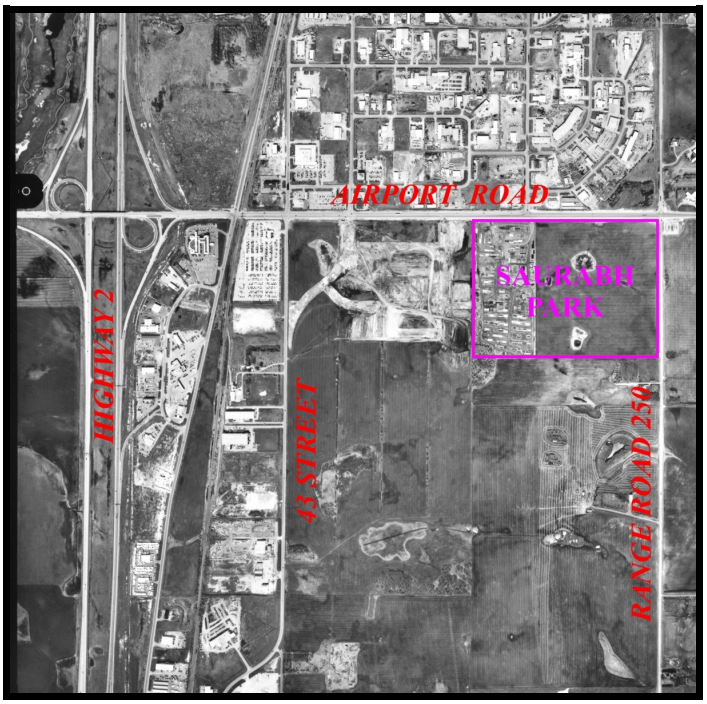
# SAURABH PARK
# OUTLINE PLAN

## STURGEON HOMES INC.




**Prepared By:**
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**BUNT & ASSOCIATES ENGINEERING LTD.**
**B.K. HYDROLOGY SERVICE**

**March 2006**

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## Appendices

# 1 INTRODUCTION

## 1.1 Purpose

This Outline Plan has been prepared on behalf of Sturgeon Homes Inc. and describes the conceptual subdivision design, land uses and associated zoning being proposed for the NE ¼ of 12-50-25-W4M. The subject ¼ section comprises four lots at about 16 hectares (40 acres) each, and is located in the northeast corner of that portion of the City of Leduc affected by the North Leduc Industrial Area Structure Plan (see Figure 1).

The North Leduc Area Structure Plan has been recently amended by Bylaw 592-1005, and the subdivision design and uses being proposed by this Outline Plan comply with the Leduc North Area Structure Plan as amended.

The **SAURABH PARK Outline Plan** has been prepared as per the ***Guidelines for ASP and OLP Preparation in the City of Leduc***. As such, the plan also describes: traffic impact and appropriate road standards and access locations onto Airport Road and Range Road 250; municipal servicing systems including water, sanitary sewer and storm water management; and, proposed staging.

## 1.2 Location Context

The Saurabh Park Plan Area is bounded by:

- Airport Road and the developed Nisku Business Park to the north;
- Range Road 250 and the proposed Saunders Lake Area Structure Plan to the east;
- Undeveloped farmland that is designated future light industrial to the south; and
- The partially developed industrial/ commercial ¼ section, being the NW 12-50-25-W4M owned by Farm Air Properties Inc. and managed by Cathton Holdings Ltd., to the west.

Both Airport Road and Range Road 250 are controlled by Leduc County and are designated as arterial roadways. The uses proposed by the Saunders Lake Area Structure Plan along the east side of the Range Road across from Saurabh Park are commercial and business industrial.

## 1.3 Legal Description

Sturgeon Homes owns three of the four lots and has an offer to purchase the fourth lot being the ¼ section remnant. The four lots comprising the Plan Area are legally described as:

- Lot A Plan 354 TR containing 15.94 hectares (39.38 acres)
- Lot B Plan 354 TR containing 16.18 hectares (40.00 acres)
- Lot C Plan 354 TR containing 16.18 hectares (40.00 acres)
- The Remaining Portion of the NE1/4 Section 12-50-25-W4M containing 16.44 hectares (40.62 acres)

The total plan area is 64.61 Ha (159.66 Ac). Removed from Lots A, B, & C Plan 354 TR are Road Plan 802-1634 containing 0.41 Ha (1.02 acres) and Road Plan 022-4257 containing 0.60 Ha (1.48 acres). The net developable area totals 63.60 hectares (157.16 acres).

## 1.4 Subdivision Concept

The subdivision concept being proposed for Saurabh Park is shown on Figure 2. Two collector roadways extend through the Plan Area as per the North Leduc Area Structure Plan. These collectors provide the framework for the block subdivision concept being proposed, and include:

1. **36th Street** that follows a north/south alignment proposed to extend from the existing 7th Street located in Nisku Business Park across Airport Road, then south through the North Leduc Area Structure Plan lands to intersect with 65th Avenue. This collector will channel traffic onto Airport Road and provides for high quality access from Saurabh Park.
2. **82nd Avenue** that follows an east/west alignment proposed to extend from 42nd Street to Range Road 250. 42nd Street is designated an arterial road. A segment of 82nd Avenue has been constructed in the adjacent Farm Air ¼ section to the west.

The subdivision design also proposes a north/south local road between future 36th Street and Range Road 250. This local road will provide access to the south. Additional local roads may be constructed for *lotting* and internal circulation purposes.

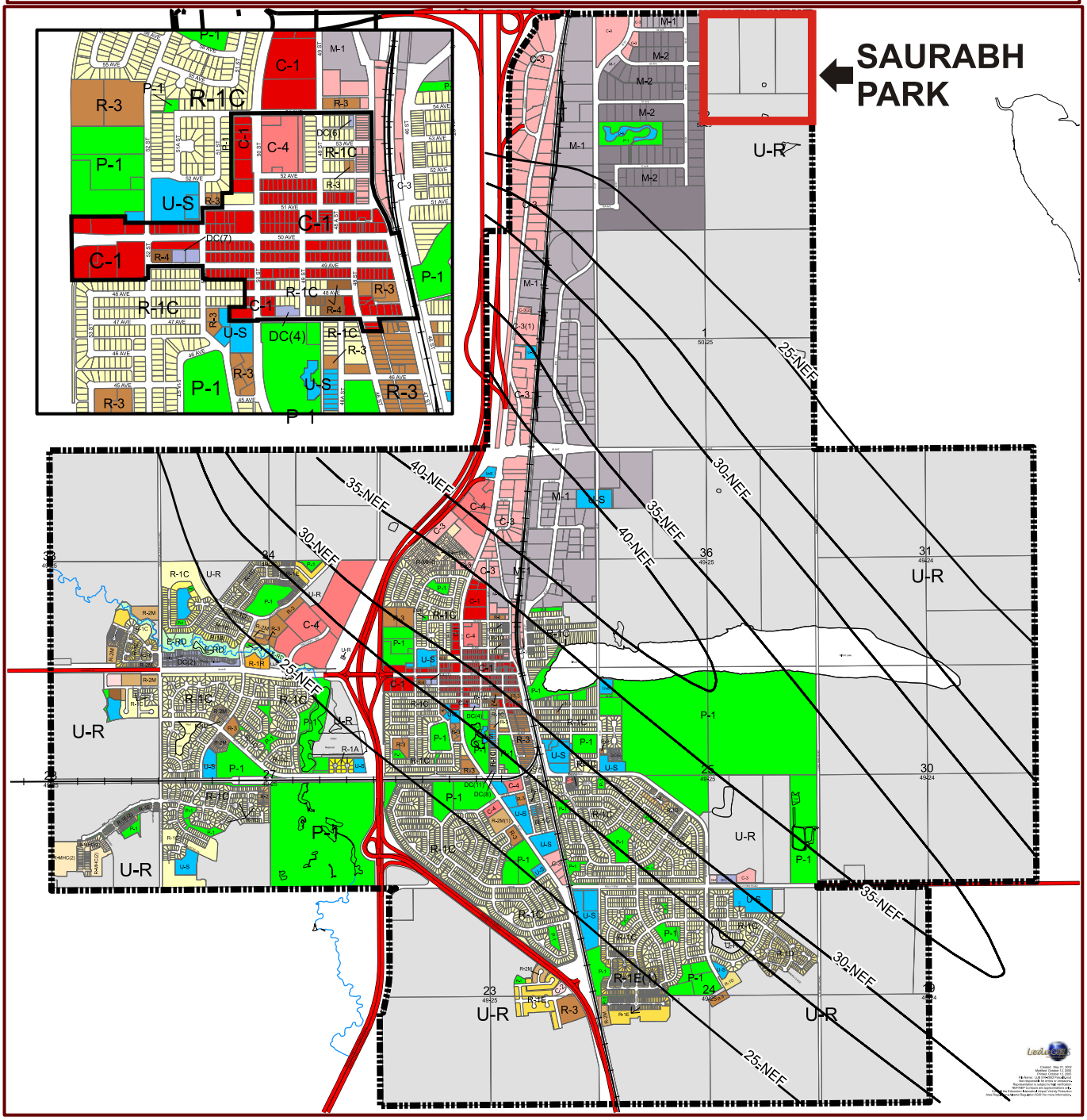
## 1.5 Land Use and Zoning

The land uses proposed for Saurabh Park are illustrated by Figure 3. As is noted above, the uses generally comply with the amended North Leduc Area Structure Plan. The objective of the Outline Plan is to promote *high end* commercial development along Airport Road and Range Road 250, with warehousing types of light industrial uses in the south portion of the Plan Area, and transitional uses such as mixed retail, office and business light industrial located in between.

The uses and related zoning are described as follows:

1. The focus of Saurabh Park will be a major hotel/convention centre proposed for the north ½ of Lot B Plan 354 TR, at the intersection of Airport Road and the future extension of 36th Street. This strategic location directly east of the

# City of Leduc
# Land Use Districts
# Land Use Bylaw 516-2002




**Legend**

- Municipal Boundary
- Railway
- Hydrology
- Hydrology Body
- C-1 - Commercial - Central Business District
- C-2 - Commercial - Neighbourhood Retail & Service
- C-3 - Commercial - General Commercial
- C-4 - Commercial - Shopping Centre
- DC - Direct Control
- E-RD - Conservation - Enviromental Restrictive
- M-1 - Industrial - Light Industrial
- M-2 - Industrial - General Industrial
- P-1 - Recreation - General Recreation
- R-1A - Residential - Single Detached
- R-1B - Residential - Single Detached
- R-1C-Residential - Single Detached
- R-1D - Residential - Single Detached
- R-1E - Residential - Single Detached
- R-1R - Residential - Single Detached (Rural)
- R-2 - Residential - Two Dwelling Units
- R-2M - Residential - Medium Density
- R-3 - Residential - Medium Density Apartment
- R-4 - Residential - High Density
- R-MHC - Residential - Manufactured Home Court
- U-R - Urban Reserve
- U-S - Urban Service - Semi Public
- RW - Railway

FIGURE 1
CITY OF LEDUC LAND USE BYLAW

Edmonton International Airport and Highway 2 will create the potential for a new level of *conventioneering* in the City of Leduc. The hotel facility will also provide the City with quality accommodation so that a full range of accommodation facilities will be available that will allow Leduc to better compete in the Edmonton market.

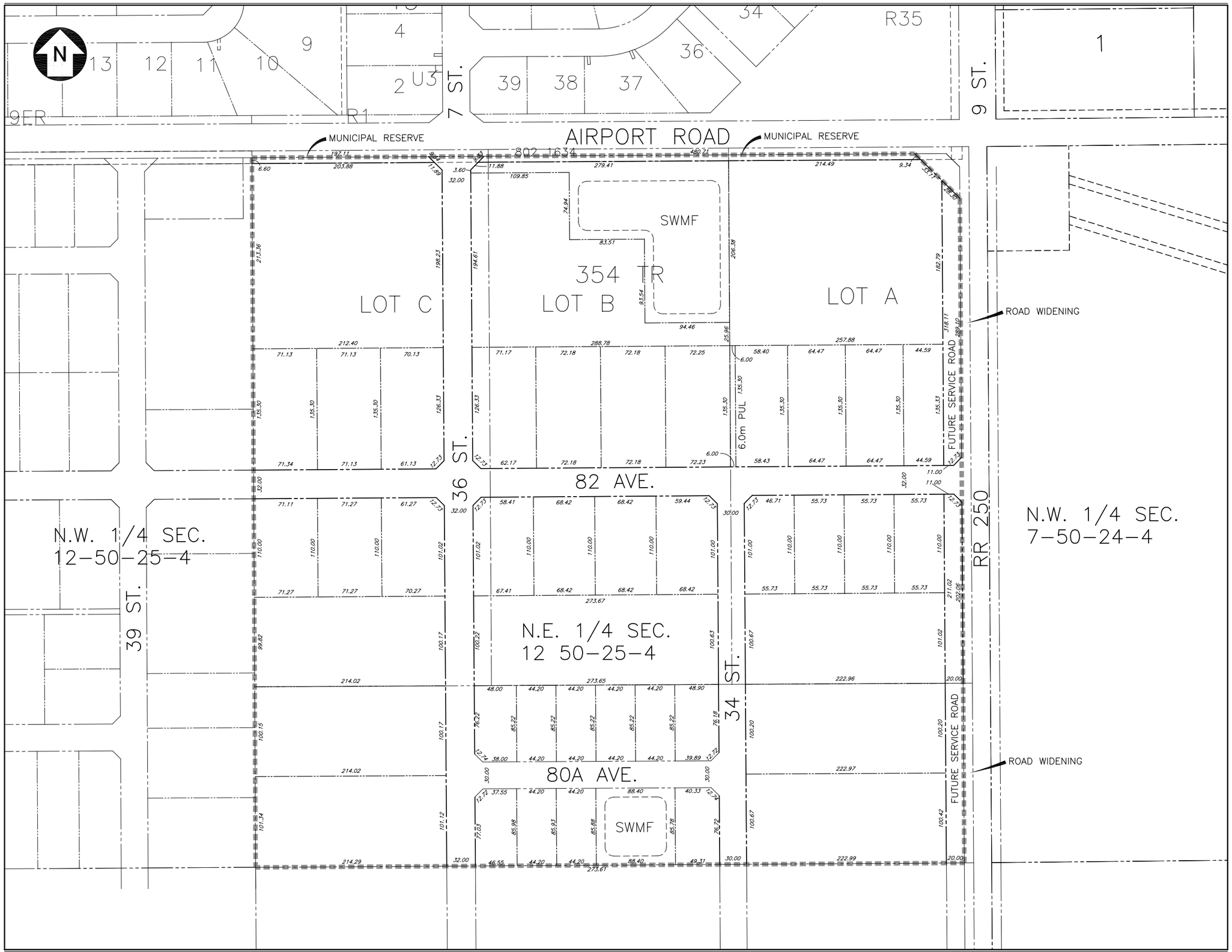
The hotel/convention centre will be accessed off 36th Street. As well, a right in/right out access off Airport Road is proposed along Airport Road, subject to County approval. The hotel will be up to 12 storeys and contain from 180 to 200 rooms, and will include all related amenities such as a fitness centre, shopping opportunities, eating and entertainment facilities as well as conference rooms. A storm water pond proposed for the northeast corner of the site will be developed as an amenity feature to be integrated with the convention centre, and will improve the aesthetics along Airport Road. A high standard of landscaping will be applied though out the site.

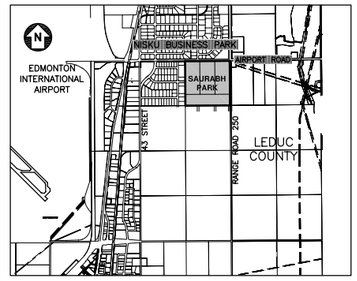
Although hotel is a Permitted Use in the C-3 – General Commercial Land Use District, the maximum height in this District is 20 metres which will not allow for a 12 storey building. This means that the hotel/convention centre site may need to be zoned Direct Control.

Regardless, the development will need to comply with the Airport Vicinity Protection regulation that is being updated by Alberta Municipal Affairs.

2. The balance of the lands designated commercial by the Leduc North Area Structure Plan and this Outline Plan are proposed to be zoned C-3 – Commercial. The types of uses that are expected to be developed comply with the purpose statement of this District. The purpose of the C-3 District is to accommodate a broad range of businesses including those that serve vehicular traffic. The District is intended to be applied to lands located adjacent arterial roadways, and primary and secondary highways, however may be considered appropriate on lands within the Plan area to transition between adjacent industrial and commercial uses.

3. The lands designated light industrial are proposed to be zoned M-1 – Light Industrial District. The general purpose of this District is to accommodate light industrial uses with activity mainly indoors. Those lands fronting onto 82nd Avenue are expected to attract business light industrial types uses, however, may transition to support a mix of general business commercial and light industrial uses along 82nd Avenue and 36 Street. The lands further south are expected to attract a variety of typical light industrial type uses. The mix of uses will reflect market demand at the time of detailed subdivision and development.




KEY PLAN

**NOTE:**

ALL DIMENSIONS SHALL BE VERIFIED BY LEGAL SURVEYOR.

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| A | 05/07/04 | ISSUED FOR OUTLINE REPORT | DCD | EJD |

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| | | REVISIONS | | |
| 3 | 06/02/14 | REVISED AS PER 3rd DRAFT CITY COMMENTS | RGG | EJD |
| 2 | 06/01/18 | REVISED AS PER 2nd DRAFT CITY COMMENTS | RGG | EJD |
| 1 | 05/11/21 | REVISED AS PER CITY COMMENTS | RGG | EJD |

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The Association of Professional Engineers, Geologists and Geophysicists of Alberta

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PROFESSIONAL ENGINEER ALBERTA — E.J. DURRANCE

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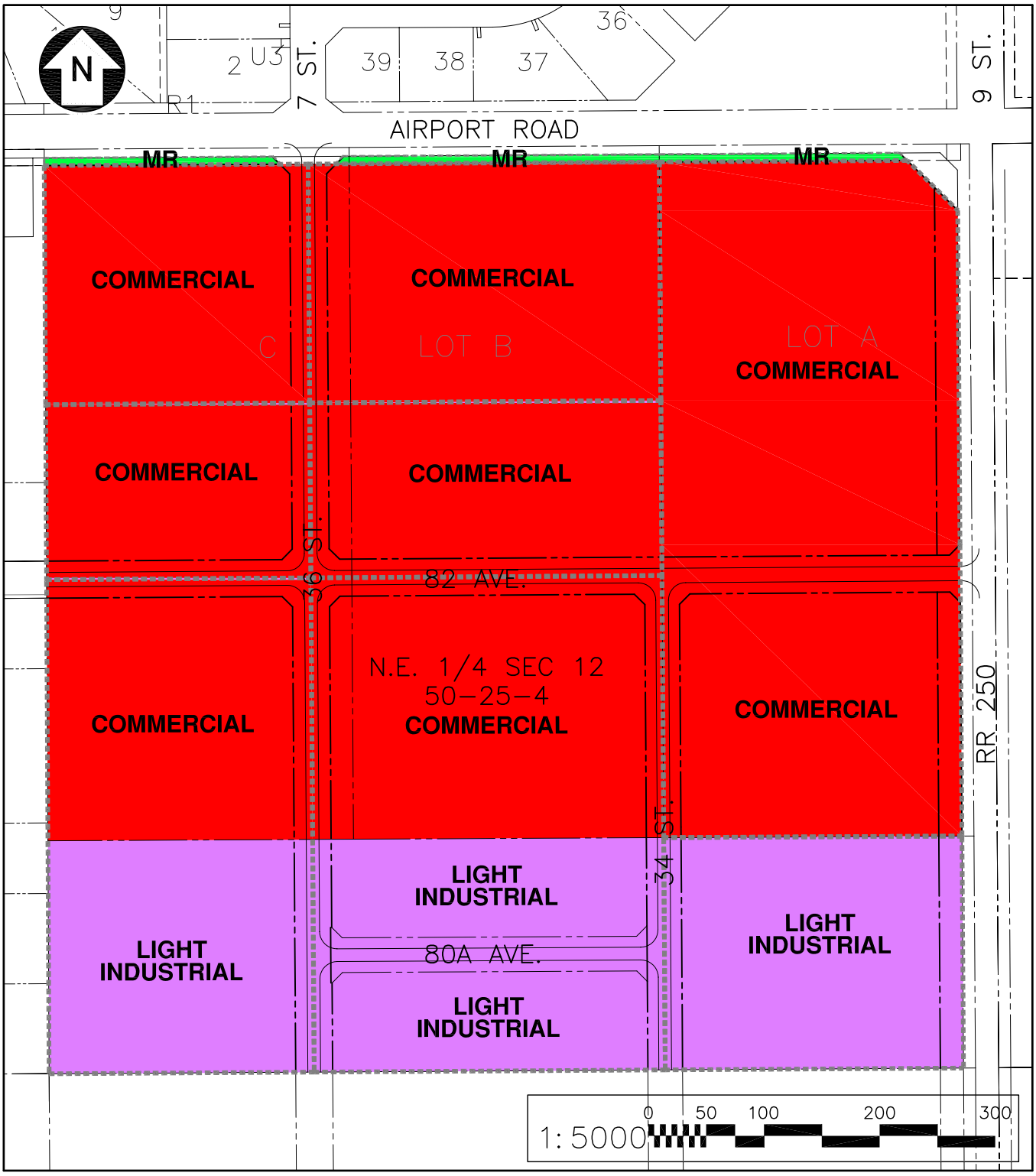


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# Tentative Land Use Plan
# Figure 3

Saurabh Park Outline Plan
February 2022

4. The following table summarizes the land use areas:

| Land Use Designation | Area – Hectares (Acres) +/- |
|---|---|
| Plan Area | 64.61 (159.66) |
| Existing Road Widening | 1.01 (2.50) |
| Net Developable Area | 63.60 (157.16) |
| Municipal Reserve (MR) | 0.46 (1.13)<br>NOTE: 5.90 Ha (14.58 Ac) to be satisfied by cash in lieu |
| | |
| Arterial Road Widening | 0.95 (2.34) |
| Future Service Road (RR 250) | 1.43 (3.54) |
| Local & Collector Roads | 7.09 (17.51) |
| Gross Developable Area | 53.67 (132.62) |
| | |
| Commercial Land Use | 37.44 (92.52) |
| Light Industrial Land Use | 12.83 (31.70) |
| Public Utility Lots (PUL) | 3.40 (8.40) |

## 1.6 Landscaping and Municipal Reserve

A landscaping plan that complies with Section 30 of the City's Land Use Bylaw will be submitted at the time of further subdivision. A higher standard of landscaping will be applied to the hotel/convention centre site. The landscaping to be applied will be considered as part of the development permit for the convention facility. As was previously noted, the storm pond proposed for the hotel/convention site will be integrated as an amenity feature into a comprehensive landscaping plan that will include the lands along Airport Road.

The City's plans for landscaping the length of Airport Road will be applied within the Plan Area. This landscaping will be located in the six metre wide Municipal Reserve strip proposed along Airport Road that extends from the existing Municipal Reserve strip located in the adjacent ¼ section.

The balance of the Municipal Reserve owing for the Plan Area will be provided as cash-in-lieu of land.

# 2 ROADWAYS

## 2.1 Transportation Impact Assessment

The proposed development site is currently designated commercial and light industrial according to the City of Leduc's North Area Structure Plan. The anticipated uses include a hotel/convention centre, typical commercial uses that service the traveling public and light industrial and business industrial uses. Currently the proposal calls for the commercial and hotel uses to front Airport Road with the industrial development on internal lots within the plan.

For the purposes of this study it was assumed that this development would build-out in approximately 15 years. However, in recognition of the staged nature of development, two time horizons were considered for transportation evaluation purposes. The first represents approximately 25% build out and the second assumes full build out as described in this Outline Plan document. While development is occurring in the Outline Plan area, the adjacent land is also expected to develop. To illustrate growth associated with development on adjacent lands the 2005 traffic volumes were increased by 2.5% per year and traffic projections from the Saunders Lake ASP transportation impact assessment were included in the background traffic volumes.

The trip generation rates used to determine the trips generated by the Commercial Site were derived from a review of ITE trip rates (*ITE Trip Generation, 7th Edition*). Under partial build out, this area has potential to generate approximately 859 two-way trips during the PM peak hour. Under full build, the Plan Area has potential to generate approximately 2500 two-way trips during the PM peak hour. The assessment assumes that approximately 50% of the trips to and from the development were from within Leduc County while the other 50% had origins or destinations within the City of Edmonton.

The analysis was completed using Synchro 6.0 to determine the operating conditions and level of service associated with development of the Outline Plan. The analysis was completed for the 2005 existing traffic volumes and 2020 background traffic volumes, as well as for the partial and full build out scenarios.

In general the analysis indicated that the existing roadway network and intersections operate well and that the proposed intersection locations fall within TAC guidelines. In addition it was concluded that with or without development in the Outline Plan area, a traffic signal and improvements to the configuration of the intersection of Airport Road and Range Road 250 will be required.

With limited growth in background traffic, development in the Outline Plan area could proceed with minor improvements to the adjacent road network. These improvements include construction of a westbound left turn bay at the 36th Street/Airport Road

intersection, provision of 60 m of storage for the northbound left turn a the 36th Street/Airport Road intersection and, to eliminate delay expected at the 36th Street/Airport Road intersection a signal could be installed. It is expected that this signal will be required when the area is approximately 25% build out.

The analysis also indicated that under full build out of the plan area additional infrastructure is required. It was also noted that the configuration of the intersection of 36th Street and Airport Road is dependant on the amount of roadway development south of the Outline Plan area.

Without additional road development to the south, a double northbound left turn at the 36th Street/Airport Road intersection would provide the additional capacity required to accommodate the volume of vehicles expected to make this movement. However, it is believed that by the time the Outline Plan area fully develops, additional roadway development to the south would provide additional routes for southbound traffic. It is also noted that with full build out of the Plan Area, left turn bays are recommended for the intersection of Range Road 250 and 82nd Avenue and that this intersection will require monitoring to determine if and when a signal would be required.

With respect to the timing of traffic signal installation, it is recommended that traffic growth at the intersections be monitored and that a signal be installed when traffic volumes and delay warrants are met.

In addition, an evaluation of a right-in right-out access to Airport Road was included in the analysis. Under both the partial and full build scenarios the right-in right-out access is expected to operate under high levels of service. The developer has indicated additional right-in right-out accesses may be proposed at the detailed design stage. Based on the analysis of the right-in right-out access currently proposed it is expected that, if designed appropriately, additional right-in right-out accesses will also operate well.

It is noted that, Airport Road and Range Road 250 are under the County's jurisdiction and all access construction is subject to the County's approval. To date access approvals include the all-directional intersections at 7th Street and Airport Road and 82nd Avenue and Range Road 250. The right-in right-out accesses as illustrated in Figure 4 are subject to the County's review and approval in conjunction with development applications for the properties fronting Airport Road and Range Road 250. A Functional Plan of Range Road 250 is currently underway. Any required widening as determined by the Functional Plan will be provided at the time of subdivision.

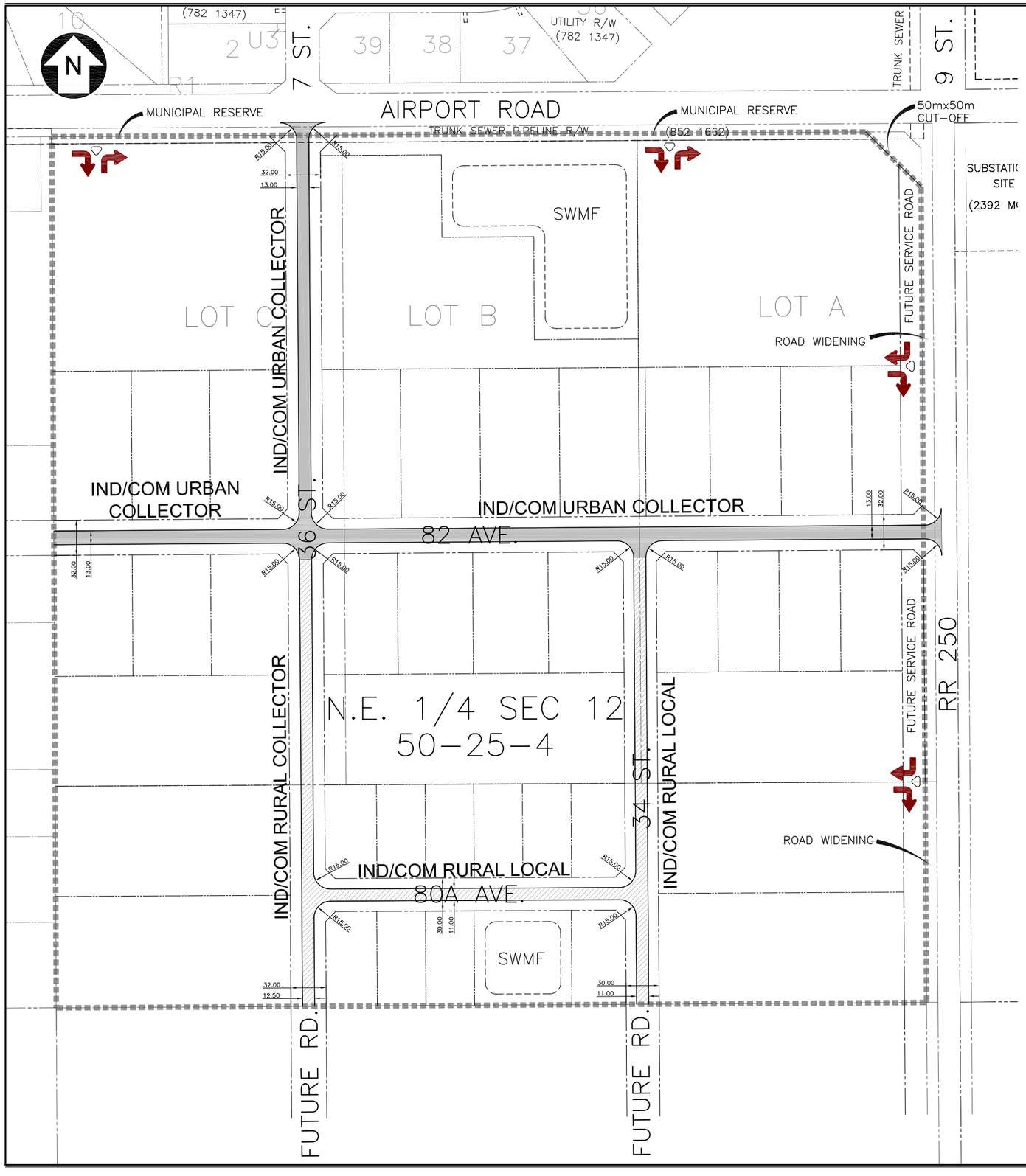
The Transportation Impact Assessment Final Report is included in Appendix 1.

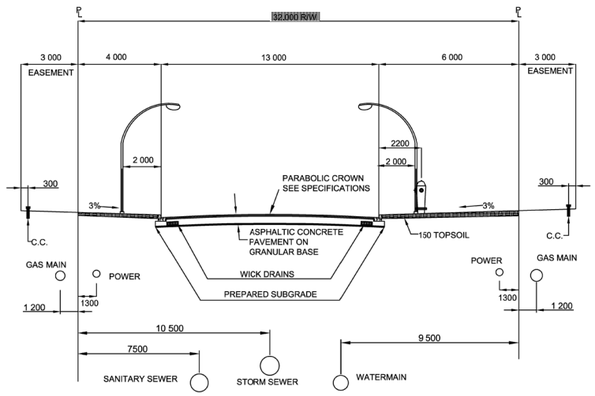
## 2.2 Roadway Standards

The development will incorporate an urban cross section for the roadways servicing the

properties fronting Airport Road to allow for high quality developments planned for these sites. It is anticipated the development of the properties along Airport Road will consist of hotel and commercial uses.

The south end of the development site will be developed consistent with the current standard of light industrial development. Figure 4 shows the areas where urban and rural standards will apply.




INDUSTRIAL / COMMERCIAL
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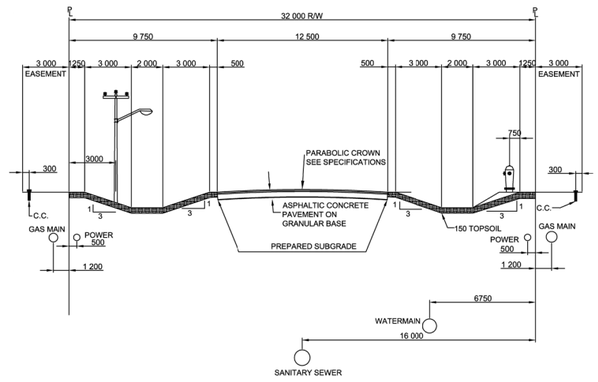


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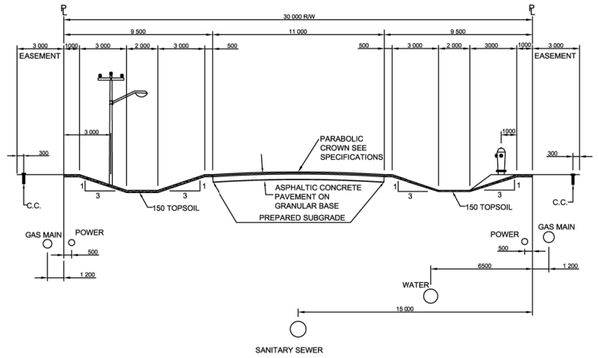
RURAL COLLECTOR SECTION

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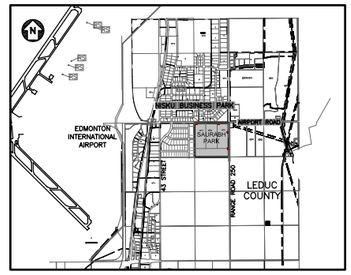
RURAL LOCAL SECTION




KEY PLAN

URBAN ROAD SECTION

RURAL ROAD SECTION

PROPOSED RIGHT-IN, RIGHT-OUT ACCESS

| No. | Y-M-D | DESCRIPTION | BY | APPD. |
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| A | 05/07/04 | ISSUED FOR OUTLINE REPORT | DCD | EJD |
| ISSUES | | | | |

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| 2 | 05/11/21 | REVISED AS PER CITY COMMENTS | RGG | EJD |
| 1 | 05/07/08 | REVISED ROADWAY WIDTHS | DCD | EJD |
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PROFESSIONAL ENGINEER ALBERTA
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OVERALL ROADWAY PLAN

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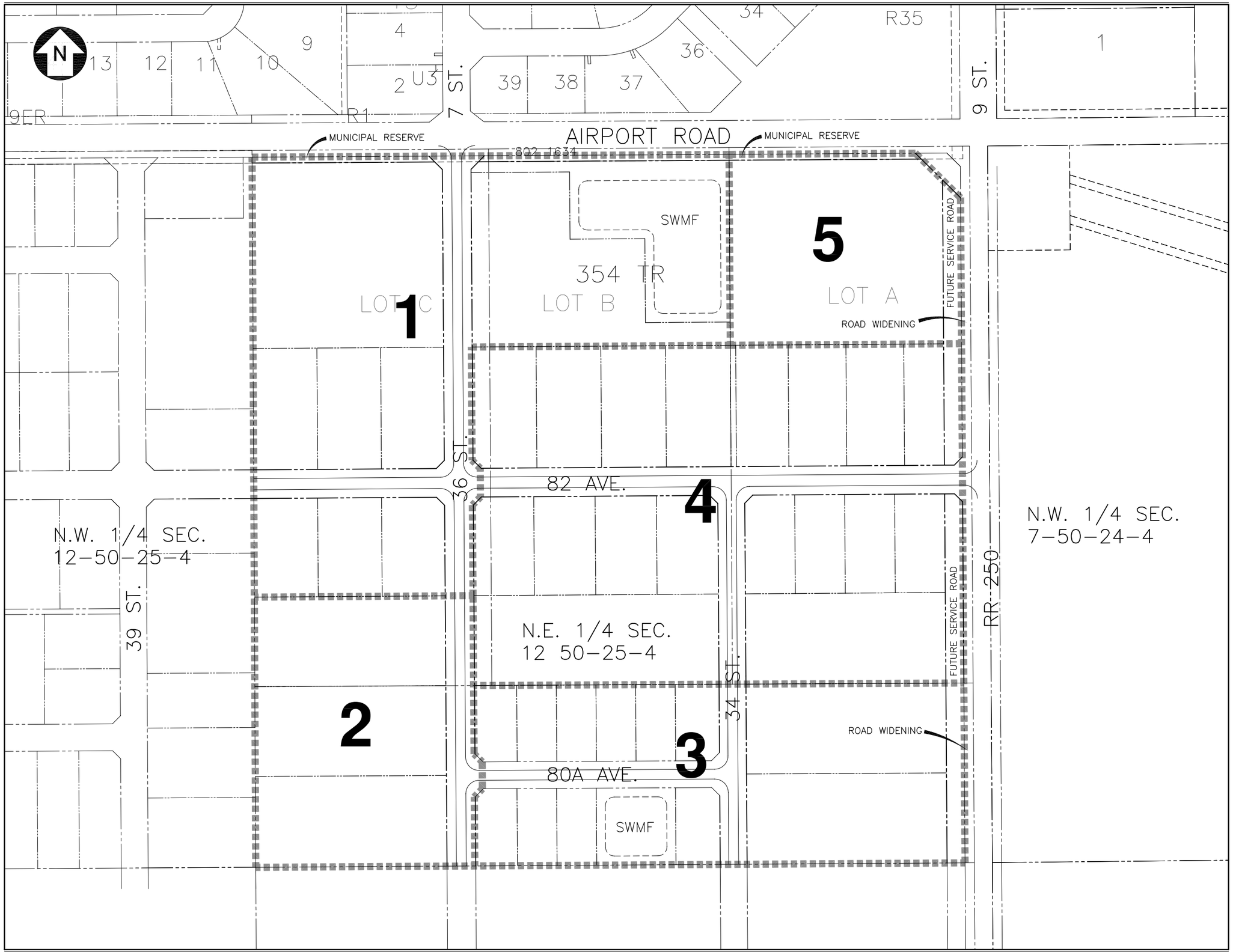
| DRAWING NUMBER: | FIGURE 4 |

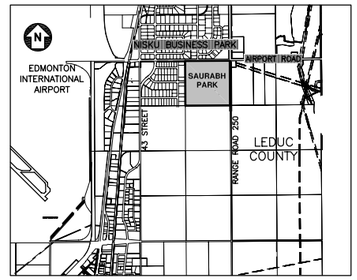
LAST EDIT DATE: 06/02/14

# 3 SUBDIVISION SEQUENCING

Development of the Saurabh Park will be completed in a number of Phases. The current plan shows the possible build out in 5 subdivision phases. The phases coincide with the need for services to be completed such that the services are extended from the existing facilities into the new development area. Where roadways are dead ended in the initial stages of development, temporary turnarounds for traffic will be provided.

Figure 5 shows the proposed development stages based on the servicing constraints and owner input into the foreseeable absorption of the building sites. Generally, the development will start in the northwest due to availability of services and continue in a easterly direction.

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# 4 MAJOR UTILITY SERVICING

## 4.1 Storm Water Management

The local storm runoff from within the Saurabh Park development will be directed to the storm pond by a combination of storm sewers, road ditches and overland drainage. Three storm pond options were considered to control the storm runoff leaving the site. Figure 6 shows the proposed storm water pond option considered for this site. The Storm Water Report in included in Appendix 2.

The proposed Storm Water Management is for a 2.12 ha storm pond just south of Airport Road and a second 0.72 ha storm pond located near the south boundary of the site. Outflow from the Airport Road (North) Pond would be at 4.2 l/s/ha.

The storm water calculations are provided in the B.K. Hydrology letter report dated November 17, 2005 (see Appendix 2).

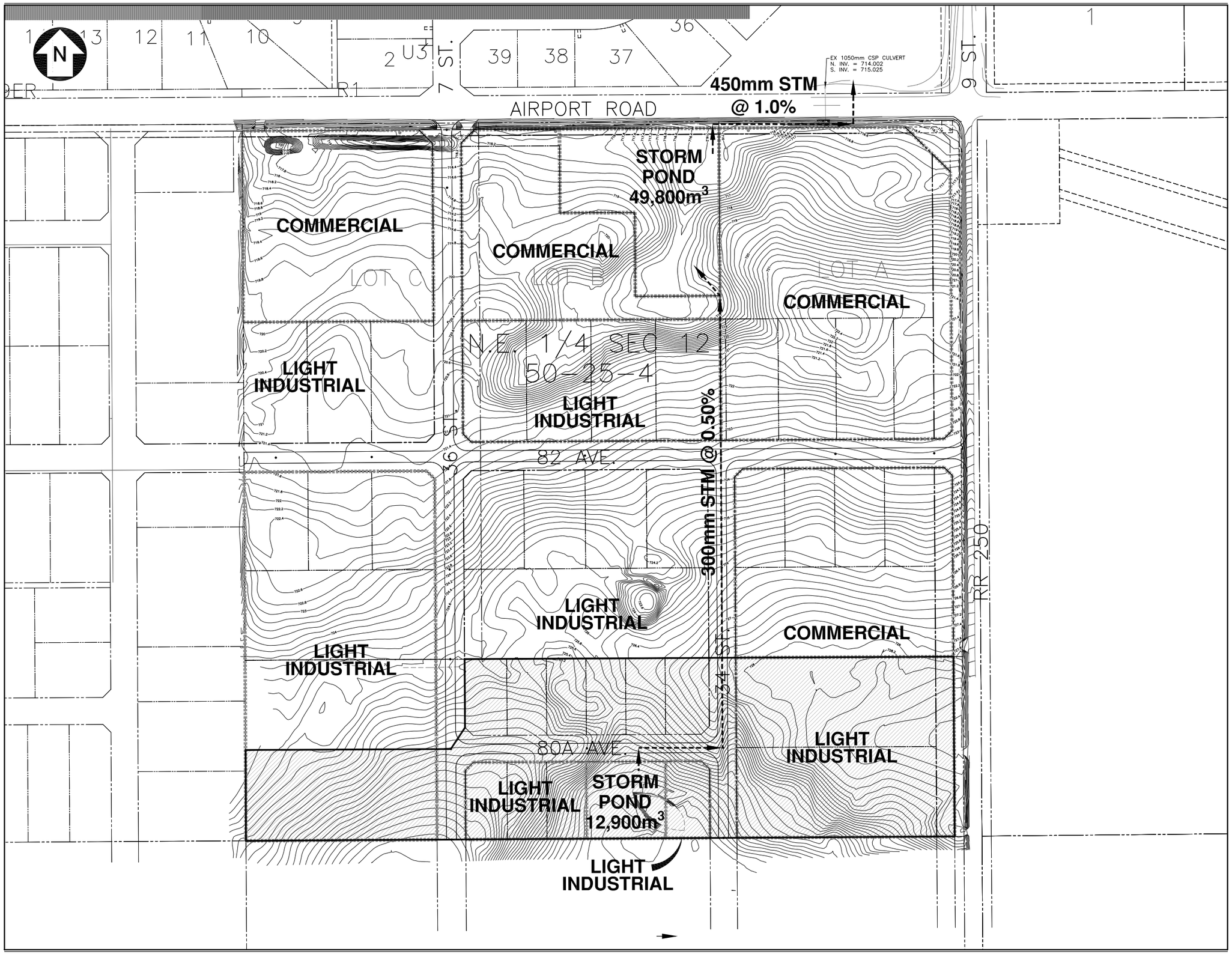
## 4.2 Water Supply

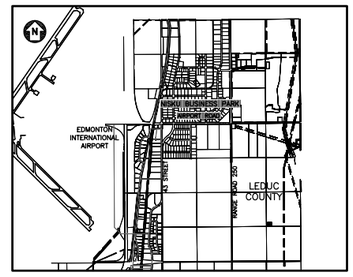
Water services will be extended from the existing water mains on Airport Road and 82nd Avenue. A network analysis was completed by the City of Leduc Engineering Department. The analysis was complete using WaterCAD by Haestad Methods and the water main sizes shown in Figure 7 are as recommended by the City. The water mains will consist of a 250mm / 350mm diameter loop from the intersection of 82 Ave/39 Street east with a second 250mm dia connection in the Airport Road R/W connecting to the existing watermain on 39th Street. All other water mains being 300 mm diameter to comply with the Engineering Servicing Standards for Light Industrial / Commercial districts in the City of Leduc. Water pressures will be in the range of 80 psi (550 Kpa) under fire flow conditions.

All watermain sizes comply with the City of Leduc water anaylsis requirements.

## 4.3 Sanitary Sewer

The sanitary sewer mains have been sized to meet the service area defined in discussions with the City of Leduc Engineering Department. Figure 8 shows the service boundary for the proposed sanitary sewer mains. The mains have been sized to have adequate capacity based on the City of Leduc Engineering Standards – Section 8.0 Sanitary Sewer System dated April 2005.




KEY PLAN

LEGEND

SOUTH WETLAND STORM POND DRAINAGE BASIN (REMAINDER OF SITE DRAINS TO NORTH WETLAND STORM POND)

STORM SEWER PIPING

AREA TABLE

| CATCHMENT AREA | AREA Ha (Ac) | % IMPERVIOUS PAVED/BLD % | GRAVEL % | GRASS % |
|---|---|---|---|---|
| ROADWAY | 7.09(17.51) | 45 | – | 55 |
| LOTS | | | | |
| – COMMERCIAL | 20.48(50.62) | 90 | – | 10 |
| – LIGHT INDUSTRIAL | 29.79(73.61) | 40 | 50 | 10 |
| STORM POND | 3.40(8.40) | – | – | – |
| TOTAL AREA | 60.76(150.14) | | | |

NOTE: LOTTING SHOWN SUBJECT TO FINAL APPROVALS.

| No. | Y-M-D | DESCRIPTION | BY | APPD. |
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| A | 05/07/04 | ISSUED FOR OUTLINE REPORT | DCD | EJD |
| ISSUES | | | | |

| No. | Y-M-D | DESCRIPTION | BY | APPD. |
|---|---|---|---|---|
| 3 | 06/02/14 | REVISED AS PER 3rd DRAFT CITY COMMENTS | RGG | EJD |
| 2 | 06/01/18 | REVISED AS PER 2nd DRAFT CITY COMMENTS | RGG | EJD |
| 1 | 05/11/21 | REVISED AS PER CITY COMMENTS | RGG | EJD |
| REVISIONS | | | | |

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Durrance & Associates Limited
Signature
Date
PERMIT NUMBER: P-5888
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

SEAL

PROFESSIONAL ENGINEER ALBERTA E.J. DURRANCE

STURGEON HOMES INC.

LEDUC, ALBERTA

# PROPOSED SITE SERVICING

STORM WATER MANAGEMENT OPTION 3

DURRANCE PROJECTS
Suite 105, 10525-170 Street
Edmonton, AB T5P 4W2
Phone: (780) 482-3430
Fax: (780) 482-3450
E-mail: durrance@telusplanet.net
Web: www.durranceprojects.com

SCALE: 1:2000 (0 20 40 80 120 160 200)

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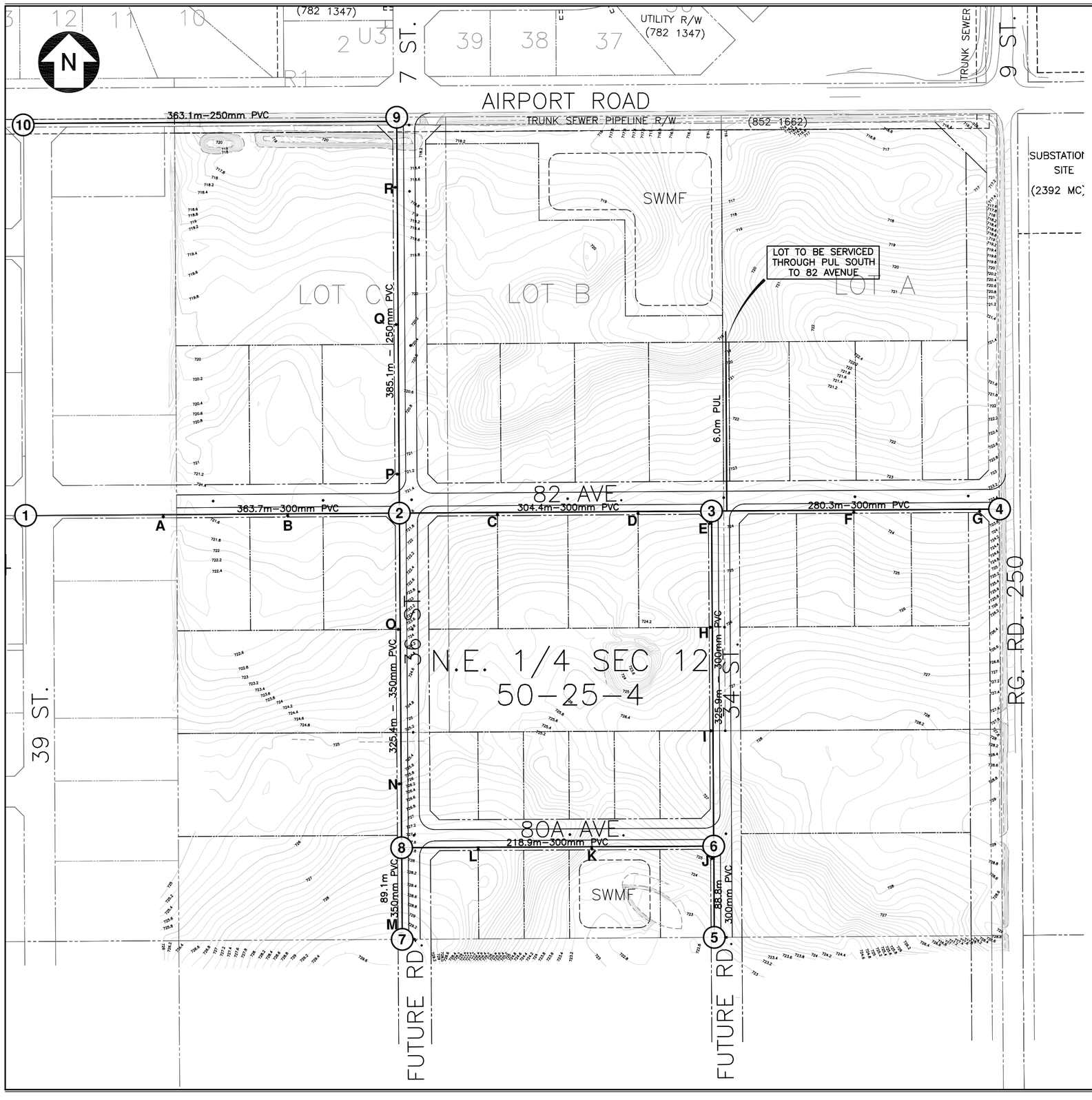
| DESIGNED BY: | – | JOB NUMBER: | 50441 |
| DRAWN BY: | DCD | | |
| CHECKED BY: | EJD | DRAWING NUMBER: | FIGURE 6 |
| DATE: | 05/01/20 | | |

LAST EDIT DATE: 06/02/14



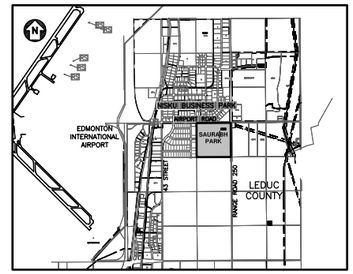

## NODE (1)

| NO. | NORTHING | EASTING | INVERT |
|---|---|---|---|
| 1 | 5909265.695 | 31517.451 | 717.35 |
| 2 | 5909267.926 | 31881.165 | 718.54 |
| 3 | 5909269.971 | 32184.909 | 720.61 |
| 4 | 5909271.858 | 32465.183 | 720.55 |
| 5 | 5908855.315 | 32187.620 | 720.11 |
| 6 | 5908944.084 | 32187.039 | 722.70 |
| 7 | 5908853.400 | 31883.957 | 726.47 |
| 8 | 5908942.514 | 31883.357 | 724.74 |
| 9 | 5909652.965 | 31878.572 | 715.26 |
| 10 | 5909645.535 | 31515.082 | |

## HYDRANTS A

| NO. | NORTHING | EASTING | NOZZLE EL. |
|---|---|---|---|
| A | 5909264.348 | 31651.412 | 721.55 |
| B | 5909265.144 | 31772.441 | 721.92 |
| C | 5909266.518 | 31976.563 | 722.92 |
| D | 5909267.440 | 32113.421 | 724.01 |
| E | 5909257.906 | 32182.938 | 724.41 |
| F | 5909268.853 | 32323.343 | 724.50 |
| G | 5909269.678 | 32445.832 | 724.04 |
| H | 5909156.888 | 32183.598 | 726.43 |
| I | 5909056.241 | 32184.256 | 727.87 |
| J | 5908932.025 | 32185.068 | 725.60 |
| K | 5908941.420 | 32068.376 | 724.76 |
| L | 5908940.825 | 31958.028 | 728.26 |
| M | 5908859.386 | 31881.866 | 729.85 |
| N | 5909004.588 | 31880.888 | 726.49 |
| O | 5909154.843 | 31879.877 | 724.15 |
| P | 5909305.869 | 31878.860 | 721.72 |
| Q | 5909451.379 | 31877.880 | 720.59 |
| R | 5909584.825 | 31876.981 | 719.25 |

– INVERTS AND FLANGE ELEVATIONS ARE APPROXIMATE AND ARE INTENDED FOR PRELIMINARY WATER NETWORK ANALYSIS ONLY.
– LOCATIONS AND ELEVATIONS ARE SUBJECT TO CHANGE.




KEY PLAN

NOTE: LOTTING SHOWN SUBJECT TO FINAL APPROVALS.

TOPOGRAPHIC SURVEY BY DURRANCE PROJECTS LTD. JANUARY 2005.

| No. | Y–M–D | DESCRIPTION | BY | APPD. |
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| A | 05/07/04 | ISSUED FOR OUTLINE REPORT | DCD | EJD |

ISSUES

| No. | Y–M–D | DESCRIPTION | BY | APPD. |
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| 3 | 06/02/14 | REVISED AS PER 3rd DRAFT CITY COMMENTS | RGG | EJD |
| 2 | 06/01/18 | REVISED AS PER 2nd DRAFT CITY COMMENTS | RGG | EJD |
| 1 | 05/11/21 | REVISED AS PER CITY COMMENTS | RGG | EJD |

REVISIONS

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Date
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PROFESSIONAL ENGINEER ALBERTA E.J. DURRANCE

STURGEON HOMES INC.

LEDUC, ALBERTA

# PROPOSED SITE SERVICING

WATER NETWORK


DURRANCE PROJECTS
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Web: www.durranceprojects.com


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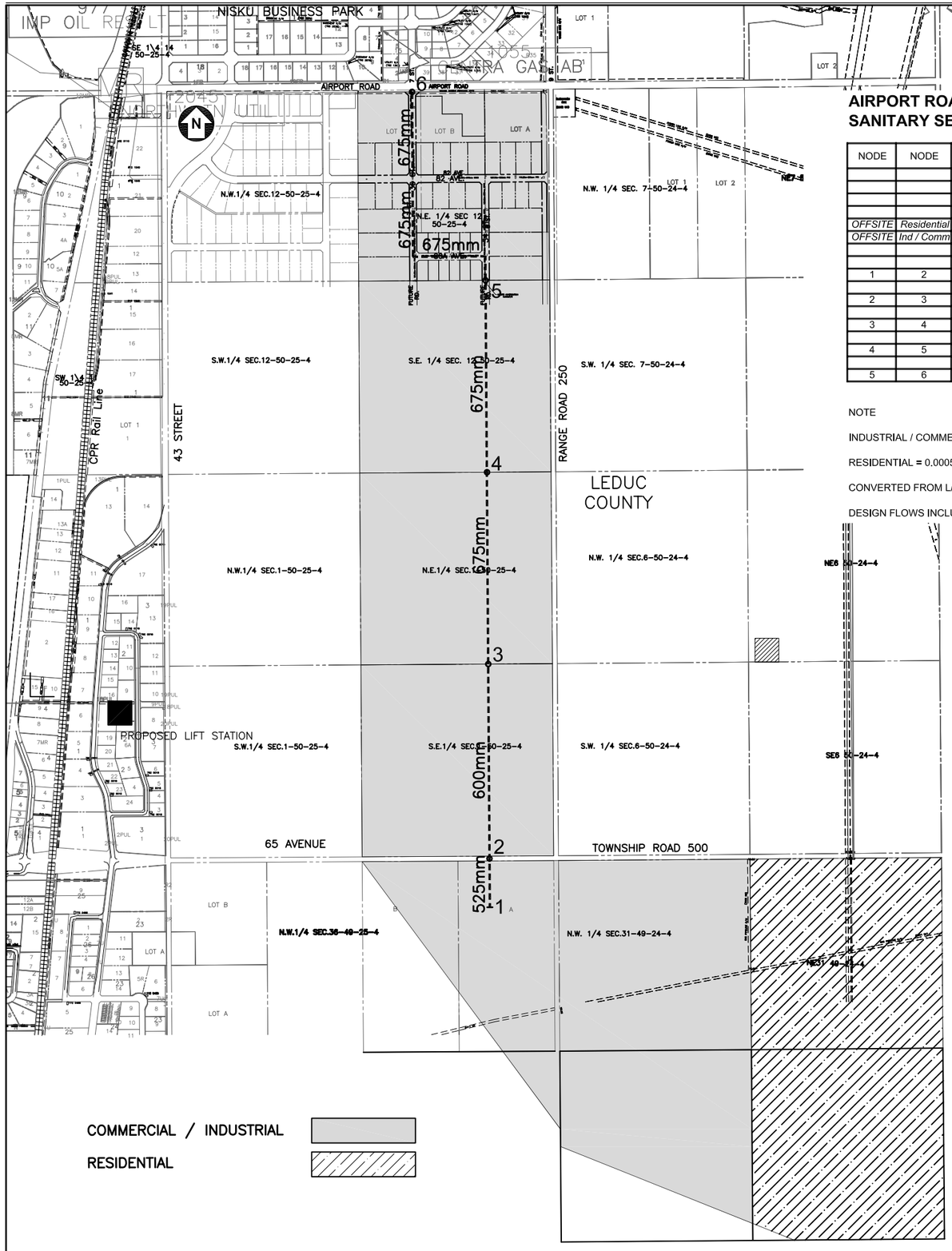
| DESIGNED BY: | DCD | JOB NUMBER: | 50441 |
| DRAWN BY: | DCD | | |
| CHECKED BY: | EJD | DRAWING NUMBER: | FIGURE 7 |
| DATE: | 05/06/21 | | |

LAST EDIT DATE: 06/02/14




## AIRPORT ROAD PROPERTY
## SANITARY SEWER (TRUNK) PLANNING

DATE: 30-Jun-05

| NODE | NODE | Length | Size | Pipe Type | Grade | Catchment Area | Total Area | Design Flow | n | Velocity | Capacity | Cap % | U/S INV. | D/S INV. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | mm | | % | Ha | Ha | m3/s | | m/s | m3/s | | (MIN) | (MIN) |
| *OFFSITE* | *Residential* | | | *Force Main* | | *127.89* | | *0.080* | | | | | | |
| *OFFSITE* | *Ind / Comm* | | | *Force Main* | | *155.91* | | *0.109* | | | | | | |
| 1 | 2 | 194.0 | 525 | CONC | 0.28 | 283.80 | 283.80 | 0.190 | 0.013 | 1.051 | 0.228 | 83% | 725.10 | 724.56 |
| 2 | 3 | 815.2 | 600 | CONC | 0.21 | 64.69 | 348.49 | 0.236 | 0.013 | 0.995 | 0.281 | 84% | 724.53 | 722.81 |
| 3 | 4 | 805.6 | 675 | CONC | 0.16 | 64.59 | 413.08 | 0.282 | 0.013 | 0.940 | 0.336 | 84% | 722.78 | 721.50 |
| 4 | 5 | 804.6 | 675 | CONC | 0.22 | 64.53 | 477.61 | 0.328 | 0.013 | 1.102 | 0.394 | 83% | 721.47 | 719.70 |
| 5 | 6 | 1094.2 | 675 | CONC | 0.52 | 64.00 | 541.61 | 0.373 | 0.013 | 1.694 | 0.606 | 62% | 719.67 | 713.98 |

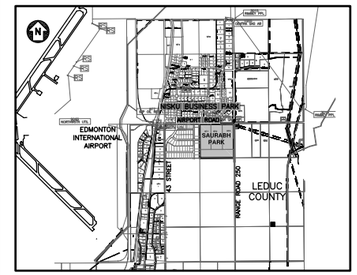
NOTE

INDUSTRIAL / COMMERCIAL = 0.00065 m3/S/Ha

RESIDENTIAL = 0.000567 m3/S/Ha

CONVERTED FROM L/S/DAY AS FOUND IN CITY OF LEDUC STANDARDS.

DESIGN FLOWS INCLUDE PEAKING FACTOR, INFILTRATION AND SAG MH ALLOWANCE AS TAKEN FROM CITY OF LEDUC 2005 STANDARDS.




KEY PLAN

| No. | Y-M-D | DESCRIPTION | BY | APPD. |
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| A | 05/07/04 | ISSUED FOR OUTLINE REPORT | DCD | EJD |

| No. | Y-M-D | DESCRIPTION | BY | APPD. |
|---|---|---|---|---|
| | | REVISIONS | | |
| 2 | 06/01/18 | REVISED AS PER 2nd DRAFT CITY COMMENTS | | |
| 1 | 05/11/21 | REVISED AS PER CITY COMMENTS | RGG | EJD |

PERMIT

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Durrance & Associates Limited
Signature_____
Date_____
PERMIT NUMBER: P-5888
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

SEAL

PROFESSIONAL ENGINEER ALBERTA
E.J. DURRANCE

STURGEON HOMES INC.

LEDUC, ALBERTA

# PROPOSED SITE SERVICING

SANITARY NETWORK


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| SCALE: | | | |
| DESIGNED BY: | DCD | JOB NUMBER: | 50441 |
| DRAWN BY: | DCD | | |
| CHECKED BY: | EJD | DRAWING NUMBER: | FIGURE 8 |
| DATE: | 05/06/21 | | |

LAST EDIT DATE: 06/01/18

# 5 CLOSURE

This Outline Plan for Saurabh Plan complies with the ***Guidelines for ASP and OLP Preparation in the City of Leduc***, and provides a framework for the zoning, subdivision and development of the Plan Area. Work on Phase 1 is expected to commence in 2005/2006 so that a timely approval of the Outline Plan through a resolution of City council is required.

It is recognized that future Development Agreements for this property will address the need for cost sharing downstream improvements needed as a result of development of this property. The Developer of Saurabh Park will be required to share in the cost of these downstream improvements.

The approval of the Outline Plan will provide the City of Leduc with the opportunity to effectively compete with South Edmonton for hotel *conventioneering* events, and will add to the City's inventory of business light industrial land. Saurabh Plan will be an asset to the City for expanding its commercial/industrial base, and will provide a finite visually appealing development on its north boundary.

# APPENDIX 1

## Transportation Impact Assessment (Bunt & Associates Engineering)

B U N T
& ASSOCIATES

March 2, 2006 3144.01

Durrance Projects
Mayfield Business Centre
Suite 105, 10525 - 170 Street
Edmonton, Alberta
T5P 4W2

Attn: Eric Durrance, P.Eng.

**Re: Airport Road Outline Plan**
**Transportation Impact Assessment Final Report**

This report was prepared in conjunction with the Outline Plan document prepared by Lovatt Planning Consultants Inc. in May 2005. The Outline Plan describes the conceptual subdivision design and land uses anticipated to be developed within the NE ¼ of 12-50-25-W4M. The plan proposes a mix of commercial and industrial uses and includes provision for a hotel/convention centre. It is expected that this document provides the technical information required for the City of Leduc's support of the Outline Plan from a transportation perspective.

**Existing Conditions**

The site is bounded on two sides by arterial roadways, Range Road 250 (9th Street) on the east and Airport Road on the north. Airport Road is a 4 lane undivided roadway. 9th Street currently exists as a two lane rural roadway. Both roadways fall within Leduc County jurisdiction.

In regards to the 9th Street corridor, the Leduc County Nisku Spine Road Functional Planning Study identifies right of way requirements for a 4 lane roadway north of the plan area and the Saunders Lake ASP indicates that 9th Street (RR 250) should be developed as a 4 lane section adjacent to the Airport Road Outline Plan area. However, details of the cross-section south of Airport Road were not available at the time of this report.

Intersection counts were completed by Bunt and Associates in May 2005. From these counts it was estimated that Airport Road adjacent to the Outline Plan area carries approximately 7500 vehicles per day and that 9th Street (RR 250) carries approximately 300 vehicles per day.

**Future Study Area Conditions**

In general, industrial subdivisions of this size take time to build out. For the purposes of this study it was assumed that this development would build-out in next 10 to 15 years. During this time the adjacent land is also expected to develop.

*Transportation Planners and Engineers*

*Bunt & Associates*
*Engineering (N. Alberta) Ltd.*

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*10339 - 124 Street*
*Edmonton, AB*
*Canada, T5N 3W1*

*Tel. 780. 732-5373*
*Fax. 780. 732-7806*
*Email. edmonton@bunteng.com*

In recognition of the staged nature of development, two time horizons were considered for transportation evaluation purposes. The first assumes that the hotel/convention centre and all of Block A plus 1/3 of Block E of the commercial lands develop in the immediate future. This represents approximately 25% build out. This staging assumption was analyzed because commercial development typically has higher trip generating potential than industrial lands and thus this scenario represents an interim development scenario with high traffic volumes. Full build-out of the area is expected over a longer time frame. For the purposes of this assessment a 15 year time frame was assumed for full build-out.

To illustrate growth associated with development on adjacent lands the 2005 traffic volumes were increased by 2.5% per year. In addition, development is expected to occur in the Saunders Lake area. It was assumed that 50% of the northwest portion of the Saunders Lake Area Structure Plan could build out in the 15 year time frame; this includes commercial, business industrial and estate residential development. **Exhibits 1** and **2** illustrate the 2005 and 2020 background traffic volumes used in the assessment.

In addition to growth in traffic volumes the adjacent roadway network will undergo improvements as development in the area proceeds. It is expected that roads in the Cathton lands outline plan to the west will be constructed in the 15 year time frame and that and that 9th Street (RR 250) will have undergone upgrading to support development in the Saunders Lake ASP.

**Proposed Development**

The proposed developable area (56 ha) is currently designated commercial and light industrial according to the City of Leduc's North Area Structure Plan. The anticipated uses include a hotel/convention centre, typical commercial uses that service the traveling public and light industrial and business industrial uses. Currently the proposal calls for the commercial and hotel uses to front Airport Road with the industrial development on internal lots within the plan.

The outline plan includes a main north-south roadway that will tie into Airport Road at the existing 7th Street intersection. The main east-west roadway services the industrial portion of the plan and the commercial area the fronts on to 9th Street (RR 250). It is anticipated that this east-west road will tie into 82nd Avenue to the west and will provide all-directional access to 9th Street (RR 250). A right-in right-out access is proposed along the property line of the proposed commercial lots Block C and Block E. This proposed right-in right-out access to airport road is approximately 260 m from the 9th Street/Airport Road intersection and approximately 280 m from the 7th Street/Airport Road intersection. The attached **Exhibit 3** illustrates the Proposed Site Plan.

**Site Traffic Generation**

<u>Assessment Time Period</u>

Trip generation of the proposed land uses schedule was evaluated for both the AM and PM peak hours. This evaluation indicated that the volume of traffic generated by the plan area was greater in the PM Peak hour than the AM peak hour. Therefore, for this assessment it was assumed that the weekday PM peak hour will be the critical assessment time period.

Trip Generation and Distribution

The trip generation rates used to determine the trips generated by the Commercial Site were derived from a review of ITE trip rates (*ITE Trip Generation, 7th Edition*).

As indicated previously, two development scenarios were analyzed, a partial build out scenario and a full build out scenario. The projected PM peak hour site generated trips for the partial and full build out scenarios are summarized in **Tables 1** and **2.** The trip generation is based on the anticipated land use schedule as described in the May 2005 Outline Plan prepared by Lovatt Planning Consultants as well as discussions with the client group.

**Table 1: Partial Build out PM Peak Hour Trip Generation**

| Block | Zoning | Size (ha) | Developable Area (1000 SF)/ # of Rooms | Trip Rate | % In | % Out | Trips | Pass-by Trips | Net Total Trips |
|---|---|---|---|---|---|---|---|---|---|
| A | C3 (commercial) | 4.5 | 145 | 3.75 | 48% | 52% | 545 | 81 | 464 |
| E | C3 (commercial) | 2.7 | 87 | 3.75 | 48% | 52% | 327 | 50 | 277 |
| C | DC (Hotel Complex) | 6.1 | 200 | 0.59 | 53% | 47% | 118 | | 118 |
| **Total** | | **13.3** | **232/200** | | | | **990** | **131** | **859** |

Table 1 indicates that, under partial build out, this area has potential to generate approximately 859 two-way trips during the PM peak hour. This assumes that 15% of the commercial trips are pass-by and that commercial Lot E develops to 1/3 its full potential.

**Table 2: Full Build out PM Peak Hour Trip Generation**

| Block | Zoning | Size (ha) | Developable Area (1000 SF)/ # of Rooms | Trip Rate | % In | % Out | Trips | Pass-by Trips | Net Total Trips |
|---|---|---|---|---|---|---|---|---|---|
| A | C3 (commercial) | 4.5 | 145 | 3.75 | 48% | 52% | 545 | 81 | 464 |
| E | C3 (commercial) | 9.0 | 291 | 3.75 | 48% | 52% | 1090 | 163 | 927 |
| C | DC (Hotel Complex) | 6.1 | 200 | 0.59 | 53% | 47% | 118 | | 118 |
| B,D,H & N1/2 F & G | C3 (commercial) M1(Light Ind) | 26.85 | 867 | 0.90 | 23% | 77% | 783 | | 783 |
| S1/2 F & G | M1(Light Ind) | 10.05 | 325 | 0.86 | 21% | 79% | 279 | | 279 |
| **Total** | | **56.5** | **1628/200** | | | | **2815** | **244** | **2571** |

Table 2 indicates that the Airport Road Outline Plan has potential to generate approximately 2500 two-way trips during the PM peak hour. Again, this assumes that 15% of the commercial trips are pass-by trips that would be on the road network whether or not development occurs within the plan area.

The trip generation rate used in area B,D,H & N1/2 F & G is a blended trip generation rate. This blended rate recognizes the fact that this area is expected to develop with commercial, business industrial and and light industrial uses.

The distribution used in the assessment assumed that approximately 50% of the trips to and from the development were from within Leduc County while the other 50% had origins or destinations within the City of Edmonton. The trips were then assigned to the collector roads and access points based proximity to the access and the roadway infrastructure assumed to be available during the

scenario being analyzed. The site generated trips for the partial and full build out scenarios are presented in **Exhibits 4** and **5.**

### Intersection Analysis

The analysis was completed using Synchro 6.0 to determine the operating conditions and level of service associated with development of the Outline Plan. The analysis was completed the for the 2005 existing traffic volumes and 2020 background traffic volumes as well as for the partial and full build out scenarios discussed previously.

Intersection operations are typically rated by two measures: the volume-to-capacity (V/C) ratio and Level of Service. The volume-to-capacity ratio describes the extent to which the traffic volumes can be accommodated by the physical capacity of the road configuration and traffic control. A value less than 0.90 indicates that generally there is sufficient capacity and good traffic conditions. A value between 0.90 and 1.0 suggests unstable operations may occur as volumes are nearing capacity conditions. A calculated value over 1.0 indicates that traffic volumes are theoretically exceeding capacity. The second measure of performance, Level of Service (LOS), is based on the estimated average delay per vehicle among all traffic passing through the intersection. A low average delay merits a LOS A rating while high average delay merits a LOS of F.

The total traffic volumes were determined by adding the site generated traffic to the background traffic volumes. This was completed for both the partial build out (2005) and full build out (2020) scenarios. The total traffic volumes are illustrated on the attached **Exhibits 6** and **7**.

### Existing Traffic Volume Analysis

The existing (2005) traffic volumes analysis was completed based on the March 2005 count volumes and the existing geometry and intersection configurations. The 7th Street/Airport Road and the 9th Street/Airport Road intersections operate under north south stop control. **Table 3** summarizes the results of the 2005 existing traffic volume analysis

**Table 3: 2005 Existing Traffic Volume Analysis Summary**

| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Movement** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** |
| **7th Street/Airport Road** | | | | | | | | | | | | |
| **Volume** | 56 | 420 | | | 272 | 16 | | | | 72 | | 286 |
| **v/c** | 0.04 | 0.12 | | | 0.11 | 0.06 | | | | 0.17 | | 0.33 |
| **Delay** | 8.0 | 0.0 | | | 0.0 | 0.0 | | | | 15.5 | | 11.1 |
| **LOS** | A | A | | | A | A | | | | C | | B |
| **Queue (m)** | 1.0 | 0.0 | | | 0.0 | 0.0 | | | | 4.7 | | 10.8 |
| **RR 250 (9th Street)/Airport Road** | | | | | | | | | | | | |
| **Volume** | 21 | 462 | 9 | 2 | 148 | 1 | 2 | 1 | 9 | 32 | 10 | 138 |
| **v/c** | 0.01 | 0.14 | 0.14 | 0.0 | 0.04 | 0.04 | 0.02 | | | 0.23 | | |
| **Delay** | 0.1 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 11.8 | | | 11.1 | | |
| **LOS** | A | A | A | A | A | A | B | | | B | | |
| **Queue (m)** | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | | | 6.9 | | |

As illustrated in Table 3 the analysis indicates that the existing roadway network and intersections operate well. It is noted that the majority of the traffic on Airport Road during the PM peak hour is traveling eastbound where as, the majority of vehicles exiting the subdivision to the north are heading westbound. The volume of vehicles making the southbound to westbound movement at 7th

Street is significant however because it is a right turn the intersection operates well and the movement experiences minimal delay.

The north and south legs of the 9th Street/Airport Road intersection experience some delay however the v/c ratios are well below capacity and therefore the delay is not considered unreasonable for the volume of vehicles making these movements. It is noted that these results concur with observations made during the March 2005 counts.

**Background Traffic Volume Analysis**

As indicated previously the future background (2020) analysis includes both general growth in existing traffic and traffic growth associated with development in the Saunders Lake area. It is noted that the Saunders Lake TIA indicates that 9th Street (RR 250) will ultimately require a 4 lane cross-section. For the purposes of this assessment it was assumed that 9th Street adjacent to the plan area had been upgraded to a 2 lane arterial with turn bays at the Airport Road and collector road intersections. For this analysis it was assumed that the 7th Street/Airport Road and the 9th Street/Airport Road intersections operate under north south stop control. **Table 4** summarizes the results of the 2020 background traffic analysis.

**Table 4: 2020 Background Traffic Volume Analysis Summary**

| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Movement** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** |
| **Airport Road/7th Street** | | | | | | | | | | | | |
| **Volume** | 77 | 769 | | | 468 | 22 | | | | 99 | | 393 |
| **v/c** | 0.07 | 0.23 | | | 0.18 | 0.10 | | | | 0.46 | | 0.52 |
| **Delay** | 8.6 | 0.0 | | | 0.0 | 0.0 | | | | 34.9 | | 14.8 |
| **LOS** | A | A | | | A | A | | | | D | | B |
| **Queue (m)** | 1.8 | 0.0 | | | 0.0 | 0.0 | | | | 16.7 | | 23.2 |
| **Airport Road/RR 250 (9th Street)** | | | | | | | | | | | | |
| **Volume** | 29 | 661 | 177 | 58 | 211 | 6 | 90 | 46 | 57 | 44 | 64 | 190 |
| **v/c** | 0.02 | 0.30 | 0.30 | 0.07 | 0.07 | 0.07 | 1.36 | 0.35 | 0.35 | 0.24 | 0.60 | 0.60 |
| **Delay** | 0.2 | 0.4 | 0.0 | 0.8 | 2.0 | 0.0 | 324.4 | 23.8 | 23.8 | 30.1 | 25.7 | 25.7 |
| **LOS** | A | A | A | A | A | A | F | C | C | D | D | D |
| **Queue (m)** | 0.5 | 0.5 | 0.0 | 1.8 | 1.8 | 0.0 | 54.4 | 11.6 | 11.6 | 6.7 | 29.3 | 29.3 |
| **82nd Avenue (into Saunders Lake)/RR 250 (9th Street)** | | | | | | | | | | | | |
| **Volume** | | | | 96 | | 96 | | 98 | 140 | 140 | 159 | |
| **v/c** | | | | 0.17 | | 0.14 | | 0.32 | | 0.23 | 0.24 | |
| **Delay** | | | | 9.4 | | 7.8 | | 10.2 | | 9.3 | 8.8 | |
| **LOS** | | | | A | | A | | B | | A | A | |
| **Queue (m)** | | | | - | | - | | - | | - | - | |

The analysis indicates that with general development in the area the northbound and southbound legs of the Airport Road/9th Street intersection will experience significant increases in delay the levels of service are expected to drop. It is noted that the northbound left turn at this intersection is expected to experience a v/c ratio of over 1. This means that the vehicles attempting to make this left turn can not be accommodated in an hour. This occurs because the eastbound and westbound through movements on Airport Road are high and experience relatively free flow conditions leaving little gap in traffic for the minor street turning movements.

To a lesser degree the southbound left turn at the 7th Street/Airport Road intersection is also impacted by the heavy through movements on Airport Road. However because this intersection is a T-intersection there are fewer vehicles fighting for gaps in through traffic and therefore the anticipated level of service is not as bad.

This analysis indicates that, to accommodate background traffic growth in the vicinity of the Airport Road Outline Plan a signal will be required at the intersection of Airport Road and 9th Street. The timing of installation of this signal is subject to the amount of development in the area. At this time it is recommended that traffic growth at this intersection be monitored and that a signal be installed when traffic volumes and delay warrants are met.

**2005 Partial Build out Traffic Volume Analysis**

The partial build out (2005) scenario assumed that, the main north-south roadway (the 7th Street extension), the right-in right-out access on Airport Road and that the 82nd Avenue connection to 9th Street are all in place. **Table 5** summarizes the results of the Synchro analysis for the partial build out scenario. Please note that the 7 vehicles making the northbound and southbound through movements were added to the analysis to represent the potential draw between the two subdivisions.

**Table 5: 2005 Partial Build Out Traffic Volumes Analysis Summary**

| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Movement** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** |
| **7th Street/Airport Road** | | | | | | | | | | | | |
| **Volume** | 56 | 455 | 271 | 88 | 300 | 16 | 276 | 7 | 101 | 72 | 7 | 286 |
| **v/c** | 0.05 | 0.25 | 0.25 | 0.10 | 0.12 | 0.07 | 4.20 | 0.20 | | 0.45 | 0.39 | |
| **Delay** | 8.0 | 0.0 | 0.0 | 9.6 | 0.0 | 0.0 | error | 13.5 | | 44.1 | 12.7 | |
| **LOS** | A | A | A | A | A | A | F | B | | E | B | |
| **Queue (m)** | 1.1 | 0.0 | 0.0 | 2.5 | 0.0 | 0.0 | error | 5.7 | | 15.5 | 13.9 | |
| **Airport Road (Right-in Right-out)** | | | | | | | | | | | | |
| **Volume** | | 558 | 70 | | 404 | | | | 73 | | | |
| **v/c** | | 0.22 | 0.15 | | 0.12 | | | | 0.11 | | | |
| **Delay** | | 0.0 | 0.0 | | 0.0 | | | | 10.9 | | | |
| **LOS** | | A | A | | A | | | | B | | | |
| **Queue (m)** | | 0.0 | 0.0 | | 0.0 | | | | 2.7 | | | |
| **RR 250 (9th Street)/ Airport Road** | | | | | | | | | | | | |
| **Volume** | 26 | 574 | 31 | 8 | 174 | 1 | 66 | 18 | 26 | 32 | 16 | 164 |
| **v/c** | 0.02 | 0.19 | 0.19 | 0.01 | 0.05 | 0.05 | 0.47 | | | 0.31 | | |
| **Delay** | 0.2 | 0.4 | 0.0 | 0.1 | 0.4 | 0.0 | 33.6 | | | 12.8 | | |
| **LOS** | A | A | A | A | A | A | D | | | B | | |
| **Queue (m)** | 0.4 | 0.4 | 0.0 | 0.2 | 0.2 | 0.0 | 17.7 | | | 10.2 | | |
| **82nd Avenue/RR 250 (9th Street)** | | | | | | | | | | | | |
| **Volume** | 35 | | 23 | | | | 21 | 75 | | | 23 | 32 |
| **v/c** | 0.04 | | 0.02 | | | | 0.01 | 0.01 | | | 0.03 | 0.03 |
| **Delay** | 9.4 | | 8.6 | | | | 0.1 | 1.7 | | | 0.0 | 0.0 |
| **LOS** | A | | A | | | | A | A | | | A | A |
| **Queue (m)** | 1.0 | | 0.5 | | | | 0.3 | 0.3 | | | 0.0 | 0.0 |

As indicated in Table 3, with the exception of northbound left turn movement at the 7th Street intersection, v/c ratios for all movements are within acceptable levels. However it is noted, that without additional connections to the south the volume of vehicles expected to make the

northbound left turn movement is quite high. It is typical that minor street left turn movements at unsignalized intersections on major roadways experience high v/c ratios and delay. It indicates that additional infrastructure is required to facilitate this development.

As with the existing conditions analysis the partial build out analysis assumes no improvements at the 9th Street corridor. The analysis indicates that under this assumption the 9th Street Airport Road and the 82nd Avenue/9th Street intersections are expected to operate well. The although the delay on northbound movements at the 9th Street/Airport Road intersection is expected to be in the 30 second range, the v/c ratio indicates that there is still plenty of capacity on this leg of the intersection. However, as volumes on 9th Street grow left turn bays would improve the operations of the north and south legs of the 9th Street/Airport Road intersection.

From this analysis it is concluded that, with limited growth in background traffic, development in the Airport Road Outline Plan could proceed with minor improvements to the adjacent road network. To eliminate the high delay and failing levels of serviced experienced by the northbound and southbound left turns at the 7th Street/Airport Road intersection a signal could be installed. To confirm the impact of a signal a scenario including signalization was analyzed, the results of this analysis are summarized in **Table 6**.

**Table 6: 2005 Partial Built out Traffic Volumes**
**Signalized 7th Street Analysis Summary**

| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Movement** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** |
| **7th Street/Airport Road** | | | | | | | | | | | | |
| **Volume** | 56 | 455 | 271 | 88 | 300 | 16 | 276 | 7 | 101 | 72 | 7 | 286 |
| **v/c** | 0.12 | 0.43 | | 0.31 | 0.19 | | 0.78 | 0.17 | | 0.16 | 0.39 | |
| **Delay** | 10.1 | 7.5 | | 14.0 | 9.7 | | 35.4 | 4.6 | | 14.2 | 3.9 | |
| **LOS** | B | A | | B | A | | D | A | | B | A | |
| **Queue (m)** | 8.7 | 26.0 | | 15.0 | 16.2 | | #61.8 | 8.5 | | 12.7 | 13.4 | |
| **Airport Road (Right-in Right-out)** | | | | | | | | | | | | |
| **Volume** | | 558 | 70 | | 404 | | | | 73 | | | |
| **v/c** | | 0.22 | 0.15 | | 0.12 | | | | 0.11 | | | |
| **Delay** | | 0.0 | 0.0 | | 0.0 | | | | 10.9 | | | |
| **LOS** | | A | A | | A | | | | B | | | |
| **Queue (m)** | | 0.0 | 0.0 | | 0.0 | | | | 2.7 | | | |
| **RR 250 (9th Street)/ Airport Road** | | | | | | | | | | | | |
| **Volume** | 26 | 574 | 31 | 8 | 174 | 1 | 49 | 8 | 16 | 32 | 16 | 164 |
| **v/c** | 0.02 | 0.19 | 0.19 | 0.01 | 0.05 | 0.05 | 0.47 | | | 0.31 | | |
| **Delay** | 0.2 | 0.4 | 0.0 | 0.1 | 0.4 | 0.0 | 33.6 | | | 12.8 | | |
| **LOS** | A | A | A | A | A | A | D | | | B | | |
| **Queue (m)** | 0.4 | 0.4 | 0.0 | 0.2 | 0.2 | 0.0 | 17.7 | | | 10.2 | | |
| **82nd Avenue/RR 250 (9th Street)** | | | | | | | | | | | | |
| **Volume** | 35 | | 23 | | | | 21 | 75 | | | 23 | 32 |
| **v/c** | 0.04 | | 0.02 | | | | 0.01 | 1.7 | | | 0.03 | 0.03 |
| **Delay** | 9.6 | | 8.6 | | | | 0.1 | 1.7 | | | 0.0 | 0.0 |
| **LOS** | A | | A | | | | A | A | | | A | A |
| **Queue (m)** | 1.0 | | 0.5 | | | | 0.3 | 0.3 | | | 0.0 | 0.0 |

This analysis indicates that installation of a signal at the 7th Street/Airport Road intersection will improve the operation of the northbound and southbound left turns at this intersection. Although in

comparison to the other movements at this intersection, the delay experienced by the left turn is still high, it does drop to reasonable levels. Thus it is concluded that with signalization, the intersection is expected to operate well. In addition, it is noted that as development to the south proceeds and additional connections into the City of Leduc are constructed the volume of vehicles making this movement is expected to drop.

As per the Synchro manual, the # footnote indicates that the volume modeled exceeds capacity. However, if the reported v/c <1 for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queue shown with the # footnote is acceptable for the design of storage bays. Thus approximately 60 m of storage is required to accommodate northbound left turns at the 7$^{th}$ Street/Airport Road intersection.

**2020 Full Build out Traffic Volume Analysis**

The full build out scenario was completed assuming that Airport Road Outline plan develops to its full capacity and background traffic growth occurs as indicated in the 2020 background traffic scenario.

It is noted that this scenario assumes that traffic generated by this area will be able to utilize the 82$^{nd}$ Avenue intersection with 42$^{nd}$ Street however additional connections to the south have yet to be developed. It also assumes that 9$^{th}$ Street adjacent to the plan area remains a two lane rural cross-section with left turn bays at the intersections.

It is noted that signalization of the 7$^{th}$ Street intersection was required in the partial build out scenario and the 2020 background scenario indicated that signalization would improve the operations of the 9$^{th}$ Street/Airport Road intersection. Therefore this scenario was analyzed assuming that both the 7$^{th}$ Street/Airport Road and the 9$^{th}$ Street Airport Road intersections were signalized. As in the 2020 background analysis this scenario also assumes that the Airport Road and 82$^{nd}$ Avenue intersections with 9$^{th}$ Street include left turn bays while Airport Road continues to operate as a 4 lane roadway accommodating turning movements in through-left and through-right lanes. The results of this analysis are summarized in **Table 7**. Please note that vehicles making the through movements at the 7$^{th}$ Street and 82$^{nd}$ Avenue intersections were added to the analysis to represent the potential draw between adjacent developments.

**Table 7: 2020 Full Build out Traffic Volumes Analysis Summary**

| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Movement** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** | **L** | **T** | **R** |
| **7th Street/Airport Road** | | | | | | | | | | | | |
| **Volume** | 77 | 952 | 252 | 103 | 580 | 22 | 307 | 10 | 162 | 99 | 10 | 393 |
| **v/c** | 0.19 | 0.56 | | 0.90 | 0.27 | | 1.27 | 0.32 | | 0.40 | 0.84 | |
| **Delay** | 12.4 | 13.4 | | 70.3 | 5.6 | | 180.0 | 15.2 | | 33.2 | 22.0 | |
| **LOS** | B | B | | E | A | | F | B | | C | C | |
| **Queue (m)** | 17.6 | 109.1 | | m#37.8 | 37.1 | | #94.8 | 26.3 | | 27.1 | 65.9 | |
| **Airport Road (Right-in Right-out)** | | | | | | | | | | | | |
| **Volume** | | 1043 | 170 | | 705 | | | | 182 | | | |
| **v/c** | | 0.41 | 0.30 | | 0.21 | | | | 0.34 | | | |
| **Delay** | | 0.0 | 0.0 | | 0.0 | | | | 15.1 | | | |
| **LOS** | | A | A | | A | | | | C | | | |
| **Queue (m)** | | 0.0 | 0.0 | | 0.0 | | | | 11.4 | | | |
| **RR 250 (9th Street)/ Airport Road** | | | | | | | | | | | | |
| **Volume** | 100 | 808 | 316 | 91 | 244 | 6 | 241 | 113 | 122 | 44 | 97 | 221 |
| **v/c** | 0.67 | | | 0.29 | | | 0.89 | 0.39 | | 0.13 | 0.50 | |
| **Delay** | 16.9 | | | 12.1 | | | 41.0 | 17.9 | | 21.4 | 14.9 | |
| **LOS** | B | | | B | | | D | B | | C | B | |
| **Queue (m)** | 118.6 | | | 30.1 | | | 66.8 | 37.3 | | 11.9 | 42.9 | |
| **82nd Avenue/RR 250 (9th Street)** | | | | | | | | | | | | |
| **Volume** | 271 | 7 | 270 | 96 | 7 | 96 | 153 | 110 | 140 | 140 | 210 | 154 |
| **v/c** | 1.95 | 0.40 | | 1.25 | 0.16 | | 0.13 | 0.15 | | 0.11 | 0.21 | |
| **Delay** | 505.4 | 13.7 | | 277.9 | 11.4 | | 8.5 | 0.0 | | 8.1 | 0.0 | |
| **LOS** | F | B | | F | B | | A | A | | A | A | |
| **Queue (m)** | 161.6 | 14.8 | | 55.5 | 4.2 | | 3.3 | 0.0 | | 2.7 | 0.0 | |

Due to the assumption that there are limited connections to the south a large portion of southbound traffic must use the 7th Street intersection to access alternate routes into the City of Leduc. This results in a large volume of vehicles making the northbound left turn at this intersection. The analysis was completed assuming the northbound left turn operates under permitted protected left turn signal phase and as indicated in Table 7 this movement is expected to operate under failing levels of service.

There are two options that would improve operation of this movement. Firstly, additional roadway development to the south would provide additional routes for southbound traffic would reduce the number of vehicles making this movement. Without addition road development to the south installation of a double left turn at this intersection would provide the additional capacity required to accommodate this volume of vehicles. Under the double left configuration the analysis indicates that the v/c ratio of the northbound left turn is expected to drop to 0.66 with delays in the 30 second range.

Again, as per the Synchro manual, the # footnote indicates that the volume modeled exceeds capacity. However, if the reported v/c <1 for this movement, the methods used represent a valid method for estimating the 95th percentile queue. In practice, 95th percentile queue shown will rarely be exceeded and the queue shown with the # footnote is acceptable for the design of storage bays. The m footnote in the queue summary indicates that volume for the 95th percentile queue is metered by an upstream signal. The analysis indicates that standard 50 m left turn bays would accommodate queues expected at the 7th Street/Airport Road Intersection with the exception of the northbound left turn. Under the conditions assumed in the analysis approximately 95 m of

storage would be required. However as noted previously, this volume is believed to be a worst case scenario and it is likely additional connections south will be in place and the volume of vehicles at making this movement could actually be much smaller. Thus it is anticipated that the 60 m of storage recommended under the partial build out scenario will adequately accommodate the full build out volumes with a single or double left turn.

Table 7 also indicates that with growth in volumes the left turn movements at the 9th Street/82nd Avenue intersection are expected to experience high delay and low levels of service. As noted previously the Scheffer Andrew Saunder's Lake TIA indicated that ultimately 9th Street South of Airport Road will be developed as a 4 lane facility however the timing of this improvement is yet to be determined. It is acknowledged that the County is in the process of preparing Functional Plans for the widening of Range Road 250, any required widening as determined by the Functional Plan will be provided at the time of Subdivision. In this analysis it was assumed that 9th Street was a 2 lane facility with left turn bays. Under this assumption the analysis indicates that signalization is required to facilitate left turning vehicles from the Airport Road Outline Plan and Saunders Lake developments.

**Ancillary Considerations**

Intersection Spacing

To accommodate turn bay and taper design requirements intersection spacing was reviewed to ensure the collector road locations as proposed are appropriate. TAC guidelines indicate that intersection spacing is a function of the type or roadway, traffic volumes as well as traffic signalization coordination requirements. TAC suggests that typical minimum spacing on arterial roadways is 200 m, which allows for two back to back turn bays of 70 m with a 60 m taper in between. TAC also indicates that 100 m is an appropriate spacing between right-in right-out and all-directional accesses.

The proposed intersections are collector-arterial intersections and at the detailed design stage the design requirements should be assessed in relation to the long term plans and functional requirements of Airport Road and 9th Street. With respect to the intersections illustrated in Exhibit 8 the following is noted:

- There is approximately 580 m between 7th Street and 9th Street intersections, and;
- The proposed intersection on 9th Street south of Airport Road (82nd Avenue) is 390 m south of Airport Road.

Thus it is concluded that the intersections as proposed meet with TAC guidelines. The right-in/right-out accesses are subject to approval by the County of Leduc and detailed site planning work. It is also anticipated that the proposed spacing will accommodate turn bay construction requirements and will accommodate future traffic signal spacing and coordination requirements.

Internal Roadways

Based on the traffic volumes projected for this development, the following roadway classifications are recommended. That the main north south roadway (7th Street) and the main east-west roadway (82nd Avenue) should be developed as collector roadways with the provision to develop separate left turn bays at the arterial/collector road and collector/collector road intersections. Extending the 7th Street collector designation south of 82nd Street is recommended to ensure that adequate capacity is provided for traffic traveling to future development to the south.

The remaining roads in the plan area can be developed to local road standards. Consideration could be given to extending the eastern north-south local road north along the property line between commercial and light industrial lots. This would provide direct access to the south and east portions of the commercial areas. As this would be a dead-end road a cul-de-sac that accommodates truck turning movements would be required at the northern terminus of this roadway.

Right-in Right-out Accesses

The developer has indicated additional right-in right-out accesses may be proposed at the detailed design stage. **Exhibit 8** illustrates the potential right-in right-out access locations. It is noted that the right-in right-out accesses on Airport Road would have to meeting the above noted TAC standards and require further approvals from the County. For the right-in right-out accesses as illustrated on Exhibit 8 the following is noted:

- On Airport Road the western right-in right-out is approximately 190 m east of 7th Street and the eastern right-in right-out is approximiately 330 m east of 7th Street and 240 m west of 9th Street, and;

- On 9th Street the northern right-in right-out is approximately 235 m south of Airport Road and the southern right-in right-out is approximately 220 m south of the proposed collector intersection.

The Synchro analysis included an evaluation of a right-in right-out access to Airport Road. The analysis indicated that under both partial and full build out of the plan area this access is expected to operate under high levels of service. Based on the analysis of the right-in right-out access it is anticipated that, if designed appropriately, additional right-in right-out accesses will also operate well.

To ensure acceptable operation of a right-in right-out access either the access must be chanellized to facilitate the right-in right-out movements while preventing the left-in and left-out movements or, a median must be installed on the main street to prevent the left-in left-out movements. Currently Airport Road and 9th Street exist as a 4 lane and 2 lane undivided roadways respectively. Therefore prior to developing additional right-in right-out accesses detailed review of the intersection separation requirements, turn bay requirements and challenization and/or median construction requirements will be required. In addition, it is recommeneded that, where possible, the right-in right-out accesses should be developed as joint accesses on property lines.

**Conclusions and Recommendations**

The traffic analysis identified that the proposed subdivision has potential to generate around 2500 two-way trips in the PM peak hour. This is believed to be a conservative estimate of trips and assumes relatively high intensity development for a light industrial area.

The analysis indicates that, to accommodate traffic growth associated with the development in the Airport Road Outline Plan and adjacent plan areas roadway infrastructure improvements will be required. In general the improvements include:

- Signalization of the 9th Street/Airport Road intersection

- Improvements to the 9th Street/Airport Road intersection to facilitate increases in traffic volumes associated with general growth in background traffic.

With respect to the Airport Road Outline Plan the following improvements are required to facilitate development:

- Construction of a westbound left turn bay at the 7th Street/Airport Road intersection.
- That the 7th Street/Airport Road intersection be constructed such that it will accommodate a 60 m northbound left turn bay.
- Installation of traffic signals at the 7th Street/Airport Road intersection will be required. The analysis indicates the signal would be required at approximately 25% build out.
- With full build out of the plan area, left turn bays are recommended for the intersection of 9th Street and 82nd Avenue.
- The 9th Street 82nd Avenue intersection will require ongoing monitoring to determine if and when traffic signalization would be required.

With respect to the timing of traffic signal installation, it is recommended that traffic growth at the intersections be monitored and that a signal be installed when traffic volumes and delay warrants are met.

If you require any additional information please do not hesitate to contacts us.

Yours truly,

**Bunt & Associates**

Mark Huberman, P.Eng.
Principle

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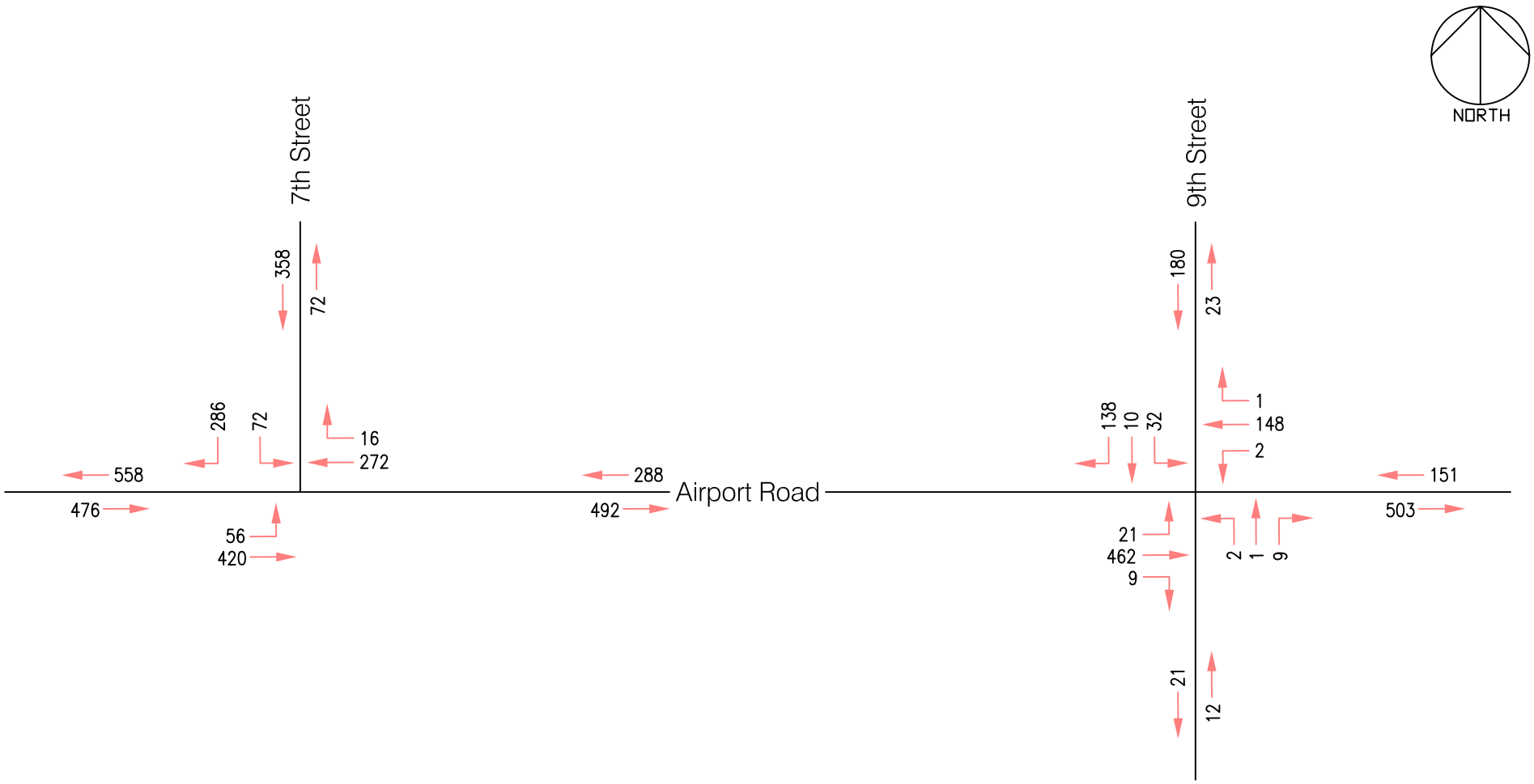
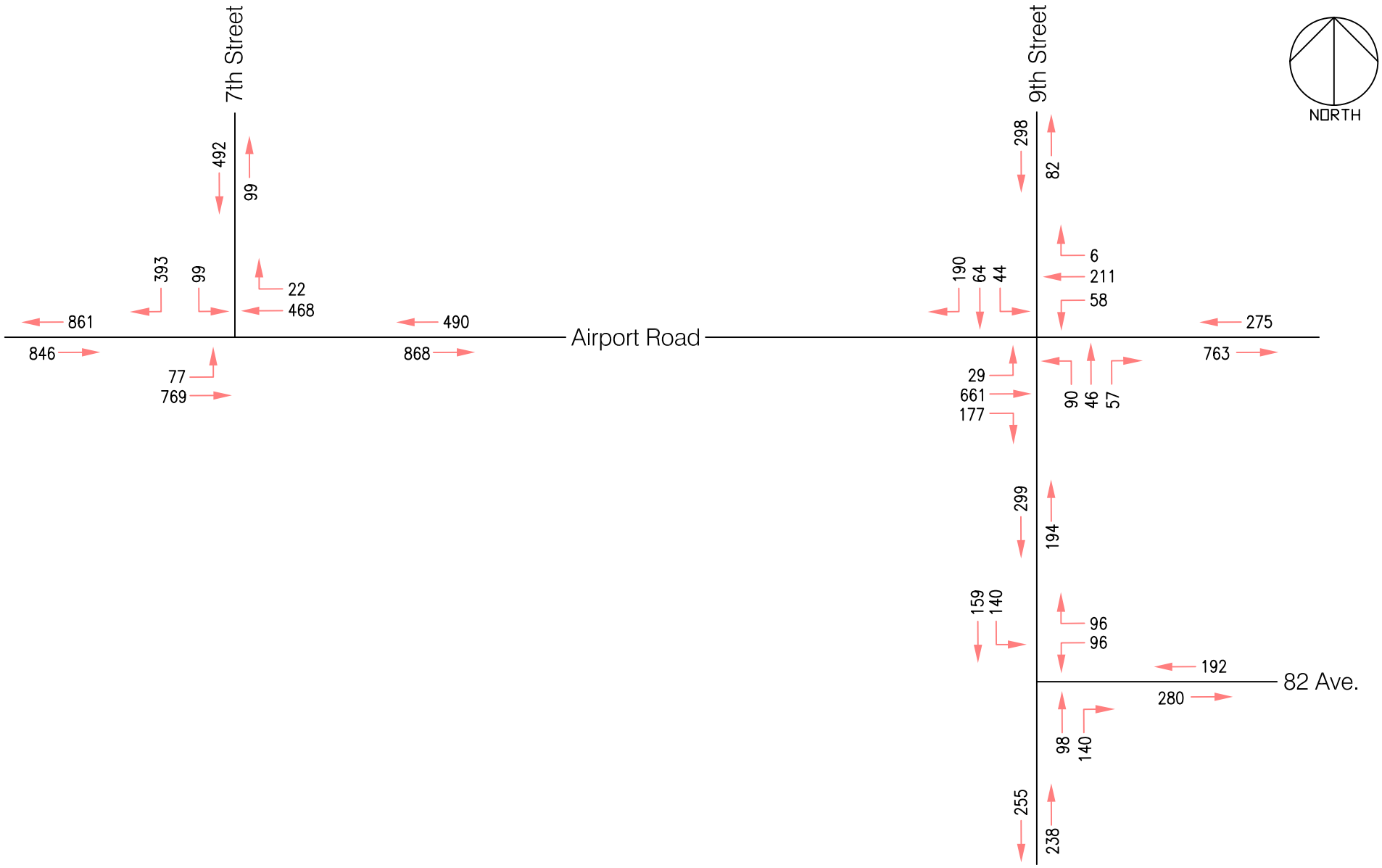



# 2005 Existing Traffic Volumes

BUNT & ASSOCIATES

Exhibit 1

January, 2006

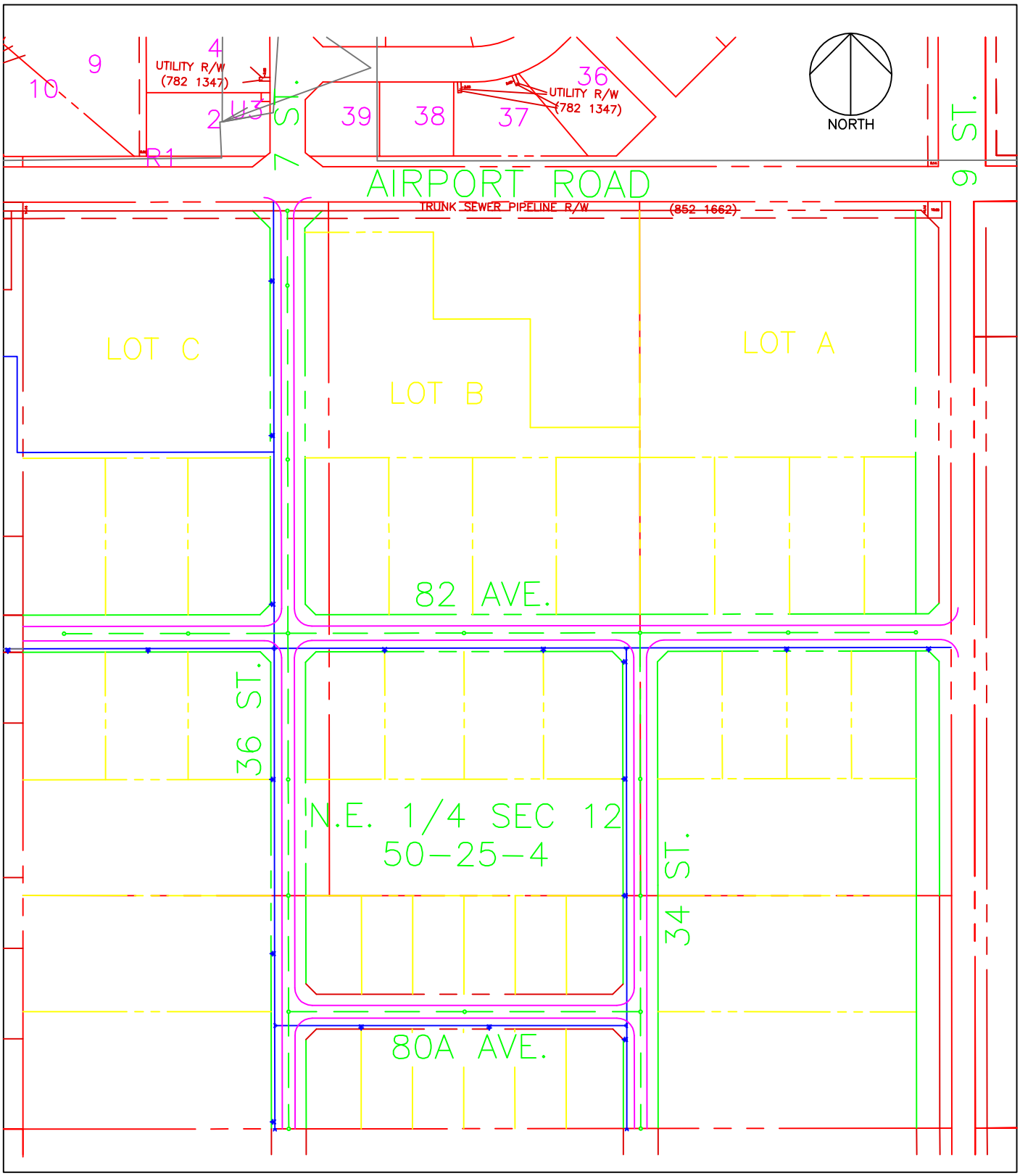



# 2020 Traffic Volumes

BUNT & ASSOCIATES

Exhibit 2

January, 2006

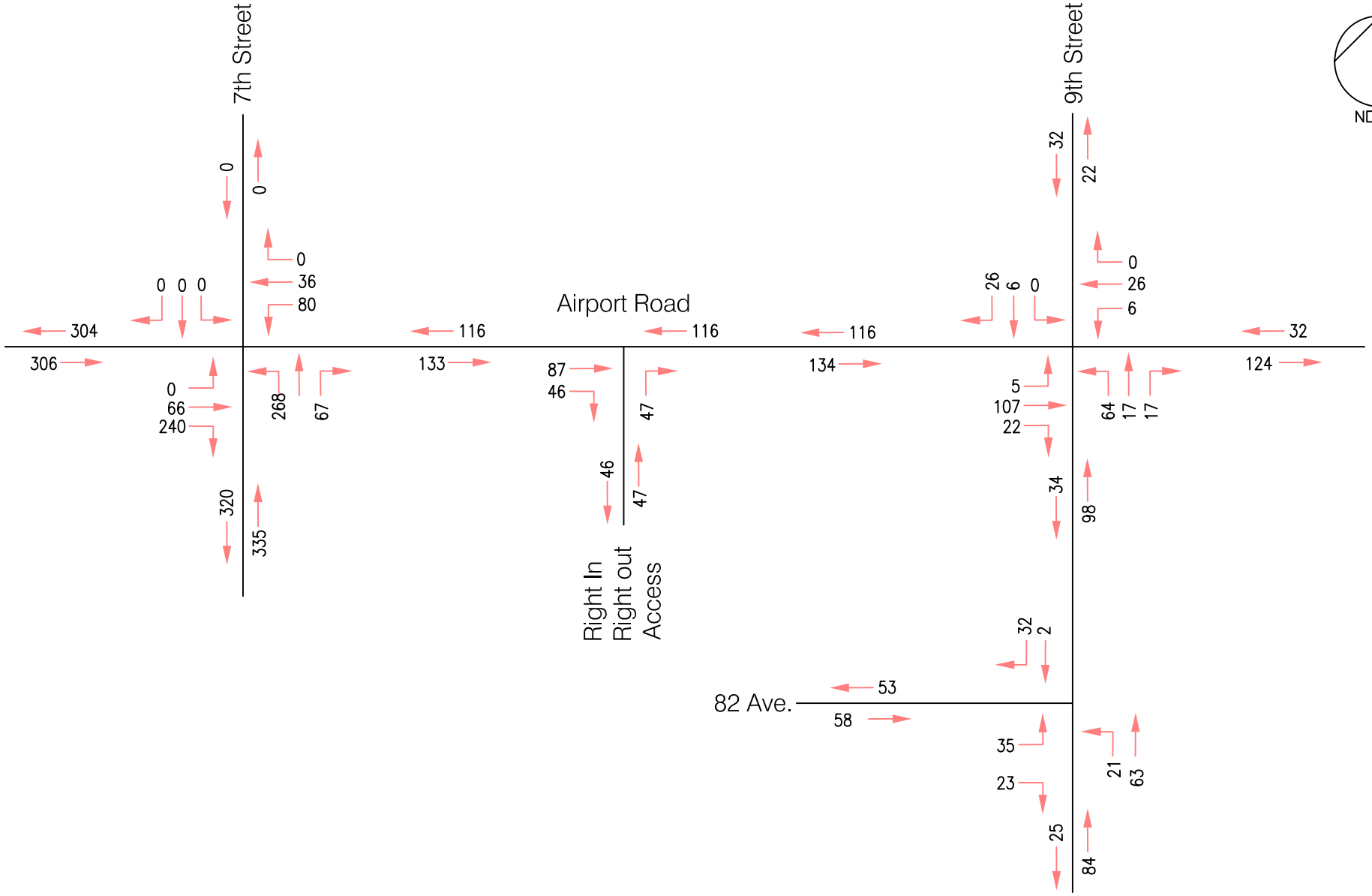



# Proposed Site Plan

BUNT & ASSOCIATES

Exhibit 3

January, 2006

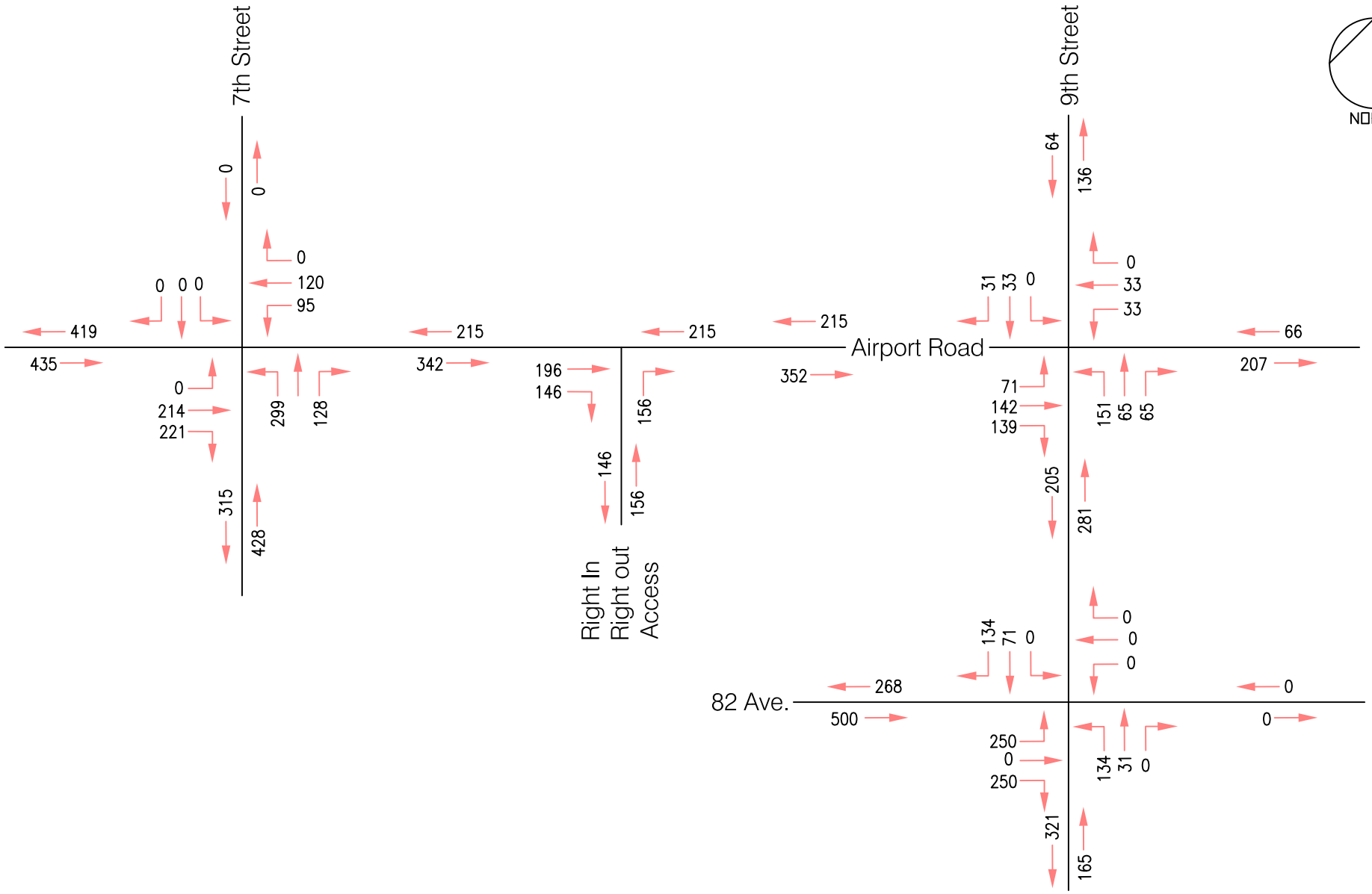



# Partial Build Out Site Traffic

BUNT & ASSOCIATES

Exhibit 4

January, 2006

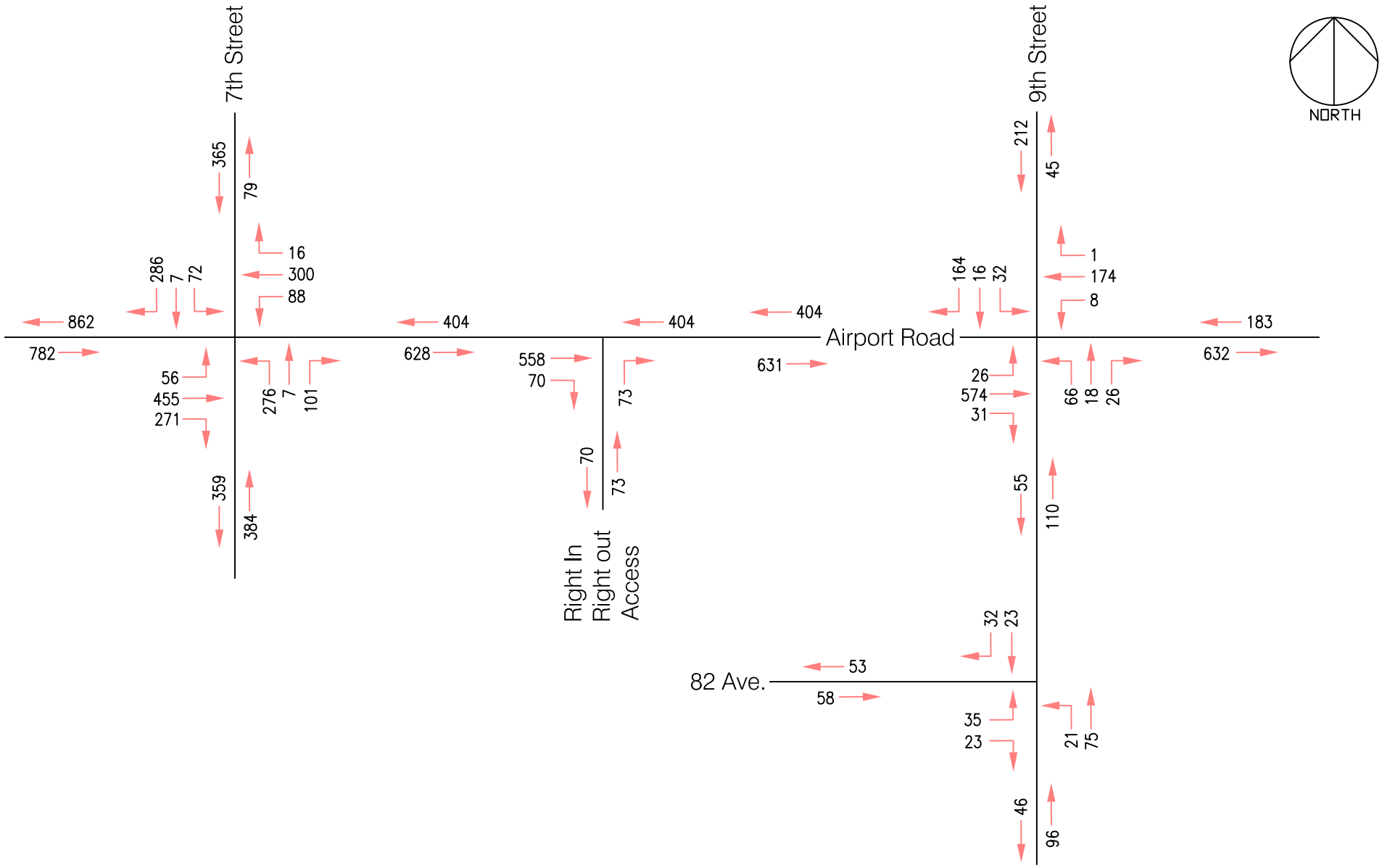



# Full Build Out Site Traffic

BUNT & ASSOCIATES

Exhibit 5

January, 2006

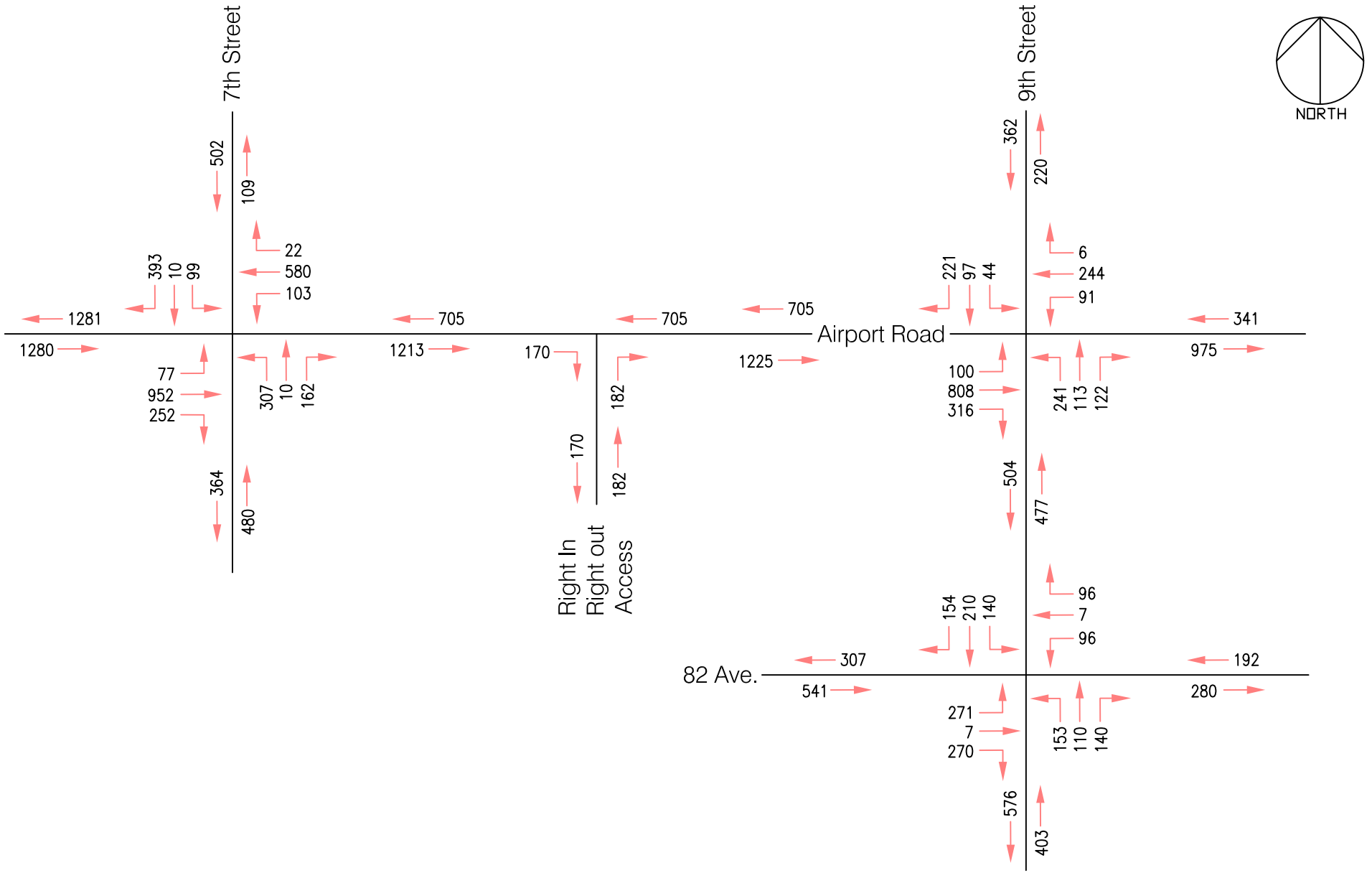



# Partial Build Out Total Traffic

BUNT & ASSOCIATES

Exhibit 6

January, 2006

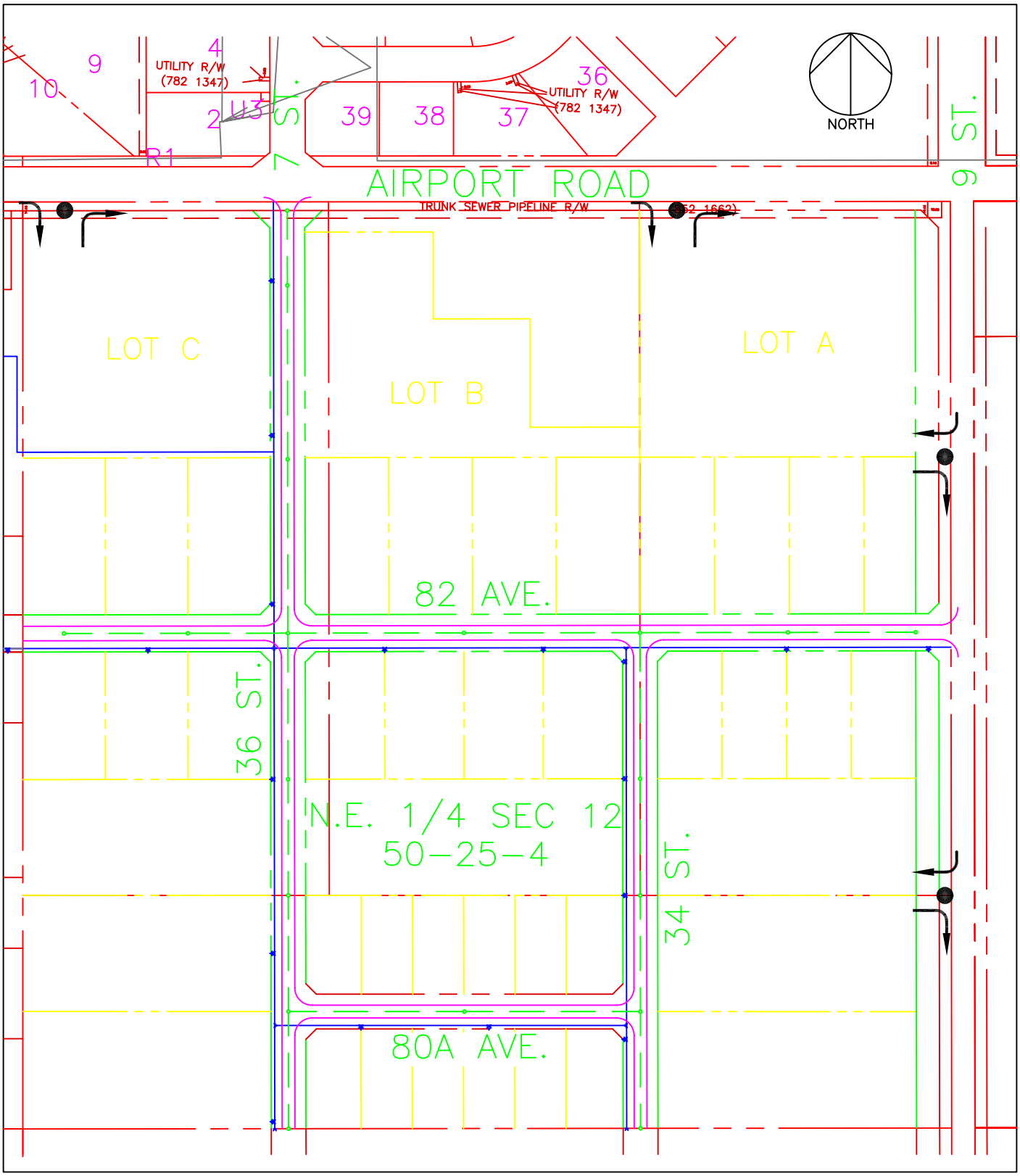



# Full Build Total Traffic

BUNT & ASSOCIATES

Exhibit 7

January, 2006




# Potential Right-in Right-out Access Locations

NOTE: Potential Riro Right-in Right-out accesses subject to county approval.

Exhibit 8

January, 2006

BUNT & ASSOCIATES

# APPENDIX 2

## Storm Water Report (B.K.Hydrology Services)

1June 28, 2005 Our File: 273

Your File: 50441

Durrance Projects Ltd.
Suite 105, 10525 - 170 Street
Edmonton, Alberta
T5P 4W2

Attention: Eric Durrance, P.Eng.

Re: **Saurabh Park - City of Leduc - NE12-50-25-W4M**
**Storm Runoff Calculations**

## 1.0 Introduction

This letter provides stormwater calculations for the Saurabh Park Development within the City of Leduc. This quarter section of land is bounded by Airport Road to the north, the Leduc Business Park to the west, Range Road 250 to the east and future industrial development to the south. The attached plan shows the general layout for the proposed 62.6 ha commercial and industrial development. Airport Road and Range Road 250 are drainage barriers and prevent off-site drainage from entering the site. Grading within the Leduc Business Park prevents off-site drainage from the west. At present a small area (less than 2 ha) located south of the quarter section, near the southwest corner of the site, drains onto the site from the south. It is expected that when this area develops, this area will be regraded to keep drainage within this south quarter section.

The general drainage on the site is from south to north. A small portion along the south side of the site drains southwards. This area will be filled to redirect the drainage to the north. The internal site drainage will be handled by a combination of ditches, swales and culverts. All the site drainage will flow to a storm pond located adjacent to Airport Road (see attached drawings). Outflow from the storm pond will be to the Airport Road Ditch. The water will flow about 100 metres east along the Airport Road Ditch and then flow north through a 1050 mm culvert under Airport Road. The flow eventually flows into Blackmud Creek located east of Nisku.

The City of Leduc has set an outflow rate of 3.25 l/s/ha for the 1:100 year storm event. For Option 1, the outflow rate was set to 3.25 l/s/ha. Based on a site area of 62.6 ha, the peak 1:100 year allowable discharge is 203 l/s. The water levels in the storm pond should rise no more than 2.0 metres during the 1:100 year design event. A minimum 0.5 metre freeboard is required above the 1:100 year design level. Also, the 1978 historical storm event should not exceed the pond freeboard level.

For Option 2, the site outflow rate is increased from 3.25 l/s/ha to 10 l/s/ha. Based on a site area of 62.6 ha, the peak 1:100 year allowable discharge is 626 l/s/. This option would require upgrading
the channel downstream of the 1050 mm culvert under Airport Road. This would allow about a 20% reduction in the footprint of the storm pond and free up more land for the development of a hotel site.

For Option 3, the site outflow rate is also 10 l/s/ha and drainage is split between two storm ponds on the site. The north storm pond would be located in the same location as in the previous options. A second pond would be located near the south boundary of the site. About 14 ha of land would drain directly to the south pond. The south pond would drain to the north pond through a 375 mm pipe on a 0.60% slope. This would further reduce the north storm pond footprint by about 20% compared to the Option 2 storm pond and make even more land available for a hotel site.

## 2.0 Storm Drainage Model

The SWMM Program, Version 4.30, was used for the storm drainage modelling. The City of Leduc design storm was used to compute storm runoff. Model parameters are summarized in Table 1. The elevation-area-volume curve for the storm ponds for the three options are listed in Tables 2 to 5. It is assumed that the light industrial site landuse is 40% impervious (buildings, paved roads, paved parking, etc.), 50% gravel (storage areas, gravel parking, etc.), and 10% grass (landscape areas, storage areas, etc.).

For Option 1, the storm pond outflow will be controlled by a 275 mm diameter orifice with the orifice invert at 715.50 metres (the normal water level in the pond). The orifice will discharge to a 600 mm pipe on a 0.20% slope. This 600 mm pipe will discharge to the Airport Road south ditch. An emergency overflow will also be constructed to discharge to the Airport Road south ditch. The invert of the weir overflow is set at 717.50 metres, with a 3.2 metre long weir. This emergency overflow will only operated during events greater than the 1:100 year storm event.

For Option 2 and 3, the main storm pond outflow will be controlled by a 507 mm diameter orifice with the orifice invert at 715.50 metres (the normal water level in the pond). The orifice will discharge to a 750 mm pipe on a 0.20% slope. This 750 mm pipe will discharge to the Airport Road south ditch. An emergency overflow will also be constructed to discharge to the Airport Road south ditch. The invert of the weir overflow is set at 717.50 metres, with a 3.2 metre long weir. This emergency overflow will only operated during events greater than the 1:100 year storm event.

## 3.0 Modelling Results

Table 6 lists the rainfall depth, runoff depth and runoff volumes for the various design storm events. Tables 7 to 10 list the storm pond peak rise in water level and peak outflow.

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For Option 1, the 1:100 year peak water level in the pond is 717.49 metres with a peak rise in water level of 1.99 metres. This meets the City of Leduc design standards. The peak outflow of 203 l/s meets the 3.25 l/s/ha release rate. The 1978 historical storm peak water level is 717.77 metres with a peak rise in water level of 2.27 metres. This is below the freeboard elevation of 718.00 metres and meets City of Leduc design standards.. Because of the relatively low outflow rate, the pond takes 110 hours to drain to 90% of the live storage volume. This exceeds the City of Leduc design standard of 96 hours by 14 hours. I believe this additional 14 hours to achieve the 90% volume will not cause any problems with the operation of the pond. If this 96 hour criteria must be met, the release rate of 3.25 l/s/ha from the pond would need to be increased.. The long retention time in the storm pond will also allow the pond to easily meet the sediment removal requirements set by Alberta Environment.

For Option 2, the 1:100 year peak water level in the pond is 717.48 metres with a peak rise in water level of 1.98 metres. This meets the City of Leduc design standards. The peak outflow of 627 l/s matches the 10 l/s/ha release rate. The 1978 historical storm peak water level is 717.89 metres with a peak rise in water level of 2.39 metres. This is below the freeboard elevation of 718.00 metres and meets City of Leduc design standards. The pond takes 33 hours to drain to 90% of the live storage volume. This meets the City of Leduc design standard of 96 hours. This retention time in the storm pond will meet the sediment removal requirements set by Alberta Environment.

For Option 3, the 1:100 year peak water level in the north pond is 717.47 metres with a peak rise in water level of 1.97 metres. The 1:100 year peak water level in the south pond is 720.47 metres with a peak rise in water level os 1.97 metres. This meets the City of Leduc design standards. The peak outflow from the site of 625 l/s matches the 10 l/s/ha release rate. The 1978 historical storm peak water level in the north pond is 717.86 metres with a peak rise in water level of 2.36 metres. This is below the freeboard elevation of 718.00 metres and meets City of Leduc design standards. The 1978 historical storm peak water level in the south pond is 720.86 metres with a peak rise in water level of 2.36 metres. This is below the freeboard elevation of 721.00 metres and meets City of Leduc design standards. The north pond takes 31 hours to drain to 90% of the live storage volume and the south pond takes 15 hours. This meets the City of Leduc design standard of 96 hours. This retention time in the storm pond will meet the sediment removal requirements set by Alberta Environment.

## 4.0 Closure

I appreciate the opportunity to undertake this work for you. Please call if you have any questions about the above material.

Sincerely,

Bernie Kallenbach, M.Eng., P.Eng.
President

**BK HYDROLOGY SERVICE**
**5610 - 56A Street, Beaumont, Alberta, T4X 1A7**
**Phone (780) 929 8325**

**TABLE 1**
**SWMM Model Parameters**

| Parameter | Value |
|---|---|
| Percent Imperviousness | |
| Roadway | 45% |
| Commercial | 90% |
| Light Commercial | 80% |
| Light Industrial (50% Gravel) | 40% |
| Catchment Length/Width Ratio | 0.67 |
| Ground Slope | 1.0% |
| Manning's n | |
| Impervious Surface | 0.015 |
| Pervious Surface | 0.25 |
| Detention Storage | |
| Impervious Surface | 1.0 mm |
| Pervious Surface | 5.0 mm |
| Ground Infiltration (Horton Equation) | |
| Initial Rate (Grass) | 75 mm / hr |
| Final Rate (Grass) | 3 mm / hr |
| Initial Rate (Gravel) | 25 mm / hr |
| Final Rate (Gravel) | 1.5 mm/ hr |
| Decay Rate | .00115 / sec. |

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**TABLE 2**
**Option 1 Pond Elevation-Area Volume Curve**

| Elevation (m) | Depth above NWL (m) | Area (ha) | Volume ($m^3$) |
|---|---|---|---|
| 715.5 | 0 | 2.15 | 0 |
| 717.5 | 1.0 | 2.65 | 24,000 |
| 718.5 | 2.0 | 3.19 | 53,200 |
| 719.0 | 2.5 | 3.49 | 69,900 |

**TABLE 3**
**Option 2 Pond Elevation-Area Volume Curve**

| Elevation (m) | Depth above NWL (m) | Area (ha) | Volume ($m^3$) |
|---|---|---|---|
| 715.5 | 0 | 1.58 | 0 |
| 717.5 | 1.0 | 2.00 | 17,800 |
| 718.5 | 2.0 | 2.46 | 40,100 |
| 719.0 | 2.5 | 2.71 | 53,000 |

**TABLE 4**
**Option 3 North Pond Elevation-Area Volume Curve**

| Elevation (m) | Depth above NWL (m) | Area (ha) | Volume ($m^3$) |
|---|---|---|---|
| 715.5 | 0 | 1.24 | 0 |
| 717.5 | 1.0 | 1.62 | 14,200 |
| 718.5 | 2.0 | 2.04 | 32,500 |
| 719.0 | 2.5 | 2.26 | 43,200 |

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**TABLE 5**
**Option 3 South Pond Elevation-Area Volume Curve**

| Elevation (m) | Depth above NWL (m) | Area (ha) | Volume ($m^3$) |
|---|---|---|---|
| 715.5 | 0 | 0.20 | 0 |
| 717.5 | 1.0 | 0.37 | 2,900 |
| 718.5 | 2.0 | 0.59 | 7,600 |
| 719.0 | 2.5 | 0.71 | 10,900 |

**TABLE 6**
**Storm Runoff**

| Storm Event | Rainfall (mm) | Runoff (mm) | Volume ($m^3$) |
|---|---|---|---|
| 1:100, 4 Hour | 69.2 | 59.6 | 37,300 |
| 1:100, 24 hour | 126.6 | 105.2 | 65,900 |
| July 10-11, 1978 | 133.6 | 116.9 | 73,200 |

**TABLE 7**
**Option 1 Model Results**

| Storm Event | Peak Depth (m) | Peak Outflow (l/s) |
|---|---|---|
| 1:100, 4 hour | 1.41 | 165 |
| 1:100, 24 hour | 1.99 | 203 |
| 1978 | 2.27 | 932 |

**TABLE 8**
**Option 2 Model Results**

| Storm Event | Peak Depth (m) | Peak Outflow (l/s) |
|---|---|---|
| 1:100, 4 hour | 1.63 | 554 |
| 1:100, 24 hour | 1.98 | 627 |
| 1978 | 2.39 | 1960 |

**TABLE 9**
**Option 3 North Pond Model Results**

| Storm Event | Peak Depth (m) | Peak Outflow (l/s) |
|---|---|---|
| 1:100, 4 hour | 1.63 | 554 |
| 1:100, 24 hour | 1.97 | 625 |
| 1978 | 2.36 | 1790 |

**TABLE 10**
**Option 3 South Pond Model Results**

| Storm Event | Peak Depth (m) | Peak Outflow (l/s) |
|---|---|---|
| 1:100, 4 hour | 1.70 | 140 |
| 1:100, 24 hour | 1.97 | 137 |
| 1978 | 2.36 | 142 |