

## 2.0 PROJECT DESCRIPTION

### 2.1 Declaration

The Project proponent is the City of Edmonton, Transportation Services, LRT Design and Construction (LRT D and C).

The primary project proponent contact is:

Nat Alampi, B.Sc., P. Eng.  
Program Manager – SE to W LRT  
City of Edmonton, Transportation Services  
Century Place  
#1400, 9803 - 102 A Ave  
Edmonton, AB T5J 3A3  
Business (780) 442-7075  
Fax: (790) 496-2803  
Email: [nat.alampi@edmonton.ca](mailto:nat.alampi@edmonton.ca)

The City's prime consultant for Preliminary Engineering of the Valley Line-Stage 1 (SE to W LRT) is Connected Transit Partnership (CTP), a team comprising a multidisciplinary suite of consulting firms, led by AECOM Ltd. Spencer Environmental Management Services Ltd. is CTP's environmental assessment specialist, responsible for preparation of this EISA.

The primary contact for the Environmental Assessment is:

Lynn Maslen, M.Sc., P. Biol.  
Spencer Environmental Management Services Ltd.  
#402 9925 - 109 Street  
Edmonton, AB T5K 2J8  
Tel: 780.429.2108  
Fax: 780.429.2127  
Email: [lmassen@spencerenvironmental.ab.ca](mailto:lmassen@spencerenvironmental.ab.ca)

This final report represents the findings and conclusions of the environmental assessment consultant and CTP but also incorporates suggestions, comments and information from the project proponent, City reviewers, and members of the public.

In 2015, the City plans to award the project to one bidder, likely a consortium, hereafter referred to as the P3 Contractor, who will become responsible for the design, construction, operation and maintenance of the Valley Line-Stage 1. The P3 Contractor will assume the role of project proponent and will be responsible for obtaining many of the required environmental permits. The specific mitigative measures outlined in this document will inform the P3 procurement phase and the P3 Contractor regarding working in the river valley and many will be incorporated directly into contract documents.

## 2.2 Project Setting

The Project is located in an area of the river valley that is wide, with a significant floodplain. This reach of Edmonton's river valley is highly developed and includes a number of important City parks, a high profile City conservatory, a number of transportation arteries, and a residential neighbourhood. The area also supports a few small recognized natural areas. The north bank and slope of the river valley is occupied by Louise McKinney Riverfront Park (Louise McKinney Park), which mainly comprises manicured parks and gardens and passive recreation infrastructure. The south bank of the NSR is occupied by Henrietta Muir Edwards Park (HME Park), a largely natural park that also has a few manicured elements. These parks are connected by the Cloverdale pedestrian bridge. HME Park is bounded on the south by 98<sup>th</sup> Avenue. To the south of 98<sup>th</sup> Avenue is the Muttart Conservatory, which comprises a number of glass houses as well as landscaped grounds. HME Park and the conservatory are located on a wide river terrace. The residential neighbourhood of Cloverdale is also located on the floodplain, just east of the proposed LRT alignment. The lower slopes of the south valley wall are occupied by Dove Hill and Gallagher Park, which are characterised by extensive lawns and steep slopes. This area also supports the Edmonton Ski Club, a downhill skiing facility. The upper slopes of the valley wall are part of Mill Creek Ravine Park and are characterised by steep, forested slopes. The upper and lower slopes of the south valley wall are separated by Connors Road, a significant arterial roadway linking eastern portions of the city to downtown.

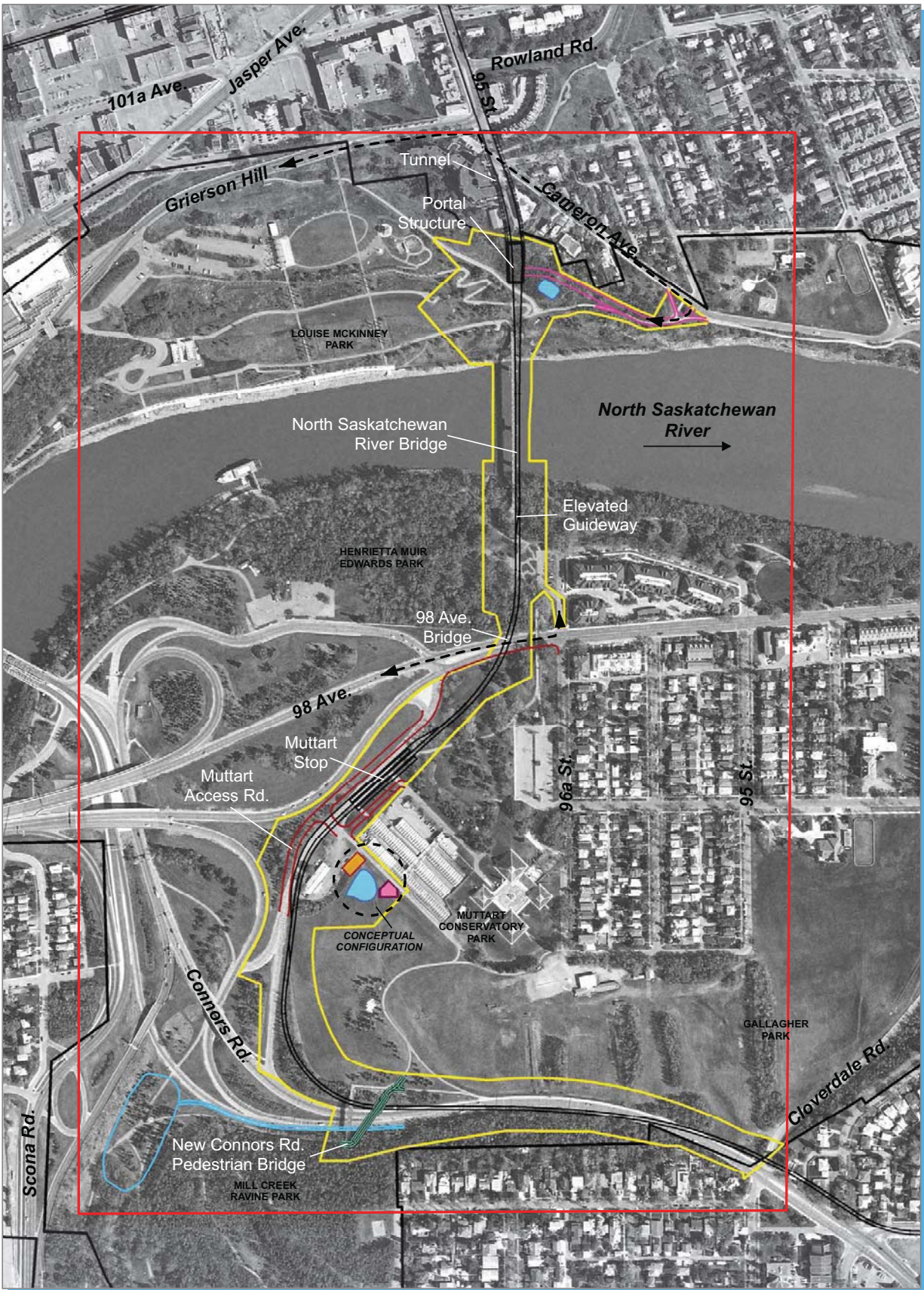
## 2.3 Key Project Components

The proposed LRT line will consist of one continuous, relatively narrow structure through the river valley; however, the infrastructure can be described as having several distinct component parts. In addition, the introduction of LRT infrastructure necessitates adjustment or replacement of some existing infrastructure. These adjustments or replacements are also considered to be part of this project. The following section describes key project infrastructure. Descriptions are derived from a suite of reports and drawings prepared by CTP for the City, during preliminary engineering. The list of materials consulted in preparing these descriptions is provided in Appendix B. In the event of detail discrepancies, the information presented in those materials supercedes that presented here.

Key project components shown in Figure 2.1 are:

- a tunnel through the north river valley,
- a tunnel portal structure situated on the north wall of the NSRV,
- portal structure maintenance/emergency access road,
- North Saskatchewan River bridge, with separate LRT and pedestrian bridge decks spanning the river and HME Park and terminating north of 98<sup>th</sup> Avenue,
- 98<sup>th</sup> Avenue LRT bridge,
- Muttart LRT Stop and Traction Power Substation (TPSS),





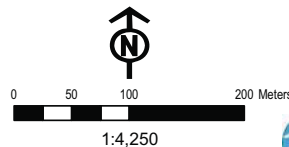
**Legend**

- EISA Study Area
- Project Area
- Proposed LRT
- Construction Access
- Bylaw 7188 Boundary
- Proposed Dry Pond and Vegetated Swale (Conceptual)
- Proposed Rain Garden
- Traction Power Substation (TPSS)
- Muttart Storage Building
- Permanent Portal Access Road (Work-in-Progress/Not Yet Approved)

**Figure 2.1 Project Components**

City of Edmonton LRT Valley Line - Stage 1

Aerial Photograph Date: May 2012  
Date Map Created: 04 July 2013



- existing roadway upgrades/realignments,
- new Connors Road pedestrian bridge,
- LRT track and trains, and
- stormwater management infrastructure.

The above list is limited to major structural elements and does not include temporary structures or construction activities. Information on key construction activities, including demolition of the existing Cloverdale Pedestrian Bridge is provided in Section 2.5.2. The following sections provide some additional project detail and include some information regarding possible construction methods. Descriptions are based on Preliminary Engineering drawings and a large body of reports prepared for the City in late February, March and early April 2013 by CTP. In general, information presented here is based on Reference Design information available as of early April 2013; however, because of the potential for change, dimensions and details provided here should be treated as approximate rather than fixed.

Beyond the key project components, the preliminary engineering phase has also included considerable effort toward developing measures to enhance certain project components in a manner that sensitively integrates the project into the surrounding environment and mitigates social impacts. These include enhancements to new infrastructure to improve river valley aesthetics, pathway adjustments, and landscaping enhancements. These measures are not included here as key components; rather they are described as mitigation measures in later sections of this document, as mitigation was the motivation behind these efforts.

### *2.3.1 Tunnel Through North Valley Wall*

The Valley Line-Stage 1 begins at-grade in the city centre, transitions to an underground line at 102 Avenue and 96<sup>th</sup> Street, and travels through a twin tunnel into the river valley. A small section of the tunnel falls within the Bylaw 7188 boundary (Figure 2.1). The Contractor will be responsible for finalizing tunnel design, tunneling methods, sequencing and schedule. Some of the major tunneling construction activities may be located within the river valley, including material hauling on and off site.

### *2.3.2 North Valley Wall Portal Structure*

The LRT will daylight at a tunnel portal structure to be situated on the upper slope of the NSRV north wall, at the extreme northeast corner of Louise McKinney Park (Figure 2.1). Bridge design, particularly elevation, slope stability considerations, and construction access considerations all influenced the selected portal structure location. Due to the long-standing instability issues in this portion of the north valley wall, the primary objective of portal structure design was to increase the factor of safety of those slopes. The slope stability issue is related to the presence of four horizontal bentonite seams in the bedrock on the north bank.



The portal structure will comprise a covered portion and an outer open top portion and will have one entrance that accommodates two tracks (Figure 2.2). It is thought that the covered portion of the portal structure will be constructed using cut and cover methods rather than sequential excavation or other tunneling methods.

In the vicinity of the portal structure, shear walls, or some other stabilizing structure, will be installed to protect slope stability. If shear walls are used, each wall would likely span approximately 40 m across the valley wall, centered on the alignment. Construction of slope stability structures would likely necessitate a large working area and involve significant earth works, large equipment and significant associated construction traffic. Construction access for the portal structure is designated as from the east, via Cameron Avenue but, as planning proceeds, the need for a secondary access from the west, through Louise McKinney Park, may also be identified. For this reason, this environmental assessment assumes an as yet unidentified secondary access from the west but also assumes that this access will be limited and will not require physical modification. Therefore, secondary access is not shown on figures, is considered to be outside of the study area and is only assessed qualitatively.

### 2.3.3 *Portal Structure Maintenance/Emergency Access Road*

The required emergency and maintenance access for the north river valley LRT components will be provided through construction of a new access road that will connect the intersection of Cameron Avenue and 94<sup>th</sup> Street to the portal structure, upslope and to the west (Figure 2.1). This road will also provide north bank access to the bridge deck. Because of its position along the valley slope, retaining walls running parallel to the road may be required in some localities. These walls may be in the order of 2 to 4 m in retained height, depending on the slope topography and the final position of the road.

### 2.3.4 *North Saskatchewan River Bridge*

Considerations influencing the elevation of the NSR Bridge included the following: the need to maintain navigability on the NSR, the need to protect against slope instability at the north valley wall, and the need for the track to remain elevated to carry the LRT south over 98 Avenue. As a result, the proposed river bridge comprises two contiguous structures: a river bridge and an elevated guideway that continues south across the valley floodplain between the river bridge and 98 Avenue (Figure 2.1). Combined, these two structures span approximately 380 m. The river bridge begins at the north valley wall portal, spans the NSR and terminates on the south river bank. The elevated guideway begins where the bridge terminates, spans HME Park and terminates just north of 98 Avenue. Bridge and guideway lighting will be required. Lighting design will be developed as part of detailed design.

The new bridge over the river will be a single tower, extradosed bridge (Figures 2.3 and 2.4) with two decks: an upper deck that will support LRT infrastructure, and an underslung pedestrian/bicycle deck (walkway). The walkway will replace the Cloverdale pedestrian bridge and has been designed to provide for walking, cycling, and to have designated areas for reflection and river valley viewing. The walkway will be

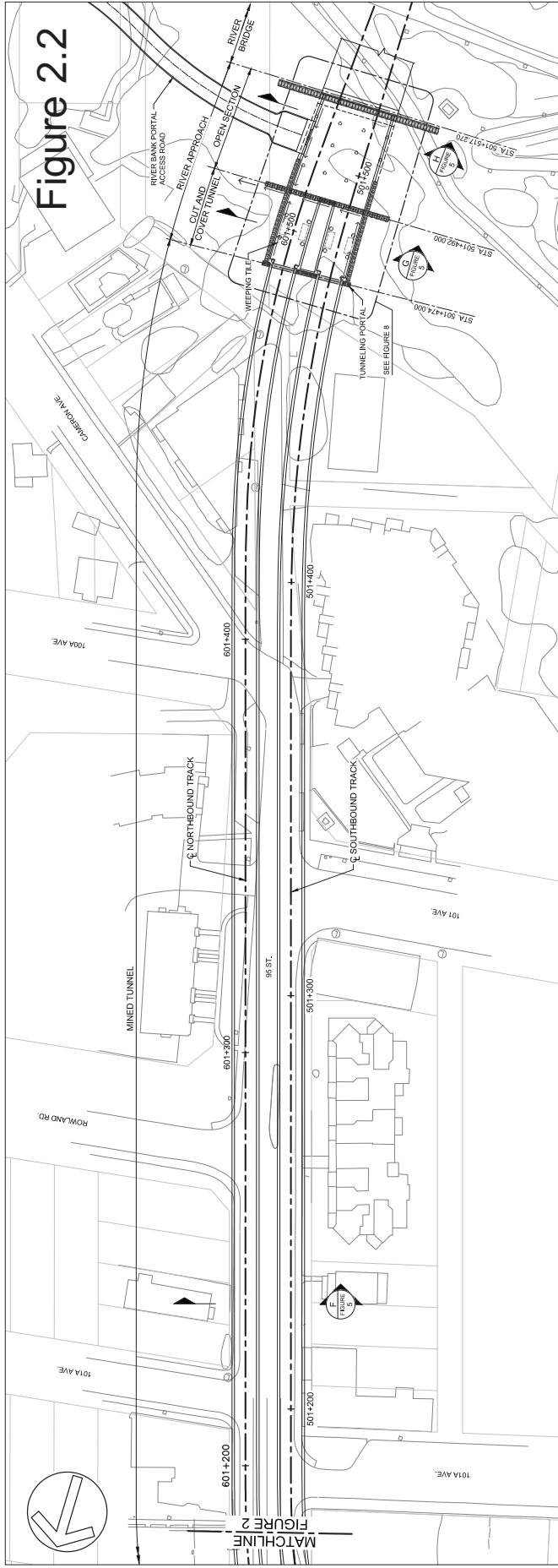
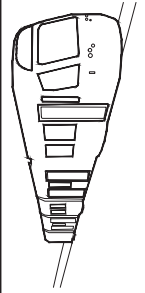
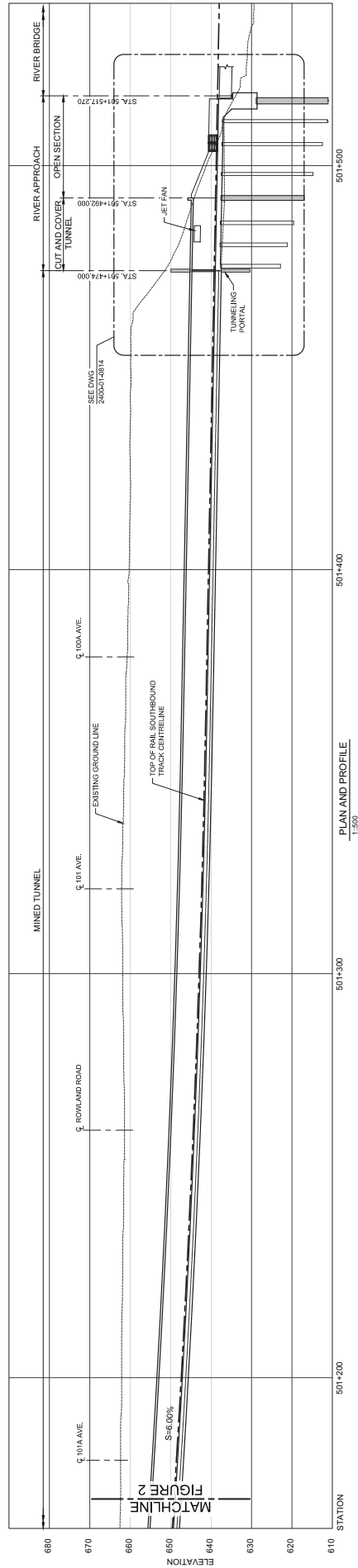


Figure 2.2



SOUTHEAST TO WEST LRT

QUARTERS TUNNEL AND PORTAL  
GENERAL ARRANGEMENT  
PLAN AND PROFILE - SHEET 2 OF 2

Drawn By: A.A.  
Designed By: J.H.  
Checked By: S.A.  
Date Issued: 12-03-2013

FIGURE 3



Figure 2.3  
River Bridge Rendering

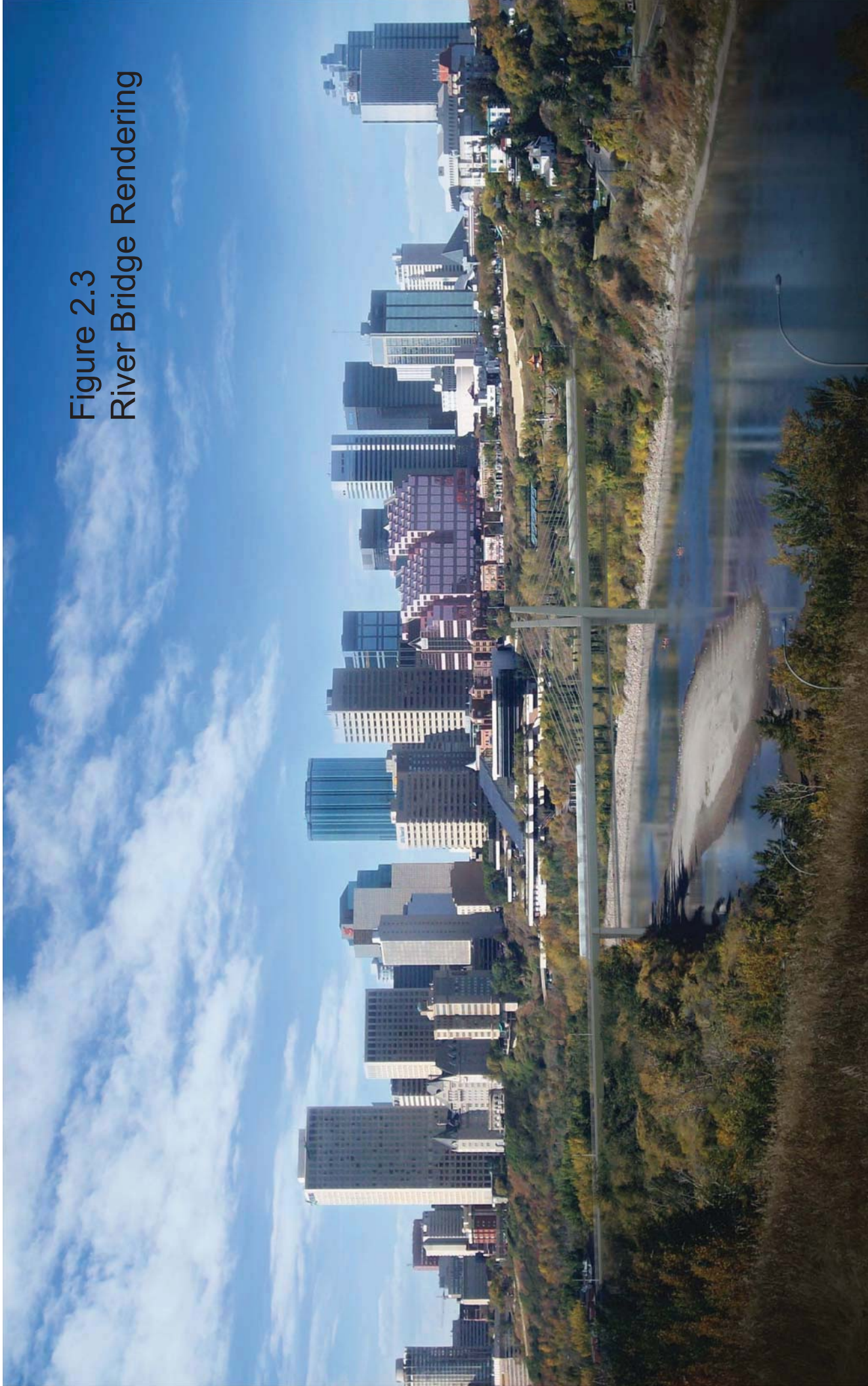
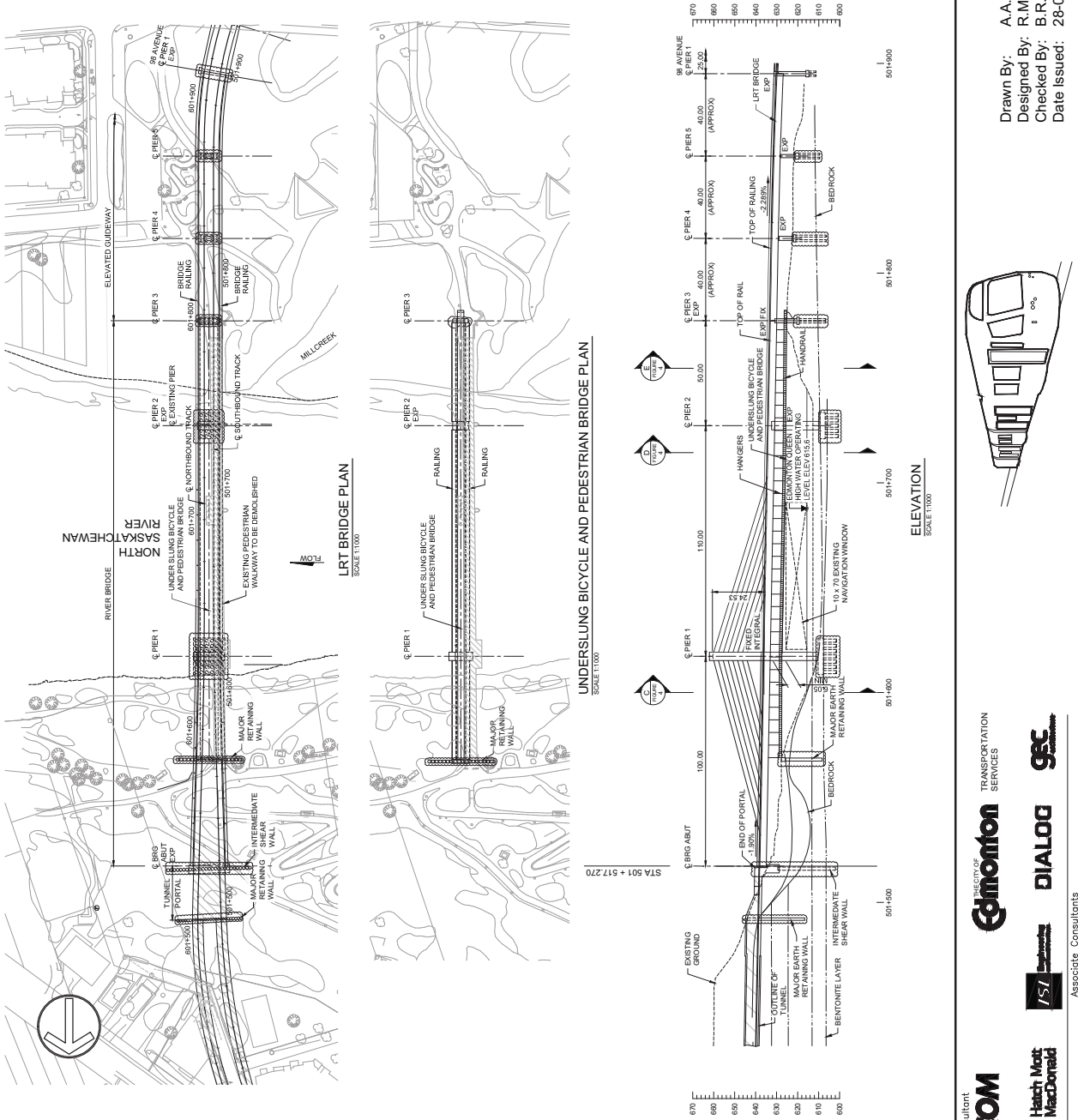
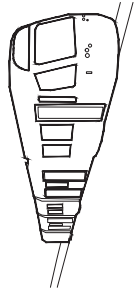


Figure 2.4



**SOUTHEAST TO WEST LRT**  
NORTH SASKATCHEWAN RIVER BRIDGE  
PLAN AND ELEVATION

Drawn By: A.A.  
Designed By: R.M.  
Checked By: B.R.  
Date Issued: 28-02-2013



Prime Consultant  
**AECOM**

TRANSPORTATION SERVICES  
**City of Edmonton**

**Heathcote MacDonald**  
Associate Consultants

**DIALOG**  
gsc



approximately 210 m long, will connect Louise McKinney Park with HME Park, and at each end will terminate at existing grade and connect with the existing pathway. The walkway will have 3.6 m clearance, with a reduction to 3.0 m at pier locations. The deck has been designed to provide separation for various activities: a 3.0 m wide SUP will run along the centre of the deck to support higher speed traffic, such as bicycles. The alignment of trails feeding into either side of the bridge will take into consideration the desire lines for the bicycle traffic. It will be flanked on either side by approximately 2.0 m of additional space, providing room for viewing and/or resting along the length of the bridge. Benches will be provided in this space and benches and viewing areas will have unobstructed views of the surrounding area.

As currently conceived the river bridge has three spans and requires two piers in the river. The length of the north span avoids the need for pier construction on the most unstable portion of the north bank, by tying into the portal structure and subterranean shear walls (or equivalents) for stabilization. Current design shows the elevated guideway as having three spans through HME Park.

#### *Navigational Clearance and Design Flood Levels*

River bridge height was driven, among other considerations, by the need to provide adequate clearance below the pedestrian deck for watercraft navigation. The Edmonton Queen Riverboat, the largest watercraft that uses this stretch of the river, served as the design vessel. A 10 m high navigation window at the normal high water level of 615.60 m (equivalent to flow rates of 1000 m<sup>3</sup>/s) was deemed to be sufficient for the Edmonton Queen Riverboat. This is slightly greater than the clearance provided by the existing bridge.

With 10 m clearance above normal high water level, the bridge is well buffered against flood events, and will be able to withstand water volumes well in excess of those associated with the 1:100 year flood event.

#### **2.3.5 98<sup>th</sup> Avenue Bridge**

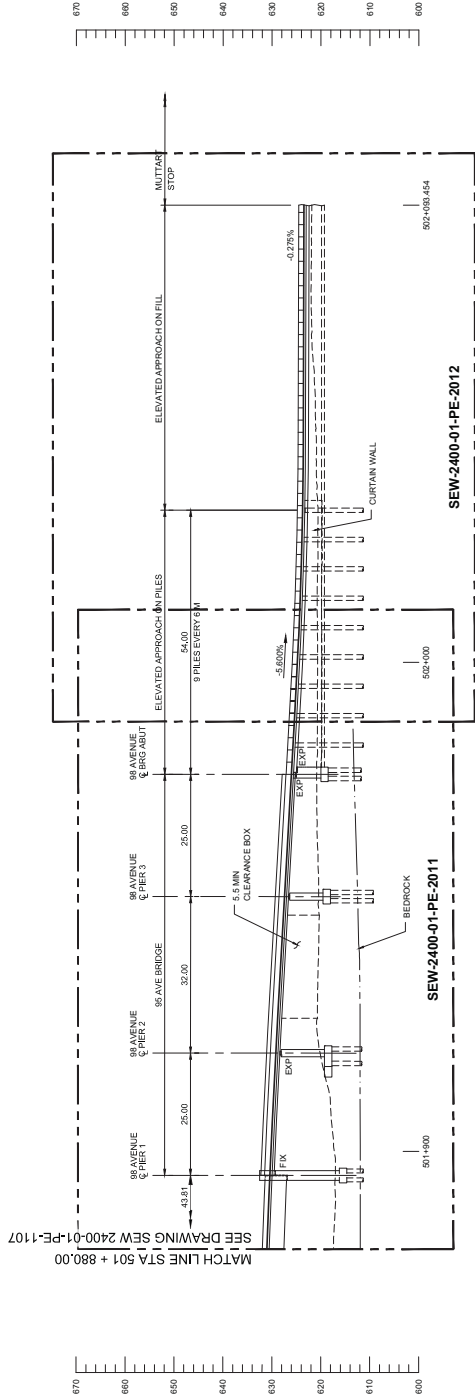
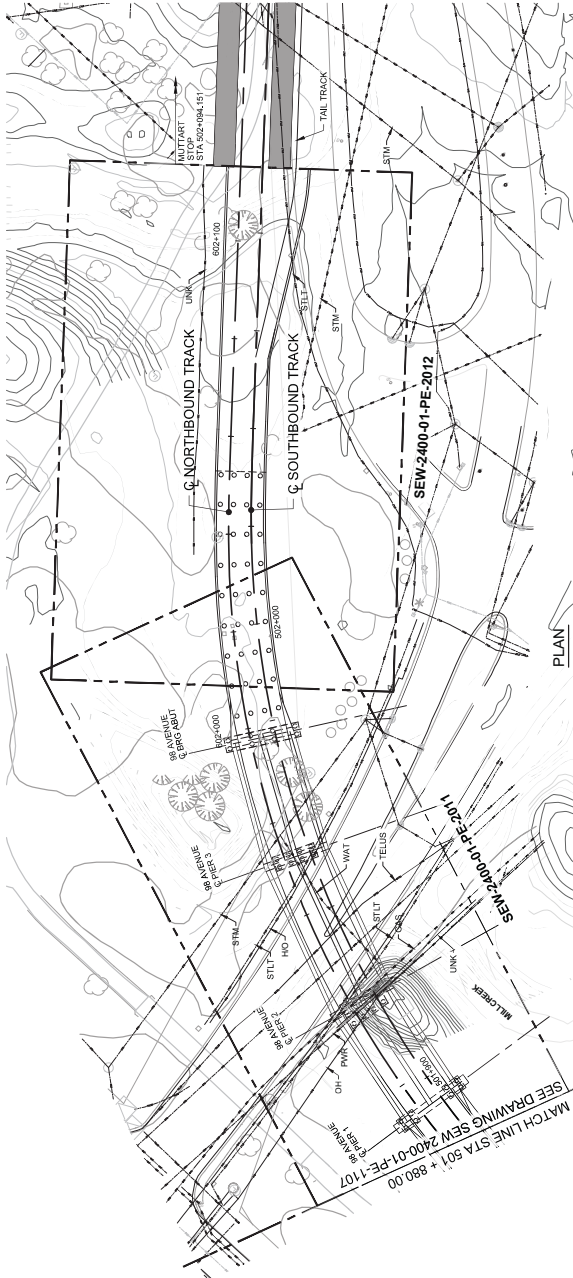
The 98<sup>th</sup> Avenue crossing structure (Figures 2.1), will be contiguous with the river bridge elevated guideway component and will provide a minimum 5.5 m clearance over 98<sup>th</sup> Avenue matching the existing clearance at the 98<sup>th</sup> Avenue pedestrian bridge located to the east. The bridge is currently shown as having three spans (Figure 2.5).

#### **2.3.6 Muttart Stop and TPSS**

Muttart Stop and the northern approach are located on a steep grade. From the 98<sup>th</sup> Avenue bridge the LRT line will descend to Muttart Stop on a pile-supported elevated approach, which will then descend to a fill-supported approach and then the stop (Figure 2.1). As currently conceived, the stop and approach require five retaining walls (RW-01 through RW-05), ranging in length from 230 to 120 m and in height from 6 to 2.5 m (Figure 2.6). Final wall length and height will be governed by final alignment/ROW design.

# Figure 2.5

- LEGEND:
- PWR - POWER LINE
  - WAT - WATER LINE
  - STLT - STREET LIGHT CABLE
  - STM - STORM LINE
  - OH - OVERHEAD LINE
  - - POWER POLE
  - GAS - GAS LINE
  - TELLUS - TELLUS LINE
  - UNK - UNKNOWN LINE



NOTES:

PILE	ESTIMATED PILE LENGTHS
PIER 1	15 m
PIER 2	18 m
PIER 3	18 m
ABUTMENT	18 m
APPROACH	8 TO 12 m



SE to W LRT  
MILL WOODS TO LEWIS FARMS

**DIALOG**  
98 AVENUE BRIDGE  
GENERAL ARRANGEMENT

**Hatch Mott MacDonald**  
PRELIMINARY ENGINEERING  
DRAWINGS  
NOT FOR CONSTRUCTION

**AECOM**  
TRANSPORTATION SERVICES  
Gannett Fleming

consultant reviewed by  
S. ALEXANDER

consultant job no.  
60222337

**AECOM**  
consultant  
drawn by  
A. ANAND  
checked by  
N. SAN PEDRO

no.	description	date	checked

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Muttart Stop was designed to be simple and visually unobtrusive, to reflect the character of the neighbourhood in which it is located and to be compatible in design with the remainder of the stops along Valley Line-Stage 1. Muttart Stop will have a standard side platform layout (Figure 2.7). The shelter will have a curved wood and metal canopy, a design that was selected to recall the river and surrounding natural setting. Sustainability design features include LED platform light fixtures, recycling containers located on platforms, and a bike rack near the platform to encourage bicycling. The project does not include Park 'n Ride facilities at Muttart Stop and there will no bus bays in the vicinity of the stop.

A railroad siding (storage track) will be built parallel to the northwest side of the Muttart Stop for the purpose of storing trains in the event of a breakdown in the valley. It will not be used for long-term storage, but may be used for staging for major events.

Traction power substations (TPSS) will serve to convert and distribute the energy needed to power LRT trains. Eleven substations will be required along the Valley Line-Stage 1, only one of which, the Muttart TPSS, is located in the study area. While a TPSS will also be constructed in association with the portal structure, it will be located outside of the Bylaw 7188 boundaries, and therefore is outside of the scope of this EISA.

The Muttart TPSS will be located to the southwest of the Muttart Stop, in the vicinity of an existing building currently used by the Muttart Conservatory for storage (Figure 2.1). The TPSS will be housed in a rectangular utility complex that will also contain three utility buildings that house electrical, communications and signals (Figure 2.8). The majority of substations along the Valley Line-Stage 1 will not be roofed, but because of its relatively prominent location, the Muttart TPSS will include a roof to reduce visual impacts. Construction of the utility complex requires demolition of the existing Muttart Conservatory storage building. A replacement storage building will be constructed to the southeast, closer to the non-public greenhouses.

### *2.3.7 Existing Roadway Upgrades/Realignments*

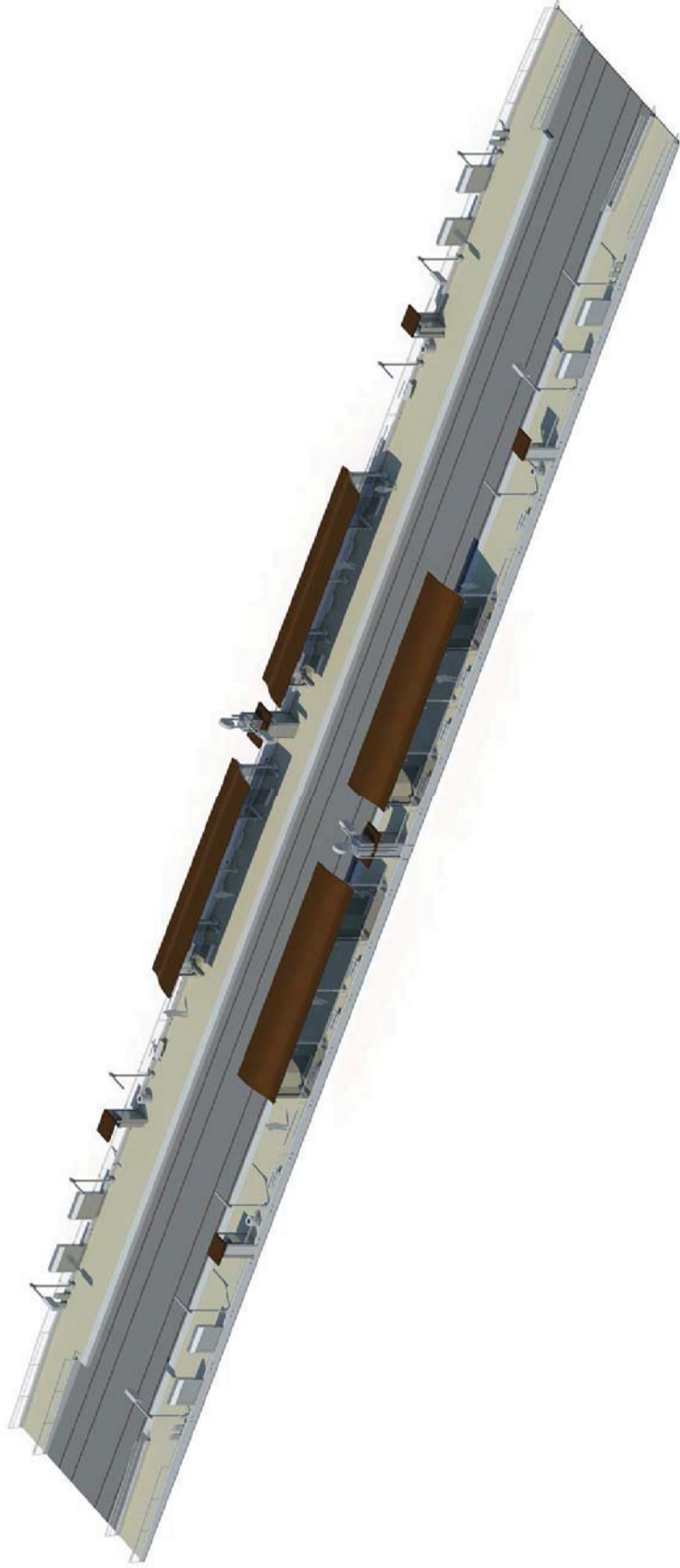
As currently conceived, the project will necessitate the realignment of the following roadways, and Shared Use Pathways (SUP):

- Connors Road, from top of the valley to Muttart Conservatory access road.
- Muttart Conservatory access road, between 98<sup>th</sup> Avenue and Connors Road.
- Existing SUP currently adjacent to the north side of Connors Road.

### *2.3.8 Realignment of Connors Road*

The LRT track will climb out of the river valley on Connors Hill, parallel to Connors Road. Accommodating a new rail corridor parallel to that road requires additional right-of-way (ROW) width. Providing for extra ROW is a challenge considering the position of the existing ROW on the steep slopes of the south valley wall. At time of writing

Figure 2.7



**SIDE PLATFORM OVERALL VIEW**

Prime Consultant  
**AECOM**

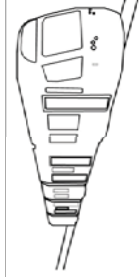
Hatch Mott  
MacDonald

**ISL**  
Infrastructure  
Services Ltd.

THE CITY OF  
**Edmonton**  
TRANSPORTATION  
SERVICES

**DIALOG**

**gsc**  
Group

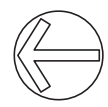
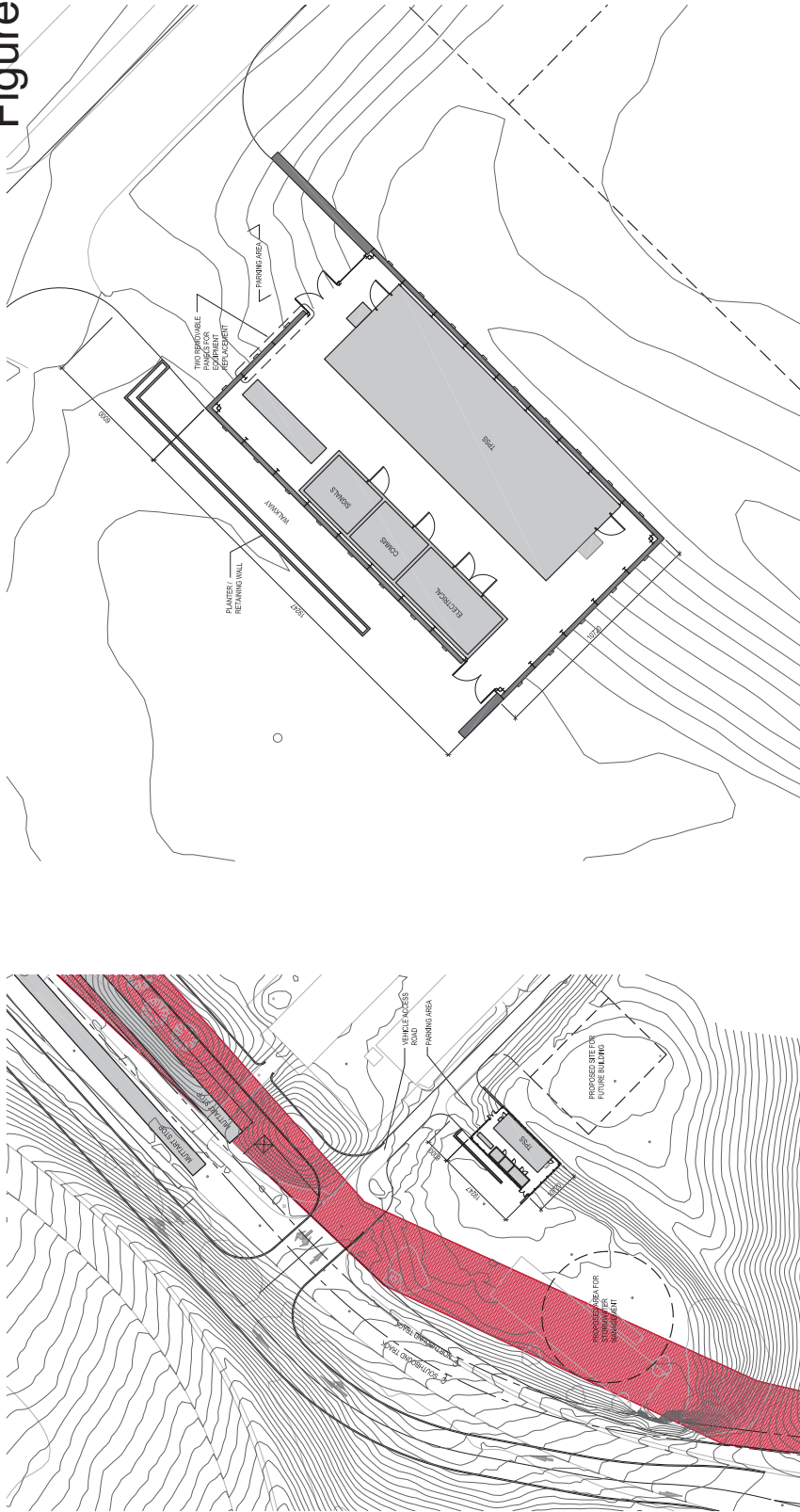


**SOUTHEAST TO WEST LRT**

Drawn By: TB  
Designed By: AECOM  
Checked By: KW  
Date Issued: 22-06-2012

FIGURE 1.1

Figure 2.8



SE to W LRT MILL WOODS TO LEWIS FARMS drawing no. SE/W-1500-01-PE-A103		ARCHITECTURE MUTTART TPSS SITE PLAN		PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION		TRANSPORTATION SERVICES job no. 6022237		CONSULTANT P. OSBORNE		CONSULTANT P. OSBORNE	
26-03-13 P.O. FINAL PRELIMINARY ENGINEERING		07-12-12 S.M./J.D. ISSUED FOR 90% REVIEW		28-03-13 designed by M. JANDRY		28-03-13 checked by P. OSBORNE		28-03-13 date		28-03-13 date	
issue date		date		date		date		date		date	
description		description		description		description		description		description	
revisions		revisions		revisions		revisions		revisions		revisions	



(early April), several options were under development by the design team but regardless of the final option selected, the widened ROW would contain: Connors Road (possibly realigned but remaining as three lanes), the LRT track, and a new 3.0 m wide Shared Use Path (SUP) (Figure 2.6). The SUP will parallel the LRT track but may have variable separation, as required. One of the options under consideration (the one assessed here), involves shifting Connors Road to the south and cutting into the forested slope on the upper valley wall.

With this option, the total new ROW width is approximately 30m and, in certain locales, the SUP would require minor cutting into the existing slope north of Connors Road. Two other options under consideration are: 1) extend the ROW less to the south and one entirely to the north. All of these involve reduced cuts into the south hill and increased building out over the slope north of Connors Road. This EISA assesses the southernmost alignment but also considers in a less detailed way, the concept of the alignment furthest to the north. The project area shown in Figure 2.1 includes the approximate working area required for a shift either south or north and therefore represents an overestimation of the area of disturbance associated with any one final selection.

The option to create new ROW to the south requires installation of four retaining walls, two on each side of the widened ROW (RW-06 through RW-09 in Figure 2.6). The walls would begin in the vicinity of the existing pedestrian bridge and terminate near the top of the hill. As currently conceived, retaining wall length would range from 100m to 250 m and height would range from 2.5 m to 8 m. Final wall length and height will be governed by final alignment/ROW design.

Retaining wall type will be determined during detailed design. Pile walls have been identified during preliminary design as one suitable option. Regardless of type, all walls must be drained and are expected to comprise three layers: the structural wall (providing the slope retention), a thin drainage infrastructure layer and a veneer wall or façade (the aesthetic component). Veneer walls will also be selected by the P3 proponent, following specifications established during preliminary design by the City. The need for retaining walls increases the width of the required temporary working area, as lands behind (upslope of) the walls must be disturbed for wall construction. This probable working area is reflected in the project area shown in Figure 2.1. Retaining wall construction is expected to be a protracted process, owing to the size of the walls and the staged approach required for construction.

#### *2.3.8.1 Realignment of Muttart Conservatory Access Road*

To accommodate Muttart Stop and the south approach rail corridor, the existing Muttart access road must be relocated to the west of its current alignment, at a distance to be determined but to a maximum of approximately 20 m (Figure 2.1). As currently conceived, realignment will be required between 98<sup>th</sup> Avenue and Connors Road and the existing tie-ins would remain as they are.

### 2.3.8.2 Sidewalk Additions

The following roadways will have sidewalks added to them to improve pedestrian access in the area:

- Addition of sidewalks on each side of 98<sup>th</sup> Avenue west of 96A Street to the Muttart Conservatory access road.
- Addition of various sidewalks and shared use pathways around Muttart Stop, primarily north of 98<sup>th</sup> Avenue and west of 96A Street.

### 2.3.9 Connors Road Pedestrian Bridge

The additional ROW width required by the LRT track along Connors Road necessitates the removal and replacement of the existing pedestrian bridge situated near the bottom of Connors Road. The proposed superstructure is a shallow steel box girder (Figures 2.9 to 2.10). A 1400 mm picket-style railing is proposed. A 1500 mm canopy could be installed above the LRT alignment on either side of the bridge to protect the catenary system.

As currently conceived, rather than following the alignment of the existing bridge, the new bridge will be skewed to the east so that it crosses Connors Road on a north east diagonal. This is intended to provide for the required clearance while allowing the bridge to connect on the south to the existing recreational network in the same vicinity as the existing bridge connection, and reduce the disturbance area. Bridge construction is expected to be completed within one construction season and to be coordinated with other construction activities on Connors Hill. Grades on the bridge are 10% on the south and 3% on the north. The south bridge approach has grades up to 12% and the north approach up to 8%.

### 2.3.10 LRT Track and Trains

#### Track

As described above, within the river valley, the LRT corridor has both elevated and at-grade sections. The at-grade track corridor width will be no greater than 10 m. Direct fixation tracks will be used for the LRT within the river valley, rather than embedded tracks. Direct fixation tracks are appropriate where tracks will be supported on grade-separated structures, where there are vertical clearance requirements or where steep slopes are present. All of these conditions are found within the river valley alignment. An additional advantage of this track style, with respect to the park setting, is that it requires less maintenance than other track types.

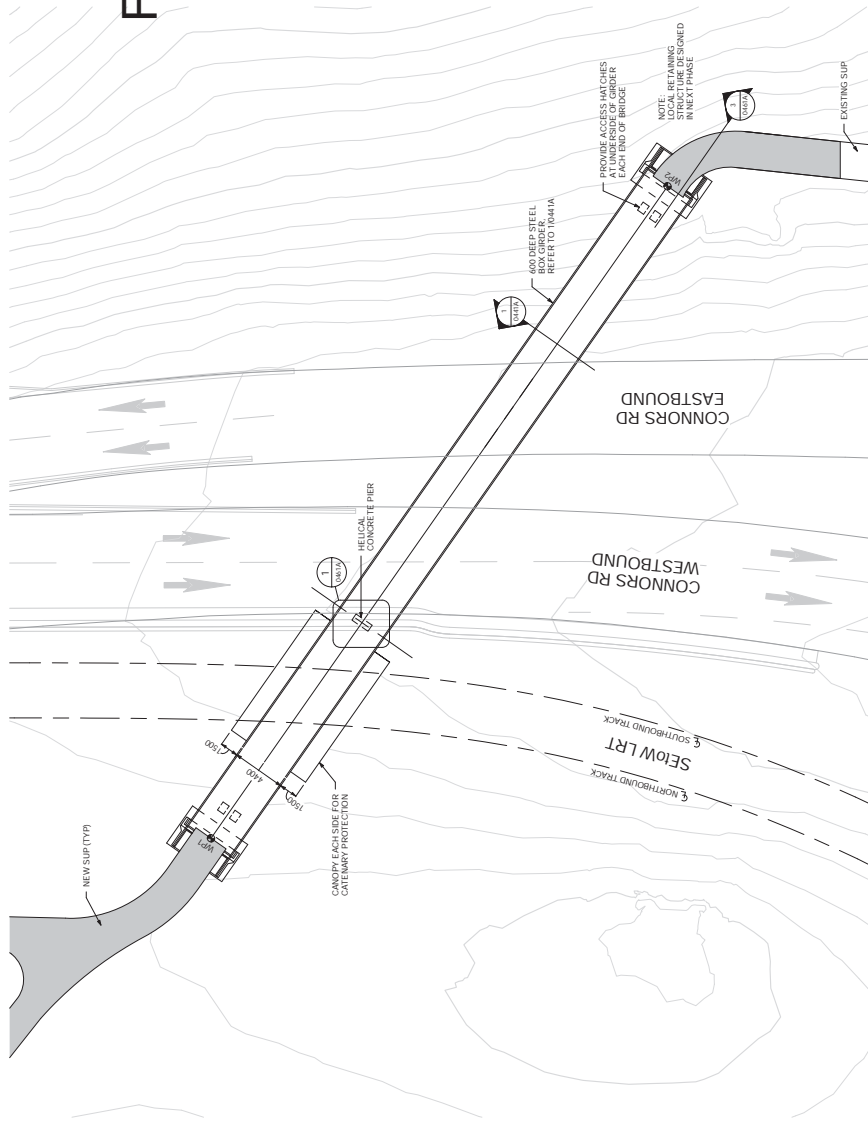
Figure 2.9  
Connors Pedestrian Bridge Rendering







Figure 2.10



NOTE:  
 1. WPI LOCATION OF WEARING SURFACE  
 2. WPI LOCATION OF CURB AND GUTTER  
 3. BEARING OF NORTH ABUTMENT  
 4. BEARING OF HELICAL PIER  
 5. BEARING OF SOUTH ABUTMENT

1 OVERALL PLAN (STEEL OPTION)

2 ELEVATION (STEEL OPTION)

	NORTHING	EASTING	ELEVATION
WPI	59286.6771	38576.675	641.687
WPI2	59345.63326	3479.392	643.953

no.	description	date	checked

**DIALOG** CONSULTANT

11 bar scale 0 2000 4000 6000 8000 10000mm

drawn by A. KEMP  
 checked by A. NELSON  
 designed by S. PROZDANAK  
 date 28-03-13

permit

consultant job no. 078580000

consultant reviewed by G. JOSE

**AECOM** Prime Consultant

**Gannont** TRANSPORTATION SERVICES

prime consultant job no. 6622337

**Hatch Mott MacDonald**

PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

prime consultant reviewed by G. MENZIES

**gpc** ARCHITECTURE

**DIALOG** ENGINEERING

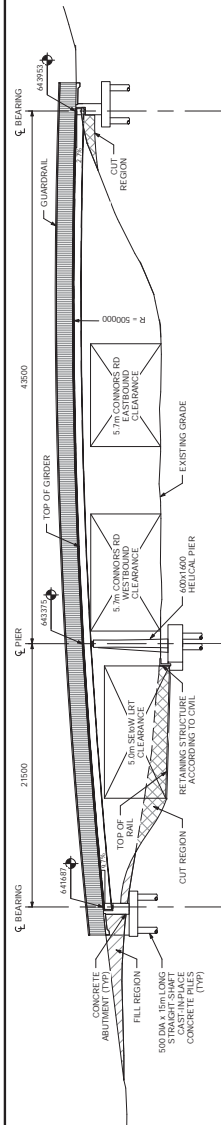
**ASL** Engineering Architecture

drawing title: CONNORS HILL PEDESTRIAN BRIDGE OVERALL PLAN AND PROFILE - STEEL OPTION

SE to W LRT  
 MILL WOODS TO LEWIS FARMS

drawing no. SEW-2400-01-PE-0403A

REV No 072



1 OVERALL PLAN (STEEL OPTION)

2 ELEVATION (STEEL OPTION)

	NORTHING	EASTING	ELEVATION
WPI	59286.6771	38576.675	641.687
WPI2	59345.63326	3479.392	643.953

no.	description	date	checked

**DIALOG** CONSULTANT

11 bar scale 0 2000 4000 6000 8000 10000mm

drawn by A. KEMP  
 checked by A. NELSON  
 designed by S. PROZDANAK  
 date 28-03-13

permit

consultant job no. 078580000

consultant reviewed by G. JOSE

**AECOM** Prime Consultant

**Gannont** TRANSPORTATION SERVICES

prime consultant job no. 6622337

**Hatch Mott MacDonald**

PRELIMINARY ENGINEERING DRAWINGS NOT FOR CONSTRUCTION

prime consultant reviewed by G. MENZIES

**gpc** ARCHITECTURE

**DIALOG** ENGINEERING

**ASL** Engineering Architecture

drawing title: CONNORS HILL PEDESTRIAN BRIDGE OVERALL PLAN AND PROFILE - STEEL OPTION

SE to W LRT  
 MILL WOODS TO LEWIS FARMS

drawing no. SEW-2400-01-PE-0403A

REV No 072

### Trains

The Valley Line-Stage 1 LRT will differ in design and concept from Edmonton's existing LRT line. The existing line features relatively high speed trains and widely spaced stations. The high floor of the existing trains necessitates elevated platforms for access. The Valley Line, by contrast, will feature low-floor, relatively slow moving trains, and closely-spaced stops rather than stations. Because the cars of low-floor LRT trains are low to the ground, they can be accessed via simple stops, which can be as little as a raised sidewalk. This greatly reduces the amount of infrastructure needed to provide access to the trains, and reduces the capital costs of stops, thus facilitating the development of a larger number of relatively closely spaced stops. While the traditional high-floor LRT promotes so-called "suburban" style development, as it can transport people quickly across large distances, the low floor style LRT is intended to promote "urban" development: closely-spaced stops are intended to foster walkable neighbourhoods and densification within developed areas of the city. Additional advantages of the low-floor trains include easier access by riders with reduced mobility, and opportunity for better integration into mature neighbourhoods.

Trains will run through the river valley in intervals of approximately 5 minutes during peak hours and 10-15 minutes during off-peak (evening and weekend) periods, in each direction. Trains are expected to travel up to 60 km/h.

#### *2.3.11 Stormwater Management Infrastructure*

Stormwater management for the project has been developed to the predesign stage only, and must be reviewed and advanced in concert with detailed design of other project components. The stormwater management goal for the Valley Line-Stage 1 is to provide a high level of stormwater management servicing to the new LRT system such that potential impacts of stormwater runoff on LRT operation are minimized, and the level of service currently being provided by existing systems is maintained. Stormwater management predesigns recommended for the river valley LRT infrastructure, as described below, all seek to maximize use of existing infrastructure. All predesigns are compatible with the Edmonton Drainage Services operating principles, which include maximizing environmental protection. Stormwater predesigns have been developed for the following river valley components of the project: north valley wall portal structure, river bridge, Muttart Stop, Connors Hill and rail corridor. Some designs are LID and all components incorporate Best Management Practices such as vegetated swales with checkdams, or end of pipe treatment. At this point in design, individual footprints of the SWM detention facilities have not been identified, rather the design event is noted in the text and the features are shown conceptually sized and located on figures. On this basis, the design team expects that the features can be accommodated within the project area delineated on Figure 2.2. Design for all drainage components will be advanced in future, in tandem with alignment design.

#### North Valley Wall Portal

Drainage through the LRT portal on the north valley wall is expected to be minimal, but small quantities of snow melt from vehicles, groundwater seepage, and portal/tunnel

wash water will collect in the portal and require draining. This water will be routed to a rain garden to be located on City property a short distance from the portal and bridge structural elements to ensure protection of those elements from possible saturated soils. Rain gardens, usually small, are landscaped detention facilities with engineered soils that are used to improve stormwater quality, reduce runoff volumes and generally facilitate infiltration of cleaned water. Rain gardens are sited ideally close to the source of the runoff and serve to slow the stormwater as it travels downhill, giving the stormwater more time to infiltrate and less opportunity to gain momentum and erosive power.

The Reference Design locates the rain garden as shown in Figure 2.1. Any water in excess of the capacity of the rain garden will flow down the valley slopes to the river, much as surface flow does now. Total volumes are expected to be minimal.

#### River Bridge

The LRT bridge deck will have deck drains to the river. Bridge deck runoff is likely to contain sediment and may contain small amounts of contaminants carried by trains. Recognizing that Fisheries and Oceans Canada and Alberta Environment have identified discharge of deleterious substances to the river as unacceptable, the deck drains will be fitted with grit traps to filter out sediments. This system can accommodate runoff up to the 1:5 year event. During major events, the bridge will shed excess runoff directly into the river. The pedestrian bridge will generate lower volumes of water owing to its position under the LRT deck and will not have deck drains.

#### Muttart Stop and TPSS

Muttart Stop is at a low point on the alignment, and all runoff on the approach of the elevated guideway and the lower part of Connor's Hill will drain to this area. In addition, the Muttart Stop introduces a larger impermeable area that will generate runoff. Drainage design for the Muttart Stop and approaches has thus been driven by the need to prevent ponding along the top of rail in this low area and on sloped track, where maintaining maximum traction is crucial for train operation. Design objectives included providing treatment for stormwater before it is released into the City's storm sewer system.

The Reference Design indicates that runoff in this catchment will be captured and conveyed along the alignment, into a swale located near the stop, and discharged into a new stormwater management facility (a rain garden) to be located in the vicinity of the Muttart Stop (Figure 2.1). The facility will be designed to accommodate flows from the 1:5 year event and will enable percolation into the subgrade. Runoff in excess of the 1:5 year event will be redirected via overland flow into adjacent parkland to the south and southwest of the alignment, mimicking existing flows. This system is expected to limit the top-of rail track ponding to a maximum of 100 mm, thus providing acceptable service.

#### LRT Track at Connors Hill

The rail corridor will increase the amount of impermeable surface on the hill. In addition, major drainage from the top of bank in the Strathearn Neighbourhood is currently directed down Cloverdale Road. Construction of tracks through the intersection



of Cloverdale and Connors roads has potential to create a barrier to this flow route, and to redirect water along the tracks down Connors Road. This would represent a significant increase in the amount of runoff directed down Connors Road and would require management.

The proposed drainage system for this area will redirect drainage to the outer curbs of the track right-of-way. Drainage inlets designed to accommodate a 1:5 year storm event will prevent ponding and the track corridor will drain to underground pipe. Runoff from this section of the track and roadway will be directed into pipes and then into the stormwater management facility near the Muttart Stop. Assuming that the new road ROW will be sloped to drain to the south, the 1:100 year event in this area will be directed down Connors Hill, into a new swale located along the south edge of the road, on the lower hill only, and into a new stormwater management facility (likely a dry pond) currently conceptually located at the base of Connors Hill (Figure 2.1). The pond would drain to the existing City storm sewer system and would have check dams to provide retention (and some treatment) to avoid overwhelming the existing system and would release at a controlled rate. The pond would receive flows during all events and would thus be designed to have a low flow channel that would be permanently wet/moist. The design, location and size of the pond will be finalized in the next design phase. Pond size is dependent on final track design and whether or not that will result in diversion of water from Cloverdale Road, as described above. If that runoff is not diverted, the pond would be significantly smaller than the one shown in Figure 2.1. If the final ROW cross section dictates drainage across the ROW to the north, the new pond would be located adjacent to and merging with the Muttart Stop rain garden. Runoff would be directed there by way of a swale along the north side of Connors Road or an upgraded pipe installed underneath Connors Road.

### 2.3.12 *Utility Installation and Relocation*

Several utilities existing in the study area must remain in operation during and after construction and will, therefore, require protection in place or relocation. Wherever feasible, utility relocation will be undertaken by the owner/operator prior to the P3 contract coming into effect. Utility owners will be responsible for any Bylaw 7188 environmental review associated with these relocations.

The LRT project will require installation of the following new buried and above-ground utilities (excluding drainage).

- Communications
  - Phone lines
  - Fibre optic lines
  - Telephone/cable TV line
  
- Electrical
  - Power line
  - Street light cable
  - Power duct

- Traffic light transit pole
- Light standard/transit pole/traffic light
- Traffic signals
  - Underground traffic signal conduits
  - Signal fixtures
  - Above ground detector
  - Traffic signal
  - Traffic signal splice box

Design details are unavailable at this time.

### 2.3.13 *Built-In Mitigation Measures*

Adding LRT within the context of existing natural and developed parkland in the heart of the City will affect natural systems, and recreational and cultural facilities. Early planning recognized that these impacts will require mitigation, and several “built-in” mitigation works have been incorporated into project designs. These include:

- Relocation or restoration of the Rose Garden in Louise McKinney Park.
- Relocation of the Centennial Garden, a project initiated by the Edmonton Horticultural Society and located in HME Park.
- Plans to relocate the entrance sign to the Muttart Conservatory.
- Relocation or replacement of affected garden beds in the Muttart Conservatory grounds.
- Plans for a new entrance plaza and pedestrian access from the Muttart Stop to the Muttart Conservatory.
- Planned relocation of lift(s) at the Edmonton Ski Club, affected by the nearby LRT ROW. (To be undertaken by the ski club but funded by this Project).
- Recreational pathway realignments to ensure that the project does not result in any long-term losses to the river valley pathway network.
- Retaining wall treatment requirements.

Most of these measures are described in more detail in later sections of this report. Following is additional information currently available for pathway realignments.

The City recognizes that construction of the LRT will cause considerable disruption to the recreational pathway system (SUPs and other pathway types) in the project area. Temporary pathway closures and realignments will be necessary in some areas and LRT D and C is committed to ensuring that the project will not result in any permanent losses of pathway connectivity. For example:

- The pathway that runs northwest of the Muttart greenhouses and through the Muttart grounds conflicts with the LRT alignment and will require some shifting. Relocation details are in preparation and will be finalized during detailed design.

- While construction of the river bridge will disrupt the existing connection across the river, the new LRT river bridge will include a pedestrian/bicycle component that will provide the same services as the existing bridge. The existing pedestrian bridge over 98<sup>th</sup> Avenue will remain in place.
- Construction of the tunnel portal on the north valley wall will likely necessitate some temporary realignment of the pathways in Louise McKinney Park. Realignment planning is underway.

LRT D and C commits to ensuring that all existing pathways will be re-established or realigned such that the new system maintains or exceeds current service. Additional information on pathway enhancements planned as part of this project is provided in Section 6.2.3.11.

#### 2.3.14 *Edmonton Design Committee Review Process*

Project designs have been subject to review by the Edmonton Design Committee (EDC), a Committee to Council that advises on projects within the river valley, major entrance corridors and all city funded projects, working towards the betterment of the design of these projects and City of Edmonton as a whole. The EDC is typically involved in the Development Permit review of design drawings for structures within a City owned project. The Committee considers three overarching urban design principles:

- **Principle A - Urbanism** – Strive to create and restore the existing urban fabric within the metropolitan region, create real communities and diverse districts, conserve the natural environment and respect Edmonton’s built legacy.
- **Principle B - Design Excellence** – Exemplify design excellence by incorporating, translating and interpreting all three design principles to the greatest extent possible, consistent with best contemporary practices.
- **Principle C – Scale, Connections and Context** – Demonstrate appropriate scale, integration of design elements and fit within the context of the precinct.<sup>1</sup>

Projects presented to the Committee must demonstrate that they meet these design principles.

The design team has met with the EDC on two separate occasions (July 17, 2012 and January 15, 2013) for informal presentations (in camera) about the project. The first meeting introduced the vision and design principles as well as the ongoing public consultation process. The second meeting provided results of the public consultation process and how stakeholder input was being addressed in design of stops, stations and the North Saskatchewan river bridge. A third meeting is in preparation. At this meeting the SE to West LRT team anticipates presenting the current preliminary designs for the Valley Line-Stage 1 corridor, including Wagner Station, typical stops, typical corridor

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<sup>1</sup> Edmonton Design Committee Principles of Urban Design  
[http://www.edmonton.ca/city\\_government/documents/Principles\\_of\\_Urban\\_Design.pdf](http://www.edmonton.ca/city_government/documents/Principles_of_Urban_Design.pdf)



landscape and other structures. Information about the P3 procurement process will be provided as well as how this process may affect the role of the EDC. This may be followed by a fourth and final meeting.

## **2.4 Project Area**

In support of preparation of this EISA, preliminary design included delineation of a project area that could reasonably accommodate the need for construction access points, staging, other temporary work areas, and final infrastructure as required by the Reference Design. This area is shown in Figure 2.1. This project area is considerably larger than the lands that will be permanently occupied by LRT surface infrastructure because certain construction activities, such as installation of shear walls on the north valley slope and retaining walls along Connors Road and at Muttart Stop, would require relatively large work areas. These additional work areas will be temporary and will be subject to reclamation as part of the project. The project area accounts for the current uncertainty surrounding the Connors Road alignment, and has been developed to capture predicted land impacts resulting from both the north and south options under consideration. Thus, the project area along Connors Road will decrease in size once a final alignment is chosen. Construction worker vehicle parking will be limited to pre-approved areas to be determined by the City during construction planning and contract negotiations.

The delineated project area does not include potential construction access routes *to the* project area. These routes remain undetermined and will be established by the P3 Contractor as part of their project planning, although probable routes through neighbourhoods are shown on Figures. Additional access routes must be approved by the LRT D and C in consultation with Community Services. South of the river it is a near certainty that access to the delineated work areas will involve 98<sup>th</sup> Avenue and Connors Road. North of the river, the contract documents will identify Cameron Avenue and Grierson Hill as the primary north valley access route. The portion of the construction access in Louise McKinney Park (between Cameron Avenue and the main project area) will require some modification to support the required loads and traffic volume. For this reason, and because it overlaps with the permanent maintenance access road, that portion of the construction access road is shown as within the project area. This assessment assumes the above-described construction accesses but also assumes use of existing access roads and/or one SUP within Louise McKinney Park, to be used as a secondary access route.

The delineated project area excludes the disjunct, conceptual location identified for the dry pond (and swale) that may be required at the base of Connors Hill (Figure 2.1); however, should final design require this pond, construction activity will also occur in this area. Impacts associated with construction in this area are assessed in later document chapters. Design of this feature, and drainage in general is less advanced, therefore, the location of this feature is less certain. The need for this facility must be verified during detailed design. The alternate location for the dry pond is near the LRT TPSS at the Muttart Stop. The project area shown on Figure 2.1 accounts for that alternate location.

Finally, most of the items identified as built-in mitigation measures, such as landscaping in the vicinity of Muttart Conservatory and potential temporary pathway relocations are not included in the delineated project area as they are smaller in spatial scale, very site-specific and described in more detail in the mitigation sections of this document.

The P3 Contractor will be encouraged to find ways to minimize the project footprint, temporally and spatially. Some possibilities are incorporated here in later chapters as select mitigation measures and the Contractor will be asked to consider this in their proposed project innovations.

## **2.5 Project Phases**

Following are brief descriptions of the anticipated activities in the various project phases: site preparation, construction, landscaping/reclamation, and operation and maintenance.

### **2.5.1 Site Preparation Phase**

In addition to pre-construction planning requirements, such as preparation of technical plans including trail detours and vehicle traffic accommodation plans, standard site preparation activities to be undertaken by the Contractor will include but may not be limited to:

- in field delineation of construction staging/laydown areas and construction access/haul routes,
- remaining utilities relocation and protection (if required),
- installation of temporary erosion and sediment control measures, and
- vegetation clearing.

Site preparation activities will be carried out beginning in 2015. Depending on how the work is scheduled with respect to geographic area (e.g. north valley wall, Connors Hill, etc.), site preparation could be undertaken in various locations within the project area throughout 2015 to 2018.

The City may undertake some more minor site preparation activities before 2015 to protect select park resources known to be affected. For example, rare plant translocations, if required will be undertaken prior to project turn over.

### **2.5.2 Construction Phase**

Following are additional significant activities that will be part of the construction phase of this project and will be undertaken in support of the key components described above:

- Demolition - Cloverdale pedestrian bridge
- Demolition- Connors pedestrian bridge
- Demolition – Muttart storage building
- Vehicle traffic management/road closures
- Concrete pours
- Significant earthworks

The following sections provide more information on the nature of these activities.

#### *2.5.2.1 Demolition - Cloverdale Pedestrian Bridge*

The Cloverdale pedestrian bridge, constructed in the mid-1970s, is a three-span truss bridge with an open top and sides, a timber deck and metal and timber handrails. It provides for pedestrians and cyclists and has two dedicated viewing areas, with benches. Lighting is provided at both ends and at intervals along the bridge. The bridge has three instream concrete piers, one of which is situated near the middle of the river. A local drainage catchbasin and outfall is located on north bank west of the bridge and some surface and subsurface electrical utilities are in the vicinity of both bridge abutments. All of these will likely be removed during demolition. Abutment piles are expected to be removed to an acceptable depth, one that avoids future conflict and minimizes subsurface disturbance.

Bridge demolition will likely be one of the first activities initiated at the river and will involve significant access through adjacent parks. The method of bridge demolition is not yet known. Development of demolition methods will be the responsibility of the P3 Contractor. Demolition planning is likely to be coordinated with bridge instream construction planning since synergies may exist for the instream work associated with each activity. The Contractor will be required to integrate any instream berms proposed for demolition into the ensuing bridge construction plans to minimize berm number, size and duration of berms in the river. Following is a description of a probable demolition scenario.

Demolition will likely begin with removing the mid-span bridge sections, followed by removal of the north and south end-spans. Containment will be required such that no debris will be allowed to enter the water or streambed. Containment and waste disposal will need to comply with all federal and provincial environmental regulations.

Pier removal will likely involve construction of temporary berms and one or more suspended platforms. Piers will be removed to the depth required by permitting authorities. The removal of the mid-stream pier will involve instream work in an area that will not be disturbed by new bridge construction.

The P3 Contractor will be required to develop a detailed demolition plan that demonstrates adequate protection of aquatic resources. The plan will be reviewed by the City and by provincial and federal regulators. Specific demolition protection measures are not covered in this EISA.

The Contractor will be asked to consider opportunities to reuse bridge component parts or materials and to consult with the City about this during demolition planning.



### *2.5.2.2 Demolition - Connors Road Pedestrian Bridge*

The existing Connors Road pedestrian bridge is a two-span truss bridge built in the 1980s (Thurber Engineering 2012a) with a wooden deck and metal, picket-style railing. It provides a route across Connors Road for pedestrians and cyclists, and connects to SUPs on either side of the road. The single pier is located south of the road, near the south abutment of the bridge.

As with the existing river bridge, methods for bridge demolition are not known. Demolition and construction may be scheduled such that they coincide with the realignment of Connors Road, when the road will be closed to traffic. A hazardous materials assessment will be undertaken prior to bridge demolition. Bridge components will be recycled to the extent possible. Demolition may require some minor excavation to remove bridge abutments.

### *2.5.2.3 Demolition - Muttart Storage Building*

The existing Muttart storage building, located south of the conservatory greenhouses, must be demolished to allow for the construction of the Muttart TPSS.

According to Muttart Conservatory Operations, the existing building is approximately 15 m x 50 m (+/-). At present, half of the building is used as a workshop for the Branch Fitness Team. The other is dedicated space for Muttart Conservatory Operations and used for storage of large items such as props used in the Feature pyramid, soil storage, etc.

This storage facility will be replaced by a similar building, of similar square footage, in the same general location, but with some shifting occurring to allow for the presence of the TPSS and utilities compound. The TPSS and storage buildings are expected to be of a similar style to provide for suitable aesthetics.

The Muttart Conservatory will be required to make alternate storage arrangements for the duration of building demolition and replacement. All demolished materials will be disposed of appropriately at approved facilities. Materials will be recycled to the extent possible.

### *2.5.2.4 Vehicle Traffic Management/Road Closures*

North of the river, traffic management will be required along Grierson Hill and Cameron Avenue (and possibly feeder roads into these) to accommodate periods of significant construction traffic. South of the river, traffic management will be required along 98 Avenue, 96 A Street, and on the Muttart Conservatory Access Road and Connors Road. Connors Road and the Muttart Conservatory access road will be fully closed for select periods of time to accommodate road realignment and other work. Work on the Muttart Stop and the Muttart access road will affect access to the rear entrance of Muttart and provision of an alternative and equally functional access arrangement will be a construction requirement. Details around traffic management will be developed during the next project phases.

### 2.5.2.5 Concrete Pours

Bridge piers, super structure, track corridors, and possibly other structures, such as retaining walls, and portal structures will require significant volumes of cast-in-place concrete. Large concrete pours involve high truck traffic volumes for select periods and will require access from both sides of the river.

### 2.5.2.6 Significant Earthworks

The following project components will require significant earthworks: installation of shear walls (or equivalents), installation of retaining walls near Muttart Stop and at Connors Road, and installation of temporary river berms to allow existing pier removal and new construction. Installation of shear walls and retaining walls are significant tasks that require relatively large areas of surface disturbance, sub-surface work and specialized equipment. Work will occur over many months, may create significant truck traffic and certain aspects will generate considerable noise. River berms are anticipated to be significant structures that will require importing large volumes of clean fill and riprap, if standard berms are employed. This work will generate significant truck traffic for a period of one to two months during installation and removal of each berm.

### 2.5.3 Landscaping/Reclamation Phase

Landscaping, reclamation and restoration of natural, semi-natural and manicured areas will be required following construction and will be initiated in a staged fashion as soon as construction of each component piece is complete. As part of preliminary engineering, preliminary landscaping plans were developed for some semi-natural and manicured areas within the study area; reclamation and restoration planning, required in certain areas, is less advanced at this point. More detailed reclamation and restoration plans will be developed by LRT D and C over the next year in accordance with principles established in the mitigation sections of this document and in the preliminary landscaping report. These plans will be reviewed by Community Services and Office of biodiversity and their impact reflected in the final plans/specifications provided by the P3 Contractor.

### 2.5.4 Operation and Maintenance Phase

Operation and maintenance of the new LRT line will be conducted by the P3 contractor for a period of 30 years following the completion of construction. The lifetime of structural components is expected to be approximately 100 years. During operations, trains will run through the study area in intervals of approximately 5 minutes during peak hours and 10-15 minutes during off-peak (evening and weekend) periods, in each direction. Trains are expected to travel at speeds up to 60 km/h.

Operational noise levels of trains are subject to the City's *Urban Traffic Noise Policy*. The policy limits noise levels in outdoor amenity areas to 65 dBA 5m from a property line. If feasible, maximum noise levels of 60 dBA will be targeted.

Regular track maintenance activities will include track corridor sweeping and snow clearing as needed. Train maintenance will be undertaken outside of the river valley at the Operations and Maintenance Facility, except in emergency circumstances.

## **2.6 Construction Protection Measures/Waste Management**

Responsibility for construction protection measures will lie with the P3 Contractor. The Contractor will be expected to prepare a comprehensive Environmental Management System, compliant with ISO 14001. This will include an Erosion and Sedimentation Control Plan of the highest standard developed by a Certified Professional in Erosion and Sediment Control. As part of this, the Contractor will be responsible for handling of all waste material generated by construction and operation. Specifically, the Contractor will be required to meet or exceed waste management practices specified in Enviso, the City's Environmental Management System. The Enviso 'Contractor's Environmental Responsibilities Package' specifies several requirements with respect to waste management. Hazardous waste must be managed in accordance with applicable provincial legislation and best management practices. All waste must be disposed of at approved facilities. Contractors are also required to reduce waste and divert materials from landfills. Material recycling and litter control are required (City of Edmonton 2013). The Contractor must also follow any federal conditions regarding waste management practices that may be attached to receipt of federal funding and will be obliged to follow all federal and provincial waste management laws, policies and best management practices.

## **2.7 Project Schedule**

### **2.7.1 Overall Schedule**

At the time of writing, construction of the Valley Line-Stage 1 is scheduled to begin with contract award in 2015, and is anticipated to take four years. That schedule would have the Valley Line-Stage 1 operational in 2019. It is expected that construction in the river valley will be ongoing during this entire period and it may involve simultaneous construction of any of the above-noted components. The P3 Contractor will be expected to develop a detailed construction schedule for submission to the City for approval, prior to initiation of any work.

Timing of certain construction activities in the NSRV will be restricted by environmental policies and regulations. The NSR at the project area is classified as a Class C water body with a restricted activity period of 16 September to 31 July. This will dictate when the proponent can build isolation works in the river.

Because of this, bridge construction is on the critical path for project delivery. A possible bridge construction schedule, assuming use of conventional methods and following the Reference Design, is as follows:



- Year 1 (2015): construct lower pile wall (or equivalent) on north bank, place berms on north and south bank for pier removal and construction, and remove existing north and south piers, construct north and south river piers.
- Year 2 (2016): begin construction from north and south piers of concrete girders, cables (north pier only) and walkways. Construct piers between south bank and 98<sup>th</sup> Avenue.
- Year 3 (2017): complete construction of concrete girders, cables and walkways from river piers, construct girders between south bank and 98<sup>th</sup> Avenue, and construct girders over the north bank. Portal structure construction should be complete at this point. Remove berm from north bank; extend south berm in order to remove the centre pier of the Cloverdale pedestrian bridge. Remove south berm.
- Year 4 (2018): Construct safety barriers and lay track on main deck, construct SUP; landscaping.

Construction methods and schedule will, however, be determined in future project stages.

### *2.7.2 Construction Working Hours*

In accordance with the City of Edmonton Community Standards Bylaw (14600), construction will be restricted to the hours between 7:00-22:00 from Monday to Saturday, and 9:00-21:00 on Sundays and holidays. Special permission may be granted by the City, upon request, to operate outside of these standard hours.

## **2.8 Alternatives Considered**

The following is a brief summary of alternative project designs considered during the preliminary design phase, but rejected for various reasons, including unacceptable environmental implications. These examples are intended to demonstrate that environmental considerations informed preliminary design decisions.

### *2.8.1 Portal Structure TPSS*

A TPSS is required in the vicinity of the portal structure. Various alternative locations were considered, including siting the substation within the river valley, near the portal structure mouth. Ultimately, a location near the top of bank, outside of Bylaw 7188 boundaries, was selected in the interest of reducing the visual impact and the number of structures situated in the river valley.

### *2.8.2 New River Bridge*

Eight bridge design alternatives were originally developed. Based on public response, evaluations against the project's Sustainable Urban Integration (SUI) guidelines, engineer reviews, and assessment via a formal evaluation matrix (undertaken in September 2012), the original eight designs were narrowed down to three:

- A three-span single tower extradosed bridge,

- A two-span single tower cable-stayed bridge, and
- A three-span variable depth box girder.

The final evaluation matrix considered numerous engineering and sustainable urban integration criteria, among them geotechnical considerations; the extent and duration of required instream construction; river valley implications - such as visual impact and nature viewing opportunities; and user experience. Some of the evaluated options required more than two piers. This did not match a project objective of minimizing piers in the river.

The single tower extradosed design was selected by the governance board on 02 February 2013 and approved by City Council on 20 February 2013. An advantage of the single tower extradosed bridge is that it does not require a pier founded on the unstable north bank of the river, as would the girder bridge. While the cable-stayed design would have avoided the need to place any piers in the river, the single tower extradosed bridge was determined to be more cost-effective and less visually obtrusive than the cable-stayed design, while still providing a long main span with only two piers in the river.

### 2.8.3 *Connors Road Pedestrian Bridge*

A reduction of grades to a maximum of 5% for both bridge and approach slopes was deemed desirable to make the bridge conform to the City's recommendations for grades on shared use paths. Full accessibility of this bridge was also raised as a concern at public involvement (PI) sessions. However, the number of switchbacks and extent of tree clearing needed to accomplish this—particularly south of Connors Road—were deemed unacceptable, at the time of EISA preparation. Efforts continue to explore alternative options to reduce bridge and approach grades but these investigations were not complete at the time of EISA preparation.

During preliminary design, various alignments were also considered for the new bridge. The decision to tie in the south abutment at approximately the same location as the existing abutment will result in reduced disturbance to the slopes south of Connors Road.

### 2.8.4 *Drainage*

Standard options for drainage design were briefly considered, but ultimately, the use of low-impact development (LID) principles was adopted as a drainage design objective. Not all features in the river valley qualify as LID; however, all features incorporate Best Management Practices.

### 2.8.5 *Aesthetics*

Preliminary engineering included development of a process to identify suitable options, and eliminate unsuitable options, for aesthetic treatments of various LRT components, including benches, stop shelters, light standards, garbage receptacles, landscape plantings and finishes for retaining walls. This process led to identification of recommended options to be carried forward into the P3 procurement phase. For example, a selection of

retaining wall and guideway wall facades with a natural stacked-stone aesthetic were identified as acceptable for integration into the river valley's natural environment.

## **2.9 Alternatives Currently Under Consideration**

At the time of writing at least two alignments are currently under consideration by the design team for the Connors Road corridor. One of these is a realignment of Connors Road to the south, which will necessitate slope cuts and retaining walls on the south valley wall. The most extreme alternative north track alignment under consideration calls for Connors Road to remain in place and the LRT corridor to be located to the north of Connors Road. This requires less intrusion into the south valley wall, but impinges on slopes north of Connors Road. Wildlife passage and rare plant concerns in the Connors Road area have been communicated to the design team, and will be considered in final alignment evaluation and selection, as will the results of this EISA.

## **2.10 Environmental Permitting Requirements**

LRT D and C have met periodically with regulators throughout preliminary design and have been tracking environmental permitting requirements. All relevant agencies are apprised of the upcoming project and thus far have not raised any insuperable concerns. Following is an account of relevant legislation and the potential permits required for this project.

### **2.10.1 Federal Government**

#### **2.10.1.1 Canadian Fisheries Act**

The proposed project requires a new bridge crossing over the NSR, which is an important fish-bearing watercourse. The presence of fish habitat and the potential for adverse effects on a fish of economic, cultural or ecological value within the creek may trigger the need for an authorization pursuant to the *Fisheries Act* by the Department of Fisheries and Oceans Canada (DFO). Changes to the *Fisheries Act* are pending as a result of the federal government's Bill C-38 and new application processes are expected in early 2013. This EISA will consider the potential for serious harm to fisheries during demolition of the existing bridge, construction of the proposed bridge and other associated works to the extent possible based on the Reference Design. Additional impact assessment and development of attendant mitigation measures for demolition and construction will be required during detailed design.

#### **2.10.1.2 Navigable Waters Protection Act**

The *Navigable Waters Protection Act (NWPA)*, administered in Alberta by Transport Canada has recently undergone changes under Bill C-45 and a new act, the *Navigation Protection Act (NPA)* was created. The new Act is expected to come into effect in 2014. Under this *NPA*, a large number of watercourses that are currently considered navigable are expected to be deemed non-navigable; however, the NSR is expected to remain a navigable water body and the new bridge construction and existing bridge demolition is

expected to require approval. Transport Canada should be consulted closer when final design is complete.

### 2.10.1.3 Federal Environmental Assessment

The City has secured partial Valley Line-Stage 1 funding from the federal P3 Canada Fund. Until recently, projects receiving federal funding were subject to the *Canadian Environmental Assessment Act* (CEAA) and the funding agency was required to complete an environmental assessment for the project prior to release of funds. Projects such as this one would typically have been subject to an Environmental Screening. In 2012, CEAA was replaced with the *Canadian Environmental Assessment Act 2012* (CEAA 2012). The Act now applies only to projects described in the Regulations Designating Physical Activities or those designated by the Minister of the Environment. The Valley Line-Stage 1 does not meet the definition of a Designated Physical Activity and therefore does not require environmental assessment under CEAA 2012. However, we are currently in a transition period and additional CEAA 2012 regulations and protocols are still in development. Whether federal funding agencies will continue to assess environmental impacts of funded projects pursuant to other legislation or policy, remains uncertain at this time. Discussions during late 2012 with P3 Canada Fund staff highlighted uncertainty on this matter. Further, a 2012 application guideline document states that “where applicable, receipt of support through the P3 Canada Fund triggers certain requirements under federal legislation that must be addressed, including but not limited to environmental assessment requirements in accordance with the Canadian Environmental Assessment Act”<sup>2</sup>. The date of the document suggests that this point does not reflect the new Act. Therefore, the need for any kind of federal environmental assessment must be clarified with the P3 Canada Fund office through continued consultation. Under the former Act, this EISA would have provided much but not all of the information required to satisfy a federal review. Under a new protocol, there may be some deficiencies and, importantly, this document does not cover the full length of the funded project. Other studies undertaken as part of preliminary engineering for the larger Valley Line-Stage 1 project would provide some if not all of that additional information.

### 2.10.1.4 Other Applicable Federal Legislation

Environment Canada administers the *Migratory Birds Convention Act (MBCA)* and the *Species at Risk Act (SARA)*. Those Acts provide guidelines for enforcement only; neither the *MBCA* nor the *SARA* requires permitting or approvals specific to the proposed project. Violation of these Acts may, nonetheless, result in penalties. This EISA provides information that facilitates the proponent’s compliance with those Acts.

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<sup>2</sup> PPP Canada. 2012. PPP Canada: Application Guide and Application Form. Round Four | April-June 2012. Government of Canada. Ottawa, Ontario.



## 2.10.2 *Provincial Government*

### 2.10.2.1 *Alberta Water Act*

The *Code of Practice for Watercourse Crossings* under Alberta's *Water Act* applies specifically to the replacement of the existing bridge. The *Code of Practice* outlines conditions and recommendations for environmentally-sound construction, placement, installation, maintenance, replacement or removal of all or part of a watercourse crossing structure, or any activity associated with those works. Specific conditions of the *Code of Practice* are dependent upon the classification of the water body. According to the *Code of Practice for Watercourse Crossings* St. Paul Management Area Map, the NSR is mapped as a Class C waterbody in the project area (Alberta Environment 2006). The river is subject to a restricted activity period extending from 16 September to 31 July to protect critical periods for spring and fall spawning fish species known to inhabit the NSR.

Provided mitigative conditions applicable to the type of watercourse crossing are met, only notification to Alberta Environment and Sustainable Resource Development is required for the river crossing work. However, the appropriate mitigation and design measures must be incorporated into the project design, including an ESC plan. Some of the information in this document will support the *Code of Practice* notification but additional information that can only be generated during or following detailed design will be required.

For construction activities on the river banks (e.g., bank recontouring and armouring) that extend beyond the width of the new bridge (i.e., beyond the bridge crossing footprint), *Water Act* approval may be required.

### 2.10.2.2 *Alberta Environmental Protection and Enhancement Act*

Stormwater drainage and management facilities are regulated by Alberta's *Environmental Protection and Enhancement Act (EPEA)*. Construction of facilities such as storm ponds may require approvals under *EPEA* but, depending on design and connections to the existing system, they may be absorbed into the City's existing approvals.

### 2.10.2.3 *Alberta Public Lands Act*

The bed and shore of permanent and naturally-occurring bodies of water are owned by the province pursuant to the *Public Lands Act*. The bed and shore of the NSR and the now-abandoned former channel of Mill Creek are both Crown-owned. Elements of the proposed project (e.g. bridge piers and bank armouring) will occupy Public Lands, which will require approval or amendment of existing approvals. The project will also require temporary works (e.g., instream berms) in the riverbed and on the shores and could potentially require temporary works in the former Mill Creek channel. Both activities would require Temporary Field Authorizations pursuant to the *Public Lands Act*.

#### 2.10.2.4 *Alberta Wildlife Act*

The Alberta *Wildlife Act* prohibits disturbance to a nest or den of prescribed wildlife species. Although permitting is not required under that *Act*, violations may result in fines. The potential to impact nests or dens is addressed in this EISA to enable this issue to be tracked through project planning. Additional investigations, such as searches for nests and dens, may be required closer to construction initiation. Results of all nest searches will be submitted to City of Edmonton Urban and Environmental Planning.

#### 2.10.2.5 *Alberta Historic Resources Act*

Any development with potential to disturb historical and paleontological resources requires clearance by Alberta Culture, Historic Resources Management Branch, pursuant to the *Historical Resources Act*. For this project, the Province requested an Historic Resources Impact Assessment (HRIA) and a paleo-HRIA in select localities. These were completed and submitted to the Province for review. Results are reported later in this document. The Province's decision is pending.

### 2.10.3 *Municipal Regulatory and Permitting/Review Processes*

#### 2.10.3.1 *North Saskatchewan River Valley Area Redevelopment Plan (City of Edmonton Bylaw 7188)*

The North Saskatchewan River Valley Area Redevelopment Plan (NSRV ARP) governs development within a defined plan area. Any City project proposed for lands within that area must undergo an environmental review. The review process is administered by City of Edmonton Sustainable Development, Urban Planning and Environment, who determine which of the three levels of review will apply. In this case, Urban Planning and Development has determined that the proposed river valley project components are considered to be a "major new development" and thus the appropriate level of environmental review is an Environmental Impact Assessment (EISA). The river valley crossing is the only section of Valley Line-Stage 1 that intersects in any way with NSRV ARP lands. Terms of Reference for this EISA were developed in consultation with Sustainable Development and Parks.

#### 2.10.3.2 *The Way We Green*

*The Way We Green* is the City of Edmonton's updated, long-term environmental strategic plan, pursuant to the City's overarching strategic plan *The Way Ahead*. *The Way We Green* sets out principles, goals, objectives, policies, and approaches for the City of Edmonton to preserve and sustain its environment. The plan outlines 12 goals that describe what ultimately must be achieved for the City to be sustainable and resilient with respect to its environment. *The Way We Green* includes a particular emphasis on the natural environment and sustaining healthy ecosystems but also emphasizes increased use of public transit and transit supportive planning.

### 2.10.3.3 *Parkland Bylaw 2202*

Project activities will occur within NSRV parkland. The City of Edmonton's *Parkland Bylaw 2202* regulates the conduct and activities of people on parkland and protection of the environment in all City parks, including the NSRV. Pursuant to Bylaw 2202, disturbance to natural areas, utilization of construction laydown areas, interference with other park users and motor vehicle access are restricted. It is anticipated that upon approval of the proposed project, LRT D and C or the City Manager, will develop a process for granting the selected P3 Contractor an exemption to Parkland Bylaw 2202, conditional upon development of an approved detailed Staging Area Agreement prior to construction onset. The agreement would cover such aspects as hazardous materials storage, staging area size, access, security, utilities hoarding, tree hoarding, public safety measures and construction staff parking. The scope of agreement would be based on contract procurement documents and discussions with Parks.

### 2.10.3.4 *Community Standards Bylaw (14600)*

Part III of the City of Edmonton's *Community Standards Bylaw 14600* establishes construction working periods (0700-2200 hours Monday to Saturday; 0900-2100 Sundays and holidays) and acceptable noise levels (not to exceed 65 dBA). Exemptions are, at times, granted.

### 2.10.3.5 *Corporate Tree Management Policy (C456)*

All ornamental trees and natural treed areas on City-owned property are the responsibility of Edmonton Parks Branch (including procurement, maintenance, protection and preservation) pursuant to the City of Edmonton's *Corporate Tree Management Policy C456*. That policy states that where damage to, or loss of City trees occurs, equitable compensation for that loss will be recovered from the entity causing the damage or loss and applied to future tree replacements. All costs associated with tree removal, replacement or relocation must be covered by the P3 Proponent. Compensation amounts are dependent on the type of plant species lost or damaged and are calculated using set formulae or, in some cases, negotiations between City departments. This project will require tree clearing on City-owned lands, thus compensation pursuant to *Policy C456* will be required. As dictated by the Policy, all vegetation clearing and clearing methods/tree protection must be pre-approved by a City forester.

### 2.10.3.6 *Natural Area Systems Policy (C531)*

In 2007, City of Edmonton adopted *Policy C531* and a new approach to natural area management. The policy commits the City to conserving, protecting, and restoring the natural uplands, wetlands, water bodies, and riparian areas, as integrated and connected natural systems throughout the City. To that end, the Natural Areas inventory has now been updated (to 2010) and includes both tablelands and river valley Natural Areas. The City is committed to balancing the ecological and environmental considerations of a project with economic and social considerations in its decision-making and will demonstrate that it has done so. This goal requires the procurement of appropriately detailed ecological information about any project that has the potential to affect a City

Natural Area. While many river valley lands intersected by the proposed project have been converted to developed parkland or other land uses, some lands still support native vegetation and are mapped as delineated Natural Areas. These lands are subject to *Policy C531*. The Bylaw 7188 EISA will satisfy that Policy's information requirements for affected Natural Areas within the river valley.

#### *2.10.3.7 City of Edmonton Wildlife Passage Engineering Design Guidelines*

In June 2010, the City of Edmonton introduced its *Wildlife Passage Engineering Design Guidelines*. The purpose of those guidelines is to provide transportation designers and decision makers with recommendations that allow the needs of wildlife to be incorporated into transportation projects. Guideline objectives will be met through restoring previously removed habitat connections and ensuring that existing connections remain. The guidelines are also meant to reduce the effects of anthropogenic habitat fragmentation and human-wildlife conflict, including wildlife-vehicle collisions. Although the guidelines present ideal designs for wildlife passage structures, the City recognizes that not all transportation projects will be capable of meeting that standard and will consider alternative structures on a project-specific basis. The wildlife passage guidelines have been considered during design and construction of each river valley LRT project component and attempts made to reduce project impacts on wildlife passage. This EISA will further assess this issue and develop mitigation measures, as required.

#### *2.10.3.8 City of Edmonton Enviso*

In 2004, Edmonton City Council approved City Policy *C505* (Edmonton's Environmental Management System) committing the City to establishing an environmental management system (now known as Enviso) based on the international standard ISO 14001 ENVISO provides the city with a systematic method of managing and improving its environmental performance and provides a framework for a strong environmental management system, aimed at legal/regulatory compliance. Edmonton has achieved ISO certification in 10 branches deemed to have the highest environmental risk. The P3 Contractor will be expected to develop an EMS that meets or exceeds Enviso. According to performance specifications set out in P3 contract documents.

#### *2.10.3.9 Sewers Use Bylaw C9675*

The release of material, including contaminated runoff, from the construction site into the NSR is regulated by the Sewers Use Bylaw. Part III of this Bylaw prohibits the release of hazardous materials and materials that produce a colour value greater than or equal to 50 true colour units. Turbidity restrictions are also in effect. The release of any material other than that permitted in this Bylaw may result in penalties. Compliance will be achieved through spill prevention measures, erosion and sedimentation control measures and adherence to the City of Edmonton's "Contractor's Environmental Responsibilities Package: Construction and Maintenance" (City of Edmonton 2008). Discharges of groundwater or stormwater into either the sanitary or storm system are only permitted through application to Drainage Regulatory Services.