5.0 SUPPORTING STUDIES

5.1 UTILITIES

The existing Walterdale Bridge supports a large number of utility pipes and other lines crossing the river. Proper planning for accommodation of this infrastructure during construction and in the long term may be one of the keys to mitigating risks of schedule creep, construction delays, and claims during implementation. These risks were identified early in the Study and were a major factor in the evaluation of options, particularly as it related to options in which the existing bridge could stay in service during construction of the new bridge. A cross-section of the bridge showing existing utilities is documented in **Appendix A.**

During the Study, all utility companies with facilities on the bridge were contacted to gain an understanding of their long term requirements and how these facilities could be accommodated. Initial contact was followed by a meeting, the Minutes of which are included in **Appendix A.** Utility contacts are indicated on the Minutes.

Utility companies with infrastructure on the existing bridge generally indicated that these facilities would be required on the new bridge. The exception is EPCOR Water, which indicated one watermain (size to be confirmed by EPCOR) could replace the two (2) existing 406 mm watermains. In addition, the 324 mm diameter high pressure pipeline is required until the end of 2011, after which ATCO Pipelines will transfer the pipeline to ATCO Gas as an intermediate pressure facility, to provide back-up supply to downtown.

EPCOR Water indicated that the watermains on the bridge can be taken out of service during bridge construction for a period of up to two (2) years or more. ATCO Gas indicated that a short term interruption during the summer months would be acceptable, but not long term. As the gas main and one of the watermains, located under the east sidewalk must be removed to facilitate the new bridge construction, a temporary arrangement to guarantee gas supply will likely be required.

If the existing bridge can be kept in service while the new bridge is being built, the utility lines can be transferred in an orderly manner before the old bridge is removed from service. Utility companies indicated that relocation prior to new bride construction could require more than two (2) years to obtain approvals, which would be prohibitive to the proposed schedule. Therefore, a bridge alignment that facilitates keeping the existing bridge in service during construction of the new bridge is key to timely implementation of the Project. Although an estimated cost of $5 Million has been carried for relocation of utilities, cost share opportunities should be explored with utility owners.

Drainage Services has also been requested to expedite condition assessment of existing sewers that may be impacted by the Project.

5.2 DRAINAGE

Stormwater management considerations for the proposed works include: quantity management, quality control, and spill containment. Existing site drainage routes directly to the North Saskatchewan River, with the existing open grate bridge deck system draining directly on the river. Today it is understood that urban runoff can have poor water quality that can negatively affect the environment, and as a result, measures that provide water quality treatment are required from new developments, including roadways. In addition, measures that provide spill containment features are also required to provide an additional level of protection of the environment from potential spills.

For this project, it is proposed that all bridge deck drainage is contained on a solid surface and routed to the north and south bridge approach areas where water quality treatment and spill containment can be provided. Three (3) stormwater Best Management Practices (BMPs) were considered for the provision of water quality treatment and spill containment, two (2) involving natural treatment process (constructed wetland and bioswale), and one involving a mechanical process (oil and grit separator). A bioswale concept was selected based on the following:

- Superior water quality treatment performance relative to oil and grit separator, utilizing the natural processes of settlement, filtration and plan uptake.
- Superior spill containment capacity relative to oil and grit separators.
- Very little maintenance required to ensure reliable performance (unlike oil and grit separators).
- Produces reduced peak flows during the 1:5 year design event, allowing use of existing downstream sewer systems.
- Requires minimal land area (much less than a wetland), and the required land area is available on site.
- Overflows during a large event can be routed overland, directly to the river.
- Low cost to construct.
- Provides an aesthetically appealing landscape feature.

For the south side system, a new storm drainage collection system would route all road surface and south bridge deck flows into a bioswale located at the tow of the slope off the west side of the realigned Walterdale Hill Road between the realigned Kinsmen Park access roads. The existing storm sewer system is to be abandoned. An underdrain system would be included in the bioswale to ensure positive drainage. Incoming flows would route along the surface of the bioswale with low flows infiltrating through the engineered bio soils and excess flows up to the 1:5 year design event picked up in a catch basin. Flows in excess of the 1:5 year event would overflow through a culvert and overland to the river. 1:5 year site runoff, not infiltrated into the local subsoils would drain into an existing storm sewer outfall system on the east side of the roadway that discharges into the river.

For the north side system, surface runoff would be collected in the existing storm sewer system at the intersection of 105 Street and River Valley Road, with the sewer system rerouted to discharge into a bioswale to be located southwest of the intersection. Bioswale drainage up to the 1:5 year event can be routed through an existing storm sewer outfall system that discharges into the river. Utilization of existing storm sewer outfalls will avoid a lengthy environmental approval process required for construction of new storm sewer outfalls.

The cost of the proposed stormwater management system is estimated at about $1.3 Million, with about $0.9 Million of the total required for the new south side storm sewer system. A more comprehensive discussion of the proposed stormwater management system is provided in **Appendix B**.

5.3 GEOTECHNICAL

A Desktop Study was undertaken by Thurber to provide preliminary geotechnical input for the evaluation of the bridge foundations, and to rank the proposed alignments of the south approaches with regard to their impact on the stability of the south valley slopes. The Study was based on a review of existing borehole information available in the general Project Area, air photos, and published geologic data. No project-specific geotechnical drilling program was conducted. Hence, the evaluations presented herein are preliminary, aimed solely at assisting the designers assess different foundation and alignment options. A detailed site investigation program and comprehensive engineering analyses should be undertaken in subsequent phases of the design.

The findings of the Study were presented in the following three memorandums (attached in **Appendix C**).

- Technical Memorandum No. 1: Walterdale Bridge, South Valley Slope Alternate Alignments, Preliminary Geotechnical Assessment. Issued on 15 December, 2010.
- Technical Memorandum No. 2: Walterdale Bridge Replacement, Arch Bridge Alternative, Preliminary Geotechnical Input. Issued on 10 February, 2011.
- Technical Memorandum No. 3: Walterdale Bridge Replacement, Arch Bridge Alternative, Preliminary Geotechnical Input for Pile Foundations. Issued on 16 February, 2011.

A brief summary of the above memorandums is presented in the following subsections.

5.3.1 Subsurface Conditions

The subsurface soil conditions at the bridge site are expected to consist, in descending order, of alluvial clay, silt and sand units (river terraces); sand and gravel; over clay shale and sandstone bedrock. Surficial fill layers may also be present at some locations.

The top of bedrock at the locations of bridge abutments/thrust blocks is expected to be present at approximate elevation 612 m; underlying some 11 to 16 m thick cover of

relatively weak/loose river terrace sediments. The bedrock generally consisted of a sequence of interbedded clay shale, siltstone, and sandstone with occasional layers of coal. In places, thin layers of bentonite were observed. The bedrock was described as very weak to weak in rock mechanics terminology. Typically, the upper 2 to 3 m of the bedrock are highly weathered and much weaker than the bedrock at deeper elevations.

The surficial deposits on the uplands of the south valley wall consisted of glaciolacustrine clay, over glacial till over, bedrock. Thin deposits of sand and gravel, representing an upper terrace of the pre-glacial channel may also be present over the bedrock in some places. Colluvium (landslide derived materials) is expected to make up the near surface soils on the south valley slope, and overlies bedrock.

The surficial deposits on the north side of the river are expected to consist of alluvial deposits of clay, silt, sand and gravel (in descending order) making up the low level river terrace. Colluvium consisting mainly of clayey soils is expected to be present on the north slopes above the low level terrace.

5.3.2 Alignment Alternatives on South Valley Slope

The main geotechnical feature affecting the south bridge approaches is the presence of deep seated ancient and presently dormant landslides that encompasses the entire valley wall from the north edge of Saskatchewan Drive down to the toe of the slopes at the low level river terrace. While these landslide areas are presently inactive, unfavourable design and construction measures have the potential to reactivate these failures and reduce the overall stability of the valley slope. Measures that could negatively impact the current state of slope stability include; placement of fill on the upper portion of the slopes; cuts into the middle or lower portions of the slopes; and activities that cause a rise in the groundwater table. On the other hand, fills placed at the toe of the slope would have positive effects on the stability of the slopes.

5.3.3 Bridge Foundations

The thrust block foundations of the proposed arch bridge may rest directly on the bedrock, or on the river terrace sediments at higher elevations.

Depending on the strength and degree of fracturing of bedrock, the ultimate bearing capacity of spread footings founded on competent Edmonton Formation bedrock could vary between 1200 and 2000 kPa. For an improved resistance against sliding, if necessary, a concrete shear key extending 2 to 3 m below the base of the footing may be constructed. For greater axial and lateral resistances, the footings may be combined with bored cast-in-place caissons to transmit some of the thrust block loads to deeper bedrock strata.

Alternatively, the thrust blocks may rest on the weaker alluvial sediments at higher elevation, but supported on driven steel piles or bored cast-in-place caissons founded in the bedrock. Straight shaft or belled, large diameter cast-in-place caissons can resist large axial and lateral loads and could be the preferred foundation option. Alternatively,

driven steel H-piles or open-ended pipe piles may be used to support the bridge thrust blocks. The piles should be driven to practical refusal in the bedrock. A combination of vertical and lateral piles may be used to improve resistance to lateral loads.

The axial load carrying capacity of bored cast-in-place piles and driven steel piles may be estimated based on the preliminary design parameters presented in **Table 5.1** below.

Table 5.1 – Preliminary Design Parameters for Pile Foundations Embedded into Bedrock

PILE TYPE	ULTIMATE LIMIT STATE DESIGN PARAMETERS			
	f_{ult} [1] (kPa)	q_{ult} (kPa)	$\Phi_{compression}$	$\Phi_{tension}$
Driven Steel Piles	150	10000	0.4	0.3
Drilled Caissons	150	3000	0.4	0.3

f_{ult}, ultimate shaft resistance; q_{ult}, ultimate end bearing resistance; Φ, geotechnical resistance factors in compression and tension.

[1] a reduced skin friction resistance of 50 kPa should be used in the upper 2 m of bedrock.

5.4 HISTORICAL RESOURCES

5.4.1 'Statement of Justification'

Turtle Island Cultural Resource Management Inc. has completed a Statement of Justification for Historical Resources Act Requirements (**Appendix D**) for the proposed Walterdale Bridge Replacement. This Statement of Justification (SoJ) was prepared as a component of the Walterdale Bridge Replacement and Approach Evaluation Study in order to obtain clearly defined Historical Resource Act (HRA) clearance requirements for this project from Alberta Culture and Community Spirit (ACCS). The SoJ was submitted to ACCS for preliminary review on October 5, 2010 and formally submitted on October 22, 2010.

The SoJ summarizes a review of the proposed Project Area carried out by Turtle Island CRM staff between May 20 and September 19, 2010 and includes the results of a combination of planning meetings and workshops with the Project Team and the City of Edmonton, a review of previous archaeological work carried out in the proposed Project Area, individual interviews with concerned stakeholders and community members, an aboriginal Elders gathering facilitated by the City of Edmonton Aboriginal Relations Office and discussions with representatives from ACCS. The SoJ included a overview of the proposed Project Area with reference to the nature of the proposed Walterdale Bridge replacement, alignment alternatives currently under consideration, previous disturbance factors, environmental context, known cultural resource sites present in the proposed Project Area (archaeological and historic), previous cultural resource management studies carried out in the proposed Project Area and the results of

interviews with a selection of key stakeholders and community members including Elders from a variety of aboriginal communities. Based on this review, specific recommendations outlining further cultural resource management work toward acquiring HRA clearance from ACCS for the six proposed Walterdale Bridge replacement alternatives then currently under consideration and general recommendations related to the Project Area as a whole were outlined at the conclusion of the document. The current proposed alignment option shown on **Exhibit 3.11** had not been finalized when this SoJ was submitted to ACCS.

5.4.2 General Background

Previously recorded cultural resources are located within the proposed development zone including the current Walterdale Bridge and the archaeological site FjPi-63. The current Walterdale Bridge will not be retained as part of this project. A demolition and recording strategy is currently under development in consultation with the City of Edmonton Planning and Development Department. Potential components to this strategy include; use of trusses as a bridge (pedestrian or otherwise) again anywhere in the City, incorporation into any development on the Rossdale site or south side park or incorporation into art work associated with the bridge replacement.

FjPi-63 includes the remains of at least two early 19th Century AD fur trade forts and historic structures related to the Rossdale Power Plant. Of particular concern are the remains of a cemetery compound (Fort Edmonton Cemetery and Traditional Burial Ground) associated with the 19th Century AD fur trade forts and located northeast of the north abutment of the current Walterdale Bridge. Due largely to road construction and the installation of utility facilities in the area of this cemetery, multiple intact grave features have been disturbed since circa AD 1950. These repeated episodes of disturbance have significantly impacted this portion of the site and garnered outrage from aboriginal, non-aboriginal and Métis descendents of those interred in this cemetery. The interpretive potential of this feature related to FjPi-63, as demonstrated by previous cultural resource work is extremely significant. The risk that the proposed bridge replacement will potentially impact components related to FjPi-63, particularly human remains is considered high. Historical Resource Act requirements in this regard are presently under development by ACCS.

5.4.3 Community Engagement

Community and stakeholder engagement played an important part of this SoJ. Consistently, stakeholders and community members approached in regard to the current project voiced dissatisfaction with the nature and scope of previous cultural resource management work carried out in the Rossdale Flats area of Edmonton, particularly that these efforts are consultant based and development driven. These efforts have produced a fractured series of poorly related reports unable to adequately communicate the collective importance of the Rossdale Flats area of Edmonton. This concern was expressed by the majority of stakeholders approached despite a large body of previous work in the area not sponsored in response to specific developments. The fact that many community stakeholders, descendents and concerned citizens

remain largely dissatisfied with cultural resource management work on Rossdale Flats underlines the importance of this area as a focus of community identity and collective heritage in Edmonton. Stakeholders and community members participating in the preparation of this SoJ expressed the almost unifying request that the methods employed and results obtained in regard to cultural resource management work in regard to the current project be given full disclosure.

The issue of encountering human remains as a result of the current project associated with the Fort Edmonton Cemetery and Traditional Burial Ground, both in the form of intact grave features and previously disturbed material, was of paramount concern to all community participants interviewed including the City of Edmonton Aboriginal Affairs Relations Office and participants of the Elders Gathering. In this regard, all parties were unified in the following two points; one, that appropriate aboriginal ceremonial protocol be carried out prior to and as an ongoing part of the construction process (at the direction of community Elders); and two, that any intact or disturbed human remains identified during the course of the Walterdale Bridge Replacement Project be treated with upmost care and respect and that they be re-interned within the boundaries of the Fort Edmonton Cemetery and Traditional Burial Ground (as currently defined). At the request of participants of the Elders Gathering, a pipe ceremony was carried out at the Memorial Site on Rossdale Flats in order to cleanse and bless the Project Team members and to request wisdom in making future planning decisions for the current development.

5.4.4 General Considerations

An HRIA related to the recommended alignment will be the least complex of all options considered. Subsurface testing can be carried out in the area of the south approach prior to construction. Subsurface testing and monitoring will likely be required in association with the north approach as outlined by ACCS requirements. Surface stripping of soil overburden will also likely be required in this area. This will present potential planning problems in regard to the handling and depot of surface over burden and potential conflicts with existing subsurface utility facilities. The possible relocation and/or installation of subsurface utility facilities is currently in development; archaeological testing and/or monitoring will likely be required in association with this component of the project.

The north bridge approach has been the subject of the most previous archaeological work and no intact cultural deposits, grave features or disturbed human remains have been identified as a result of this work. As such, this area is considered to be the alignment option of least risk to cultural resources of all those considered. However, the identification of intact grave features and/or previously disturbed human remains is a possibility in this area, the management consequences of which would be significant. The current recommended alignment will not impact the area of the Fort Edmonton Cemetery and Traditional Burial Ground as currently defined. However, portions of the memorial site will be impacted including the removal of the interpretive belvedere. It is anticipated that community reaction to the removal of this important component of the memorial site will be negative. Therefore, it is recommended that the construction plan

for the new bridge include the relocation, redesign and/or reconstruction of the interpretive belvedere. Community engagement will play a role in the site design, content (if redefined) and construction. Further planning work will be required to address the interpretive belvedere relocation in more detail.

5.4.5 Moving Forward

Given that the proposed replacement for the Walterdale Bridge is currently subject to a very strict timeline, three (3) principal recommendations in regard to cultural resources are made; one (1) , that cultural resource assessment work (where possible) for this project be initiated at the earliest opportunity; two (2), incorporate the replacement reconstruction and/or relation of the interpretive belvedere in the construction plan; and three (3), develop a protocol which will be followed in the event human remains are identified.

In light of these three areas of concern, it is recommended that a comprehensive risk management plan regarding cultural resources be developed as part of the new Walterdale Bridge construction project. The value of this plan would be to minimize risk to both schedule and cost but most importantly, underline the City of Edmonton's desire to respect the cultural sensitively of this area. In order to help ensure the proposed 2013 completion date for this project is realized, a proposed risk management plan is recommended. This plan would include:

- A comprehensive Historical Resources Impact Assessment (HRIA) including the controlled removal of surface fill in lands impacted by the north bridge abutment in order to inspect for intact grave features, deep archaeological testing at locations within the development area previously not subject to assessment and where assessment prior to construction is not possible, archaeological monitoring of all ground disturbance related to construction including buried utility and infrastructure facilities.
- Development a concept strategy for the replacement, reconstruction, and/or relocation of the interpretive belvedere in cooperation with community members and stakeholders.
- Development of a protocol, that any human remains identified during the course of the Walterdale Bridge Replacement Project be treated in the appropriate manner and re-interned within the boundaries of the Fort Edmonton Cemetery and Traditional Burial Ground (as currently defined).

5.5 ENVIRONMENTAL

The City of Edmonton's Walterdale Bridge is approaching the end of its useable life and will require replacement in the near future. Presently, peak hour traffic demand is greater than the capacity of the existing bridge. Further, indirect roadway geometry and steep grades require improvement. To that end, the City proposes to replace the existing bridge with a new, realigned structure and to realign the roadways associated with that new bridge. The City has also expressed its desire for the new structure to be a "signature" bridge, forming an attractive entrance to Edmonton's downtown through

the North Saskatchewan River Valley. The existing bridge may be demolished and decommissioned; however, it is unknown at this time whether that will be undertaken as part of this project.

Several design options were assessed and all environmental information that could make any of those options untenable or particularly challenging from an environmental perspective were identified. Based on that review, in concert with a review from the overall Design Team, one option was chosen and is the subject of this report.

The project will require various federal, provincial and municipal environmental review processes and permits/approvals, including approval pursuant to the *Navigable Waters Protection Act* and, if decommissioning of the existing bridge is included in the project, a *Fisheries Act* Authorization. Because the new bridge is single-span, there is a strong possibility that an Authorization pursuant to the *Fisheries Act* will not be required for new bridge construction as there would be no piers in the river. The requirement for those federal permits will trigger an environmental assessment pursuant to the *Canadian Environmental Assessment Act (CEAAct)*, even if there is no application for federal funding (another trigger for *CEAAct*). Construction of a new bridge on the banks of the North Saskatchewan River will require a License of Occupation under Alberta's *Public Lands Act*, as the Province owns the bed and shore of all waterbodies; the potential to disturb historical resources requires clearance under Alberta's *Historical Resources Act*. The project falls within the boundaries of the City of Edmonton's *North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)*, which governs all development within the river valley, and is, therefore, subject to an environmental assessment and review. Several additional City bylaws and policies, including the *Parkland Bylaw*, *Natural Area Systems Policy* and *Corporate Tree Management Policy*, also apply. Coordination with the City of Edmonton and the Responsible Authorities will be required to ensure that the Environmental Impact Assessment document meets both City of Edmonton *Bylaw 7188* requirements and *CEAAct* requirements.

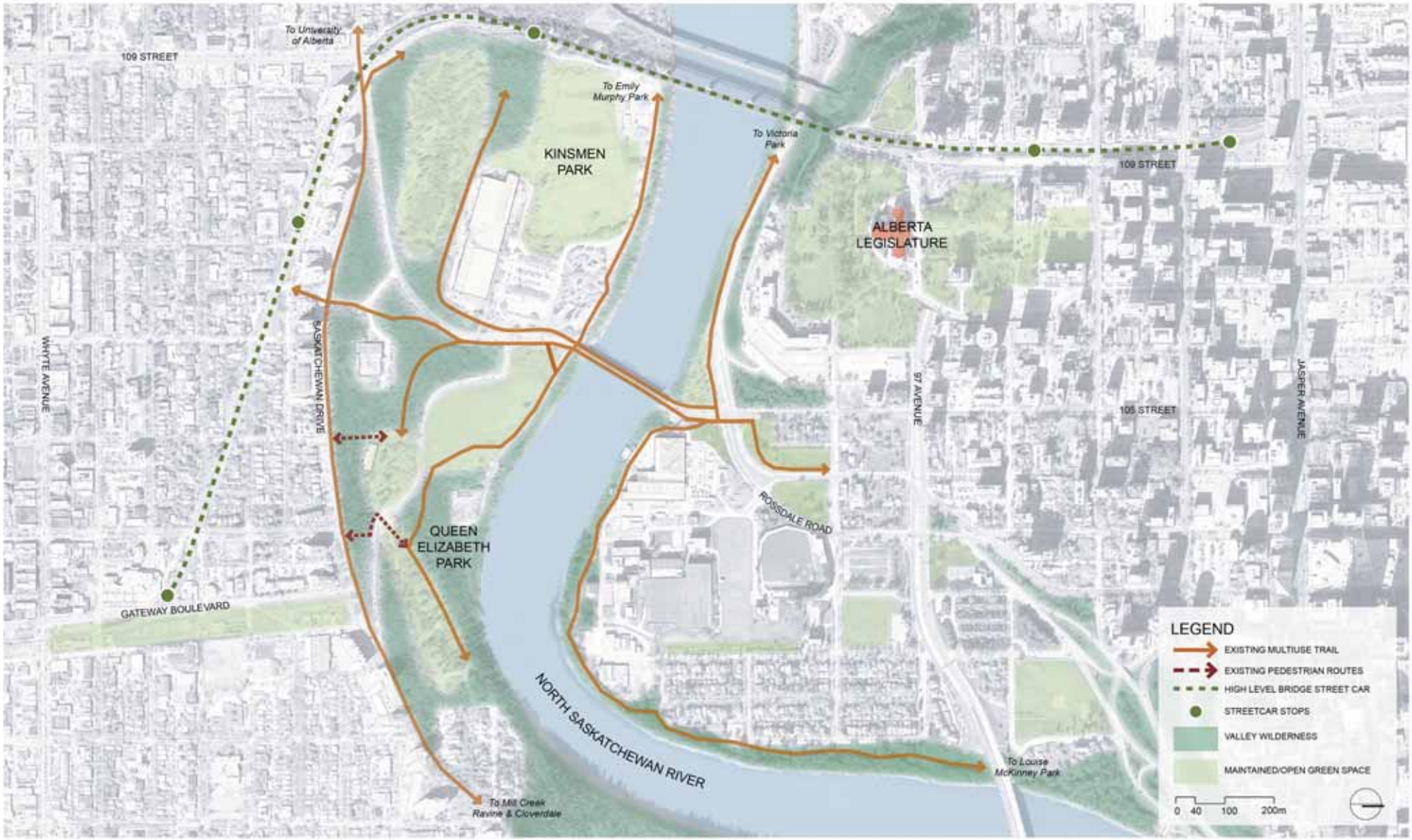
Several environmental issues were identified in relation to the project, including potential for slope instability from the new bridge; introduction of deleterious substances into the North Saskatchewan River from construction and, if required, demolition/ decommissioning; loss of vegetation and wildlife habitat; construction noise; recreational trail closures/realignments; improved navigability; and the potential impact to heritage resources.

Detailed environmental information exists for the identified Valued Environmental Components (VECs) in the Study Area; however, there are some cases where the information is not site-specific enough. Based on the review of existing environmental information, the following site-specific infill investigations will be required: geotechnical, including groundwater information at the bridge site and on the south riverbank and terrace along the proposed roadway alignments; a hydrotechnical assessment with respect to bridge clearance; air quality (required for a *CEAAct* review); rare plant surveys; breeding bird and amphibian surveys at the bridge site; and noise (required for a *CEAAct* review). A fish and fish habitat assessment has been undertaken in autumn 2010 in support of this project. Detailed information concerning heritage resources will

also be required, however, that is being undertaken under separate contract to the City of Edmonton and will be summarized in the environmental assessment review. Once all existing environmental information has been obtained, an Environmental Impact Assessment pursuant to the *CEAAct* and *Bylaw 7188* will be undertaken and is anticipated to be completed by early 2012.

A preliminary impact analysis identified several potential adverse impacts, including introduction of deleterious substances to the North Saskatchewan River, adversely affecting surface water quality and fish and fish habitat; loss of vegetation; loss of wildlife habitat; loss of fish habitat during pier removal, increased noise levels during construction; and potential recreational trail realignment (temporary or permanent). Standard mitigation measures are, however, available for the majority of those impacts. Several positive impacts are anticipated, including increased fish habitat resulting from removal of existing bridge piers, improved navigation along the NSR (if the existing bridge is removed) and improved views of the river valley.

By complying with applicable environmental legislation and Best Management Practices, as well as some potential site-specific mitigation measures, the proposed new Walterdale Bridge and associated roadway upgrades can be constructed and operated in an environmentally-sound manner, resulting in a “signature” bridge within the river valley.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To Victoria Park
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ALBERTA LEGISLATURE
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97 AVENUE
105 STREET
JASPER AVENUE
ROSSDALE ROAD
QUEEN ELIZABETH PARK
GATEWAY BOULEVARD
NORTH SASKATCHEWAN RIVER
To Louise McKinney Park
To Mill Creek Ravine & Cloverdale
LEGEND
EXISTING MULTIUSE TRAIL
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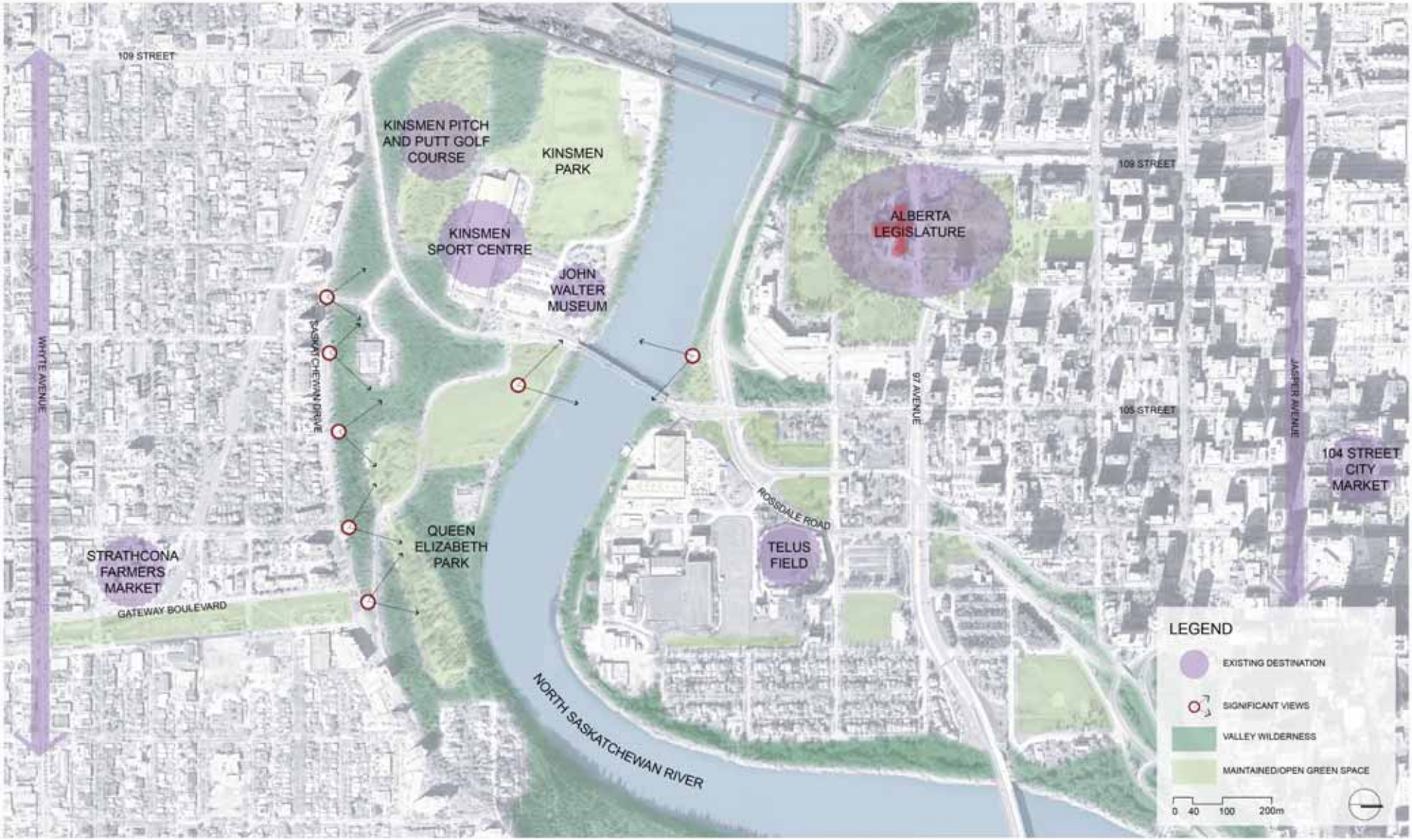
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ALBERTA LEGISLATURE
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WHYTE AVENUE
SASKATCHEWAN DRIVE
97 AVENUE
105 STREET
JASPER AVENUE
104 STREET CITY MARKET
ROSSDALE ROAD
QUEEN ELIZABETH PARK
TELUS FIELD
STRATHCONA FARMERS MARKET
GATEWAY BOULEVARD
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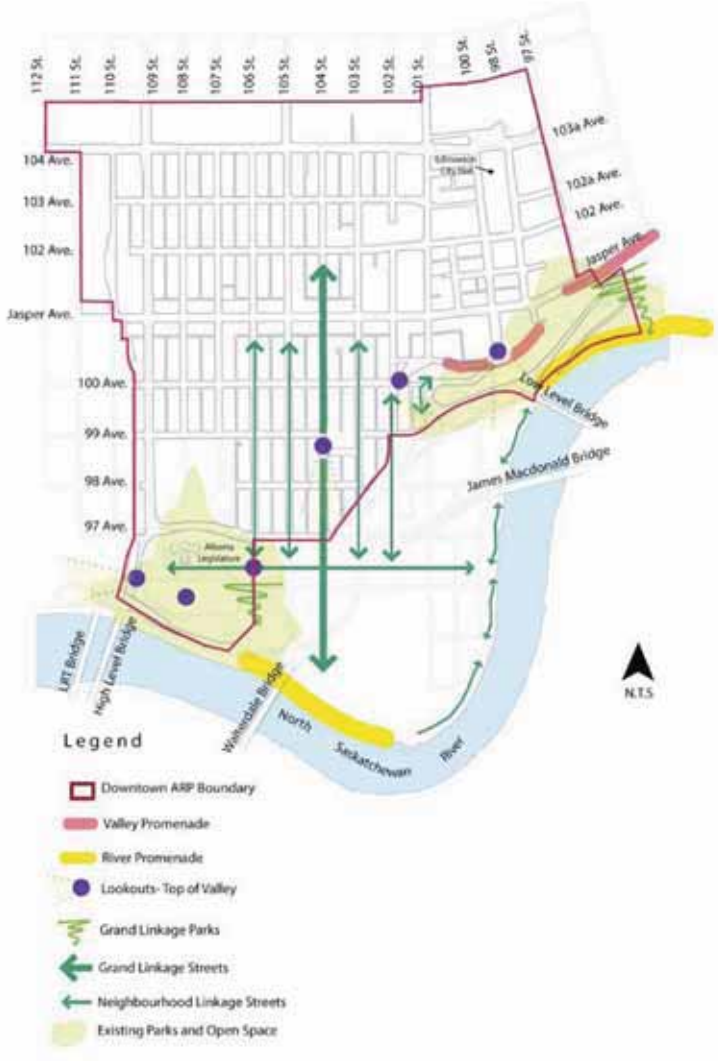
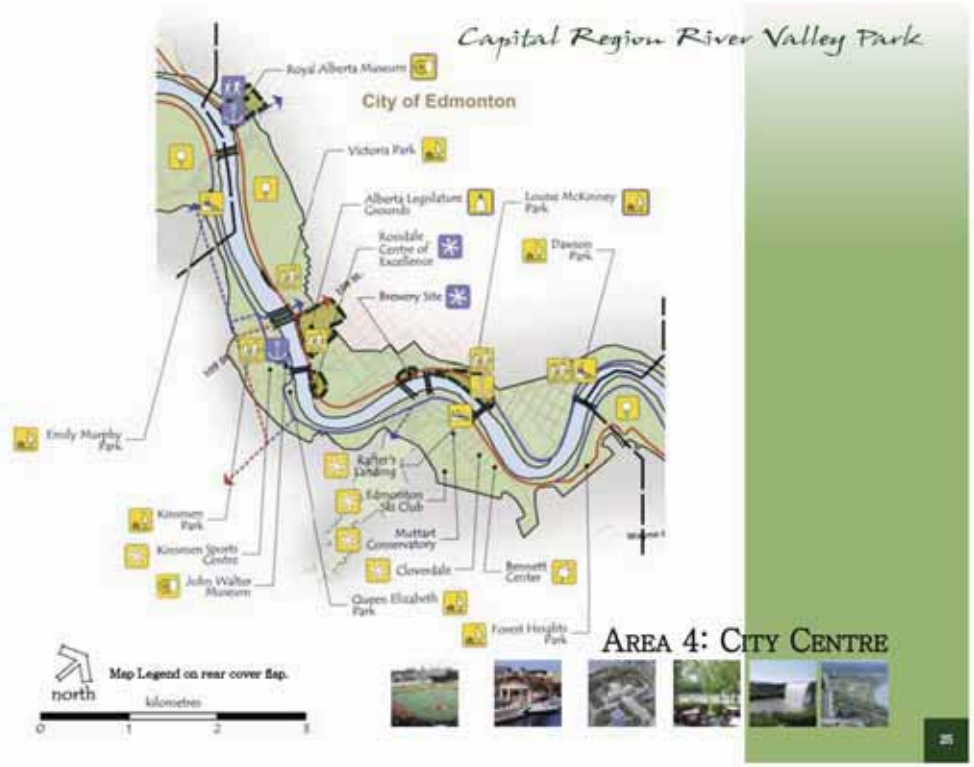
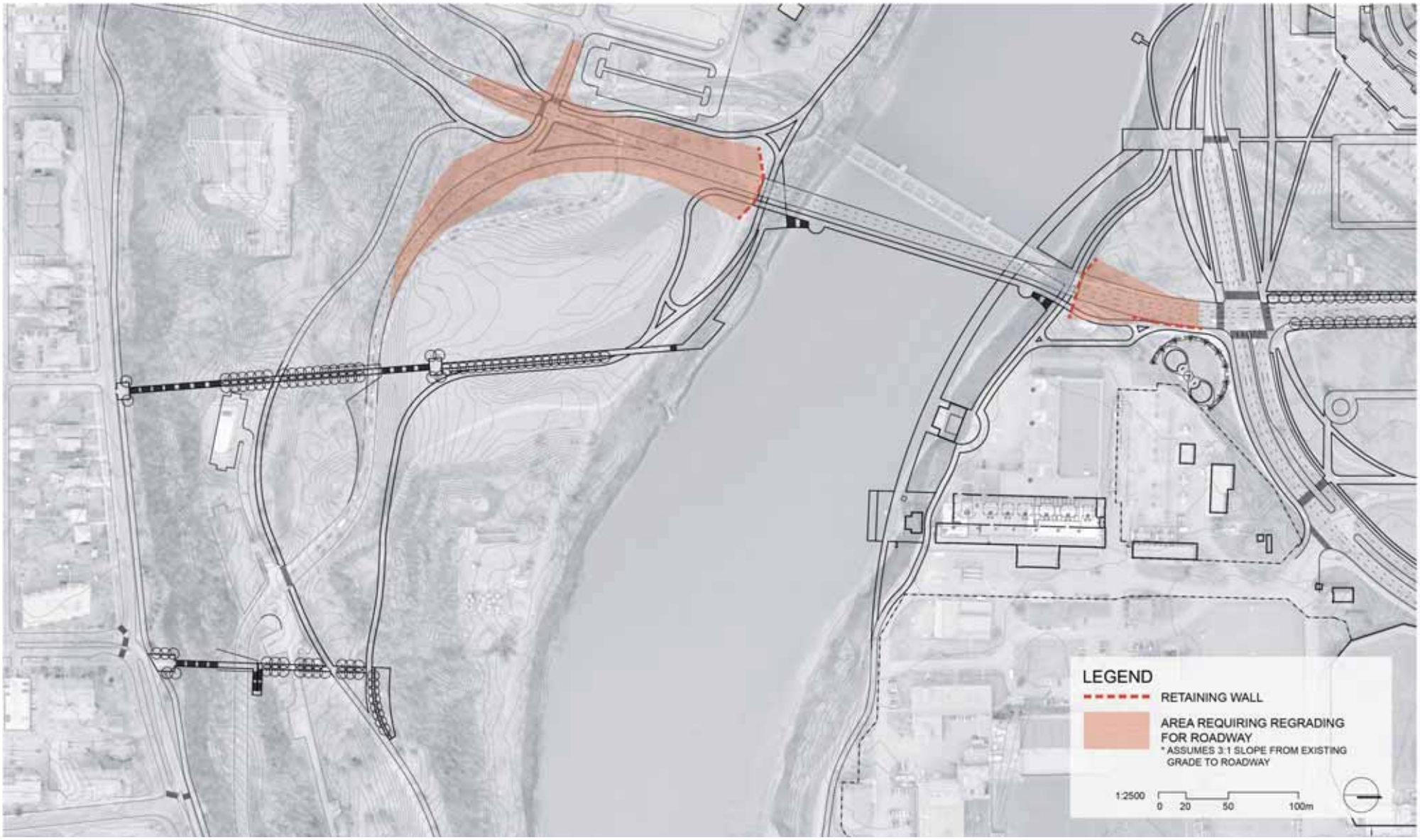


River Valley Promenades plan from Capital City Downtown Plan



River Valley Park Plan from River Valley Alliance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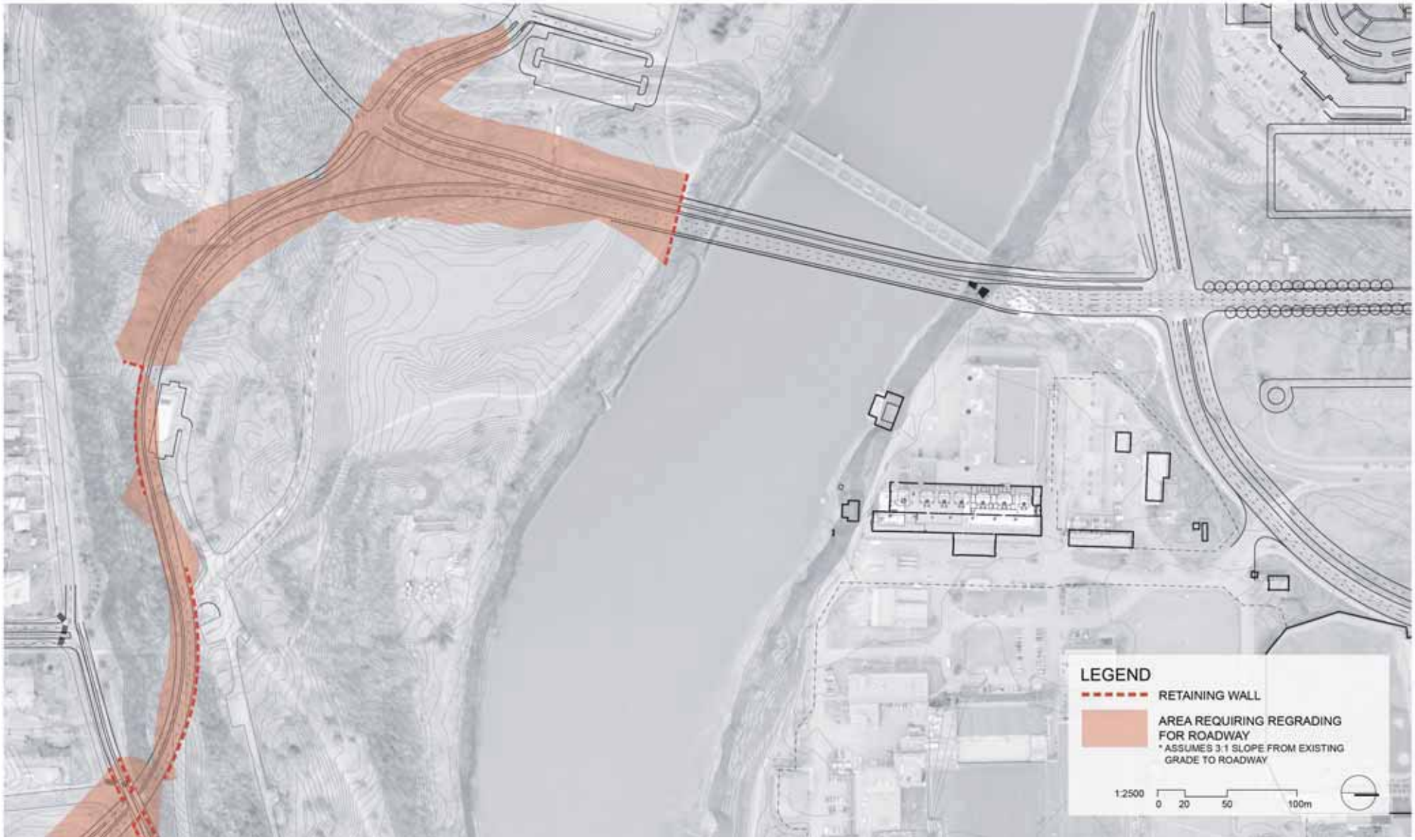
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