



Daylighting the Downstream Reach of Mill Creek Project Overview

The City of Edmonton
Final Report

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Project Overview

1.0 INTRODUCTION

Mill Creek is a tributary of the North Saskatchewan River and regarded as a prominent feature of Edmonton's river valley and ravine system. As a result of urban development and completed freeway interchange elements of the now defunct 1969 "Metropolitan Edmonton Transportation Study", Mill Creek and its ravine are disconnected from the North Saskatchewan River and no longer support surface flows directly to the river. The loss of surface flows has resulted in fragmentation of the creek corridor and disconnection of habitat, and attendant loss of biodiversity in the area. As such, restoration of connectivity between Mill Creek and the North Saskatchewan River has been identified as a key priority for enhancing and supporting Edmonton's ecological network. Restoration of the channel will extend the existing creek corridor, resulting in improved fish habitat, water quality, flood mitigation, enhanced biodiversity, and recreational and cultural opportunities for the benefit of all Edmontonians.

Mill Creek Ravine is one of 12 ravines within Edmonton that contributes flow to the North Saskatchewan River. The Mill Creek basin is approximately 132 km² and consists of developed lands within the City of Edmonton (City) boundaries and primarily undeveloped lands within Strathcona County (Associated Engineering 2016). The creek varies considerably from the upper to the lower reach, slowly transitioning from a narrow and degraded channel to a more substantial channel that meanders through a wooded ravine.

The Mill Creek corridor south of Connors Road provides key ecosystem services such as biodiversity, aquatic and riparian wildlife habitat, local and regional ecological connectivity, water quality improvement, flood attenuation and cultural services. The ravine provides numerous recreational opportunities for Edmontonians including shared pathways, picnic sites, and an off-leash area, and is frequented by dog walkers, runners, and cyclists. In addition to recreational opportunities, nearby attractions include the Argyll Velodrome & BMX Course, Mill Creek Ravine Park, Mill Creek Outdoor Pool, the Muttart

Conservatory, Henrietta Muir Edwards Park, and Rafter's Landing. Despite the numerous environmental, social, and economic benefits provided by Mill Creek, the stream has been subject to a number of impacts as the City and other municipalities in the watershed have grown and developed. As a result, the ability of Mill Creek to provide valuable ecosystem services has been diminished.

The aim of this study was to assess the feasibility of reconnecting the creek to the North Saskatchewan River, through daylighting, by developing three feasible conceptual plans that restore surface flow in the downstream reach of Mill Creek. These plans were developed based on technical requirements, opportunities for improved ecological function, recreation and social opportunities, regulatory requirements, costs, and stakeholder feedback. This project initiative is supported by several key City of Edmonton policy documents, including “The Way We Live”, “The Way We Move”, and “The Way We Green”, which were referenced as part of this study along with several provincial and national health and wellness and active transportation initiatives.





2.0 BACKGROUND

Many alterations have been made along Mill Creek and within its basin in order to accommodate development. Portions of the upper reach were piped to accommodate industrial development and roadway infrastructure. Flows from the nearby Fulton Creek have also been diverted to tunnels and directed to Mill Creek, thus increasing the total drainage area and amount of industrial runoff contributing to Mill Creek.

Portions of the lower creek were diverted in the 1960s to facilitate the development of a freeway interchange connecting the Low Level Bridge, 98 Avenue, and Connors Road. Completion of the James MacDonald Bridge and associated interchange occurred in the early 1970s and resulted in complete infill and diversion of approximately 1 km of the downstream reach of Mill Creek to an underground tunnel. Due to the negative public feedback in

response to the proposed freeway, and a desire to reduce impacts to Edmonton's creeks, the inner city freeway was abandoned, leaving only the existing freeway section in place.

These alterations have led to higher peak runoff rates, resulting in erosion issues, altered channel stability, and water quality degradation. As a result of these outcomes, significant engineered modifications have been made along the extent of the creek, including the construction of a spill containment facility, a high-flow by-pass, a combined-sewer overflow, erosion control measures, and a tunnel inlet that, during high rain events, collects debris that backs up and floods the existing trail network.



1970 Air Photo showing approximate creek alignment



Downtown Freeway Loop - Metropolitan Edmonton Transportation Study 1969





3.0 VISION

To re-establish a vital link in Edmonton’s terrestrial and aquatic ecological network, while improving the safety and efficiency of key active transportation connections, and providing new recreational opportunities for Edmontonians to experience and recreate in nature.

The vision for daylighting Mill Creek builds on the shared vision of the City of Edmonton and the Province of Alberta to enhance aquatic habitat along the North Saskatchewan River within the city limits. This vision also infuses stakeholder and public input in an effort to respond to the many varied needs of Mill Creek corridor users.

Daylighting Mill Creek is expected to provide fish spawning and rearing habitat as well as additional habitat for invertebrates, amphibians, birds, and mammals. The creation of additional fish habitat, including in-stream habitat and spawning and nursery habitat within constructed wetlands, and re-establishment of connectivity to the North Saskatchewan River, will support recreational and Indigenous fisheries within Edmonton and the broader region.

Restoration of a natural Mill Creek channel allows for the creation of open space that respects the area’s ecology while providing Edmontonians with cultural and recreational opportunities. It also provides the opportunity to integrate the project area within the broader park system, enhancing the recreational and cultural value of the area, and providing opportunities for interactions between the public and nature.





4.0 PUBLIC ENGAGEMENT PROCESS

Engagement was broken into two parts: project visioning and concept feedback. Two visioning sessions allowed community stakeholder groups and the public to learn about the project, provide feedback, and ultimately guide the vision for a daylighted Mill Creek.

A variety of communication methods were used to inform the community about opportunities to learn about and share thoughts on the Mill Creek Daylighting project. Media advertisements, road signs, and community newsletters are some of the methods that were used to promote engagement opportunities.

The aim of the first engagement event, held on October 25, 2016, was to begin to develop the project vision. This event brought together representatives from various community groups with a direct interest in



the daylighting project. This workshop began with a brief presentation to inform participants on the initial project vision, background information, technical opportunities and constraints, project objectives, and timeline. The presentation also included examples of what other municipalities have done to daylight streams, and concluded with a question and answer period. Following the presentation, focus group discussions were held where participants were able to discuss ecology, recreation, and water in the context of the project. Some of the key themes from this workshop were:

- providing educational opportunities
- making ecology, fish, and wildlife a top priority
- creating connections to the existing trail network
- replicating the upstream naturalized character of the creek
- improving the pedestrian experience around roads and at road crossings

The second engagement event, held on November 16, 2016, was open to the public and also had the aim of developing the project vision. Information was available on boards to inform participants about daylighting, project background, technical aspects, project objectives, and daylighting done in other jurisdictions. Participants were asked to review the available information and provide thoughts on what they value about Mill Creek, any concerns they have, and suggestions for specific features to be included in the concepts. Feedback was gathered on comment forms, idea maps, and sticky notes placed on boards.

Some of the key themes from this open house were:

- providing a naturalized environment in the City
- rethinking the current road network
- creating year-round recreational opportunities
- improving accessibility
- focusing on ecosystem restoration

The final engagement event, held on December 13, 2016, was open to the public and presented the three daylighting concepts with the aim of receiving feedback. Comments were gathered on concept preference, supported features, concept improvement, and feature preference.

The City complemented this engagement process by organizing a concurrent student engagement process. Four engagement sessions were held during the first and second weeks of December 2016 at Rutherford, Donnan, and Delwood elementary schools. Students were asked to present their vision for the Mill Creek restoration. Feedback received from these events mirrored what was heard at the project workshops and reflected a desire for a natural creek that would provide fish habitat.

An Indigenous engagement process has commenced and preliminary budgets for Indigenous participation during future design and construction phases have been identified.







5.0 OVERVIEW OF TECHNICAL OPPORTUNITIES AND CONSTRAINTS

Numerous technical constraints were navigated throughout concept development. A summary of how daylighting concepts can address project constraints is presented below. A detailed description of technical constraints can be found in Section 5.0 of the technical feasibility study.

Aquatic

- Northern Pike has been identified as the primary target species for Mill Creek with Walleye and White Sucker as secondary target species.
- By-directional fish movement between the river and the downstream reach of the creek can be accommodated by lowering the elevation at the mouth of the remnant creek channel.
- Lowering the channel elevation for an extended distance from the North Saskatchewan River (north of 98 Avenue to the river), so that the North Saskatchewan River reliably backfloods a portion of the channel during higher flows, is preferred.
- Channel design should strive for: habitat diversity, and appropriate spring-time flow velocities that allow for fish navigation and minimize potential for bank and bed erosion, while allowing for minor natural lateral creek movement.
- Addition of gravels, aquatic vegetation, and dense bank vegetation would both enhance fish habitat potential and assist with erosion control.
- To provide spawning habitat, some on- or off-stream wetlands should be created along the reach of the creek between 98 Avenue and the North Saskatchewan River.

Wildlife

- The existing road network acts as a deterrent to wildlife movement and a mortality risk to wildlife such as coyotes, deer, beaver, porcupine, and skunk. Roadway crossing structures must be able to accommodate wildlife passage, including for larger mammals such as deer, and the creek, and dimensions must conform to wildlife passage guidelines.

Vegetation

- Some forest may need to be converted to other habitat types.
- Earthworks in areas supporting mature coniferous stands should be minimized.

Valley Line LRT

- Work should be limited to outside of the TransEd Partners (LRT P3 contractor) working limits.
- A barrier-free connection to the Valley Line LRT Muttart Stop, with access to the creek and trails, should be provided.

Parks and Trails

- Trail type should be matched to the surrounding trail system.

Historical Resources

- A known archaeological site is present in the area. A Historical Resources Impact Assessment should be undertaken during subsequent project planning and design stages, and avoidance or mitigation should be implemented as required.



Hydrology and Hydraulics

- Peak flows to downstream Mill Creek should be limited to approximately 5m³/s.
- A shallower stream slope is preferred for establishment of fish habitat.

Roadways

- A large number of bridges associated with road crossings poses a monetary constraint.
- The existing road network configuration limits functional space for daylighting the creek.

Utilities

- Conflicts exist between the daylighted creek and the storm and combined sewer system that will need to be addressed via the creation of outfalls, lift stations, or syphons.
- Shallow utility and water main conflicts exist; however, these utilities can be lowered.

Environmental

- Soil contamination was confirmed through borehole information from the Valley Line LRT expansion project.
- Other areas of concern include the historical CPR railway, historical clay and sand stockpiles, and the historical clay borrow pit filled with domestic refuse.

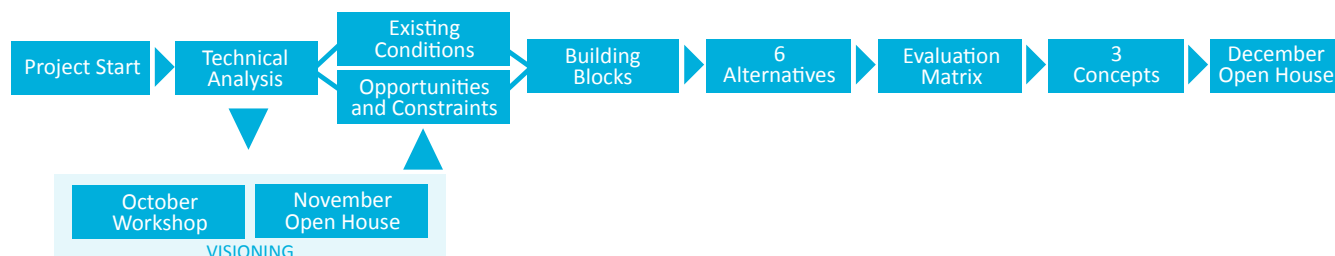
Geotechnical

- Extensive fill of variable material quality is expected to be encountered throughout the site and therefore cut and fill slopes should not exceed 3:1.
- Mill Creek has experienced past slope instability, and evidence of previous movement exists at the steep slope at the drainage tunnel location. For stability reasons, the channel alignment is recommended to be set back as far away as possible from the toe of the steep slope.
- Erosion protection should be implemented as active creek erosion and slumping are evident along the meander bend of the creek.





6.0 DEVELOPMENT OF DAYLIGHTING CONCEPTS



Development of the three final concepts involved three phases. The first phase included a technical analysis of existing conditions and identification of opportunities and constraints. This phase also initiated the stakeholder engagement component of the project, which continued through all three phases.

The second phase of concept development included the creation of technical components, development of six daylighting alternatives, evaluation of each alternative against project priorities and constraints, and selection of three concepts. Alternatives were created from technical components that weren't eliminated during the constraints analysis. Examples of components include a variety of creek slopes or pathway materials. Technical components also took into consideration desirable and undesirable elements identified through the stakeholder

consultation process. The intent was to identify all options for components that could then be mixed and matched to create six daylighting alternatives. At this point the term 'alternatives' was used as each alternative had yet to be evaluated against the evaluation criteria. The top three ranked alternatives were then moved forward for more detailed development as concepts.

The third phase involved concept refinement, reporting, and visualization. The top three ranked alternatives from the second phase were identified as concepts and developed in more detail. This included details such as creek alignment, trail locations, roadway network modifications, extent of vegetation, and habitat creation. Creation of fully formed concepts also allowed for concept visualization and the development of cost estimates.

7.0 CONCEPT 1: ECOLOGY FOCUS

This concept places the highest priority on providing ecological function. It fully restores ecological connectivity between Mill Creek Ravine and the North Saskatchewan River, as it creates the widest, highest-functioning ecological corridor with significant terrestrial habitat on both sides of the creek. With the highest number of wetlands of the three concepts, this concept provides for the greatest aquatic biodiversity, the most abundant fish cover, and the richest aquatic food chain. Habitat diversity is high and includes flowing water, gravel riffles, still water, emergent marsh, riparian grass, shrubs, mature forest, and young forest. With the combination of abundant, diverse habitat and low disturbance, this concept is expected to support the highest level of biodiversity of the three concepts.

The trail network in this concept is limited to a single trail connecting the existing south end of Mill Creek to the existing trail network adjacent to the river, with minimal creek crossings. The trails will also create an informal connection to the LRT Stop. The connection between the James MacDonald Bridge and Connors Road is adjusted to increase the available area for the creek. The connection between the James MacDonald Bridge and 98 Avenue is also consolidated and shifted to the north, allowing for an increase in the usable space between roads. Retaining structures are required in this concept,

with the most significant structure being adjacent to the James MacDonald Bridge to Connors Road east-bound connection. Road underpasses are wide and high enough to accommodate deer, the granular trail, and the creek.

Recreational opportunities are primarily low impact activities such as walking and birdwatching. Quiet seating areas provide respite from the activity of the surrounding city. Wildlife interpretive opportunities are located in strategic areas to highlight plant and animal species found in the newly restored corridor. Cultural information on Edmonton's Indigenous and later settlement history are highlighted.



Concept 1:
Ecology Focus







Concept 1 Rendering

8.0 CONCEPT 2: TRAIL CONNECTIVITY FOCUS

This concept focuses on creating extensive connections between the existing trail system and the new trails adjacent to the creek. The new trails connect with the existing paved trails to the north and ties in to the existing paved trail to the south. Existing connections to the footbridge spanning Connors Road remain. Connections to the new Valley Line LRT Muttart Stop provide opportunities for access to the Mill Creek trail system from areas served by the LRT. The trail minimizes curved sections to help increase the traveling efficiency for commuting cyclists accessing downtown from Mill Creek. Trail construction consists of an asphalt shared-use path with several creek crossings and a connection to the Muttart Stop.

Existing road connections are maintained with the exception of the James MacDonald Bridge – 98 Avenue connection. Consolidating the roads connecting James MacDonald Bridge to 98 Avenue reduces the number of bridges and the extent of retaining walls required. Road underpass dimensions accommodate cyclists, pedestrians, and some wildlife.

Retaining wall structures are required in this concept to accommodate the creek under the existing

roadway network. Retaining wall structures occur predominantly near bridges and other areas where the grade cannot be sloped gently. This concept requires the most extensive amount of retaining structures due to the retention of the majority of the existing road network. Retaining walls may be concrete, natural stone, or concrete block, depending on the height of retaining wall required.

Opportunities for recreation in this concept include cycling, running, and walking. Space for benches and picnic tables is incorporated in a small lawn space near the Muttart Stop.

A boardwalk area along a wetland near the creek provides a location for interpretive signage to explain plants and animals that can be found in the area. This concept places priority on ecological function west of the creek and providing for a variety of recreational trails and associated uses. Wetlands and fish spawning habitat are provided north of 98 Avenue and to a lesser degree near the Muttart Conservatory. The naturalized corridor is narrower than the other concepts due to the preservation of most existing roads. This results in a shorter and less sinuous creek. Habitat diversity is moderate due to the narrower corridor width and increased human activity.



Concept 2:
Trail Connectivity Focus







Concept 2 Rendering

9.0 CONCEPT 3: DESTINATION PARK FOCUS

This concept focuses on providing a central focus area adjacent to the LRT that seamlessly ties in with the daylighted creek corridor. It presents the greatest variety of passive and active recreational opportunities, and creates a continuous park space and trail connection to the nearby Louise McKinney, Gallagher, and Henrietta Muir Edwards parks.

A combination of ramps and stairs connect the shared-use path to the Muttart Stop. Seating is integrated into the plaza and provides quiet areas for reading and resting. Viewpoints are created where visitors can overlook the park below and enjoy displays about the cultural and historical significance of the area.

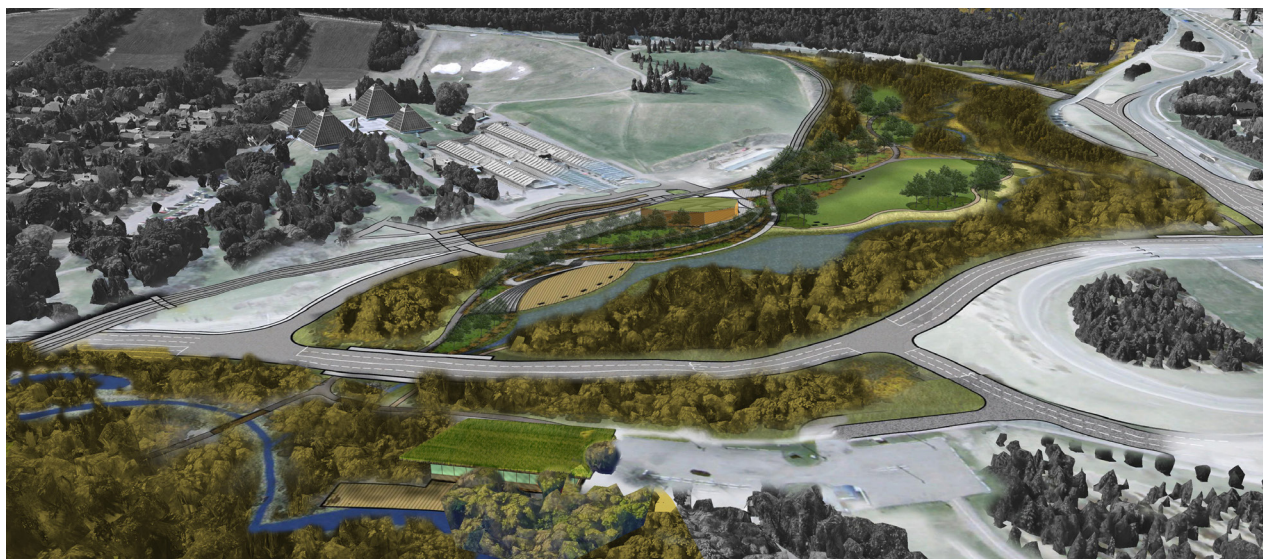
Dark sky-sensitive decorative lighting and art pieces are part of the plaza space and act as beacons highlighting the location of the station and the park from the north side of the river.

A large, open grassed area provides opportunities for casual sports and recreation, along with smaller open spaces located further upstream from the main park space. A ring of picnic spots, fire pits, and shelters surrounds the open space. Nearby, a natural play area provides a space for children to actively engage in nature through play.

An amenity building and year-round washroom are provided to establish the plaza as a stopping point for people enjoying a longer journey through the river valley. Sun shades between the washroom and LRT Stop provide reprieve on hot days and warming shelters provide a warm rest spot for wintertime users.

The north end of the creek features a new ecological learning centre that complements the work of the Bennet Centre. The ecological learning centre would be a provincial or City-run facility where children and adults alike can learn about the ecology of creeks and rivers. A boardwalk area outside of the learning centre overlooks a remnant oxbow and provides a space where visitors can learn about the plants and animals that live in Mill Creek Ravine and the North Saskatchewan River Valley.

This option presents several opportunities for trails and trail connections. Connections between the existing paved trails to the south and north are created. On the west side of the creek, a granular trail connects to existing granular trails to the north and south. Bridges cross the creek at multiple locations, providing opportunities for viewing the creek and wildlife. A trail connection to the Muttart LRT Stop is emphasised through the urban clues presented by the built elements of the station and adjacent walkways.



Concept 3:
Destination Park Focus

Attachment 3



CR_4529





Concept 3 Rendering

This concept presents the most extensive re-design of the road network by consolidating traffic over fewer bridges. Controlled intersections replace free flow lanes to enable road lane consolidation. This allows for a wider corridor and more open land for park space. Retaining wall structures are minimised in this concept as the greater open space allows for gentle slopes down from the road to the creek. All underpass dimensions accommodate cyclists, large wildlife, and the creek.

The naturalized movement corridor in this concept is narrow and limited to the west side of the creek only. Wetlands and fish spawning habitat are provided north of 98 Avenue. Habitat diversity remains high but natural habitat is the least abundant of the three concepts. Recreational use may deter some wildlife species from inhabiting the ravine.

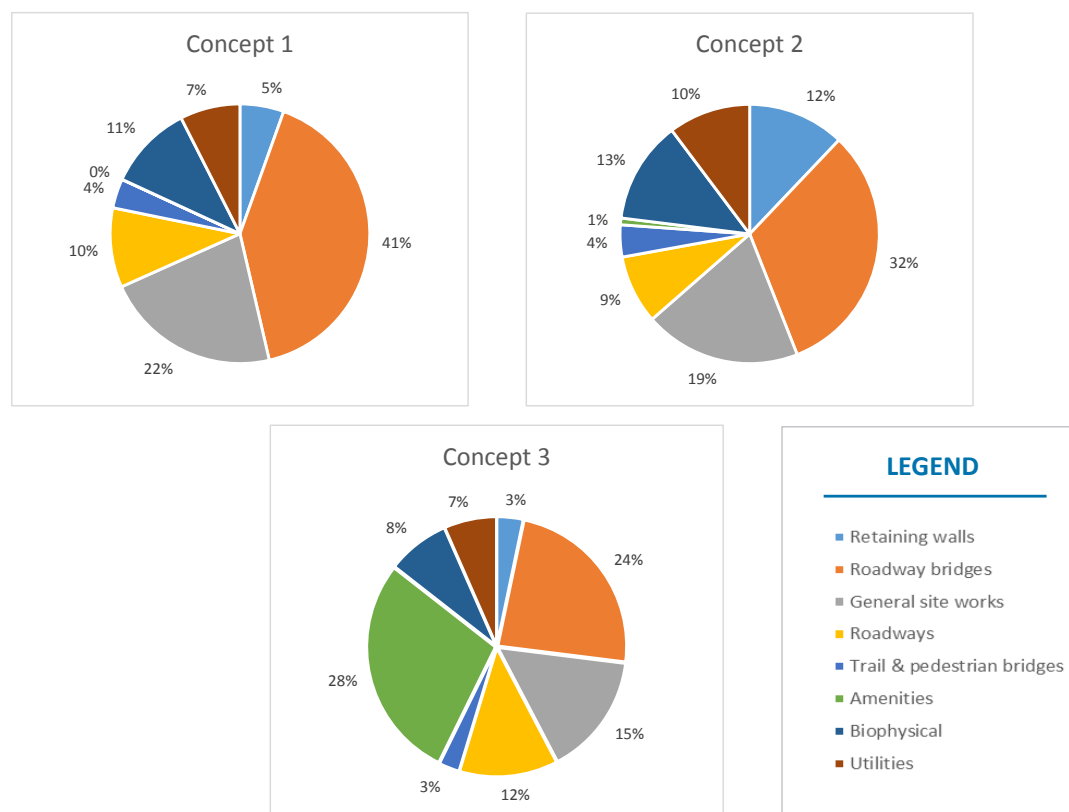
10.0 PUBLIC FEEDBACK ON DAYLIGHTING CONCEPTS

Initial feedback was gathered on the three daylighting concepts through a public open house event as well as through a questionnaire available online. Some of the most supported features included a naturalized creek, connections to existing trails, balance between ecology and recreation, and amenities at the LRT station. Both granular and paved trails were found to be desirable by different user groups. Some of the recurring suggestions for improving the concepts included ensuring access to the creek, reducing the manicured park area, and reducing manufactured elements. Attendees also expressed concern around project cost and the project not proceeding past the feasibility stage. It is recommended that City staff engage residents throughout the city through a survey to garner further feedback.

11.0 OPINION OF PROBABLE COST

Opinion of probable costs for the three daylighting concepts have been prepared and are summarized below. Professional fees (engineering, environmental) and a 50% contingency fee (feasibility level) were added to the construction costs to provide overall project costs for budgeting purposes. The construction cost breakdown for each concept is presented graphically to illustrate the differences between the three concepts.

	CONCEPT 1: Ecology Focus	CONCEPT 2: Trail Connectivity Focus	CONCEPT 3: Destination Park Focus
Construction	\$70.7 million	\$51.6 million	\$80.5 million
Contingency & Fees	\$42.7 million	\$31.2 million	\$48.4 million
Total	\$113.4 million	\$82.8 million	\$128.9 million





12.0 IMPLEMENTATION AND PHASING

Due to the magnitude of the costs of daylighting Mill Creek, there may be interest in implementing the project over a number of construction phases or stages. The preferred way to phase the daylighting would be to construct downstream reaches first and move in an upstream direction. Creating a wetland within Henreitta Muir Edwards Park by excavating and deepening the existing abandoned channel is technically feasible and would be relatively cost effective. However, the wetland would not receive any Mill Creek flows and thus would rely on water from the North Saskatchewan River to maintain its water levels. It should be noted that while it is possible to implement the daylighting in phases, the design and construction process would be much less efficient, which would increase the overall daylighting costs.

Implementation of the daylighting project is expected to take approximately four years following the selection of a preferred daylighting concept and confirmation of funding. This includes 18 to 24 months for planning and design, 12 months for permitting and approvals, and up to 24 months for construction.





13.0 SUMMARY

The key finding of this technical feasibility study is that it is technically feasible to daylight the downstream reach of Mill Creek and create an ecological connection between the creek and the North Saskatchewan River. The existing roadway network, consisting of numerous ramps to and from Connors Road— and 98 Avenue, is the most significant constraint to the development of a creek corridor that offers ecological connectivity, active transportation connections, and recreational opportunities. Reconfiguring the roadway network with a focus on maximizing the ecological and recreation potential of the daylighted creek, without adversely affecting traffic, results in an option with the highest capital costs.

As the future Muttart Stop will be the only LRT Stop within the river valley, there is strong merit in reconfiguring the 98 Avenue connection to the James MacDonald Bridge to provide a direct pedestrian connection between the Muttart Stop and Mill Creek. However, it is not practical to try to incorporate the daylighted creek into the Valley Line LRT project or have the daylighted creek cross the Valley Line LRT.

The three daylighting concepts presented as part of this study represent three different functional focuses (ecology, trail connectivity, and destination park) and three different roadway layouts. There is a connection between the concept focus and the proposed roadway layout (e.g. Concept 3 roadway layout maximizes available park space), but they are not exclusive. For example, it would be feasible to combine the Concept 2 roadway layout (lowest cost layout) with an ecology or destination park focus.

The three concepts herein were developed with three distinct focuses as a way to elicit greater public and stakeholder feedback. Feedback received to date has indicated limited support for any specific concept, with broader support for a hybrid of the three concepts. The broadest support has been for a blend of Concepts 1 and 2 (Ecology Focus and Trail Connectivity Focus, respectively) with well-developed connectivity between the Muttart Stop and Mill Creek.