Mill Creek Trestle Bridge (B034) and Culvert under 76 Avenue (B038) Replacement Site Location Study

City of Edmonton | 16307

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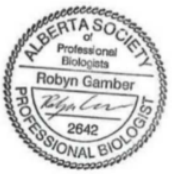

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1.0 Project Introduction

1.1 Trestle Bridge Replacement and 76 Avenue Culvert Works

The City of Edmonton (the City) is proposing to replace a culvert with a road bridge on 76 avenue at Mill Creek and to restore a historic timber trestle bridge (B034) in Edmonton, Alberta (the Project). Specifically, the Project will include:

- stream realignment and establishing a daylighted Mill Creek channel,
- construction of a new single span roadway bridge, and
- reconstruction of a historic trestle bridge and provide bank stability improvements.

The Project is located in the North Saskatchewan River Valley Area Redevelopment Plan (City of Edmonton 2018; Bylaw 7188) and has triggered a requirement for a Site Location Study (SLS) and Environmental Impact Assessment (EIA). The EIA has been prepared and submitted under a separate cover.

1.2 Project Scope

1.2.1 Culvert Replacement and Creek Realignment

The existing concrete culvert, constructed in 1932, carries Mill Creek below 76 Avenue and outlets between spans of the timber trestle. Numerous issues exist for the culvert, including:

- The culvert has insufficient hydraulic capacity and there is a risk of water over topping 76 Ave during a major flood event.
- The culvert inlet on the south side of 76 Avenue is protected by gabion baskets on both sides. The gabion baskets have been undermined on both sides and the bottom basket is failing and no longer retaining the rock.
- Undermining of the west gabion has led to loss of fill behind the gabion and a large erosion hole. The exterior culvert concrete is now visible, and the erosion hole is approaching the existing roadway guardrails.
- There is a large scour hole at the outlet of the culvert. The scour is also wrapping around and undermining the bridge foundations on either side of the culvert. Due to the constriction of Mill Creek caused by the culvert, the flow becomes turbulent and the velocity increases from the upstream reach, which increase the risk of scour and bank erosion at the downstream end.

Life cycle strategies for the culvert included replacement or rehabilitation, and through the preliminary design process, it was determined that the culvert required replacement. ISL considered three life cycle strategies for the culvert including two rehabilitation options and one full replacement. Based on recommendations from ISL, the City determined that the culvert would be replaced by a bridge crossing to improve hydraulic capacity and lifespan of the crossing. To accommodate the new bridge, creek realignment is required and Mill Creek will be daylighted in the project area. The creek realignment is anticipated to extend the channel length further west, parallel to 76 avenue, before turning north and matching the existing outlet area. Habitat features have been included within the channel and a significant landscaping program will be implemented to provide the most naturalized channel.

The following rendering shows the proposed new roadway bridge and reconstructed trestle bridge.

New Roadway Bridge and Reconstructed Trestle, looking south

New Roadway Bridge and Reconstructed Trestle, looking southeast

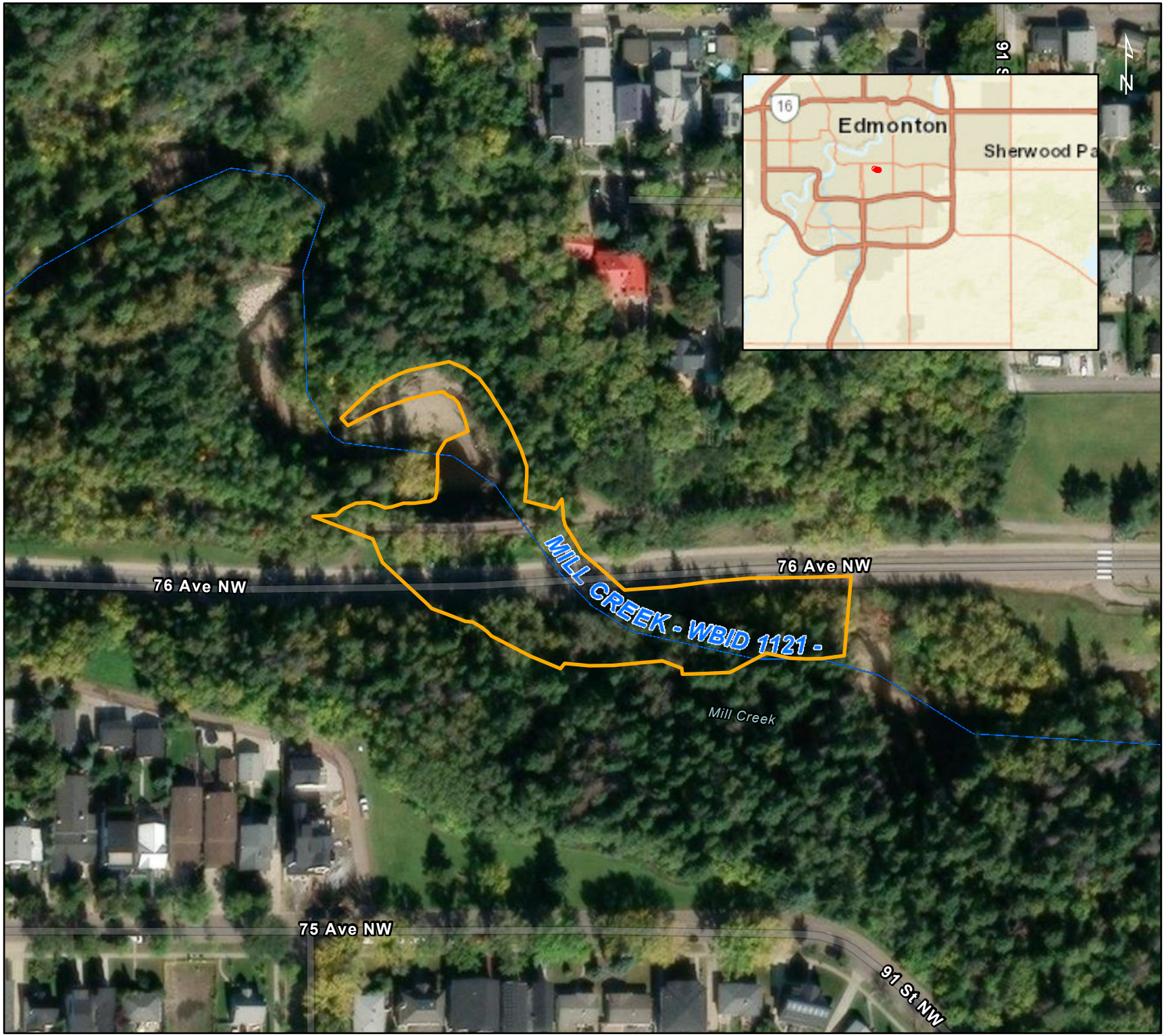
1.2.2 Trestle Bridge Replacement

The trestle bridge in its current state is inadequate to carry the full pedestrian live load or maintenance and municipal vehicle loads. ISL considered three replacement options for the trestle bridge. All options are timber structures similar in form to the existing and supported on concrete foundations. The recommended bridge replacement structure includes concrete foundations and an aesthetically similar timber trestle with new main span truss.

As the Project's intent is for a like-for-like replacement of the trestle bridge, the SLS does not focus on it further, and instead focuses on the replacement of the culvert and realignment of the creek as the major Project activity.

1.3 Project Location and Setting

The project site includes the 76 Avenue crossing over Mill Creek (B038) and the historic timber trestle bridge (B034) located just north of 76 Avenue and is shown in Figure 1.1. 76 Avenue is a collector roadway connecting the Richie and Hazeldean Neighbourhoods with the adjacent neighbourhoods of King Edwards Park and Avonmore. It is a designated District Connector (Bike Arterial) within the City's Bike plan, although does not have any dedicated bike infrastructure. It is one of only a few roads providing access across the natural barrier created by the Mill Creek Ravine, with the closest alternate crossings at 82 Avenue to the north and Argyll Road to the south.



Legend

Grading Limits (updated February 2025)

0 0.05 Kilometers

FIGURE 1.1
PROJECT LOCATION OVERVIEW

ISL

2.0 Alternative Analysis and Justification

2.1 Project Alternatives

Four replacement options for the existing 76 Avenue bridge culvert were considered through the design process (ISL 2024) which is summarized below. All options maintain the crossing along the current roadway alignment. The options included the following:

- Option 1 – New Culvert on Same Alignment
- Option 2 – Arch Culvert with Creek Realignment
- Option 3 – Bridge with Creek Realignment
- Option 4 – Bridge with Creek Realignment and No Trestle Bridge (dual-purpose bridge scenario)

An additional option (i.e., the Active Modes scenario) of removing the 76 Avenue vehicle bridge entirely was also considered.

2.1.1 Option 1 – New Culvert on Same Alignment

This option is for a new culvert with a larger hydraulic opening on the same alignment. The culvert size was selected to meet the hydrotechnical requirements of the site and to fit within the available opening of the trestle bridge. The proposed culvert is a cast-in-place concrete box culvert with 6.6 m by 3.4 m opening. The new culvert would extend approximately 13 m further downstream than the existing culvert to flatten the 76 Avenue side slope and reduce geotechnical risk. The culvert would also extend approximately 10 m further upstream and will have retaining walls at the inlet to accommodate the increased width.

The following preliminary rendering shows the proposed replacement culvert and the trestle bridge with reduced pier heights due to the modified slope.

Option 1 Rendering (looking southeast)

2.1.2 Option 2 – Arch Culvert with Creek Realignment

This option includes a new open bottom arch culvert with retaining walls on each side of 76 Avenue. The arch would span 6.8 m parallel to the stream with a 3.4 m rise and would be installed on a 45 degree skew to the roadway. This option includes realignment of Mill Creek upstream of the site, which is required for this option to be feasible. For this option, the culvert size was selected to provide adequate hydraulic capacity. A larger culvert is feasible to provide improved hydraulic performance but would increase cost. The stream realignment was selected based on minimizing impacts, restoring the channel as close as possible to it's pre-culvert location, optimizing slope stability of the ravine, and achieving a reasonable bridge / culvert structure.

The following preliminary rendering shows the proposed arch culvert and the trestle bridge with increased pier heights due to the retained side slope.

Option 2 Rendering (looking northwest)

Option 2 Rendering (looking southeast)

Option 2 Rendering (looking south)

2.1.3 Option 3 – Bridge with Creek Realignment

This option consists of a single 39 m span semi-integral bridge carrying 76 Avenue over a realigned stream. The proposed bridge structure is 1.6 m deep pre-cast concrete NU girders with a cast-in-place concrete deck on concrete abutments supported by drilled concrete piles. The bridge will be on a 40 degree skew and will have a varying height abutment on the east side to optimize the stream alignment. Similar to Option 2, slope stabilization of the upstream southwest bank will be required for the stream realignment. The hydraulic opening for this option matches the natural channel and provides the maximum capacity with minimum velocity. Armoring of the banks will be required for short-term and long-term bank stability. As with option 2, the stream realignment was selected based on minimizing impacts, restoring the channel as close as possible to it's pre-culvert location, optimizing slope stability of the ravine, and achieving a reasonable bridge / culvert structure.

Similar to Option 2 above, this option allows for the reconstructed trestle bridge to be more like the original timber structure. Since the headslopes of the roadway bridge will match the headslope of the trestle bridge, the piers can be built on horizontal foundations with column heights similar to the original structure. The following rendering shows the proposed new roadway bridge and reconstructed trestle bridge.

Option 3 Rendering (looking south)

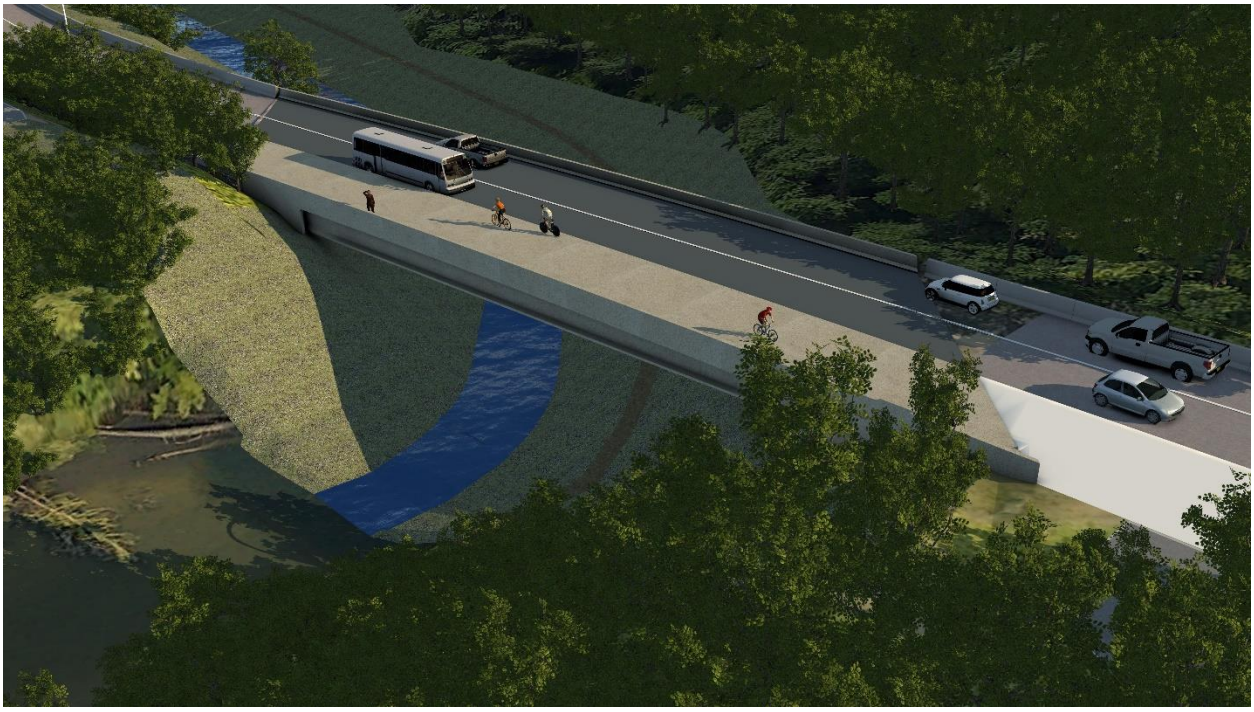
Option 3 Rendering (looking southeast)

Option 3 Rendering (looking northwest)

2.1.4 Option 4 – Bridge with Creek Realignment and No Trestle Bridge

This option is similar to Option 3, but with a wider roadway bridge and no pedestrian trestle bridge. The type of bridge structure is the same as Option 3, 39 m single span box girder bridge, but with additional girder lines to accommodate the increased width. As with option 2, the stream realignment was selected based on minimizing impacts, restoring the channel as close as possible to it's pre-culvert location, optimizing slope stability of the ravine, and achieving a reasonable bridge structure.

The following rendering shows the proposed roadway crossing.



Option 4 Rendering (looking southeast)

Option 4 Rendering (looking northwest)

Option 4 Rendering (looking south)

2.2 Alternative Review and Justification

The bridge replacement options were evaluated based on cost, risk, and long-term benefit to the City. A multi-criteria decision matrix was developed to aid in the evaluation process (ISL 2024). The various evaluation criteria were assigned a ranking from 1 to 10 with 1 being the lowest or worst ranking and 10 being the highest or best. Each criterion was assigned a weighting based on its importance (determined in collaboration with the City project team). Rankings were multiplied by the weighting to assign a score to each criterion for each option, a higher score indicates a more favourable option. The outcome of the multi-criteria decision matrix is that Option 3 provides the best overall solution.

Table 2.1: Evaluation Criteria

	1 – Box Culvert on Same Alignment	2 – Arch Culvert on New Alignment	3 – Bridge with Trestle Bridge	4 – Wider Bridge no Trestle Bridge
Constructability	High risk due to challenging water management.	High risk due to challenging water management and MSE wall backfill constraints	Channel re-alignment can be completed before bridge.	Similar to Option 3, but simpler without trestle bridge
Net Present Value	Medium	Highest	Medium	Lowest
Active Modes	Maintains connectivity for 76 Ave and Mill Creek trail users	Same as Option 1	Same as Option 1	Two separate trails systems combined over crossing
Historical Preservation	Includes trestle, but with reduced height	Includes trestle with MSE wall backdrop	Rebuilt trestle similar to original setting	No trestle, does not comply with bylaw
Aesthetics	Slightly reduced due to short trestle	Requires aesthetic focus for wall design	Improved aesthetic with open channel	Reduced aesthetic for trail users
Public Response Risk	Environmental concerns likely to be expressed	Environmental and aesthetic concerns may be expressed	Likely a preferred option based on past project experience	High probably of negative public response to no trestle
Geotechnical Risk	Lowest risk option	Highest risk due to MSE walls and cuts in SW bank	Risk due to cut in SW bank	Same as Option 3
Hydrotechnical Performance	Increased velocity an risk of debris catching	Slightly constricted channel	Open channel flow	Same as Option 3
Wildlife Passage & Fish Habitat	Does not meet requirements	Does not meet terrestrial passage	Provides wildlife passage but with reduced clearances	Same as Option 3
Impact to Trees/Vegetation	Least area of tree removals	Significant impact to trees on SW bank.	Same as Option 2	Same as Option 2 but with additional impacts on north side road

Legend:

2.3 Other Locations Considered

This Project is the removal and replacement of creek crossing infrastructure located within the North Saskatchewan River Valley Area Redevelopment Plan. The replacement of the culvert at the current location is preferable as it minimizes new disruption to environmental features and maximizes construction efficiencies. Replacement at alternate locations would, for example, require additional disturbance to the natural environment through construction staging and access, the building of additional pathway lengths to connect to existing pathways, and disruption of traffic if the 76 Avenue crossing of Mill Creek were not accommodated. Development of an additional roadway crossing of Mill Creek at alternate locations would not provide the same functionality for local users and would have significant environmental impacts. Providing creek realignment in this location also provides the additional environmental benefits of daylighting in an area that has been devoid of an active channel for over 90 years.

2.3.1 Active Modes Scenario

Paths for People (2025) provided the City an alternative proposal for the future design of this part of Mill Creek Ravine in which vehicles no longer cross the ravine from east to west and only the pedestrian bridge is replaced.

The City of Edmonton decided not to pursue the closure of 76 Avenue to vehicle traffic due to its critical role as an east-west connection in an area with limited crossings. The avenue is designated as an important future district mass transit route, and its removal would redirect traffic, including emergency services, and deliveries, to other corridors, creating additional strain. Future reallocations of vehicle space on 82 Avenue for mass transit would further limit east-west travel options. Additionally, the planned replacement of the 76 Avenue culvert with a bridge aligns with environmental goals by daylighting the creek and addressing erosion while maintaining necessary vehicular connectivity.

2.4 Project Dependence on Mill Creek Ravine

The roadway crossing in the Mill Creek Ravine is already located in the North Saskatchewan River Valley and are accommodating current and future need in an ever-evolving City. The Project is dependent on occurring within the River Valley, due to the constraints of being a replacement Project. Relocating the project outside of the River Valley would not be feasible, as it would require the Project to occur outside of the City, potentially impact natural ecological areas, and disrupt the well-established transportation networks that rely on this crossing.

2.5 Location Justification

The selected location for the Project is the most suitable option when evaluated against alternative locations and configurations. The existing crossing provide an east-west connection in an area with limited crossings. Removing or relocating this crossing would increase congestion on alternative routes, impacting transit efficiency, emergency response times, and local traffic patterns. Additionally, 76 Avenue will continue to serve an important function into the future. Future changes to 82 Avenue as part of the Mass Transit Plan will reallocate vehicle space to transit and public realm space, further limiting the options for vehicles travelling east to west.

From an environmental perspective, keeping the infrastructure at its current location minimizes new land disturbance while restoring and enhancing the existing Mill Creek ecosystem. The daylighting of Mill Creek and realignment efforts will improve hydraulic performance, reduce erosion, and create a healthier aquatic and riparian habitat. Relocating the infrastructure would require additional disturbances to natural areas, potentially impacting sensitive ecological zones and requiring extensive new grading, tree removal, and habitat disruption. Furthermore, the preservation and enhancement of the historic trestle bridge maintains the cultural and recreational significance of the site, ensuring that the pathway network remains intact for pedestrians and cyclists. By prioritizing this location, the project balances mobility, environmental protection, and historical preservation, making it the most responsible and sustainable choice.

3.0 Opportunities and Constraints

An analysis of the financial, social, environmental and institutional opportunities and constraints is provided below.

3.1 Financial Opportunities and Constraints

As provided in Table 2.1 above, for the roadway bridge alone, Options 1 and 3 have the lowest net present value (NVP) cost when considering the roadway bridge alone, but Option 4 has the lowest NPV when the additional cost of building and maintaining the trestle bridge is considered. Option 2 has the highest capital cost and NPV, making it the worst option from a cost perspective. The present value analysis shows that there are short-term and long-term cost savings associated with Option 4. The increased cost of the wider roadway bridge is offset by the cost savings associated with not rebuilding the trestle bridge resulting in net cost savings to the City.

Option Three was chosen as it had a good balance of Net Present Value, Capital Cost, and inclusion of the Trestle Bridge to meet the Historic Designation Bylaw. Relocating the bridge outside the River Valley Bylaw Area would introduce significant cost increases due to the need for additional roadworks, pathway connections, and potential land acquisition. Moving the bridge would also disrupt local connectivity, requiring further cost-incurring infrastructure to maintain access for pedestrians and cyclists. The selected location ensures that the necessary east-west connection is preserved while minimizing additional environmental and financial impacts.

3.2 Social Opportunities and Constraints

The Mill Creek Ravine and North Saskatchewan River Valley are frequently visited natural areas valued by all recreational users. By selecting the culvert replacement option that includes the restoration of the Trestle Bridge, the project upholds the existing Historic Designation Bylaw, preserves the social and cultural value of the trestle, and maintains the historic character of the project area. Removing the trestle bridge as part of the project was identified as a high-risk action due to the potential for significant public opposition.

Replacing the culvert with an open bridge and realigning the creek presents social opportunities by enhancing the aesthetic and recreational value of the area, improving the natural connection between the community and Mill Creek. The open channel design creates a more visually appealing and accessible environment for trail users, while also fostering a greater appreciation for the restored creek ecosystem. Maintaining connectivity across the ravine at 76 Ave aligns with future City plans for reallocation of space on 82 Ave, mass transit, and maintains customers access to local businesses.

3.3 Environmental Opportunities and Constraints

The Mill Creek Trestle Bridge and 76 Avenue culvert replacement project presents several key environmental opportunities aimed at enhancing the ecological integrity of the area. One of the most significant improvements is the daylighting of Mill Creek, which will restore the natural flow of the stream, improve water quality, and provide increased habitat for aquatic species. By replacing the existing culvert with an open-channel bridge crossing, the project reduces barriers to fish passage and enhances hydraulic capacity, reducing the risk of flooding and erosion. Additionally, the creek realignment and bank stabilization efforts, including engineered vegetated slopes and riprap reinforcements, will strengthen the resilience of the ravine against extreme weather events while promoting biodiversity. These measures align with the City's environmental goals by mitigating historical disturbances and ensuring long-term sustainability.

Furthermore, the project integrates wildlife-friendly infrastructure, fostering connectivity for terrestrial species that rely on the ravine for movement. The replacement bridge design improves sightlines, increases natural light penetration, and enhances habitat conditions compared to the existing culvert, which currently restricts passage for small mammals and amphibians. These improvements collectively support Edmonton’s broader biodiversity and green network strategies, ensuring that the Mill Creek Ravine continues to function as a valuable natural corridor within the city.

Finally, keeping the infrastructure at its current location minimizes new land disturbance in the City while restoring and enhancing the existing Mill Creek ecosystem. If the Project did not occur, the existing culvert would remain and the opportunity to daylight the creek in the Project area would not be possible. Relocating the infrastructure would require additional disturbances to natural areas, potentially impacting sensitive ecological zones and requiring extensive new grading, tree removal, and habitat disruption.

3.4 Institutional Opportunities and Constraints

The Project presents significant institutional opportunities by aligning with the City of Edmonton’s long-term infrastructure and environmental policies. The project directly supports the goals of Bylaw 7188 (North Saskatchewan River Valley Area Redevelopment Plan), which emphasizes balancing infrastructure needs with environmental preservation. By incorporating sustainable engineering practices such as creek daylighting, bank stabilization, and wildlife-friendly design, the project demonstrates the City's commitment to environmental stewardship while maintaining critical transportation and recreational connections. Additionally, the project aligns with Edmonton’s Breathe: Green Network Strategy and Natural Connections Strategic Plan, reinforcing the City’s dedication to enhancing ecological corridors and ensuring sustainable urban development. Finally, selecting the culvert replacement option that includes the restoration of the Trestle Bridge upholds the existing Historic Designation Bylaw.

4.0 Conclusion

The Project represents a strategic infrastructure renewal that balances transportation functionality, environmental sustainability, and historical preservation. The selected design maintains east-west connectivity for vehicles and active modes users, while also significantly enhancing the ecological integrity of Mill Creek through creek daylighting, bank stabilization, and improved wildlife passage. By replacing the aging culvert with an open-channel bridge, the project mitigates long-term erosion issues, restores aquatic habitat, and aligns with the City of Edmonton's commitment to sustainable urban development and environmental conservation under Bylaw 7188 and the City's broader strategic plans.

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