# Functional Study for a future Light Rail Transit alignment

from Saddletowne Circle at 60th Street NE to Stoney Trail North via 128th Avenue NE



## The City of Calgary

# Functional Study NE LRT Draft Report

Calgary, Alberta

September 2012

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Project # 6211

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- A. Airport Transit Link Service Options Overview
- B. Alignment Plans and Profiles
- C. Operating Plan Schematic and Headway Analysis
- D. Station and Context Maps
- E. Country Hills Station Schematic Design
- F. Utilities Drawings and Contacts
- G. Level A Cost Estimate
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- A. Geotechnical Report
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### 1. PROJECT PURPOSE AND NEED

The City of Calgary has planned an extension to the Northeast light rail transit (NE LRT) line. This line forms part of Calgary's future Primary Transit Network (PTN). NE LRT opened in 1985 connecting downtown with Whitehorn Station. An extension to McKnight/Westwinds opened in 2007. Currently, construction is underway for an extension to Martindale and Saddletowne scheduled to open in 2012. The focus of this study is the future extension from Saddletowne to Stoney Trail.

Prior to this study, approximate right-of-way allowances and station locations for the extension north of Saddletowne Station were determined as part of land use studies and approved outline plans. The purpose of this functional planning study is to determine the alignment considerations and constraints (horizontal and vertical), review high level environmental issues, determine existing and future infrastructure that will be required to cross the LRT corridor and verify station locations and multi-modal connections to each station. As a result of this process the proposed LRT extension alignment and the extent of ROW to be protected has been determined.

For the station areas that currently have approved land use studies, they have employed the use of Transit Oriented Design (TOD) for the development in the lands surrounding the stations. TOD is a walkable, mixed-use form of area development typically focused within a 600 metre radius of a transit station. This type of development ensures that higher density development is concentrated near the station to make transit more convenient for people and encourage ridership.

In addition to the functional planning study of the future NE LRT extension to Stoney Trail, a study reviewing options for providing transit service between NE LRT and Calgary International Airport (YYC) was completed. This document reviewed rail based options including a spur line and a separate rail link. Bus transit options were also reviewed. This review examined each option from a service and operations perspective. This focused on the passenger experience for both YYC bound passengers and NE LRT passengers not bound for YYC. The airport transit options overview is appended to this report (**Appendix A**). This review was completed in concert with the Airport Trail Functional Planning Study.

#### 2. CORRIDOR ROUTING

The existing Northeast LRT line connects downtown Calgary with the McKnight / Westwinds Station located just south of 64 Avenue N.E. Construction is underway on a line extension from McKnight / Westwinds Station to Saddletowne Circle N.E. The future extension alignment, approximately 7,515 metres long, has been identified as follows and is shown in **Appendix B**:

- Travelling north from Saddletowne Station along the west side of 60 Street
- LRT will cross 88 Avenue at-grade
- A station will be located immediately north of 88 Avenue
- LRT will continue north, curving west and increasing in elevation to allow a grade separated crossing at the future Airport Trail and 60 Street interchange
- Once over the interchange, the LRT line will curve east, but remain on the west side of 60
   Street

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- Continuing north, the next station will be a below grade station at Country Hills Boulevard.
   Four options for this station location were reviewed and the location centred under Country Hills Boulevard is recommended.
- The Country Hills Boulevard station location will be accommodated with a lowering of the vertical alignment to allow for a below grade station and grade separation under Country Hills Boulevard
- The track alignment will continue north along the west side of 60 Street turning west and dropping in elevation to go below 128 Avenue
- The track will cross under 128 Avenue, returning to grade on the north side of 128 Avenue
- The track alignment will continue west on the north side of 128 Avenue
- The 128 Avenue station will be located at-grade just east of the intersection of 128 Ave and Redstone Street
- From the 128 Avenue station, the alignment will continue west, rising in elevation to cross over the Metis Trail and 128 Avenue intersection
- West of Metis Trail, the alignment will then drop in elevation to return to grade
- As the alignment continues west, it will follow the curve of 128 Avenue, remaining on the north side
- The alignment will turn north on the west side of 32 Street
- Stoney Station will be located south of Barlow Crescent at-grade
- North of Stoney Station there will be 230m of tail tracks at-grade up to the Transportation Utility Corridor limits.
- Alignment is able to cross over Stoney Trail if needed in the future.

### 2.1 <u>Horizontal Alignment</u>

The horizontal alignment runs north on the west side of 60 St NE up to 128 Ave where it turns west following the 128 Ave alignment on the north side of that road until 32 St NE where it begins to turn north up to Stoney Trail. The major changes in direction at the 128 Ave underpass and 32 St were achieved by using 250 m curves with speed reduction to 50 km/h. Curves are superelevated for maximum permissible track speed.

The alignment allows for an operation speed of 80 km/h with speed reductions to 70 km/h at the Airport Trail interchange area and to 50 km/h where major directional changes occur at the 128 Ave underpass and west of 32 St.

The alignment also includes 230 metres of tail tracks between Barlow Crescent NE and Stoney Trail Transportation Utility Corridor. The alignment also allows for a possible future extension passing over Stoney Trail to continue north along 36 St NE.

### 2.2 <u>Vertical Alignment</u>

The proposed profile is based on available information of the future development of 60 St, 128 Ave, Airport Trail Functional Planning Study and the surrounding communities, as well as the location of proposed stations and crossovers.

The profile is generally at-grade along future developments and will require overpass structures at Airport Trail and Metis Trail as well as underpass structures at Country Hills Boulevard and

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128 Ave. A maximum grade of 4% is proposed for all major changes in elevation in combination with a minimum K value of 50 to ensure smooth riding and enhanced operating speed.

The proposed profile also shows the future extension over Stoney Trail and north along 36 St NE.

### 2.3 <u>Right-of-Way Requirements</u>

The proposed Right of Way dimensioning is based on the requirements of Calgary Transit's LRT Design Guidelines – Rev # 2, March 2009:

Location	Minimum ROW
Tangents and curves with Radius larger than 1500 m	15.85 m
Curve with radius shorter than 1500 m	17.85 m
Center Loading Platforms (Min. 200 m)	21.00 m
Side Loading Platforms (Min. 180 m)	18.85 m
Double Interlocked Crossover (Min. 80 m)	18.50 m
Bridges and Tunnels	7.50 m beyond structure side
Substations (Outside of track ROW)	30 m x 30 m

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All stations are considered to be Side Loading Platforms; however, the right of way reserved for Stoney Station allows a Center Loading Platform as it is currently the terminal station on the LRT extension. The right of way reserved for Country Hills Boulevard Station is also sufficient for a Center Loading Platform as this may temporarily be the terminal station if the NE LRT extension is constructed in phases. The required right of way can be described as follows:

From	To	ROW	Description
15+550	16+150	18.00	Existing ROW
16+150	16+420	34.00	Includes Airport Transit Connection
16+420	16+690	Variable	Depends on Airport Transit Connection
16+690	17+915	15.85	Tangent
17+915	18+060	Variable	Transition to Crossover
18+060	18+230	18.50	Crossover
18+230	18+400	Variable	Transition to Underground Station
18+400	18+800	26.10	Country Hills Underground Station
18+800	18+944	Variable	Transition to Tangent
18+944	19+610	15.85	Tangent
19+610	19+690	Variable	Transition to Underpass
19+690	20+200	30.80	Underpass
20+200	20+300	Variable	Transition to Station
20+300	20+990	18.85	128 Ave Station
20+990	21+850	Variable	Transition to curved alignment
21+850	22+730	17.85	Curved Alignment
22+730	22+985	21.00	Stoney Station
22+985	23+220	17.85	Tail Tracks

The areas for substations outside of the main track required right of way are proposed to be located at 16+400, 17+520, 18+670, 19+600, 20+500, 21+500, 22+250 and 23+000. The horizontal and vertical alignment along with the right-of-way requirements is included in **Appendix B**.

#### 3. OPERATING PLAN

The purpose of this Operating Plan section is to establish the operational parameters for the NE LRT extension from Saddletowne Station to Stoney Trail and has been used as input into the functional design.

#### 3.1 <u>Vehicle Characteristics</u>

The following table outlines vehicle characteristics that will help determine station and track dimension requirements and headway analysis. Trains will consist of four cars.

Table 3-1: Vehicle Characteristics

Characteristic	Type 1 (UC-DC)	Type 2 (U2-AC)	Type 3 (SD-160-AC)
Body Length (excluding coupler)	23,150 mm	23,150 mm	23,590 mm
Overall Length	24,350 mm	24,350 mm	24,800 mm
Body Width (excluding accessories)	2,650 mm	2,650 mm	2,654 mm
Body Height (rail to top of roof)	3,320 mm	3,320 mm	3,315 mm
Overall Height (top of rail to most protruding accessory, current collector locked down)	3,660 mm	3,660 mm	3,847 mm
Maximum Operating Speed	80 km/h	80 km/h	80 km/h
Maximum grade achievable with speed reduction to 40 km/h	6%	6%	6%
Maximum acceleration starting (all vehicles are currently operated with a maximum acceleration of 1.1 m/s² to reduce wheel spin)	1.34 m/s <sup>2</sup>	1.34 m/s <sup>2</sup>	1.34 m/s <sup>2</sup>
Average full service acceleration to Vmax (V/T cruise velocity divided by minimum time to reach cruise velocity)	0.34 m/s <sup>2</sup>	0.68 m/s <sup>2</sup>	0.76 m/s <sup>2</sup>
Average emergency deceleration from Vmax to stop (on level, dry track with AW2 loading, not considering operator reaction time)	2.75 m/s <sup>2</sup>	2.75 m/s <sup>2</sup>	2.75 m/s <sup>2</sup>
Emergency stop distance	< 100 m	< 100 m	< 100 m
Minimum horizontal turn radius from track centerline: Under load in revenue service	35 m	35 m	35 m
Empty (shops and yards)	25 m	25 m	25 m
Minimum vertical radius (from top of rail)	500 m	500 m	500 m

Reference: City of Calgary LRT Design Guideline Manual (2009)

### 3.2 <u>Storage Tracks</u>

Storage tracks are required to store and dispatch revenue service trains and right of way maintenance equipment. Two storage tracks will be provided beyond the Stoney Station. The timing of construction for this extension is undetermined. It could be built in stages such that any of the stations may be a temporary terminal station. However, due to its location and the advanced stage of development in the surrounding areas, the Country Hills Boulevard station may be more likely to be a temporary terminal station. For all of the stations as temporary terminal stations, there is a requirement of temporary storage tracks being provided beyond each

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station. Each of these storage tracks will provide for two four-car trains plus one single car spot, plus 5 metres to accommodate a bumping post. If there is insufficient space for tail tracks behind stations, sidings adjacent to the main tracks and reasonably close to the stations may be considered.

#### 3.3 Crossovers

In order to support operating requirements, achieve operating flexibility during planned track maintenance or equipment failure, and achieve required operating headways, provision has been made for interlocked crossovers in advance of each station. Generally, double crossovers (scissor type) will be assumed, thereby minimizing the length of the interlocking. Turnouts will be Calgary's standard #8-S41a/10, although higher speed turnouts may be considered during detailed design to meet operational requirements. The preferred location for crossovers is inbound side of the station at all stations.

#### 3.3.1 End of Line Turnback

The likely terminal station for the NE LRT will be the Stoney station. A double crossover south of the station platform will be required to terminate and initiate trains to or from either track and to maintain the required turnaround time.

There is a possibility that any station may be an interim terminal station. In order to accommodate any of the stations as both a station along the NE LRT line and an interim terminal station, crossover placement requires special consideration. The placement of these crossovers is such that they will accommodate operation on the NE LRT line with any of the stations acting as an interim terminal station or a standard intermediate station.

Future extensions beyond Stoney Station may be considered if appropriate as part of the Calgary Regional Partnership planning.

#### 3.3.2 Intermediate Crossovers

The crossover locations have been determined by considering headway and operational requirements. This has allowed for general placement of crossovers before each station. However, specific crossover location also depends on factors such as road crossing locations, vertical and horizontal track alignment. The location of crossovers is shown on the operating plan schematic.

### 3.4 <u>LRT Signalization</u>

For the purposes of the functional study, it is assumed that the entire alignment will be equipped with track circuits and a fixed Automatic Block Signal System (ABS). The ABS will provide continuous train tracking and train separation for bi-directional train movement. Block overlap circuits will be incorporated.

Final signal placement and block design will be determined utilizing route simulation and modelling during subsequent detailed design. Signal spacing will allow for a minimum 2-minute headway and will provide safe braking distances for all modes of operation.

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At-grade roadway/pedestrian crossings will be equipped with automatic crossing protection which will include flashing lights, bells, and gates.

# 3.5 <u>Overhead Contact System (OCS) Sectionalization and Traction</u> Power Substation (TPSS) Requirements

Overhead Contact System sectionalization considers the location of traction power substations and NE LRT operational requirements for flexibility under all conditions. The traction power system will interconnect with the existing NE LRT at Saddletowne. For the purposes of the functional design, it is assumed that traction power substations will be located at each station. This is appropriate considering the short station spacing.

The final number, location, and size of substations will be determined from a Load Flow Study during subsequent detailed design during which there will be an analysis of the light rail vehicle power requirements, utility supply availability, and the power distribution system. Additional analysis during detailed design will consider end-of-line options, final alignment and grade, operation and maintenance, passenger station locations and available property.

The final design analysis will determine the minimum number of substations required to effectively power the vehicles under the defined operational headways. It is anticipated that the traction power system will be designed for a minimum of 3-minute "design" headways for four car trains. The final design analysis will consider contingency operations including; occasional train movements at 2-minute "design" headways with all substations in service; and any single substation out of service.

#### 3.6 Transit Service Plan

The transit service plan will establish basic headway analysis, operating speed and station dwell times.

### 3.7 <u>LRT Headway Analysis</u>

This LRT headway analysis is based on the vehicle characteristics outlined in **Table 3-1** above.

#### 3.7.1 Operating Speed

The maximum operating speed for the NE LRT will be 80 km/h. The operating speed will be reduced at stations, on grades and curves, and through turnouts and crossovers.

#### 3.7.2 Station Times

It is assumed trains will spend 90 seconds at stations for the headway analysis.

#### 3.7.3 Travel Time

The outbound travel time is approximately 12.9 minutes (Saddletowne Station to Stoney Station), the turnaround time is assumed to be 5 minutes and the inbound travel time is

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approximately 12.5 minutes (Stoney Station to Saddletowne Station). This equates to a current round trip travel time for the NE LRT route of approximately 30.4 minutes. This considers the alignment with the crossover and station placements shown in **Appendix C** and includes the 90 seconds at each station. The travel time analysis is shown in **Appendix C**.

### 4. LAND USE, ZONING, AND PUBLIC POLICY

Land use planning and transportation planning go hand in hand. The City of Calgary has developed a number of strategic documents that form the basis of transportation and land use planning. The following documents provide a picture of how the NE LRT extension will fit with the future transit network and development plans for the City of Calgary:

- Municipal Development Plan (adopted by Council, September 2009): This document is a product of Plan It Calgary and provides a long term strategy for a more sustainable city and the transportation network needed to serve it. This document is integrated with the Calgary Transportation Plan.
- *Calgary Transportation Plan* (adopted by Council, September 2009): This document provides policy direction on multiple aspects of the city's transportation system.
- Calgary LRT Network Plan: This document provides an overview of Calgary's LRT Network plan for both existing and future alignments.
- 2011 Interim Complete Streets Guide. This document serves as a guide to foster an understanding of the application of the CTP and MDP. The purpose of this document is to supplement the policies in the CTP and MDP and facilitate implementation of the concepts contained in these planning documents.

The lands surrounding the future NE LRT extension which will be served by this transit line are in various stages of planning. Currently, the following planning documents have been approved:

- Stonegate LOC 2006-0090 (January 8, 2007)
- Redstone LOC 2008-0128 (November 30, 2009)
- Northpoint Town Center LOC 2008-0049 (June 11, 2009)
- Northeast Community 'A' Area Structure Plan Part I (July 2007)
- Northeast Community 'A' Area Structure Plan Part II Country Hills Station Area Plan (July 13, 2009)
- Northeast Regional Policy Plan (April 24, 2006)
- Saddle Ridge Area Structure Plan and Supporting Information (2007 November, 2008 July)
- Northeast Industrial Area Structure Plan (January 2007)
- Northeast Residual Area Policy Plan (June 2005)
- Revised Stoney Industrial Area Structure Plan (May 9, 2006)

The future arrangement of land uses in each of these plans has taken into account the approximate location of the LRT track and stations and how stations should be integrated into the community. Mostly, these future developments have employed the use of Transit Oriented Design (TOD) in the lands surrounding the stations. TOD is a walkable, mixed-use form of area development typically focused within a 600 metre radius of a transit station. This type of development ensures that higher density development is concentrated near the station to make transit more convenient for people and encourage ridership.

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#### 5. TRANSPORTATION

The key purpose of the NE LRT extension to Stoney Trail is to provide local and regional accessibility to those living and working within the surrounding communities. Many of the land use planning documents include future roadways, sidewalks, pathways and bus routes, including connections to LRT stations. These connections were reviewed to ensure all modes (pedestrian, cycle, bus and vehicle) will have access to LRT stations, and to design these connections where there were any gaps in the land use planning documents. The City of Calgary forecasts population and transportation volumes based on their future land use and transportation network plans. The following forecasts are based on the Calgary Regional Transportation Model Long Range Horizon (Horizon Year 2076).

### 5.1 <u>LRT Ridership Modeling and Overall Travel Projections</u>

The long range horizon provides population forecast data by zone for the area surrounding the NE LRT extension. The following indicates the range of population forecasts in each zone surrounding the future stations:

- 88 Avenue Station: growing to 3,700
- Country Hills Boulevard Station: 3,900 to 6,100
- 128 Avenue Station: 1,800 to 2,200
- Stoney Station: 0

For the stations having a population forecast of zero in some zones, this indicates that the future land use will not be residential. The future LRT ridership estimates for each station are summarized in **Table 5-1**.

Table 5-1: Forecasted LRT Ridership

5	C+++:	AM Peak (2 hrs)		PM Peak (2 hrs)		24 Hour	
Direction	Station	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
NB - To	Saddletowne	100	600	100	3200	600	8200
Stoney Trail	88 Avenue	100	50	100	200	800	650
	Country Hills Boulevard	100	1200	100	4250	550	12870
	128 Avenue	50	100	50	500	120	1700
	Stoney Trail	0	350	0	150	0	1550
	Total	350	2300	350	8300	2070	24970
SB – To	Stoney Trail	50	0	600	0	2300	0
City Centre	128 Avenue	1750	50	400	50	4900	100
	Country Hills Boulevard	3250	150	1300	150	10650	1000
	88 Avenue	400	50	300	50	1750	100
	Saddletowne	2500	600	400	350	7200	2000
	Total	7950	850	3000	600	26800	3200

#### 5.2 Bus Transit

There are three types of bus transit that provide passenger access to the future NE LRT extension:

- Bus Rapid Transit (BRT) lines
- Community routes
- High School Routes

Primary Transit service is planned along Airport Trail and Country Hills Boulevard. Primary Transit network service will operate on a minimum 10 minute frequency, 15 hours/day, 7 days/week. BRT provides distinctive, frequent and limited stop bus service. Currently, there is a BRT cross town connection planned to run along Country Hills Boulevard. Feeder routes serve a community and provide a transit connection to each LRT station. High school routes serve students through the surrounding community and those students transferring from the LRT. The future bus routes are unknown until the classification of Métis Trail is confirmed.

The forecasted bus ridership at each of the future LRT stations is summarized in **Table 5-2**.

24 Hour AM Peak (2 hrs) PM Peak (2 hrs) LRT Station Alighting **Boarding** Alighting **Boarding** Alighting **Boarding** Stoney Trail 10 10 30 110 880 10 230 30 2650 128 Avenue 10 **Country Hills** 8500 2810 3600 1360 14260 2330 **Boulevard** 1730 88 Avenue 210 20 330 80 20 12990 Total 3910 3640 1950 14390 2360

Table 5-2: Long Range Bus Ridership Forecast

#### 5.3 <u>Vehicular Traffic</u>

The future vehicular traffic in the vicinity of the NE LRT extension will be supported by the future road network of varying classifications. This future road network is shown in the "Road and Street Network Map" from the *Calgary Transportation Plan*. Because some of these roadways will be classed as Skeletal Roads (Airport Trail and Stoney Trail) it is important to identify access routes to each of the LRT stations. The future LRT tracks will run adjacent to 60 Street and 128 Avenue. 60 Street will be classified as an arterial street and 128 Avenue will be classified as an industrial arterial.

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The LRT tracks will cross a number of future roadways at-grade, with signal pre-emption and crossing protection for the LRT. These roadways (organized north to south) and the forecasted link traffic volumes are summarized in **Table 5-3** below.

Table 5-3: Future at-grade crossing roadway forecasted volumes

Roadway	AM Peak Hour	PM Peak Hour	24 Hour
Saddlehorn Drive	200	400	4300
88 Avenue	200	700	3100
Access Road	No volumes provided	No volumes provided	No volumes provided
Skyview Centre Gate	360	1000	10,200
Skyview Centre Road	200	200	500
Skyview Centre Drive	600	700	8,200
Skyview Avenue	No volumes provided	No volumes provided	No volumes provided
Red Embers Gate	200	200	200
Redstone Street	600	700	6,400
32 Street	No volumes provided	No volumes provided	No volumes provided
Barlow Crescent (east)	700	800	8,600
32 Street	No volumes provided	No volumes provided	No volumes provided
Barlow Crescent (north)	700	800	8,300

### 5.4 <u>Pedestrian and Cyclist Pathways</u>

Through the *Calgary Transportation Plan*, the Primary Cycling Network has been identified. Within the study area, Country Hills Boulevard and 60 Street NE are routes on the future primary cycling network. The type of cycling facility envisioned would include an off-street cycling facility on both sides of the street, separated from the carriageway by a boulevard on each side of the street. For those streets that are part of the Primary Cycling Network, a multiuse pathway is required in the boulevard space on both sides of the carriageway. The width of that pathway should be 5 metres, such that 2 metres would be used for cyclists, and 2.5 metres for a sidewalk with a 0.5 metre buffer and 1 metre clearance on either side. Where a buffer is not possible, to delineate the sidewalk from the cycling pathway, a difference in paving material or line marking should be considered.

The approved outline plans and area structure plans for the surrounding communities provide information on pedestrian and cycling connections. The pedestrian and cycling pathways are shown in the NE LRT expansion map. Ideally, these multi-use pathways should be 3.5 m wide.

The *2010 Interim Complete Streets Guide* recommends 3.5 metres of pathway to accommodate cyclists and pedestrians on Arterial Streets. At a minimum, the 3 metre width required by the *Parks Standard Specifications for Landscape Construction* should be used.

The Calgary Perimeter Greenway is planned to follow the Transportation Utility Corridor (TUC) either within or adjacent to the "inside" of Stoney Trail. The point at which this future greenway would integrate into the NE LRT extension is at Stoney Station.

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The local road network within each community provides for sidewalks on both sides of each roadway. This facilitates pedestrian connectivity to each LRT station.

#### 5.4.1 Airport Trail Interchange

The pedestrian and cyclist movements at the Airport Trail Interchange will be along the 60 St corridor. The proposed primary cycling route along 60 St includes a series of pathways located mainly on the east side of the road; therefore, it is recommended to provide a sidewalk on the west side of 60 St and a multi-purpose pathway on the east side of the road, both within the roadway structure.

#### 5.4.2 Metis Trail Intersection

Today, the pedestrian and cyclist movements at the Metis Trail intersection will be along the 128 Ave corridor. The proposed primary cycling network along 128 Ave includes a series of pathways located on the north side of the road. It is recommended to provide a sidewalk on the south side of the road and a pathway on the north side of the road, both within the roadway structure.

#### 6. STATIONS AND URBAN DESIGN

Prior to the commencement of this study, the general location of each station had been determined via land use planning. As the alignment evolved, the location and form of each station was determined. Each station incorporates standard elements; however, each station also has unique aspects related to transit facilities, park and ride, multi-modal access and the relationship of the station to the surrounding community. Stations are to be significant focal points or 'places' within communities and they are also the access points for transit customers. To ensure that the requirements of The City of Calgary, transit customers, and future residents were met several meetings and workshops were held. In addition, information regarding the surrounding communities was gathered in the form of development outline plans. Because each of the surrounding communities is in a different stage of planning, the level of detail available for each station area is different. To illustrate the stations and associated elements, each station has a context map and station map (**Appendix D**).

The considerations taken into account when integrating the station within the community include:

- Functional Requirements: Any functional requirements that may impact station location and land requirements such as vertical profile, horizontal alignment, crossover location and platform configuration (side loaded or centre loaded).
- Station connectivity is required for all modes: pedestrians, cyclists, bus transit and vehicles (kiss and ride, park and ride). These connections will integrate into the surrounding land uses and greater transportation network (i.e.: regional pathways and road network).
- Bus Routes will service the surrounding community and cross town connections and provide access to the LRT stations. Locations of bus stops with consideration of pedestrian access are noted for each station.
- Parking provisions for both vehicle parking and bicycle parking. These facilities may be shared or dedicated to the transit station.

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# NORTHEAST LRT FUNCTIONAL PLANUSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

Vehicle parking requirements were initially gathered from the *Calgary LRT Network Plan*. Through examinations of development Outline Plans and Calgary Transit requirements, these parking stall requirements were refined.

Bicycle parking consists of Class 1 and Class 2 facilities. Class 1 facilities are secure and protected from the elements in individual lockers or within a building. These can be lockers, cages or rooms. If in a cage or room, up to half the spaces can be vertical or tiered. If in a cage, a wall (of transparent material such as plexiglass) on the side of the prevailing wind may be included. Where space is constrained, some of the Class 1 stalls may be located in the Park and Ride lot closer to the entrance than any parking stall. These stalls shall be located where connections to power and the transit information can be made in the future. Use of new transit access and payment technologies for access to these parking facilities may be considered.

Class 2 facilities are outdoor racks which may be covered. At least half of the Class 2 stalls should be covered. This coverage may be provided by a building overhang, an awning, a covered walkway or a free-standing roof structure. These facilities should be located as close as possible to the LRT platform entrance.

The *Bicycle Parking Guidelines* by the Association of Pedestrian and Bicycle Professionals recommends the following for Class 1 and Class 2 spaces at a rail/bus terminal and stations/airports:

- Class 1: Spaces for 5% of projected a.m. peak period daily ridership
- Class 2: Spaces for 1.5% of projected daily ridership

These guidelines provide the ultimate bicycle parking recommendations for each station. For Opening Day, it is recommended that a minimum number of bicycle parking stalls be provided. As adjacent development occurs, and LRT ridership increases, additional bicycle parking should be phased in. To achieve the ultimate recommended requirement, bicycle stalls may be incorporated into park and ride facilities, or into adjacent commercial developments.

#### 6.1 88 Avenue Station

The 88 Avenue Station<sup>1</sup> will be located on the north side of 88 Avenue, on the west side of 60 Street. Currently, the land uses surrounding the station are designated as industrial although this land use designation may change. On three quadrants surrounding the station area, the land use is primarily residential. There is no outline plan for the northwest quadrant, and as such, general principles for access, connectivity and land use density were assumed for this area. A 600 metre radius around the station is shown in the context plan highlighting the land uses, pedestrian and cycling pathway connections and roadway connections surrounding the communities. Apart from the northwest quadrant, the primary land use is single family residential.

The potential for a future airport transit connection to NE LRT would integrate at 88 Avenue Station and has been protected for. Multiple options for this connection were examined in the **Airport Transit Link Service Options Overview (Appendix A)**.

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<sup>&</sup>lt;sup>1</sup> For the purposes of consistency, this station will be labelled as 88 Avenue Station. However, before construction it will go to the naming committee for an official name.

#### 6.1.1 Functional Requirements

The track alignment on both the north and south side of the station is at-grade with no horizontal curves. The station is to be located at-grade with side loaded platforms. The location of the station north of 88 Avenue is to accommodate the horizontal and vertical alignment changes required to have a grade separated crossing at the Airport Trail and 60 Street interchange. A double crossover is located south of 88 Avenue. A substation is located northwest of the station.

The airport transit connection that would require the greatest right-of-way requirement is a separate rail link terminating at 88 Avenue Station. This option has been shown in the 88 Avenue Station map with a side loading platform configuration. A centre platform would serve both the NE LRT line and the YYC link.

#### 6.1.2 Station Connectivity

Because the area surrounding the station does not have an outline plan, detailed information regarding the road network and pathway links is not available. Road access to the subdivision is required. Two points of access are on 60 Street north of the station and on 88 Avenue west of the station. Road access would provide vehicle (kiss and ride), bus, pedestrian and cyclist access to the station.

A plaza west of the platforms would incorporate the station as a prominent 'place' within the community. This plaza could also accommodate a transit link connection to the airport, and other bus link connections. Ideally, there would be little or no grade separation between the plaza and the station platform. Pedestrian connectivity should be facilitated with a seamless connection to the platform (ie: a ramp with minimal grade along the length of the platform). The platform and plaza could be differentiated with different pavement textures.

Although not much is known about the surrounding land use, it is recommended that any buildings have active frontage facing the LRT station to further integrate the station into the community.

The east platform abuts 60 Street which has been identified as part of the primary cycling network. This cycling pathway is on the east side of 60 Street. To promote pedestrian connectivity, the platform and sidewalk should be at the same grade Crossing the tracks between the platforms is facilitated by pedestrian crossings at each end of the platforms. The pedestrian crossing at the south end of the platform also permits for the crossing of the tracks to access the intersection of 60 Street and 88 Avenue.

#### 6.1.3 Bus Routes and Stops

Saddletowne station will be a major bus route hub for NE LRT. Because 88 Avenue is in such close proximity to Saddletowne station, there are no local bus routes currently planned for this station. There will be a transit connection to the airport from this station. This connection would stop directly at the station. Shelters for this station could be provided in the plaza.

#### 6.1.4 Parking

Parking facilities for both bicycles and vehicles are required at each LRT station. For 88 Avenue Station, 500 park and ride stalls will be provided. The location of these stalls is not yet known but should be configured in future outline plans and does not need to abut the station area. The amount of space required for these stalls is shown in the context map and station map. The recommended ultimate number of bicycle parking stalls is:

- Class 1: 26 Stalls
- Class 2: 20 Stalls
- The minimum recommended number of bicycle parking stalls to be provided on Day 1 is:
- Class 1: 10
- Class 2: 10

Space for 24 Class 1 stalls and 12 Class 2 stalls has been provided south west of the station. The ultimate bicycle parking requirements may be met by incorporating cycle parking in with vehicle parking or within the surrounding development.

### 6.2 <u>Country Hills Boulevard Station</u>

Currently, the approved outline plan for the development east of 60 Street shows the future LRT station south of 60 Street on a public plaza (see Error! Reference source not found.). This outline plan also assumes that the LRT would be grade separated at Country Hills Boulevard. With the station located at-grade at the location shown, it is not possible to achieve a grade separated LRT crossing at Country Hills Boulevard. Four station location options were examined for the Country Hills Boulevard Station location. Based on this review, the LRT is planned to be grade separated under Country Hills Boulevard with the Station under the intersection with 60 Street. This option achieves LRT feasibility, station accessibility to all four intersection quadrants and ability to meet the objectives of the outline plan. This station and surrounding area were reviewed at a conceptual design level jointly with the developer of the lands surrounding the station. The results of this review are summarized in Northeast LRT Functional Plan Country Hills Station – Schematic Design in Appendix E.

#### 6.3 128 Avenue Station

The 128 Avenue station will be located on the north side of 128 Avenue between Redstone Street and Red Embers Gate within the Redstone community. The land uses immediately surrounding the station include multi-family residential and commercial. Within this community there is also single family residential, parks and two schools. A 600 metre radius around the station is shown in the context plan highlighting the land uses, pedestrian and cycling pathway connections and roadway connections surrounding the community. The land use around 128 Avenue station supports the principles of TOD development with high density residential mixed with some commercial closest to the station. Green spaces and school and recreation facilities are also within a 600 metre radius of the station.

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#### 6.3.1 Functional Requirements

The track alignment on both sides of the station is at-grade with no horizontal curves. This station is located at-grade with side loaded platforms. The station is located on the west end of the block between Redstone Street and Red Embers Gate. A double crossover east of the station is located east of Red Embers Gate. A substation is located on the east side of Red Embers Gate.

#### 6.3.2 Station Access

A plaza located north of the platform provides a gateway into the Redstone community. This plaza facilitates LRT passenger drop off (kiss and ride) and pedestrian and cyclist access from the community. This plaza is not intended for bus use. Vehicles may access this plaza via Redstone Street or Red Embers Gate which both intersect with 128 Avenue.

There is an opportunity to match the grade of the LRT platform with the plaza by having the surrounding buildings designed to take the grade difference between the required platform height and ground level. A low sloping ramp could also provide pedestrian access on the length of the north platform to the plaza. This provides an LRT station that is connected seamlessly with the plaza and the surrounding land uses.

West of the plaza there is multi-family residential land use and commercial land use on the east. To further incorporate the station as a prominent 'place' within the Redstone community, active street frontage facing the LRT station and tracks for both the multi-family and commercial land uses is recommended.

The inbound platform is along the north side of 128 Avenue. The platform will be at the same grade as the adjacent multi-use pathway zone. This provides the greatest connectivity for pedestrians accessing the platform as there is no grade separation between the pathway and the platform. However, this multi-use platform facilitates cyclists and cycling is not permitted on the platform. To ensure a distinction between the platform zone and the pathway zone is made, different pavement textures could be used for each surface. Physical barriers to pedestrians such as fences, bollards or domes are not recommended as they decrease the usable pedestrian space.

Crossing the tracks between the platforms is facilitated by pedestrian crossings at each end of the platform. The pedestrian crossing at the west end of the platform also permits the crossing of the tracks to access the intersection of Redstone Street and 128 Avenue.

60 Street has been identified as part of the primary cycling route. 128 Avenue has been identified as part of a local bicycle route and multi-use pathway. This local multi-use pathway also connects north of the station on Red Embers Gate and south of the station along the identified greenway. The road network shown in this context plan will provide sidewalks on both sides of each street facilitating pedestrian connection. In addition, cyclists may travel within the roadway of the local road network. A 600 metre radius around the station highlights what is in a walkable distance of the station. The combination of the primary cycling network, local multi-use pathways and road network with sidewalks provides connectivity locally and regionally for pedestrians and cyclists at 128 Avenue station.

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#### 6.3.3 Bus Routes and Stops

Several bus routes service 128 Avenue Station:

- 2 local residential feeder routes
- 2 local industrial feeder routes

The bus stop locations for these routes are identified on the 128 Avenue station map. These stops may be a bus zone or have a bus bay in timepoint locations. For both types of bus stop, shelters should be provided. Crosswalks, sidewalks and pedestrian track crossings allow pedestrians to travel between bus stops and 128 Avenue station.

#### 6.3.4 Parking

Parking facilities for both bicycles and vehicles are required at each LRT station. For 128 Avenue station, 200 park and ride stalls will be provided on the east side of Red Embers Gate. There is an opportunity for these parking stalls to be incorporated into the commercial and multi-family land uses immediately adjacent to the station. These stalls could be phased into the development. The recommended ultimate number of bicycle parking stalls is:

- Class 1: 90 Stalls
- Class 2: 30 Stalls

The recommended number of bicycle parking stalls to be provided on Day 1 is:

- Class 1: 20
- Class 2: 30

Space for the Day 1 bicycle parking has been provided east of the station. The ultimate bicycle parking requirements may be met by incorporating cycle parking in with vehicle parking or within the surrounding commercial development. There is an opportunity for providing a "bonus" to developers for providing the remaining recommended bicycle stalls.

### 6.4 Stoney Station

Stoney Station is located south of Barlow Crescent within the Stonegate development. The land uses immediately surrounding the station include commercial and industrial. As the developer for this station intends to submit a revised Outline Plan, specific information about the building configurations and internal road network are not known. However, provision for multi-modal connections to the station and functional requirements for station location has been made.

#### 6.4.1 Functional Requirements

Stoney Station must be designed to function as a long term terminal station for the NE LRT line. Typically, terminal stations have centre load platforms for ease of operations. The right-of-way required for a centre load platform has been protected at this station. Stoney Station will be a centre load station, or a side load station in the unlikely event the LRT is extended beyond Stoney Trail. With the advancement of digital real-time communication technologies, Calgary Transit is implementing digital information displays at LRT stations. This communication will inform passengers with up to date train schedule information.

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For terminal station operation, it is beneficial to have crossovers located as close as possible to the station. A double crossover is located south of Stoney station. Terminal stations also require a utility building to house lunchroom and washroom facilities for train operators. Terminal stations, like all other stations, require housing for snow removal equipment. This utility building is located north of the station on the east side of the tracks. A substation is located north of the station on the west side of the tracks. A switch heater is located south of the platform, on the west side of the tracks. 255 m of tail track is provided north of the station.

For the purposes of this study, Stoney Station is the terminal station on the NE LRT line extension. However, an extension north of Stoney Trail may be desired in the future. As such, the station location and track design do not preclude the possibility of crossing Stoney Trail. Because Stoney Trail is a freeway, a grade separated crossing would be required. In the event that this extension is required, the planned tail tracks would be removed and the grade separated crossing shown in the functional planning drawings could be completed.

#### 6.4.2 Station Connectivity

Barlow Crescent provides road access through Stonegate. This street provides connectivity to the Station for buses, vehicles (kiss and ride), pedestrians and bicycles. Additional information about the future road network is not yet known. However, it is imagined that there may be an east-west road connection south of the station.

The land use immediately surrounding the station is commercial. To promote Stoney Station as an important 'place' within this development, it is recommended that active street frontage of the surrounding buildings be implemented.

Stoney Station is currently planned to have a side loading platform configuration. Crossing the tracks between the platforms is facilitated by pedestrian crossings at each end of the platform. At the north end of the platform, there is an additional pedestrian crossing on the north side of Barlow Crescent. South of the station, there is a possible east-west road connection with an additional pedestrian crossing on the south side of this road.

A local multi-use pathway has been identified on 128 Avenue, running north into the development on 32 Street, having an east-west connection south of the station and continuing north on the east side of the tracks and the station. This north connection could tie into the Calgary Perimeter Greenway south of Stoney Trail. If the LRT does cross Stoney Trail, a pathway component must be included in the bridge structure over Stoney Trail.

A 600 metre radius around the station highlights what is in a walkable distance of the station. Within this radius, there is a local multi-use pathway network, pathway connection to the Calgary Perimeter Greenway, and local roadway connections. All of the roads are planned to have sidewalks providing pedestrian links.

#### 6.4.3 Bus Routes and Stops

Several bus routes are planned to service Stoney Station:

- 3 routes coming to the station on Barlow Crescent:
  - 2 local feeder routes (each eastbound and westbound)

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#### • 1 crosstown route

The bus stop locations have not yet been identified as this development is still in the planning stages. Ideally, the bus stops would be layby style on Barlow Crescent with 3 eastbound stops and 3 westbound stops. There is a long term plan for an additional regional route to service Stoney Station. Shelters should be provided for all bus stops. Crosswalks, sidewalks and pedestrian track crossings allow travel between the station and bus stops.

#### 6.4.4 Parking

Parking facilities for both bicycles and vehicles are required at each LRT station. For Stoney station, 100 shared park and ride stalls will be provided southeast of the station. These stalls will be shared with the surrounding development.

The recommended number of bicycle parking stalls is:

- Class 1: 16 Stalls
- Class 2: 20 Stalls

The minimum recommended number of bicycle parking stalls to be provided on Day 1 is:

- Class 1: 10 Stalls
- Class 2: 10 Stalls

Space for 24 Class 1 stalls and 12 Class 2 stalls has been provided south east of the station adjacent to the tracks. Additional bicycle parking could be incorporated into the park and ride facilities.

#### 7. STORMWATER DRAINAGE

The NE LRT corridor alignment is situated along 36 Street E, 128 Avenue NE and 60 Street E, within the Nose Creek watershed. Along this corridor, a number of area structure plan reports have been developed in which stormwater management policies have been established. In general, the purpose of these policies is to provide for the development of a suitable and efficient stormwater management system to serve development within each plan area. It is required that all stormwater management facilities be designed and constructed in accordance with the established policies, guidelines and standards set by The City of Calgary and Alberta Environment for water quality.

The stormwater management system for the NE LRT shall adhere to applicable City policies, principles, and City specified technical performance requirements, including the Stormwater Management and Design Manual, Nose Creek Water Management Plan, and NE Community 'A' Master Drainage Plan.

Two storm management principles are stated in the Nose Creek Water Management Plan (January, 2007) for a future development within the Nose Creek Watershed. These principles are further detailed as follows:

#### Maximum Allowable Release Rate

Discharges to Nose Creek should be limited to 1.257 L/s/ha for the 100-year storm event.

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#### **Runoff Volume Control Targets**

The average amount of rainfall that is discharged to Nose Creek annually should not exceed the following targets for areas approved for development in the period indicated:

- 2010-2012 30mm
- **2**013-2016 16 mm
- 2017 and later 11 mm.

The majority of rainfall should be retained by integrated SWM facilities or site specific facilities if feasible such as use of low impact development (LID) and Best Management Practice (BMP) techniques. BMP measures may include:

- oil/grit separators,
- permeable pavement or permeable concrete in suitable locations,
- absorbent landscaping,
- bio-swale and bio-retention,
- green roof for multi-family homes and commercial areas,
- stormwater capture and reuse in multi-family homes and commercial area,
- irrigation of stormwater accumulated in wet ponds for municipal reserve (MR) and environmental reserve (ER),
- porous pavements,
- reduction of impervious areas.

Sufficient water quality enhancement should be provided before stormwater is discharged to Nose Creek. The current target established by The City of Calgary and Alberta Environment (AENV) is a reduction of 85 percent of Total Suspended Solids for all particles 50 µm microns and over. This can be achieved through source control measures including LID and BMPs as listed above. These source control measures should be addressed in the Staged Master Drainage Plan.

Upon review of the existing area structure plans, the NE LRT corridor has been segregated into four segments for the purpose of discussions and planning of the stormwater management system. These are described in more detail below.

NE LRT Segment #1 (Seg#1). Segment #1 is the southernmost segment and extends into the Saddle Ridge area between 80 Avenue NE and Airport Trail NE. The Saddle Ridge area is bounded by 64 Avenue NE to the south, Airport Trail NE to the north, 36 Street E to the west and Stoney Trail to the east. The area is located on the south terminal of the NE LRT corridor. A portion of the area immediately west of Seg. #1 between 88 Avenue NE and Airport Trail NE is currently undeveloped, however the area has been planned as part of the Saddle Ridge Area Structure Plan. The Saddle Ridge area is predominantly developed and contains stormwater infrastructure which services the existing subdivisions.

The Saddle Ridge Area Structure Plan addressed stormwater management concepts and policies for implementation. Based on the recommendations of the Area Structure Plan report, storm

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runoff from the Saddle Ridge developed area would be drained to the McKnight Boulevard storm sewer trunk system. Due to inadequate capacity in the McKnight Boulevard storm sewer for direct discharge from the Saddle Ridge area, peak storm discharge from the development area was restricted to 1.71 l/sec/ha. The excess water was required be stored in stormwater management ponds. Based on Map 9 – Stormwater Management in the Saddle Ridge Area Structure Plan, the NE LRT corridor appears to have been incorporated into the Staged Master Drainage Plan (or Stormwater Management Report) of the Saddle Ridge Area Structure Plan. A review of the existing drainage system is required to verify that Seg. 1 of the NE LRT corridor was planned and implemented as part of the existing Staged Master Drainage Plan for the Saddle Ridge development.

Item No. **Design Phase** Action Review Nose Creek Water Management 30% design 1 2 Review Saddle Ridge Area Structure 30% design 3 Review Master Drainage Plan 30% design 4 30% design Review/verify existing drainage system capacity and release rate. Coordinate with the City and adjacent 5 30% design landowners to achieve an integrated SWM strategy incorporating Seg 1 drainage to the satisfaction of the Approving Authority. Submit Stormwater Water Management Upon 60% design 6

Table 7-1 - Action to be Taken upon Site Development for Seg.#1

**NE LRT Segment #2 (Seg. #2).** Seg. #2 is situated between Airport Trail NE and 128 Avenue NE running in a north-south direction along 60 Street E as well as between Metis Trail and 60 Street E in an east-west direction along 128 Ave NE. The Northeast Community 'A' Area Structure Plan report encompasses an area bound by Airport Trail NE to the south, future Stoney Trail to the north, Metis Trail to the west and 60 Street E to the east.

The Northeast Community 'A' Area Structure Plan Revised Stormwater Master Drainage Plan (MDP) was prepared in 2007. Based on the MDP, stormwater runoff from the Plan area will be directed to Nose Creek by the storm trunk along 128 Ave NE. Discharge rate and volume control targets from the Nose Creek Watershed Management Plan will be applied to stormwater management and infrastructure design in the Plan area. Stormwater detention facilities will be used to control the discharge rate and contain the excess runoff for up to 100 year storm events. Onsite BMPs such as bio-retention areas and stormwater re-redirection are planned to reduce runoff volumes to Nose Creek.

In the Plan report, it is also required that the stormwater management system for the community be designed to adequately and efficiently serve the ultimate development of the area, and in accordance with the Master Drainage Plan prepared in support of this Area Structure Plan.

Report

In the context of these requirements to the proposed NE LRT corridor, it is understood that Seg. #2 of the NE LRT corridor has been included into the overall stormwater management plan for the Northeast Community 'A" Area. Notwithstanding the above, confirmation of the NE LRT corridor drainage system integration into the Northeast Community 'A' area stormwater management system should be verified. Any development within the Plan area must submit a Staged Master Drainage Plan or Stormwater Management Report , ensuring that it is in accordance with the overall design of the storm sewer system for the Northeast Regional Policy Plan.

Table 7-2 - Action to be Taken upon Site Development for Seg.#2

Item No.	Action	Design Phase
1	Review Nose Creek Water Management Plan	30% design
2	Review Northeast Community 'A' Area	30% design
	Structure Plan - Stormwater Master Drainage	
	Plan	
3	Review/verify existing drainage system	30% design
	conditions and designated releasing rate	
4	Coordinate with the City and adjacent	30% design
	landowners to achieve an integrated SWM	
	strategy incorporating Seg 2 drainage to the	
	satisfaction of the Approving Authority.	
5	Update Existing Master Drainage Plan if	30% design
	required	
6	Submit a Site Specific Stormwater Water	60% design
	Management Report	

**NE LRT Segment #3 (Seg. #3).** Seg. #3 consists of an east-west alignment between 36 Street E and Metis Trail and a north-south alignment between 128 Avenue NE and Stoney Trail. The Northeast Industrial Area Structure Plan report encompasses a plan area that is bounded by future Stoney Trail to the north, Barlow Trail to the west and Metis Trail to the east. Seg. #3 traverses this plan area on the northeast corner.

The NE Industrial Area Structure Plan Stormwater Master Drainage Plan has been prepared for this Plan area, which proposes an extensive network of stormwater facilities to manage storm drainage, with a portion discharging to Nose Creek. Seg. #3 is situated within this Plan area and as such has been accounted into the overall stormwater management strategy for this Plan area. A review of this Master Drainage Plan is necessary to confirm that Seg #3 was included in the stormwater management plan.

Table 7-3 - Action to be Taken upon Site Development for Seg.#3

Item No.	Action	Design Phase
1	Review Nose Creek Watershed	30% design
	Management Plan	
2	Review NE Industrial Area Structure Plan -	30% design
	Stormwater Master Drainage Plan	
3	Review/determine existing drainage	30% design
	conditions and designated releasing rate	
4	Coordinate with the City and adjacent	30% design
	landowners to achieve an integrated SWM	
	strategy incorporating Seg 3 drainage to the	
	satisfaction of the Approving Authority.	
5	Submit Staged Master Drainage Plan or	30% design
	Master Drainage Report	
6	Submit a Site Specific Stormwater Water	60% design
	Management Report	

**NE LRT Segment #4 (Seg #4)**. Seg. #4 is situated within the Northeast Residential Area Policy Plan north of future Stoney Trail. The Plan area does not have municipal stormwater infrastructure in place. The nearest stormwater discharge watercourse is Nose Creek, located west of the plan area. Alberta Environment and the Nose Creek Watershed Partnership initiated the Nose Creek Water Management Plan. As a result, development within this area will require a Master Drainage Plan (MDP) to address stormwater treatment.

Although stormwater collection and conveyance is required to be accommodated individually, on each site, at the responsibility of the developer the policies in the Northeast Residential Area Policy Plan further state:

- "Where a stormwater facility is required to serve a catchment area under multiple land ownership, the various landowners involved shall be encouraged to co-operate in the location, design, timing and financing of the facility with the resolution of these matters to the satisfaction of the Approving Authority.
- Where the landowners can not reach a consensus on those matters identified under (c) above, the Approving Authority should identify the location of, and mechanism for land acquisition for the stormwater facility prior to Outline Plan/Land Use approval within the stormwater catchment Area."

Therefore, Prior to Outline Plan/Land Use Amendment approval, a developer shall be required to submit a Staged Master Drainage Plan or Stormwater Management Report, which is also the requirement in the City's Stormwater Management and Design Manual.

Table 7-4 - Action to be Taken upon Site Development for Seg.#4

Item No.	Action	Design Phase
1	Review Nose Creek Water Management Plan	30% design
2	Review Northeast Residential Area Policy	30% design
	Plan	
3	Review/determine existing drainage	30% design
	conditions and designated release rate.	
4	Submit Staged Master Drainage Plan or	30% design
	Master Drainage Report	
	Coordinate with the City and adjacent	30% design
	landowners to achieve an integrated SWM	
	strategy incorporating Seg 4 drainage to the	
	satisfaction of the Approving Authority.	
5	Submit a Site Specific Stormwater Water	60% design
	Management Report	

#### 8. UTILITIES AND SUBSURFACE STRUCTURES

The objective of this was to identify potential conflicts between utilities and the proposed LRT Right of Way and provide cost estimates for relocating the utilities that conflicted with the LRT alignment.

Representatives for the following utilities were contacted to provide plans showing the locations of their systems within close proximity to the proposed alignment:

- ENMAX (electrical distribution and transmission),
- ATCO Gas (natural gas distribution and transmission lines),
- ATCO Pipelines (high pressure transmission lines,
- TELUS (telephone distribution cables),
- SHAW (telephone distribution cables), and
- City of Calgary (watermains, feedermains, sanitary sewer and storm sewer).

Locations of oil, petroleum product lines and sour gas lines within the study area was verified using AbaData.

The information provided by the utilities and other companies was placed on the plans showing the LRT alignment. On the basis of this information potential conflicts were identified. The utility companies were contacted to confirm whether their installations at the identified locations conflicted with the proposed LRT alignment. The utility companies provided estimates of probable cost for relocating portions of their systems that conflicted with the alignment of the proposed LRT extension.

A majority of the utility companies do not remove their abandoned pipes, conduits, cables or duct work. Separate estimates were provided for the probable cost of removing the abandoned utilities within the LRT right of way.

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A brief description of each of these utilities is given below. A Class 'A' Estimate of Probable Costs for the relocation of these utilities is in Section 3 of this report. This Estimate of Probable Costs is strictly for study purposes and a more comprehensive cost estimate will be needed when the detailed design is finalized. **Appendix F** of this report is a table of the utility companies and the internal contacts that provided information for this section.

The Estimate of Probable Costs does not include cost of new easements, rights of ways, or other encumbrances.

#### 8.1 Review of Utility Crossings and Possible Relocations

The task of reviewing the shallow utilities was performed by inquiring with the various utility companies which have utilities in the right of way of the proposed extension of the NE LTR. AbaData was also checked for information about location and ownership of Oil and Sour Gas pipelines in the area. Four drawings were prepared to cover the proposed right of way for the extension of the NE LRT. The locations of the existing utilities (based on information received from the utilities) were plotted on these plans. The proposed extension of the NE LRT has been superimposed on these drawings to help identify potential conflicts with the utilities within the right of way. These drawings are found in **Appendix F**.

#### 8.1.1 Enmax

Within the study area for the extension of the NE LRT electrical lines are underground in the developed areas and above ground in the more "rural" areas. The 25kV (Main Feeder, Single Phase and 3 Phase) lines are shown on the four drawings located in **Appendix F**. The following lines were identified as potentially conflicting with the proposed LRT alignment:

- 1. 25 KV Main Feeder and 25 kV 3 Phase underground lines crosses the alignment at Saddletowne Circle NE.
- 2. Overhead 25 kV Single Phase line crosses the alignment in NW 23-25-29-4.
- 3. Overhead 25 kV Main Feeder line crosses the alignment north side of 112 Ave. N.E.
- 4. Overhead 25 kV 3 Phase line crosses the alignment on north side of 128 Ave at 52 St NE.
- 5. Overhead 25 kV Single Phase line crosses the alignment on the north side of 128 Ave at 36 St NE then runs north on east side of LRT.
- 6. Underground 25kV single Phase line crosses the alignment on the 36 Street ROW south of Stoney Trail

When contacted about the potential conflicts ENMAX provided the following responses:

- The installations at location 1 were lowered in 2009 to avoid conflict with the extension of the LRT. The original installation was abandoned in place.
- An order of magnitude cost estimate was provided for the relocation of conflicts 2 thru 6 (estimate is shown in Section 8.2.1).

There is an agreement in place between ENMAX and the City of Calgary in which the cost of relocation will be shared on LRT projects.

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# NORTHEAST LRT FUNCTIONAL PINA Nud SADDUE TO WHE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

When ENMAX relocates their power lines, the existing duct and lines, are usually left abandoned and not removed by their forces. Cost of removal of abandoned ENMAX ducts and lines will be in addition to the cost of relocation. An estimate of probable costs for removal of abandoned ENMAX ducts and lines has been provided in Section 8.2.7.

Once the LRT profiles have been finalized, conflicts with the ENMAX facilities will need to be reconfirmed. ENMAX will then need to be contacted in order to secure a more detailed cost estimate for relocating any ENMAX facilities that conflict with the LRT extension.

#### 8.1.2 ATCO Gas

The following ATCO Gas distribution lines were identified as potentially conflicting with the proposed LRT alignment:

- 1. 88mm 410 kPa line crosses the alignment at Saddletowne Circle NE.
- 2. 219mm 410 kPa line crosses the alignment at lane south of Saddlehorn Drive NE.
- 3. 273mm 410 kPa line crosses the alignment south side of 88 Ave NE.
- 4. Proposed crossing of 128 Ave NE in line with Skyview Ranch Road in NE 27-25-29-4.
- 5. Abandoned lines (48mm and 66mm) cross alignment at 2 locations north of 128 Ave at 36 St NE.

When contacted about the potential conflicts ATCO Gas provided the following responses:

- The pipe at location 1 was lowered in 2009, in order to avoid a conflict with the Light Rail Transit.
- An order of magnitude cost estimate was provided for the relocation of the conflicts 2 thru 4 (see Section 8.2.2).
- Abandoned lines are left in place when new lines are installed unless removal is requested. Cost of removing abandoned lines is not included in the relocation costs estimates.

There is an agreement in place between ATCO Gas and the City of Calgary in which the cost of relocation will be shared on LRT projects. The estimate provided in Section 8.2 shows the City of Calgary's share (50%) of the costs.

When ATCO relocates their lines, the existing lines, are usually left abandoned and not removed by their forces. Cost of removal of abandoned lines will be in addition to the cost of relocating any lines. An estimate of probable costs for removal of abandoned lines has been provided in Section 8.2.7.

Once the LRT profiles have been finalized, conflicts with the ACTO Gas facilities will need to be reconfirmed. ATCO Gas will then need to be contacted in order to secure a more detailed cost estimate for relocating the facilities that conflict with the LRT Extension.

#### 8.1.3 ATCO Pipelines

The following ATCO Pipelines were identified as conflicting with the planned construction of the LRT:

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# N**@RTHEAST** LRT FUNCTIONAncPinANudSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

- 1. A 408mm Natural Gas pipeline crosses the alignment north of Airport Trail from SW 23-25-29-4 to SE 23-25-29-4.
- 2. A 323mm Natural Gas pipeline crosses the alignment east of 52 Street in NW 6-25-29-4.

Both pipelines will have to be relocated. ATCO Pipelines has provided an order of magnitude budget figure for relocation of sections of both pipelines to avoid the conflicts with the LRT alignment. When ATCO Pipelines relocates their lines, the existing lines, which will be abandoned by the relocation, will be removed by their forces. The cost of removal of the abandoned lines has been included in the order of magnitude budget figure (estimate is shown in Section 8.2.3). There is an agreement in place between ATCO Pipelines and the City of Calgary in which the cost of relocation will be shared on LRT projects.

Once the LRT profile has been finalized, the conflict with the ATCO Pipelines facilities will need to be reconfirmed. ATCO Pipelines will then need to be contacted in order to secure a more detailed cost estimate for relocating the pipelines that conflict with the LRT Extension.

#### 8.1.4 Telus

The following TELUS telecommunication lines were identified as potentially conflicting with the planned construction of the LRT:

- 1. Underground conduit crosses alignment on south side of Saddletowne Circle NE.
- 2. Underground conduit crosses alignment at Saddleback Way NE.
- 3. Abandoned cables crosses alignment in NW 23-25-29-4.
- 4. Buried cables crosses alignment south side of 112 Avenue NE.
- 5. Buried conduit crosses alignment north of 128 Avenue NE in line with Skyview Ranch Road NE.
- 6. Buried cable and overhead cable crosses alignment on the 36 Street right of way.
- 7. Buried drop crosses alignment in SE 33-25-29-4.
- 8. Aerial fiber cable on east side on alignment in NW 35-25-29-4 past the end of the proposed extension.

When contacted about the potential conflicts TELUS confirmed the following:

- The underground conduits that cross the alignment south of Saddletowne Circle (location 1) were lowered in 2009 to avoid conflict with the LRT.
- The underground conduit at Saddleback Way (location 2) was installed at an elevation low enough to avoid conflict with the LRT.
- The underground conduit at Skyview Ranch Road (location 5) was installed at an elevation low enough to avoid conflict with the LRT.
- It is anticipated the other identified TELUS crossings of the LRT alignment (location 3, 4, 6, 7 and 8) will "probably" be replaced prior to construction of the LRT because of new construction in the area. When the new TELUS crossing are installed they will be installed in accordance with the LTR guidelines.
- In addition to the other 8 identified conflicts, an aerial cable on ENMAX poles on the north side of Country Hills Blvd would be in conflict with the LRT where it crosses 60 Street.

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# NORTHEAST LRT FUNCTIONAL PLANUS ADDULETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

TELUS provided a cost estimate for moving the aerial cable at Country Hill Boulevard and 60 Street to underground (see Section 8.2.4).

There is an agreement in place between TELUS and the City of Calgary in which the cost of relocation will be shared on LRT projects.

When TELUS relocates their lines, the existing lines, are usually left abandoned and not removed by their forces. Cost of removal of abandoned lines will be in addition to the cost of relocating any lines. An estimate of probable costs for removal of abandoned lines has been provided in Section 8.2.7.

Once the LRT profiles have been finalized, conflicts with any TELUS facilities will need to be reconfirmed. TELUS will then need to be contacted in order to secure a more detailed cost estimate for relocating the facilities that conflict with the LRT Extension.

#### 8.1.5 Shaw

The following SHAW telecommunication lines were identified as potentially conflicting with the proposed LRT alignment:

- 1. Underground duct crosses alignment at Saddletowne Circle NE.
- 2. Underground cables and conduit cross alignment at Saddleback Way NE.
- 3. Temp overhead fiber route crosses alignment at 52 Street NE.
- 4. Future Underground fiber optic route crosses alignment north of 128 Avenue NE in line with Skyview Ranch Road NE.
- 5. Future Underground fiber optic route on west side alignment in SE 33-25-29-4.

When contacted about the conflicts SHAW provided an order of magnitude cost estimate for relocating their ducts and conduit at locations 1 and 2 (see Section 8.2.5).

There is an agreement in place between Shaw and the City of Calgary in which the cost of relocation will be shared on LRT projects.

The other conflicts (locations 3 to 5) are overhead lines which will eventually be relocated underground. Their installation will be coordinated with the City and therefore be installed at a depth which does not conflict with the LRT construction.

When SHAW relocates their lines, the existing lines, are usually left abandoned and not removed by their forces. Cost of removal of abandoned lines will be in addition to the cost of relocating any lines. An estimate of probable costs for removal of abandoned lines has been provided in Section 8.2.7.

Once the LRT profiles have been finalized, conflicts with any SHAW facilities will need to be reconfirmed. SHAW will then need to be contacted in order to secure a more detailed cost estimate for relocating the facilities that conflict with the LRT Extension.

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#### 8.1.6 Nexen

There is one live pipeline and a number of abandoned NEXEN pipelines that cross the proposed LRT alignment. Below is a list of the potential conflicts:

- 60mm Fuel Gas pipeline crossing the alignment from NW 23-25-29-4 to NE23-25-29-4.
- Three (3) Abandoned lines (60mm miscellaneous liquid, 60mm Fuel Gas, 168mm Natural Gas) crossing the alignment from NW 23-25-29-4 to NE23-25-29-4.
- Five (5) Abandoned lines (two (2) sour natural gas, two (2) miscellaneous liquid, fuel gas) cross the alignment at 52 Street NE.

When contacted about the conflicts, NEXEN stated the 60mm Fuel Gas pipeline has been abandoned. All nine (9) NEXEN pipelines that conflict with the LRT right of way have been abandoned. NEXEN does not remove pipelines when they are abandoned. Removal of the abandoned lines will have to be undertaken by others as part of the LRT project. An order of magnitude cost estimate has been provided by NEXEN for removal of the abandoned lines. The estimate is in Section 8.2.7.

Once the LRT profiles have been finalized, conflicts with any abandoned NEXEN facilities will need to be reconfirmed.

The City of Calgary will have to apply to NEXEN to remove the sections of pipelines that conflict with the LRT right of way. Removal of the sections of pipelines must be approved by the regulator, the Alberta Energy Resources Conservation Board (ERCB). NEXEN would provide the City with a Pipeline Removal Agreement. An application will have to be made to the ERCB to have the pipeline license split out so that the section of pipeline to be removed is a stand-alone license. NEXEN will be responsible for the regulatory approvals in this regard, but the City will be responsible for the costs associated with the removal.

#### 8.1.7 City of Calgary Water, Storm And Sanitary Mains

There are a number of City of Calgary watermain, feedermain, storm sewer and sanitary sewer lines that cross the proposed LRT alignment or are in close proximity to the proposed LRT alignment. Below is a list of the City of Calgary utilities that cross or are close to the proposed alignment:

- 250mm PVC Watermain crosses alignment on Saddletowne Circle NE.
- 200mm PVC sanitary sewer crosses alignment on Saddletowne Circle NE.
- 525mm concrete storm sewer crosses alignment on Saddletowne Circle NE.
- 400mm PVC watermain crosses alignment at Saddleback Way NE.
- 600mm PVC storm sewer crosses alignment at Saddleback Way NE.
- 250mm PVC sanitary sewer crosses alignment at Saddleback Way NE.
- 300mm PVC watermain crosses alignment at the lane south of Saddlehorn Drive NE.
- 300mm PVC sanitary sewer crosses alignment at the lane south of Saddlehorn Drive NE.
- 1350mm concrete Storm Sewer crosses the alignment in Saddlehorn Drive NE.
- 250mm PVC watermain crosses alignment from lane north of Saddlehorn Drive NE.
- 200mm PVC watermain crosses alignment south of 88 Avenue NE.

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# NORTHEAST LRT FUNCTIONAL PLANUSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

- 750mm PVC storm sewer crosses alignment at 88 Avenue NE.
- 525mm PVC sanitary sewer crosses alignment at 88 Avenue NE.
- 300mm PVC watermain crosses alignment on north west corner of Metis Trail and 128 Avenue NE.
- 900mm Concrete Feeder Watermain runs parallel on the east side of the alignment from Saddletowne Circle past 128 Avenue NE.
- 900mm feeder Watermain crosses the alignment on south side of Stoney Trail within the 36 Street NE right of way.
- Future Country Hill Crosstie Feeder Main may cross the alignment at Country Hills Boulevard.
- Future North Ridge Macdonald Storm Trunk may cross the alignment at Country Hills Boulevard.
- Existing North Ridge Macdonald Storm and Sanitary Trunks will run adjacent to proposed alignment on the south from Metis Trail west until the LRT alignment swings north.

It is not anticipated any of these lines conflict with the proposed LRT construction. Water, sanitary sewers and storm sewers are generally at a depth where conflicts with the LRT line should not be a concern.

Once the design for the LRT is finalized a review of all profiles for the water and sewers lines would be required to confirm whether there are indeed any conflicts.

#### 8.1.8 Oil Pipelines

There is an abandoned oil pipeline and a pipeline Right of Way that run parallel to the proposed LRT alignment in the following locations:

- An abandoned 89mm oil pipeline abandoned LVP pipeline owned by Plains Midstream Canada Ltd is located on the east side of the alignment between Saddletowne Circle to just south of 88 Avenue NE.
- An oil pipeline R/W is adjacent to the east side of alignment from 88 Avenue north to 128 Ave NE.

Based on information available the proposed LRT alignment does not cross the abandoned LVP pipeline or the oil pipeline right of way, so there does not appear to be any conflicts. Once the design of the LRT is finalized, confirmation is required in the field whether there is a conflict with the abandoned pipeline or the right of way.

### 8.2 <u>Utility Crossing Cost Estimate</u>

#### 8.2.1 Enmax

Below is the City's portion of the order of magnitude cost for the relocating ENMAX facilities in conflict with the proposed extension of the LRT and removing the existing ductwork. ENMAX provided one cost figure for the following 5 relocations.

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# NORTHEAST LRT FUNCTIONANCPINANUS SADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

Work Proposed	City Cost (\$)
Relocate overhead 25KV Mainline feeder N of 112 Avenue NE	
Relocate overhead 25KV Single line feeder NW 23-25-29-4	
Relocate overhead 25KV 3 Phase N side of 128 Avenue at 52 Street	
Relocate overhead 25KV Single Phase Line N of 128 Avenue at 36 NE	387,500
Relocate underground 25 KV Single Phase Line S side of Stoney Trail at 36 St. R.O.W.	
TOTAL	\$387,500

#### 8.2.2 ATCO Gas

Below is the order of magnitude budget cost estimate for the relocation of the ATCO Gas pipes. This is the City's share of the relocation costs.

Work Proposed	City Cost (\$)
Relocate 219 mm line at Saddlehorne Drive	25,000
Relocate 273 mm line S side of 88 Avenue	40,000
Relocate proposed crossing at 128 Avenue and Skyview Ranch	30,000
TOTAL	\$95,000

### 8.2.3 ATCO Pipelines

Below is the order of magnitude budget cost estimate for the relocation of the ATCO Pipeline pipe. This is the City's share of the relocation costs.

Work Proposed	City Cost (\$)
Relocate existing 408 mm Pipeline N of Airport Trail (Cost includes removal of pipeline)	200,000
Relocate existing 408 mm Pipeline E of 52 Street (Cost includes removal of pipeline)	200,000
TOTAL	\$400,000

#### **8.2.4** Telus

Below is the order of magnitude budget cost estimate for the relocation of the TELUS line. The remaining lines will be relocated prior to the LRT construction because of new construction in the areas close to the LRT alignment. This is the City's share of the relocation costs.

Work Proposed	City Cost (\$)
Relocate cables S side of 112 Avenue	7,680
TOTAL	\$7,680

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#### 8.2.5 Shaw

Below is the order of magnitude budget cost estimate for the relocation of the SHAW lines. This is the City's share of the relocation costs.

Work Proposed	City Cost (\$)	
Relocate duct at Saddletowne Circle	58,120	
Relocate duct at Saddleback Way	30,120	
TOTAL	\$58,120	

#### 8.2.6 Nexen

None of the NEXEN lines are to be relocated. All NEXEN lines will have been abandoned when the LRT line is extended. An order of magnitude budget cost estimate for removing the NEXEN lines is included in Section 8.2.7.

# 8.2.7 Removing Abandoned Utilities

The utilities will relocate the pipes, conduits, and cables that conflict with the LRT alignment. General practice for the utilities is to abandon in place the pipes, conduits or cable which are no longer being used to provide services. These abandoned pipes, conduits or cables will have to be removed by others as part of the LRT project.

Below are the order of magnitude budget costs for removing those abandoned pipes, conduits and cables.

Work Proposed	City Cost (\$)
Remove abandoned ENMAX underground lines at Saddletowne Circle	18,000
Remove abandoned ENMAX underground line S of Stoney Trail at 36 St. R.O.W.	18,000
Remove abandoned ATCO Gas 88 mm line at Saddletowne Creek	10,000
Remove abandoned ATCO Gas 219 mm line at Saddlehorne Drive	10,000
Remove abandoned ATCO Gas 273 mm line S of 88 Avenue	10,000
Remove abandoned ATCO Gas 48 mm line N of 128 Avenue	10,000
Remove abandoned ATCO Gas 66 mm line N of 128 Avenue	10,000
Remove abandoned TELUS conduit at Saddletowne Circle	24,000
Remove abandoned TELUS cables at NW 23-25-29-4	10,000
Remove abandoned TELUS cables S of 112 Avenue	10,000
Remove abandoned TELUS cables at 36 Street R.O.W.	10,000
Remove abandoned TELUS cables at SE 33-25-29-4	10,000
Remove abandoned SHAW ducts at Saddletowne Circle and Saddleback Way	48,000
Remove 9 NEXEN abandoned pipelines	90,000
TOTAL	\$288,000

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# 8.2.8 Contingency

A 40% contingency factor was added to the budget figures provided by the utilities. A contingency factor is required for the following reasons:

- The budgets figures were not based on detailed design; and
- Market conditions can vary widely, increasing construction costs.

# 8.3 <u>Cost Summary</u>

Utilities	City Costs (\$)
ENMAX	\$387,500
ATCO Gas	\$95,000
ATCO Pipelines	400,000
TELUS	7,680
SHAW	58,120
REMOVE ABANDONED UTILITIES	288,000
Sub- total	1,236,300
CONTINGENCY	494,520
Grand Total	\$1,730,820

# 8.3.1 Assumptions

The following assumptions were made by the utilities when preparing their construction cost estimates:

- All relocations would occur during construction season, excavations would occur in frost free conditions.
- New lines will be within 0.5m of existing lines.
- No cost included for permitting, traffic accommodations plans or approvals.
- Replacement of sidewalks, pavement and landscaped areas were not included. This work will take place within the construction zone required for the LRT construction. Sidewalks, pavement and landscaping will be disturbed by the LRT construction and repair of sidewalks, pavement and landscaping will be part of the overall LRT project.
- Cost estimates are based on 2011 construction rates
- Estimates are for relocating approximately 30 metres of pipe, cable or conduit in areas of conflicts.
- Removal estimates are for removing approximately 30 metres of abandoned pipe, cable or conduit in areas of conflicts.
- Joint Use Construction is anticipated for relocating shallow utilities, i.e., TELUS, SHAW and ENMAX will coordinate relocations so that the three utilities will use common trench installations were possible.
- Estimates do not include cost of new easements, right of ways, or other encumberances.
- Estimates do not include any costs associated with applications to regulators such as the Alberta Energy Resources Conservation Board (ERCB) for work related to remove the abandoned NEXEN pipelines.

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# 9. GEOTECHNICAL REVIEW

A preliminary geotechnical assessment reviewed the existing geotechnical information in the vicinity of the proposed alignment. The expected soil, bedrock and groundwater conditions were assessed to identify any key geotechnical constraints that could affect the project. Preliminary evaluation and recommendations were made for the following items:

- LTS Trackbed Support
- Temporary Excavations
- Permanent Cuts
- Embankment and Retained Fills
- Foundations for structures

Based on the available information for the project area, the key geotechnical issues that need to be addressed include the relatively high groundwater table, the potential to encounter shallow bedrock within the depth of excavation at the underpasses and deeper cuts, unfavourable subsurface conditions expected in the slough areas along the alignment, and potentially loose man-made fills near the intersection of 36 Street and 128 Avenue and along the current construction areas. These issues are addressed and preliminary geotechnical recommendations suitable for a functional planning study or the project are provided in the geotechnical assessment. The geotechnical assessment is included in **Appendix II-A**.

# 10. PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

A Phase 1 Environmental Site Assessment was completed for the future LRT corridor in accordance with Canadian Standards Association guidance document CSA Z768-01 Phase 1 Environmental Site Assessment (April 2003 revision). The complete report is included in **Appendix II-B**.

# 10.1 <u>Findings</u>

In general terms, there are two distinct types of potential environmental risk to any property. The first type of risk is from potential contamination from on-site land use. This would include potential accidental spills or site practices that may contaminate the property directly. The second type of risk is from contamination caused by adjacent property owners, which might then be transported through the subsurface soils by groundwater, or in overland runoff onto the subject site.

#### 10.1.1 Potential for Impairment from On-site Source(s)

There are no apparent potential sources of environmental impairment relating to the subject site from historical and/or current on-site land uses.

#### 10.1.2 Potential for Impairment from Off-site Source(s)

There are no apparent potential sources of environmental impairment relating to the subject site from historical and/or current off-site land uses.

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#### 10.1.3 Recommendations

Based on the present study, we recommend that no further work is required.

We recommend the following for consideration:

- Surficial debris should be removed from the site area prior to construction activities.
- If buried debris (i.e., unaccounted farm dumps), odours, or staining are encountered during grading or ground disturbance activities, a qualified environmental professional should be contacted.
- If water wells, septic tanks, or septic fields are encountered, they should be decommissioned according to current regulations.
- If the LRT ROW crosses over or covers the well site access road ROW in NW 1/4 23-025-29 W4M, a ROW agreement with the owner of the access road is needed.
- When crossing the pipelines along the LRT ROW, a materials management plan needs to be created and followed if environmental concerns are encountered.

# 10.2 <u>Historical Resource Overview</u>

The primary objective of the Historical Resources Overview (HRO) is to assess the potential for historical resources on or adjacent to the study area. The complete report is included in **Appendix II-C**.

An application for Historical Resource Act clearance for construction of the project was submitted to Alberta Culture and Community Spirit (ACCS). ACCS is requiring an Historical Resources Impact Assessment (HRIA) for paleontology. As such, it is recommended that the HRIA be completed during the detailed design stage. The Historical Resources Act Requirements are attached in **Appendix II-C**.

# 11. COST ESTIMATE

The level 'A' cost estimate including 15% contingency costs is \$355,000,000 (approximately \$47,240,000 per kilometre). The cost estimate detailed calculation summary is included in **Appendix G**.

# 12. RISK ASSESSMENT

As a part of the functional planning process, a risk assessment based on the triple bottom line philosophy of The City of Calgary was completed. This is a thoughtful process of examining and fully understanding the risks associated with impacts from economic, social, environmental and timing perspectives. These identified risks can either be mitigated or accepted.

# 12.1 <u>Economic Impacts</u>

Prior to the initiation of this functional planning study, efforts were made to work with land use planning and developers in the vicinity of this NE LRT extension to maximize ridership revenue. Through the process of this study, communication with land owners and City of

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# NORTHEAST LRT FUNCTIONAL PLANUS ADDITETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

Calgary staff confirmed the Transit Orientation Development principles were applied to development areas around the stations.

This study ensured that appropriate design standards (*LRT Design Guidelines – Rev #2*, March 2009) were used in the functional planning of the plans and profiles of this future NE LRT extension. Thoughtful consideration of the future detailed design process was given in designing an appropriate alignment.

To ensure management of constructability in the future, geotechnical conditions were assessed. In general, the geotechnical findings indicate that this alignment is located on lands that are suited for construction of an LRT line. With this initial assessment, there are no geotechnical issues that would increase the cost of construction outside of normal parameters. Where structures will be required to support the planned alignment, no unusual requirements will reduce the constructability of the extension.

Currently, the City owns much of the right-of-way lands required to construct the NE LRT extension. However, some of these lands have not yet been acquired. As with any land acquisition, this may pose an economic risk to the City when they move forward with the design and construction of the NE LRT extension.

# 12.2 <u>Social Impacts</u>

Land use planning and transportation planning are an integrated process. This LRT extension has been planned to be integrated into the surrounding communities. Each station will be a 'place' within the community and integrated with pedestrian, cyclist, bus transit and vehicular access. The station locations, configurations and connections were considered thoughtfully to increase community accessibility. As this integrated approach has been taken throughout the planning process, this has mitigated social risks.

# 12.3 Environmental Impacts

Currently, the future LRT alignment lands are mostly undeveloped greenfield. As part of this study, a Phase 1 Environmental Site Assessment was completed. The findings of this study indicated there are no unusual environmental risks encountered in the area. No mitigation is required from an environmental perspective at this time.

# 12.4 <u>Timing Impacts</u>

The timing of the construction of the NE LRT extension is not yet known. There is a potential for this extension to be built in stages, with any of the stations as a potential interim terminal station. This was taken into account in the design of the track plans and profiles to provide for the necessary infrastructure at each station to allow it to act as an interim terminal station. In addition, Stoney Station is the terminal station for this extension, however, an extension north of Stoney Trail may be desired in the future. In consideration of this potential future extension, the alignment design ensured that a grade separated crossing will be feasible in the future.

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# N**@RTHEAST** LRT FUNCTIONAncPinANudSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

The timing of the construction of this project is dependent on when the community development reaches an appropriate level of development and when the capital is available to complete design and construction.

# 13. PUBLIC PARTICIPATION

Public participation and stakeholder meetings were undertaken throughout the study to garner input and information from both internal and external stakeholders. The following were meetings held to date:

# Project Kick-off meeting – March 24, 2011

This meeting was attended by internal stakeholders at The City of Calgary. Items discussed at this meeting included:

- Project Scope and Approach
- General Corridor and Alignment
- Other project stakeholders
- Project Schedule
- Opportunities and Risk Register
- Communications strategy
- Next Steps

# Operations Review - April 21, 2011

The purpose of this meeting was to confirm LRT operations and service criteria with The City of Calgary.

# Design Charette – May 5, 2011

The purpose of this meeting was to garner input from internal stakeholders on the following items for each station:

- General Configuration and Utility
- Surrounding land uses
- Pedestrian and cycling linkages
- Feeder Bus network
- Parking

# Transit planning in the vicinity of YYC – May 12, 2011

The purpose of this meeting was to begin discussions and share information on a transit connection to the airport from NE LRT. Stakeholders from The City of Calgary and Calgary International Airport attended.

#### Stakeholder Meeting (Stoney Station) – July 15, 2011

The purpose of this meeting was to obtain input from the landowner in the vicinity of the Stoney Station (WAM Development Group). Information gathering included stage of development planning, input and relative priorities pertaining to the routing, design and construction of the future LRT.

# Airport Trail Brainstorming Session – July 20, 2011

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# NORTHEAST LRT FUNCTIONAL PLANUSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

This meeting was hosted by the Airport Trail functional planning study team. Stakeholders from YYC, The City of Calgary and consultants for the functional planning study and the NE LRT functional planning study were in attendance. Items discussed in the meeting included:

- YYC future development plans
- YYC traffic projections
- YYC road infrastructure priorities
- YYC transit plans
- NE LRT functional planning study project overview
- Airport Trail functional planning study overview
- Identification of constraints and opportunities for coordination between groups
- Communication strategy for coordination between groups

# Stakeholder Meeting (128 Avenue Station) - July 27, 2011

The purpose of this meeting was to obtain input from the landowner in the vicinity of the 128 Avenue Station (Walton International Group). Information gathering included stage of development planning and other development stakeholders (Qualico Group). Information gathered indicated that Qualico Group is proceeding with the development of Redstone Community which will include 128 Avenue Station.

# Stakeholder Meeting (128 Avenue Station and Country Hills Boulevard Station) – August 9, 2011

The purpose of this meeting was to obtain input from the landowner in the vicinity of the 128 Avenue Station (Qualico Group) and Country Hills Boulevard (LaCaille Group and IBI Group). Information gathering included stage of development planning, input and relative priorities pertaining to the routing, design and construction of the future LRT.

#### YYC Service: Options Profiles – September 22, 2011

The purpose of this meeting was to present and discuss the initial transit service options to connect YYC and NE LRT with Calgary Transit.

# Transit Service Options to YYC – October 13, 2011

The purpose of this meeting was to present and discuss transit service options to connect YYC and NE LRT. Input from YYC stakeholders was provided.

#### Functional Station plans NE LRT – October 28, 2011

The purpose of this meeting was to review the functional station plans for the NE LRT extension with Calgary Transit stakeholders and City of Calgary stakeholders for the Airport Trail functional planning study.

#### Stakeholder Meeting (Country Hills Boulevard Station) – November 9, 2011

The purpose of this meeting was to discuss functional planning work completed for the Country Hills Boulevard Station and surrounding track alignment. The outline plan for the surrounding development placed the station south of Country Hills Boulevard with a grade separation between road and LRT at Country Hills Boulevard. Further examination of the functional design revealed that this station location at-grade in concert with a grade separation at Country Hills Boulevard is not possible. Alternative options were discussed as outlined in this report.

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# NORTHEAST LRT FUNCTIONAL PLANUSADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

# Stakeholder Meeting (Stoney Station) - November 18, 2011

The purpose of this meeting was to discuss functional planning work completed for Stoney Station and the surrounding track alignment. Landowner stakeholders (WAM Development Group) expressed concern with the grade of the LRT track and station at Barlow Crescent. WAM is reviewing the grade of their site for stormwater drainage purposes and will require the elevation of Barlow Crescent at the intersection with the LRT to be lower in the order of 0.5 metres to 2.0 metres. Detailed design work had not yet been completed by WAM. The vertical alignment and station location in this area were reviewed to provide a lower grade at the location requested. This was communicated to WAM.

# Stakeholder Meeting (128 Avenue Station) - November 18, 2011

The purpose of this meeting was to discuss functional planning work completed for 128 Avenue Station and the surrounding track alignment. Landowner stakeholders (Qualico Group) shared information regarding a revised community plan. This revision did not effect the station location or track alignment.

# Functional Plan Review - November 25, 2011

The purpose of this meeting was to have an 80% review meeting with internal stakeholders at The City of Calgary. Topics discussed at this meeting included:

- Project status and next steps
- Functional Requirements
  - Alignment and Stations specifically options at the Country Hills Boulevard Station
  - Operating Plan
  - YYC Connection
  - Utilities review
  - Stormwater drainage
  - Geotechnical review
- Station Integration items for each station:
  - Cycling and Pedestrian links
  - Cycle Parking
  - Park n Ride
  - Feeder Bus Network
  - Station Access
  - Surrounding Land Use
- Airport Transit Connection Service Options Overview
- Internal stakeholder input

## Station Review - Country Hills Boulevard - December 9, 2011

The purpose of this meeting was to discuss the options for station location and track alignment at Country Hills Boulevard and their impact to affected stakeholders. City of Calgary stakeholders (Calgary Transit, Land Use Planning) and landowner stakeholders (IBI Group) were present. Landowner stakeholders are to provide a detailed summary of impacts from a change in station location.

# Plan and Profile Review – January 18, 2012

The purpose of this meeting was to review the plans and profiles of the NE LRT extension internally with City of Calgary staff.

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# NORTHEAST LRT FUNCTIONAL PLANUS ADDUETOWNE TO STONEY TRAIL Saddletowne Circle to Stoney Trail

# Stakeholder Meeting (88 Avenue Station) – February 14, 2012

The purpose of this meeting was to discuss functional planning work completed for 88 Avenue Station and the surrounding track alignment. The landowner expressed concern regarding access to his land from the surrounding network. He also expressed preference for the LRT to be grade separated under the Airport Trail interchange, rather than over it.

# Stakeholder Meeting (Country Hills Boulevard) – February 24, 2012

The purpose of this meeting was to discuss the station location option under Country Hills Boulevard and the associated track alignment in relation to the planned land use surrounding station. Discussion was had around maintaining the pedestrian 'high street' and having the station under Country Hills Boulevard. An additional piece of work to more accurately determine ROW requirements if designed in conjunction with the adjacent buildings was discussed. A potential issue is after-hours access for transit customers into commercial use buildings.

# Airport Trail Median Review - March 8, 2012

The purpose of this meeting was to discuss the protection for LRT within the median of Airport Trail with the NE LRT functional planning team and the Airport Trail Functional Planning team. Forecast numbers for transit ridership were discussed.

# Stakeholder Meeting (128 Avenue) – March 22, 2012

The purpose of this meeting was to discuss the potential relocation of the station within the community. No formal review to the Outline Plan had been completed at this time.

# Open House - April 24, 2012

An Open House to show the functional planning study and airport transit connection work was held at the Genesis Centre from 4 p.m. to 8 p.m. There were three other City of Calgary projects presenting at the same location:

- Airport Trail Functional Planning Study
- Metis Trail
- Airport Tunnel progress report

The open house boards and feedback are included in **Appendix H**. Two major stakeholders have provided letters of support and are included in **Appendix I**.

September 2012

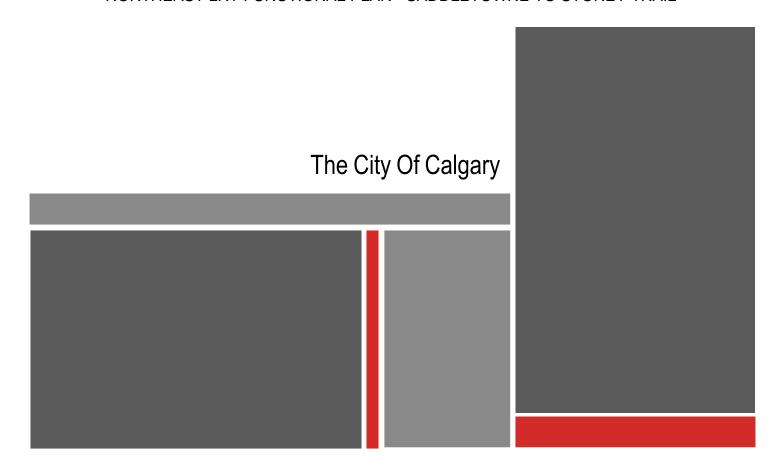
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# Appendix A





# NE LRT Functional Study Airport Transit Link Service Options Overview

Calgary, Alberta

September, 2012



# The City of Calgary

# NE LRT Functional Study Airport Transit Link Service Options Overview

Calgary, Alberta

August, 2012

Many Solutions<sup>SM</sup>

4838 Richard Road SW, Suite 140 WestMount Corporate Campus Calgary, AB T3E 6L1 Tel: (403) 537-0250 Fax: (403) 537-0251 www.hdrinc.com

Project # 6211

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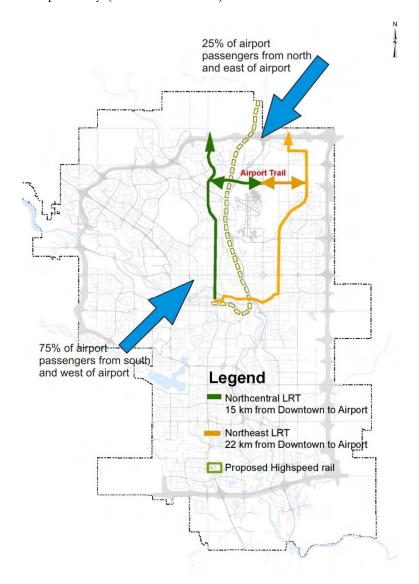
**Appendix A:** Future Bus Routing Concepts

Appendix B: Passenger Transfer and Travel Time Summary

# 1. INTRODUCTION

The route of the **NE LRT** extension from **Saddletowne Station to Stoney Trail** has been identified, and the horizontal and vertical track alignment, station characteristics and land requirements have been determined through a functional planning study. As part of the functional study for the NE LRT extension the transit service options to the **Calgary International Airport (YYC)** are being considered.

The Calgary International Airport is located in the northeast quadrant of Calgary. This urban airport serves a population base primarily located to the south and west of the airport. Current road access is provided via Airport Trail NE (96 Avenue N) which connects with Deerfoot Trail to the west; and Barlow Trail which connects with Country Hills Boulevard to the north. The graphic below shows the geographic location of the airport relative to the balance of the city of Calgary and the travel distance from the city centre to the airport via the north central and north east LRT corridors respectively (15 km and 22 km).



# THORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONE YUNG PAIL Study Airport Transit Link Service Options Overview

YYC has begun construction of a parallel runway (running north/south on the east side of the airport) as part of the Airport Development Project which also includes a new International Concourse to accommodate increased passenger demand.

The City is connecting Airport Trail east and west of YYC by constructing a tunnel under the new north-south runway. The Airport Trail tunnel is designed to accommodate five vehicle lanes and space for transit. In the future, Airport Trail will be continuous between Harvest Hills Boulevard and Stoney Trail. The future Calgary Transit LRT network will include the NE LRT extension to Stoney Trail east of the airport, the North Central LRT line running north/south west of the airport, and Alberta Transportation has plans for high speed rail connecting Calgary to Edmonton with a station west of the airport at Airport Trail (96 Avenue N).

Current transit service to the airport is provided by bus Routes 100, 300 and 430. Ridership data provided by Calgary Transit indicates around 1,300 passengers per day (September 2011) are using these transit routes to/from the airport. The current peak hour peak direction ridership is approximately 100 passengers. This indicates that peak hour peak direction ridership is about 8% of the daily ridership. Current ridership is primarily air travel passengers and airport employees. The current split between air travel passengers and airport employees on Route 300 is 54% and 44% respectively.

Airports throughout the world utilise a variety of types of bus and rail transit connections. In Canada, airport transit connections range from bus connections (Edmonton, Toronto) to rail connections (Vancouver). Airports may also have "people movers" to allow passengers and employees to move within the airport facilities.

The 15 km Canada Line SkyTrain connection from downtown Vancouver to the Vancouver International Airport is currently considered one of the most successful (10,000 passengers per day) airport transit connections in Canada. Although a future transit ridership forecast to the Calgary airport is difficult to estimate, using a YYC transit ridership forecast of twice the current Vancouver airport transit traffic would give an upper limit (20,000 passengers per day) that would be suitable for planning purposes.

Given Calgary's geography and the access routes to the airport the possible future 20,000 transit trips per day would have a directional split in the range of about 75% accessing YYC to/from the south and west and 25% accessing YYC to/from the east. For the purposes of this discussion, this results in an approximate ridership of 5,000 transit trips per day from the NE LRT service area east of the airport. Considering the peak hour travel ratio of 8% this would result in a peak volume of about 400 passengers per hour approaching the airport by transit from the east.

The purpose of this discussion is to review bus and rail transit options to connect the NE LRT to the Airport by way of the Airport Trail tunnel, and evaluate the options in terms of a best "fit" in consideration of passenger carrying capacity, operational integration and the customer service experience, including examining impacts to non-YYC destined passengers.

# 1.1 Planning Considerations

The planning considerations of connecting transit to YYC from the NE LRT along Airport Trail are both physical and service related:

- The dimensions (dynamic envelope) of the Airport Trail tunnel allow sufficient space for LRT tracks, or other similar or smaller types of transit to travel through the tunnel. The tunnel cross-section allows for five lanes of traffic and a single LRT track.
- The distance from the NE LRT 88 Avenue station to the airport is approximately 4.5 km.
- Airport Trail will ultimately have grade-separated interchanges at 36 Street E and Barlow Trail that would need to be navigated by a transit connection.
- YYC is planning an expanded road network and people mover within the airport lands to ensure access to its terminals, parking and employment centres.
- A rail transit connection from YYC to NE LRT would require land for track right-of-way and the station footprint within both the YYC air terminal facility, Airport Trail and the 88 Avenue LRT station.

From a customer service perspective the following questions need to be considered:

- How many transfers will a customer experience?
- How long will the customer need to wait for a train or bus?
- What is the travel time for the customer?
- What is the ease of transferring between transit modes? Are stations "luggage-friendly?"
- How may service to the airport affect NE LRT customers not bound for YYC?

These constraints and questions help outline the planning considerations for the design of a transit connection between the NE LRT and the airport. Although the physical constraints limit the technologies or modes that can be used to create this connection, the customer service experience is also important.

# 2. TECHNOLOGY SCAN

There are a large number of transit technologies which could potentially be considered for service from NE LRT to the airport. The technologies range from multiple sizes of rubber tired buses, single rail cars (tram or streetcar), multiple car rail trains (LRT, Metro, and High Speed Rail), automated guideway (Skytrain, People Movers), cable drawn cars and urban gondolas.

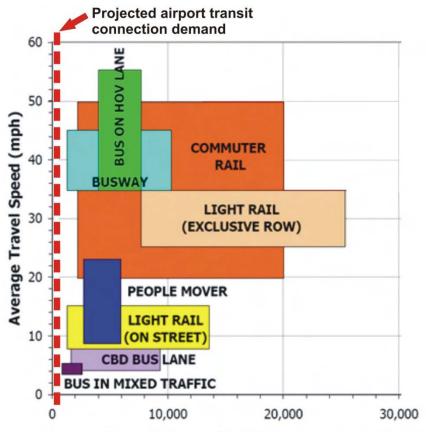
Some of the transit technologies would not be feasible for service to the airport due to capacity, speed, distance or right of way considerations. Minibuses are typically used for community transit routes or specialized service with low passenger demand. High speed rail has a high passenger capacity and can operate over long distances at high speed. Urban gondolas use small cars on elevated cable, and are well suited to bypass roadways or natural features. A people mover is a guideway technology that is intended for smaller groups of passengers travelling short distances with multiple origin and destination options. As such, these technologies are not well suited for this airport connection and will not be considered further.

Airports throughout Canada utilize a variety of transit connection options:

- TransLink has extended SkyTrain Service (automated guideway) to Vancouver International Airport (YVR) as a branch of the Canada Line.
- Montreal-Pierre Elliott Trudeau International Airport can be accessed with the
  AirConnect shuttle bus service provided by VIA Rail Canada. This minibus service
  transports passengers about 2 kilometres between the airport terminal and Dorval
  Station. Societé de Transport Montréal (STM) also runs an express bus between the
  airport and downtown that is in operation 24 hours a day, 7 days a week.
- Edmonton International Airport is accessible by the C-Line bus route. This route also travels to Nisku and Leduc.
- Toronto Pearson International Airport is currently serviced by buses from GO Transit, Brampton Transit, Mississauga Transit and Toronto Transit Commission (TTC). Internally, Pearson International Airport has a "people mover" system that travels between terminals and parking facilities within the airport complex.
- Calgary's airport is served by Routes 100, 300 and 430 providing access from downtown, the west and the east of the airport.

The typical speed and capacity of transit modes is shown in **Exhibit 2-1**. Based on consideration of the capacity required to carry the estimated ridership and the distance travelled, **Exhibit 2-1** indicates that bus and light rail options (streetcar or LRT) would be appropriate options to be considered.

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Person Capacity (peak direction passengers/hour)

Exhibit 2-1: Typical Speed and Capacity of Transit Modes

Source: TCRP Report 100 – Transit Capacity and Quality of Service Manual, 2nd Edition (2003)

The technology scan reviewed several proven transit technologies considering the particular criteria of each mode. These technologies were divided into bus based and rail based technologies. The following defining characteristics for each technology are summarized below:

- Vehicle type
- Passenger Capacity
- Infrastructure required

# 2.1 <u>Bus Technology Review</u>

Bus technology allows for flexibility in routing and level of service (capacity) for the airport transit connection.

# Vehicle Type

The 40 foot urban bus is considered a North American standard; however, urban transit buses range in size from 30 foot community shuttle buses to 60 foot articulated buses. The 40 and 60 foot low floor urban buses are available within the current Calgary Transit fleet and are considered appropriate for a service link to the airport.

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# **Vehicle Capacity**

The seated capacity of a 40 foot bus ranges from 40 to 50 plus an additional standee capacity of 50% of the seated capacity for a total capacity range of 60 to 75. Articulated buses have a seated capacity of 65 passengers plus an additional standee capacity of 35 passengers for a total capacity of 100 or less with luggage.

# Infrastructure and Operation

Buses would operate within the roadway shared with other traffic. Bus passenger loading areas (bus stops) would be required within the YYC air terminal facility and the 88 Avenue station area. Operating speed is governed by the roadway infrastructure speed limit and a bus service would achieve an average overall speed of approximately 30 km/h including time for stops.

# 2.2 <u>Rail Based Technology Review</u>

The height and cross-section provided for transit within the Airport Trail tunnel allows for rail transit using the LRT technology currently in use in Calgary or smaller. This is considered the "upper" limit of rail based technology that would be used to connect the NE LRT to the airport. However, there is a large variation in available rail transit. The following is a general discussion on rail transit technologies that fit into three categories: Light Rail Transit (currently operating in Calgary), Tram or Streetcar, and cable-drawn Automated Guideway.

# 2.2.1 Light Rail Transit

# Vehicle Type

Calgary Transit currently operates three Light Rail Vehicle types: U2, SD160 and SD160NG.

# **Vehicle Capacity**

Capacity is approximately 200 passengers per light rail vehicle. Trains may consist of one to four cars which could provide a capacity of 200 to 800 passengers per train.

#### Infrastructure

Current LRT technology has in service operating limits of a 6% vertical grade and a horizontal turning radius about 65 metres. Operation at the upper limits of these criteria requires an operating speed reduction. Average operating speed is assumed to be approximately 35 km/h including station stops.

# 2.2.2 Tram or Streetcar

There is no clear technology distinction between Light Rail Transit and a tram or streetcar. For the purposes of this discussion, a streetcar or tram is considered to be rail transit operating with one vehicle within a constrained or lower operating speed environment. LRT is a multi car train operating in an exclusive or higher speed environment.

# Vehicle Type

Trams or streetcars typically operate as single cars and range from historical type trams operating in Toronto and New Orleans to more modern low floor systems such as in Melbourne, Australia.

# **Vehicle Capacity**

Vehicle capacity varies between vehicle types, but would typically be approximately 50 to 180 passengers.

#### Infrastructure

As the type of technology varies greatly, so do the infrastructure requirements. However, trams may operate in a shared right-of-way with vehicle traffic. Maximum operating speeds are typically less than those of LRT. For example, the Toronto Transit Commission streetcar system has an average speed of 15 km/h. However, new build streetcar systems have average operating speeds of approximately 30 km/h.

# 2.2.3 Automated Guideway – Cable Drawn

Automated guideway transit is a rubber or steel wheeled, fully automated, driverless, grade-separated transit system which may be electrically powered or cable-drawn along a fixed guideway, and may operate with a single car or multi-car trains.

For evaluation purposes a cable-drawn automated guideway option as currently used within many airports is being considered.

This type of technology is often referred to as a "people mover" technology. It is used within Toronto Pearson International Airport to connect terminals and long term parking. Other airports that are currently using this technology include Birmingham International Airport, UK and Mexico City International Airport.

# Vehicle Type

The vehicles are typically rubber tired, but may be steel wheeled, and can be combined together to form trains. They are driverless and controlled from a central location. The cars are propelled by gripping a continuously drawn cable that is housed within the guideway.

# **Vehicle Capacity**

Vehicle capacity varies depending on the type of car selected; however, a system such as used at Toronto's Pearson International Airport has a capacity of 25 passengers (17 standing, 8 seated) per car and may be connected into trains of two cars.

#### Infrastructure

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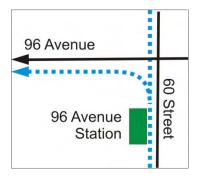
The automated guideway infrastructure is typically a grade-separated concrete guideway. The cable-drawn technology may be used for distances up to 9 kilometres depending on system characteristics which as the locations of stations and the horizontal and vertical guideway alignment. Although a cable-drawn automated guideway system may reach a maximum speed of 45 km/h an average system speed would be approximately 20 km/h. Considering the limitation of the distance and speed of this technology as well as the significant guideway infrastructure required, it is not ideally suited to the YYC to NE LRT airport connection application.

# 3. SERVICE ANALYSIS AND OPERATIONAL INTEGRATION

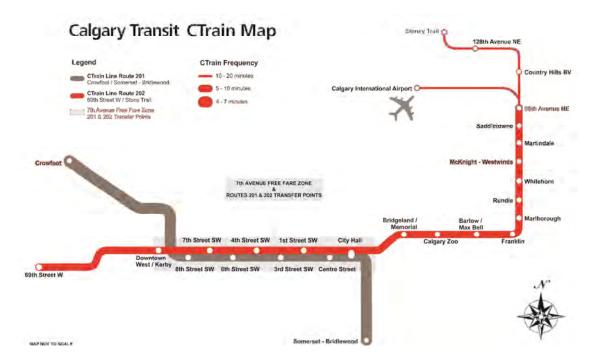
This section describes the configuration and passenger experience of the bus and rail transit technology options. At YYC, there are two service options. The bus or rail service may travel in the Airport Trail right-of-way and passengers transfer to the YYC "people mover" or the bus or rail service would access the YYC air terminal directly. The transit connection options can be divided into three groups:

# 1. LRT Spur Line

The LRT Spur Line is a branch of the NE LRT which would leave the mainline north of the 88 Avenue station and travel to YYC by way of a rail right-of-way in the median of Airport Trail. For this option, the spur line is from the south only (shown below). At YYC the LRT spur line may stay within the Airport Trail right-of-way with passengers transferring to the YYC "people mover" or the LRT spur line may be routed directly to the YYC air terminal facility.



Northbound LRT trains would either continue north on the mainline or follow the spur line to the west. This option would create a less frequent LRT operation for both the NE LRT mainline and the Airport Spur north of 88 Avenue Station relative to the NE LRT mainline south of 88 Avenue Station. For example, if there was a 5 minute service northbound on the mainline and every third train followed the Spur Line to YYC, then the Spur line would have service every 15 minutes whereas the mainline north of 96 Avenue would have two trains 5 minutes apart, then a gap of 10 minutes. This sequence would provide 4 trains per hour to YYC and 8 trains per hour north of 96 Avenue on the mainline. The service north of 96 Avenue would have an irregular schedule. This difference in service frequency is illustrated graphically below.



# 2. Separate Rail Link

A separate rail line from the vicinity of the 88 Avenue station (track not connected to the NE LRT mainline) and travelling to YYC in the median of Airport Trail. This separate rail based technology may be a tram/streetcar or LRT.

Service on the NE LRT mainline north and south of 88 Avenue station would not be affected by the operation of the Separate Rail Link. All passengers travelling to/from the NE LRT to YYC are required to transfer at 88 Avenue station. At YYC the Rail Link may stay within the Airport Trail right-of-way with passengers transferring to the YYC "people mover" or the Rail Link may be routed directly to the YYC air terminal facility.

#### 3. Bus Link

Bus route options connect the bus terminal at the 88 Avenue station or Saddletowne station with the YYC air terminal facility. Passenger transfers are required to/from NE LRT to the bus service.

#### Evaluation

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As previously discussed, the following planning considerations are used for evaluation:

- YYC infrastructure, such as a possible "people mover" to connect the airport terminals with remote parking and other developments.
- The approximate forecasted ridership for a transit connection to the northeast is approximately 5,000 trips per day. This results in an estimated ridership of about 400 peak hour/peak direction passengers.
- Transit passenger experience:
  - Number of transfers

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# THORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONE WITTRAL Study Airport Transit Link Service Options Overview

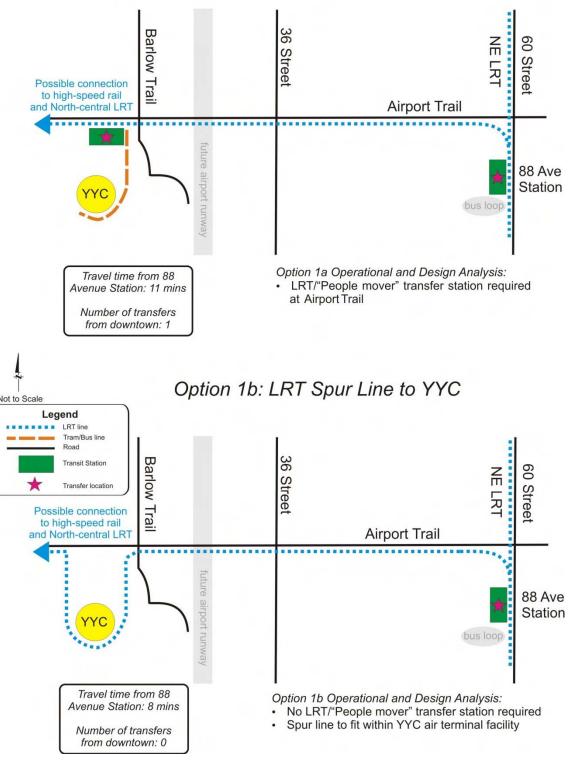
- Travel time
- Travel speed
- Impacts to other transit customers (ie: non-YYC bound)
- Availability of transit right-of-way, both along Airport Trail and at the Airport terminal

Each of the options are illustrated schematically and are shown in greater detail below.

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# **Option 1: LRT Spur Line**

# Option 1a: LRT Spur Line and "People Mover"



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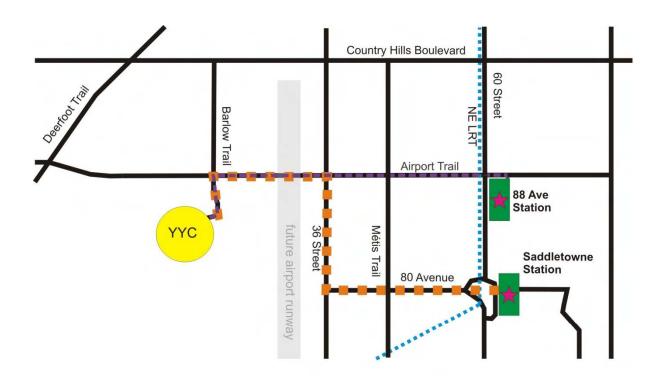
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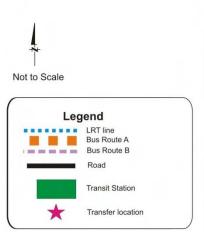
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# Option 2: Separate Rail Link

Option 2a: Separate Rail Link and "People Mover" Barlow Trail Z Street Possible connection to high-speed rail Airport Trail and North-central LRT 88 Ave Station Option 2a Operational and Design Analysis: Travel time from 88 Rail Link/"People mover" transfer station Avenue Station: 15 mins required at Airport Trail Number of transfers from downtown: 2 Option 2b: LRT Separate Rail Link to Legend Transit Station Barlow Transfer location Possible connection to high-speed rail and North-central LRT Airport Trail 88 Ave Station bus loop Travel time from 88 Avenue Station: 12 mins Option 2b Operational and Design Analysis: Rail Link line to fit within YYC air terminal facility Number of transfers from downtown: 1

# **Option 3: Bus Routes**





# Option 3a: Bus Route A

Travel time from 88 Avenue Station: 17 mins

Number of transfers from downtown: 1

Bus Route A Operational and Design Analysis:

- Transfer at Saddletowne Station
- Possible Stops along the route
- Bus stop within YYC air terminal facility

# Option 3b: Bus Route B

Travel time from 88 Avenue Station: 13 mins

Number of transfers from downtown: 1

Bus Route B Operational and Design Analysis:

- · Transfer at 88 Avenue Station
- Express service to YYC
- · No stops along 96 Avenue
- Bus stop within YYC air terminal facility

# 3.1 Cost Estimates

A high level relative cost comparison of the transit options is summarized in **Table 3-1**. As bus routes would operate within existing roadways, bus system costs would only include vehicles and bus stops. LRT or other rail based or guideway options would require land within the Airport Trail right-of-way, 88 Avenue station and the YYC terminal, and track, traction power and station costs.

Table 3-1: Transit Mode Options Relative Costs

Transit Connection Mode	Relative Cost Comparison
LRT	\$\$\$\$\$
Tram/Streetcar	\$\$\$\$
Bus Routes	\$

# 3.2 <u>Service and Operational Summary</u>

A summary of the passenger origin, destination, transfer points and travel time are summarized in **Appendix B**.

Because of the short travel distance between the NE LRT and YYC travel time does not vary significantly between options, however, the number of transfers between modes has a much greater effect on overall customer travel time.

The LRT Spur Line options would provide direct access to YYC from the NE LRT mainline with minimal transfers for passengers and a higher operating speed. A spur line would require LRT infrastructure to navigate the YYC road access network and would reduce the level of service for through passengers travelling north of 88 Avenue.

A Separate Rail Link would have fewer design constraints and could more easily navigate the YYC road access network; however, it would require all passengers to make a transfer at 88 Avenue station.

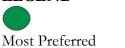
Bus options provide the most implementation and operational flexibility as they do not require additional right of way or infrastructure. Bus service options would have the required capacity; however, this option requires a transfer from the NE LRT. A bus stop could be provided within the YYC air terminal facility.

An evaluation matrix showing the relative characteristics and strengths of each bus and rail transit service option is presented in **Table 3-2**.

Table 3-2: Evaluation Matrix Summary of Options

Option	Number of Transfers	Travel Time	Non-YYC bound passenger impact	Land Requirements	Flexibility of Infrastructure	Cost
1a: Spur line and "people mover"						
1b: Spur line direct YYC access						
2a: Separate Rail link and "people mover"						
2b: Separate Rail link direct YYC access						
Bus Route A (80 Avenue)						
Bus Route B (Airport Trail)						

LEGEND





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# 4. **CONCLUSIONS**

The selection of transit technology options to connect the NE LRT to YYC is not driven by travel time or capacity. Given the short travel distance all service options provide reasonable travel times, and either bus or rail based service options would provide sufficient capacity. Even with an optimistic estimate of transit ridership to YYC from the east, the estimated 5,000 transit passengers per day could be accommodated on a bus or street car service. For example, either an articulated 60 foot bus or a single street car on a 10 minute frequency would more than meet the expected ridership demand.

Given the short distance (4.5 kilometres) from NE LRT to YYC and the relatively similar average travel speeds of the bus and rail options (30 to 35 KPH) there is not a significant difference in bus or rail in-service travel time.

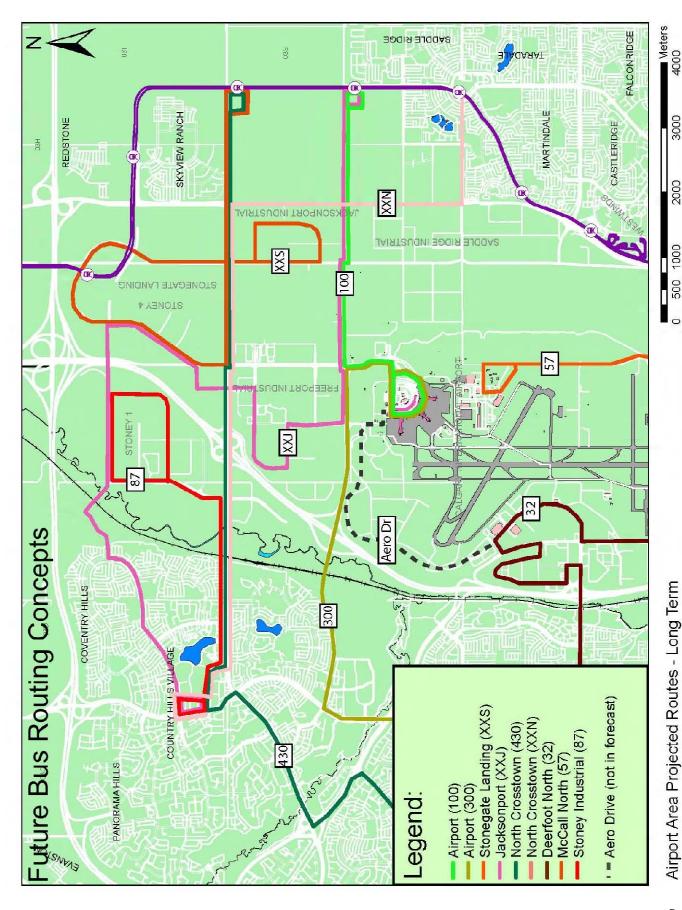
The number of passenger transfers between the Calgary Transit bus and rail network options and the YYC "people mover" and air terminal has a more significant influence on travel time and customer experience.

The bus options have the least land requirements, the most flexibility in infrastructure and lowest cost. The bus options also provide a comparable YYC-passenger bound experience to a separate rail link option.

The selection of a YYC transit service connection from the NE LRT service area must also consider the Calgary Airport Authority's plans for the YYC air terminal facility. These plans will influence the feasibility of either a passenger transfer facility within the Airport Trail right-of-way or direct access within the YYC air terminal facility.

In conclusion, the most reasonable transit access to YYC would be to initiate service with the bus mode and monitor growth in ridership. When or if ridership demand reaches the upper limit of bus capacity, consideration of initiating a rail mode could be considered. With the provision of space for transit in the Airport Trail tunnel and road right-of-way, future rail service options to YYC from the east are protected. The bus option is also significantly easier to integrate within the YYC air terminal.





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Table A documents the passenger origin, destination and transfer points for each transit service option.

Table A: Passenger Transfer Summary

Option	Passenger Origin	Passenger Destination	Transfer Points	Number of Transfers
1a: Spur Line	South of 96 Avenue	YYC	■ Transfer to "people mover" at YYC station	1
	North of 96 Avenue	YYC	<ul> <li>Transfer to airport bound train at 96 Avenue Station</li> <li>Transfer to "people mover" at YYC station</li> </ul>	2
and "People	YYC	Downtown	■ Transfer from YYC "people mover" to Downtown bound train	1
Mover"	YYC	North of 96 Avenue	<ul> <li>Transfer from YYC "people mover" to Downtown bound train</li> <li>Transfer at 96 Avenue station to Stoney Station bound train</li> </ul>	2
	South of 96 Avenue	YYC	■ None	0
1b: Spur	North of 96 Avenue	YYC	■ Transfer to airport bound train at 96 Avenue Station	1
Line to YYC	YYC	Downtown	■ None	0
110	YYC	North of 96 Avenue	■ Transfer to Stoney Station bound train at 96 Avenue	1
	South of 96 Avenue	YYC	<ul> <li>Transfer to airport bound rail based transit at 96 Avenue Station</li> <li>Transfer to "people mover" at YYC station</li> </ul>	2
2a: Separate Rail Link and "People Mover"	North of 96 Avenue	YYC	<ul> <li>Transfer to airport bound rail based transit at 96 Avenue Station</li> <li>Transfer to "people mover" at YYC station</li> </ul>	2
	YYC	Downtown	<ul> <li>Transfer to eastbound rail based transit from "people mover"</li> <li>Transfer to downtown bound LRT at 96 Avenue Station</li> </ul>	2
	YYC	North of 96 Avenue	<ul> <li>Transfer to eastbound rail based transit from "people mover"</li> <li>Transfer to northbound LRT at 96 Avenue Station</li> </ul>	2

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# Table A Continued:

Option	Passenger Origin	Passenger Destination	Transfer Points	Number of Transfers
2b: Separate	South of 96 Avenue	YYC	■ Transfer to airport bound rail based transit at 96 Avenue Station	1
	North of 96 Avenue	YYC	■ Transfer to airport bound rail based transit at 96 Avenue Station	1
Rail link to YYC	YYC	Downtown	■ Transfer to Downtown bound LRT at 96 Avenue Station	1
	YYC	North of 96 Avenue	■ Transfer to northbound LRT at 96 Avenue station	1
	South of Saddletowne Station	YYC	■ Transfer to Bus Route A at Saddletowne Station	1
Bus Route A – 80 Avenue	North of Saddletowne Station	YYC	■ Transfer to Bus Route A at Saddletowne Station	1
	YYC	Downtown	■ Transfer to Downtown bound LRT at Saddletowne Station	1
	YYC	North of Saddletowne Station	■ Transfer to northbound LRT at Saddletowne Station	1
	South of 96 Avenue	YYC	■ Transfer to Bus Route B at 96 Avenue Station	1
Bus Route B - 96 Avenue	North of 96 Avenue	YYC	■ Transfer to Bus Route B at 96 Avenue Station	1
	YYC	Downtown	■ Transfer to Downtown bound LRT at 96 Avenue Station	1
	YYC	North of 96 Avenue	■ Transfer to northbound LRT at 96 Avenue Station	1

Travel time for each of the options was evaluated using average speed and a transfer time of 3 minutes. The travel time summary considers 96 Avenue Station and YYC to be the starting and ending points for this analysis. However, additional travel time for the "people mover" was not included. This travel time analysis considered the following average speeds for each mode:

Bus: 30 km/hLRT: 35 km/h

■ Alernative Rail (Streetcar): 30 km/h

Table B: Travel Time

Option	Distance (km)	Transfer at 96 Avenue (+ 3 mins)	Transfer at YYC "people mover" (+3 mins)	Travel Time (minutes)
Bus Route A (80 Avenue)	7	Yes*	No	17
Bus Route B (96 Avenue)	5	Yes	No	13
1a: LRT Spur Line and "people mover"	4.5	No	Yes	11
1b: LRT Spur line to YYC	4.5	No	No	8
2a: Separate Rail link and "people mover"	4.5	Yes	Yes	15
2b: Separate Rail link to YYC	4.5	Yes	No	12

<sup>\*</sup>Bus Route A requires a transfer at Saddletowne Station

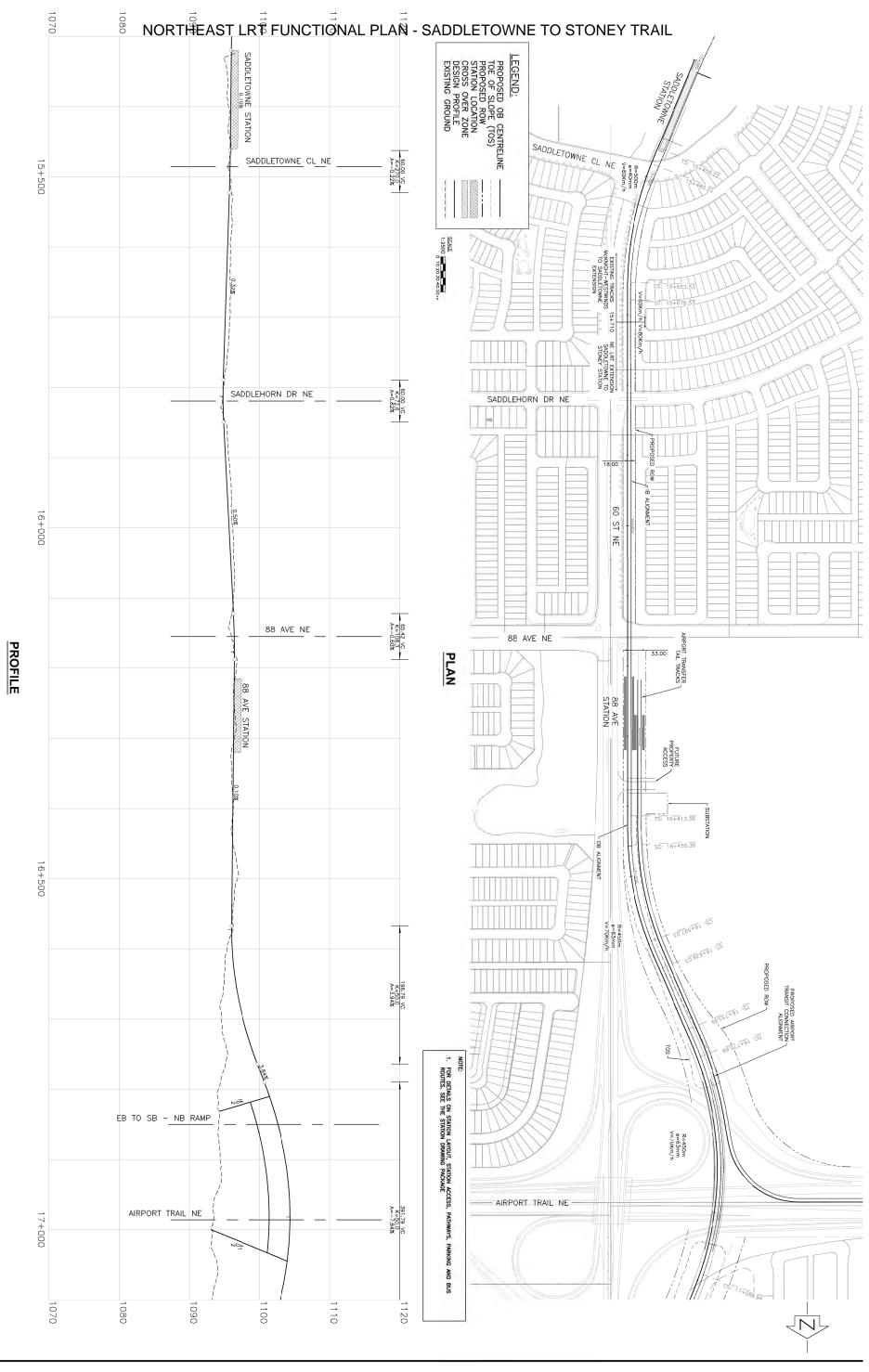
# **HDR**

4838 Richard Road SW, Suite 140
Westmount Corporate Campus
Calgary, Alberta T3E 6L1
Tel: (403) 537-0250
Fax: (403) 537-0251
www.hdrinc.com



### Appendix B

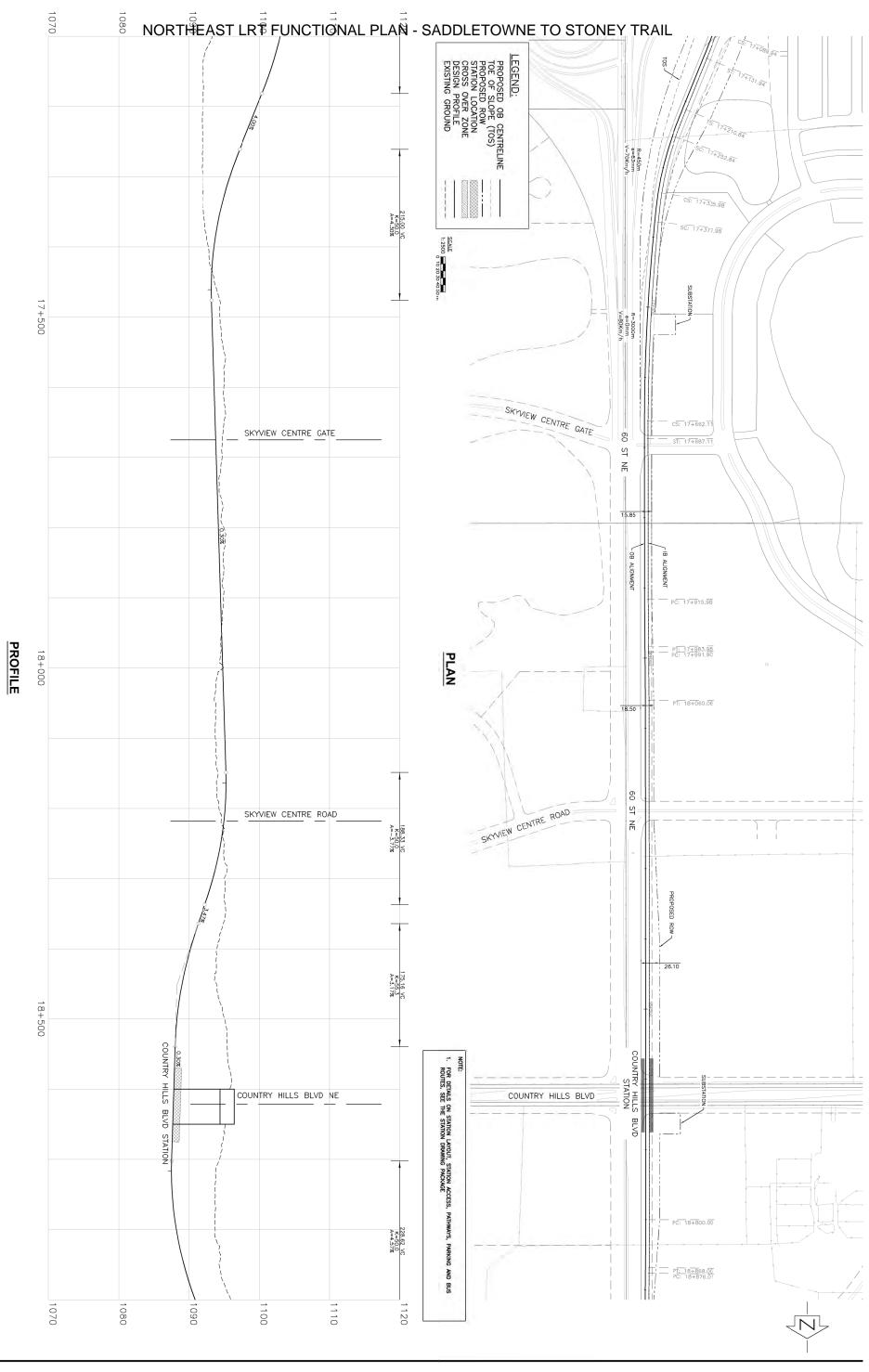




NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY **SEPTEMBER 15, 2012 STATION 15+320 TO STATION 17+100** HORIZONTAL SCALE 1:2500, VERTICAL SCALE 1:250





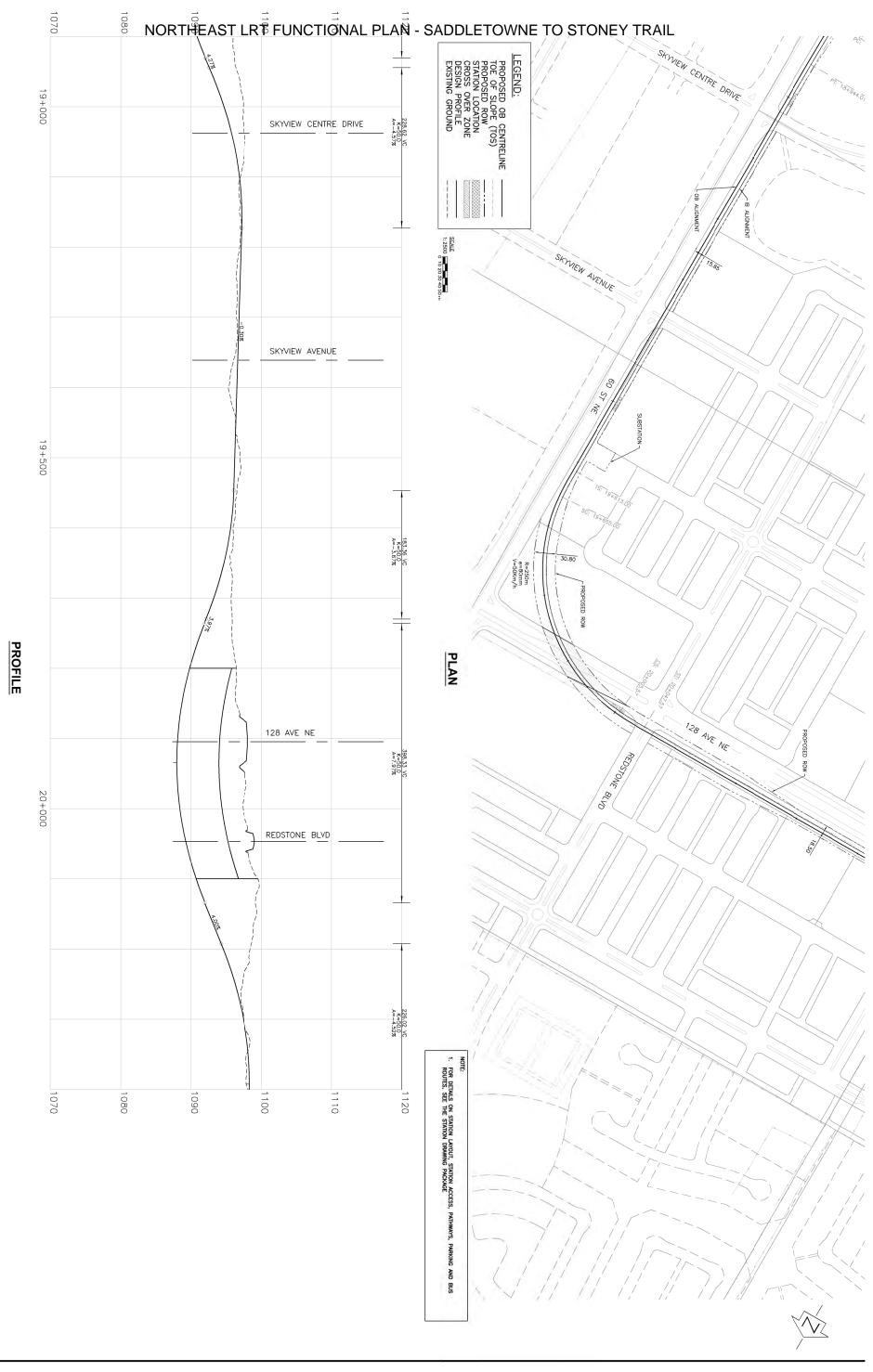


NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY SEPTEMBER 15, 2012 **STATION 17+100 TO STATION 18+900** HORIZONTAL SCALE 1:2500, VERTICAL SCALE 1:250 SHEET2 OF 5
TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail

ISC Coding: Unrestricted



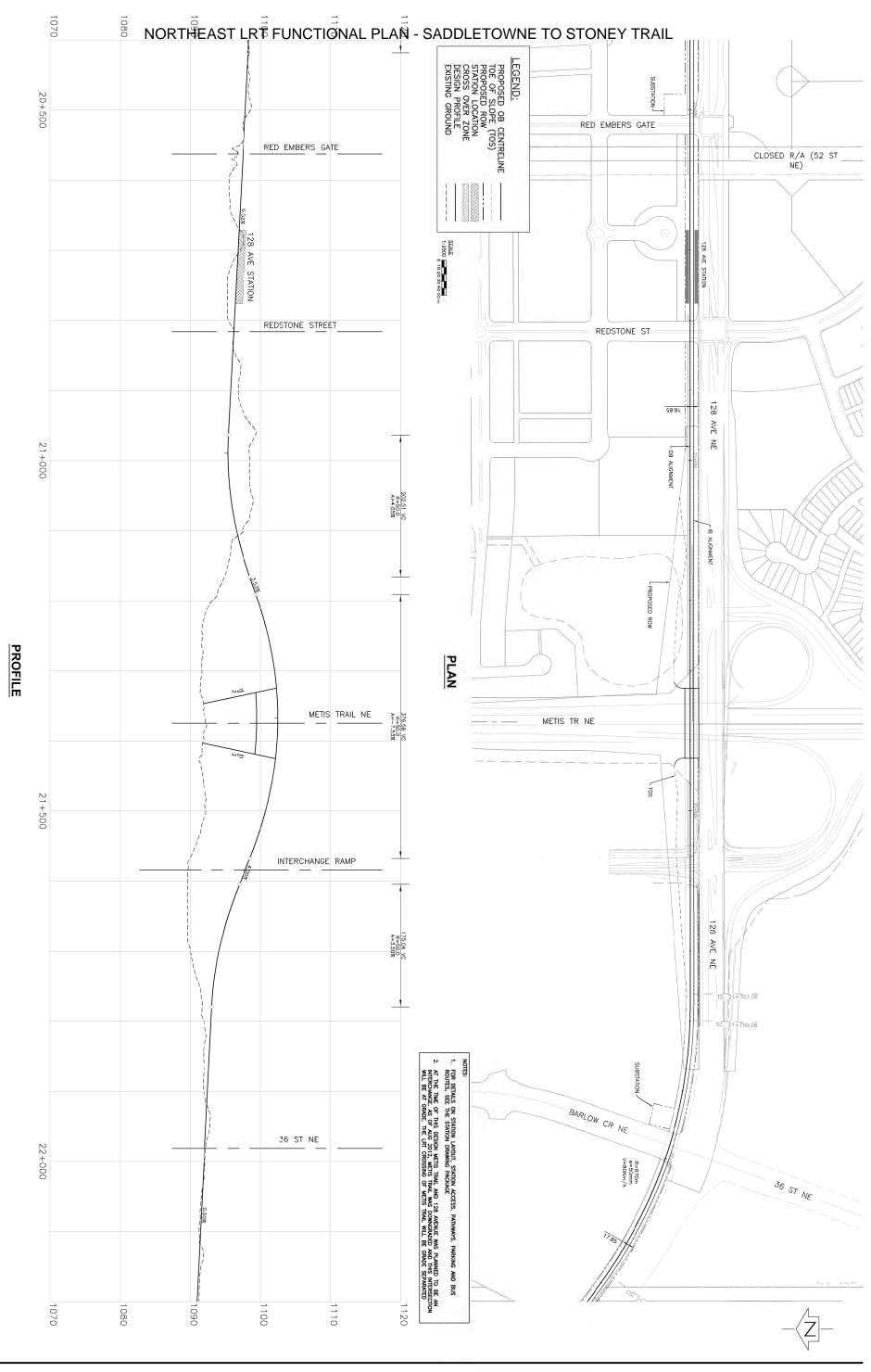




NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY SEPTEMBER 15, 2012 **STATION 18+900 TO STATION 20+400** HORIZONTAL SCALE 1:2500, VERTICAL SCALE 1:250





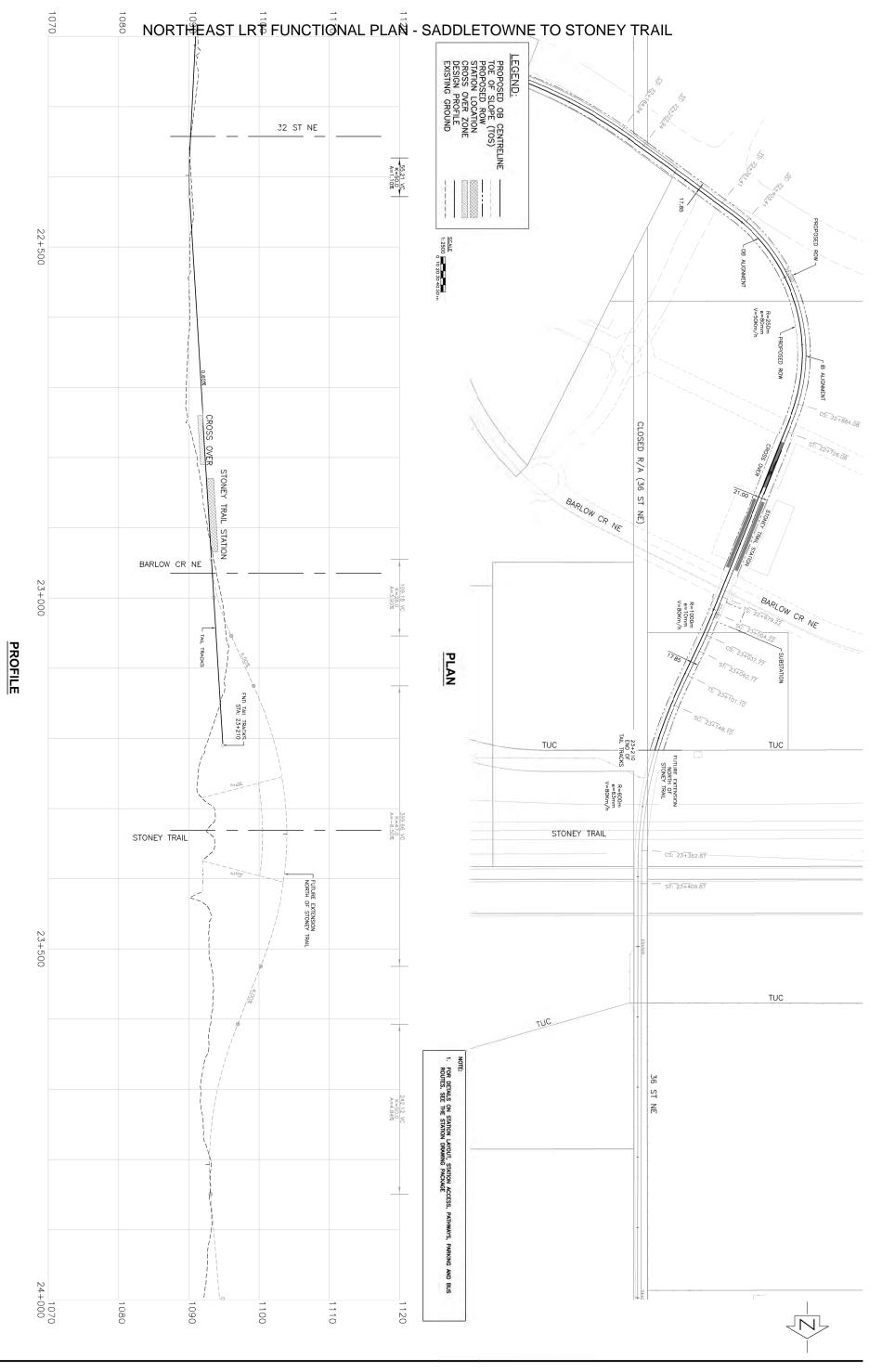


NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY SEPTEMBER 15, 2012 **STATION 20+400 TO STATION 22+200** HORIZONTAL SCALE 1:2500, VERTICAL SCALE 1:250 SHEET 4 OF 5
TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail

ISC Coding: Unrestricted







NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY **SEPTEMBER 15, 2012 STATION 22+200 TO STATION 24+000** HORIZONTAL SCALE 1:2500, VERTICAL SCALE 1:250 SHEET 5 OF 5
TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail

ISC Coding: Unrestricted

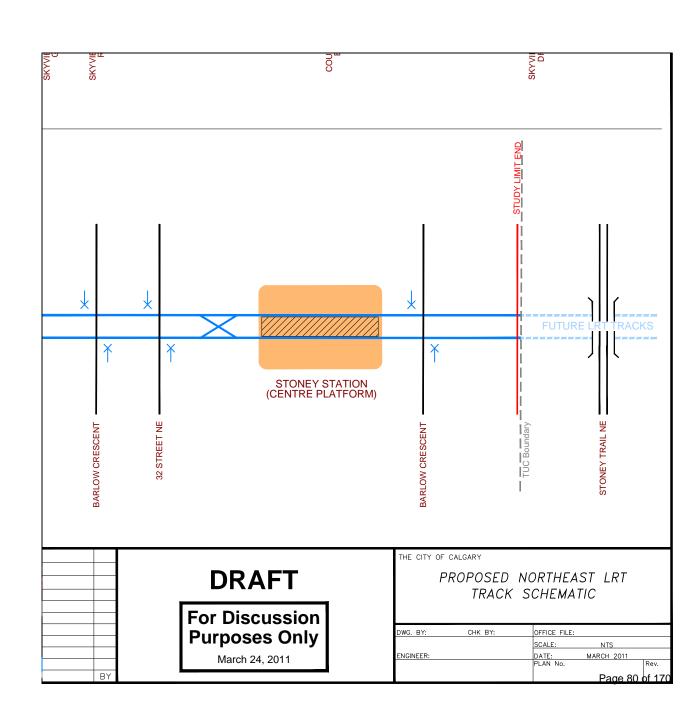






### Appendix C





0.68 m/s^2 Acceleration (average) Deceleration (average) 0.71 m/s^2 80 kph 1.12 m/s^2 70 kph 0.98 m/s^2 60 kph 0.84 m/s^2 0.70 m/s^2 50 kph 0.56 m/s^2 40 kph 0.42 m/s^2 30 kph 0.28 m/s^2 20 kph 10 kph 0.14 m/s^2 **Dwell Time** 90 s 300 s Turnaround time 20 km/h Crossover max operating speed

from table 2.1 - Vehicle Performance Characteristics calculated from exhibit 3.2/b

No. 8 -S41/10 tangential or No. 8 - 100 lb RE tangential

						Distance	
						(between	
						alignment	
Segment Number	Segment Elements	Distance (m)	Time (s)	Speed (m/s)	Speed (km/h)	elements)	Chainage
1	Deceleration	0.0	0.0	0.0		238.53	
Saddle Towne Station	Steady/stop	0.0	0.0	0.0	0.0		15440
	Acceleration	204.2	24.5	0.0			
2				0.0			
Curve max speed 60kph	Steady/stop	34.3	2.1	16.7	60		15678.53
	Acceleration	158.9	8.2	0.0			
3						641.47	
tangent		262.6	11.8	22.2	80.0		
4	Deceleration	220.0	19.8	0.0			
96 Avenue Station	Steady/stop	0.0	90.0		0.0		16320
	Acceleration	278.0	28.6				
5				0.0		1057.98	
Tangent	Steady/stop	0.0	0.0	0.0			
				0.0			
6				0.0			
Curve max speed 70 kph	Steady/stop	780.0	40.1	19.4	70.0		17377.98
	Acceleration	85.1	4.1	0.0			
7						1297.02	
tangent		991.9	44.6	22.2	80.0		
8	Deceleration	220.0	19.8				
Country Hills Station	Steady/stop	0.0	90.0		0.0		18675
	Acceleration	363.1	32.7	0.0			
9				0.0		938	
Tangent	Steady/stop	440.8	19.8		80.0		19613
				0.0			
10	Deceleration	134.1	7.4			434.57	
Curve max speed 50 kph	Steady/stop	434.6	31.3	13.9	50.0		20047.57
	Acceleration	221.3	12.3	0.0			
11	- 1			0.0		729.16	
Tangent	Steady/stop	287.9	13.0		80.0		<u> </u>
12	B 1 ::	225 -		0.0			
12	Deceleration	220.0	19.8			4	20776 70
128 Avenue Station	Steady/stop	0.0	90.0		0.0		20776.73
12	Acceleration	363.1	32.7	0.0		4504.60	
13	Charal data	1007.5	40.0	0.0	60.0	1584.68	22264 44
Tangent	Steady/stop	1087.5	48.9		80.0	1	22361.41
1.4	Deceleration	4244	7.4	0.0		366.05	1
Curve may speed E0 kph	Deceleration Stoody/stop	134.1	7.4		F0.0	366.05	22727.40
Curve max speed 50 kph	Steady/stop	303.1	21.8	13.9	50.0	J	22727.46

		TO THE TEN DIR	AFT O' (D			01121 110	
15	0. 1./.		2.0	0.0		52.54	
Tangent	Steady/stop	0.0	0.0	0.0	0.0		
10	Deceleration	115.5	11.0	0.0		30	
16 Crossover	Deceleration Steady/stop	115.5 30.0	11.9 5.4	0.0 5.6	20.0	30	22780
Crossover	Acceleration	0.0	0.0	0.0	20.0		22/80
17	Acceleration	0.0	0.0	0.0		127.18	
tangent	Steady/stop	72.2	13.0	5.6	20.0	127.10	22810
tangent	Steady/stop	72.2	13.0	0.0	20.0		22010
18	Deceleration	55.0	19.8	0.0		2290	
Stoney Station (Terminal Station)	Turnaround time	0.0	300.0	0.0	0.0	2230	22937.18
Storie y Station (Terminal Station)	Acceleration	141.8	20.4	0.0	0.0		22832.18
19	Acceleration	111.0	20.1	0.0		141.84	22032.10
tangent	Steady/stop	0.0	0.0	13.9	50.0	1.1.0.	22690.34
	- Committee of the comm			0.0			
20						328.93	
Curve max speed 50 kph	Steady/stop	328.9	23.7	13.9	50.0		22361.41
·	Acceleration	221.3	12.3	0.0			
21						1689.68	
tangent	Steady/stop	1248.4	56.2	22.2	80.0		
	,, ,			0.0			
22	Deceleration	220.0	19.8	0.0			
128 Avenue Station	Steady/stop	0.0	90.0	0.0	0.0		20671.73
	Acceleration	363.1	32.7	0.0			
23				0.0		624.16	
Tangent	Steady/stop	127.0	5.7	22.2	80.0		20047.57
				0.0			
24	Deceleration	134.1	7.4	0.0		434.57	
Curve max speed 50 kph	Steady/stop	434.6	31.3	13.9	50.0		19613
	Acceleration	221.3	12.3	0.0			
25				0.0		1043	
Tangent	Steady/stop	601.7	27.1	22.2	80.0		
				0.0			
26	Deceleration	220.0	19.8	0.0			
Country Hills Station	Steady/stop	0.0	90.0	0.0	0.0		18570
	Acceleration	363.1	32.7	0.0			
27				0.0		1192.02	
Tangent	Steady/stop	777.3	35.0	22.2	80.0		17377.98
				0.0			
28	Deceleration	51.6	2.5	0.0		972.98	
Curve max speed 70 kph	Steady/stop	973.0	50.0	19.4	70.0		16405
	Acceleration	0.0	0.0	0.0			
29				0.0		190	
Tangent	Steady/stop	-2.5	-0.1	19.4	70.0		
				0.0			
28	Deceleration	192.5	19.8	0.0			40045
96 Avenue Station	Steady/stop	0.0	90.0	0.0	0.0		16215
20	Acceleration	363.1	32.7	0.0		F2C 47	
29	Stoady/ston	77.4	2 -	0.0	90.0	536.47	15670 52
Tangent	Steady/stop	77.1	3.5	22.2	80.0		15678.53
20	Deceleration	96.3	5.0	0.0		343.53	
30 Curve max speed 60 kph		178.5	10.7	0.0 16.7	60.0	343.53	
си че шах зреей во крп	Steady/stop	1/6.5	10.7	10.7	00.0		
29	Deceleration	165.0	19.8	0.0			
Saddle Towne Station	Steady/stop	0.0	0.0	0.0	0.0		15335
Saddle Towne Station	Jieday/ Stop	0.0	0.0	0.0	0.0		1000
TOTAL		14994 4	1820.8				

TOTAL 14994.4 1820.8
Runtime 30.3 minutes

Manually entered value



### Appendix D







Calgary Transit

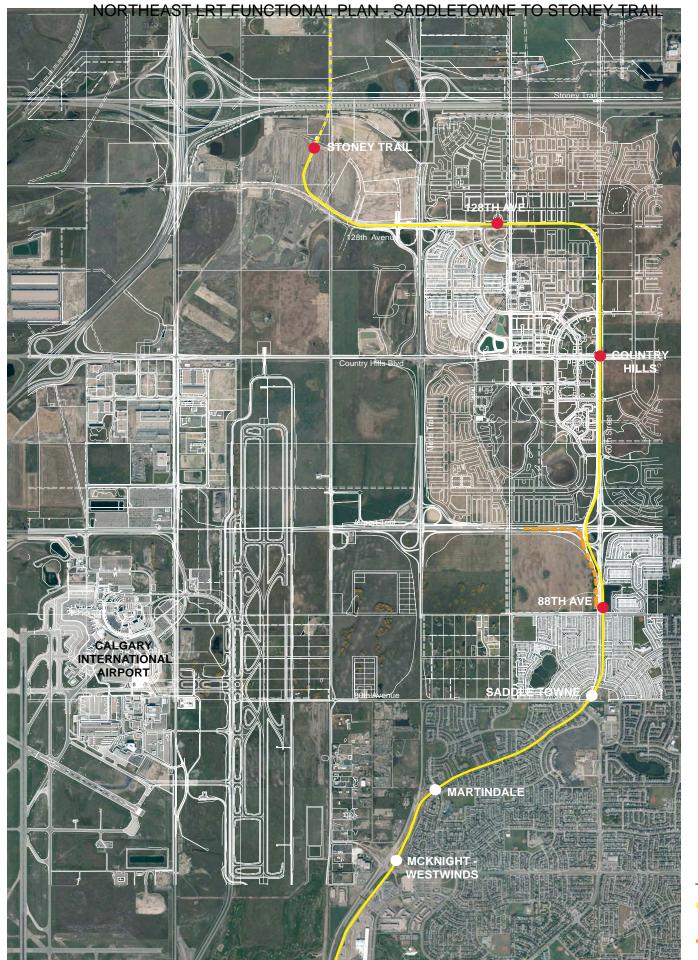
AREA CONTEXT MAP NE LRT EXPANSION MAP

- 1.1 88TH AVENUE CONTEXT MAP 88TH AVENUE STATION MAP
- 2.1 COUNTRY HILLS BLVD CONTEXT MAP
- COUNTRY HILLS BLVD STATION MAP
- 3.1 128TH AVENUE CONTEXT MAP
- 3.2 128TH AVENUE STATION MAP
- 128TH AVENUE STATION R.O.W. SECTION
- STONEY TRAIL CONTEXT MAP 4.1
- STONEY TRAIL STATION MAP
- 5.1 **BICYCLE PARKING STANDARDS**

**FUNCTIONAL** R

ISSUE 03 DATE SEPT. 2012

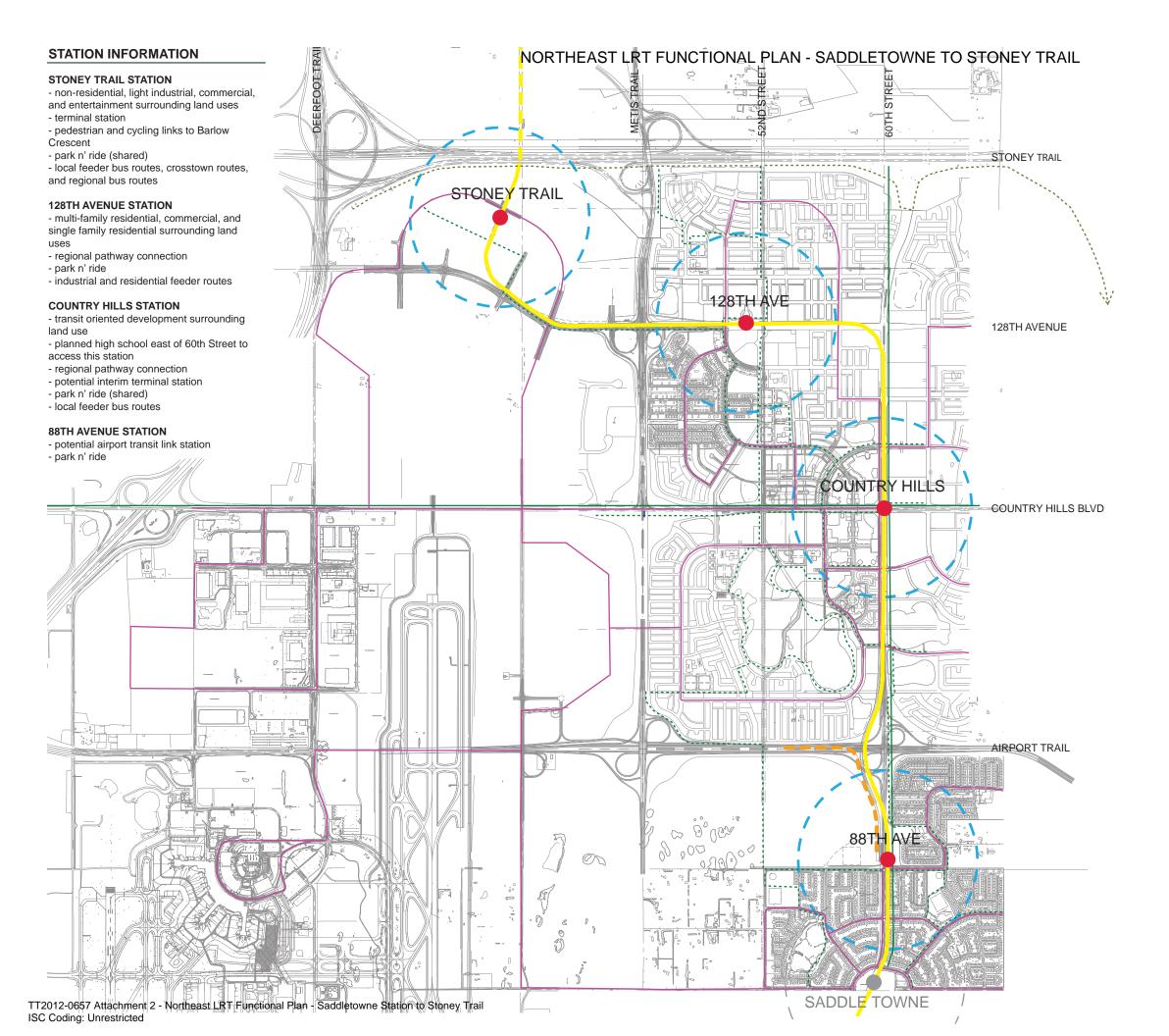




**LEGEND** 

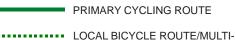
LRT LINE LRT STATION POSSIBLE AIRPORT TRANSIT CONNECTION





### **LEGEND**

600m RADIUS



USE PATHWAY







POSSIBLE AIRPORT TRANSIT CONNECTION

### **PARK AND RIDE**

88TH AVENUE STATION

- 500 park and ride (shared)

**COUNTRY HILLS STATION** 

- 200 park and ride (shared)

128TH AVENUE STATION

- 200 park and ride (shared)

STONEY TRAIL STATION

- 100 park and ride (shared)

### **ULTIMATE REQUIRED BICYCLE** PARKING

Class 1 - 5% of projected AM peak ridership (secure)

Class 2 - 1.5% of projected AM peak ridership

88TH AVENUE STATION

- Class 1, 26 STALLS

- Class 2, 20 STALLS

COUNTRY HILLS STATION

- Class 1, 166 STALLS

- Class 2, 50 STALLS

128TH AVENUE STATION

- Class 1, 90 STALLS

- Class 2, 30 STALLS

STONEY TRAIL STATION

- Class 1, 16 STALLS - Class 2, 20 STALL



### MAP SION Z

T FUNCTIONAL

TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail

ISC Coding: Unrestricted





8th AVENUE CONTEXT I

00

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### STATION MAP VENUE 88th

NE LRT FUNCTIONAL STUDY ISSUE 03 DATE SEPT. 2012 SCALE 1:1500





# ONTEX





NE LRT FUNCTIONAL STUDY ISSUE 03 DATE SEPT. 2012 SCALE 1:1500

on right—of—way, horizontal and vertical le Functional Plan Profile Drawing Package





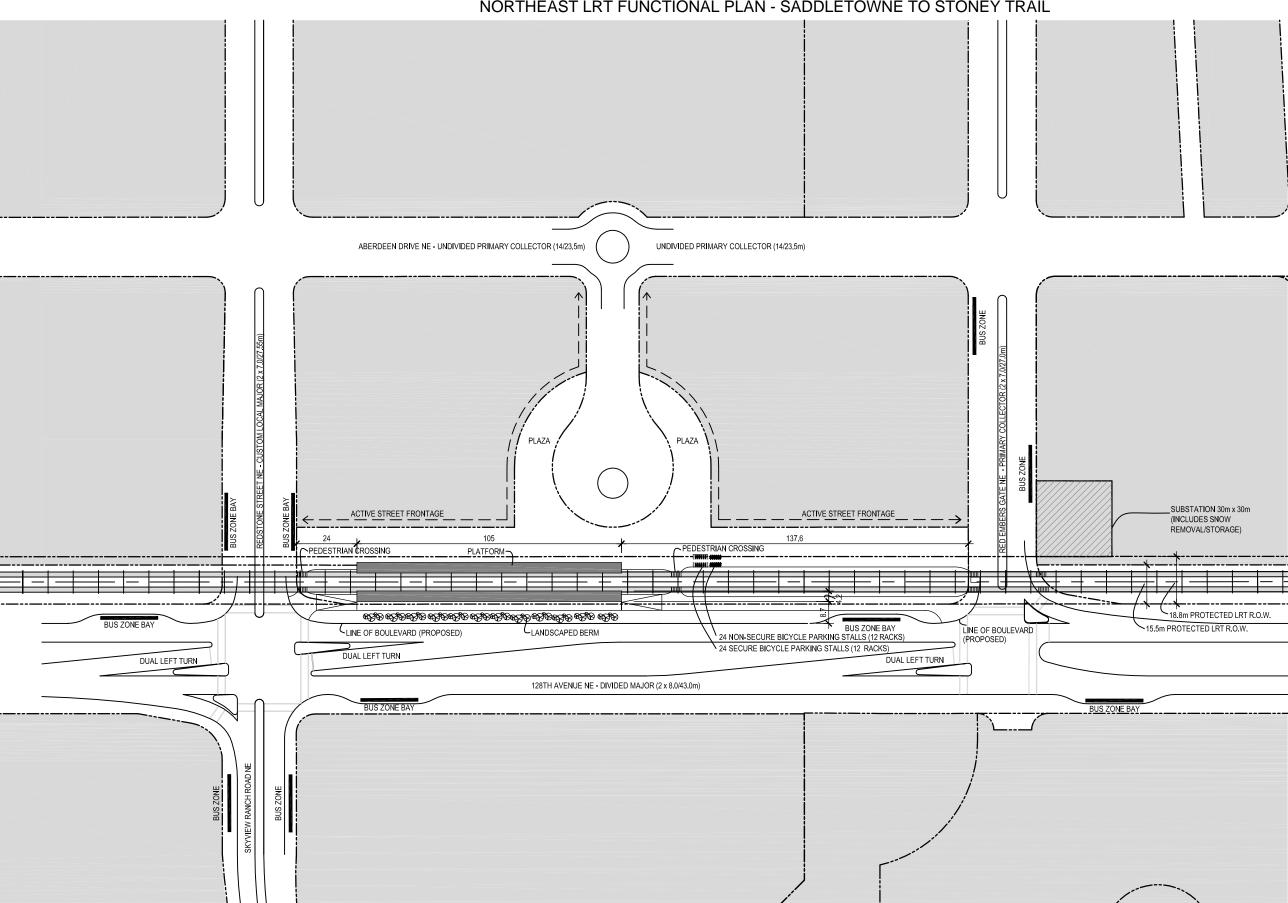
# h AVENUE CONTEXT MAI

LRT FUNCTIONAL STUDY UE 03 TE SEPT, 2012

**28th** 







7160

TRACK R.O.W.

15500

PLAZA R.O.W. 30500 7600 STANDARD BOULEVARD

P.L.





### HAR Calg



**AVENUE** 

**28th** 

LRT FUNCTIONAL STUDY SUE 03

### NOTE:

- platform and two-way multi-use pathway to have different surface







ONEY TRAIL CONTEXT MA





### STATION MAP TRAIL

NE LRT FUNCTIONAL STUDY ISSUE 03
DATE SEPT. 2012
SCALE 1:1500
Note: For details on right-of-way, halignment, see the Functional Plan P

on right—of—way, horizontal and vertical le Functional Plan Profile Drawing Package

1220 MIN.

4876

-1.4 SQ.M./2 STALLS

1828 MIN.

610 MIN.

762 MIN.

610 MIN.

5792





# G STANDARDS FTR

PARKING STANDARDS BICYCLE

- from 'Bicycle Parking Guidelines'

www.apbp.org

28.2 SQ.M. - 24 STALLS

NE LRT FUNCTIONAL STUDY ISSUE 03 DATE SEPT, 2012

TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail ISC Coding: Unrestricted

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### Appendix E





### Northeast LRT Functional Plan Country Hills Station - Schematic Design











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1.2	Purpose	2
2.	CONTEXT	2
2.1	Regional and Local Setting	2
3.	SCHEMATIC DESIGN	5
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3.5	Corner Plazas	
3.6	Other Considerations	15
	3.6.1 TREATMENT ALONG WEST BOUNDARY OF LRT RIGHT OF WAY	15
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APPENDIX A - Northeast Functional Study - Station Location Alternatives

APPENDIX B - Station Relocation Options

APPENDIX C - Station Area Plan





### INTRODUCTION

### Background

### 1.1.1 AREA STRUCTURE PLAN, OUTLINE PLAN AND LAND USE REDESIGNATION

In July of 2009, City of Calgary Council approved the Northeast Community A Area Structure Plan (ASP), Part II Country Hills Station Area Plan, along with an Outline Plan and Land Use Redesignation for this area. The Country Hills Station Area (the Station) is envisioned as the heart of the Community A residential growth area which is an extensive area that will accommodate over 70,000 people in five communities. This development will include an adjacent employment corridor to the west. The Station area comprises some 100 hectares of land which is located on each side of both 60th Street and the Light Rail Transit line. It extends outward from the LRT station in a 600m radius (7.5 minute walking distance) in all directions.

### 1.1.2 NORTHEAST FUNCTIONAL PLANNING STUDY

The original station location in the ASP was not viable due to vertical alignment constraints associated with the need for the LRT line to have a grade-separated crossing of Country Hills Boulevard. As part of the Northeast Functional Planning Study, four possible station locations and track profile options were examined for the Country Hills Boulevard Station. Based on this review, Option 4 (LRT grade separated under Country Hills Blvd. with Station under intersection) was recommended. This recommendation was based on its achievement of LRT feasibility, other transportation objectives, station accessibility to all four quadrants of the intersection, accessibility to the future high school east of 60 street, and ability to still meet the objectives of the outline plan. A more detailed explanation is provided in Appendix A.

Given the importance of the Country Hills Station to the adjacent development, the City of Calgary authorized the IBI Group along with the Northeast LRT Functional Design Team (HDR and Sturgess Architecture) to undertake preliminary schematic design so as to ensure compatibility between the proposed station and surrounding mixed use development. and realization of the mutual objectives of the Functional Plan, Area Structure Plan and the approved Outline Plan.

### 1.2 Purpose

The primary purpose of the schematic design is to add detail around Country Hills Boulevard station and achieve the intention of the area plans as well as assisting with future construction of the LRT and area development.

This will better define the footprint of the LRT R.O.W., and allow development to be planned and designed to match the LRT R.O.W. This coordinates land uses and minimizes costs for both the City and developer.

Specifically, the schematic design was focused on determining the following:

- Spatial requirements of the various components (construction, trench, platform and station location, etc);
- Location and treatment of access/egress points;
- Bus routing and stop locations and treatment;
- Schematics of pedestrian realm along west side of LRT right of way;
- Schematic design of corner plazas with options for station access points within or outside proposed building; and
- Location and specifications of building foundations/retaining walls required for LRT trench.

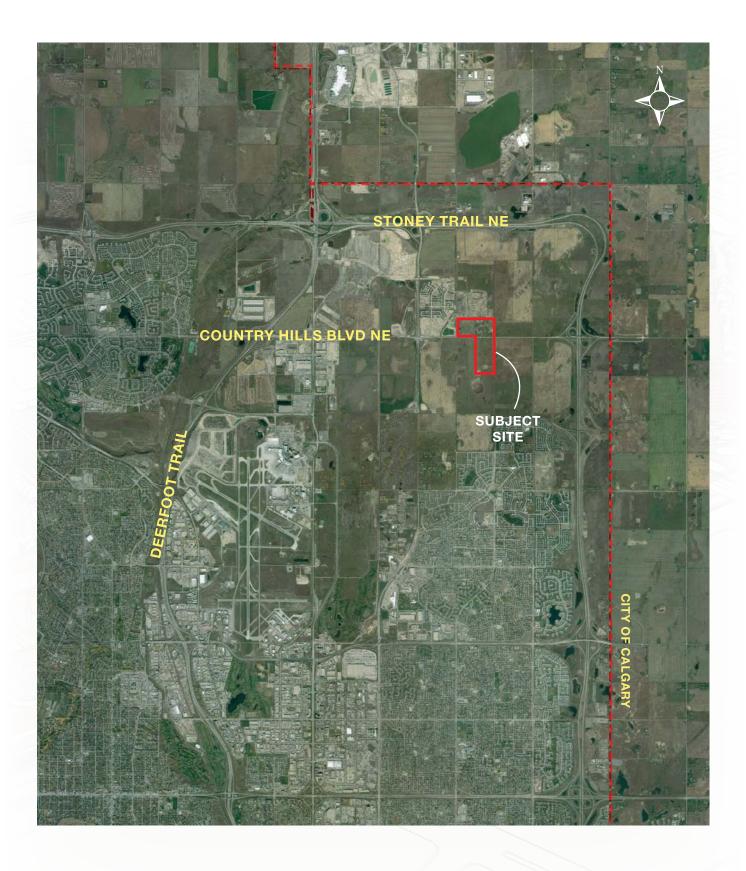
### CONTEXT

### Regional and Local Setting

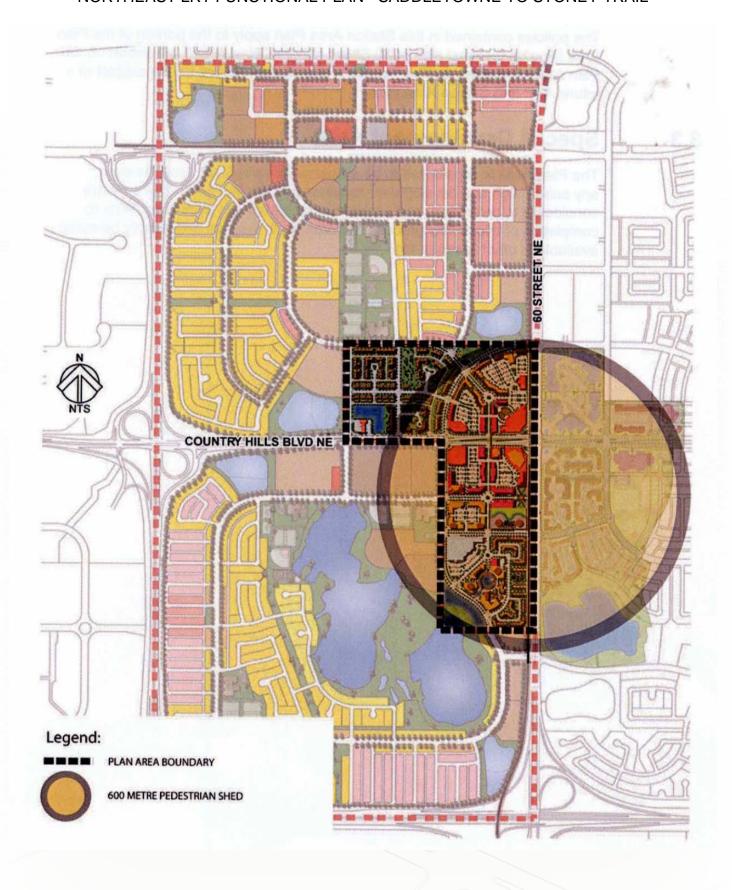
Exhibits 2.1 depicts the site in a local context, while Exhibit 2.2 illustrates the Country Hills Station Area ARP boundary.



TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail ISC Coding: Unrestricted



**EXHIBIT 2.1 - LOCAL CONTEXT MAP** 



**EXHIBIT 2.2 - COUNTRY HILLS STATION AREA ARP BOUNDARY** 

### **SCHEMATIC** 3. **DESIGN**

### Plan Options 3.1

Based on the proposed location of the Station at the intersection of Country Hills Boulevard and 60th Street NE, eleven (11) alternative plan options were developed and are contained in Appendix B. After careful review and analysis, Option 10 (Exhibit 3.1) was selected as the preferred alternative. It features a 1,672m<sup>2</sup> (18,000 ft<sup>2</sup>) library building situated on 2 acres of land fronting onto the original public plaza at the east end of the proposed High street. The proposed library is an excellent alternative use in this location for many reasons:

- It is an activity generator with extended hours of operation, adding life and vitality to this retail district and helping expand the 24/7 attributes;
- 2. The use is complementary to the adjacent urban square, where there is opportunity for joint programming and casual use;
- 3. The site at the terminus of "High street" provides the perfect opportunity for a building that will add character to the town centre;
- 4. There is an opportunity for shared parking with the adjacent park and ride lot; and
- 5. The convenience factor associated with its location adjacent to the LRT station will help promote usage.

The provision of libraries adjacent to LRT station areas has policy support through various policy documents. The Northeast Community 'A' Area Structure Plan indicates that "the Library shall be located within the Core Centre". The purpose of the Core Centre is clarified as being "anchored by an LRT station" (Northeast Community 'A' ASP, p. 34, 45). The Transit Orientated Development Policy Guidelines contains a section on transit supportive land uses:

### 4.1 TOD Guidelines - Transit-supportive land uses

Uses that provide support services to primary transit-supportive uses and transit riders

and/or off-peak ridership include, but are not limited to:

- · Entertainment, recreational and cultural facilities
  - Library

(Transit Orientated Development Policy Guidelines pg.12)

In addition, specific policy areas also describe libraries as being either a transit supportive use or recommend the library to be located directly in a station area. Examples include:

- Banff Trail Station ARP
- Brentwood Station ARP
- Chinook Station Area Plan
- Fish Creek / Lacombe Station Area Community planning and Design Workshop Summary
- Westbrook Village ARP

It follows that the station planning in the NE ASP can fruitfully adopt the same model in the adjacent location of LRT and library services.

This concept (Exhibit 3.1) also features a reduced park and ride facility from the initial outline plan. Transit has indicated a desire for 200 stalls which have been situated immediately to the south of the library building and public square. It is envisioned that sometime in the future, this could become a parkade with the possibility of some active uses along the northern façade of the structure and the use of air rights for possible employment or residential uses.

### 3.2 Right of Way Requirements

Exhibit 3.2 illustrates the location and dimensions of the right of way required to accommodate the proposed Country Hills Station and associated LRT track. At its widest point where it underlies the Country Hill Blvd. and 60th Street intersection, it measures 26m, tapering to approximately 16m plus an area along the west for the required sidewalk and planting. The taper is situated some 100m from the station ends both north and south (see Exhibits 3.5 and 3.6).



### 3.3 Station Layout/Access

Exhibits 3.3 and 3.4 illustrate the station plan both above and below grade with Exhibits 3.5 and 3.6 detailing the Station area cross sections. The proposed station is side-loading with access points at both the north and south ends of the platforms. The station buildings are equipped with escalators, elevators and stairs to reach the below grade platforms. Sufficient R.O.W. has been provided to allow either side-loading or centre-loading, but side-loading is proposed due to the operational benefits. If it is decided to construct the NE LRT line in stages, and Country Hills Boulevard is an interim terminal station, a centre loading configuration is available for consideration.

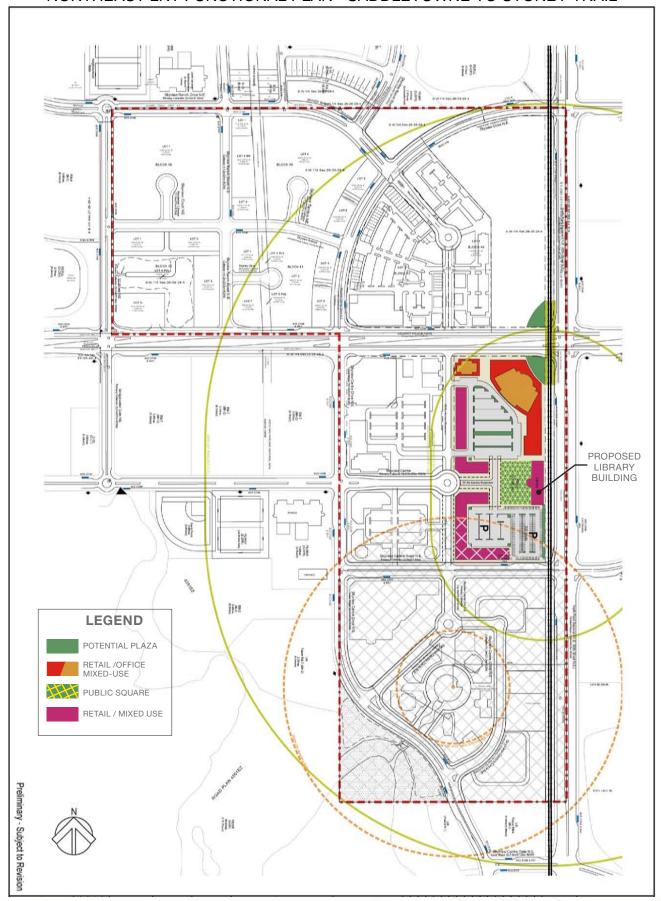
At grade, pedestrian access is achieved from both 60th Street and Country Hills Blvd. As well, the trench is bridged to facilitate access to and from the bus bays located immediately to the south of the Station. Access from the commercial, retail and residential uses to the west will be facilitated through a series of building breaks and/or public access routes through the buildings themselves. The latter is to be determined at the detailed design stage. The pedestrian accesses will be consistent with the direction in the Northeast Community 'A' ASP.

Two options were developed with respect to the location of the required sub-station. The preferred location is situated south of the station within the proposed park and ride facility, located adjacent to the proposed library and public plaza.

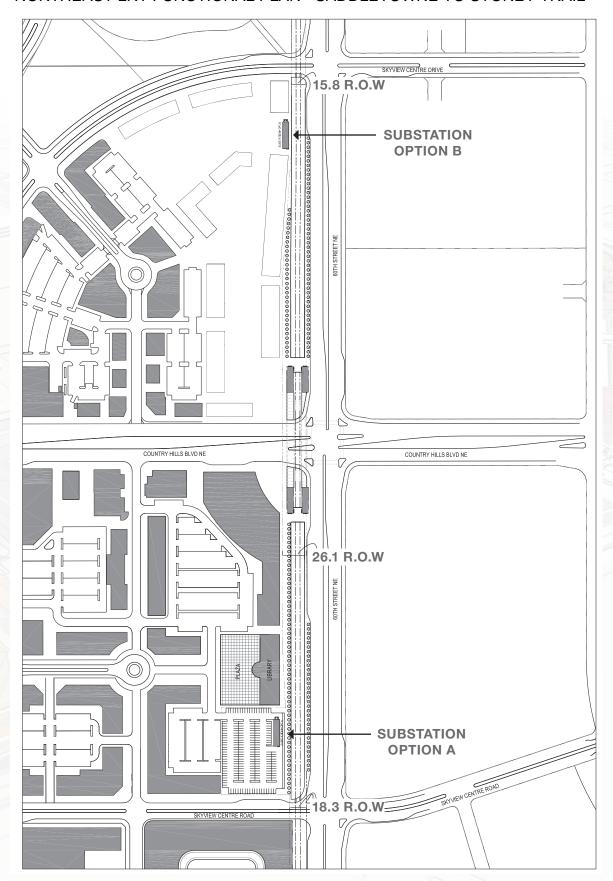
### 3.4 Bus Routing/Pick-up and Drop-off

Exhibit 3.7 illustrates the proposed bus network servicing the Country Hills Blvd. Station.

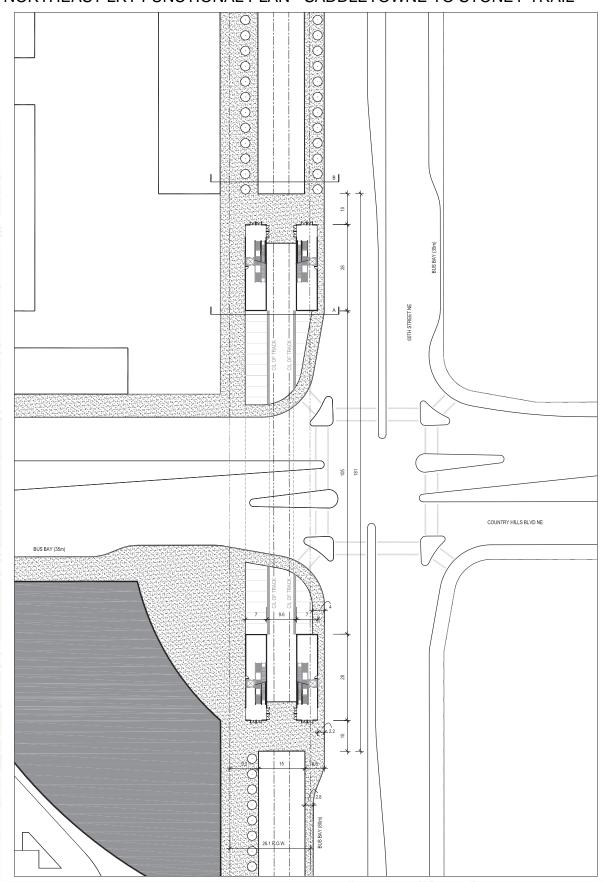
Exhibit 3.2 illustrates the location of bus bays serving the Station. The primary stop is an 80m bay situated immediately to the south of the Station on 60th Street NE. A 35m bay is situated adjacent to the east bound lane of Country Hills Blvd. NE, while another 35m bus bay is located immediately adjacent to the park and ride lot on the westbound lane of Skyview Centre Road west of 60th Street NE. Additional 35m bays are located on Skyview Centre Road just to the east of 60th Street NE and adjacent to the northbound lane of 60th Street NE immediately north of Country Hills Blvd. NE.



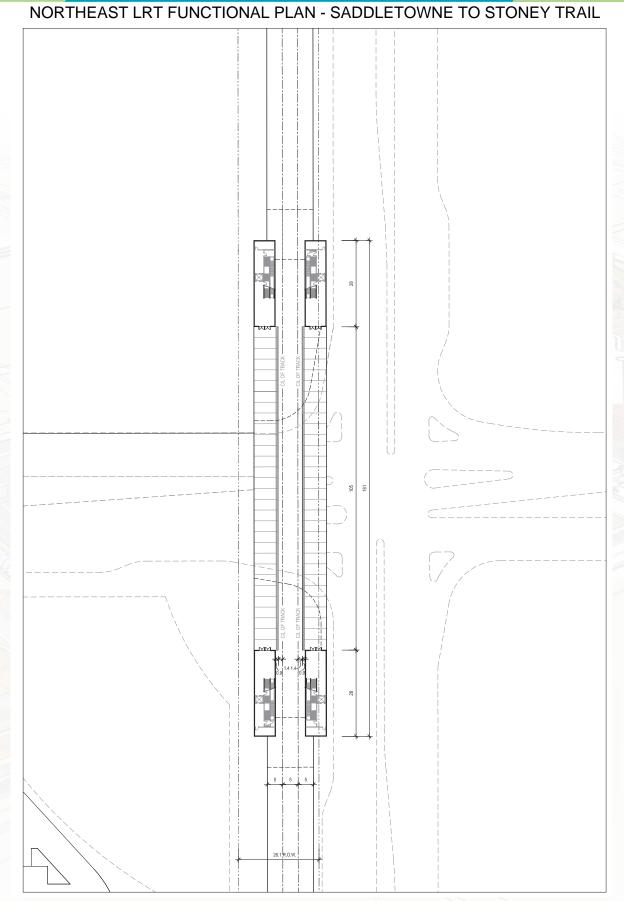
**EXHIBIT 3.1 - OUTLINE PLAN REVISION - OPTION 10** 



**EXHIBIT 3.2 - STATION AND R.O.W. CONTEXT PLAN** 



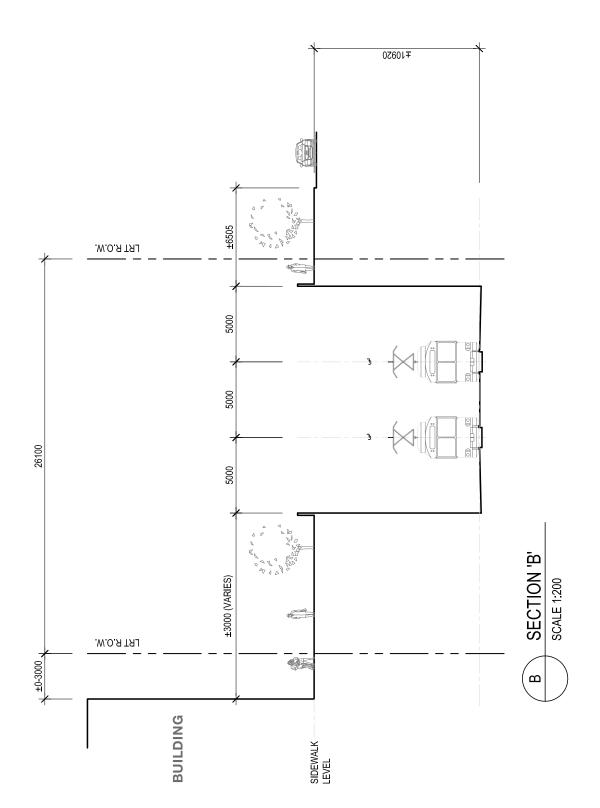
**EXHIBIT 3.3 - STATION PLAN ABOVE GRADE** 



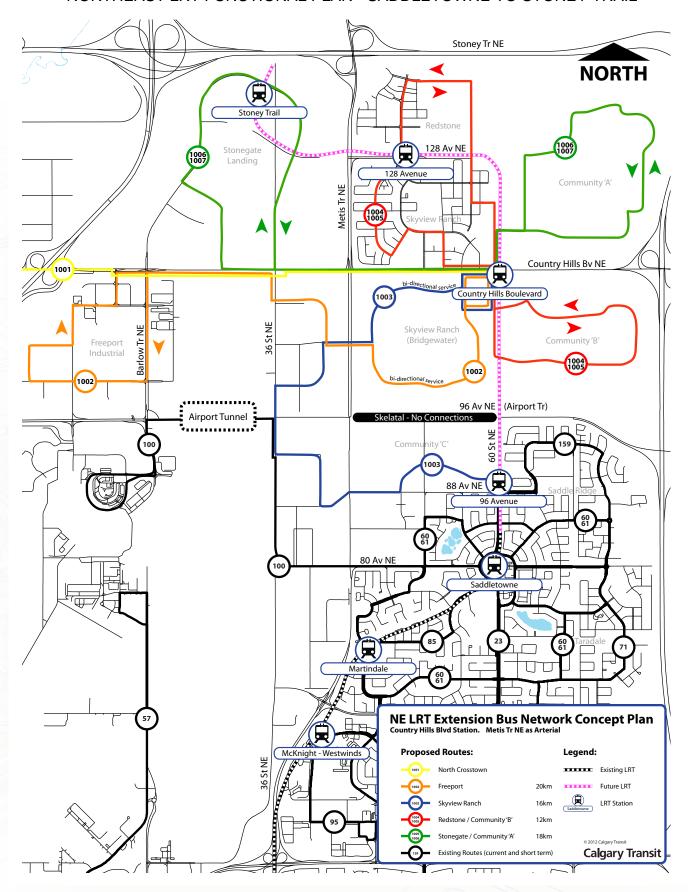
**EXHIBIT 3.4 - STATION PLAN BELOW GRADE** 

# 100001∓ 0098∓ 920 41200 W O R TRJ 7900 23610 5000 7900 **SCALE 1:200** 100 ±3000 (VARIES) **9** W.O.R TRJ +0-3000

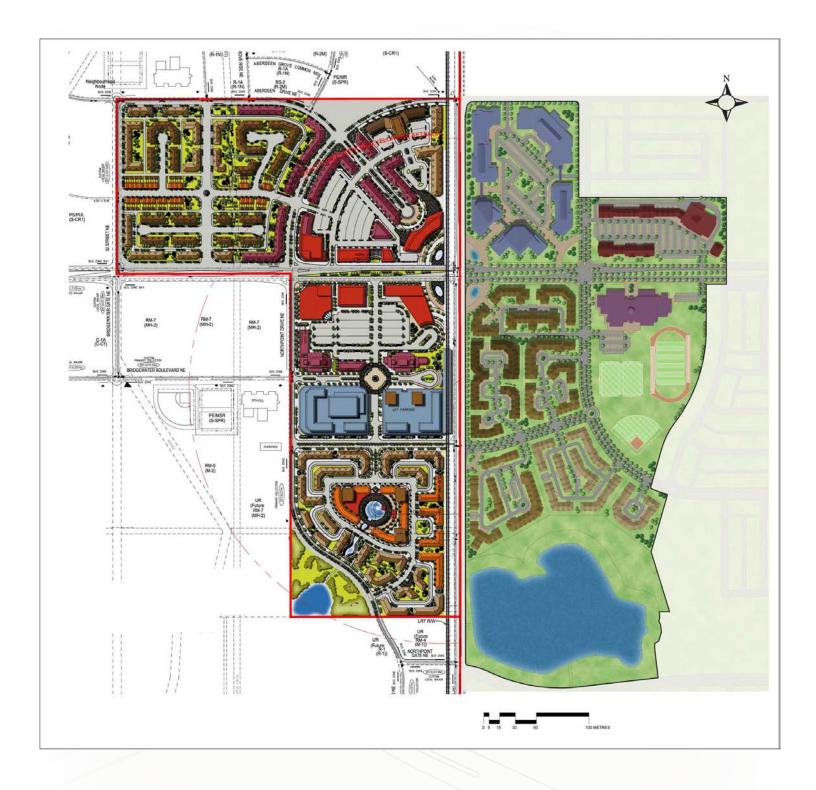
The City of Calgary > NORTHEAST LRT FUNCTIONAL PLAN - COUNTRY HILLS STATION - SCHEMATIC DESIGN



The City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - COUNTRY HILLS STATION - SCHEMATIC DESIGN



**EXHIBIT 3.7 - NE LRT EXTENSION BUS NETWORK CONCEPT PLAN** 



**EXHIBIT 3.8 - SKYPOINT TOWN CENTRE CONCEPT PLAN** 

# 3.5 Corner Plazas

The Concept Plan for the Town Centre, which includes conceptual building layouts for all four corners of the Country Hills Blvd and 60th Street intersection, depicts symmetrical, urban plazas to announce the Town Centre and provide a sense of arrival and entry (see Exhibit 3.8). This general design principle fits well with the relocation of the LRT station. It is desirable to maintain views to the Station with building orientation and setbacks. If final building configurations start to obscure sight lines, it will be important to incorporate vertical elements and signage to indicate the presence of the Station.

# 3.6 Other Considerations

# 3.6.1 TREATMENT ALONG WEST **BOUNDARY OF LRT RIGHT OF WAY**

Within the station area proper, a 6-8m pedestrian zone has been defined adjacent to the track trench. This would logically be a hard surface area with landscape planting and is intended to facilitate the volume of pedestrian, car and bus traffic passengers both accessing and egressing the LRT station. Outside the Station area, this zone tapers to 3-5m and facilitates pedestrian access from the park and ride lot to the south as well as pedestrian traffic entering from the Town Centre area to the west. This zone would accommodate a reduced sidewalk from the Station area along with tree planting adjacent to the LRT trench.

Given the location of these pedestrian access zones, there is a reduced requirement for building setbacks immediately to the west of the LRT right of way. In which case, a 0-3m setback is suggested at the Developer's discretion with the provision that a maintenance access agreement can be negotiated for the west face of these buildings if required.

It will also be important to provide active edges with direct building access whenever possible where building façades are situated adjacent to the LRT right of way. Alternatively, animation can also be accomplished with tromp l'oeil, graphics, lighting, display windows, vegetation, signage, decorative architecture, etc.

# LAND USE **CHANGES**

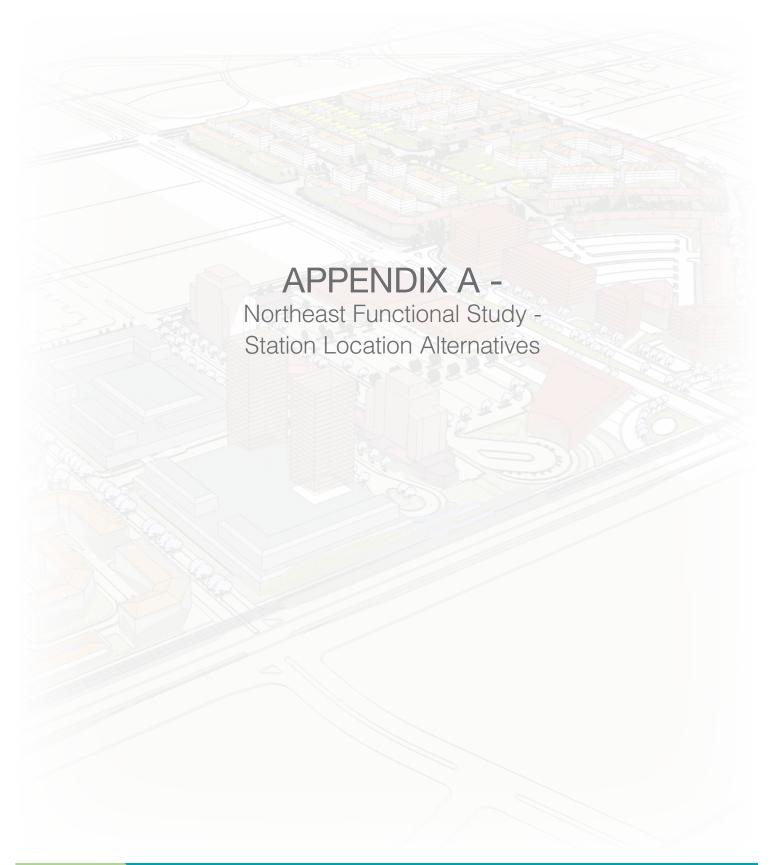
It is understood that the revised concept plan for the station area will require a land use amendment to facilitate the location of the library building on land designated appropriately. It is also understood that an amendment to the Northeast Community A Area Structure Plan, Part II Country Hills Station Area Plan will be required to reflect the modifications to the station area core zone.

# **CONCLUSION &** RECOMMENDATIONS

The schematic design process provided additional design detail and guidelines for the future development of the Town Centre and the LRT station. This coordinated exercise has enabled a reduced footprint of the LRT R.O.W. and will allow development to occur in a coordinated manner with the LRT which will reduce costs to both the City and the developer. This early collaboration between transportation, transit and planning has ensured compatibility of vision and realization of key design objectives. The following recommendations are proposed as a means of formalizing the proposed changes to the Station Area Plan:

- 1. That the City of Calgary review the required land use amendments along with the amendments to the Station Area ASP.
- That the future location of library facilities in the plan area be confirmed subject to service requirements and funding when appropriate.





#### 1.1 Country Hills Boulevard Station

Currently, the approved outline plan for the development east of 60 Street shows the future LRT station south of 60 Street on a public plaza (see Figure 1). This outline plan also assumes that the LRT would be grade separated at Country Hills Boulevard. With the station located at grade at the location shown, it is not possible to achieve a grade separated LRT crossing at Country Hills Boulevard.

The purpose of this section is to review possible station location and track profile options for the Country Hills Boulevard Station. The following will outline each option and discuss the potential positive and negative impacts.

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TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail ISC Coding: Unrestricted

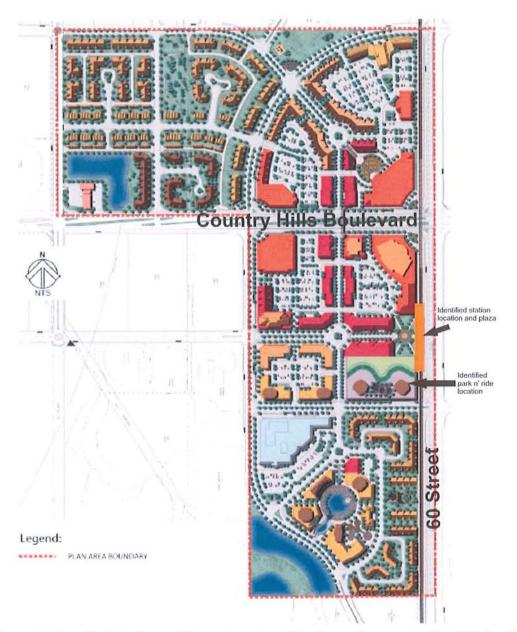


Figure 1: Identified Station and Plaza Location (Northeast Community 'A' ASP Part II)

#### 1.1.1 Option 1: At-grade crossing with Country Hills Boulevard

In this option, the NE LRT would cross Country Hills Boulevard, a major arterial, at grade. This would allow the station to be where it was initially planned by the developer, north of the proposed Skyview Centre Road. This is shown in the Option 1 vertical profile.

Positive impacts:

Source: Northeast Community 'A' ASP

- Development Outline Plan will remain unchanged.
- Land use planning and transit oriented development (TOD) principles surrounding the station remain.
- At-grade station accessible by surrounding land uses on the southwest quadrant of the intersection of Country Hills Boulevard and 60 Street.
- Minimized infrastructure costs for station and track alignment.

### Negative impacts:

- Increased delay for pedestrians at Country Hills Boulevard and 60 Street due to required split phasing at this intersection.
- At-grade crossing of Country Hills Boulevard would reduce intersection operational efficiency.
- Lights, bells and gates would be required, adding to long-term maintenance costs, similar to the crossing on 56 Street.
- Transportation Impact Assessments for the development Outline Plan have assumed a grade separation of the LRT at Country Hills Boulevard, and therefore, did not take into account the effects on intersection operation with LRT signal pre-emption.
- At-grade LRT crossings for pedestrians and cyclists would be required at this intersection meaning a longer crossing distance.
- Land Use Planning and Policy would view an at-grade LRT crossing at Country Hills Boulevard as a barrier
- Train operations would be impacted. With respect to trying to balance rapid transit, customer access and community connectivity, The City of Calgary draft Crossing Guidelines state: "Crossing protection (and the number of at-grade crossings) should allow Calgary Transit to operate the LRT at the highest possible speed based on track geometry and station spacing, and to maintain schedule reliability. This must be balanced with the need for customers to access stations efficiently and for community connectivity."
- In the past, The City has traditionally grade-separated LRT crossings at major arterials. The City's experience with West LRT and the Northeast LRT Extension from McKnight-Westwinds to Saddle Towne confirms that the public, Calgary Transit and The City is comfortable with some at-grade crossings, but that grade-separation at major roadways is still worthwhile.

### 1.1.2 Option 2: LRT grade separated over Country Hills Boulevard

This option would have the LRT tracks cross over Country Hills Boulevard. In order to achieve the grade required to make this grade separation, the vertical grade increase must occur in advance of the grade separation. Because stations should be located on a tangent with a maximum 1.5% grade, the station may not be located where it was previously planned. This is shown on the option profile. The station would be located south of the proposed Skyview Road.

### Positive impacts:

- Grade separation over Country Hills Boulevard would allow intersection of Country Hills Boulevard and 60 Street to operate without any impact from the LRT line.
- Gates, lights and bells would not be required at this crossing.
- Would not require at-grade crossings for cyclists and pedestrians

### Negative Impacts:

Cannot locate station where initially proposed by the developer.

- Current planned land use mix distribution is not planned for the station location proposed in Option 2.
- Amending pathway to access this proposed station location.
- Amending bus connections to access this proposed station location.
- Proposed station location is further south than initially planned and would not serve the planned high school on the east side of 60 Street as well as the initial proposed location.
- Increased infrastructure costs for a grade-separated crossing.

### 1.1.3 Option 3: LRT grade separated under Country Hills Boulevard with a long approach trench

This option would have the LRT tracks cross under Country Hills Boulevard. There is a proposed development access road (Skyview Centre Road) that intersects with 60 Street approximately 400 metres south of Country Hills Boulevard. In order to locate the station at the proposed location and achieve a grade separation under Country Hills Boulevard, the vertical alignment of the LRT track is required to be in trench. To achieve this station location, the vertical alignment also needs to cross under the proposed Skyview Centre Road. This is shown in the Option 3 vertical profile.

### Positive Impacts:

- Grade separation at Country Hills Boulevard would allow the intersection with 60 Street to operate without any impact from the LRT line.
- Gates, lights and bells would not be required at this crossing.
- Does not require at-grade crossings for cyclists and pedestrians.
- A grade separation under the proposed Skyview Centre road would allow this intersection to operate without impact from the LRT line. No gates, lights or bells would be required at this second intersection.
- The station would be located at the location initially proposed by the developer.
- Land use planning surrounding the station is planned to be configured to support TOD principles at this location.

### Negative Impacts:

- Increased costs for length of trench required.
- Increased cost to construct station in the trench.
- Infrastructure cost of two overhead crossing roadways.
- Requirement for stairs, escalators and elevators to provide station access at a midblock location
- Increased maintenance costs for LRT facilities in the trench
- Trench along 60 Street creates a greater barrier than LRT tracks for access for the development. Either midblock pedestrian bridges would be constructed to allow pedestrians a shorter route to the station, or pedestrians would be required to cross at an intersection (Country Hills Boulevard or Skyview Centre Road).
- Increased maintenance costs as trench would act as a collection area for blowing debris and snow.
- This location is the most accessible from one quadrant out of four of the Country Hills Boulevard and 60 Street intersection.

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### 1.1.4 Option 4: LRT grade separated under CHB with station under intersection

This option would have the LRT tracks cross under Country Hills Boulevard. In order to achieve the elevation required to make this grade separation, the vertical grade decrease must occur a minimum distance in advance of the grade separation. Because stations should be located on a tangent with a maximum 1.5% grade, the station can not be located where it was proposed by the developer. In this option, the station is located under Country Hills Boulevard, centred on the west leg of the intersection with 60 Street. This is shown in the Option 4 vertical profile.

### Positive Impacts:

- Grade separation at Country Hills Boulevard will allow the intersection with 60 Street to operate without impact from the LRT line.
- Gates, lights and bells would not be required at this crossing
- Does not require at-grade crossings for cyclists and pedestrians that would be required for an atgrade LRT intersection crossing.
- Station access would be provided from both the north and south side of Country Hills Boulevard serving a larger area. This also reduces the number of pedestrians needing to cross the intersection north and south as it is accessible from both sides.
- Station would be located more accessible to planned High School on east side of 60 Street
- The station access could be incorporated into adjacent land use (ie: arcade into commercial building).
- Infrastructure cost would be less than that of the longer trench in Option 3.

### Negative Impacts:

- Infrastructure cost to construct tunnel for track and station under Country Hills Boulevard.
- More difficult to access station for maintenance.
- Current land use mix is not oriented towards the station location proposed in Option 4.
- Pathway connections not oriented towards the station location proposed in Option 4.
- Bus connections would need to be reconsidered to access this proposed station location.
- Grade separation between station and adjacent land use could potentially be a barrier to pedestrian and cyclist access. However, because the station would straddle the intersection, it may be possible to integrate with adjacent land uses and create usable pedestrian and cyclist connections.
- Station location further north than initial location proposed by the developer.
- The distance from the crossover to the station is greatest in Option 4. This would impact operations if this station were a terminal station.

### 1.1.5 Cost Estimate

The estimated construction cost review compares the base cost of an at-grade crossing of Country Hills Boulevard at 60 Street with two grade separated alternatives. Option 2 was not considered for a cost estimate as it does not provide any advantages over the other options. Detailed cost estimate break downs are attached to this memorandum.

The following table represents the estimated construction cost comparison:

Option	Description	Estimated Cost (\$'000)

1	At grade LRT track and Country Hills Boulevard crossing	400		
2	LRT tracks over Country Hills Boulevard	Not Considered		
3	Grade separation with LRT tracks in a trench and underpass	43,000		
4	Grade separation with LRT tracks underpass	26,500		

#### 1.1.6 Conclusions and Recommendations

In conclusion, there are four possible options for station location and track profile in the vicinity of the intersection of Country Hills Boulevard and 60 Street. From the discussion above, the following is concluded:

- 1. At-grade crossing of Country Hills Boulevard: the station location for this option is where it was initially proposed by the developer, but the at-grade crossing negatively impacts intersection operation, pedestrian and cyclist crossings at the intersection and LRT operation. This is most accessible from one quadrant of the intersection (60 Street and Country Hills Boulevard).
- 2. LRT grade separated over Country Hills Boulevard: the station location for this option is further south from where it was initially proposed by the developer and has the added infrastructure costs of a grade separation.
- 3. LRT grade separated under Country Hills Boulevard with a long approach trench: this option has the station location where it was initially proposed by the developer, but has greatly increased infrastructure and maintenance costs for the trench, station and road crossings. It also creates a barrier for access in the area.
- 4. LRT grade separated under Country Hills Boulevard with station under intersection: this option allows station access from both the north and south side of the intersection, does not negatively impact intersection operation and has minimized infrastructure costs (in comparison to Option 3) as the track elevation will remain at-grade until required to decrease for the grade separation. This provides better east-west access.

Based on these conclusions, from an LRT perspective Option 4 is recommended (LRT grade separated under Country Hills Boulevard with station under intersection). This option has been protected for in the right-of-way requirements. It is recommended that the outline plan be reviewed to determine whether land use objectives can be met with a station that straddles Country Hills Boulevard. It is recommended that this be reviewed in more detail in an additional piece of work separate from this functional planning study.

TT2012-0657 Attachment 2 - Northeast LRT Functional Plan - Saddletowne Station to Stoney Trail ISC Coding: Unrestricted

# LEGEND = 600m RADIUS PRIMARY CYCLING ROUTE LOCAL BICYCLE ROUTE/MULTI-**USE PATHWAY** LRT LINE BUS ROUTE BRT ROUTE LRT PLATFORM SUBSTATION/UTILITY SINGLE FAMILY MULTI-FAMILY COMMERCIAL SCHOOL/RECREATION PARK AND RIDE GREEN AND OPEN SPACE

STORMWATER POND

### PARK AND RIDE

STONEY TRAIL STATION

- 100 park and ride (shared)

128TH AVENUE STATION

- 200 park and ride (shared)

COUNTRY HILLS STATION

- 200 park and ride (shared)

96TH AVENUE STATION

- 500 park and ride (shared)

# ULTIMATE REQUIRED BICYCLE PARKING

Class 1 - 5% of projected AM peak ridership (secure) Class 2 - 1.5% of projected AM peak ridership

### STONEY TRAIL STATION

- Class 1, 16 STALLS
- Class 2, 20 STALL

### 128TH AVENUE STATION

- Class 1, 90 STALLS
- Class 2, 30 STALLS

## COUNTRY HILLS STATION

- Class 1, 166 STALLS
- Class 2, 50 STALLS

### 96TH AVENUE STATION

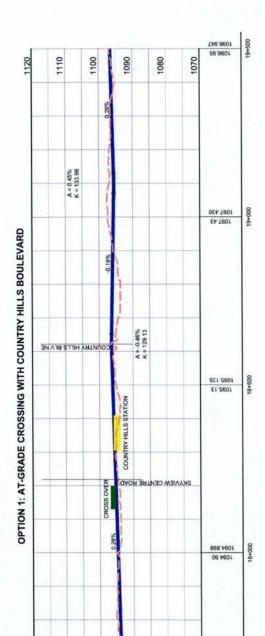
- Class 1, 26 STALLS
- Class 2, 20 STALLS

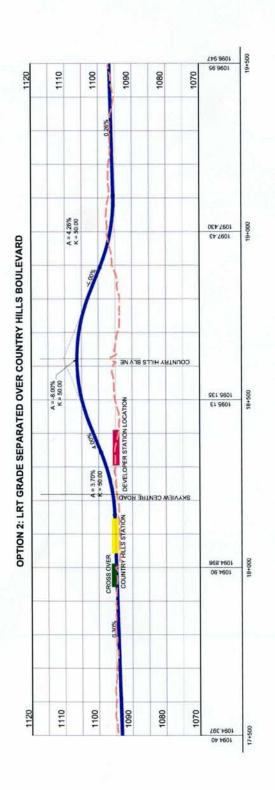


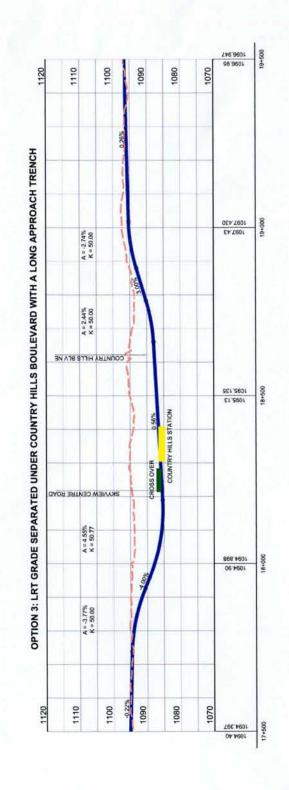


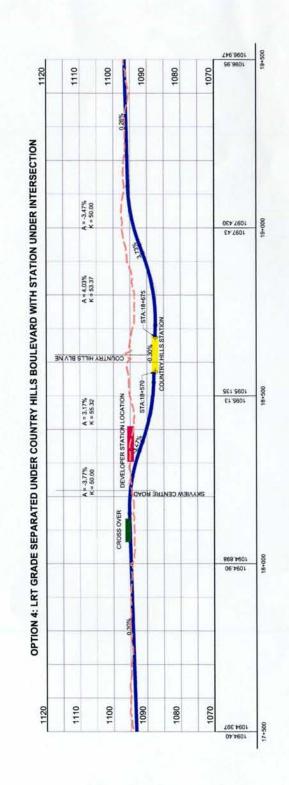
COUNTRY HILLS CONTEXT











**BOULEVARD STATION OPTIONS** 



NE LRT FUNCTIONAL STUDY FOR DISCUSSION PURPOSES ONLY DECEMBER 06, 2011 VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:5000

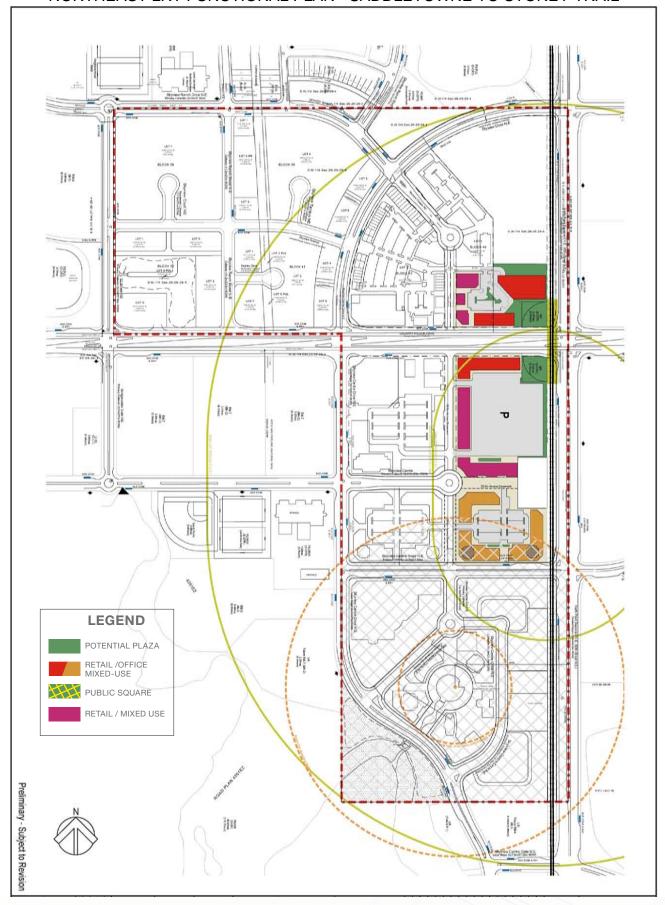
**OUNTRY HILLS** 

1110

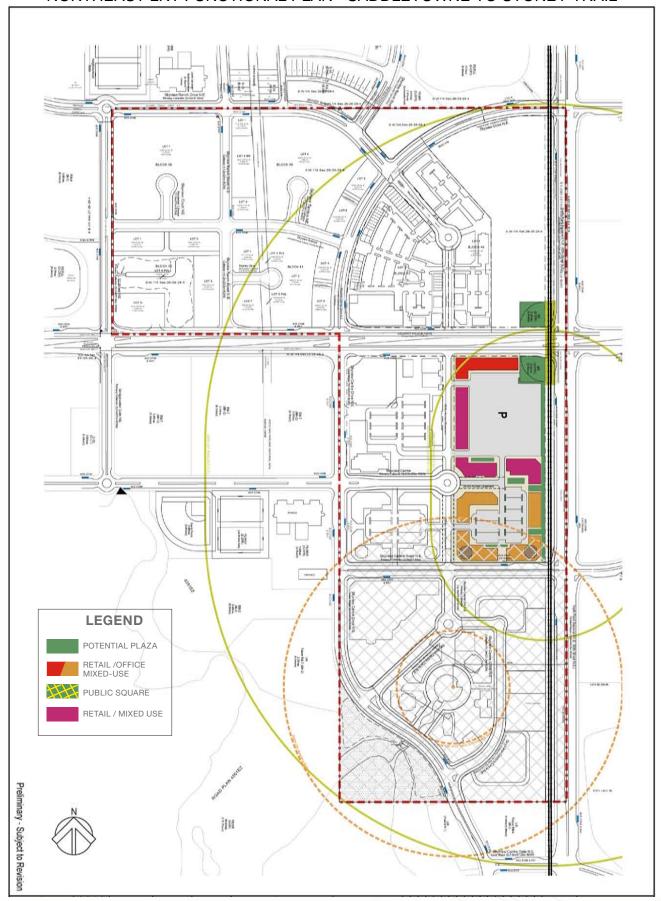
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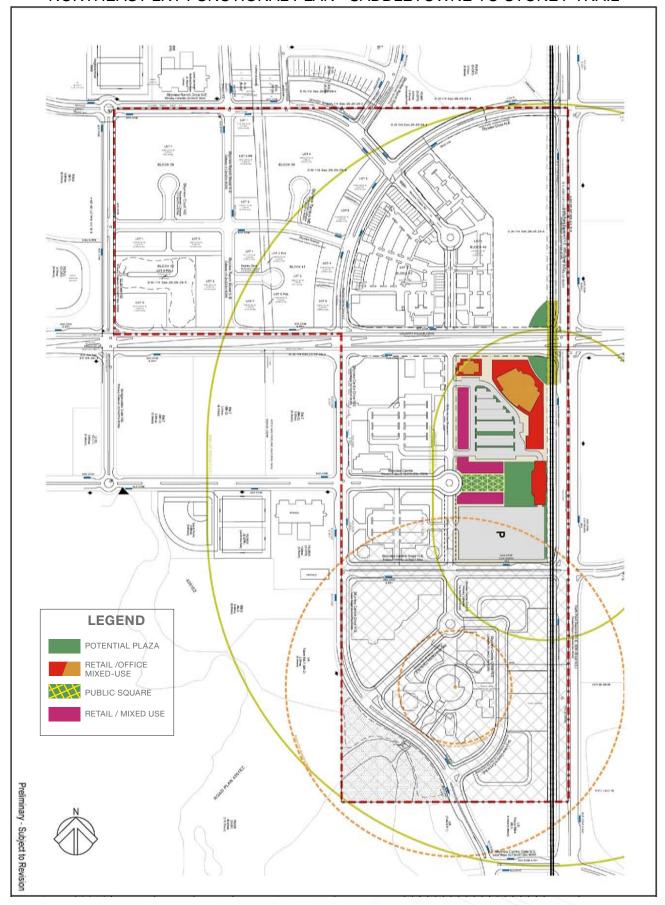




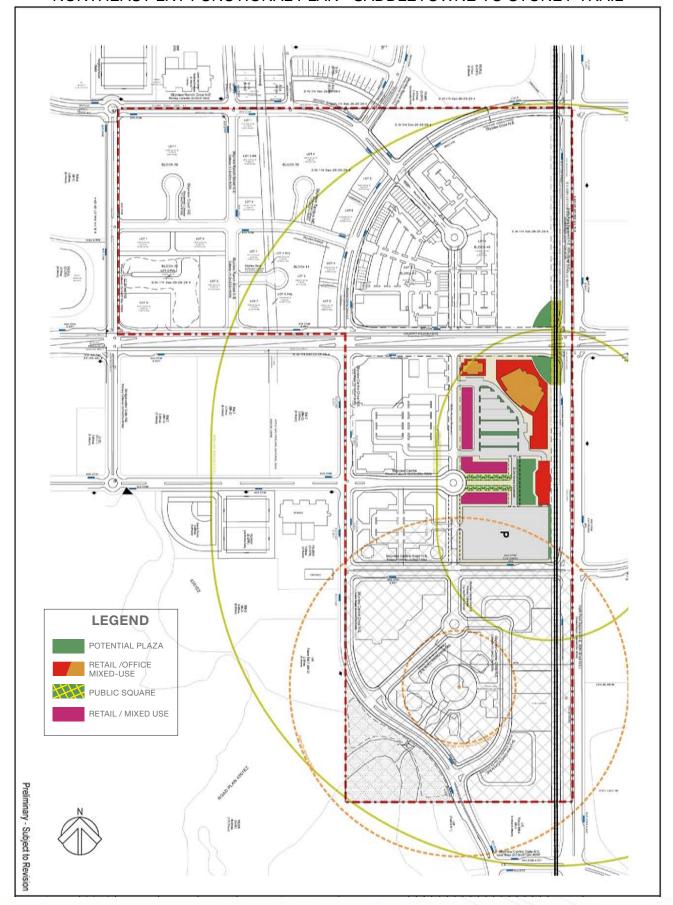
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 1** 



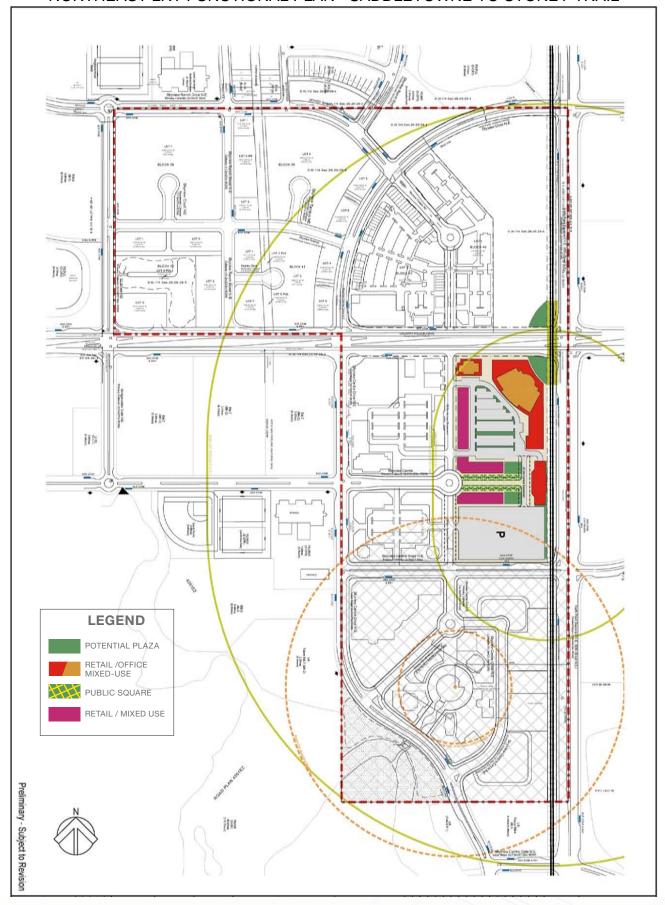
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 2** 



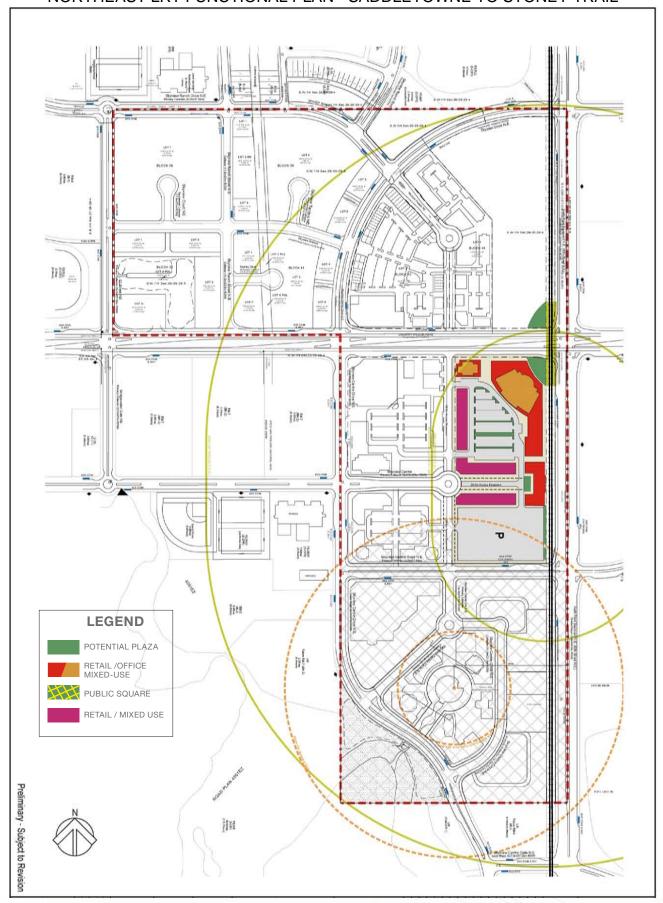
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 3** 



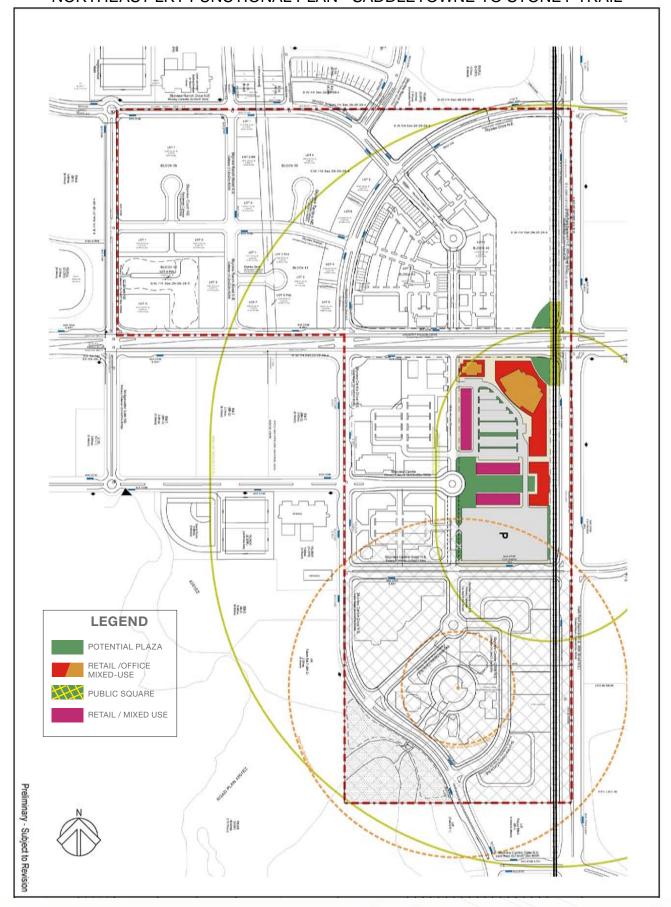
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 4** 



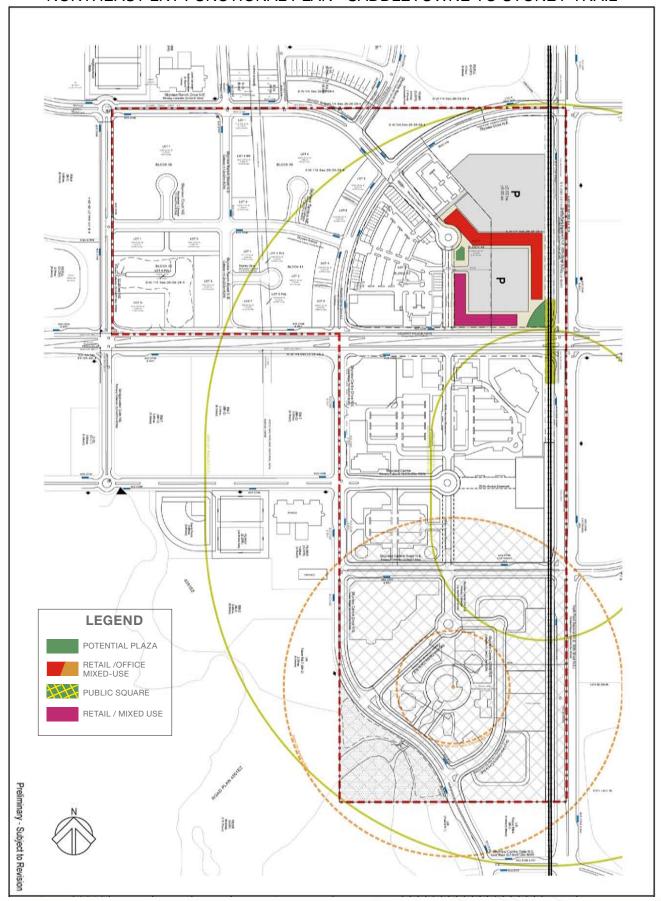
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 5** 



**APPENDIX B - OUTLINE PLAN REVISION - OPTION 6** 

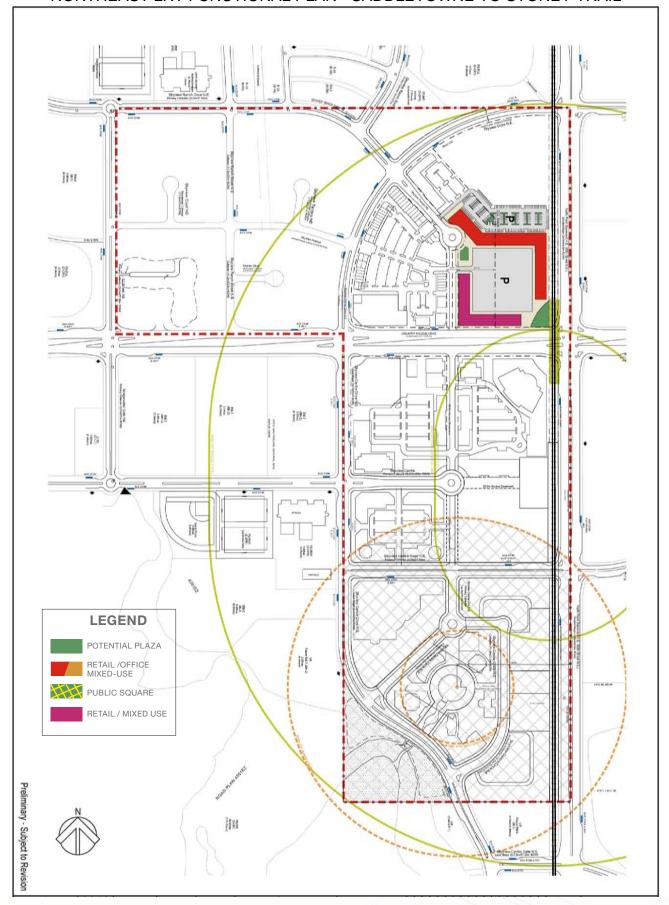


**APPENDIX B - OUTLINE PLAN REVISION - OPTION 7** 

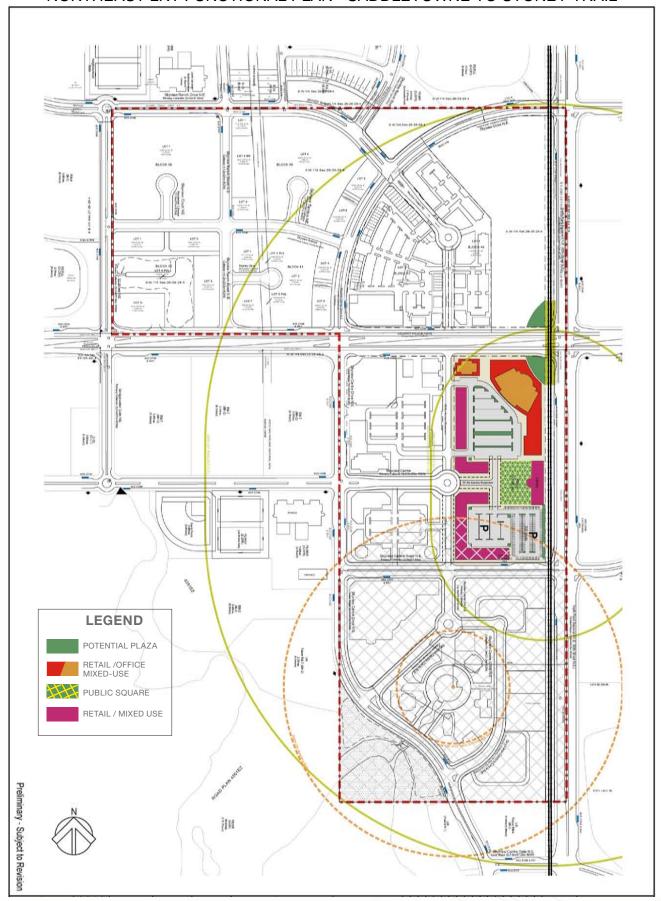


**APPENDIX B - OUTLINE PLAN REVISION - OPTION 8** 

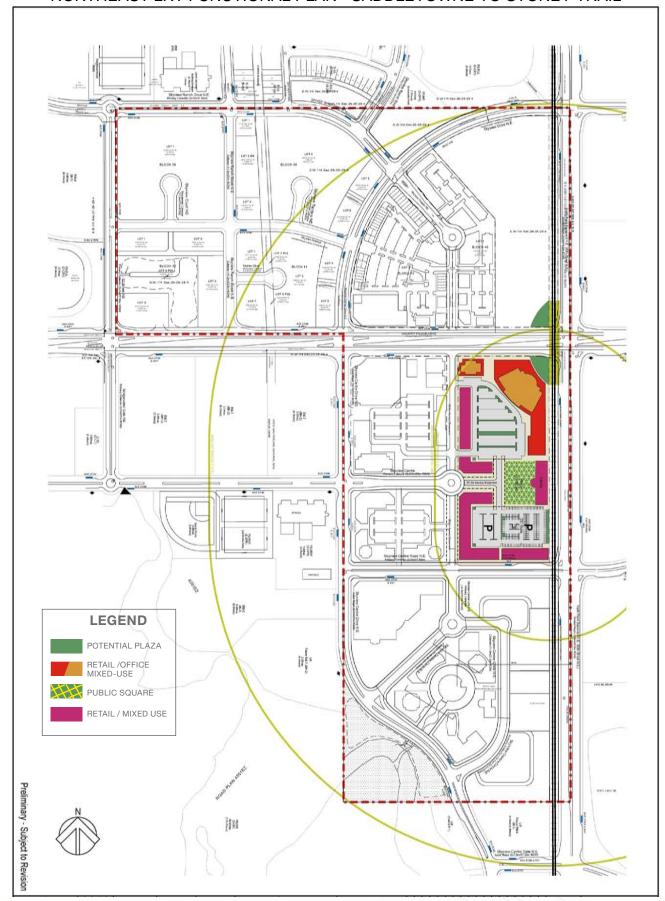
ISC Coding: Unrestricted



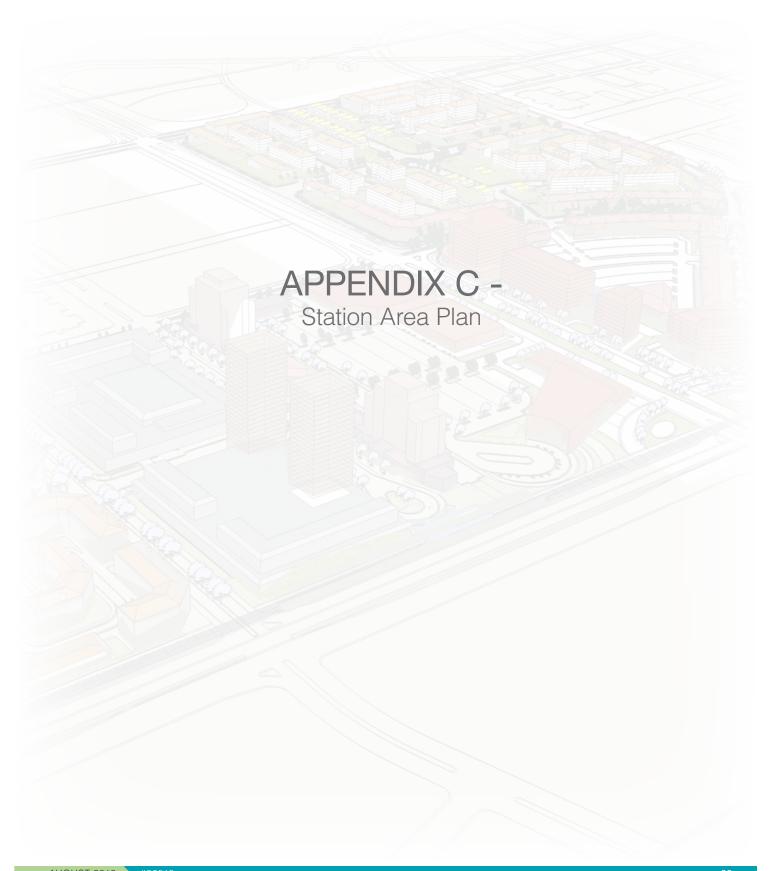
**APPENDIX B - OUTLINE PLAN REVISION - OPTION 9** 

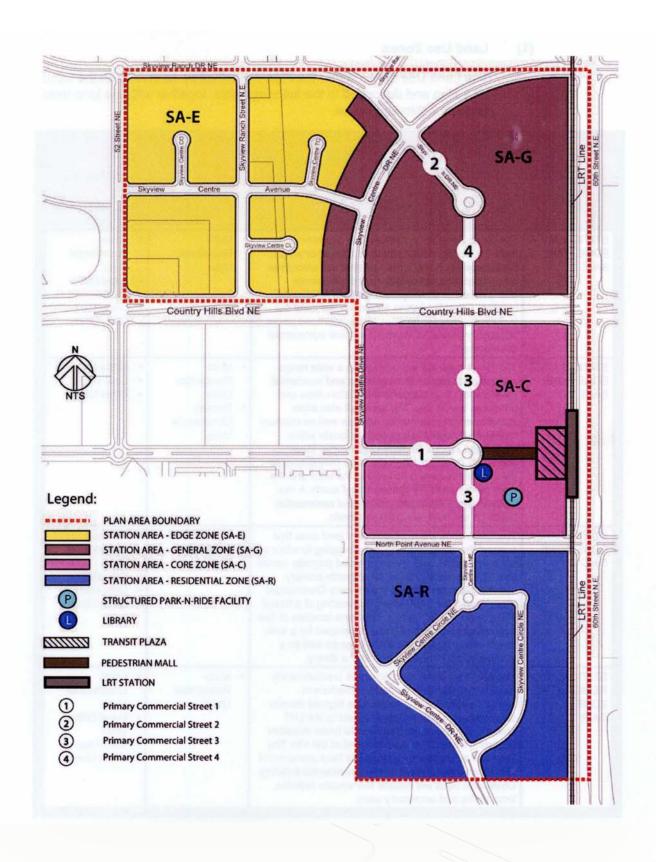


**APPENDIX B - OUTLINE PLAN REVISION - OPTION 10** 



**APPENDIX B - OUTLINE PLAN REVISION - OPTION 11** 



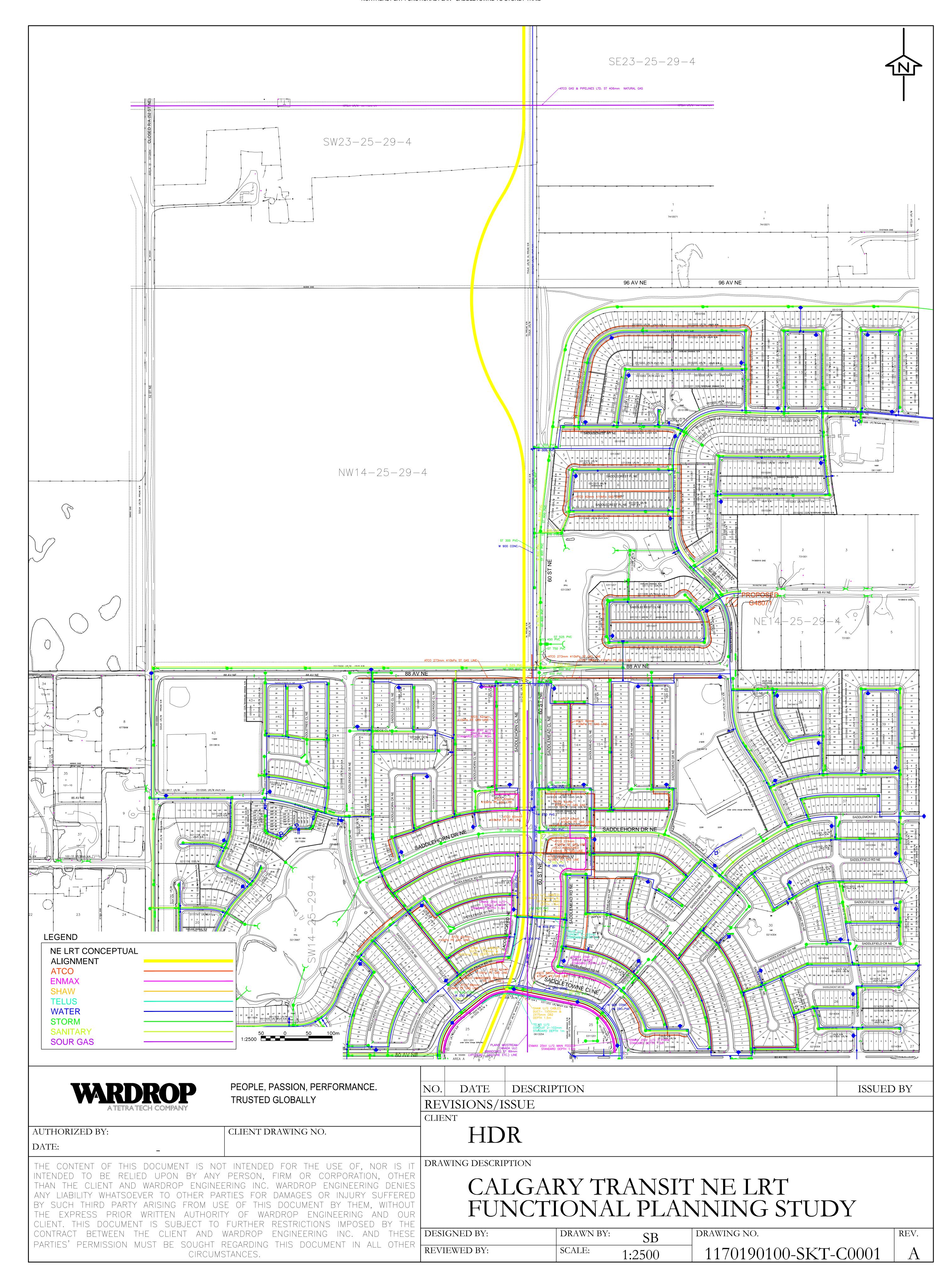


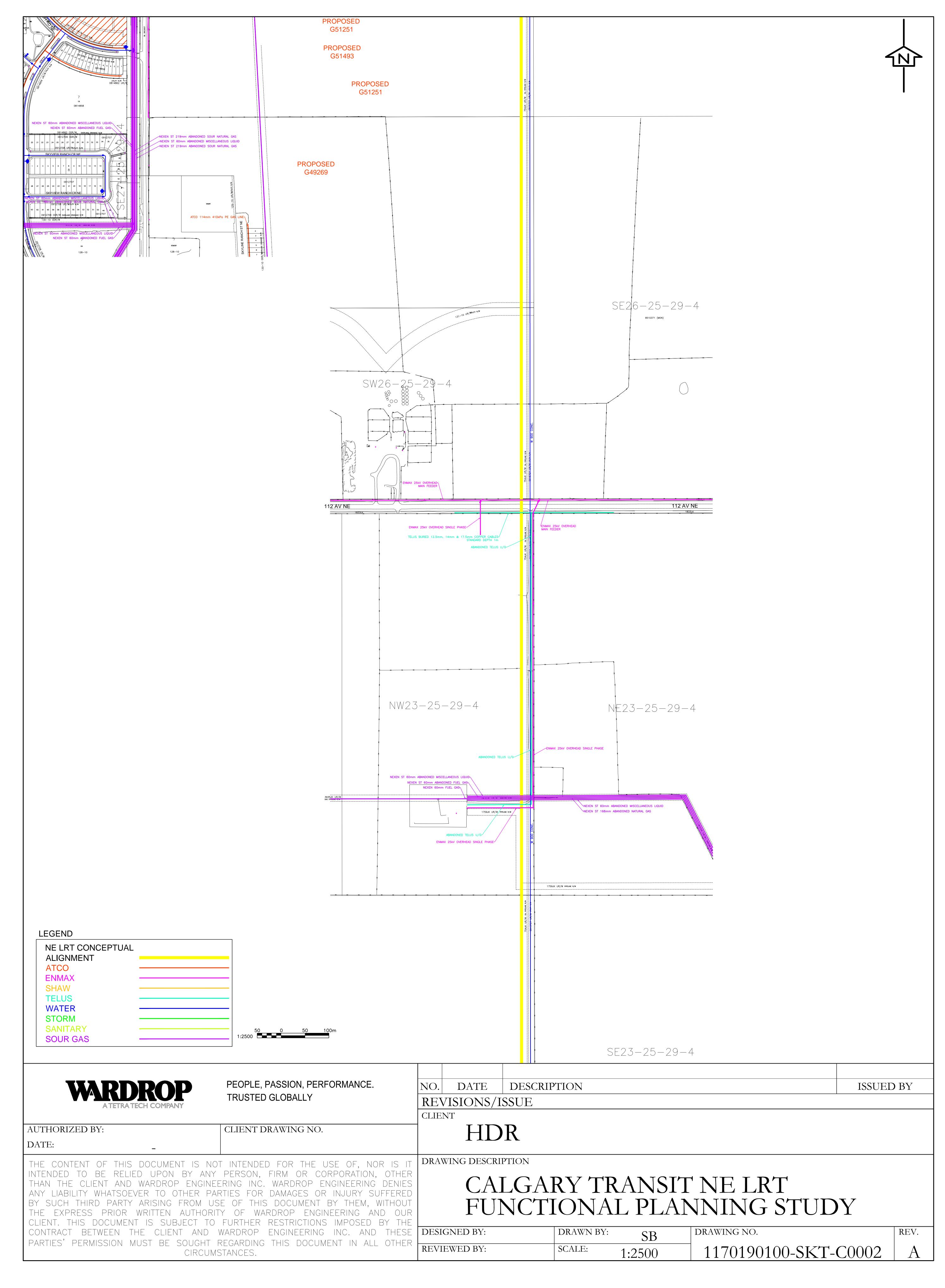
APPENDIX C - STATION AREA PLAN

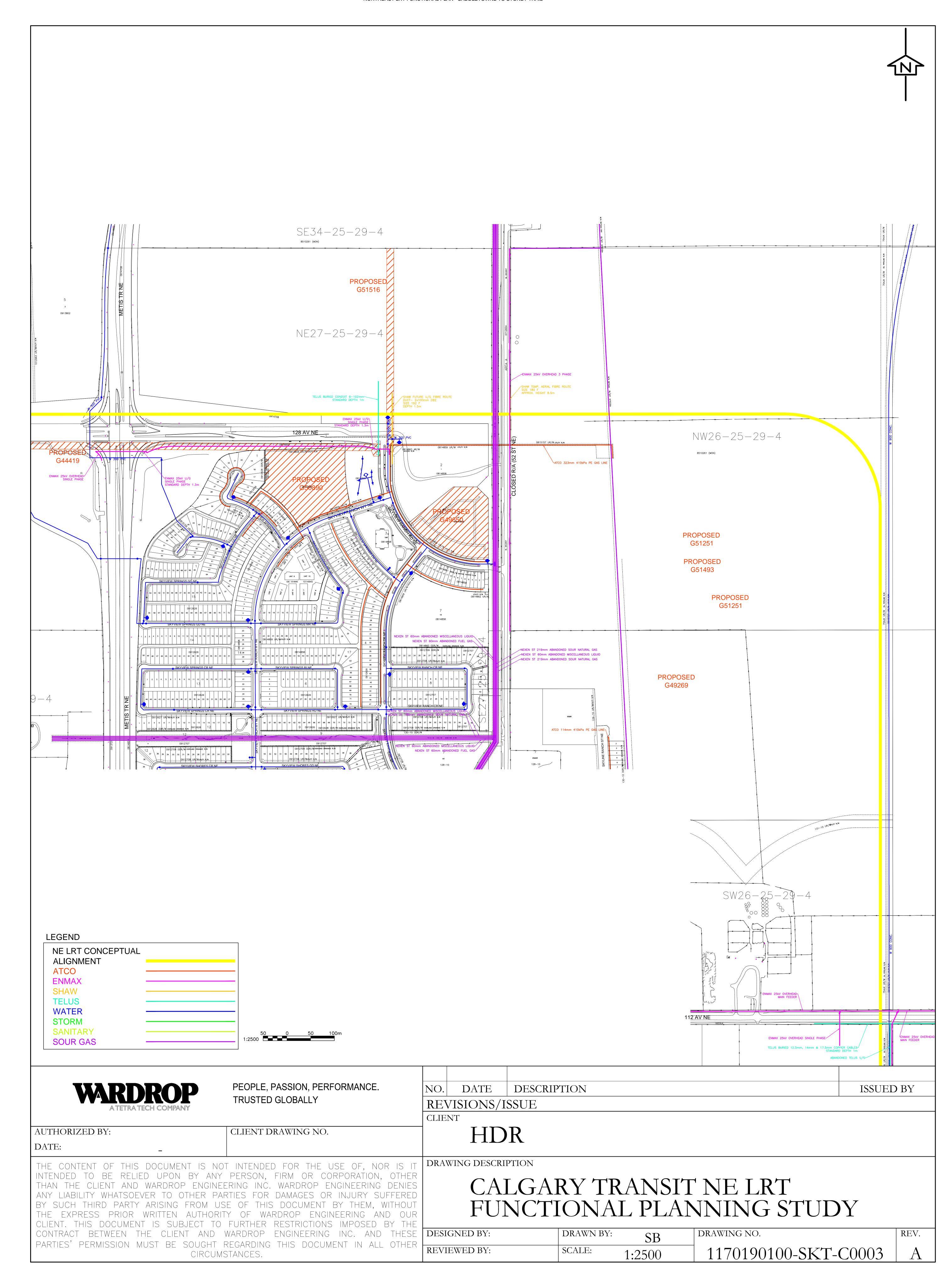


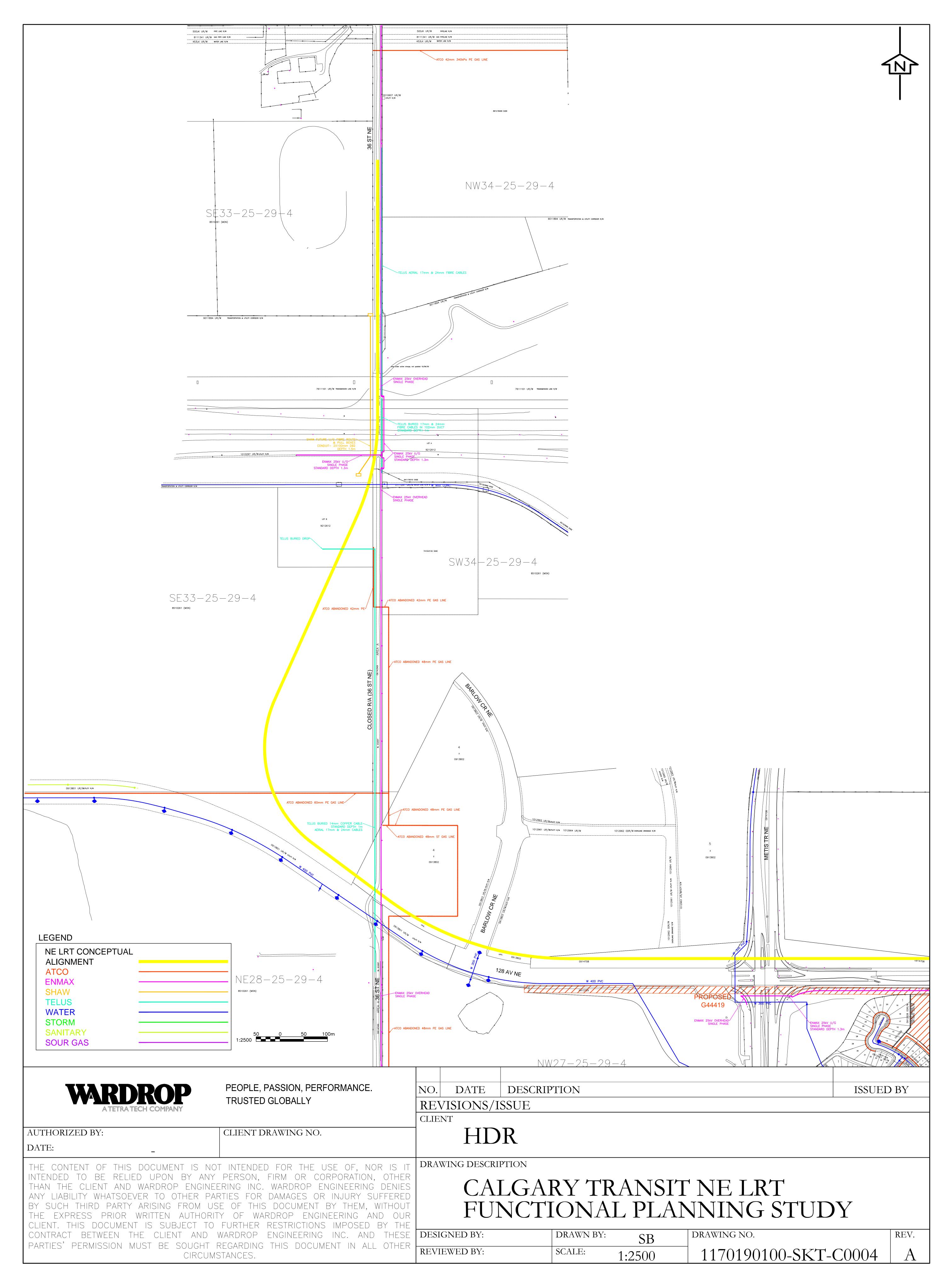
# Appendix F











# Appendix A - Utility Conhom Resided Sofital Tinforth Control ONAL PLAN - SADDLETOWNE TO STONEY TRAIL

	General		Emergency					Contact
<b>Company Name</b>	Contact	Address	Contact	Contact Name	Fax	Phone	Email	Notes
ATCO Gas	403-245-7888	5005 2nd Street W Calgary, AB	1-403-245-7222		403-245-7405			
		3. 3.		Irena Gierkowicz	403-245-7405	403-245-7763	Irena.Gierkowicz@atcogas.com	Senior Engineer
Natural Gas Distribution				Ryan Clark	403-245-7405	403-245-7149	Ryan.Clark@atcogas.com	Engineer
ATCO Pipelines	1-780-420-8957	7210-42 Street NW Edmonton, AB T6B 3H1	1-877-496-9380	Brad Cann	780-420-7411	780-420-8953	brad.cann@atcopipelines.com	Project Leader
High Pressure Gas Line				Lance Radke	780-420-7411	780-420-3643	Lance.radke@atcopipelines.com	Group Leader
Telus	1-800-646-0000	. Avenue, NE Calgary, AB T2E 3P8	611	Wayne Secord	403-276-7202	403-530-3528	Wayne.Secord@telus.com	Customer Service Delivery
				Sherry Hunter	403-276-7202	403-530-5829	sherry.hunter@telus.com	Technical Support Assistant
Telphone Lines				Rob Neil		403-530-3417	rob.neil@telus.com	

<b>Enmax</b> Power		8820 52 <sup>nd</sup> Street Se Calgary, AB T2C4E7		Dan Dodkin Keith Emanuel		403-514-1061 403-514-3717	ddodkin@enmax.com  Kemanuel@enmax.com	Distribution Engineer
SHAW Communications	1-403-716-6000	2400 32 <sup>nd</sup> Ave NE Calgary, AB T2E 9A7	1-403-716-6000	Walt Emsley Cathy Martin	403-539-6777 Call to inform recipient a fax was sent. 403-539-6777	403-539-6733 403-539-6767	walt.emsley@sjrb.ca  Cathy.Martin@sjrb.ca	
NEXEN Inc. Oil & Gas	403-699-4000	801 7th Ave SW Calgary, AB T2P 3P7	1-403-699-4000	Ray MacEachern	403-232-1676	403-699-5657	Ray MacEachern@nexeninc.com  Surface land@nexeninc.com	Crossing Agreements



# Appendix G



## **City of Calgary**

### **NE LRT Extension**

Saddletowne Station to Stoney Trail Station

Estimated Capital Cost (Level A) - 2012 Base

## City of Calgary NE LRT Extension: Saddletowne to Stoney Trail Estimated Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (2012 Base)

#### **Considerations:**

- **1** Estimate is all inclusive for construction costs, including labour and materials.
- 2 Project starts at end of the existing LRT extension (15+710) and ends at 23+215. Total length is 7.5 kms LRT extension (or 15 track-kms.)
  This also includes end of track train set storage in layovers (2 train sets per 2 tracks).
- **3** There are four (4) LRT stations along this route, namely:

Saddletowne Station (existing)	15+390	Distance from previous station.
96th Avenue Station	16+260	870
Country Hills Station	18+610	2,350
128th Avenue Station	20+710	2,100
Stoney Trail Station	22+890	2,180
Architects estimate cost at \$ 18 m / station.		

4 Only Stoney Trail station is being treated as a terminal station, with a set of special trackwork ahead of the station.

Country Hills Blvd. at present is not to be a terminal station and therefore no special trackwork is included at this location. Should Country Hills Blvd. be a terminal station, special trackwork will be required.

- The LRT right-of-way is located on City owned property. Additional land may be required for grade separations and land costs are excluded from this estimate. Land required for Park 'n' Ride facilities is also excluded.
- 6 Structures include overpasses at Country Hills Blvd., a tunnel at 128th Ave. and underpasses at Airport Trail and Métis Trail.

7	There are twelve at-grade road-rail level crossings:	+/-	Distance to next
	Saddle Horne Dr.	15+810	level road crossing
	88 <sup>th</sup> Avenue	16+150	340
	Future Access (?)	16+410	260
	Skyview Centre Gate	17+690	1280
	Skyview Centre Road	18+210	520
	Skyview Centre Drive	19+040	830
	Skyview Avenue	19+360	320
	Red Stone Blvd.	20+050	690
	Red Embers Gate (52 nd Street)	20+525	475
	Red Stone Street	20+815	290
	Commercial Access (name?)	21+590	775
	Barlow Crescent (36 th Street)	21+980	390
	32 <sup>nd</sup> Street	22+340	360
	Barlow Crescent	22+970	630

8 Electrical sub-stations are positioned at every LRT station and at approximately 1 km spacing.

LRT Station TP	&C Sub-station
16+260	16+360
	17+520
18+610	18+550
	19+600
20+710	20+500
	21+750
22+890	23+000
	18+610 20+710

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLE TOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (2012 Base)

1.0	LRT TRACKS & CIVILS	\$	75,210,500
	Grading	\$	6,750,000
	Drainage	\$	11,250,000
	Trackwork	\$	41,250,000
	Special Trackwork (including Switch Heaters)	\$	2,000,000
	At-grade Road Crossings	\$	4,800,000
	Right-of-way Fencing	\$	4,580,250
2.0	LRT SYSTEMS	\$	57,750,000
	Traction Power	\$	34,500,000
	Signals	\$	8,250,000
	Communications	\$	15,000,000
3.0	ROADWORKS	\$	4,000,000
	Park 'n' Ride (Entrance Accesses Only)	\$	4,000,000
	,	7	1,000,000
4.0	STRUCTURES	\$	76,470,000
	Airport Trail	\$	19,800,000
	Country Hills Blvd.	\$	3,200,000
	Métis trail	\$	9,000,000
	128 <sup>th</sup> Avenue (Tunnel)	\$	43,750,000
	Retaining & Barrier Walls	\$	720,000
5.0	STATIONS & FACILITIES (including Park 'n' Ride and Bike stalls)	\$	90,045,000
3.0	96 <sup>th</sup> Avenue	\$	23,050,000
	Country Hills (at underpass)	\$	18,225,000
	128 <sup>th</sup> Avenue	\$	20,120,000
			•
	Stoney Trail TP&C Sub-stations	\$ \$	18,150,000
	I PAC SUD-SIGNOTIS	>	10,500,000
6.0	UTILITIES	\$	3,100,000
	Deep Utilities - LRT Tracks	\$	3,000,000
	Shallow Utilities - LRT Tracks	\$	100,000

SUB-TOTAL	\$ 306,575,500
Contingency 15%	\$ 45,986,325
TOTAL	\$ 352,561,825
LEVEL 'A' CONSTRUCTION COST ESTIMATE	\$ 355,000,000

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (2012 Base)

<u>No.</u>	Description	<u>Qty</u>	<u>Unit Cost</u>	U of M	<u>Extension</u>
1.0	LRT TRACKS & CIVILS				
1.1	Grading	7.5	\$ 900,000	km	\$ 6,750,000
1.2	Drainage	7.5	\$ 1,500,000	km	\$ 11,250,000
1.3	Trackwork	7.5	\$ 5,500,000	km	\$ 41,250,000
1.4	Special Trackwork (including Switch Heaters)	1	\$ 2,000,000	ea	\$ 2,000,000
1.5	At-grade Road Crossings	12	\$ 400,000	ea	\$ 4,800,000
1.6	Right-of-way Fencing (split 75-25 chain link vs. barrier wall)				\$ 4,580,250
	Chain link Fence (75%)	11.3	\$ 120,000	km	\$ 1,350,000
	Barrier Wall (25%) (Barrier wall along residential properties.)	3.7	\$ 885,000	km	\$ 3,230,250

SUB-TOTAL		\$ 75,210,500
Contingency	15%	\$ 11,281,575
TOTAL - LRT TRACKS & CIVILS		\$ 86,492,075

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLE TOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NORTHEAST LRT FUNCTIONAL PLAN - SADDLE TOWNE TO STONEY TRAIL Capital Cost (2012 Base)

No.	Description	<u>Qty</u>	Unit Cost	<u>U of M</u>	Extension
2.0	LRT SYSTEMS				
2.1	Traction Power				\$ 34,500,000
	Power Installation	7.5	\$ 1,750,000	kms	\$ 13,125,000
	U/G Ducts and Pole Bases	7.5	\$ 1,600,000	kms	\$ 12,000,000
	OCS	7.5	\$ 1,250,000	kms	\$ 9,375,000
2.2	Signals	7.5	\$ 1,100,000	km	\$ 8,250,000
2.3	Communications	7.5	\$ 2,000,000	km	\$ 15,000,000

SUB-TOTAL		\$ 57,750,000
Contingency	15%	\$ 8,662,500
TOTAL - LRT SYSTEMS		\$ 66,412,500

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Capital Cost (2012 Base)

<u>No.</u>	Description	<u>Qty</u>	Unit Cost	U of M	<u>Extension</u>
3.0	ROADWORKS				
3.1	Park 'n' Ride (Entrance Accesses Only)				\$ 4,000,000
	96 <sup>th</sup> Avenue		\$ 1,000,000	ls	\$ 1,000,000
	Country Hills Station		\$ 1,000,000	ls	\$ 1,000,000
	128 <sup>th</sup> Avenue		\$ 1,000,000	ls	\$ 1,000,000
	Stoney Trail Station		\$ 1,000,000	ls	\$ 1,000,000

SUB-TOTAL		\$ 4,000,000
Contingency	15%	\$ 600,000
TOTAL - ROADWORKS		\$ 4,600,000

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Capital Cost (2012 Base)

No.	<u>Description</u>	<u>Area</u>	Unit Cost	U of M	Extension
4.0	STRUCTURES				
4.1	Airport Trail	3,300	\$ 6,000	m2	\$ 19,800,000
4.2	Country Hills Blvd.	800	\$ 4,000	m2	\$ 3,200,000
4.3	Métis Trail	1,500	\$ 6,000	m2	\$ 9,000,000
4.4	<b>128<sup>th</sup> Avenue</b> (Tunnel 19+700 : 20+050) <sup>1</sup>	350	\$ 125,000	m	\$ 43,750,000
4.5	Retaining & Barrier Walls	800	\$ 900	m2	\$ 720,000

Note: 1 - Tunnel requires track to be constructed on slab using concrete plinths.

I	SUB-TOTAL		\$ 76,470,000
	Contingency	15%	\$ 11,470,500
	TOTAL - STRUCTURES		\$ 87,940,500

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (2012 Base)

No.	Description	<u>Qty</u>		Unit Cost	U of M		<u>Extension</u>
5.0	O STATIONS & FACILITIES (including Park 'n' Ride and Bike stalls)						
5.1	<b>96<sup>th</sup> Avenue</b> Station Park 'n' Ride (exclusive use 500 stalls) Bike Stalls (50)	50	\$ \$ \$	18,000,000 5,000,000 1,000	ls Is ea	<b>\$</b> \$ \$ \$	23,050,000 18,000,000 5,000,000 50,000
5.2	Country Hills Blvd. (at underpass) Station Park 'n' Ride (200 shared parking stalls) <sup>1</sup> Bike Stalls (225)	225	\$ \$	18,000,000	ls ea	\$ \$ \$ \$	18,225,000 18,000,000 - 225,000
5.3	128 <sup>th</sup> Avenue Station Park 'n' Ride (exclusive use 200 stalls) Bike Stalls (120)	120	\$ \$ \$	18,000,000 2,000,000 1,000	ls Is ea	<b>\$</b> \$ \$ \$	20,120,000 18,000,000 2,000,000 120,000
5.4	Stoney Trail Station Park 'n' Ride (100 shared parking stalls) <sup>1</sup> Bike Stalls (50) Terminal Station CT Lunchroom and Washrooms	50	\$ \$ \$	18,000,000 1,000 100,000	Is ea Is	\$ \$ \$ \$ \$	18,150,000 18,000,000 - 50,000 100,000
5.5	TP&C Sub-stations (refer to last page for further details.) 96th Avenue Station Skyview Centre Gate Country Hills Blvd. Station Skyview Ave. 128th Avenue Station Barlow Crescent S. Stoney Trail Station	Location 16+360 17+520 18+550 19+600 20+500 21+750 23+000	\$ \$ \$ \$ \$ \$	1,500,000 1,500,000 1,500,000 1,500,000 1,500,000 1,500,000	ea ea ea ea ea ea	\$ \$ \$ \$ \$ \$ \$ \$	10,500,000 1,500,000 1,500,000 1,500,000 1,500,000 1,500,000 1,500,000

Note: 1 - Shared parking stalls provided by land developer.

SUB-TOTAL		\$ 90,045,000
Contingency	15%	\$ 13,506,750
TOTAL - STATIONS & FACILITIES		\$ 103,551,750

## City of Calgary NORTHEAST LRT FUNCTIONAL PLAN - SADDLETOWNE TO STONEY TRAIL Estimated Capital Cost (Level A) NE LRT Extension: Saddletowne to Stoney Trail Capital Cost (2012 Base)

<u>No.</u>	Description	-	<u>Unit Cost</u>	U of M	<u>Extension</u>
6.0	UTILITIES				
6.1	Deep Utilities - LRT Tracks	\$	3,000,000	ls	\$ 3,000,000
6.1	Shallow Utilities - LRT Tracks	\$	100,000	ls	\$ 100,000

As this area is presently a greenfield site, future utilities should accommodate the future LRT line.

SUB-TOTAL		\$ 3,100,000
Contingency	15%	\$ 465,000
TOTAL - UTILITIES		\$ 3,565,000

City of Calgary NE LRT Extension: Saddletowne to Stoney Trail
Estimated Capital Cost (Level A) Capital Cost (2012 Base)

#### **Traction Power & Communication Sub-Stations**

TP & C sub-stations are located at every LRT station, and located as per the Sturgess layouts. Additional sub-stations preferred spacing is approximately 1 km apart.

	LRT Station	TP&C Sub-station	Distance Between
96th Avenue Station	16260	16360	
Skyview Centre Ga	17520	1160	
Country Hills Station	18610	18550	1030
Skyview Ave.		19600	1050
128th Avenue Station	20710	20500	900
Barlow Crescent S.		21750	1250
Stoney Trail Station <sup>1</sup>	22890	23000	1250

Notes: 1 At Terminal stations employee lunchroom and washrooms are incorporated in TP&C buildings. At Stoney Trail Station it will be across the street from the station, across Barlow Crescent.



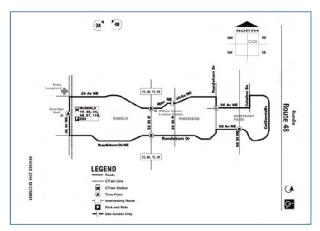
## Appendix H







# Transit works in today's NE communities







#### **Transit connects you**

- Routes are simple and frequent
- Routes are connected citywide
- Streets offer sidewalks and pathways
- Ridership is higher than citywide average

#### **Transit takes you places**

- Lester B. Pearson High School
- Sunridge Shopping Centre
- Peter Lougheed Hospital
- Prairie Winds Park
- Genesis Centre

#### It's your Transit

- Accessible by buses, walking, and cycling
- Heated shelters
- Real-time information
- 70,000 Calgarians use Northeast LRT everyday







# Planning for future NE communities

# Two new LRT stations opening fall 2012:

- Martindale
- Saddletowne



#### Saddletowne LRT Station

# Four future stations are planned:

- 96 Avenue NE
- Country Hills Boulevard
- 128 Avenue NE
- Stoney Trail







# **Functional Study**

## Outcomes of the Northeast LRT Functional Study

- # of LRT Stations (4)
- Cost
- Land requirements
- Track layout: Underpasses and overpasses

- Station placement and access:
  - Pedestrians
  - Cyclists
  - Transit buses
  - Park & Ride opportunities

2007	2009	2011	2012	
Identify LRT stations in land use plan	Council approves land use plans, LRT route and stations	Begin LRT Functional Study	Public Ask Council engagement & for approval on Study	



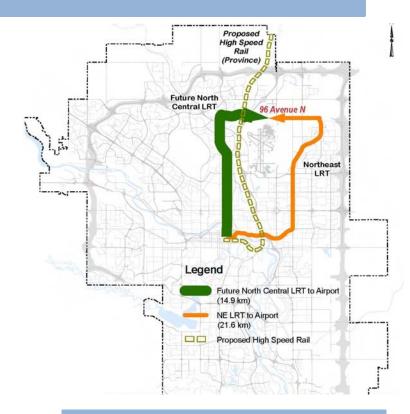




# LRT connection to the airport

#### **Considerations**

- Where are you coming from?
- What's the shortest route?
- How can the North Central and Northeast LRT lines connect?
- How many people travel to and from the airport?
- How many people work in the area?
- Are there other travel options (tram and cable cars)?
- How can the terminal accommodate public transit?



#### Did you know?

75% of airport passengers come from Calgary's south and west areas.







# **Airport Transit Options**

#### **Considerations**

- Convenient connection to YYC and other destinations
- Frequent service

- Trip time
- Luggage friendliness



**Toronto, Canada**"People mover" connection to different terminals at Pearson Airport



Melbourne, Australia
Frequent buses between
downtown and airport



Innsbruck, Austria
Cable-car connection
between downtown and zoo







# Airport Transit Options



Atlanta, USA
Automated "people mover"
connection to different terminals at
Atlanta Airport



Calgary, Canada
Express bus from downtown to Calgary
airport:

- Approx. 1,000 Calgarians travel by bus to the airport daily- #300, #100, #57
- Service goal: ten minutes or better between buses
- Buses can meet the long term travel demands



Vancouver, Canada
Skytrain connection between airport , downtown and
Richmond





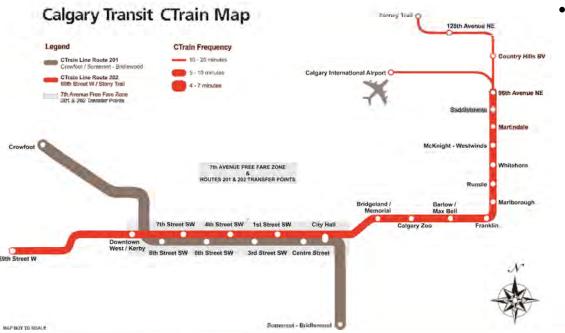


# LRT "Spur" line to airport

#### **Considerations**

• An LRT spur line shares the NE LRT route before branching off to the airport. It represents a direct connection between downtown and the airport.

- Long term, fewer than 500 people are expected to travel to Calgary's airport in the busiest hour of the day
- Calgary's CTrains can carry 600 customers in each trip



#### **Conclusion**

A spur line from downtown to the airport would means less LRT frequency for both the northeast and the airport



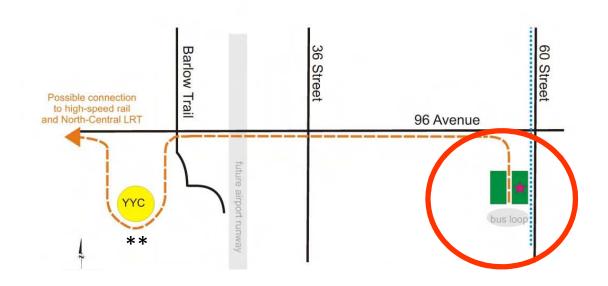




# A separate Transit connection to the airport

# One transfer means better connections:

- Frequent service to all NE communities and the airport
- Use the right transit option for the right use
  - LRT, tram, bus, etc...
- Use the right transit option for both Calgary and YYC
- Connection to future North Central LRT and future high speed rail



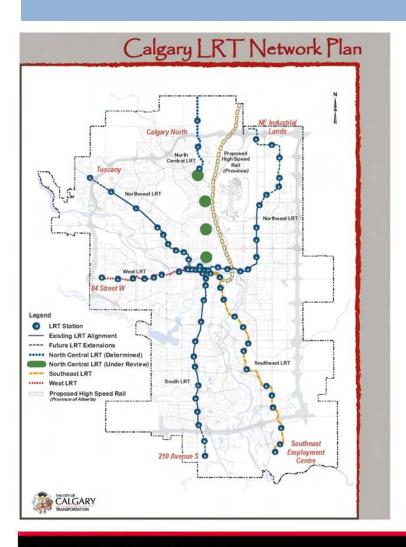
\*\*Travel to the airport terminal is subject to YYC master plan







# The airport connection



- Internationally, public transit options are becoming more specialized
- The right transit option will provide the highest quality of service
- In 2012 and 2013, The City will continue to work with stakeholders:
  - Calgary International Airport as they update their master plan
  - Calgarians
- Work will also continue on the North Central LRT Route Study



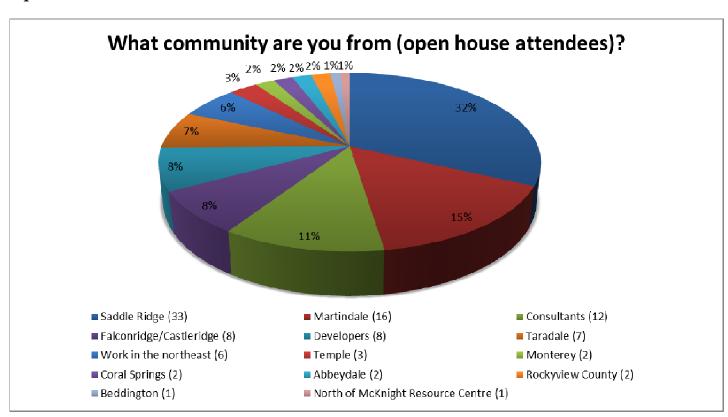


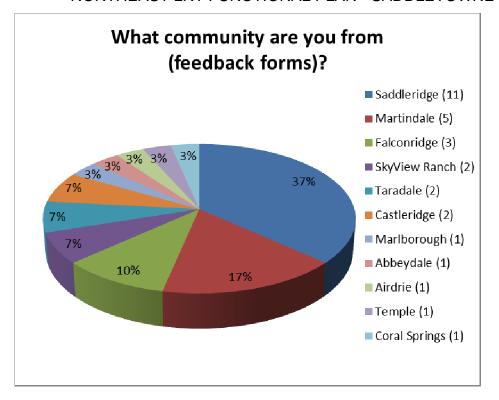


## Northeast Transportation Studies Public Open House Feedback Summary

The City of Calgary held a public open house on April 24, 2012, from 4 - 8 pm at the Genesis Centre of Community Wellness (7556 Falconridge Boulevard NE). Approximately 104 people attended and 29 feedback forms were submitted. Information about four important transportation studies happening in the northeast was presented: 96 Avenue N.E. (Airport Trail) Functional Study, NE Transportation Network Study, Airport Tunnel, and Northeast LRT Extension.

#### Open house attendees

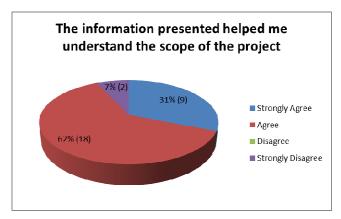




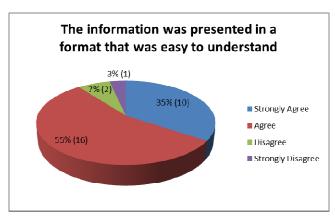
#### Open house/information evaluation

Respondents were pleased with the open house and information provided, giving positive evaluations overall.

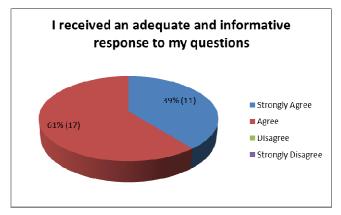
The large majority (93%, 27 responses) of respondents agreed (18 responses) or strongly agreed (9 responses) the information presented helped them understand the scope of the project. The remaining 7% (2 responses) strongly disagreed.



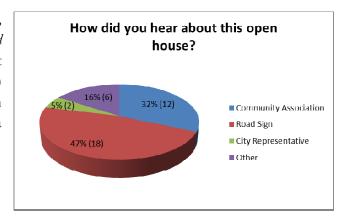
When asked if the information was presented in a format that was easy to understand, again the large majority (90%, 26 responses) of respondents agreed (16 responses) or strongly agreed (10 responses).



When asked if they received adequate and informative responses to their questions, all respondents *agreed* (17 responses) or *strongly agreed* (11 responses) that they did.



When asked how they heard about the open house, 47% (18 responses) of respondents said from *road signs*, 32% (12 responses) of respondents heard about it from their *community association*, 5% (2 responses) from a *City representative* and 16% (6 responses) from *other sources*. Other sources included family and a community Facebook page.



A number of stakeholders said the open house was very good and no improvements were necessary. Improvements recommended by other respondents included making clearer maps (with legends) and distributing handouts.

#### Comments for 96 Avenue N.E. (Airport Trail) Functional Study

Respondents were pleased with the plans for the 96 Avenue N.E. Functional Study (positive assessments were the most frequent, with five respondents commenting).

#### Comments for Northeast Transportation Network Study

The most frequent comment (69%, 11 responses) by respondents for the Northeast Transportation Network Study was that they want Metis Trail to remain a skeletal road (expressway). Respondents were strongly opposed to Metis Trail being reclassified as and arterial road, with increased traffic and congestion cited most frequently as the reasons against the arterial classification. Only one respondent preferred an arterial designation for Metis Trail. Other comments included that there should be more open houses and that the events should be promoted more.

#### **Comments for Airport Tunnel**

Respondents were generally pleased with the plans for the Airport Tunnel, saying that it will be a valuable piece of infrastructure (six comments). Other repeated comments included the request to double the train

tracks (three comments) and to ensure The City of Calgary is planning for the future, not only the present (three comments).

#### Comments for Northeast LRT Extension

The majority of comments were respondents communicating their satisfaction with the Northeast LRT Extension plan. Eight respondents commented that the plan makes sense and the extension will be a positive addition to the area. Two respondents raised noise attenuation concerns and two respondents requested that the northeast LRT lines be extended to the airport.

#### Conclusions

- The large majority of respondents (69%, 11 responses) want Metis Trail to remain a skeletal road (expressway).
- Respondents were generally pleased with the plans for the 96 Avenue N.E. (Airport Trail) Functional Study, Airport Tunnel and Northeast LRT Extension.



## Appendix I





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