



The City of Calgary

Final Executive Summary

Country Hills Boulevard Widening -
Functional Planning Study -
Harvest Hills Gate N.E. to Barlow Trail N.E

August 2021





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1.0 Introduction

Country Hills Boulevard (CHB) is an essential east-west connection in north Calgary, establishing a vital link to Deerfoot Trail and access to the Calgary International Airport. CHB carries approximately 18,000 to 33,000 vehicles per day (vpd) west and east of Deerfoot Trail including commercial, industrial, and residential areas and is identified as a six-lane Arterial Street in the 2020 Calgary Transportation Plan (CTP). The majority of CHB between Barlow Trail and Coventry Hills Boulevard N.E. is currently a rural standard four-lane road with discontinuous sidewalks between Deerfoot Trail and Coventry Hills Boulevard N.E. Segments of CHB between Deerfoot Trail and Barlow Trail N.E. were recently upgraded to six lanes with pathways on both sides. The existing bridge crossings along the corridor were explored regarding bridge upgrades required to widen the corridor to six lanes and accommodate pathways on both sides across the Canadian Pacific Railway (CP) tracks, Nose Creek, and Deerfoot Trail.

In 2000, Alberta Infrastructure completed the Deerfoot Trail / CHB Functional Planning Study (FPS) which provides long-term and Ultimate stage planning for the Deerfoot Trail / CHB interchange, including upgrading CHB to a six-lane divided Arterial Road west of the Deerfoot Trail interchange. Road right-of-way (ROW) was previously protected by The City of Calgary (The City) and varies in width along the corridor.

The need for a long-term plan arose from anticipated growth identified in both the Stoney Industrial Area Structure Plan (ASP) approved by City Council in 2004 (amended in 2014), and the Northeast Industrial ASP approved by City Council in 2007. Both previous studies acknowledged that widening of CHB from four to six lanes will improve mobility for existing residents and support future growth. This Executive Summary accompanies and summarizes the technical report for the Country Hills Boulevard Widening FPS.

The Country Hills Boulevard Widening FPS Study Area (Study Area) spans a section of CHB between Harvest Hills Gate N.E. to Barlow Trail N.E. as shown in **Exhibit ES 1.01**

The key objectives of the CHB Widening FPS are to:

- Develop a widening plan along CHB between Deerfoot Trail and Coventry Boulevard from four to six lanes, including continuous multi-use pathways;
- Examine widening strategies for existing bridges over CP, Nose Creek and Deerfoot Trail; and
- Better accommodate and improve safety for people walking, cycling, taking transit, and driving in the Study Area.



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2.0 Existing Conditions

A comprehensive review of existing conditions on the corridor was completed for the CHB Widening FPS. Key information and findings included:

- The road ROW available for the CHB widening was previously protected by The City and varies in width along the corridor.
 - **Existing posted speed limit** is set at 70 km/h within the Study Area.
 - **Existing pedestrian and cycling connectivity** was reviewed based on existing infrastructure, and missing links were identified along the existing corridor. Existing pathways / sidewalks are not continuous on both sides of CHB within the Study Area. Sections with missing pathways include:
 - North side of CHB between Harvest Hills Gate N.E. and Coventry Boulevard N.E.
 - North side of CHB between Coventry Boulevard and 14 Street N.E.
 - South side of CHB between 15 Street N.E. cul-de-sac and Deerfoot Trail east junction.
 - Key routes for **existing transit service** relevant in the Study Area include regular / express Routes 100, 157, and 161 with service along CHB, to the Stoney Industrial Area, and connecting to the North Pointe MAX Station and Bus Rapid Transit (BRT) Route 301.
 - Review of current **traffic operations** along the corridor showed that only the CHB / 14 Street N.E. intersection in the PM peak exceeds the 0.90 threshold for volume to capacity (v/c) ratio. All other intersections are below 0.90 v/c with acceptable level of service (LOS). With existing lane configurations, westbound (WB) traffic experiences longer through queues. The long WB queues may potentially create weaving issues for traffic exiting from southbound (SB) Deerfoot Trail and accessing the South District Development south of the CHB / 14 Street N.E. intersection.
 - Three bridge crossings are within the Study Area:
 - **CP Crossing** – Consists of two separate bridges spanning 20.0 m, constructed in 1991. Currently has substandard shoulders and narrow pathways.
 - **Nose Creek Crossing** – Consists of two separate bridges spanning 31.0 m, constructed in 1990 using post-tensioned deck-bulb tee girders. This type of girder is no longer fabricated.
 - **Deerfoot Trail Crossing** – Consists of two separate bridges: south bridge constructed in 1975 with rehabilitation in 1998, and north bridge constructed in 2002
 - There are many **major utilities** that run along and across CHB. Abandoned utilities from Telus, Plains Midstream, and Bonavista Energy exist in the area, along with multiple active aerial and underground utilities.
 - The major **environmental feature** of the Study Area is the Nose Creek. Hydraulic analysis and reporting for Nose Creek was completed by AECOM as part of the 128 Avenue N.E. FPS. ISL completed a Phase 1 Environmental Site Assessment (ESA) and noted that Areas of Potential Environmental Concern (APEC) presented are conservative in nature and future design consultants should reassess them based on their proximity to excavation areas and the depths of the excavations, when finalized.
 - A planning-level **safety review** for CHB was completed in the Study Area. This included a formal In-Service Safety Review (ISSR) at all intersections in the Study Area.
- Several improvement opportunities were identified that can be implemented in the short-term and with the plans developed as part of this study.



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3.0 Transportation Design Criteria

The desired transportation facility requirements for roadway geometry and traffic operations are defined in this report section. Primary guiding documents for technical details include:

- The City of Calgary Complete Streets Guide 2014;
- The City of Calgary Design Guidelines for Subdivision Servicing 2014 (DGSS);
- The City of Calgary Traffic Impact Assessment (TIA) Guidelines 2011;
- Alberta Transportation Highway Geometric Design Guide (HGDG);
- Transportation Association of Canada Geometric Design Guide for Canadian Roads 2017 (TAC GDG); and
- Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis (HCM).

3.1 Typical Cross Section

The proposed CHB cross section was adopted from The City's DGSS alternative section for 46 m wide six-lane Arterial Street by the study team and City stakeholders (see **Figure ES 3.1**).

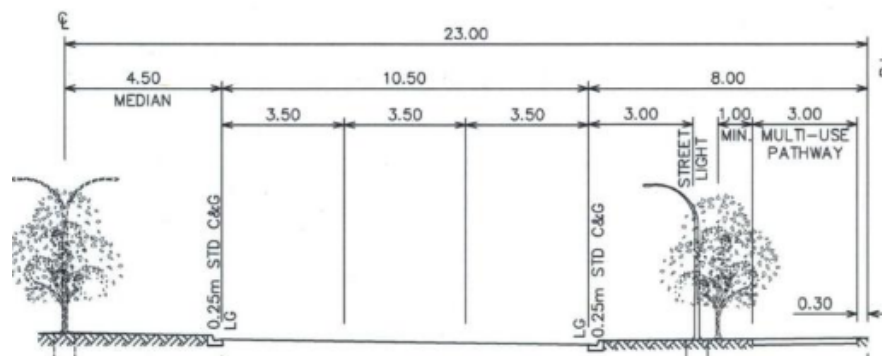


Figure ES 3.1: Standard Cross Section for Six-Lane Arterial Street with Multi-Use Pathway

3.2 Design Vehicles

Turning template reviews for intersections modified in this study were to achieve the following requirements:

- Single lane turn movements on Arterial Streets will use WB-21 design vehicle;
- Simultaneous opposing left turn movements will use opposing WB-21 design vehicle;
- Dual lane turning movements are designed to accommodate WB-21 in the outside lane and a passenger car on the inside lane;
- Dual lane left/right turning movements at the Deerfoot Trail interchange will accommodate a combination of WB-21 on the outside lane of the turning movement and a SU-9 vehicle on the inside lane of the turning movement;
- Ramp junctions at the Deerfoot Trail interchange will also accommodate a modified WB-36 design vehicle. Modified WB-36 while turning will take over both the lanes through the intersections; and
- AT requested future design stages also evaluate 27.5m WB-23's.



3.3 Traffic Analysis and Modelling

Several analysis tools were used in this study, including:

- FHWA CAP-X – Capacity Analysis for Planning of Junctions, used to provide a planning capacity assessment of the Deerfoot Interchange and to explore options at some intersections;
- Synchro – Analysis software used to measure performance for all signalized intersections;
- SIDRA – Roundabout analysis software used to measure performance of a roundabout intersection; and
- VISSIM – A multi-modal microscopic simulation modelling software to evaluate weaving and operations along Country Hills Boulevard within the influence of the Deerfoot Interchange.



■ 4.0 Traffic Review, Forecasting and Analysis

In existing AM and PM peak hours, CHB west of Deerfoot Trail carries 18,000 to 24,000 vpd and carries 30,700 to 33,000 vpd east of Deerfoot Trail based on data from 2017 to 2018. The existing intersection configurations were analyzed. Three movements at intersections west of the Deerfoot Trail interchange operate over capacity, LOS F, and/or long queue:

- Existing CHB / 14 Street N.E. intersection in PM peak exceeds the 0.90 threshold for v/c.
- Existing CHB / 14 Street N.E. experiences longer through queues in PM Peak. The long WB through queue may potentially create weaving issues with traffic exiting south from Deerfoot Trail.
- Existing CHB / Coventry Boulevard N.E. experiences longer through queues in PM Peak. The long WB through queue blocks right turn traffic into the Coventry Hills community.

Travel forecasts prepared by The City are based on data available at time of study and current expectations of population and job growth, development trends, and travel mode split. Several adjustments were completed to the 2048 horizon to represent current and future development aspirations. The CHB Widening FPS Ultimate horizon traffic volumes used in this study are derived from The City's 2048 traffic volumes plus the full build-out of adjacent undeveloped lands. Scenarios with and without 128 Avenue N.E. connecting to Stoney Trail / crossing Nose Creek / connecting to Deerfoot Trail were also considered in choosing the Ultimate traffic scenario. CHB long range Ultimate forecast estimates ranged from 42,000 to 56,000 vpd.

The future AM and PM peak volumes were analyzed with widening from four to six lanes. Results are summarized below:

- The intersections east of Deerfoot Trail appear to operate adequately in the future and do not require further traffic review.
- In the Ultimate horizon, several critical movements at Coventry Boulevard, 11 Street N.E., and 14 Street N.E. operate beyond the 0.90 v/c threshold or at LOS F despite widening upgrades. High directional traffic from commuters during morning and evening peaks contribute to the failing movements noted below:
 - Coventry Boulevard – EBT, WBL, SBL, and SBT in AM Peak. EBT in PM Peak
 - 11 Street N.E. – EBT and WBL in AM Peak. EBL, WBT, NBR, and SBR in PM Peak
 - 14 Street N.E. – EBT and WBL in AM Peak. EBL, WBL, WBT, and SBR in PM Peak
- The Deerfoot Trail interchange junctions appear to operate adequately, but there may be some weave related issues between the west junction and the 14 Street N.E. intersection.

4.1 11 Street N.E. to 14 Street N.E.

The intersection volumes were combined to explore multiple options with the Federal Highway Administration (FHWA) Cap-X software to resolve the traffic issues identified at the 11 Street N.E. and 14 Street N.E. intersections. Displaced Left Turn / Continuous Flow Intersection (CFI) and R-Cut / J-Turn were identified to resolve the issues from a traffic perspective, but they did not align with project constraints.



One option that looked promising to resolve the issues was the possibility of a quadrant intersection. This solution would have been possible with the now existing quadrant south of CHB from 11 Street N.E. to the roundabout on 14 Street N.E., in combination with the east-west connection in the future development north of CHB that would have also connected 11 Street N.E. and 14 Street N.E. The double quadrant intersection system would have reduced signal phases by using both intersections to accommodate all turning movements. Ultimately, this potential connection to the north was not feasible through a separate development application process with The City.

There were concerns from various stakeholders of trying to force certain turning movements to only be available at one of the two intersections (e.g., CHB lefts only at 11 Street or 14 Street as shown on **Figure ES 4.1**). Therefore, the option that moved forward was to utilize the standard signalized intersections previously planned during the adjacent landowner's development application process.

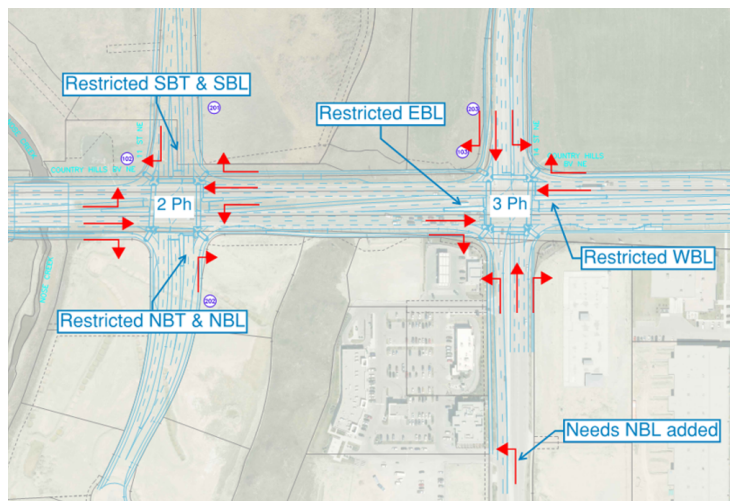


Figure ES 4.1: Review of Quadrant Intersection Option

4.2 Deerfoot Trail Interchange and Weave to 14 Street N.E.

The interchange volumes were entered into the FHWA Cap-X software to see what other interchange configurations may work at this location. The results confirmed that the existing Parclo A4 interchange configuration is the most suitable.

Based on the traffic analysis, two WB lanes at the west and east Deerfoot Trail junctions are at capacity using Ultimate (2048 + full build-out) horizon traffic.

The potential weaving concerns from the west Deerfoot Trail interchange junction to 14 Street N.E. were reviewed. Three solutions were evaluated to understand the SB Deerfoot Trail to SB 14 Street N.E. weave including: a channelized WB left, a bowtie roundabout, and a dual signalized right. All three explored options significantly improved WB weaving operations between SB Deerfoot Trail ramp to 14 Street N.E.; they also improved ramp queuing as people would not need to wait as long to safely make this maneuver.



After discussion with Alberta Transportation (AT), area stakeholders and The City, the final recommended solution to eliminate weaving and unsafe queuing along the SB exit ramp is a dual signalized right option at CHB / SB Deerfoot Trail ramp (shown in **Figure ES 4.2**). The dual signalized right option was recommended due to having no additional property requirements, and a lower capital cost when compared to the alternate options.

We expect the weave between the west interchange junction and 14 Street N.E. will fail before the interchange junction itself. It is recommended that yearly monitoring be implemented as part of development applications. Once the weave fails, the dual signalized SBR movement will be required and likely three WB lanes will require upgrades to the existing WB / north bridge structure over Deerfoot Trail.

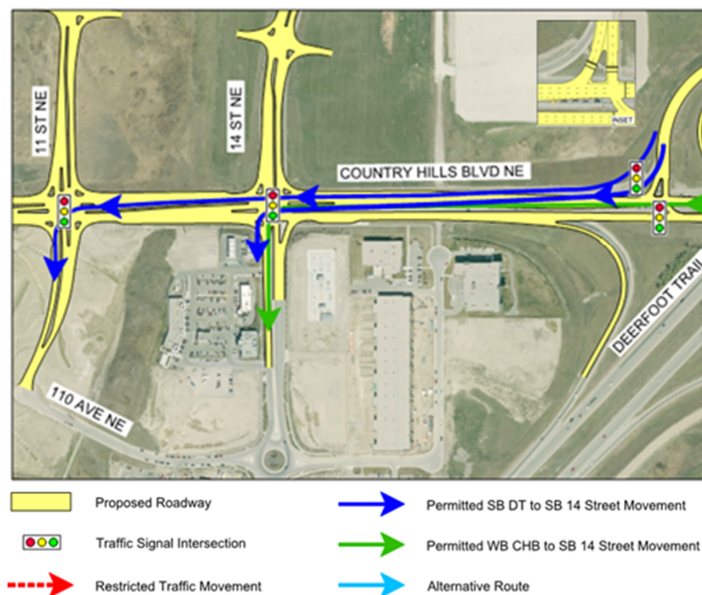


Figure ES 4.2: Dual Signalized Right at CHB / SB Deerfoot Trail Ramp



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5.0 Transportation and Bridge Options

With traffic forecasting and analysis of the corridor completed, the proposed intersection configurations and bridge geometry was explored. This is summarized in the following sections.

5.1 CP Bridge to Coventry Boulevard N.E. / Harvest Hills Way N.E.

5.1.1 CP Bridge Widening Options

CP bridge widening is dependent on the options considered at Coventry Boulevard N.E. / Harvest Hills Way N.E. as the length of the WB left turn storage bay and overall median influences the bridge width. Consideration was given to the existing concrete deck-bulb tee girders used for the bridge superstructure as those are no longer fabricated.

Three options were explored:

- Option 1 – Widen inwards to provide additional lanes. This option requires narrower shoulders (estimated 1.0 to 1.2 m), below the desired 1.4 m requirement from TAC guidelines.
- Option 2 – Maintain existing sidewalks and widen only enough to accommodate additional lanes. Cost savings for this case are relatively minimal when compared to Option 1.
- Option 3 – A separate multi-use pathway (MUP) on a new separate bridge is proposed. Changes will be required to the existing MSE wall and a new alignment for the MUP will need to be considered.

5.1.2 Coventry Boulevard N.E.

A dual lane and single WBL turn lane was evaluated at Harvest Hills Way N.E. / Coventry Boulevard N.E. A single WB left aligns with widening of the CP bridges inward to accommodate the storage length required at the turning movement. A dual WB left (**Figure ES 5.1**) aligns with widening the existing north bridge to the outside and the existing south bridge to the inside. The dual left option would require modification to the south leg of the Harvest Hills Way N.E. intersection to accommodate two receiving lanes, with one needing to be dropped 80 m after the turn is completed.



Figure ES 5.1: Dual WBL at Harvest Hills Way and CP Bridge



Therefore, the single WB left option was recommended, which aligns with bridge options that widened to the inside or used separate/independent pedestrian bridges. The recommended intersection and bridge plan is shown below in **Figure ES 5.2** and additional details are discussed in ES Sections 6 and 7.

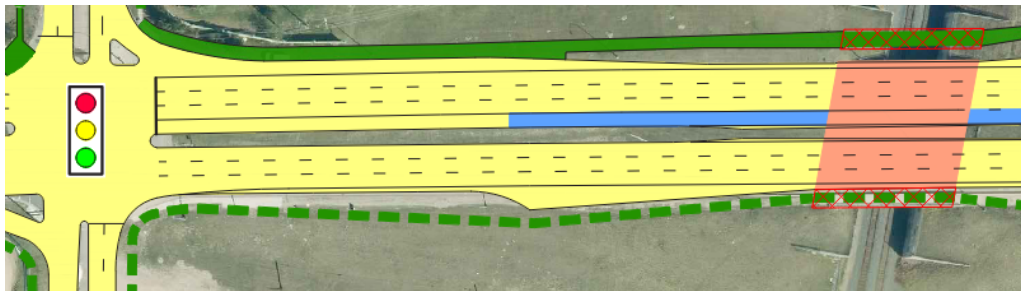


Figure ES 5.2: Single WBL at Harvest Hills Way and CP Bridge Widened to Inside

With the very long left turn identified for Coventry Boulevard a conceptual dual WBL was reviewed to possibly divert some of the turning volumes west to the Harvest Hills Gate N.E. intersection. This option shown in **Figure ES 5.3**, could be explored in the future, if required.



Figure ES 5.3: Dual WBL at Harvest Hills Gate

5.2 Nose Creek Bridge and 11 Street N.E.

5.2.1 Nose Creek Bridge Widening Options

The existing Nose Creek north and south bridges provide two lanes of travel. Three options were explored for the Nose Creek bridge widening.

- Option 1 – Widening inwards and outwards to accommodate seven lanes of traffic (six through lanes + one turn bay) and the MUP. Cost to widen the north bridge would be similar to the cost of a new separate pedestrian bridge.
- Option 2 – Maintain existing sidewalk by removing the median. This option would result in less than desirable shoulder widths on the north bridge.
- Option 3 – A new separate pedestrian bridge would be built to accommodate the MUP, reserving the entire width of the existing bridges to vehicular traffic.



5.2.2 11 Street N.E.

With the extremely close spacing of the Nose Creek bridge to 11 Street N.E. it was determined that bridge widening Option 2 of widening to the inside on the existing bridge deck was not feasible. Option 1 utilizing the existing full median bridge deck with widening to the outside was chosen and is shown on **Figure ES 5.4**.

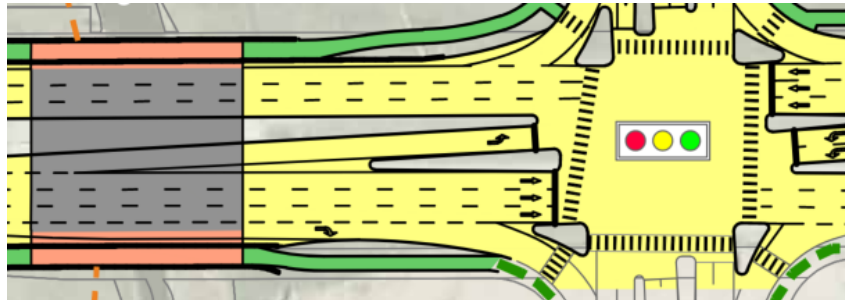


Figure ES 5.4: Nose Creek Bridge and 11 Street N.E.

5.3 14 Street N.E.

The existing right turn treatment for northbound (NB) 14 Street N.E. to EB CHB is a yield. Traffic analysis shows that a yield configuration fails in future horizons. Two options were considered to resolve operation issues: a free flow right turn and a dual signalized right turn.

A free flow right turn with lane away to EB CHB and a dual NBL and single NB through lane on 14 Street N.E. is shown on **Figure ES 5.5**. This option was presented to the public during Phase 3 engagement but is less desired by Calgary Transit as it may require the relocation of the existing EB transit stop 2274, just east of 14 Street N.E. intersection. With the transit stop in the auxiliary lane, there is a risk for high-speed rear end and/or side swipe related conflicts. The bus stop may be relocated depending on the preferred option but may require the existing transit route to be rerouted to 11 Street N.E. in the future, adding to Calgary Transit operational costs.

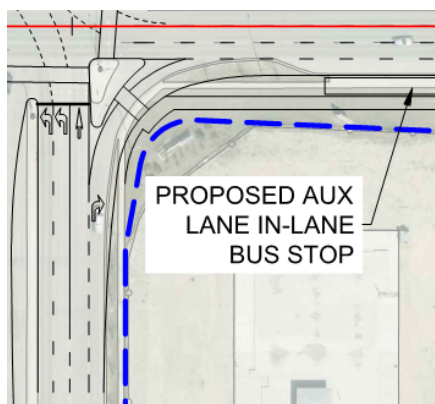


Figure ES 5.5: 14 Street N.E. – Free Flow Right Turn



The dual signalized right option also requires one of the NB through lanes to be dropped and converted to be a part of the dual right turn lane. This option has a single NB left lane, which results in a longer left turn queue along with the queue for the NB dual right. The dual signalized right more likely allows for a future in-lane bus stop at the location desired by Calgary Transit (see **Figure ES 5.6**). Signalizing the NBR movement in the signalized dual right option could also improve safety at the crossing and minimize weaving conflicts between EB CHB and SB Deerfoot Trail on-ramp.

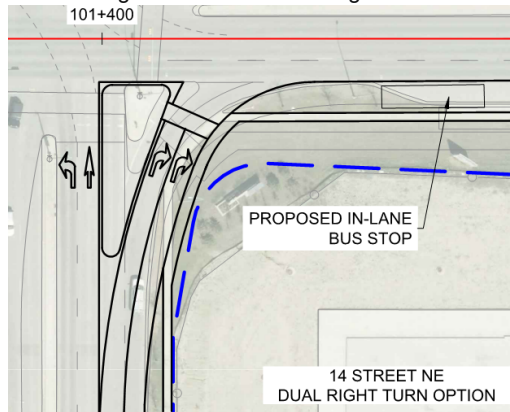


Figure ES 5.6: 14 Street N.E. – Dual Signalized Right Turn

Both options are shown in the recommended plans and should be reviewed again in future design stages.

5.4 Deerfoot Trail Interchange

The existing Parclo A4 interchange is the most suitable interchange type for existing and future traffic volumes. The City plans to ultimately accommodate six lanes of traffic, two auxiliary lanes and two pathways.

5.4.1 Bridges

Challenges with the existing girders, foundation system, and on-going maintenance costs on the south bridge made options that kept the existing south bridge unfeasible. Through discussions with project stakeholders, it was agreed that a new south bridge will be constructed and then the existing bridge will be demolished. An AT design exception was prepared as the new south bridge is required to be on a crest curve to match the existing north bridge and interchange junction elevations.

The north bridge is flared and widens from 17.22 m at the east abutment to 20.51 m at the west abutment, providing some challenges for widening. Three options were explored to widen the north bridge to achieve the requirements of a 6-lane Arterial Road.

- Option 1 – Widen north bridge to accommodate four lanes of traffic and a 4.0 m MUP. The anticipated costs for this option are high.
- Option 2 – Reduce existing sidewalk width, lane widths and/or shoulder widths to allow space to accommodate three lanes and an auxiliary lane.



- Option 3 – A new separate bridge that can accommodate the 4.0 m MUP north of the existing bridge. The entire width of the existing deck would be used to accommodate vehicular traffic.

The project team explored several design exceptions with both The City and AT to proceed with Option 2 to maximize use of the existing bridge deck. The City wanted to reduce lane widths and shoulders widths to accommodate the three WB lanes without changes to the existing sidewalk. AT wanted to maintain lane widths, have shy distance shoulder widths as per AT standards, and close or reduce the sidewalk width. A design exception for cross section widths was not achievable at the time of this CHB Widening FPS, and the recommended way forward is Option 3 with the construction of a future pedestrian bridge at the point in time when the existing WB bridge is required to be upgraded to improve WB traffic operations. Through discussion with The City and AT it was agreed to modify the MUP width to 4.2 m following option evaluation to meet revised standards.

The vertical geometry of the existing bridges and loop ramps do not provide adequate decision sight distance and shoulder drainage storage. AT required The City to explore options to avoid having the Deerfoot Trail bridges on vertical crest curves, to improve the sightlines, and to have a continuous 1% grade for the bridges. Building the new south bridge with a 1% grade was shown to create significant elevation discrepancies at the interchange junctions and was also ruled out as it would require the removal of the existing WB bridge that still has a significant remaining life span of ~50 years. A design exception for the Deerfoot Trail bridge to be on a vertical crest curve was completed as requested by AT.

5.4.2 Interchange Ramps

The horizontal geometry of many of the existing interchange ramp gores does not match today's guidelines. Options to upgrade to current guidelines were explored including loop ramps with tighter radius curves to lower right turn speed and reduce severity potential for pedestrians at the loop ramp cross walks. Ultimately, through review with AT, the ramp gore horizontal geometry will generally match existing and did not require a design exception.

The vertical geometry of the existing loop ramps does not provide adequate decision sight distance. AT required the completion of a design exception for inadequate Decision Sight Distance (DSD) to the loop ramps.

5.4.3 Deerfoot Trail to 14 Street N.E. Weave

As previously described in **ES Section 4.2**, several options were explored to eliminate the potential weaving issue from SB Deerfoot Trail to SB 14 Street N.E. The roadway geometry for each of the options was explored along with cost estimates. A dual signalized right for the Deerfoot Trail SB right was chosen as the preferred option.



6.0 Recommended Transportation Plan

The recommended Ultimate transportation plan widens existing CHB between Deerfoot Trail and Coventry Boulevard from four to six lanes. Widening strategies were also developed for all existing bridges in the Study Area. Recommendations in the Ultimate plan include capacity and safety improvements for all modes of travel within the Study Area. The recommended Ultimate transportation plan for the Study Area is shown on **Exhibits ES 6.01 to 6.06**.

6.1 CHB Alignment and Profile

Due to significant variation in median width throughout the corridor, independent alignments were defined for WB and EB roadways along CHB. The profile of CHB matches the existing conditions of the roadway throughout the Study Area. A small section of new profile design matching the existing crest curve of the existing WB bridge was completed for the new EB bridge at the Deerfoot Trail interchange.

6.2 Active Mode Connectivity

There are multiple existing and planned pathways within and adjacent to the CHB Study Area, with several gaps or missing links, including:

- North side of CHB between Harvest Hills Gate N.E. and Coventry Boulevard N.E.
- North side of CHB between Coventry Boulevard and 14 Street N.E.
- South side of CHB between 15 Street N.E. cul-de-sac and Deerfoot Trail East Junction.

Exhibit ES 6.07 shows the existing pathways in green dashed linework and proposed pathways in solid green linework. The proposed pathways fully connect the pedestrian pathway system along the corridor and vary in width between 3.0 m and 4.2 m on the north and south sides of CHB. Connections from the Study Area pathways to the Rotary Mattamy Greenway and The Trans Canada Trail are provided between Harvest Hills Way N.E. and 14 Street N.E.

6.3 Calgary Transit Connectivity

With the improved road capacity after widening, CHB can provide quicker and more efficient trips for the Calgary Transit fleet to and from the Stoney Transit Facility located on 14 Street N.E., north of CHB. Additional future transit routes can be accommodated on CHB as a result increased capacity from the widening. Future new transit routes will be dependent on ridership in future communities, funding availability, and road network improvements.

Modifications to existing transit stops and new stops are proposed throughout the Study Area, with new continuous pathways on north and south sides providing improved access for transit users. A summary of transit stops in the Study Area is provided in **Table ES 6.1**.



Table ES 6.1: Transit Stops

Stop ID	Direction	Location	Recommended Plan
4454	EB CHB	East of Harvest Hills Gate N.E.	Existing In-Lane Maintained
4455	EB CHB	East of Harvest Hills Way N.E.	Existing In-Lane Maintained
NEW	EB CHB	East of 11 Street N.E.	New Proposed In-Lane
2274	EB CHB	East of 14 Street N.E.	Existing Revised to In-Lane
9676	EB CHB	East of Freeport Dr N.E.	Existing Pull-Out Maintained
4713	WB CHB	West of Coventry Blvd N.E.	Existing Revised to In-Lane
2275	WB CHB	West of 14 Street N.E.	Existing In-Lane Maintained
2294	WB CHB	West of Freeport Dr N.E.	Existing Pull-Out Maintained
2860	NB 14 ST	North of CHB	Existing Stop Maintained

Options for bus lane queue jumps to bypass future vehicle queues at 11 Street N.E. and 14 Street N.E. intersections were not possible as property throughout the corridor had been previously negotiated and set with adjacent landowners. The City did not want to pursue land acquisition for future bus lanes and/or queue jumps. In the future, once the area is developed and the transit network requirements are finalized, The City could explore converting the two outside lanes of the Ultimate six lanes to be special purpose for transit such as High Occupancy Vehicles (HOV).

Two intersections options are available for 14 Street intersection: a free flow NBR and a dual signalized NBR. The free flow right option may result in the relocation of the existing bus stop 2274 east of 14 Street N.E. to between 11 Street N.E. and 14 Street N.E. With the transit stop in the auxiliary lane, there is a risk for high-speed rear end and/or side swipe related conflicts. Transit route 157 may also be rerouted to ensure transit service is maintained. Calgary Transit is not supportive of the relocation of bus stop 2274 and prefers the dual signalized NBR option at 14 Street N.E. intersection.

6.4 Harvest Hills Gate to Coventry Hills Boulevard

The western segment of the Ultimate recommended plan includes minor modifications to complete the pathway connectivity and transfer from three core lanes back to two lanes for WB CHB as highlighted on **Exhibit ES 6.02**. Key features include:

- Approximately 140 m west of the CHB / Harvest Hills Gate intersection, the additional third WB lane is dropped, leaving two WB lanes.
- A 3.0 m pathway connection is created to connect the existing north pathway to provide a continuous pathway system.
- The existing bus layby in the northwest quadrant of the CHB / Coventry Boulevard intersection is revised to an in-lane bus stop by modifying the SB-WB right turn curb return.
- The EB direction is already set up for three future EB lanes. Minor modifications to paint lines, the WBL turn bay, and the right turn pork chops will be required.



6.5 Coventry Hills Boulevard to Nose Creek Bridge

For this segment of the Ultimate recommended plan, six core lanes of 3.5 m width are included along with continuous 3 m pathways, as shown on **Exhibits ES 6.02 and 6.03**. Key features include:

- The existing bus layby in the southeast quadrant of the CHB / Coventry Boulevard intersection is maintained as an in-lane bus stop with the 3 m pathway wrapping behind it.
- The right-in and right-out along EB CHB is maintained with minor modifications.
- The westbound CHB left to Harvest Hills Way N.E. is extended across the Nose Creek bridge.
- The pond access road on the north side of CHB will remain in place using the existing access road with minor changes required.
- Several future roadway barriers will be required.

6.6 Nose Creek Bridge to 14 Street N.E.

For this segment of the Ultimate recommended plan, six core lanes of 3.5 m width are added along with continuous 3 m wide pathways as shown on **Exhibits 6.03 and 6.04**. Key features include:

- Additional pathway connectivity from CHB to Nose Creek pathways are provided.
- The bus stops are proposed to be in-lane side stops prior to the beginning of the right turn auxiliary lanes between 11 Street N.E. and 14 Street N.E. This differs from previously shown plans by others.
- The median roadway barrier on the Nose Creek bridge previously shown by others has been removed. The outside barriers for the bridge are still required.

6.7 14 Street N.E. to Barlow Trail N.E.

This segment of the recommended plan includes revisions to the Deerfoot Trail interchange to accommodate three core lanes of 3.7 m width in each direction and 3 m pathways with 4.2 m widths on the bridges, as shown on **Exhibits ES 6.04 to 6.06**.

Key features include:

- The NBR turn lane at the 14 Street N.E. intersection is revised from Melcor's design. The proposed right turn changes from yield condition to either a free flow right or dual signalized right to accommodate the increase in traffic volume. The option chosen in the future modifies the NB 14 Street N.E. laning and the existing bus stop 2274 east of 14 Street N.E.
- A design exception was submitted to AT for the reduced DSD to the loop ramp exits and lack of 1% gradient over the proposed south bridge.
- The existing dual left turns for the interchange junctions are maintained with minor adjustments to tie with the future roadway geometry.
- High entry angle signalized dual right is proposed for the SB-WB ramp. These right turns provide numerous benefits including reduced driver workload by reducing the angle that drivers must turn their heads to check approaching traffic, improved visibility of pedestrians due to reduced driver viewing angle, and reduced turning speed consistent with a yield condition. The SB Deerfoot Trail exit ramp is modified to extend turn lanes and minimize ramp queueing that results from the implementation of the dual signalized right.



- The free flow right for NB Deerfoot Trail exit ramp is maintained and modified to feed into a continuous auxiliary lane between the east interchange junction and the Freeport Drive intersection.
- The proposed plans tie to existing lanes west of the Freeport Drive intersection. Note: the existing bus stops at Freeport Drive are shown as the existing laybays, but would likely be converted to in-lane stops in the future.

6.8 Road Safety Audit

Bunt & Associates/Watt Consulting Group were engaged to complete an independent Road Safety Audit (RSA) based on the preliminary version of the functional plan. The RSA team agrees that based on anticipated traffic levels, the proposed design will provide sufficient capacity and safety benefits for the motorized users.

The RSA team stated the proposed geometrics and laning are appropriate for the intended corridor operations and were in agreement with the requested design exceptions. Continuous pathways included in the recommended plan will address significant safety concerns.

The project team accepted and adopted many of the RSA suggestions typical for FPS level of design. Remaining issues and suggested mitigation should be reviewed and considered as the design progresses, including:

- Pedestrian signage at Deerfoot Trail interchange ramps, right turn crossings at intersections throughout the corridor, and where MUP is adjacent to bus stops.
- Barrier end treatments and heights approaching and on bridge crossings.



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7.0 Recommended Bridge Plans

After intensive analysis of multiple options for each crossing as previously described in ES Section 5, final recommended bridge plans were determined for the three bridge crossings.

7.1 CP Crossing

The CP overpass on CHB consists of two existing bridges (shown in **Figure ES 7.1**) that were built in 1991 with a total span of 20.0 m over the CP tracks. The south bridge is 13.6 m wide and the north bridge is 12.6 m wide.

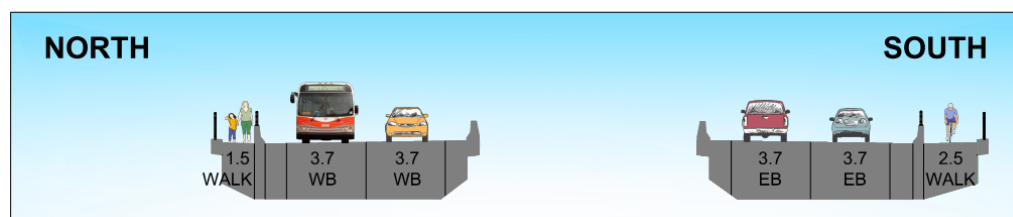


Figure ES 7.1: CP Existing Bridge Cross Section

The final recommended bridge plan (refer to **Figure ES 7.2**) for the CP crossing includes widening to the inside to accommodate an additional lane of traffic in both directions, and wider sidewalks. Three box 900 girders will be used to widen each bridge deck by 4.43 m. A gap of 1.3 m will remain between the two bridges. A gap is essential to allow contractors adequate access to pour the deck and barriers of the new widened structure. For safety reasons, a high barrier with railing has been specified to restrict users from jumping from one bridge to the next.

A new pedestrian bridge built north of the existing WB bridge will provide a 4.0 m pathway for pedestrians. The WB bridge can then be modified to add an additional right turn lane, replacing the existing walk on the north WB bridge.

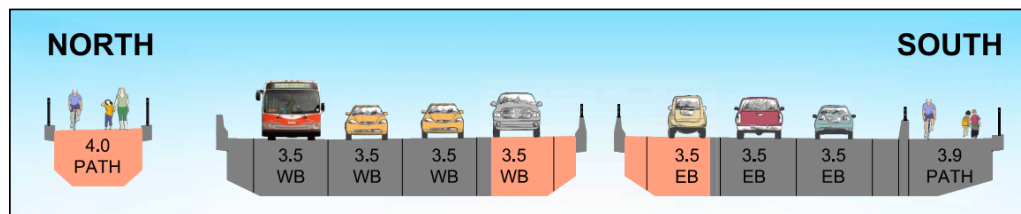


Figure ES 7.2: CP Proposed Ultimate Bridge Cross Section

7.2 Nose Creek Crossing

The Nose Creek crossing consists of two separate bridges (shown in **Figure ES 7.3**). The north WB bridge is a single span 31.0 m long bridge built in 1982. The south EB bridge is a single span 31.0 m long bridge built in 1990. The current crossing consists of four lanes (two each direction). There is currently a 5.7 m wide median which can be modified to accommodate additional lanes of traffic.

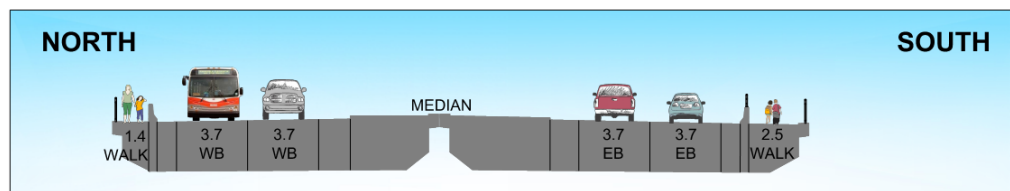


Figure ES 7.3: Nose Creek Existing Bridge Cross Section

The recommended bridge plan includes widening to the south by an additional 9.39 m and reduced median to accommodate five lanes on the south bridge. The north WB bridge can be widened to provide a 4.0 m wide pathway (shown in **Figure ES 7.4**). Minor changes may be required to the median width and the alignment of the lanes based on the staging plans selected by The City. The final stage at this crossing will support eight lanes and two 4.0 m wide paths.



Figure ES 7.4: Nose Creek Ultimate Bridge Cross Section

7.3 Deerfoot Trail Crossing

The Deerfoot Trail crossing consists of two bridges. The existing south EB bridge was built in 1975 and is a two-span bridge with an overall length of 116 m by 10 m wide. The existing superstructure of the bridge consists of three trapezoidal steel girders. The existing north WB bridge was built in 2002; it is also a 116 m long two-spanned structure. The bridge is flared with a variable width of 17.2 m to 20.5 m.

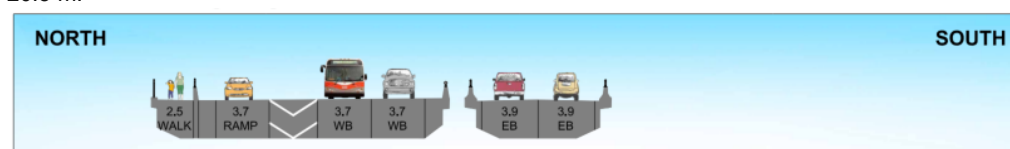


Figure ES 7.9: Deerfoot Trail Existing Bridge Cross Section

For the Ultimate stage, the sidewalk on the existing WB bridge will be removed and shifted onto a new 5.10 m wide pedestrian bridge built north of the existing WB bridge. The existing sidewalk on the WB bridge will be removed providing wider shoulders. Minor changes to the alignment of the auxiliary lane to the ramp are also planned. The south bridge will be demolished completely and replaced with a new EB bridge.

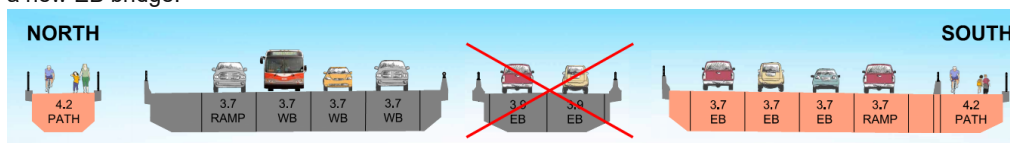


Figure ES 7.9: Deerfoot Trail Proposed Ultimate Bridge Cross Section



■ 8.0 Stormwater Management System

A separate technical memorandum was prepared by ISL to document the preliminary stormwater design methodology and the main mitigation measures to the existing Stormwater Management System (SWMS). Stormwater catchment areas are provided in the main report.

- The existing SWMS should be retained as much as possible; the existing inlet control devices (ICD) types should be retained or replaced with the equivalent types that are widely used at present.
- No new outfalls are proposed according to the proposed SWMS concepts.

■ 9.0 Utilities Review

A desktop review of utilities was completed for this FPS. Existing and proposed shallow and deep utilities were located within the Study Area and were overlaid with the proposed transportation infrastructure.

Existing shallow and deep utilities were located based on information provided by The City and the utility companies. A separate utility memorandum and utility tracking log were also prepared; they are included in Appendix I of the main report.



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10.0 Project Implementation

The project implementation scope included an initial review of construction staging, development of project capital construction costs, and definition of property requirements. It is expected that the proposed initial phase of construction be further reviewed and modified as the project progresses in future design stages.

10.1 Proposed Stage 1

Stage 1 widens EB CHB throughout the entire corridor and provides three through lanes between Harvest Hills Gate N.E. and Barlow Trail N.E. Auxiliary lanes, turning lanes, and a MUP between 3.0 m and 4.0 m is also provided. WB CHB is widened to three lanes throughout, except for the Deerfoot Trail interchange, and only provides for sidewalk widths on the north side of the bridges. Traffic analysis shows that the Deerfoot Trail interchange will operate within a reasonable threshold for some time. The sidewalks (<3 m) / pathways (>3 m) will be provided and added to each of the existing bridges in Stage 1 providing continuous active modes connectivity.

The Stage 1 transportation plan for the Study Area is shown in **Exhibits ES 10.01 to 10.06**.

10.1.1 CP Crossing

Stage 1 upgrades to the CP bridge involve widening to the inside to accommodate one additional lane of traffic, a wider north side sidewalk, and a new south side pathway. Three box 900 girders will be used to widen each bridge deck by 4.43 m. As shown in **Figures ES 10.1**, minor changes will also be needed to the alignment of the lanes due to the wider sidewalks.

A gap of 1.3 m will remain between the two bridges. A gap is essential to allow contractors adequate access to pour the deck and barriers of the new widened structure. For safety reasons, a high barrier with railing has been specified to restrict users from jumping from one bridge to the next.

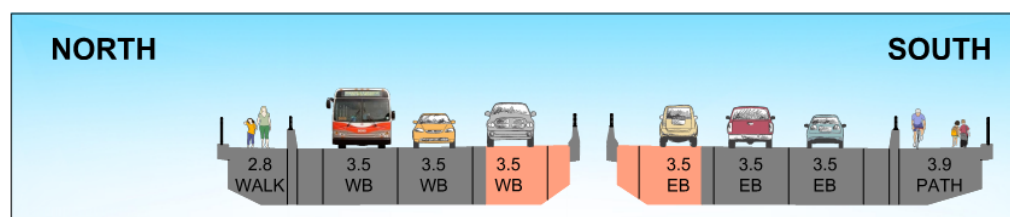


Figure ES 10.1: CP Proposed Stage 1 Bridge Cross Section

10.1.2 Nose Creek Crossing

Stage 1 Nose Creek Crossing widens the south bridge by an additional 9.39 m and the existing bridge deck median will be reduced to accommodate the required vehicle lanes in both directions. The north bridge sidewalk is maintained and a full 4 m wide space for the MUP is provided.

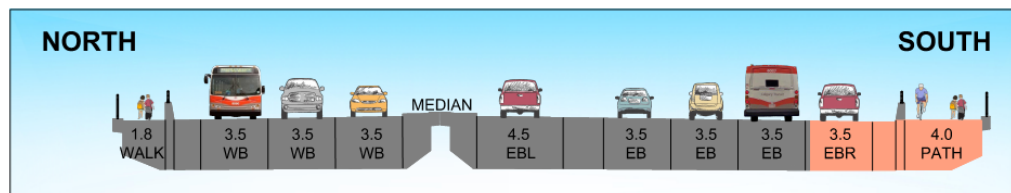


Figure ES 10.2: Nose Creek Proposed Stage 1 Bridge Cross Section

10.1.3 Deerfoot Trail Crossing

In Stage 1, a new south bridge will be constructed at the Deerfoot Trail crossing and the existing south bridge will be demolished. The new EB bridge will be far enough away from the existing bridge to prevent issues with access from the existing bridge. The new EB bridge will be designed to be 23.5 m wide to accommodate four lanes with a 4.20 m wide pathway.

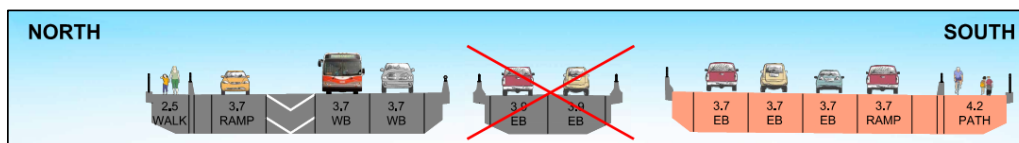


Figure ES 10.3: Deerfoot Trail Proposed Stage 1 Bridge Cross Section

10.2 Proposed Stage 2

The Stage 2/Ultimate widening of CHB includes either widening of existing north bridges or the construction of a new pedestrian bridge to accommodate 4.0 m to 4.2 m pathway widths on the north side of CHB at all three of the bridge crossings. The primary difference between Stage 1 and Stage 2 plan lies in the bridge configurations at CP bridge, Nose Creek bridge, and Deerfoot interchange. Minor pathway and roadway upgrades would be complete to connect to the new bridges and/or bridge widenings.

The Stage 2 transportation plan for the Study Area is shown in **Exhibits ES 10.07 to 10.12.**



10.3 Cost Estimate

Ultimate Stage Cost Estimate

The Ultimate stage widening of CHB includes either widening of existing bridges or the construction of a new bridge to accommodate pathways at each of the crossing locations. **Table ES 10.1** summarizes the Class 4 Cost Estimate.

Table ES 10.1: Ultimate Cost Estimate Summary

		Harvest Hills to Nose Creek	Nose Creek to 14 Street N.E.	Deerfoot Trail Interchange*	Total
ITEM	DESCRIPTION	COST			
1	REMOVALS	\$170,000	\$270,000	\$710,000	\$1,140,000
2	EARTHWORKS	\$3,810,000	\$7,200,000	\$20,520,000	\$31,530,000
3	ROAD / PATH ASPHALT -	\$680,000	\$930,000	\$420,000	\$2,030,000
4	SURFACE CONCRETE	\$580,000	\$1,540,000	\$1,510,000	\$3,620,000
5	STRUCTURES	\$2,370,000	\$2,850,000	\$24,940,000	\$30,160,000
6	TRAFFIC & WAYFINDING	\$1,110,000	\$1,810,000	\$2,760,000	\$5,680,000
7	STORMWATER MANAGEMENT	\$380,000	\$880,000	\$630,000	\$1,880,000
8	UTILITIES	\$1,250,000	\$1,250,000	\$1,250,000	\$3,750,000
9	LANDSCAPING AND MISCELLANEOUS	\$340,000	\$340,000	\$340,000	\$1,000,000
	Construction Subtotal (Approximate)	\$10,690,000	\$17,070,000	\$53,080,000	\$80,790,000
	Contingency 30%	\$3,210,000	\$5,130,000	\$15,930,000	\$24,240,000
	Engineering & Testing (Incl. Contingency) 15%	\$2,090,000	\$3,330,000	\$10,360,000	\$15,760,000
	City Costs 5%	\$540,000	\$860,000	\$2,660,000	\$4,040,000
	Subtotal	\$16,530,000	\$26,390,000	\$82,030,000	\$124,830,000
	Class 4 Cost Estimate	\$16,600,000	\$26,400,000	\$82,100,000	\$124,900,000

*East of 14 Street N.E. to West of Freeport Trail N.E.

- Harvest Hills to Nose Creek and Nose Creek to 14 Street N.E. sections is solely within the jurisdiction of The City and does not require collaboration with other shareholders. These sections could be upgraded independently from the Deerfoot Trail Interchange to their ultimate cross sections as an alternate Stage 1 configuration and funding strategy. Nose Creek to 14 Street N.E. may have cost share opportunities with adjacent landowners and covered by existing levies.
- The Deerfoot Trail interchange section will require collaboration with Alberta Transportation to finalize the recommended widening and bridge designs and contract specifications. Therefore, it might be advisable to complete this work independent from the other corridor upgrades from both a funding and approvals perspective.



Stage 1 Cost Estimate

Stage 1 cost estimate is provided in **Table ES 10.2**. This cost estimate aligns with providing 3 continuous EB lanes and wide active modes facilities on the south side of the three bridge crossings as outlined in **ES section 10.1**.

Table ES 10.2: Stage 1 Cost Estimate

		Stage 1	Stage 2	Total
ITEM	DESCRIPTION	COST		
1	REMOVALS (INCLUDES DISPOSING)	\$900,000	\$240,000	\$1,140,000
2	EARTHWORKS (GRADING)	\$23,620,000	\$7,910,000	\$31,530,000
3	PAVEMENT (ROADWORKS) -	\$1,380,000	\$650,000	\$2,030,000
4	CONCRETE WORKS	\$2,460,000	\$1,160,000	\$3,620,000
5	STRUCTURES	\$23,720,000	\$6,440,000	\$30,160,000
6	TRAFFIC & WAYFINDING	\$5,350,000	\$330,000	\$5,680,000
7	STORMWATER MANAGEMENT	\$1,880,000	\$ -	\$1,880,000
8	UTILITIES	\$3,750,000	\$ -	\$3,750,000
9	LANDSCAPING AND MISCELLANEOUS	\$1,000,000	\$ -	\$1,000,000
	Construction Sub-Total (Approximate)	\$64,060,000	\$16,750,000	\$80,790,000
	Contingency 30%	\$19,220,000	\$5,030,000	\$24,249,000
	Engineering & Testing (Incl. Contingency) 15%	\$12,500,000	\$3,270,000	\$15,760,000
	City Costs (Land Survey, Inspection, City Roads, City Admin and Insurance) 5%	\$3,210,000	\$840,000	\$4,040,000
	Subtotal	\$98,990,000	\$25,890,000	\$124,830,000
	Class 4 Cost Estimate	\$99,000,000	\$25,900,000	\$124,900,000



10.4 Property Requirements

A property plan was developed for the recommended Ultimate CHB corridor and is shown in **Exhibits ES 10.13 to ES 10.17**. Property is required to maintain a 2.0 m buffer between lip of gutter and pathway on the northeast corner of the intersection of 14 Street N.E. and CHB. No other additional ROW is required, but there are several grading easements required, identified in **Table ES 10.3**.

Table ES 10.3: Grading and Property Requirements

Property Owner	Title Number	Legal Description	Grading Easement	Required ROW
Country Hills Communities Inc	171009142	PLAN 8910090 BLOCK 1 LOT 1MR	0.011 acres (0.005 ha)	
The City of Calgary	161148907001	PLAN 1611516 BLOCK 4 LOT 6MR	0.125 acres (0.051 ha)	
Country Hills Communities Inc	171009142	PLAN 8910090 BLOCK 1 LOT 2ER	0.005 acres (0.002 ha)	
Country Hills Communities Inc	171009142	PLAN 8910090 BLOCK 1 LOT 1	0.271 acres (0.110 ha)	
Country Hills Communities Inc	171009142	PLAN 8910090 BLOCK 1 LOT 7ER	0.148 acres (0.060 ha)	
Country Hills Communities Inc	171009142	PLAN 8910090 BLOCK 1 LOT 6	0.070 acres (0.029 ha)	
Hyatt Auto Sales Ltd		PLAN 1610310 BLOCK 1 LOT 6		0.036 acres (0.015 ha)



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11.0 Engagement

The project team engaged with stakeholders and the public throughout 2019, 2020 and 2021 to gather feedback to develop design concepts, evaluation criteria and a recommended plan for the CHB Study Area. Engagement was organized into three phases, each tied to key milestones in the development of the FPS.

1. **Discover:** Discover opportunities, challenges, priorities, and evaluation criteria for the Study Area with stakeholders and the public
2. **Explore:** Explore design concepts and evaluation results with stakeholders and the public
3. **Reveal:** Present preferred plan to stakeholders and the public

In addition to newsletter, road sign and social media advertisements, letters were sent to key businesses and landowners whose property abuts CHB to promote the in-person (Phase 1 only) and online engagement opportunities throughout the study. Stakeholders and the members of the public were also encouraged to join the project email list to receive email updates about the project and engagement opportunities.

Following public health restrictions on public gatherings that came into effect in March 2020, public engagement was delayed several months to adapt the process to be conducted entirely online in Phase 2 Explore and Phase 3 Reveal. To better support participants through virtual engagement, online tools remained active for slightly longer periods than previously (i.e., three weeks rather than two weeks). Static project displays and information were supplemented with a narrated presentation of the concept options in Phase 2, and the recommended plan in Phase 3 was made available through The City's online Engage Portal.

11.1 Discover Phase

The first Discover Phase engagement events were held in person on November 20, 2019, and November 21, 2019. Online opportunities for input were offered between November 20 to December 4, 2019, at engage.calgary.ca, The City's online engagement portal.

What We Heard

The key themes we heard during the public engagement throughout the Discover phase included:

- It is important to accommodate pedestrians and cyclists along the study corridor and connections within communities and to existing pathways, and to improve or create this infrastructure with the safety of users in mind (e.g., mud or dirt paths are slippery and unsafe).
- There is concern about the high number of traffic lights on CHB and whether alternative options such as roundabouts could be considered.
- Concerns about potential environmental impacts caused by construction, such as flooding in the area, were raised.
- Additional design considerations included:
 - A longer merge lane onto Deerfoot Trail
 - Bus pull-outs along the corridor
 - A right turn lane at the intersection of CHB / Coventry Hills Boulevard



11.2 Explore Phase

In June and July 2020, The City held virtual meetings with stakeholders and an online engagement opportunity for the public to provide an update about the FPS and to collect feedback on the concepts and options developed and evaluated.

In compliance with Public Health recommendations in effect during 2020, engagement for the Explore phase was held entirely online. Online opportunities for feedback were offered from June 29 to July 26, 2020, at engage.calgary.ca. The City received 115 submissions online.

■ What We Heard

The key themes we heard during the public engagement throughout the Explore phase included:

- Participants carefully weighed costs for perceived benefits when considering the options presented – looking for a balance of lower cost options that still achieved meaningful improvements.
- Participants appreciated the enhanced pathway connections in the Study Area.
- There was some concern that not enough consideration has been given to transit-only lanes or queue jumps.
- Participants liked the focus on improved traffic flow and safety but had mixed opinions on the options presented for the Deerfoot Trail loop ramps and between Deerfoot Trail and 14 Street N.E.

11.3 Reveal Phase

In April and May 2021, The City held virtual meetings and online events to provide an update about the FPS and reveal and gather feedback on the recommended plans for the Study Area. A 3D fly over of the Study Area was completed and is available at the following link:

<https://www.youtube.com/watch?v=a-Q4QaRo2ms>

In compliance with Public Health recommendations in effect during 2021, engagement for the Reveal phase was held entirely online. Online opportunities for feedback were offered from April 19 to May 2, 2021, at engage.calgary.ca. The City received 62 submissions online.

■ What We Heard

The key themes we heard during the public engagement throughout the Reveal phase included:

- Participants felt the widening would decrease congestion and improve traffic flow in the area.
- Participants liked the improvements to pathways and pedestrian connectivity and expressed some concern that crossings for people who walk and ride their bikes should be considered more in the plan.
- Participants had some concerns about potentially negative impacts to the environment and area wildlife near Nose Creek.




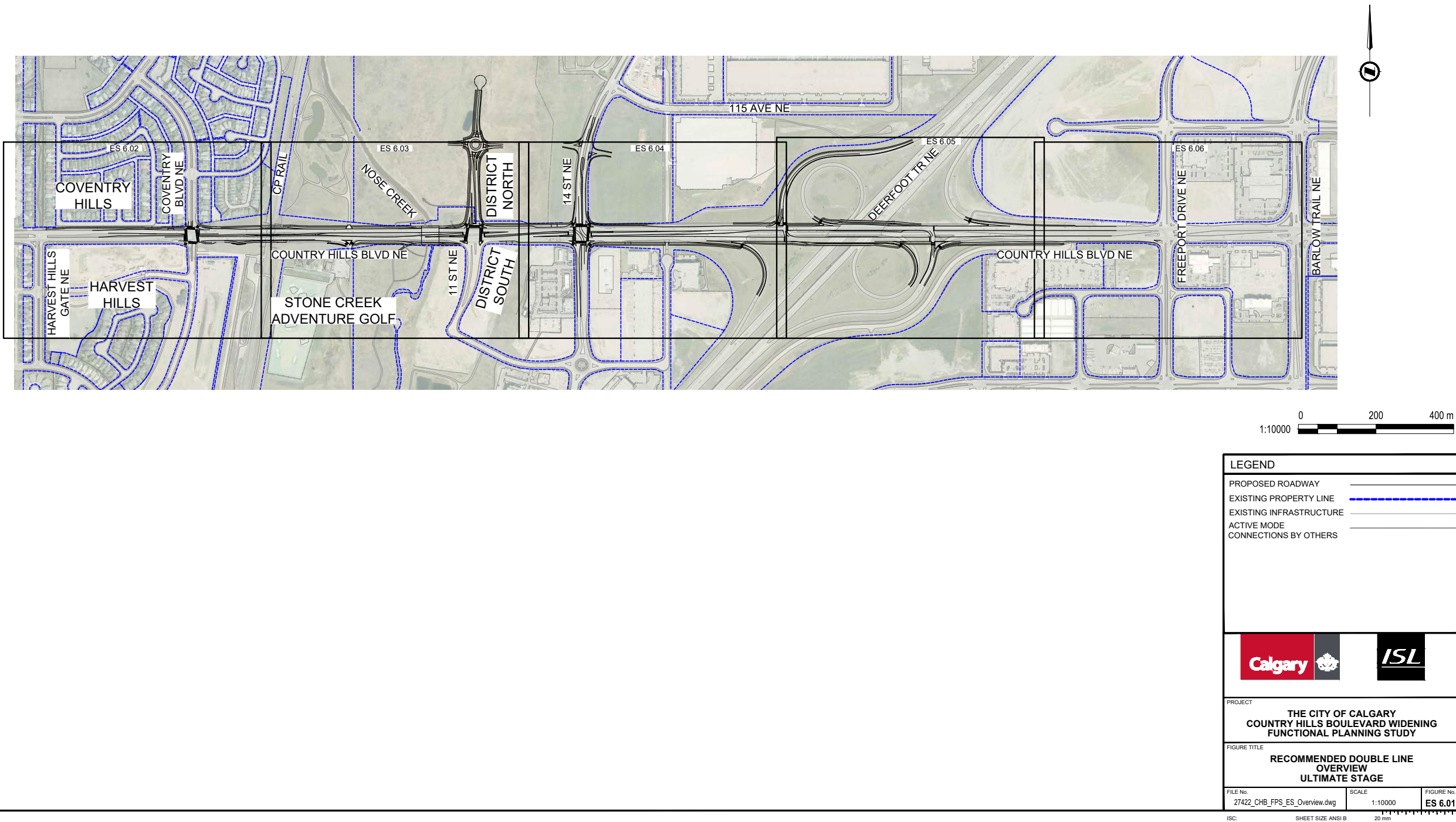
■ 12.0 Closure

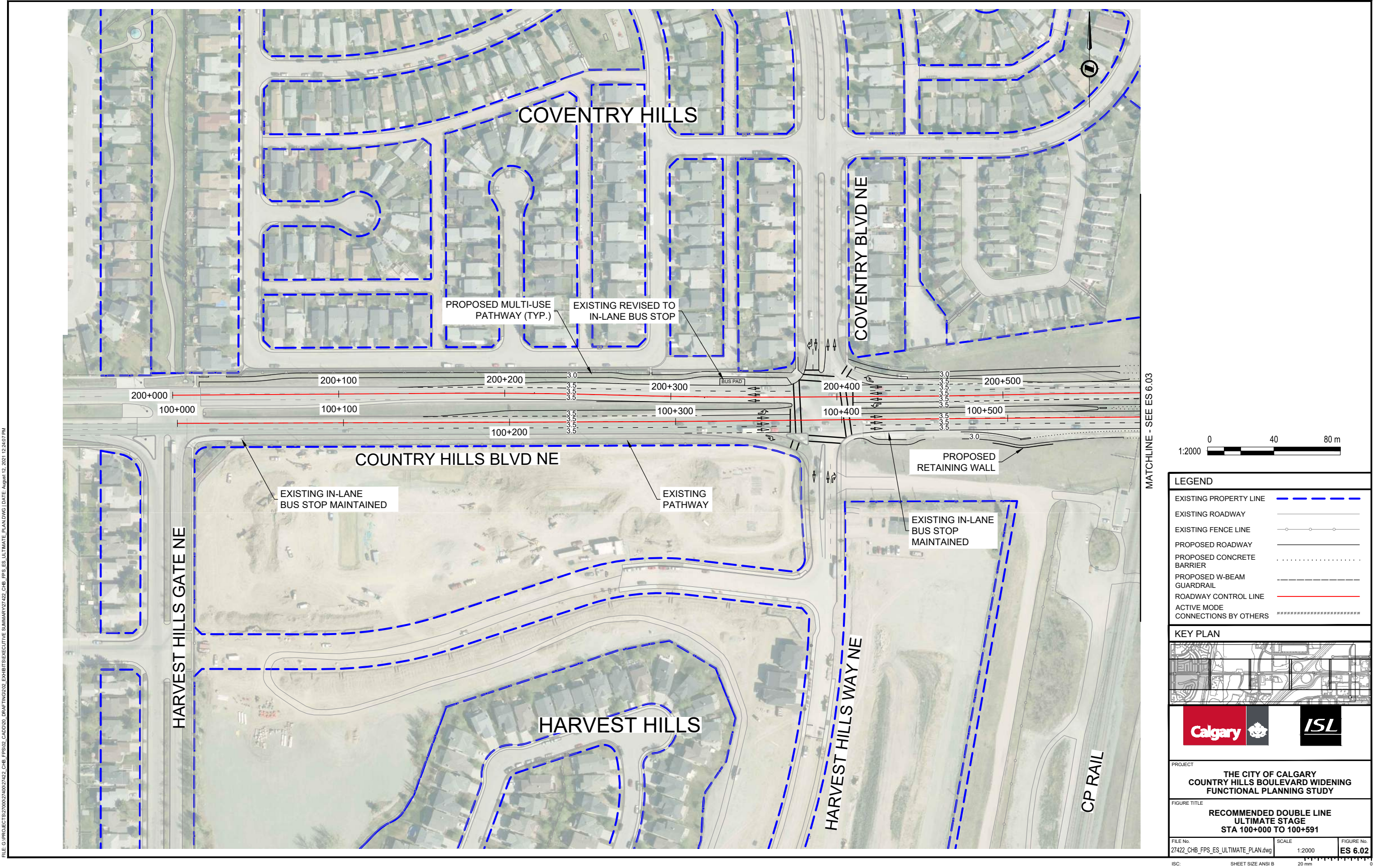
The Country Hills Boulevard Widening Functional Planning Study was undertaken to provide a roadway widening and pathway connectivity plan for Country Hills Boulevard between Barlow Trail N.E. and Harvest Hills Gate N.E. The recommended plan will improve mobility for existing facility users, area residents and support future growth. Key objectives of the study have been met including:

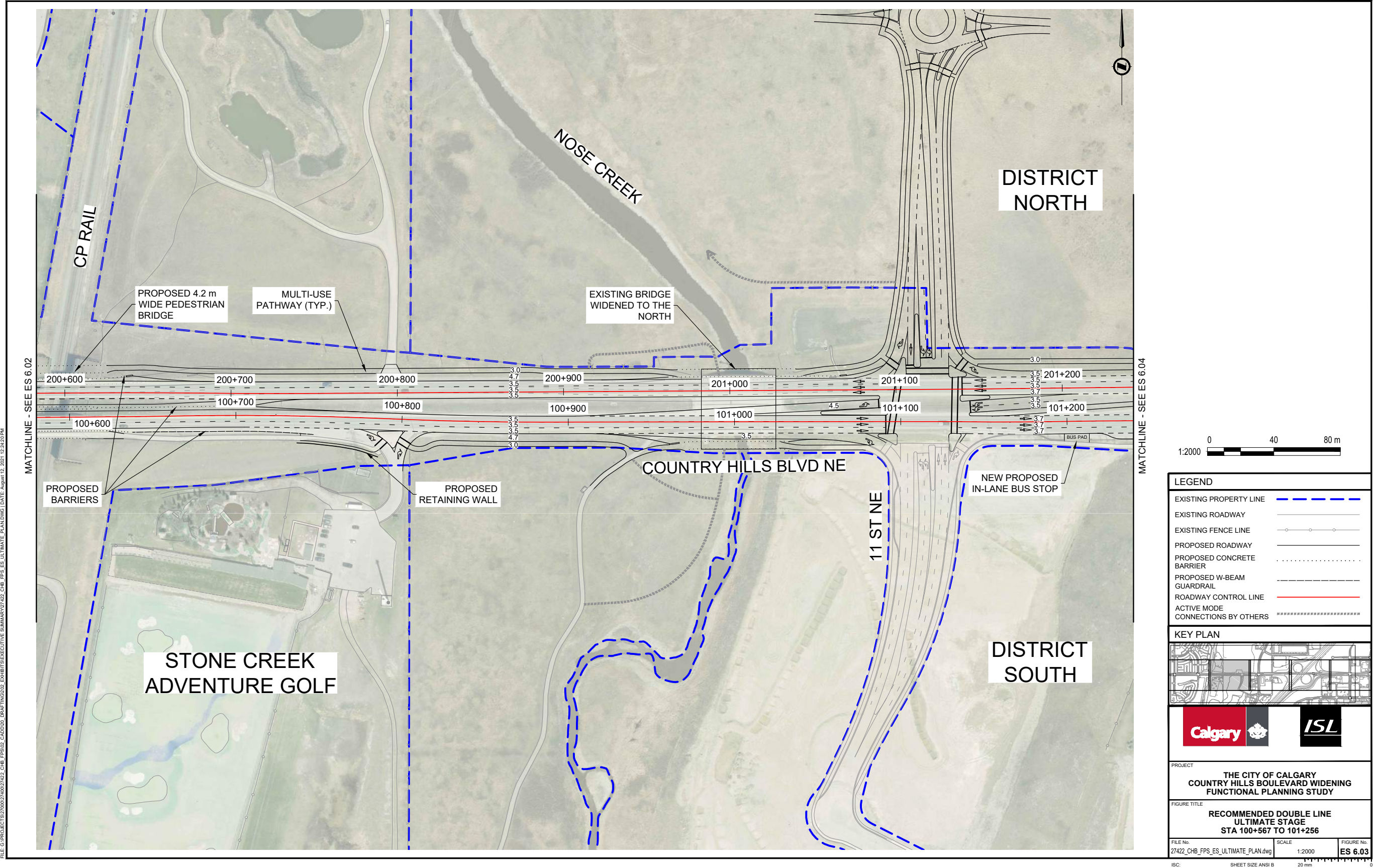
- The existing bridge structure as-builts were reviewed and potential widening strategies for the three existing bridge crossing locations were developed;
- Providing 2 continuous multi-use pathways primarily will connect to existing pathways and sidewalks, as well as, to the future pathways along Nose Creek;
- The existing Bus stops will be upgraded, future transit routing and potential HOV lanes to be evaluated as the development growth occurs over time;
- 6 core lanes and intersection upgrades will reasonably accommodate the future vehicular volume requirements; and
- The cost for the corridor improvement objectives is estimated to be \$124.9 Million.

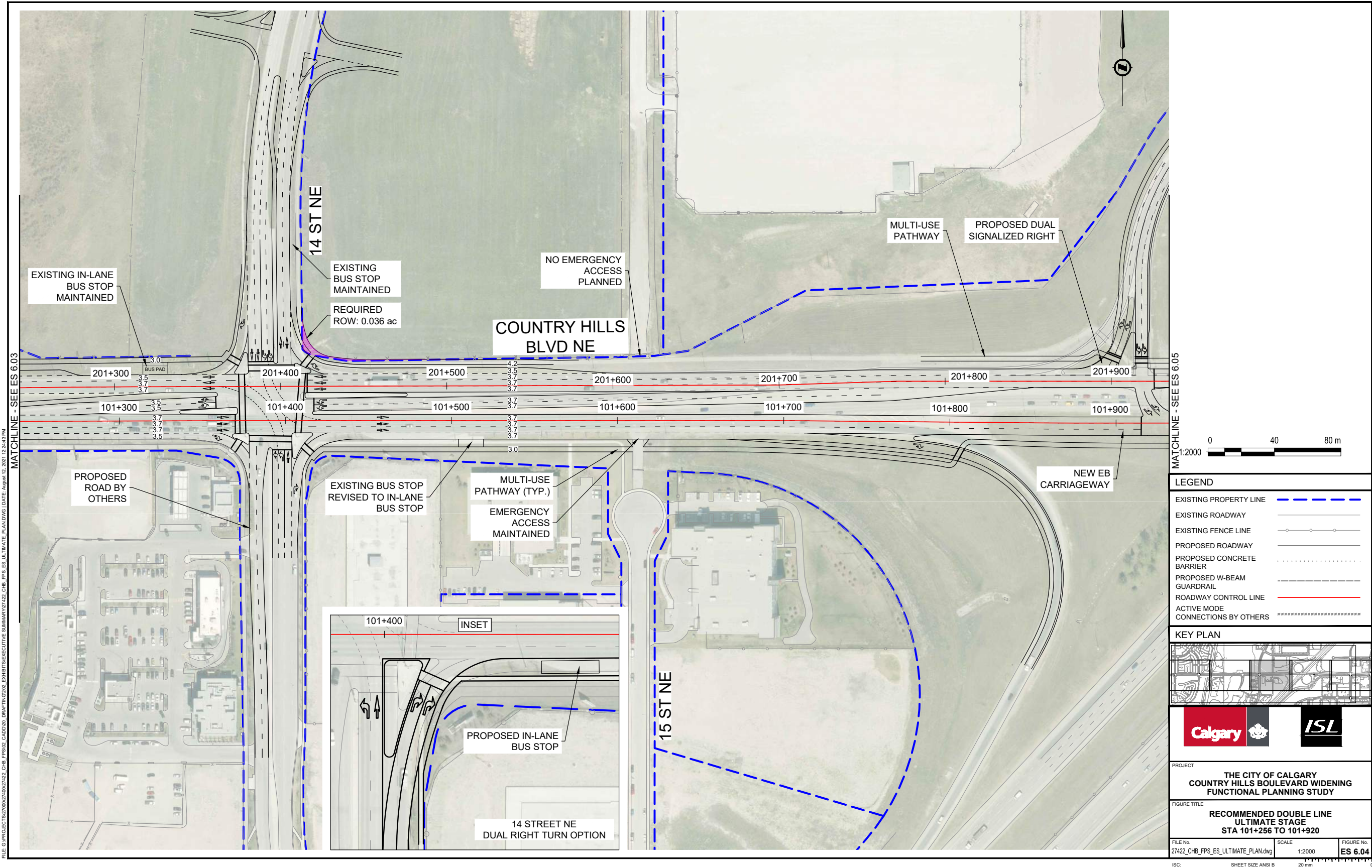


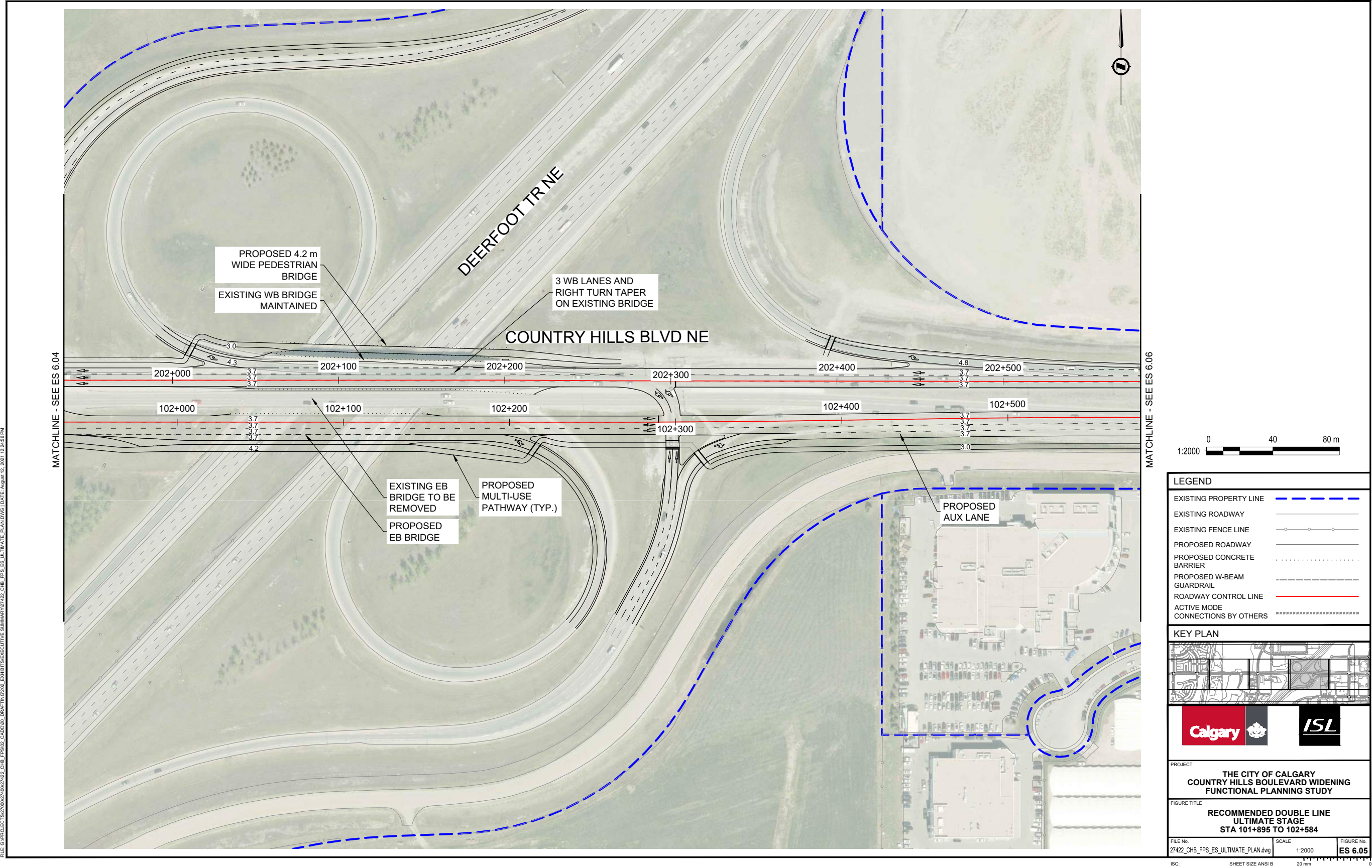
LEGEND		 	
 Existing 2 Lane Section		PROJECT THE CITY OF CALGARY COUNTRY HILLS BOULEVARD WIDENING FUNCTIONAL PLANNING STUDY	
 Existing 3 Lane Section		FIGURE TITLE STUDY AREA	
 Existing Pathway / Sidewalk		FILE No. 27422_CHB_FPS_ES_StudyArea.dwg	
 Intersecting Roadways		SCALE NOT TO SCALE	
 Water Course		FIGURE No. ES 1.01	
		ISC. SHEET SIZE ANSI B 20 mm 0	

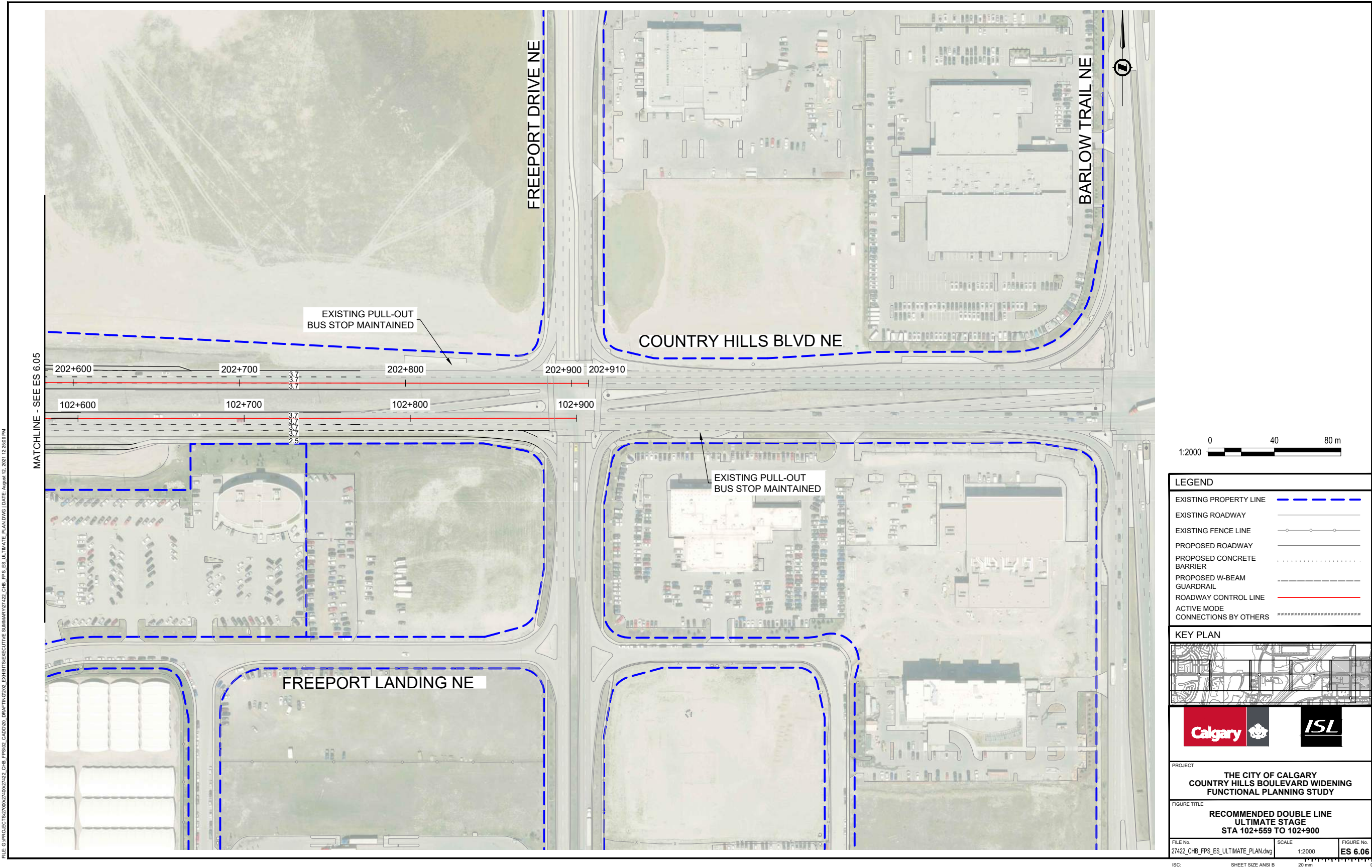


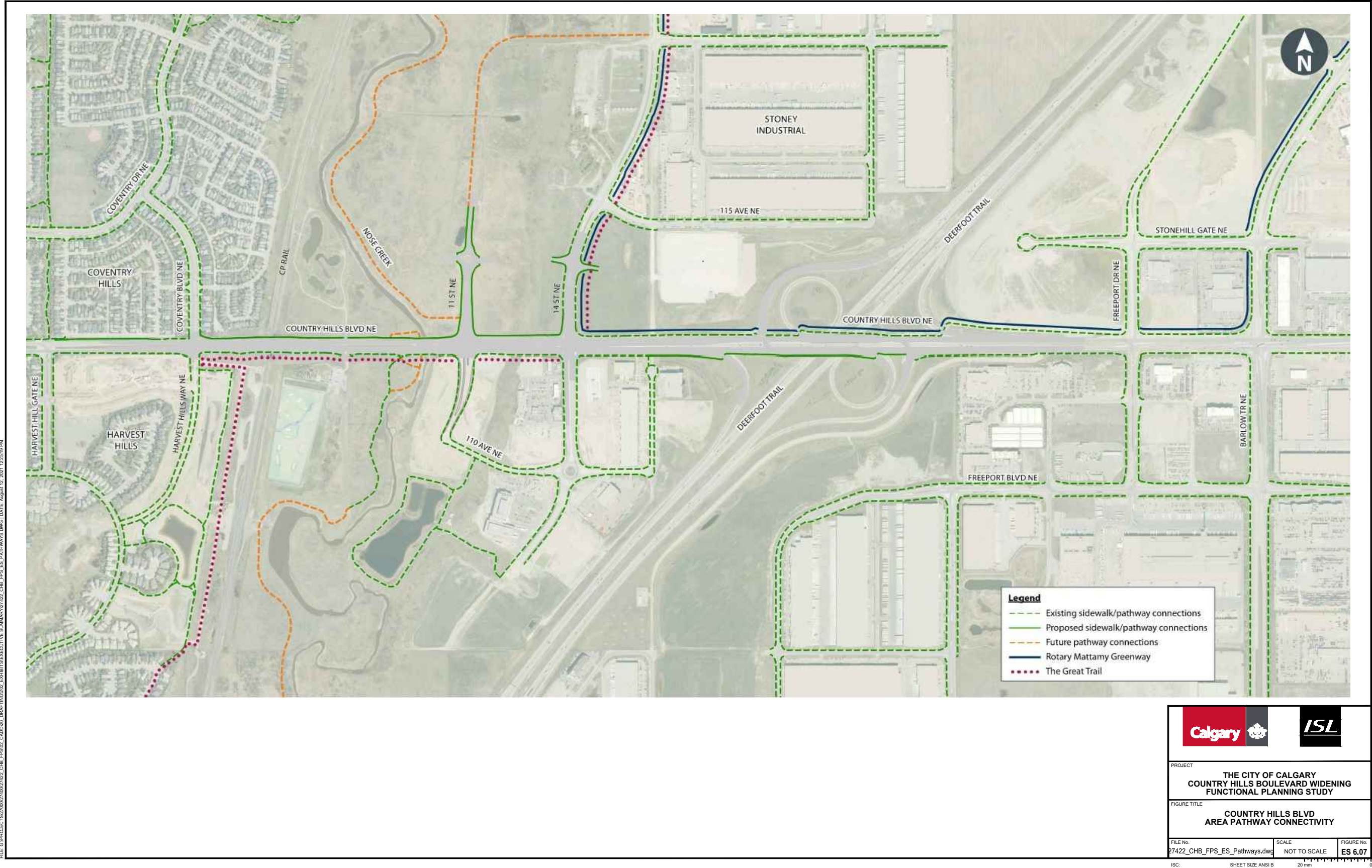


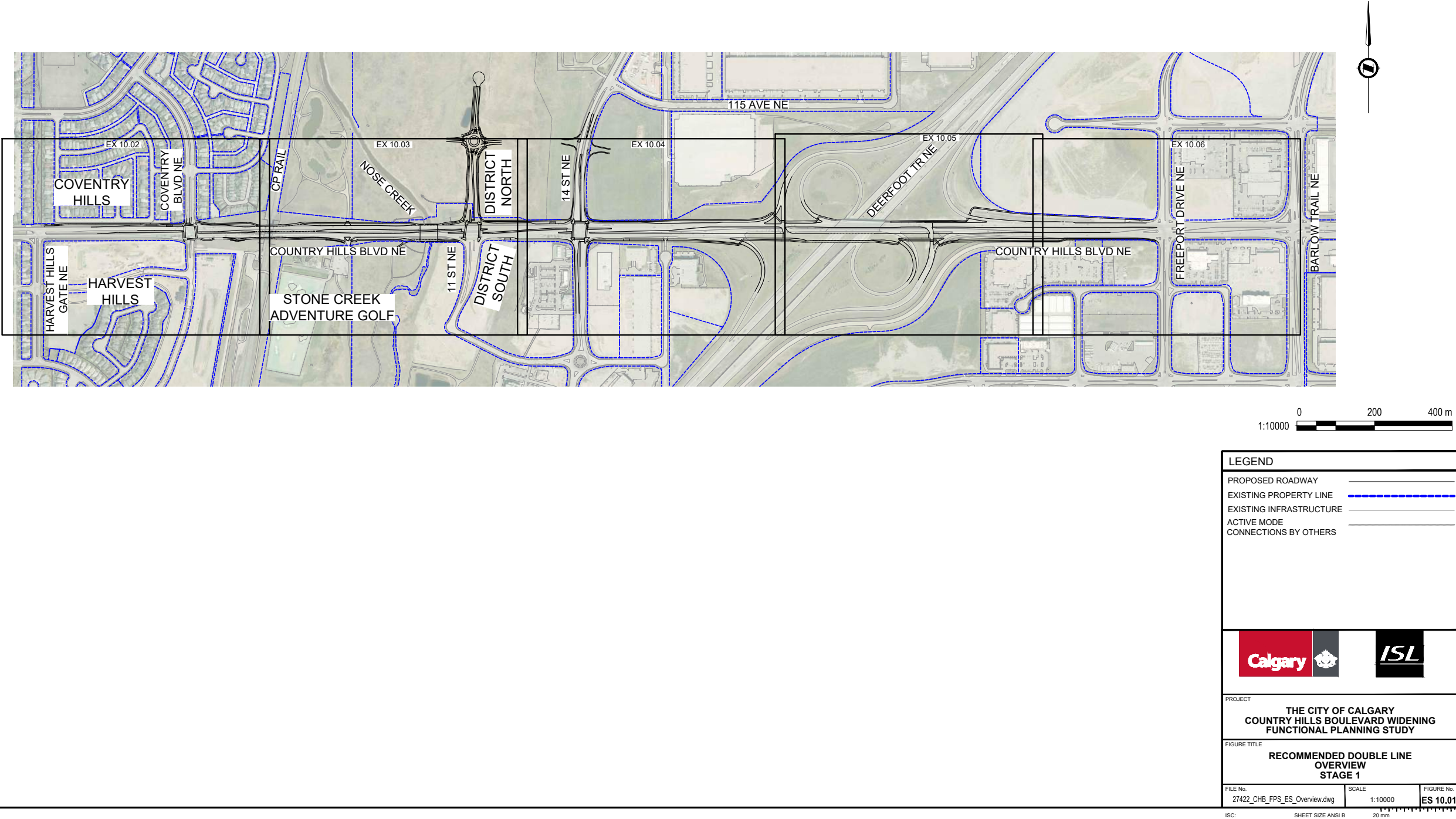


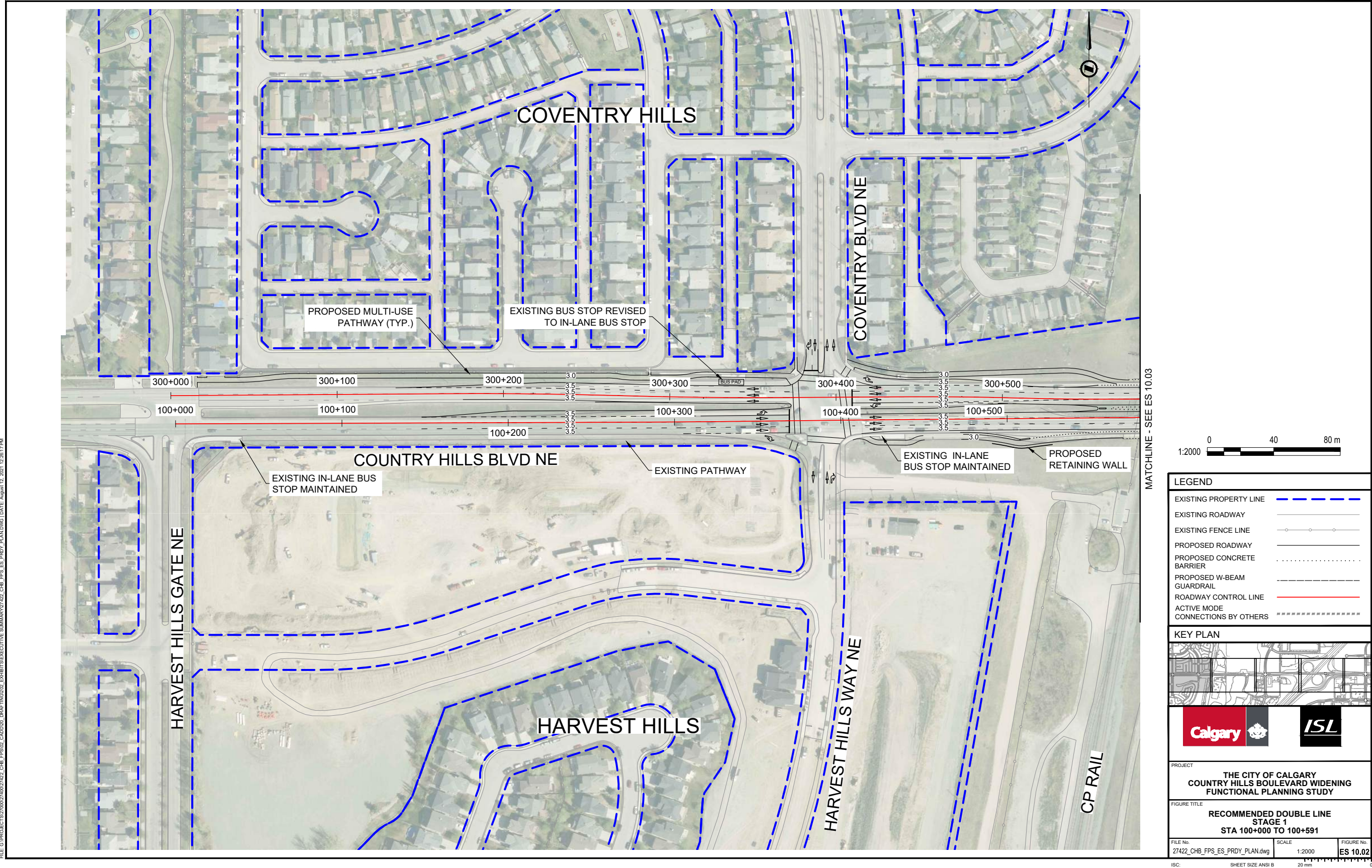


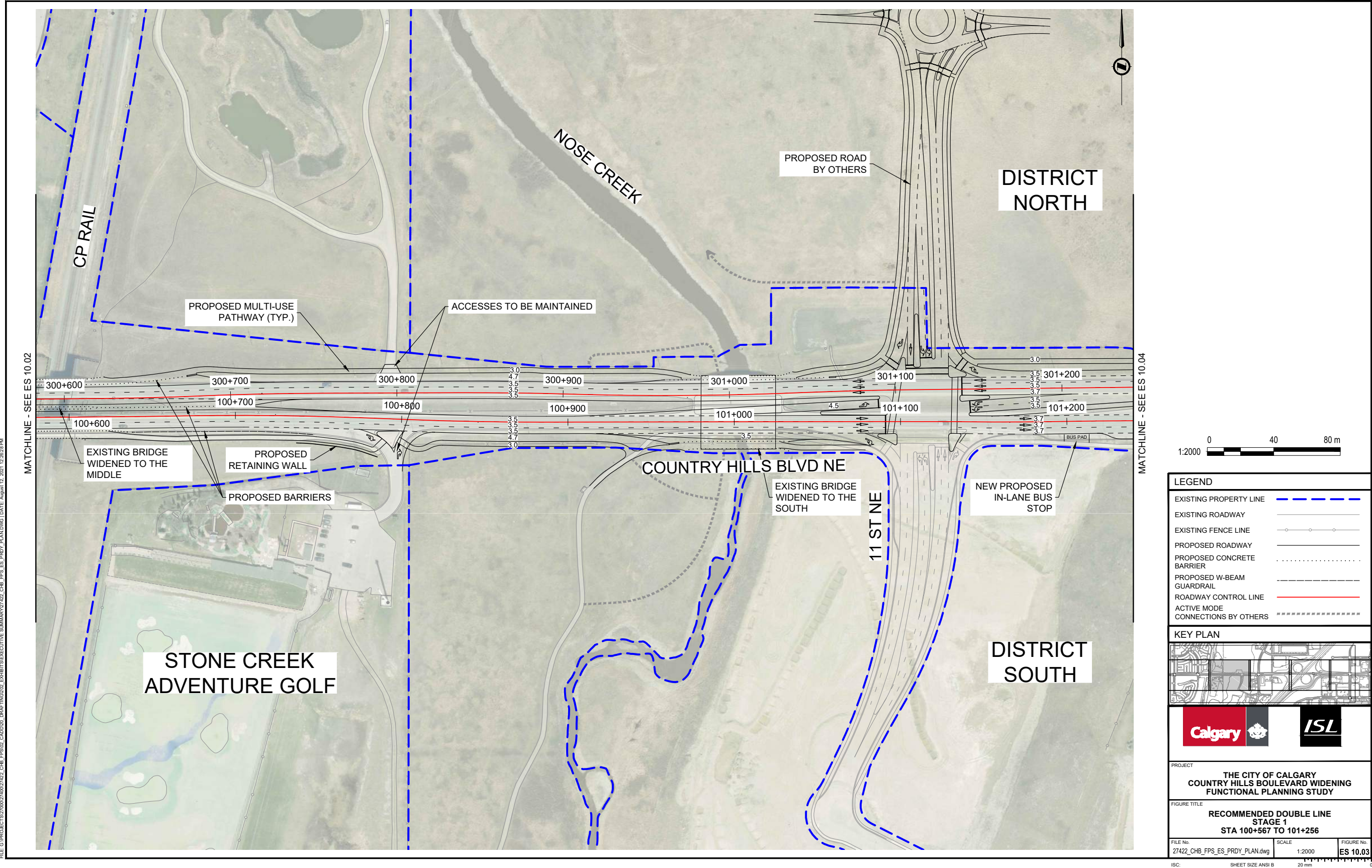


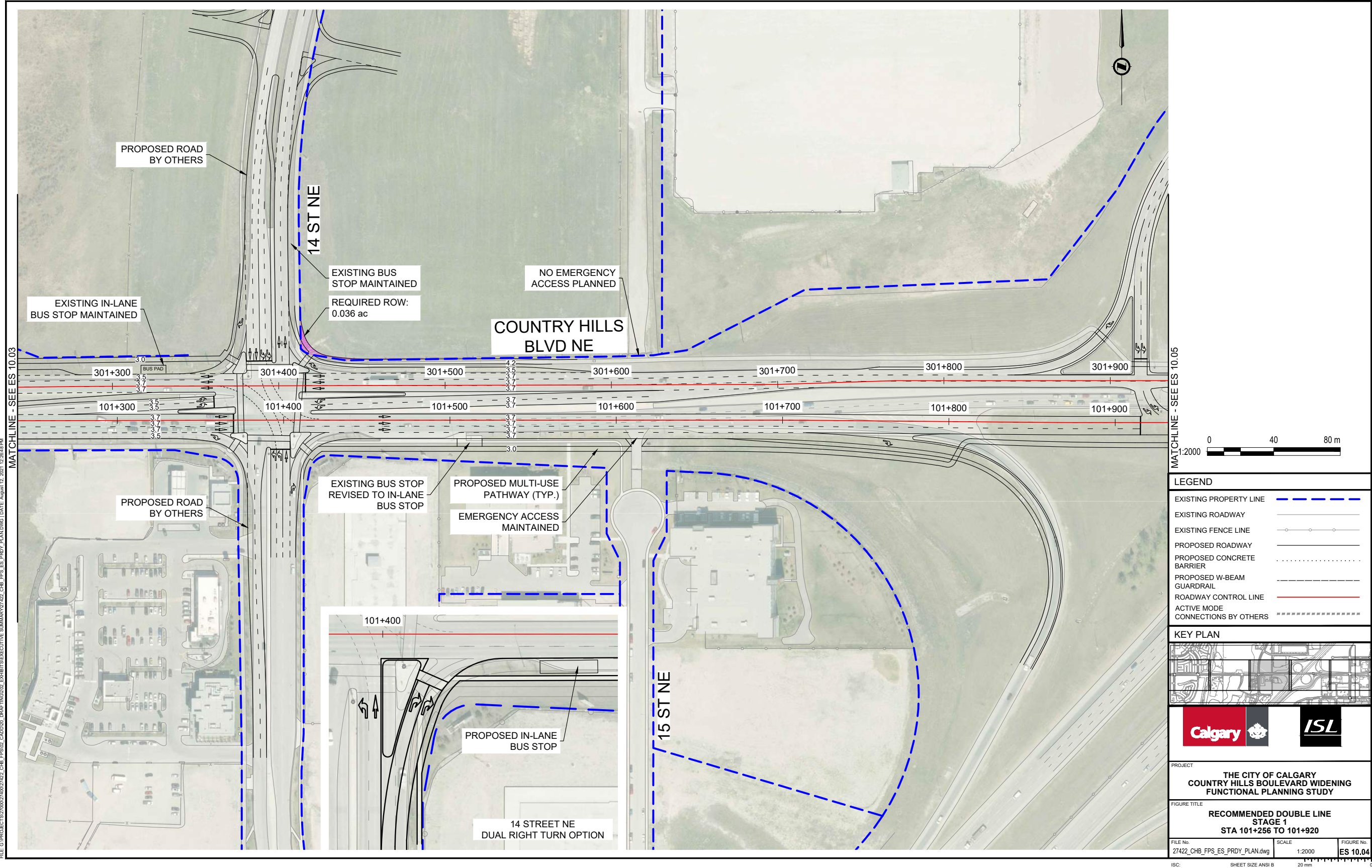


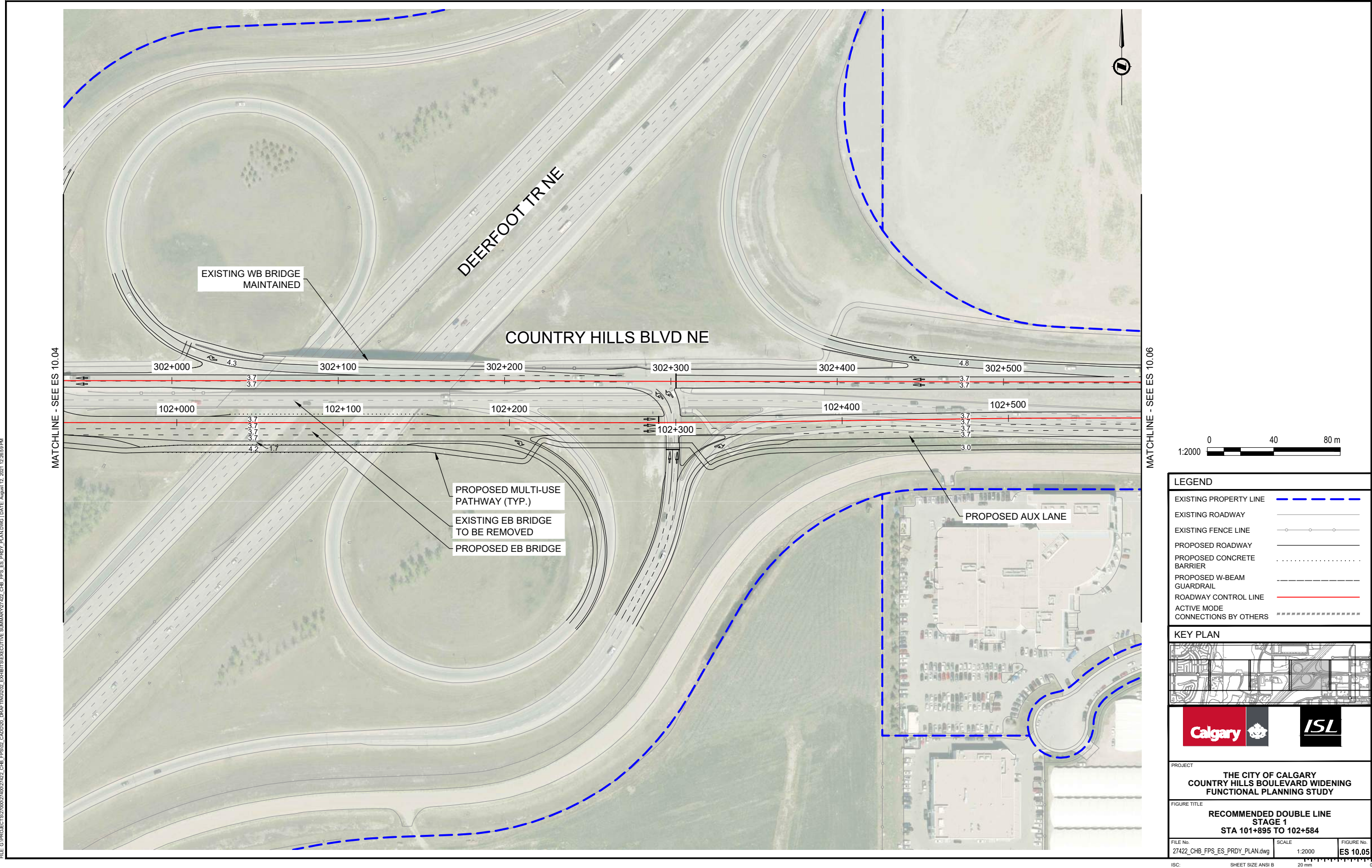


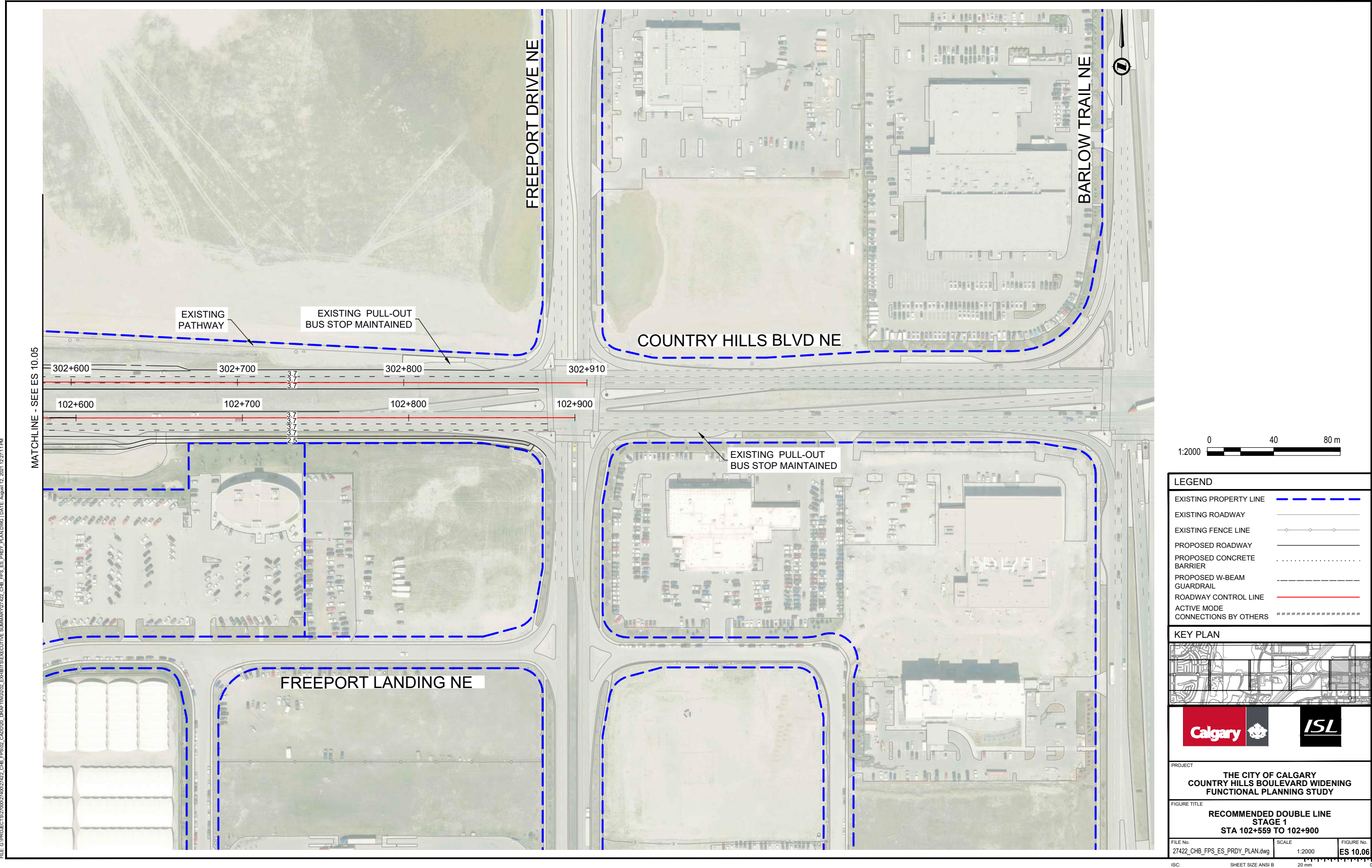


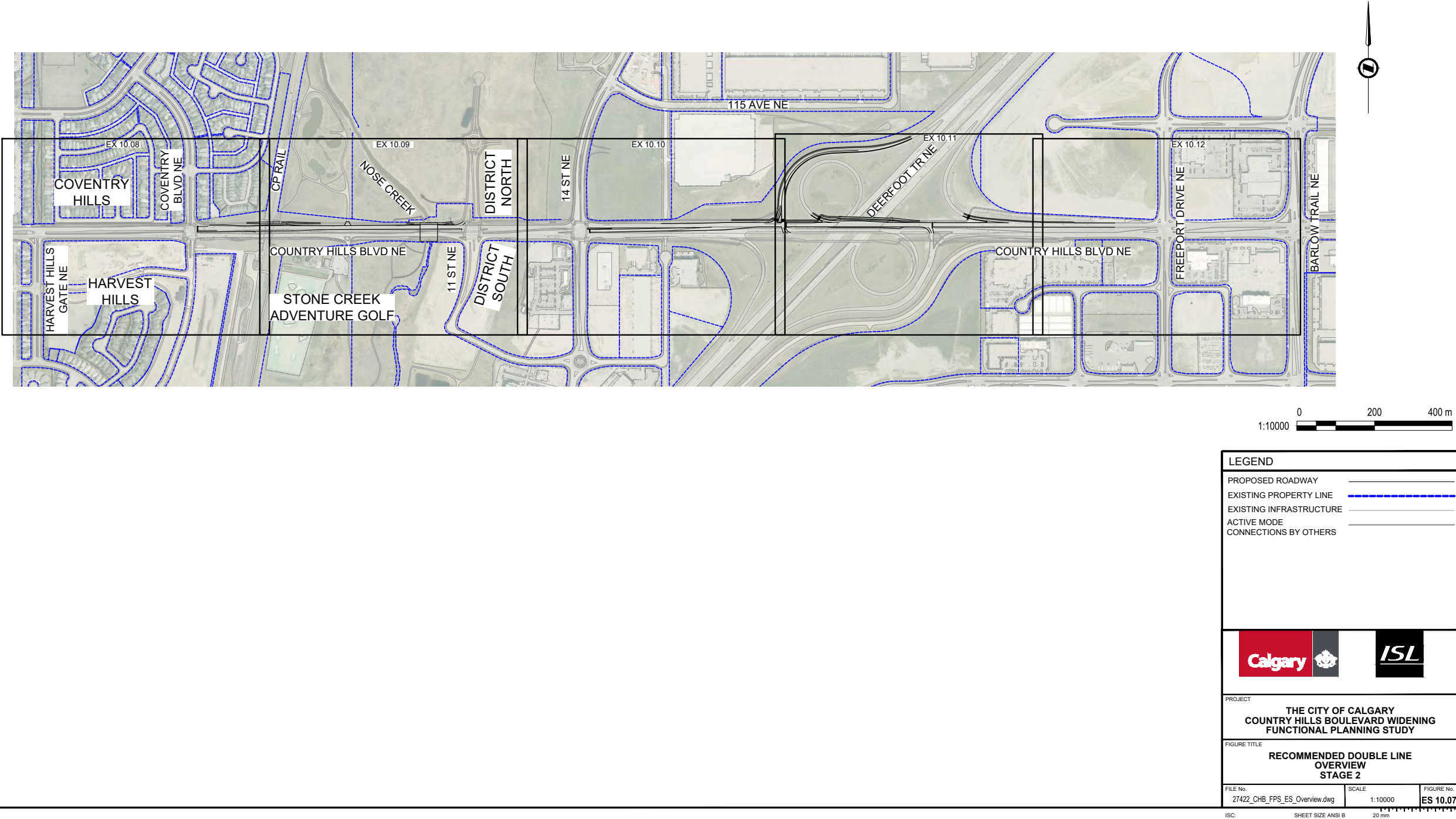


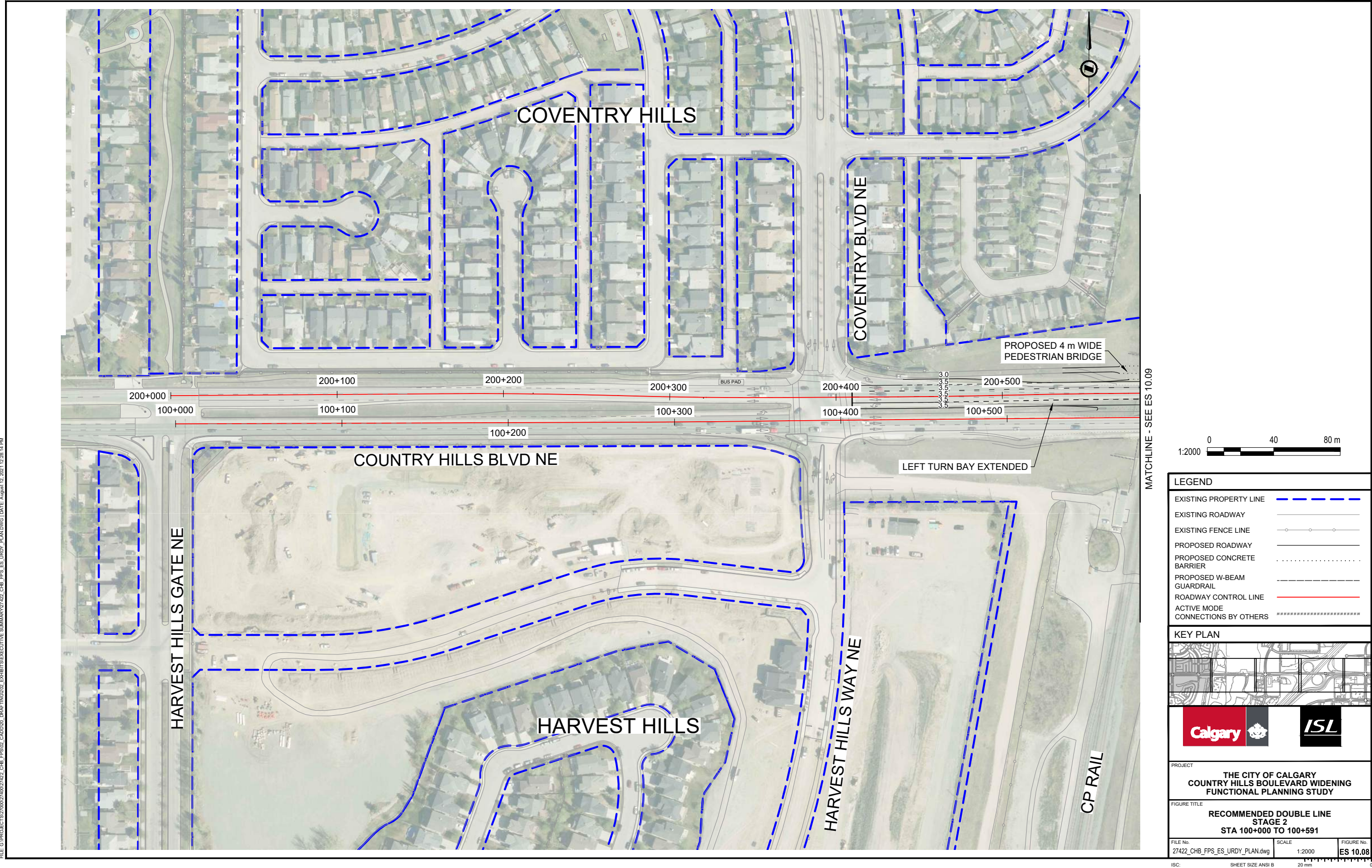


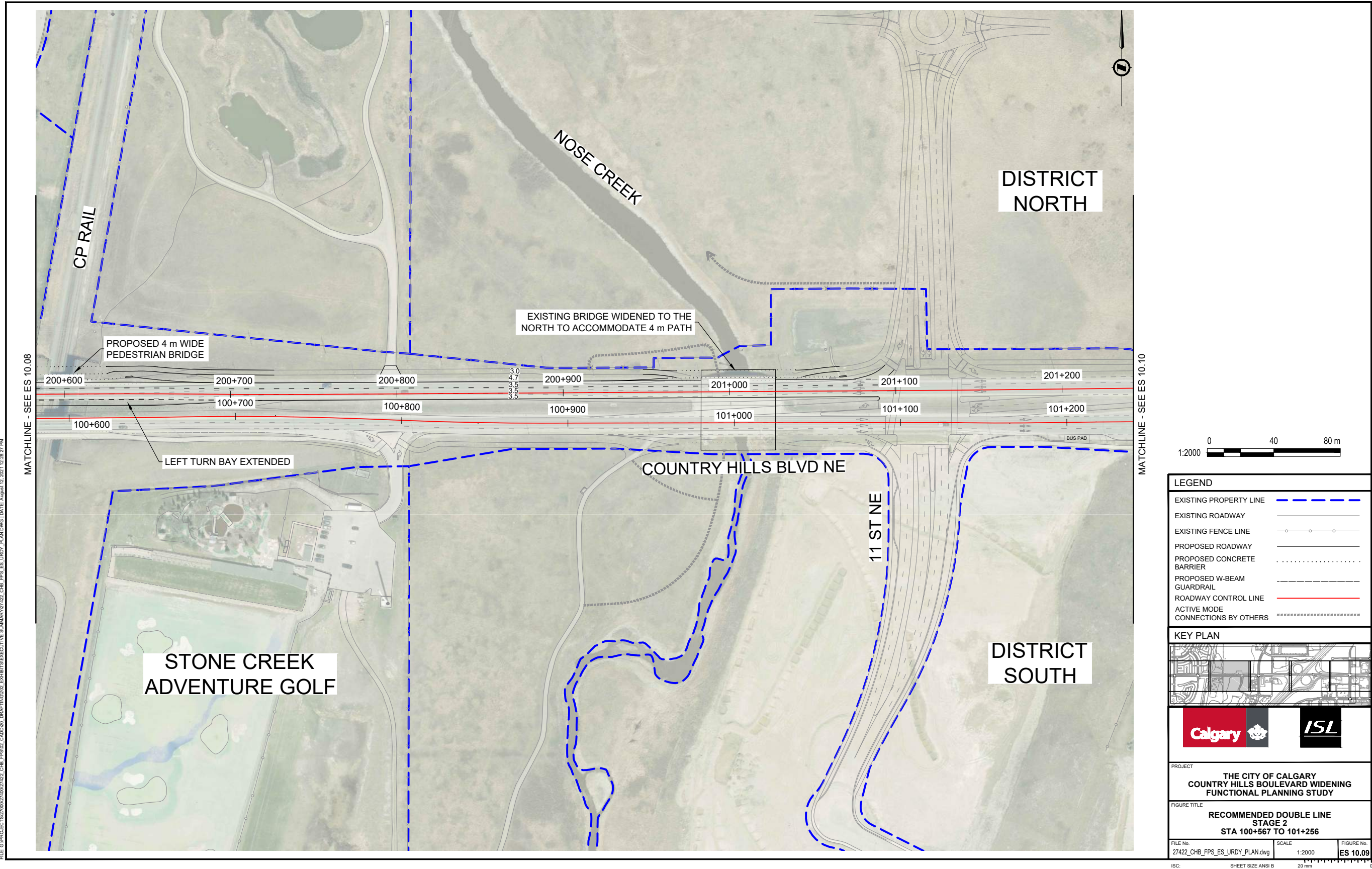


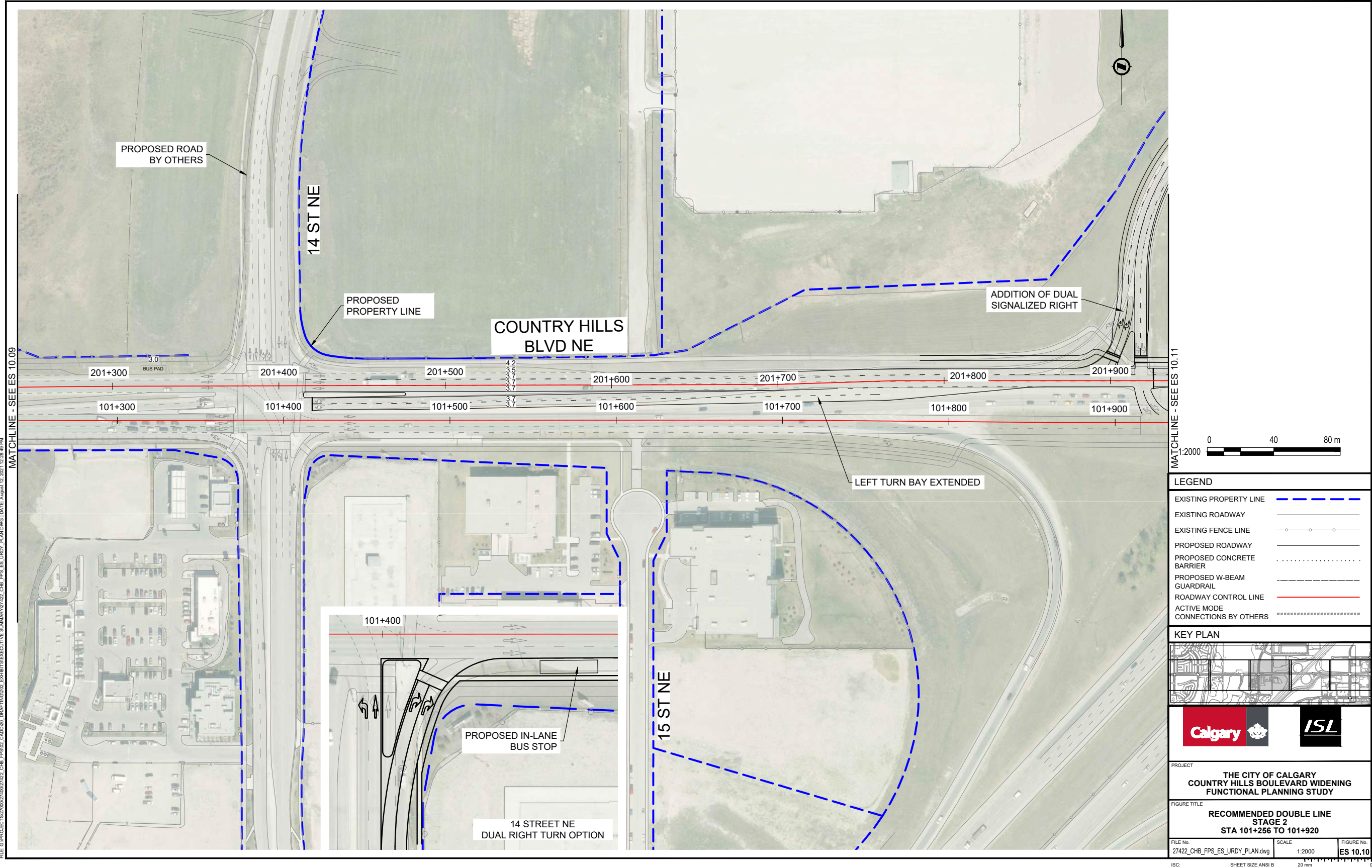


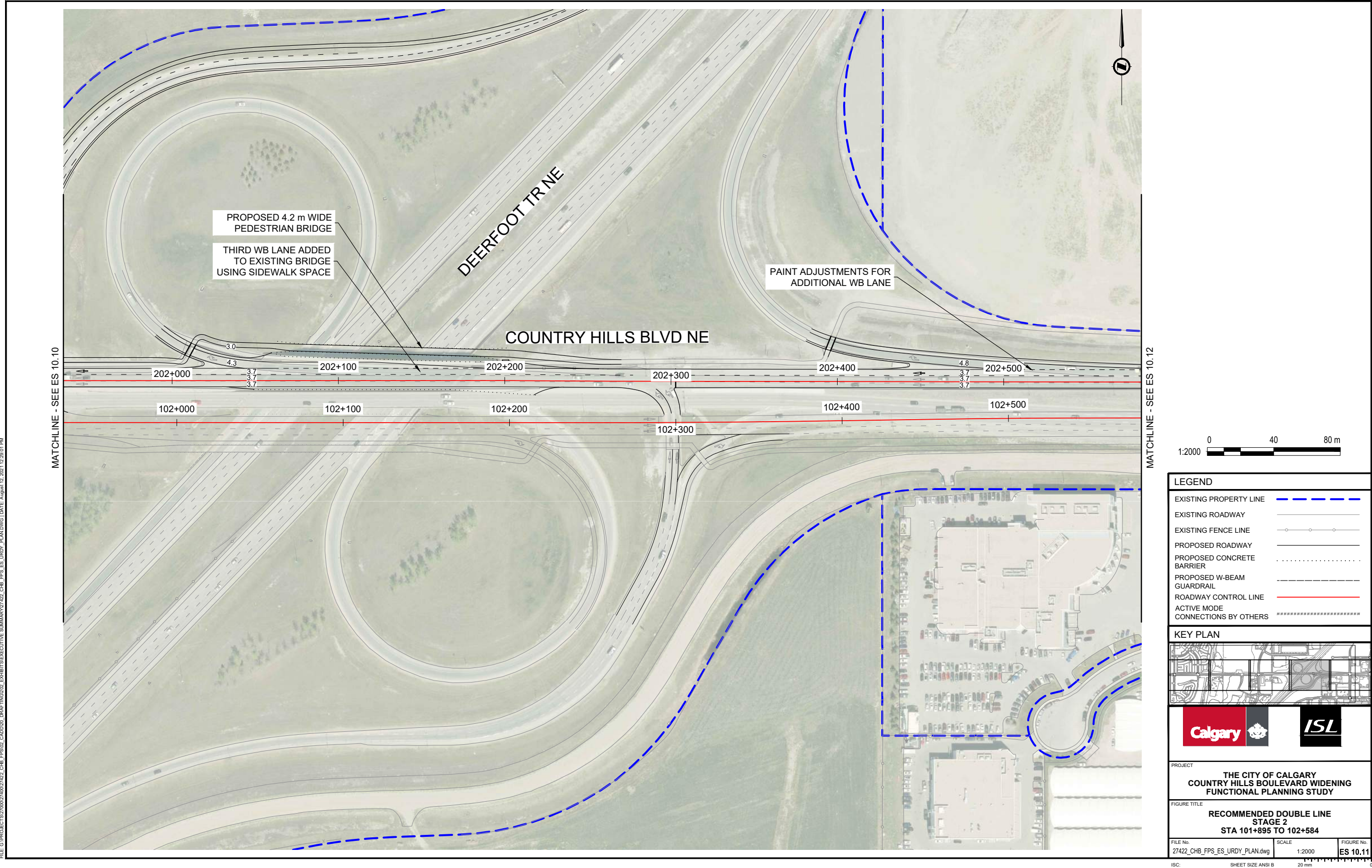


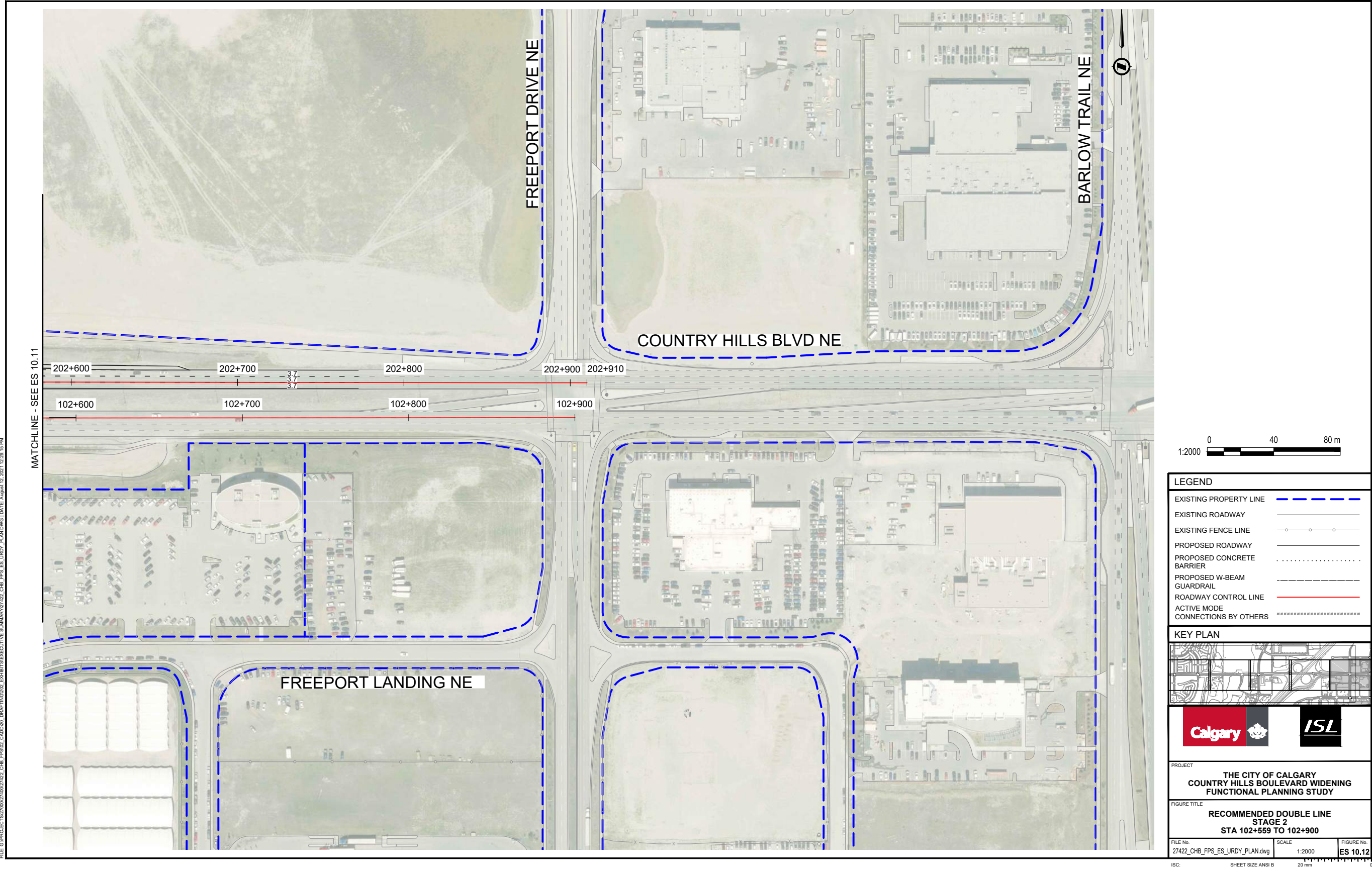




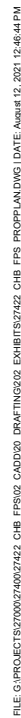


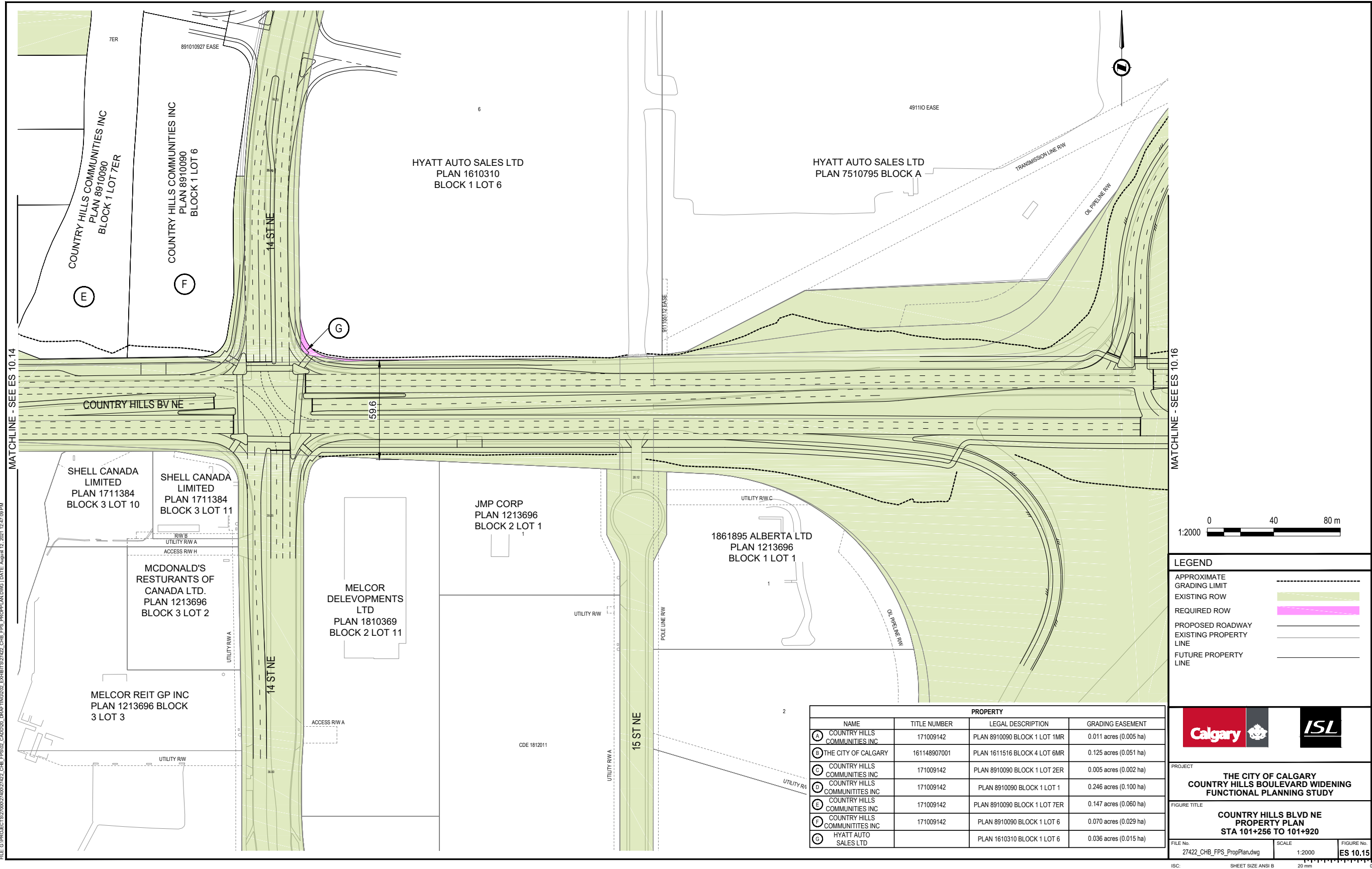


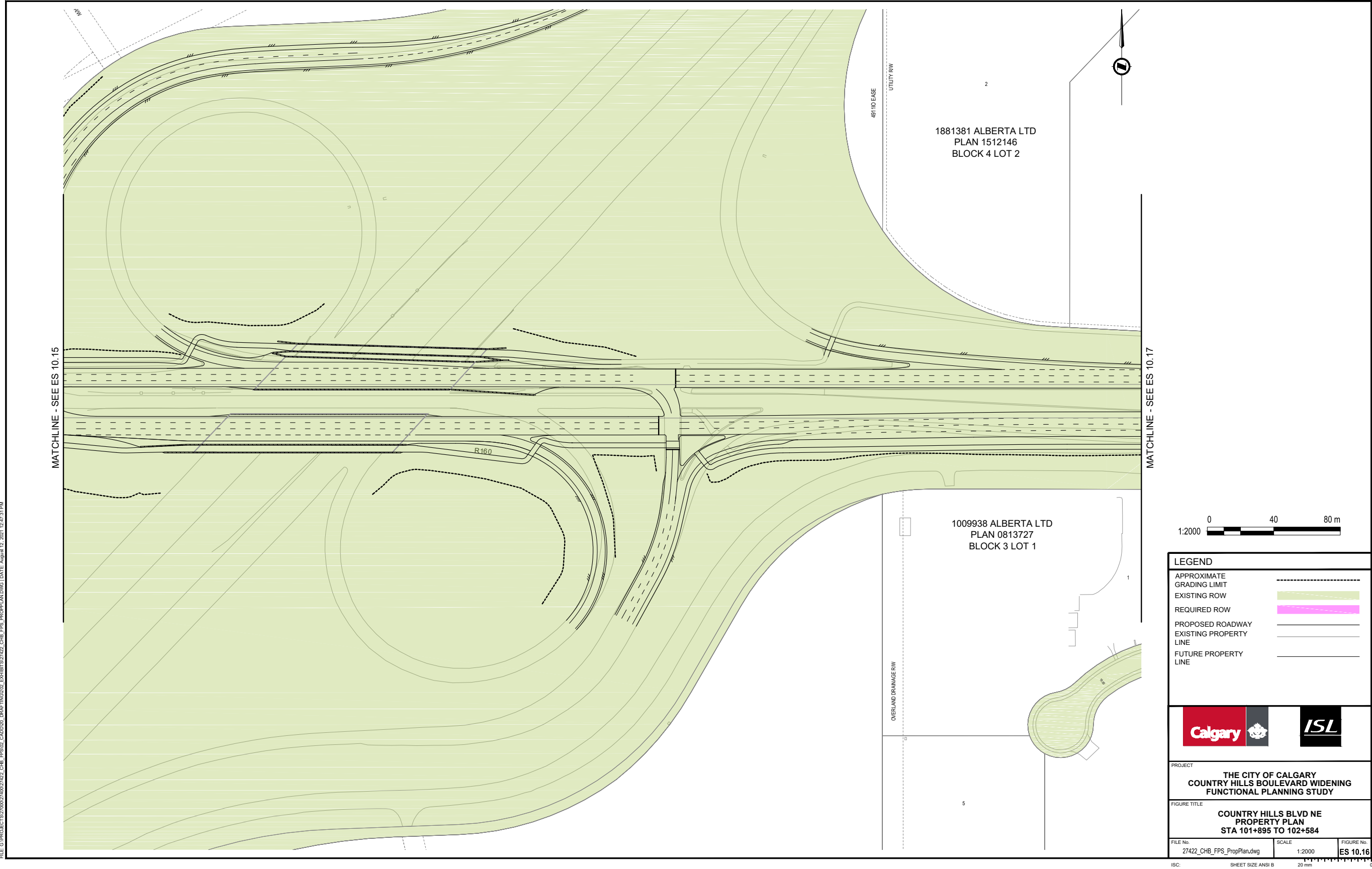


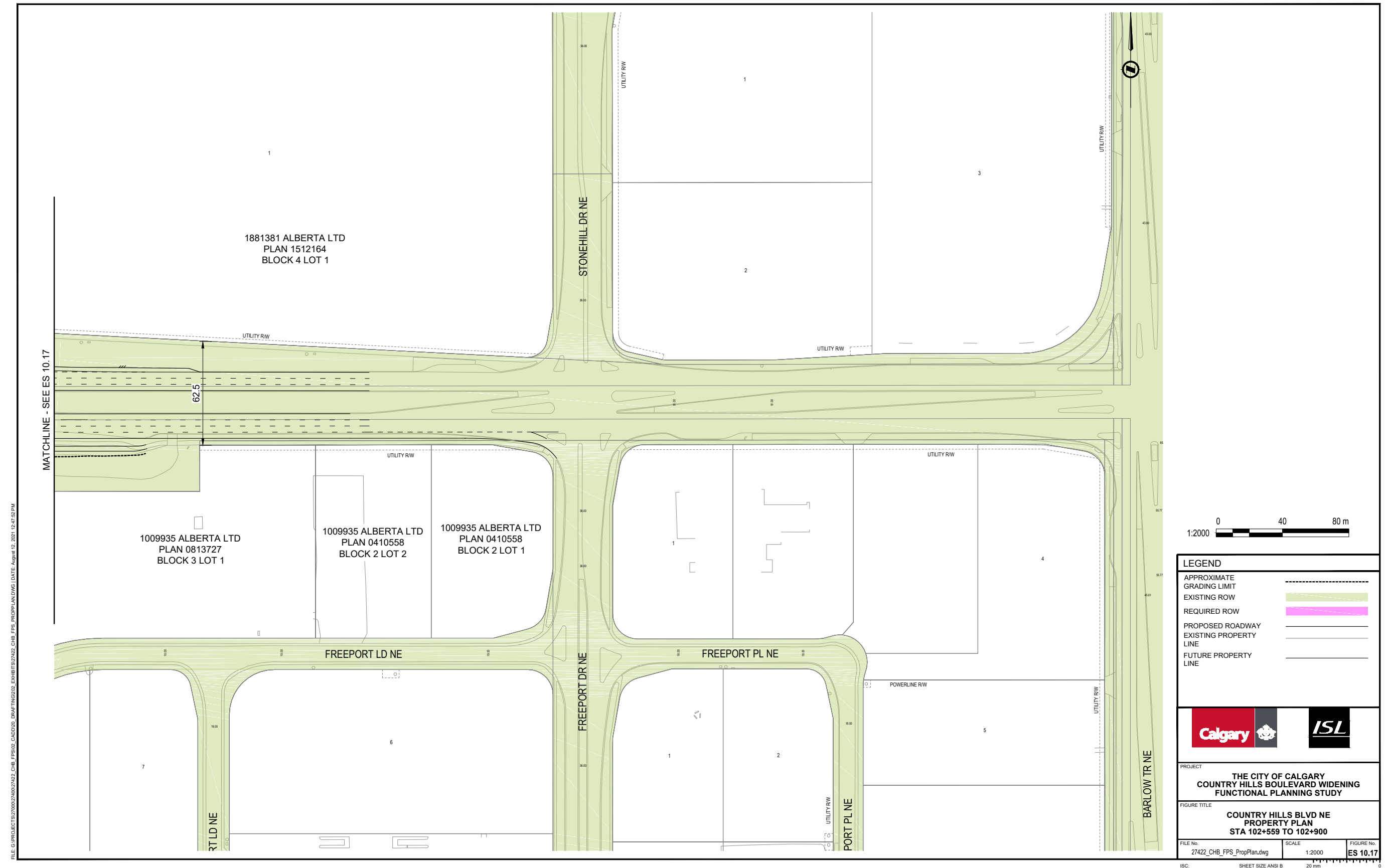














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