft./day.

11.0 AREA AVAILABLE FOR THE FINAL TREATMENT COMPONENT

There are 56,928 square feet (5,289 m^2) available within the 'proposed final treatment area', as depicted in Figure 2. Utilizing secondary treatment and pressure distribution, and applied at a loading rate of 0.56 gallons/sq. ft./day the 'proposed final treatment area' can provide treatment for 31,879 gallons of effluent per day.

There are an additional 19,631 square feet (1,824 m^2) available within the 'additional final treatment area', as depicted in Figure 2. Utilizing secondary treatment and pressure distribution, and applied at a loading rate of 0.56 gallons/sq. ft./day the 'additional final treatment area' can provide treatment for 10,993 gallons of effluent per day.

By combining the total available area for final treatment, there is capacity within the identified areas to provide treatment for 42,872 gallons of secondary treated effluent per day when pressure distribution is utilized.

12.0 SUMMARY

The subject site is composed of Phases 1 to 3 of the re-development at Water's Edge Resort. The proposed development consists of 100 lots, all of which will be upscale, environmentally conscious cabins. Water's Edge Resort is located on the shores of Lac Ste. Anne at Gunn, Alberta at SE-10-055-03 W5M, in Lac Ste. Anne County.

The site assessment indicates that the soil, groundwater, vegetation, and landscape conditions in the area of the proposed final treatment system are very conducive to a

[7] Alberta Private Sewage Systems Standard of Practice – 1999 Handbook. 1st Edition. July 2000.

successful shallow bury trench OWTS. The most appropriate loading rate for a shallow bury trench system at this site is 0.56 gallons/sq. ft./day. There is enough suitable land available to accommodate a shallow bury trench system for 42,872 gallons/day at a loading rate 0.56 gallons/sq. ft./day if secondary treatment and pressure distribution are used.

13.0 LIMITATIONS OF LIABILITY

Recommendations presented herein are based on the suitability of the subject site as described in Section 1.0. This report has been prepared for the exclusive use of Water's Edge Resort Incorporated for the specific application described in Section 1.0 of this report. It has been prepared in accordance with generally accepted environmental engineering practices. No other warranty is made, either expressed or implied. Professional judgment has been applied in developing the recommendations of this report.

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

14.0 CLOSURE

EBA appreciates the opportunity to provide this report to Water's Edge Resort, and trusts it meets your present requirements. If you have any questions or comments about any aspect of this report, please contact the undersigned at your convenience.

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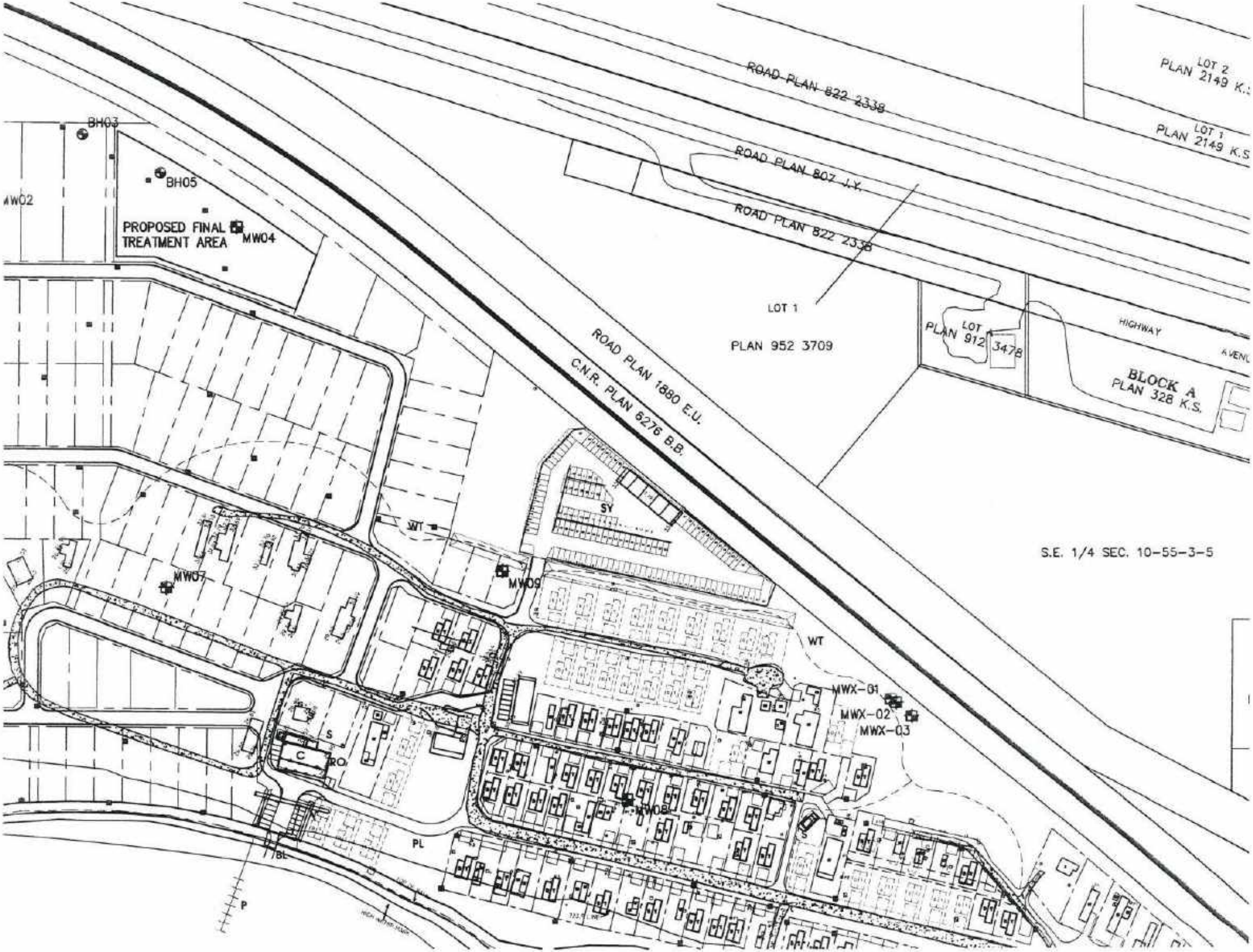
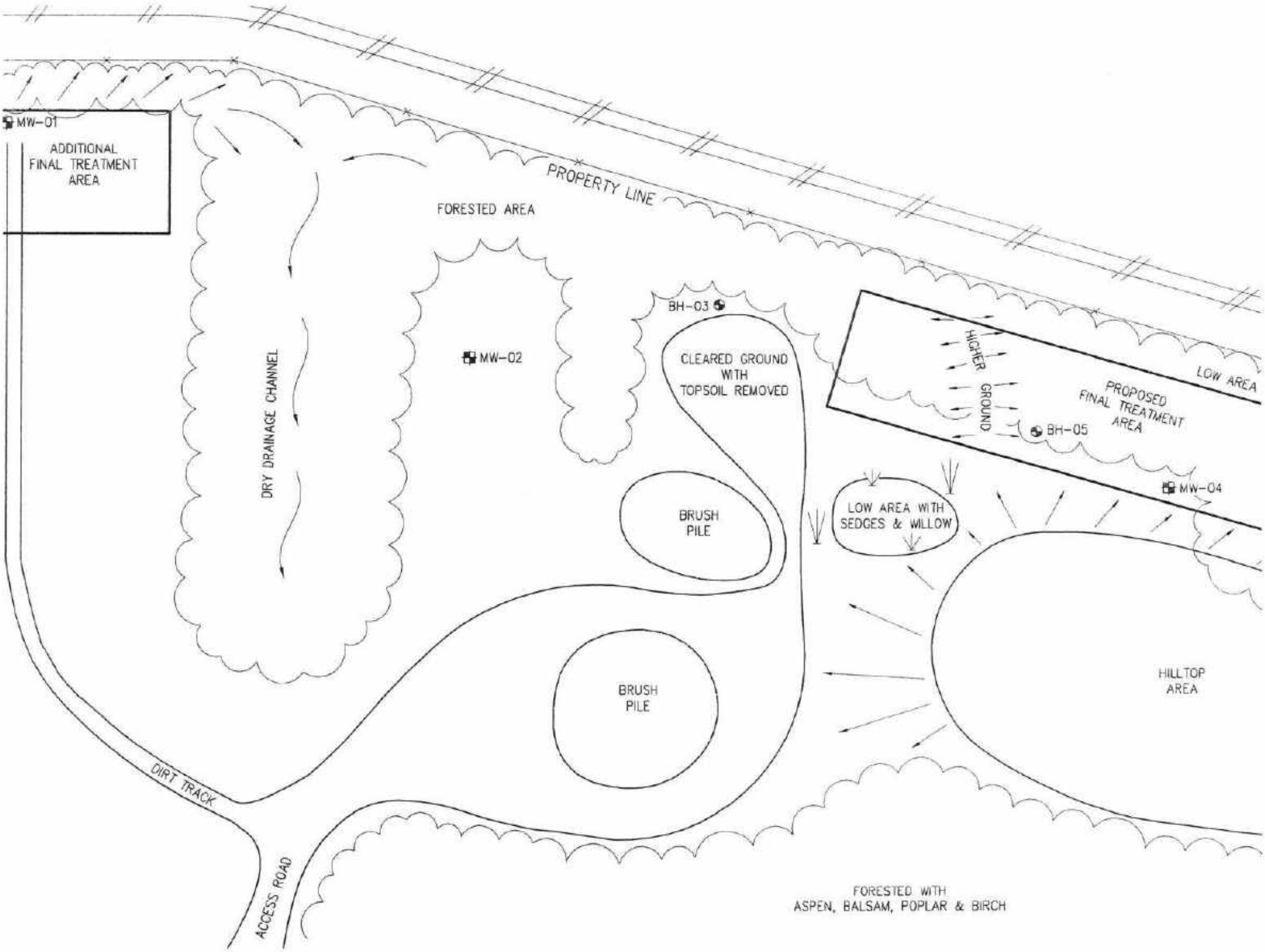
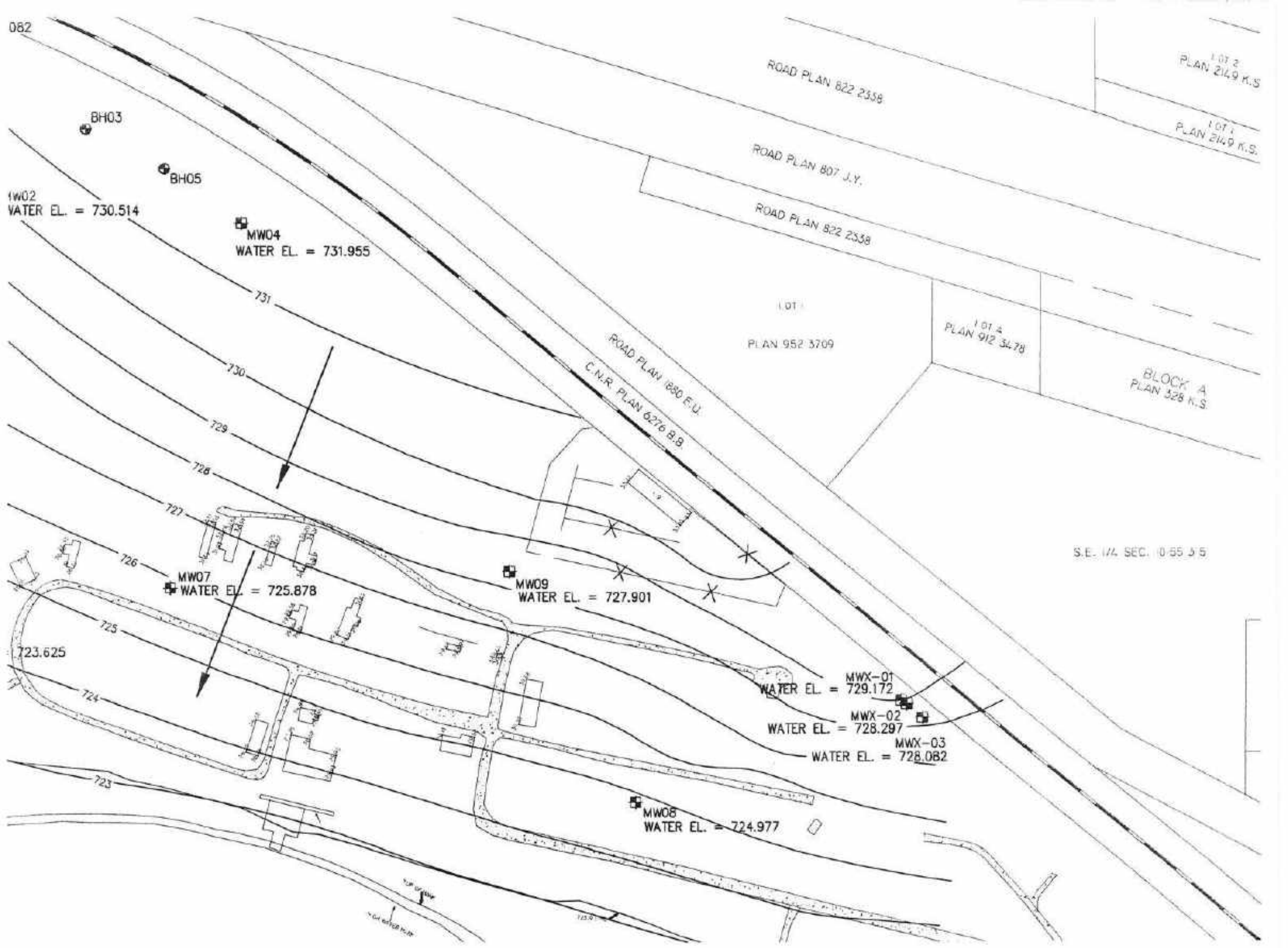
FIGURES


ROAD PLAN 822 2338
LOT 2
PLAN 2149 K.S
LOT 1
PLAN 2149 K.S
ROAD PLAN 807 J.Y.
ROAD PLAN 822 2338
BH03
BH05
MW02
PROPOSED FINAL
TREATMENT AREA
MW04
LOT 1
PLAN 952 3709
LOT
PLAN 912 3478
HIGHWAY
BLOCK A
PLAN 328 K.S.
ROAD PLAN 1880 E.U.
C.N.R. PLAN 6276 B.B.
SY
WT
MW07
MW09
S.E. 1/4 SEC. 10-55-3-5
WT
MWX-01
MWX-02
MWX-03
S
C
RO
MW08
PL
BL
P


MW-01
ADDITIONAL FINAL TREATMENT AREA
PROPERTY LINE
FORESTED AREA
DRY DRAINAGE CHANNEL
MW-02
BH-03
CLEARED GROUND WITH TOPSOIL REMOVED
HIGHER GROUND
LOW AREA
PROPOSED FINAL TREATMENT AREA
BH-05
MW-04
LOW AREA WITH SEDGES & WILLOW
BRUSH PILE
BRUSH PILE
HILLTOP AREA
DIRT TRACK
ACCESS ROAD
FORESTED WITH ASPEN, BALSAM, POPLAR & BIRCH


082
BH03
BH05
1W02
WATER EL. = 730.514
MW04
WATER EL. = 731.955
731
730
729
728
727
726
725
724
723
723.625
ROAD PLAN 822 2338
ROAD PLAN 807 J.Y.
ROAD PLAN 822 2338
LOT 1
PLAN 952 3709
LOT 4
PLAN 912 3478
LOT 2
PLAN 2149 K.S.
LOT 1
PLAN 2149 K.S.
BLOCK A
PLAN 328 K.S.
ROAD PLAN 1880 E.U.
C.N.R. PLAN 6276 B.B.
S.E. 1/4 SEC. 0 55 3 5
MW07
WATER EL. = 725.878
MW09
WATER EL. = 727.901
MWX-01
WATER EL. = 729.172
MWX-02
WATER EL. = 728.297
MWX-03
WATER EL. = 728.082
MW08
WATER EL. = 724.977

APPENDIX

APPENDIX A EBA TERMS AND CONDITIONS

ENVIRONMENTAL REPORT – GENERAL CONDITIONS

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

1.0 USE OF REPORT

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

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

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

2.0 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA's investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

2.1 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

3.0 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA's liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

1. With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;
2. With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.

4.0 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

6.0 STANDARD OF CARE

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

7.0 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

8.0 NOTIFICATION OF AUTHORITIES

The client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

9.0 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

10.0 ALTERNATE REPORT FORMAT

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

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

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

APPENDIX

APPENDIX B SOIL PROFILE DESCRIPTIONS

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-01
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	Depth(ft)
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments						Pipe stickup = 0.795 metres Bag sample. Bag sample.	0.0
	Ahe horizon, brown (10YR5/3), loam, medium platey, friable, common roots, moist, 0% coarse fragments						Bag sample.	
	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments						Bag sample.	
1.0	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates						Bag sample.	
	Ck horizon, yellowish brown (10YR5/6), sandy clay loam, medium subangular blocky, friable, few roots, moist, <5% coarse fragments, weak effervescence, red and white precipitates						Bag sample.	5.0
2.0	Ck horizon, yellowish brown (10YR5/4), sandy loam, strong subangular blocky, friable, few roots, moist, <5% coarse fragments, weak effervescence, red and white precipitates						Bag sample.	
3.0	Ckg horizon, brown (10YR4/3), clay loam, massive, firm, few roots, moist, <5% coarse fragments, weak effervescence, yellow, white and red precipitates, weakly gleyed						Bag sample.	10.0
	Ck horizon, dark yellowish brown (10YR3/4), sandy loam to sandy clay loam, massive, friable to loose, no visible roots, 15% coarse fragments (60mm diameter), moderate effervescence, red and white precipitates							
4.0	Cgk horizon, dark grey (10YR4/1), clay loam, massive, slightly plastic, no visible roots, moist, <5% coarse fragments (40mm diameter), weak effervescence, strongly gleyed							15.0
5.0							Bag sample.	

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LOGGED BY: SMM	COMPLETION DEPTH: 7.5 m
REVIEWED BY: SMM	COMPLETE: 05/11/15
Fig. No: 5101408-01	Page 1 of 2

05/12/14 (DNS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-01
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	WELL INSTALLATION	Depth(ft)
5.0									
6.0	Cg horizon, dark grey (10YR4/1), clay loam, massive, plastic, no visible roots, moist to wet, <5% coarse fragments, strongly gleyed						Bag sample.		
7.0									
	END OF BOREHOLE (7.50 metres) Monitoring well installed to 6.408m								
8.0									
9.0									
10.0									30.0

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Edmonton, Alberta	REVIEWED BY: SMM	COMPLETE: 05/11/15
	Fig. No: 5101408-01	Page 2 of 2

05/12/14 03:12PM (DNS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-02
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) 10 100 10^3 10^4	NOTES & COMMENTS
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments						Pipe stickup = 0.822 metres Bag sample. Bag sample. Bag sample.
	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments						Bag sample.
1.0	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates						Bag sample.
	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, moist, <5% coarse fragments, weak effervescence, red precipitates						
2.0	Ckg horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, moist, 10% coarse fragments (40mm diameter), orange and white precipitates, weakly gleyed						Bag sample.
	Ckg horizon, brown (10YR5/3), clay loam, massive, slightly plastic, moist, 15% coarse fragments (80mm diameter), moderate effervescence, orange and white precipitates, weakly gleyed						
3.0							Bag sample.
	C horizon, yellowish brown (10YR5/4), clay loam with loamy sand seams, plastic, wet, 15% coarse fragments (50mm diameter), no visible effervescence, red precipitates						Bag sample.
4.0	Cg horizon, greyish brown (10YR5/2), clay loam, massive, slightly plastic, moist, 15% coarse fragments (50mm diameter), no visible effervescence, red precipitates, weakly gleyed						Bag sample.
5.0	END OF BOREHOLE (4.50 metres)						

Depth(ft): 0.0, 5.0, 10.0, 15.0

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LOGGED BY: SMM	COMPLETION DEPTH: 4.5 m
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Fig. No: 5101408-02	Page 1 of 1

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-03
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) 10 100 10^3 10^4	NOTES & COMMENTS	WELL INSTALLATION	Depth (ft)
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments						Bag sample.		0.0
							Bag sample.		
	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments						Bag sample.		
							Bag sample.		
1.0	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates								
	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, moist, <5% coarse fragments, weak effervescence, red precipitates						Bag sample.		5.0
2.0	Ckg horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, moist, 10% coarse fragments (40mm diameter), orange and white precipitates, weakly gleyed								
							Bag sample.		
	Ckg horizon, light yellowish brown (10YR6/4), clay loam, massive, plastic, moist, 10% coarse fragments (50mm diameter), weak effervescence, weakly gleyed								
3.0	END OF BOREHOLE (3.00 metres)								10.0
4.0									
									15.0
5.0									

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LOGGED BY: SMM | COMPLETION DEPTH: 3 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-03 | Page 1 of 1

05/12/14 03:13PM (EBNS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-04
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	Depth(ft)
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments						Pipe stickup = 0.670 metres Bag sample. Bag sample. Bag sample.	0.0
	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments						Bag sample.	
1.0	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates						Bag sample.	
	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, dry, <5% coarse fragments, weak effervescence, red precipitates							5.0
2.0	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, dry, 10% coarse fragments (40mm diameter), orange and white precipitates						Bag sample.	
	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, friable, loose, dry to moist, <5% coarse fragments, strong effervescence, white precipitates							
3.0	Ck horizon, dark yellowish brown (10YR3/4), sandy loam to sandy clay loam, massive, friable to loose, 15% coarse fragments (60mm diameter), moderate effervescence, red and white precipitates						Bag sample.	10.0
4.0							Bag sample.	
	Cgk horizon, dark grey (10YR4/1), clay loam, massive, slightly plastic, moist, <5% coarse fragments (40mm diameter), weak effervescence,							15.0
5.0								

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LOGGED BY: SMM	COMPLETION DEPTH: 7.5 m
REVIEWED BY: SMM	COMPLETE: 05/11/15
Fig. No: 5101408-04	Page 1 of 2

05/12/14 09:13PM (ENG)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-04
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE / RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	WELL INSTALLATION	Depth(ft)
5.0	strongly gleyed							
6.0	Cg horizon, dark grey (10YR4/1), clay loam, massive, plastic, moist to wet, <5% coarse fragments (40mm diameter), strongly gleyed					Bag sample.		20.0
7.0	- sand lens (7.1-7.5m)							
	END OF BOREHOLE (7.50 metres) Monitoring well installed to 6.841m							25.0
8.0								
9.0								30.0
10.0								

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LOGGED BY: SMM	COMPLETION DEPTH: 7.5 m
REVIEWED BY: SMM	COMPLETE: 05/11/15
Fig. No: 5101408-04	Page 2 of 2

05/12/14 09:13PM (EAVS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-05
SE 1/4, SEC. 10-55-3 S5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE / RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	WELL INSTALLATION	Depth(ft)
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments, no visible effervescence, no visible precipitates					Bag sample. Bag sample. Bag sample.		0.0
1.0	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments, no visible effervescence, no visible precipitates					Bag sample.		
	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, no visible effervescence, red precipitates					Bag sample.		5.0
2.0	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, dry, <5% coarse fragments, weak effervescence, red precipitates					Bag sample.		
	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, dry, 10% coarse fragments (40mm diameter), orange and white precipitates					Bag sample.		
3.0	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, friable, loose, dry to moist, <5% coarse fragments, strong effervescence, white precipitates							10.0
	END OF BOREHOLE (3.00 metres)							
4.0								15.0
5.0								

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LOGGED BY: SMM | COMPLETION DEPTH: 3 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-05 | Page 1 of 1

05/12/14 03:13PM (DWS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-06
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE / RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 1, 3, 10, 4)	NOTES & COMMENTS
0.0	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, friable, no visible roots, moist, 10% coarse fragments (50mm diameter), moderate effervescence, red and white precipitates					Pipe stickup = 0.878 metres
						Bag sample.
1.0						
2.0						Bag sample.
	C horizon, yellowish brown (10YR5/4), clay loam with loamy sand seams, plastic, massive, wet, 15% coarse fragments (50mm diameter)					Bag sample.
3.0	Ck horizon, dark greyish brown (10YR4/2), clay loam, massive, firm, moist, <5% coarse fragments, weak effervescence, red and white precipitates					Bag sample.
4.0	C horizon, brown (10YR5/3), loamy sand, single grained, loose, wet, 10% coarse fragments (30mm diameter), water bearing layer					Bag sample.
						Bag sample.
	Cgk horizon, dark grey (10YR4/1), sandy clay loam, massive, slightly plastic, <5% coarse fragments, moderate effervescence, strongly gleyed					
5.0						

Depth(ft): 0.0, 5.0, 10.0, 15.0

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LOGGED BY: SMM | COMPLETION DEPTH: 4.61 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-06

05/12/14 03:15PM [EWS]

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO. 5101408-07
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO. 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	Depth(ft)
0.0	Ah horizon, dark brown (10YR3/3), sandy loam, medium granular, friable, many roots, moist, 0% coarse fragments						Pipe stickup = 0.867 metres	0.0
	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments							
1.0	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates							
	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, dry, <5% course fragments, weak effervescence, red precipitates							5.0
2.0	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, dry, 10% coarse fragments (40mm diameter), orange and white precipitates							
	Ckg horizon, dark yellowish brown (10YR3/4), sandy clay loam, massive, friable to loose, 15% coarse fragments (60mm diameter), moderate effervescence, red and white precipitates, weakly gleyed							
3.0	Cgk horizon, dark grey (10YR4/1), clay loam, massive, slightly plastic, moist, <5% coarse fragments (40mm diameter), weak effervescence, no visible precipitates, strongly gleyed							10.0
4.0								
								15.0
5.0								

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LOGGED BY: SMM | COMPLETION DEPTH: 6 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-07 |

05/12/14 03:13PM (EMB)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-07
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	WELL INSTALLATION	Depth(ft)
5.0									
6.0	END OF BOREHOLE (6.00 metres) Monitoring well installed to 5.878m								20.0
7.0									
8.0									25.0
9.0									30.0
10.0									

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LOGGED BY: SMM | COMPLETION DEPTH: 6 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-07

05/12/15 03:14PM (EMS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-08
SE 1/4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	Depth(ft)
0.0	Ah horizon, black (10YR2/1), loam to clay loam, weak granular, friable, few roots, moist, 0% coarse fragments						Pipe stickup = 0.775 metres	0.0
	Bg horizon, greyish brown (10YR5/2), clay loam, weak subangular blocky, plastic, few roots, moist to wet, 0% coarse fragments, moderately gleyed							
1.0	Cg horizon, dark grey (10YR4/1), clay loam, massive, slightly plastic, no visible roots, moist to wet, 5% coarse fragments, red and white precipitates, strongly gleyed							5.0
2.0								
3.0								10.0
4.0							water - 3.2 metres at 0 hrs. Monitoring well installed to 4.925 metres	
5.0								15.0

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LOGGED BY: SMM	COMPLETION DEPTH: 4.93 m
REVIEWED BY: SMM	COMPLETE: 05/11/15
Fig. No: 5101408-08	Page 1 of 1

5/12/14 03:14PM (ENG)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO: 5101408-09
SE 1.4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	Depth(ft)
0.0	Ae horizon, yellowish brown (10YR5/4), loam, medium platey, friable, few roots, dry to moist, 0% coarse fragments						Pipe stickup = 0.740 metres	0.0
	Bt horizon, pale brown (10YR6/3), loam, medium subangular blocky, friable to firm, few roots, dry to moist, 0% coarse fragments, red precipitates							
1.0	Ck horizon, dark yellowish brown (10YR3/4), loam, weak blocky, friable to firm, few roots, dry, <5% coarse fragments, weak effervescence, red precipitates							
	Ck horizon, yellowish brown (10YR5/4), sandy clay loam, massive, slightly plastic, no visible roots, dry, 10% coarse fragments (40mm diameter), orange and white precipitates							5.0
2.0	Ckg horizon, dark yellowish brown (10YR3/4), sandy clay loam, massive, friable to loose, 15% coarse fragments (60mm diameter), moderate effervescence, red and white precipitates, weakly gleyed							
3.0	Cgk horizon, dark grey (10YR4/1), clay loam, massive, slightly plastic, moist, <5% coarse fragments (40mm diameter), weak effervescence, strongly gleyed							10.0
4.0								
								15.0
5.0								

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LOGGED BY: SMM	COMPLETION DEPTH: 6 m
REVIEWED BY: SMM	COMPLETE: 05/11/15
Fig. No: 5101408-09	Page 1 of 2

05/12/14 8:57AM (GMS)

OWTS ASSESSMENT	WATER'S EDGE RESORT	BOREHOLE NO. 5101408-09
SE 1-4, SEC. 10-55-3 W5M	DRILL: SHELBY TUBE AND SOLID STEM AUGER	PROJECT NO: 5101408
GUNN, ALBERTA		ELEVATION:

SAMPLE TYPE: SHELBY TUBE | DISTURBED | SPLIT SPOON | NO RECOVERY | A CASING | CORE

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

Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	HYDROCARBON VAPOUR (ppm) / HYDROCARBON VAPOUR (%LEL) (10, 100, 10^3, 10^4)	NOTES & COMMENTS	WELL INSTALLATION	Depth(ft)
5.0									
	– sand lens (5.8 to 6.0m)								
6.0									20.0
	END OF BOREHOLE (6.54 metres) Monitoring well installed to 6.541m								
7.0									25.0
8.0									
9.0									30.0
10.0									

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LOGGED BY: SMM | COMPLETION DEPTH: 6 m
REVIEWED BY: SMM | COMPLETE: 05/11/15
Fig. No: 5101408-09 |

05/12/14 03:14PM (ENS)

APPENDIX

APPENDIX C ORIGINAL LABORATORY DATA

NORWEST LABS

425389 Control Number E 239188

Environmental Sample Information Sheet

NOTE: Proper completion of this form is required in order to proceed with analysis
See reverse for your nearest Norwest location and proper sampling protocol

Billing Address:	Copy of Report To:	Copy of Invoice: ☐
Company: EBA ENGINEERING	Company:	Mail invoice to this address for approval ☐
Address: 14940-123 AVE EDMONTON, AB T5V 1B4	Address: Same ↩	
QA/QC Report ☐		
Attention: STEPHANIE MORIN	Attention:	
Phone:	Phone:	
Fax:	Fax:	
Cell: 818-9368	Cell:	
e-mail: SMorin@eba.ca	e-mail:	
Report Result: Fax ☐ Mail ☐ Courier ☐ e-mail ☑ e-Service ☐	Report Result: Fax ☐ Mail ☐ Courier ☐ e-mail ☐ e-service ☐	

Information to be included on Report and Invoice

Project ID: 5101408
Project Name: Water's Edge
Project Location:
Legal Location:
PO#:
Proj. Acct. Code:
Agreement ID:

RUSH Please contact the laboratory to confirm rush dates and times before submitting samples.

Upon filling out this section, client accepts that surcharges will be attached to this analysis

Required on: all analyses or as indicated ☐ or ☐

Date Required:
Signature:
Norwest Authorization:

Sample Custody (Please Print)

Relinquished by: Stephanie Morin
Company EBA Signature [signature]

I authorize Norwest Labs to proceed with the work indicated on this form:
Date: Nov. 21/05
Initial: [initials]

Received by: [signature] ☐ Coolers
Waybill # 3 ☐ Boxes
Company ✓ Time ☐ Samples

Received by: [signature] Date: NOV 21
Company NWLE Time: 6:10

Special Instructions / Comments ☐ Check here if Norwest is required to report results directly to a regulatory body (Please include contact information)

	Sample Identification	Location	Depth IN CM (M)	Date / Time Sampled	Matrix	Sampling Method	Number of Containers	PS1: Detailed Available	Enter tests above (✓ relevant samples below)
1	BH04		0.0 - 0.1	Nov 15/05	Soil	Auger	B	X	
2	↓		0.1 - 0.2	↓	↓	↓	B	X	
3			0.2 - 0.4				B	X	
4			0.4 - 1.0				B	X	
5			1.0 - 1.5				B	X	
6	↓		1.5 - 3.0				B	X	
7	Treatment Area A horizon		0.0 - 0.2				B	X X	
8	Treatment Area B horizon		0.2 - 0.4				B	X X	
9	Treatment Area 50cm Below B horizon		0.4 - 1.0				B	X X	
10			-						
11			-						
12			-						
13			-						
14			-						
15			-						

NOTE: All hazardous samples must be labelled according to WHMIS guidelines.
Accredited by the Standards Council of Canada for specific tests

Page 1 of 1 ##

NWL008 (08/03)

NORWEST LABS

Report Transmission Cover Page

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name: Water's Edge
Location:
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 425389
Control Number: E 239188
Date Received: Nov 21, 2005
Date Reported: Nov 26, 2005
Report Number: 785675

Contact	Company	Address
Stephanie Morin Web x Email Notification	EBA Engineering Consulting Lt	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email:smorin@eba.ca

	Copies	Delivery Strategy	Format
	1	Post	
A	1	Email - Single Report	PDF
A	1	Email - Single Report	Standard Crosstab

NOTE: **P** indicates a preliminary report is required
NOTE: **A** indicates report is delivered using automated delivery

_____ # OF PAGES IN THIS TRANSMISSION

Report Transmission Notes

Agreement Notes

Lot Notes

Sample Notes:

Notes to Clients

Lot Notes:

Sample Notes:

Batch Notes:

Method Notes:

Method Result Notes:

Reports associated with this Lot

Id/Format/Reported Date	Id/Format/Reported Date	Id/Format/Reported Date
785675 Env2 3 Smp & DL		

Comment:
See Methodology and Notes page of Analytical Report for all comments pertaining to this report.

If this report transmission is not satisfactory, please send report requirements to the address at the top of this page.

NORWEST LABS

Sample Custody

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project
ID: 5101408
Name: Water's Edge
Location:
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 425389
Control Number: E 239188
Date Received: Nov 21, 2005
Date Reported: Nov 26, 2005
Report Number: 785675

Sample Disposal Date: Dec 26, 2005

All samples will be stored until this date unless other instructions are received. Please indicate other requirements below and return this form to the address or fax number on the upper right of this page.

_____ **Extend Sample Storage Until** _____ **(MM/DD/YY)**

The following charges apply to extended sample storage:

Storage for 1 to 5 samples per month	$ 10.00
Storage for 6 to 20 samples per month	$ 15.00
Storage for 21 to 50 samples per month	$ 30.00
Storage for 51 to 200 samples per month	$ 60.00
Storage for more than 200 samples per month	$ 110.00

_____ **Return Sample, collect, to the address below via:**

_____ Greyhound
_____ Loomis
_____ Purolator
_____ Other (Specify) _____

Name: _____
Company: _____
Address: _____
_____
Phone: _____
Fax: _____
Signature: _____

If no other arrangements have been made, samples will be disposed of on Dec 26, 2005.

NORWEST LABS

Analytical Report

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name: Water's Edge
Location:
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 425389
Control Number: E239188
Date Received: Nov 21, 2005
Date Reported: Nov 26, 2005
Report Number: 785675

		NWL Number	425389-1	425389-2	425389-3	
		Sample Date	Nov 15, 2005	Nov 15, 2005	Nov 15, 2005	
		Sample Description	BH04 / 0.0-0.1 / m	BH04 / 0.1-0.2 / m	BH04 / 0.2-0.4 / m	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	**Detection Limit**
Physical and Aggregate Properties						
Texture			Sandy Loam	Loam	Loam	
Sand	Soil Texture	% by weight	58.3	38.6	34.0	0.1
Silt	Soil Texture	% by weight	37.3	42.2	42.0	0.1
Clay	Soil Texture	% by weight	4.3	19.2	24.0	0.1

		NWL Number	425389-4	425389-5	425389-6	
		Sample Date	Nov 15, 2005	Nov 15, 2005	Nov 15, 2005	
		Sample Description	BH04 / 0.4-1.0 / m	BH04 / 1.0-1.5 / m	BH04 / 1.5-3.0 / m	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	**Detection Limit**
Physical and Aggregate Properties						
Texture			Loam	Sandy Clay Loam	Sandy Clay Loam	
Sand	Soil Texture	% by weight	44.0	51.0	58.0	0.1
Silt	Soil Texture	% by weight	29.4	25.0	21.4	0.1
Clay	Soil Texture	% by weight	26.6	24.0	20.6	0.1

NORWEST LABS

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Analytical Report

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name: Water's Edge
Location:
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 425389
Control Number: E239188
Date Received: Nov 21, 2005
Date Reported: Nov 26, 2005
Report Number: 785675

		NWL Number	425389-7	425389-8	425389-9	
		Sample Date	Nov 15, 2005	Nov 15, 2005	Nov 15, 2005	
		Sample Description	Treatment Area A horizon / 0.0-0.2 / m	Treatment Area B horizon / 0.2-0.4 / m	Treatment Area 50cm Below B horizon / 0.4-1.0 / m	
		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Detection Limit
Available Nutrients						
Nitrate - N	Available	mg/kg	<1	<1	<1	1
Phosphorus	Available	mg/kg	40	34	9	5
Potassium	Available	mg/kg	330	100	130	10
Sulfate-S	Available	mg/kg	10	3	1	1
Salinity						
pH	Saturated Paste	pH	6.1	6.9	5.9	
Electrical Conductivity	Saturated Paste	dS/m at 25 C	0.66	0.77	0.14	0.01
SAR	Saturated Paste		0.2	0.2	0.4	
% Saturation		%	59	64	27	
Calcium	Saturated Paste	meq/L	4.95	6.10	0.85	0.01
Calcium	Saturated Paste	mg/kg	58.3	78.4	4.6	
Magnesium	Saturated Paste	meq/L	1.94	2.76	0.35	0.02
Magnesium	Saturated Paste	mg/kg	13.8	21.5	1.2	
Sodium	Saturated Paste	meq/L	0.3	0.44	0.3	0.04
Sodium	Saturated Paste	mg/kg	4	6	2	
Potassium	Saturated Paste	meq/L	1.2	0.1	0.1	0.03
Potassium	Saturated Paste	mg/kg	28	4	1	
Chloride	Saturated Paste	meq/L	1.5	2.0	0.38	0.03
Chloride	Saturated Paste	mg/kg	31	46	4	
Sulfate-S	Saturated Paste	meq/L	0.83	0.6	0.4	0.06
Sulfate-S	Saturated Paste	mg/kg	7.8	6	2	
Nitrate and Nitrite - N	Saturated Paste	meq/L	<0.05	<0.05	<0.05	0.05
Nitrate and Nitrite - N	Saturated Paste	mg/kg	<0.3	<0.3	<0.1	
TGR	Saturated Paste	T/ac	<0.1	<0.1	<0.1	

Approved by: R.L. Neumann

Randy Neumann, BSc
Vice President, Environmental

NORWEST LABS

Methodology and Notes

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name: Water's Edge
Location:
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 425389
Control Number: E239188
Date Received: Nov 21, 2005
Date Reported: Nov 26, 2005
Report Number: 785675

Method of Analysis:

MethodName	Reference		Method	Date Analysis Started	Location
Nutrients in General Soil	Comm. Soil Sci. Pl. Anal.	*	Modified Kelowna Soil Test, Vol 26, 1995	23-Nov-05	Norwest Labs Edmonton
Particle Size Analysis - GS	Carter	*	Hydrometer Method, 47.3	24-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	EC of Saturated Soil Paste, 4.13	22-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	pH of Saturated Soil Paste, 3.14	22-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	Soluble Salts in Saturation Extract, 3.21	22-Nov-05	Norwest Labs Edmonton
Sulfate in General Soil	McKeague	*	Sulfate Extractable by 0.1M CaCl2, 4.47	23-Nov-05	Norwest Labs Edmonton

* Norwest method(s) is based on reference method

References:

Carter	Soil Sampling and Methods of Analysis
Comm. Soil Sci. Pl. Anal.	Communications in Soil Science and Plant Analysis
McKeague	Manual on Soil Sampling and Methods of Analysis

Comments:

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted

NORWEST LABS

426459

Control Number E 255553

Environmental Sample Information Sheet

NOTE: Proper completion of this form is required in order to proceed with analysis
See reverse for your nearest Norwest location and proper sampling protocol

Billing Address:	Copy of Report To:	Copy of Invoice:
Company: EBA ENGINEERING	Company: Same	Mail Invoice to this address for approval ☐
Address: 14940-123 AVE EDMONTON AB	Address:	
QA/QC Report ☐		
Attention: STEPHANIE MORIN	Attention:	Report Result:
Phone:	Phone:	Fax ☐
Fax:	Fax:	Mail ☐
Cell: 780-818-9368	Cell:	Courier ☐
e-mail: SMORIN@EBA.CA	e-mail:	e-mail ☐
Report Result: Fax ☐ Mail ☐ Courier ☐ e-mail ☑ e-Service ☐		e-service ☐

Information to be included on Report and Invoice

Project ID: 5101408
Project Name:
Project Location: Waters Edge Resort
Legal Location:
PO#:
Proj. Acct. Code:
Agreement ID:

RUSH Please contact the laboratory to confirm rush dates and times before submitting samples.

Upon filling out this section, client accepts that surcharges will be attached to this analysis

Required on: all analyses or as indicated ☐ or ☐

Date Required:
Signature:
Norwest Authorization:

Sample Custody (Please Print)

Sampled by: Stephanie Morin
Company EBA Signature S Morin

I authorize Norwest Labs to proceed with the work indicated on this form:
Date: Nov. 24/05
Initial: SMM

Received by: JM Coolers ☐ NOV 25
Waybill # Date Boxes ☐
Company NWLED Time Samples ☐

Received By: Date
Company: Time

Special Instructions / Comments ☐ Check here if Norwest is required to report results directly to a regulatory body (Please include contact information)

* D.O. bottle is unpreserved and can be used for routine water analysis.

3°C

Nov. 24/05

	Sample Identification	Location	Depth IN CM M	Date / Time Sampled	Matrix	Sampling Method	Number of Containers	Routine	BOD	TSS	Total Coliforms	Fecal Coliforms	Ammonia	Total Kjeldahl Nitrogen	Total Phosphorus	Detailed Salinity	Available NPK
							↓	Enter tests above (✓ relevant samples below)									
1	BH01		—	3:50pm	Ground Water	Bailer	5	X	X	X	X	X	X	X	X		
2	BH02		—	3:20pm	↓	↓	5	X	X	X	X	X	X	X	X		
3	BH09		—	4:15pm	↓	↓	5	X	X	X	X	X	X	X	X		
4	Downslope of Treatment Area A horizon				Soil	Grab										X	X
5	Downslope of Treatment Area B horizon				↓	↓										X	X
6	Downslope of Treatment Area 50cm Below B horizon				↓	↓										X	X
7			—														
8			—														
9			—														
10			—														
11			—														
12			—														
13			—														
14			—														
15			—														

NOTE: All hazardous samples must be labeled according to WHMIS guidelines.

Page 1 of ##

NWLU08 (06/05)

NORWEST LABS

Report Transmission Cover Page

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E 255553
Date Received: Nov 25, 2005
Date Reported: Dec 05, 2005
Report Number: 787967

Contact	Company	Address
Stephanie Morin Web x Email Notification	EBA Engineering Consulting Lt	14940 - 123 Avenue Edmonton, AB T5V 1B4 Phone: (780) 451-2130 Fax: (780) 454-5688 Email:smorin@eba.ca

	Copies	Delivery Strategy	Format
	1	Post	
A	1	Email - Single Report	PDF
A	1	Email - Single Report	Standard Crosstab

NOTE: P indicates a preliminary report is required
NOTE: A indicates report is delivered using automated delivery

_____ # OF PAGES IN THIS TRANSMISSION

Report Transmission Notes

Agreement Notes

Lot Notes

Sample Notes:

Notes to Clients

Lot Notes:

Sample Notes:

Batch Notes:

Method Notes;

Method Result Notes:

Reports associated with this Lot

Id/Format/Reported Date	Id/Format/Reported Date	Id/Format/Reported Date
787967 Env2 3 Smp & DL		

Comment:
See Methodology and Notes page of Analytical Report for all comments pertaining to this report.

If this report transmission is not satisfactory, please send report requirements to the address at the top of this page.

NORWEST LABS

Sample Custody

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E255553
Date Received: Nov 25, 2005
Date Reported: Dec 05, 2005
Report Number: 787967

Sample Disposal Date: Jan 04, 2006

All samples will be stored until this date unless other instructions are received. Please indicate other requirements below and return this form to the address or fax number on the upper right of this page.

_____ **Extend Sample Storage Until** _____ **(MM/DD/YY)**

The following charges apply to extended sample storage:

Storage for 1 to 5 samples per month	$ 10.00
Storage for 6 to 20 samples per month	$ 15.00
Storage for 21 to 50 samples per month	$ 30.00
Storage for 51 to 200 samples per month	$ 60.00
Storage for more than 200 samples per month	$ 110.00

_____ **Return Sample, collect, to the address below via:**

_____ Greyhound
_____ Loomis
_____ Purolator
_____ Other (Specify) _____

Name: _____
Company: _____
Address: _____
_____
Phone: _____
Fax: _____
Signature: _____

If no other arrangements have been made, samples will be disposed of on Jan 04, 2006.

NORWEST LABS

Analytical Report

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E255553
Date Received: Nov 25, 2005
Date Reported: Dec 05, 2005
Report Number: 787967

			NWL Number	426459-1	426459-2	426459-3	
			Sample Date	Nov 24, 2005 3:50:00PM	Nov 24, 2005 3:20:00PM	Nov 24, 2005 4:15:00PM	
			Sample Description	BH01	BH02	BH09	
			Matrix	Water	Water	Water	
Analyte		**Units**		**Results**	**Results**	**Results**	**Detection Limit**
Aggregate Organic Constituents							
Biochemical Oxygen Demand	5 Day	mg/L		<4	<4	<4	4
Inorganic Nonmetallic Parameters							
Ammonium - N		mg/L		0.14	<0.05	0.16	0.05
Kjeldahl Nitrogen	Total	mg/L		0.82	1.11	0.72	0.05
Phosphorus	Total	mg/L		0.4	0.5	0.1	0.1
Microbiological Analysis							
Total Coliforms	Membrane Filtration	CFU/100 mL		100	2	<1	1
Fecal Coliforms	Membrane Filtration	CFU/100 mL		<1	<1	<1	
Physical and Aggregate Properties							
Temperature of observed pH		°C		21.4	21.2	21.0	
Solids	Total Suspended	mg/L		1610	4100	831	1
Routine Water							
pH				7.59	7.48	7.55	
Electrical Conductivity		µS/cm at 25 C		882	1180	1060	1
Calcium	Dissolved	mg/L		130	164	146	0.2
Magnesium	Dissolved	mg/L		32.4	45.8	45.4	0.1
Sodium	Dissolved	mg/L		14.5	9.3	12.4	0.4
Potassium	Dissolved	mg/L		4.9	2.2	4.1	0.4
Iron	Dissolved	mg/L		<0.01	0.02	<0.01	0.01
Manganese	Dissolved	mg/L		0.062	0.265	0.662	0.005
Chloride	Dissolved	mg/L		6.2	99.6	25.2	0.4
Nitrate - N		mg/L		0.08	0.03	0.03	0.01
Nitrite - N		mg/L		0.008	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L		0.09	0.03	0.03	0.02
Sulfate (SO4)	Dissolved	mg/L		56.7	38.3	28	0.9
Hydroxide		mg/L		<5	<5	<5	5
Carbonate		mg/L		<6	<6	<6	6
Bicarbonate		mg/L		536	568	670	5
P-Alkalinity	as CaCO3	mg/L		<5	<5	<5	5
T-Alkalinity	as CaCO3	mg/L		440	466	549	5
Total Dissolved Solids	Calculated	mg/L		508	639	591	1
Hardness	Dissolved as CaCO3	mg/L		458	598	551	
Ionic Balance	Dissolved	%		98	96	95	

NORWEST LABS

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Analytical Report

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E 255553
Date Received: Nov 25, 2005
Date Reported: Dec 05, 2005
Report Number: 787967

		NWL Number	426459-4	426459-5	426459-6	
		Sample Description	A Horizon / Downslope of Treatement Area	B Horizon / Downslope of Treatement Area	50cm Below B Horizon / Downslope of Treatement Area	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	**Detection Limit**
Available Nutrients						
Nitrate - N	Available	mg/kg	<1	<1	<1	1
Phosphorus	Available	mg/kg	37	15	12	5
Potassium	Available	mg/kg	190	70	100	10
Sulfate-S	Available	mg/kg	13	3	9	1
Salinity						
pH	Saturated Paste	pH	5.4	5.2	5.2	
Electrical Conductivity	Saturated Paste	dS/m at 25 C	0.39	0.24	0.20	0.01
SAR	Saturated Paste		0.3	1.0	0.5	
% Saturation		%	49	31	37	
Calcium	Saturated Paste	meq/L	2.93	1.26	1.29	0.01
Calcium	Saturated Paste	mg/kg	28.6	7.7	9.5	
Magnesium	Saturated Paste	meq/L	1.21	0.54	0.65	0.02
Magnesium	Saturated Paste	mg/kg	7.2	2.0	2.9	
Sodium	Saturated Paste	meq/L	0.44	0.98	0.48	0.04
Sodium	Saturated Paste	mg/kg	5	7	4	
Potassium	Saturated Paste	meq/L	0.52	0.2	0.1	0.03
Potassium	Saturated Paste	mg/kg	10	2	2	
Chloride	Saturated Paste	meq/L	0.90	1.3	0.34	0.03
Chloride	Saturated Paste	mg/kg	16	14	4	
Sulfate-S	Saturated Paste	meq/L	1.3	0.77	0.83	0.06
Sulfate-S	Saturated Paste	mg/kg	9.9	3.8	4.9	
Nitrate and Nitrite - N	Saturated Paste	meq/L	<0.05	<0.05	<0.05	0.05
Nitrate and Nitrite - N	Saturated Paste	mg/kg	<0.2	<0.2	0.2	
TGR	Saturated Paste	T/ac	<0.1	<0.1	<0.1	

Approved by: Darren Crichton

Darren Crichton, BSc, PChem
Operations Chemist

NORWEST LABS

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Methodology and Notes

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E255553
Date Received: Nov 25, 2005
Date Reported: Dec 05, 2005
Report Number: 787967

Method of Analysis:

MethodName	Reference		Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	*	Conductivity - Laboratory Method, 2510 B	25-Nov-05	Norwest Labs Edmonton
Alkalinity, pH, and EC in water	APHA	*	Electrometric Method, 4500-H+ B	25-Nov-05	Norwest Labs Edmonton
Alkalinity, pH, and EC in water	APHA	*	Titration Method, 2320 B	25-Nov-05	Norwest Labs Edmonton
Ammonium-N in Water	APHA	*	Automated Phenate Method, 4500-NH3 G	28-Nov-05	Norwest Labs Edmonton
Anions (Routine) by Ion Chromatography	APHA	*	Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	28-Nov-05	Norwest Labs Edmonton
BOD in water (surrey)	APHA	*	5 Day, 5210 B	28-Nov-05	Norwest Labs Surrey
Chloride in Water	APHA	*	Automated Ferricyanide Method, 4500-Cl- E	28-Nov-05	Norwest Labs Edmonton
Coliforms - Membrane Filtration	APHA		Fecal Coliform Membrane Filter Procedure, 9222 D	26-Nov-05	Norwest Labs Calgary
Coliforms - Membrane Filtration	APHA		Standard Total Coliform Membrane Filter Procedure, 9222 B	26-Nov-05	Norwest Labs Calgary
Kjeldahl Nitrogen & Phosphorus (Total) in Water	Alberta Research Council	*	Nitrogen, Total Kjeldahl, 07021 626	28-Nov-05	Norwest Labs Edmonton
Kjeldahl Nitrogen & Phosphorus (Total) in Water	APHA	*	Automated Ascorbic Acid Reduction Method, 4500-P F	28-Nov-05	Norwest Labs Edmonton
Metals Trace (Dissolved) in water	APHA	*	Inductively Coupled Plasma (ICP) Method, 3120 B	28-Nov-05	Norwest Labs Edmonton
Nutrients in General Soil	Comm. Soil Sci. Pl. Anal.	*	Modified Kelowna Soil Test, Vol 26, 1995	28-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	EC of Saturated Soil Paste, 4.13	28-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	pH of Saturated Soil Paste, 3.14	28-Nov-05	Norwest Labs Edmonton
Saturated Paste in General Soil	McKeague	*	Soluble Salts in Saturation Extract, 3.21	28-Nov-05	Norwest Labs Edmonton
Solids Suspended (Total, Fixed and Volatile)	APHA	*	Total Suspended Solids Dried at 103-105'C, 2540 D	29-Nov-05	Norwest Labs Surrey
Sulfate in General Soil	McKeague	*	Sulfate Extractable by 0.1M CaCl2, 4.47	28-Nov-05	Norwest Labs Edmonton

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted

NORWEST LABS

Methodology and Notes

Norwest Labs
7217 Roper Road NW
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: EBA Engineering Consulting Lt
Report to: EBA Engineering Consulting Lt
14940 - 123 Avenue
Edmonton, AB, Canada
T5V 1B4
Attn: Stephanie Morin
Sampled By: Stephanie Morin
Company: EBA

Project
ID: 5101408
Name:
Location: Water's Edge Resort
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 426459
Control Number: E255553
Date Received: Nov 25, 2005
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* Norwest method(s) is based on reference method

References:

Alberta Research Council	Methods Manual for Chemical Analysis of Water and Wastes
APHA	Standard Methods for the Examination of Water and Wastewater
Comm. Soil Sci. Pl. Anal.	Communications in Soil Science and Plant Analysis
McKeague	Manual on Soil Sampling and Methods of Analysis

Comments:

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted

APPENDIX

APPENDIX D SLUG TEST RESULTS

Assuming Head Difference of 10.46 m

$\acute{O} = 0.40$

$k = 1.55 \text{ X } 10^{-7}$ m/s

$i = \frac{10.46}{250} = 0.042$ m/m

$$V_s = \frac{-k\,i}{\acute{O}}$$

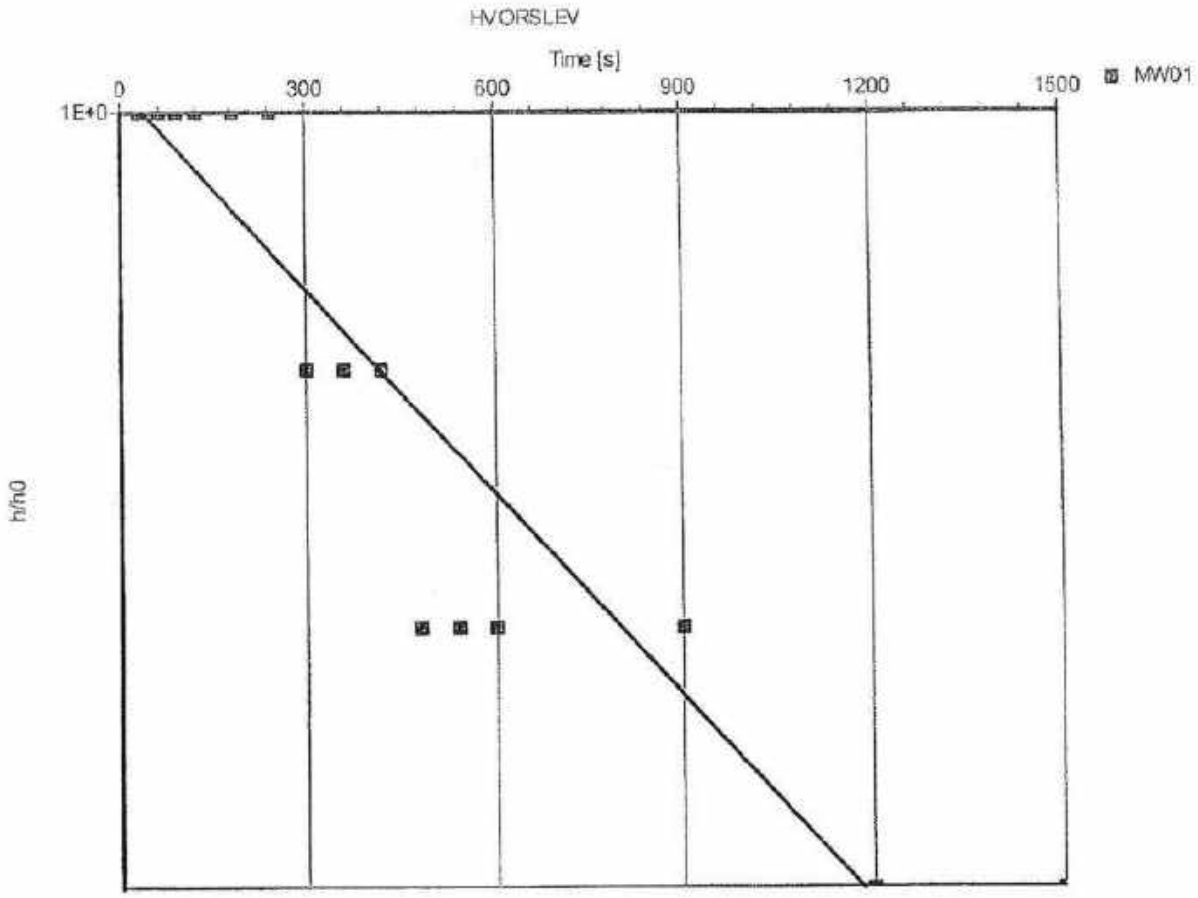
$$V_s = \frac{1.55 \text{ X } 10^{-7} \text{ X } 0.042}{0.40}$$

$V_s = 1.63 \text{ X } 10^{-8}$ m/s

$V_s = 1.41 \text{ X } 10^{-3}$ m / day

$V_s = 0.5$ m / year

EBA Engineering Consultants 14940-123 Ave Edmonton, Alberta, Canada Phone: (780) 451-2121	Slug test analysis No: 5101408 Project: Site Assessment for OWTS Client: Water's Edge Resort	
Location: Gunn, Alberta	Slug test: MW01 Nov 16/05	Test well: MW01
Test performed by: Stephanie Morin Test date: 11/16/2005	Evaluated by: SMM Evaluation date: 12/2/2005	
Analysis method: HVORSLEV	Aquifer thickness: 10	



Conductivity: 3.53×10^-9 [m/s]

Falling Head Test

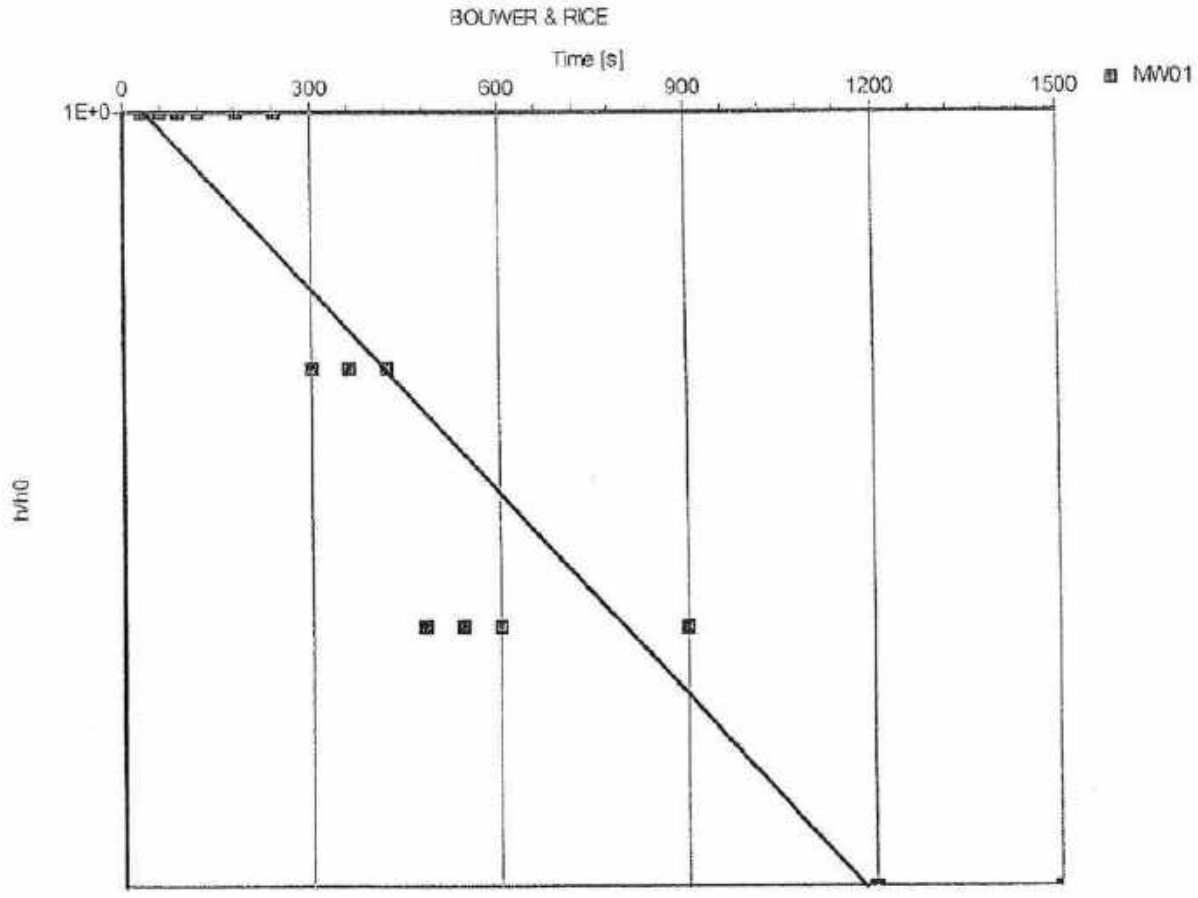
EBA Engineering Consultants
14940-123 Ave
Edmonton, Alberta, Canada
Phone: (780) 451-2121

Slug test analysis

No:	5101408
Project:	Site Assessment for OWTS
Client:	Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW01 Nov 16/05	Test well: MW01

Test performed by:	Stephanie Morin	Evaluated by:	SMM
Test date:	11/16/2005	Evaluation date:	12/2/2005
Analysis method:	BOUWER & RICE	Aquifer thickness:	10



Conductivity: 3.43×10^-9 [m/s]

Falling Head Test

EBA Engineering Consultants
14940-123 Ave
Edmonton, Alberta, Canada
Phone: (780) 451-2121

Slug test analysis

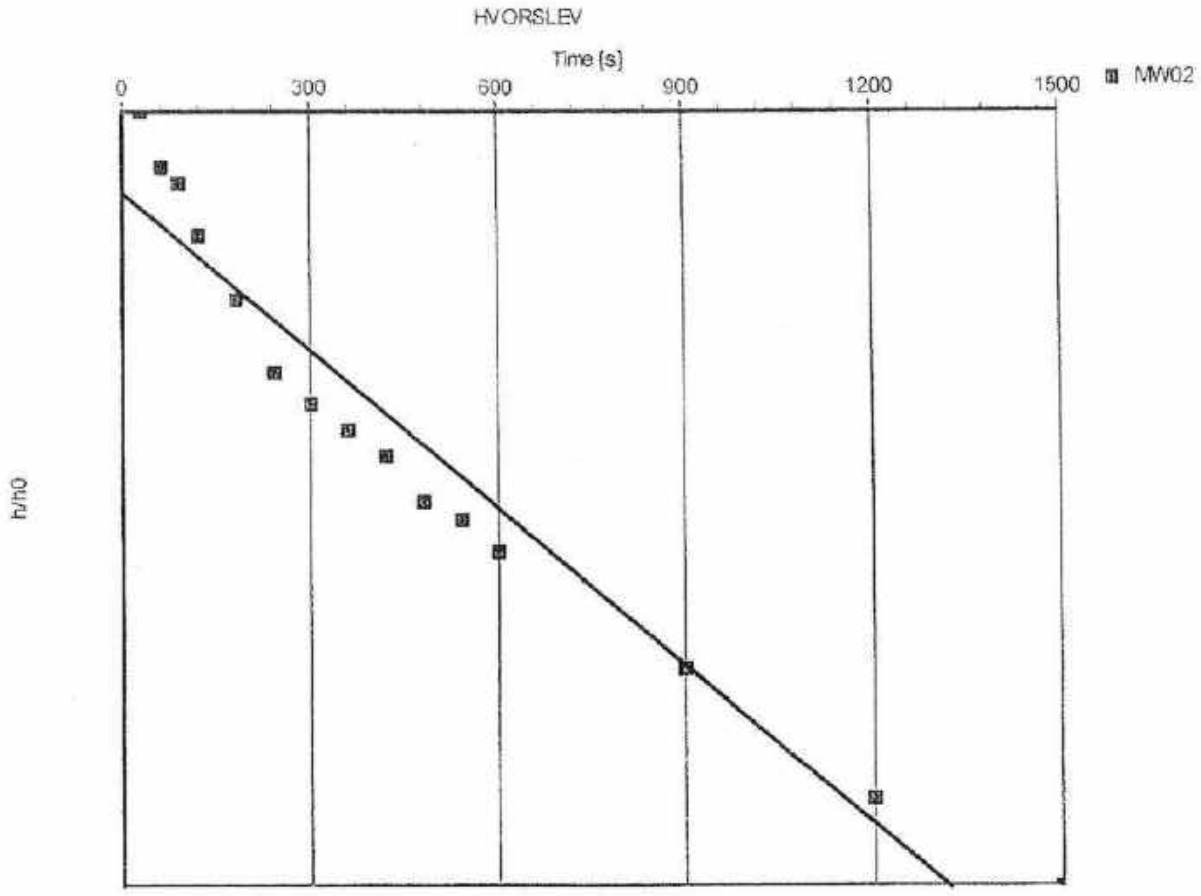
No: 5101408

Project: Site Assessment for OWTS

Client: Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW02 Nov 16/05	Test well: MW02

Test performed by: Stephanie Morin	Evaluated by: SMM
Test date: 11/16/2005	Evaluation date: 12/2/2005
Analysis method: HVORSLEV	Aquifer thickness: 10



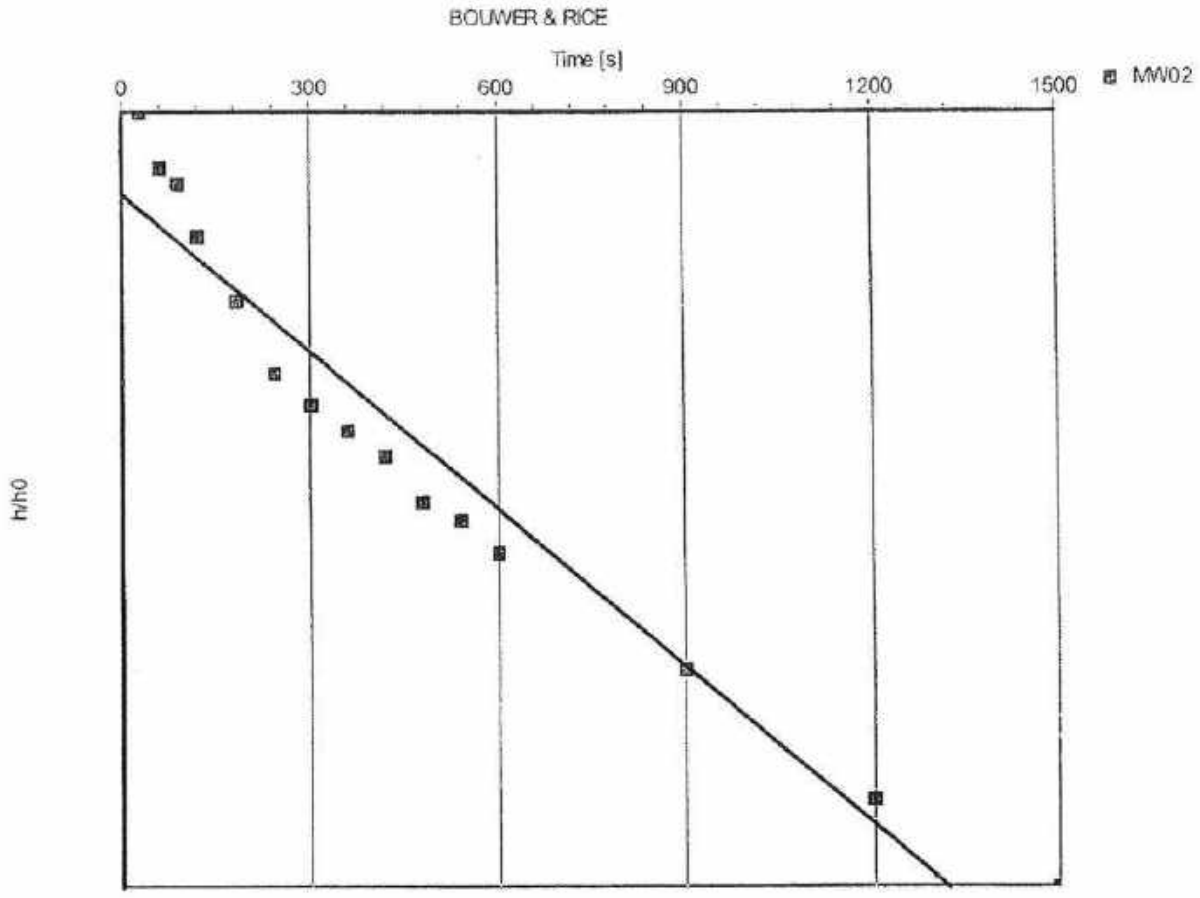
Conductivity: 1.77×10^-7 [m/s]

Falling Head

EBA Engineering Consultants 14940-123 Ave Edmonton, Alberta, Canada Phone: (780) 451-2121	Slug test analysis No: 5101408 Project: Site Assessment for OWTS Client: Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW02 Nov 16/05	Test well: MW02

Test performed by: Stephanie Morin	Evaluated by: SMM
Test date: 11/16/2005	Evaluation date: 12/2/2005
Analysis method: BOUWER & RICE	Aquifer thickness: 10



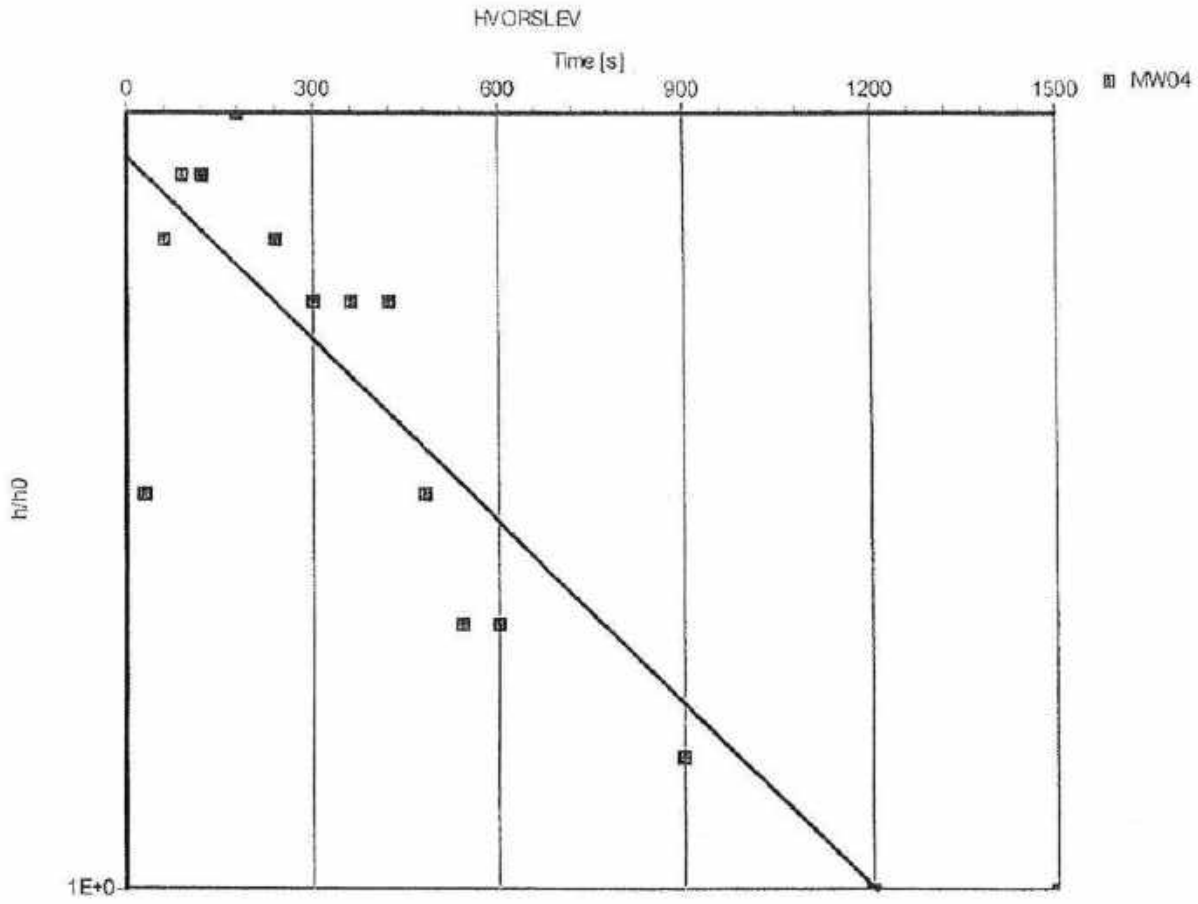
Conductivity: 1.55×10^-7 [m/s]

Falling Head

EBA Engineering Consultants 14940-123 Ave Edmonton, Alberta, Canada Phone: (780) 451-2121	Slug test analysis No: 5101408 Project: Site Assessment for OWTS Client: Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW04 Nov 16/05	Test well: MW04

Test performed by: Stephanie Morin Test date: 11/16/2005	Evaluated by: SMM Evaluation date: 12/2/2005
Analysis method: HVORSLEV	Aquifer thickness: 10



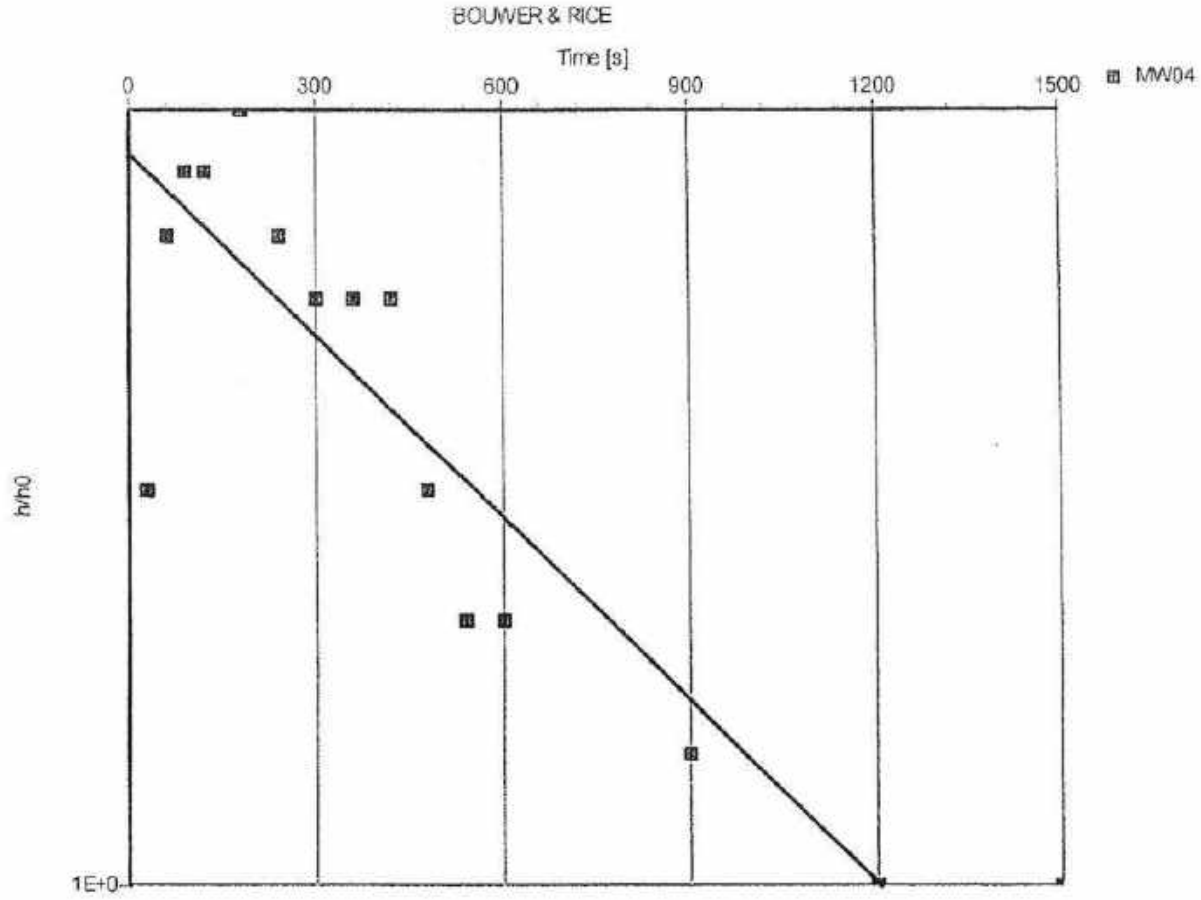
Conductivity: 1.08×10^-8 [m/s]

Falling Head

EBA Engineering Consultants 14940-123 Ave Edmonton, Alberta, Canada Phone: (780) 451-2121	Slug test analysis No: 5101408 Project: Site Assessment for OWTS Client: Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW04 Nov 16/05	Test well: MW04

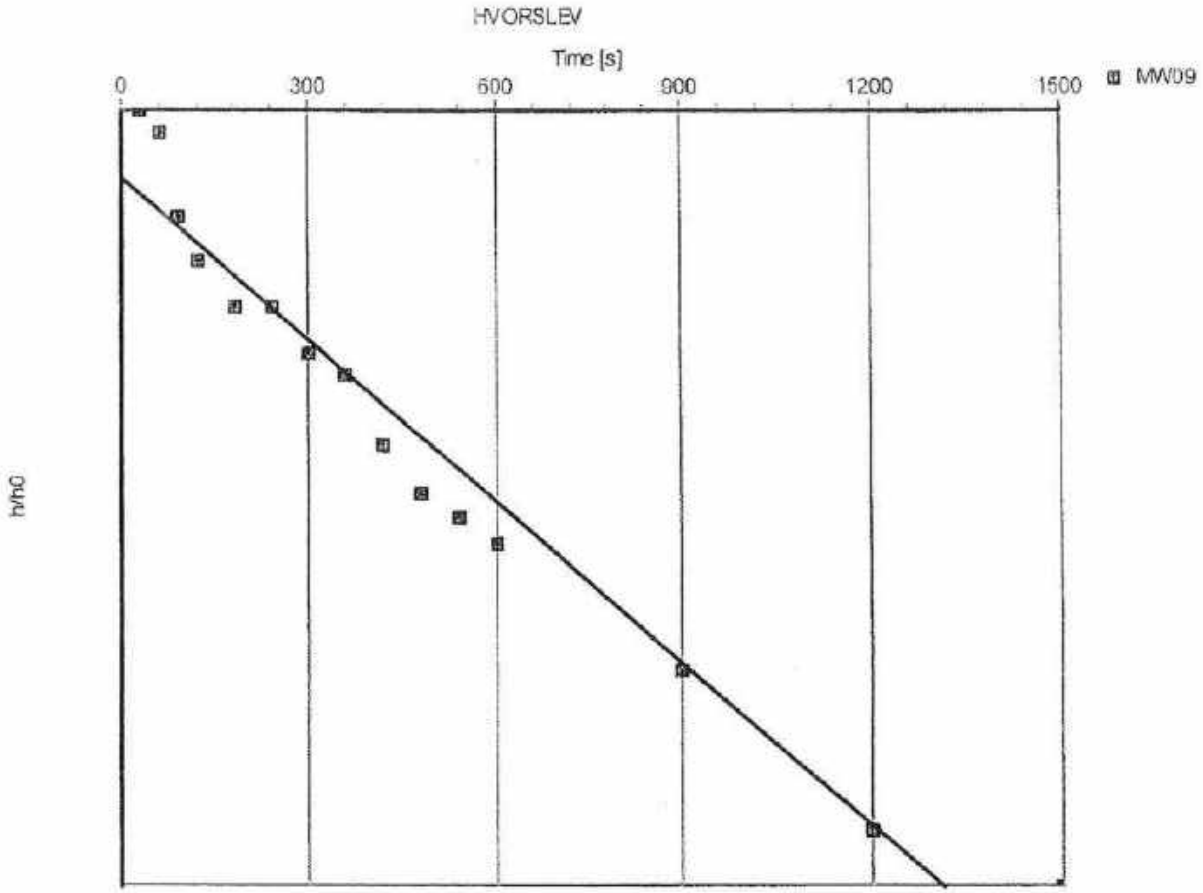
Test performed by: Stephanie Morin	Evaluated by: SMM
Test date: 11/16/2005	Evaluation date: 12/2/2005
Analysis method: BOUWER & RICE	Aquifer thickness: 10



Conductivity: 1.06×10^-8 [m/s]

Falling Head

EBA Engineering Consultants 14940-123 Ave Edmonton, Alberta, Canada Phone: (780) 451-2121	Slug test analysis No: 5101408 Project: Site Assessment for OWTS Client: Water's Edge Resort	
Location: Gunn, Alberta	Slug test: MW09 Nov 16/05	Test well: MW09
Test performed by: Stephanie Morin Test date: 11/16/2005	Evaluated by: SMM Evaluation date: 12/2/2005	
Analysis method: HVORSLEV	Aquifer thickness: 10	



Conductivity: 3.94×10^-8 [m/s]

Falling Head

EBA Engineering Consultants
14940-123 Ave
Edmonton, Alberta, Canada
Phone: (780) 451-2121

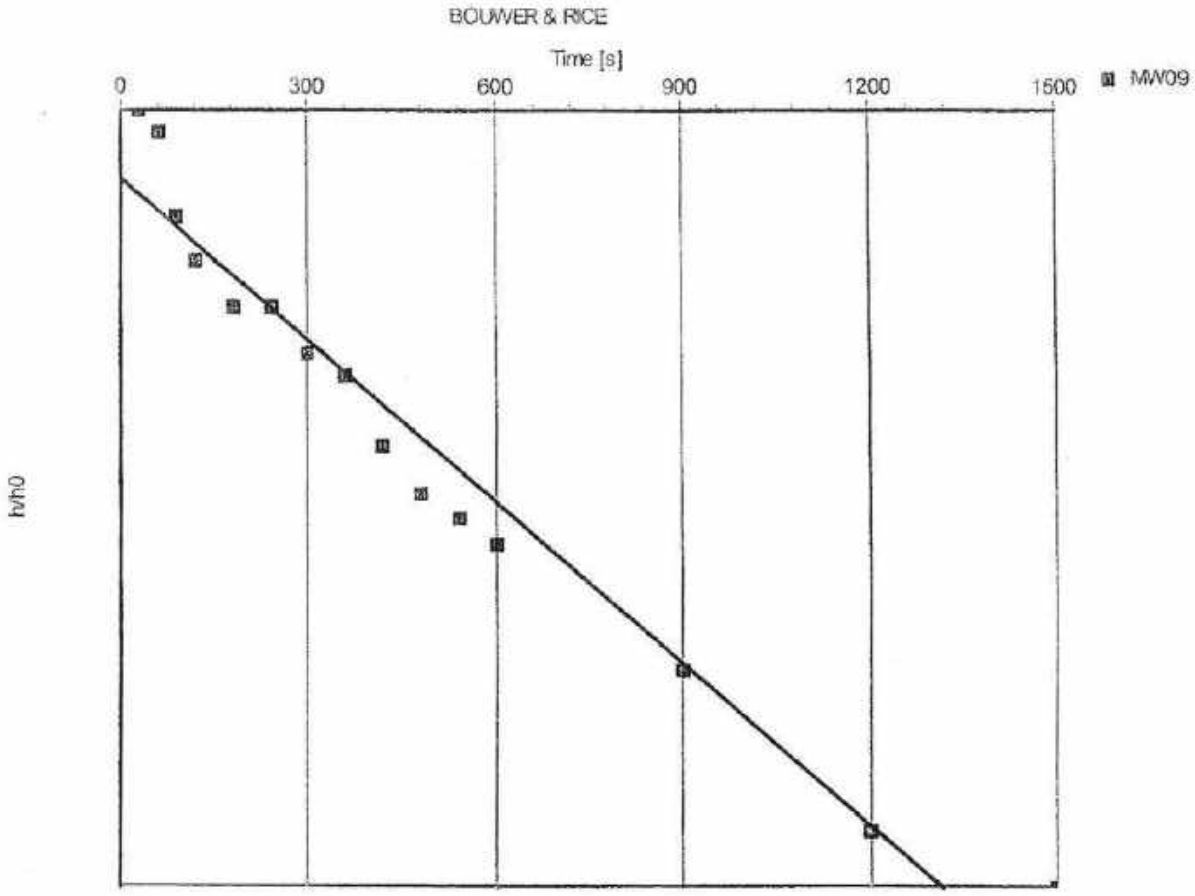
Slug test analysis

No: 5101408

Project: Site Assessment for OWTS

Client: Water's Edge Resort

Location: Gunn, Alberta	Slug test: MW09 Nov 16/05	Test well: MW09
Test performed by: Stephanie Morin	Evaluated by: SMM	
Test date: 11/16/2005	Evaluation date: 12/2/2005	
Analysis method: BOUWER & RICE	Aquifer thickness: 10	



Conductivity: 3.83×10^-8 [m/s]

Falling Head