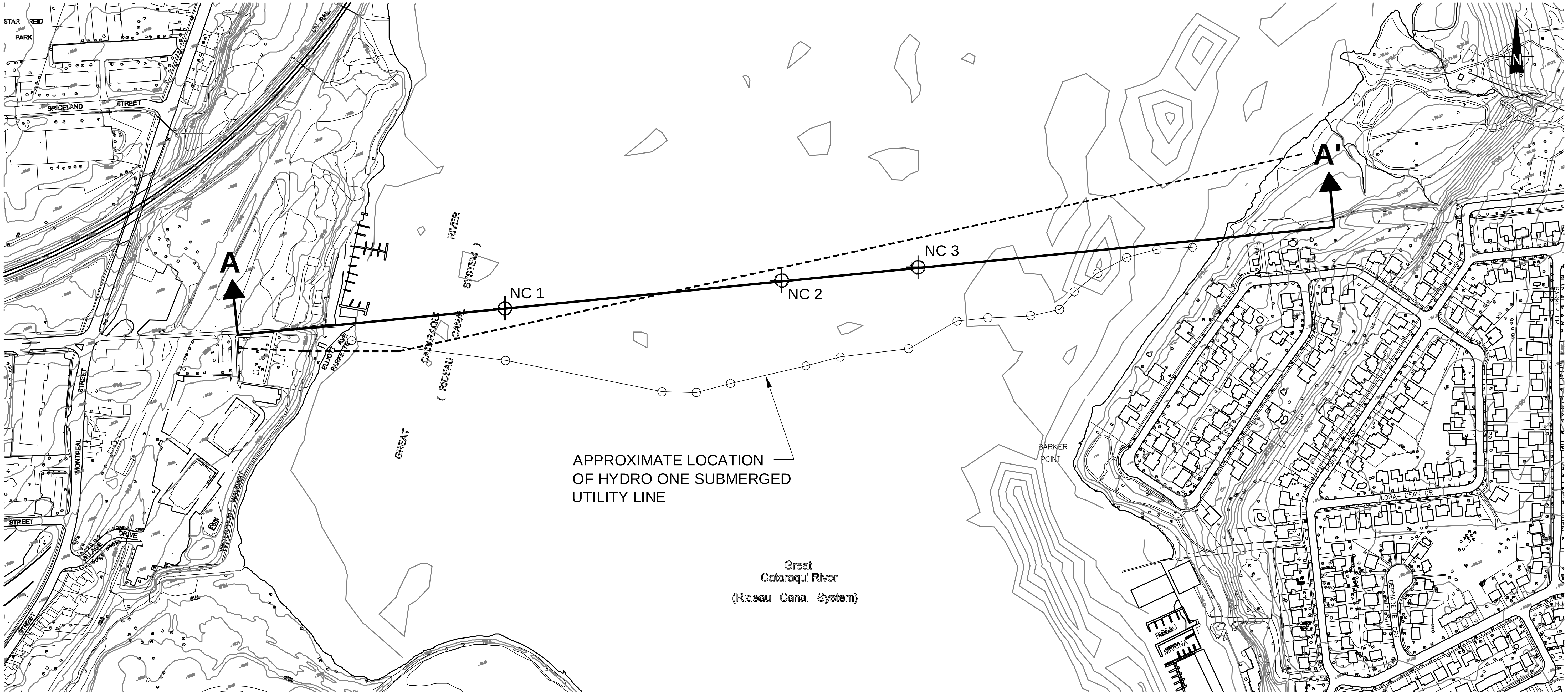


LEGEND

- APPROXIMATE BOREHOLE LOCATION IN PLAN
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY STRATA ENGINEERING CORP. (1991)
- APPROXIMATE DYNAMIC CONE TEST LOCATION IN PLAN, PREVIOUS INVESTIGATION BY STRATA ENGINEERING CORP. (1991)
- A — APPROXIMATE CROSS-SECTION LOCATION IN PLAN
- ERI SURVEY LINE

NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 09-1121-0016-1500

REFERENCE

BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY J.L. RICHARDS AND ASSOCIATES LTD.

File Location: P:\23000\23446-02 - Cataraqui River EA - Stage 2\23443-02 - Third Crossing ESR\Figures\Figure 4-13 Borehole Locations.dwg

PROJECT:
CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT

DRAWING:
BOREHOLE LOCATIONS

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS
J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:
DRAWN:
CHECKED:
PLOTTED: 1-Feb-12

DRAWING NO.: 4-13
JLR NO: 23446-02

The geophysical investigation was done between September 1 and September 3, 2010. It delineated the bedrock surface along the proposed bridge alignment using an electrical resistivity imaging (ERI) survey. The ERI survey measures the electrical resistivity (reciprocal of conductivity) of the subsurface to infer rock/soil types, stratigraphy and soil conditions. The apparent resistivity of the subsurface is calculated for increasing electrode separations by applying a current to the ground using two electrodes and measuring the potential difference (voltage) between two different electrodes.

.2 Fieldwork Findings

For context, the City is situated on the northeast edge of the Palaeozoic Plain of the Lake Ontario homocline. To the north and east of the City is the Frontenac Axis, which was introduced earlier in this Report. The Frontenac Axis is a low eastward trending ridge of Precambrian intrusive and metamorphosed sediments of the Grenville structural province of the Canadian Shield. The Frontenac Axis crosses the St. Lawrence River in the Thousand Island region and extends southeast ward to the Adirondack Mountains of New York State, thereby separating the strata of the Ottawa-St. Lawrence plain from the Southern Ontario plain.

Overlying the Precambrian surface are consolidated Palaeozoic sediments of the Late Cambrian to Middle Ordovician Periods. The Palaeozoic stratigraphy consists of a sedimentary sequence including basal conglomerates, sandstones, shales and carbonaceous rocks. This suggests that during Cambrian and Early Ordovician times, the Precambrian Shield was inundated by shallow, westward transgressing seas in which deposits consisted of the Potsdam and Shallow Lake Formations. These deposits were overlain by marine carbonates, indicative of increased water depths during the Middle Ordovician time. The carbonate sequence, collectively known as the Simcoe Group, is represented locally by the Gull River Formation.

The Precambrian bedrock underlying the project site location consists of Grenville Supergroup Clastic Metasediments which are intruded by younger granitic rocks and diabase/andesitic dykes. The Grenville Supergroup Clastic Metasediments includes crystalline limestone interlayered quartzite and marble, quartzite, several types of gneiss, pyroxene granulite, migmatite, gabbro, pegmatite, red granite, monzonite. This is overlain by the Cambro-Ordovician Potsdam Formation which consists of sandstone and siltstone of variable thickness. Lying above the Potsdam formation is a series of shales, sandstones and arkoses of the Middle Ordovician Shadow Lake Formation. The Potsdam and Shadow Lake formations are limited in thickness and are commonly absent on and adjacent to Precambrian highs.

With this context in mind, the interpreted subsurface conditions at the project site location are shown on Drawing 4.14. The bedrock surface appears to be variable across the site. The bedrock is exposed or near surface on both sides of the Cataraqui River (at an elevation of 73 m at the east bank and 76 m at the west bank) and then dips to elevations ranging from elevation 30 m to elevation 55 m within the river. Limestone, present on the banks of the river, is underlain by a 3 m to 5 m layer of Shadow Lake shale. The ERI profile indicates that Precambrian rock is likely present beneath the shale across the whole site.

There are two zones where low resistivity is observed within the bedrock beneath the river, centred at distances of 320 m and 970 m along the survey line. These areas are most likely associated with the Frontenac Axis.

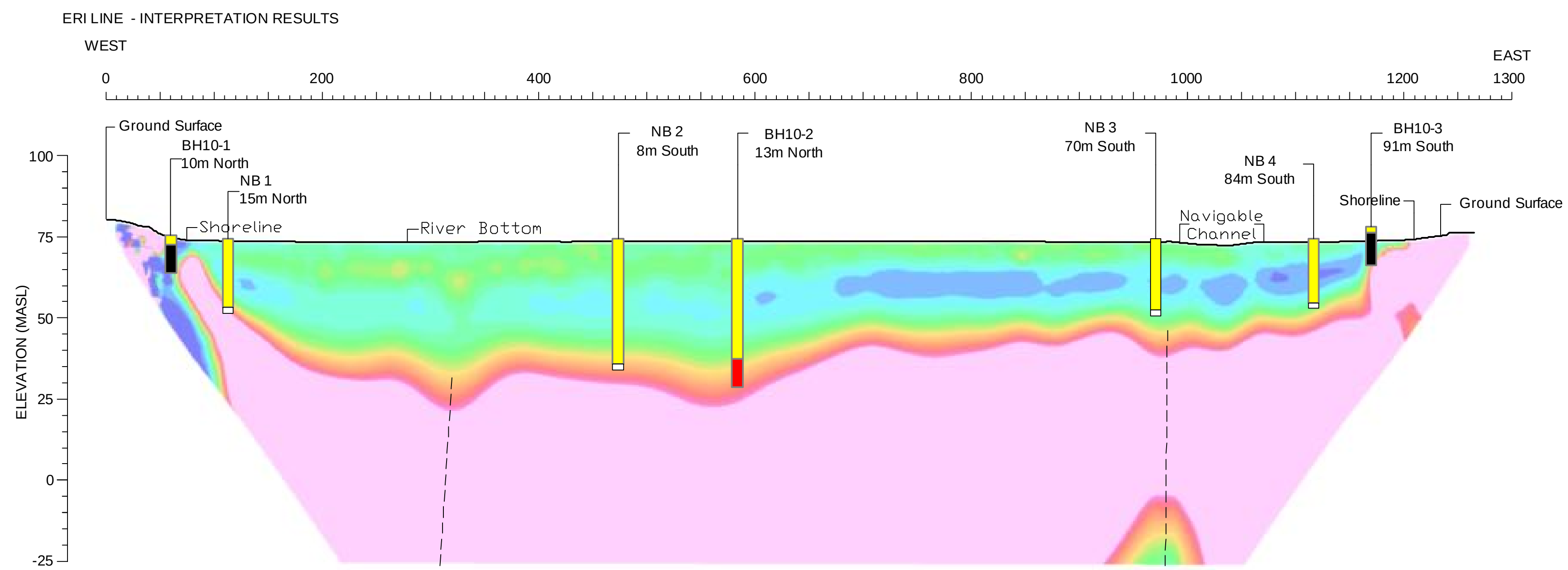
As also shown on Drawing 4.14 and highlighted further below, the subsurface conditions at the project site location consist of overburden soils that vary from limited thickness (2 m to 3 m) at the river banks to about 40 m within the river. Along the banks, the overburden consists of fill over peat over silty clay or glacial till. Within the river, the overburden consists of peat over silty clay:

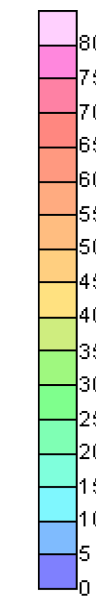
1. *Topsoil and Fill*: At Borehole 10-1 (west bank), a layer of fill consisting of silty sand to sandy silt with some gravel, trace clay, cobbles and organic matter was encountered. The thickness of the fill is about 1.5 metres. At Borehole 10-3 (east bank), a layer of topsoil was encountered at the existing ground surface and is about 0.15 metres thick.

2. *Organic Soil*: Beneath the fill layer at Borehole 10-1 (west bank) and at the floor of the river, a layer of organic soil was encountered. The organic soil is fibrous and includes peat and organic silt with traces-to-some sand and rootlets. The thickness of the organic soil generally varies from about 0.8 m to 2.2 m, with the exception of Borehole NB2 (near mid-river from the 1992 TSH study), where the organic soil is about 6.4 m thick. With the exception of the surface topsoil, no organic soil was encountered at Borehole 10-3 (east bank).

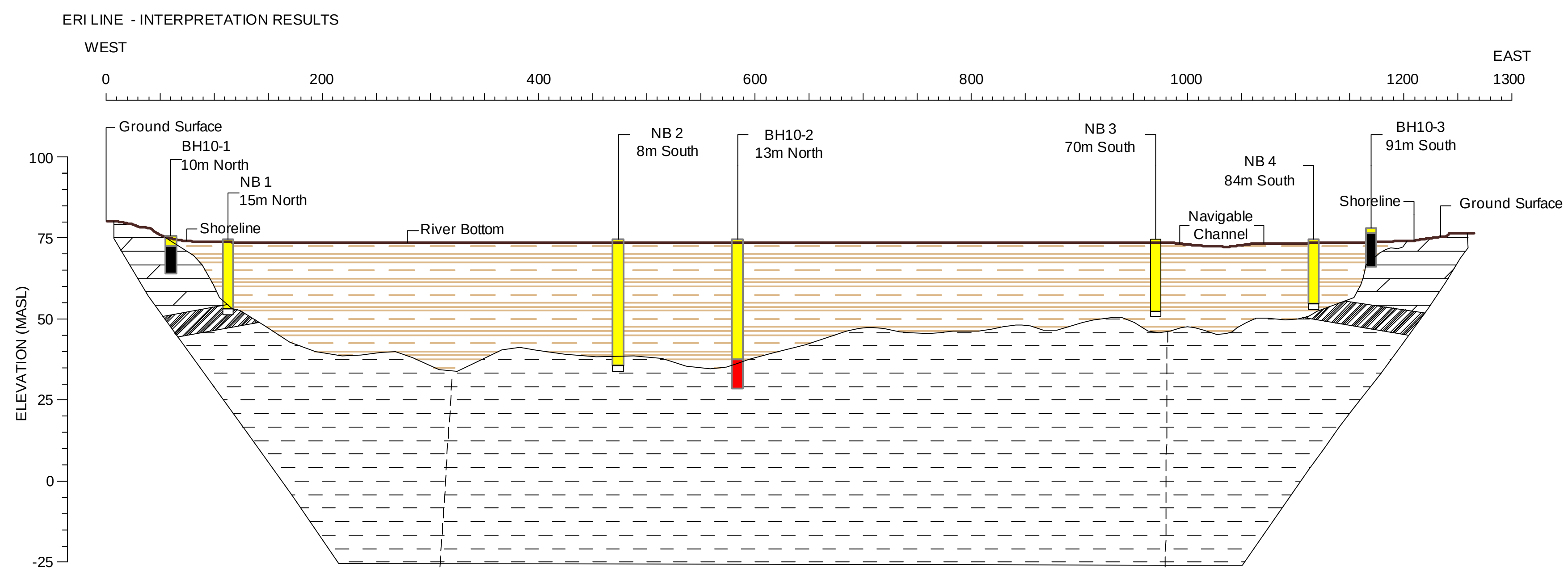
3. *Silty Clay*: The organic soils are underlain by a deposit of silty clay, which thickens away from the riverbanks toward the centre of the river. The silty clay was not encountered at Borehole 10-3 (east bank). The silty clay extends to depths ranging from about 3 m at Borehole 10-1 (west bank) to about 39 m at Borehole NB2 (near mid-river from the 1992 TSH study). The surface of the silty clay deposit within the river was generally encountered at elevations ranging from about 71.1 m to 72.6 m, with the exception of Borehole NB2, where the surface of the silty clay was encountered at elevation 66.8 m, due to the thicker organic soils present. At the west bank, the silty clay is about 0.8 m thick and its surface is at elevation 73.4 m.

   The upper 4 m to 6 m of the silty clay deposit is grey-brown in colour and shows signs of weathering. The measured SPT 'N' values in this portion of the deposit were between 2 and 16 blows per 0.3 m of penetration and these results indicate that this upper silty clay layer has a firm to very stiff consistency. The silty clay below the depth of weathering is grey in colour. The in situ vane testing resulted in undrained shear strengths ranging from about 40 kilopascals (kPa) to 95 kPa. However, uncharacteristically low unconfined compression and undrained strength values of 20 and 25 kilopascals were reported in Boreholes NB2 and NB3 (near mid-river and the east shore from the 1992 TSH study), located at elevations between 60 m and 63 m, respectively.





MODEL APPARENT RESISTIVITY (OHM-M)



LEGEND BOREHOLES

- Fill + Silty Clay
- Limestone Bedrock
- Precambrian Bedrock
- Probable Bedrock

LEGEND SECTIONS

- Silty Clay
- Limestone Bedrock
- Shale Bedrock
- Precambrian Bedrock
- Potential faulting zones within the bedrock

NOTES

1. This Figure is to be analyzed in conjunction with the accompanying report.
2. ERI section generated using the Res2D Software Package.
3. Elevations of the ERI lines presented based on GPS data provided by Richards & Associates Ltd.
4. Borehole data provided by Golder Associates Ltd..

100 0 100 200
SCALE 1:5000 METRES

VERTICAL EXAGGERATION = 3X

PROJECT:
CATARAQUI RIVER THIRD CROSSING
EA - STAGE 2
ENVIRONMENTAL STUDY REPORT

DRAWING:
ELECTRICAL RESISTIVITY
IMAGING SURVEY RESULTS

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS
J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:
DRAWN:
CHECKED:
PLOTTED: 1-Feb-12

DRAWING NO.: 4-14
JLR NO: 23446-02

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4. *Glacial Till*: The topsoil at Borehole 10-3 (east bank) and the native clay deposit at Boreholes NB3 and NB4 (near the east shore from the 1992 TSH study) are underlain by glacial till. At Borehole 10-3, the glacial till layer was encountered at a shallow depth and was fully penetrated to a depth of 1.7 m. At Boreholes NB3 and NB4, the glacial till layer (about 0.6 m and 1.7 m thick, respectively) was encountered at a greater depth.

   The glacial till is considered to be a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of sandy silt or silty sand. Only limited standard penetration testing was possible in the till deposit due to the presence of cobbles and boulders. The SPT 'N' values obtained from the limited testing possible ranged from 38 to greater than 50 blows per 0.3 m indicating a dense state of packing. The higher blow counts likely reflect the presence of the cobbles and boulders in the deposit.

5. *Refusal*: Practical refusal to augering by bedrock was encountered at all the Boreholes, the details of which are shown in Table 4.12 below.

Table 4.12
Practical Refusal to Borehole Augering at the Project Site Location

Borehole Number	Ground / Water Surface Elevation (m)	Depth to Auger Refusal (m)	Auger Refusal Surface Elevation (m)
10-1 (West Bank)	75.7	3.1	72.6
NB1 (Near West Shore)	74.6	21.3	53.3
NB2 (Near Mid-River)	74.6	38.8	35.8
10-2 (Mid-River)	74.6	37.1	37.5
NB3 (Near East Shore)	74.6	22.1	52.5
NB4 (Near East Shore)	74.6	19.8	54.8
10-3 (East Bank)	78.1	1.7	76.4

6. *Bedrock*: As noted earlier, bedrock underlies the glacial till along the riverbanks and underlies the silty clay deposit within the river. Bedrock was proven in Boreholes 10-1 (west bank), 10-2 (mid-river) and 10-3 (east bank). The bedrock consists of limestone at both riverbanks and Gabbro bedrock of the Precambrian Formation within the river.

   The general weathering of the bedrock is slightly weathered to fresh at Boreholes 10-1 and 10-3 and entirely fresh at Borehole 10-2. In Borehole 10-1, the Rock Quality Designation (RQD) values range from 70 percent to 100 percent (generally increasing with depth), indicating a good to excellent quality rock. In Borehole 10-2, the RQD values range from 80 percent to 95 percent, indicating a very good to excellent quality rock. In Borehole 10-3, the upper 1 m of bedrock has a RQD value of zero percent, indicating high weathering. Below this weathered zone, the RQD values increase with depth, ranging from 80 percent to 100 percent, indicating a very good to excellent quality rock. The discontinuities observed in the rock core are typically sub-horizontal to sub-vertical.

   The unconfined compressive strengths range from 39 Megapascals (MPa) to 183 MPa within the limestone bedrock cores at Boreholes 10-1 and 10-3. This indicates a medium strong to very strong rock quality. The results of the point load index testing on the limestone cores gave $Is_{(50)}$ values ranging from 1.7 MPa to 3.8 MPa (40 MPa to 91 MPa unconfined compression). The unconfined compressive strengths range from 65 MPa to 373 MPa within the Gabbro bedrock core at Borehole 10-2. This indicates a medium strong to extremely strong rock quality. The results of the point load index testing on the Gabbro core gave $Is_{(50)}$ values ranging from 11.7 MPa to 12.3 MPa (280 MPa to 295 MPa unconfined compression).

7. *Groundwater Conditions*: Standpipes were installed in Boreholes 10-1 (west bank) and 10-3 (east bank) and sealed within the bedrock. The water levels measured in the standpipes are generally near the river water level and are summarized in Table 4.13 below.

Table 4.13
Groundwater Conditions at the Project Site Location

Borehole Number	Date	Depth Below Existing Ground Surface (m)	Geodetic Elevation (m)
10-1 (West Bank)	August 16, 2010	0.63	75.09
10-3 (East Bank)	August 16, 2010	3.08	75.06

   Note the water elevation in the river was not measured at the time of the Stage 2 fieldwork drilling but it is documented at 74.6 m in the borehole logs appended to the 1992 TSH study. It should be expected that the groundwater levels will fluctuate seasonally.

4.1.9 Hydrotechnical Conditions

This section of the Report discusses the hydrotechnical fieldwork undertaken at the project site location. It is divided into the following two sub-sections:

1. The fieldwork methodology.

2. The fieldwork findings.

.1 Fieldwork Methodology

A technical review and analysis of environmental variables which are relevant to the conditions at the project site location was completed. This included considerations for hydrologic inputs (flows), water levels, winds and ice.

The project site location is not typical of a flow-governed watercourse. The cross section of the river at the project site location is shallow, wide and slow-moving. As a result, the magnitude of the flow becomes significantly less important in defining the conditions within the channel. The broad and shallow cross section is influenced significantly by local wind conditions. Water levels within the channel are primarily defined by the water levels in Lake Ontario. Given the complex relationship between the various environmental variables at the project site location, and the limited flow data available, a rigorous multi-variate statistical analysis has not been possible. The heavily regulated state of the Rideau Canal for navigation purposes further complicates the hydrologic variables. Therefore, it has been assumed that extreme flows may be coincident with design wind conditions. It has also been assumed that the design wind conditions may be coincident with extreme water level fluctuations in Lake Ontario.

.2 Fieldwork Findings

The alignment of the Cataraqui River is generally along a SSW / NNE axis. The project site location is at a section of the Cataraqui River that is approximately 1 km wide. The watercourse is relatively shallow over the majority of this cross section, with the exception of the Rideau Canal's navigation channel. Depths at normal water levels typically range from about 1.5 m over the majority of the cross section to roughly 4.5 m in the channel.

Wind stress is considered to be an important factor in generating flow velocities and potential water level setup within the watercourse. 1987 to 2007 wind data from the Kingston Airport was analyzed to assess typical wind direction, magnitude and persistence. Most of the winds are from the southwesterly quadrants. The largest contributions are from due south and due west, caused mainly by the effects of Lake Ontario. Table 4.14, which shows probable hourly wind speeds aggregated annually, suggests that high winds can be experienced from any direction, in that 100 year wind speeds are roughly 20 m/s (or 72 km/hr) from either the south or north.

Table 4.14
Extreme Winds By Direction at Kingston Airport [m/s (km/hr)]

Years	North	Northeast	East	Southeast	South	Southwest	West	Northwest
2	12.6 (45.3)	11.2 (40.2)	9.8 (35.3)	11.0 (39.7)	15.3 (55.0)	15.4 (55.5)	15.6 (56.0)	11.3 (40.8)
5	14.2 (51.2)	12.1 (43.6)	10.9 (39.2)	12.6 (45.5)	16.4 (59.2)	17.2 (61.8)	17.3 (62.4)	12.5 (45.0)
10	15.5 (56.0)	12.8 (46.2)	11.7 (42.2)	13.9 (49.9)	17.3 (62.3)	18.5 (66.5)	18.7 (67.2)	13.4 (48.2)
25	17.4 (62.6)	13.8 (49.6)	12.8 (46.2)	15.4 (55.6)	18.4 (66.1)	20.2 (72.7)	20.4 (73.5)	14.6 (52.4)
50	18.8 (67.8)	14.5 (52.2)	13.7 (49.2)	16.7 (60.0)	19.1 (68.9)	21.0 (77.5)	21.8 (78.3)	15.4 (55.6)
100	20.3 (73.2)	15.2 (54.8)	14.5 (52.1)	17.9 (64.4)	19.9 (71.6)	22.8 (82.2)	23.1 (83.1)	16.3 (58.8)

Flows in the Cataraqui River are heavily regulated for navigation and power generation purposes. While no detailed flow data is available for the reach, its physical characteristics are such that it is in effect a lake-like setting. Thus, flows are not considered critical to the assessment of bridge performance. A flow of 50 m^3/s is reported by Parks Canada to be a significant freshet flow. But this would not generate significant velocities or water levels within the reach due to the cross sectional area of the watercourse at the project site location, which is estimated to be 775 SM at the low water datum of 74.2 m elevation.

Existing condition modeling suggests flow velocities at the project site location range from negligible up to approximately 0.4 m/s in either the upstream or downstream directions. The flow velocity is varied across the section, with the higher velocities focused towards the mid-channel area, just west of the Rideau Canal's navigable channel. Lower velocities are typically found along the western side of the Cataraqui River where the channel is broad and relatively shallow. Under low flow conditions and southerly winds, the analysis shows reversed flows within portions of the channel, with circulation cells generated upstream and downstream of Belle Island.

Due to the effect of Lake Ontario water levels at the site, design high water levels are to be expected during the late spring and early summer months, and are therefore typically associated with ice-free conditions. It is noted however, that lake ice can persist in the Kingston region into April. Characteristic water level conditions relevant to the project site location are summarized below in Table 4.15. These water levels are referenced to the Geodetic Survey of Canada (GSC).

Table 4.15
Water Levels at the Project Site Location

Condition	Water Surface Elevation
Low Water Datum (LWD)	74.16 m
Average High Water (AHW)	75.26 m
100 Year Lake Ontario Water Level	75.99 m
CRCA Regulatory Water Level	76.30 m

The CRCA Regulatory Water Level of 76.3 m is the Regulatory Limit (or 'design high water level') for the project site location, which is based on the Lake Ontario water level and includes an allowance for wave action. The CHBDC requires the bridge deck to have a minimum 1 m vertical clearance above the design high water level.

In addition, ice cover on the river is variable from year to year, depending largely on climate conditions. A review of the historic ice cover charts from the Canadian Ice Service for the 1989-90 through to the 2010-11 seasons indicate that:

1. Ice cover is not typically established until mid to late December, with ice-free conditions possibly delayed as late as April 25. This would appear to indicate that thick lake ice is not generally established until early February, but can last until April.
2. The analysis of annual measured extremes would suggest that the ice is 0.84 m thick and has a strength of 1100 kilopascals (kPa) under dynamic ice (or 100 year) conditions.
3. The ice generally melts in place due to the limited flow-generated velocities.

Given these observations, ice cover design water levels have also been estimated for the purposes of preliminary design, as shown below in Table 4.16.

Table 4.16
Ice Cover Water Levels at the Project Site Location (December to April)

Condition	Water Surface Elevation
Long Term Average (Static Ice)	74.49 m to 74.84 m
Historic Extremes (Static Ice)	73.70 m to 75.61 m
100 Year Extremes (Dynamic Ice)	73.65 m to 75.86 m
Winter Surge Conditions	-0.25 m to +0.47 m

4.1.10 Noise Impact Considerations

As discussed earlier, the project must satisfy both the Provincial and Federal EA frameworks. This also includes Provincial and Federal transportation noise guidelines.

The Provincial 'Joint Protocol' (1986) from the MTO and OMOE provides guidelines on assessing municipal road traffic noise impacts. The importance of changes from a noise impact perspective is based on the objective level and change from existing conditions. Cumulative sound levels are assessed based on a projected ten-year horizon. Noise mitigation is warranted when increases in sound level over the 'no-build' ambient is 5 dBA or greater at Noise Sensitive Areas (NSAs)[31]. Mitigation measures can include noise barriers, noise reducing asphalts and changes in the project's vertical profile and/or horizontal alignment. Such measures, where applied, must be economically and technically feasible and must provide a noise reduction of at least 5 dB, averaged over the first row of noise-sensitive receivers. The measures are restricted to within the road right-of-way. Off right-of-way noise mitigation, such as window upgrades and air conditioning, is not considered. The Joint Protocol also sets out an outdoor objective sound level of 55 dBA, or the existing ambient, whichever is higher. Mitigation should be applied to achieve the no-build ambient where feasible, or alternately as close to the Provincial objective of 55 dBA as possible.

[31] NSAs include the following land uses, provided they have an Outdoor Living Area (OLA) associated with them: i) private homes; ii) multiple unit buildings such as apartments; iii) hospitals and nursing homes for the aged; iv) schools, educational facilities and day care centres; v) churches and places of worship; vi) campgrounds; vii) hotels and motels; and viii) vacant land that has been zoned to accommodate future development.

Health Canada's active interest in environmental noise reflects its RA role under the Federal CEAA. Noise sensitive receptors in its 'Fact Sheet for Noise Issues' (2005) include residential land uses, hospitals, schools, daycares, seniors residences and sites where First Nations cultural/religious activities take place. Commercial and industrial land uses as well as churches and/or non-First Nations places of worship are not included. Health Canada's assessment involves calculating changes in 'percent highly annoyed' using the ISO 1996-1:2003(E) international standard. For operational noise, Health Canada suggests that an increase in percent highly annoyed of 6.5 percent or higher, or an L_{dn} value exceeding 75 dBA, may constitute a significant noise impact. Note however, that these guidelines are still in draft form. Health Canada uses Daytime L_{eq} (15 h), night-time L_{eq} (9 h) and L_{dn} sound exposures for its own noise impact assessments.

4.2 Alternative Designs

A design work plan was prepared by the project team during Stage 2 of this EA study. It served as an iterative guide in the development of the alternative bridge designs and the ultimate selection of a preferred bridge design. The work plan was initially presented at a meeting with City and Parks Canada staff on September 16, 2010. This meeting involved a boat tour of the EA study area and discussions on various EA study topics, including preliminary bridge design and viewscape considerations. The design work plan and the tasks associated with it, were reviewed, vetted and updated accordingly during subsequent TAC and PLC meetings.

The design work plan involved the following four major steps:

1. The 'Look and Listen' step, which involved:
    a) Reviewing the background survey information from Stage 1 of this EA study;
    b) Undertaking and reviewing the Stage 2 fieldwork discussed above;
    c) Identifying the key views and viewsheds;
    d) Preparing bridge design objectives and guidelines; and
    e) Developing a catalogue of bridges.
2. The 'Alternative Bridge Designs' step, which used the information from the 'Look and Listen' step to:
    a) Develop three alternative bridge designs;
    b) Introduce in-water bridge construction options; and
    c) Confirm whether any utility distribution improvement works could (or should) be incorporated into the bridge designs.
3. The 'Refinement of the Alternative Bridge Designs' step, which assessed the three alternative bridge designs.
4. The 'Selection of a Preferred Design' step, which selected a preferred bridge design for a further detailed assessment.

4.2.1 Look and Listen

The 'Look and Listen' step was critical as it set the foundation for the subsequent preparation of the alternative bridge designs. It involved three main sub-tasks, namely: i) the establishment of key views and viewsheds; ii) the identification of bridge design objectives and guidelines; and iii) the preparation of a catalogue of bridges. These sub-tasks are discussed further below.

.1 Key Views and Viewsheds

The limits of the key views and viewsheds at the project site location and surrounding area are shown on Drawing 4.15 and are defined further by:

1. Highway 401 to the north.
2. Craftsman Boulevard and the northern portion of Belle Island / Belle Park Fairways up to John Counter Place (immediately west of the John Counter Boulevard – Montreal Street intersection) to the south.
3. The tree line and first row of houses to the east.
4. The CNR line and tree line to the west.

N

Lake Ontario

PROJECT:	DRAWING:			DRAWING NO.:
CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	PROJECT SITE LOCATION VIEWSHED	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS J.L. Richards & Associates Limited 203-863 Princess Street Kingston, ON Canada K7L 5N4 Tel: 613 544 1424 Fax: 613 544 5679	DESIGN: DRAWN: CHECKED: PLOTTED: 26-Jan-12	4-15 JLR NO: 23446-02

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 3-19 3-20 3-22 4-15 PS-2 PS-3.dwg

The key views and viewsheds were established in response to two related factors. The first regards the landscape conditions at the project site location, which as stated earlier, are part of a transition point between the natural landscape of the Cataraqui River to the north up to Highway 401 and the City's urban landscape which starts to emerge at the project site location just north of the Inner Harbour entrance near Belle Island. To reiterate, at this location, full views are evident of the Elliott Avenue Parkette, Village On The River apartments and the River Park subdivision to the west as well as the Rideau Marina and Point St. Mark residential neighbourhood to the east. With Belle Island and Belle Park in mind, the second factor relates to a design consideration that informed the evaluation and selection of a bridge at the project site location as the preferred solution during Stage 1 of this EA study. If the bridge profile was low to the water from west-to-east and then gradually rose above the Rideau Canal's navigable channel, the silhouette of the bridge, in conjunction with the backdrop of Belle Island and Belle Park to the south, would be below the tree line when viewed from the north. Similarly, when viewed from the west, the rising silhouette of the bridge could either be at or below the tree line on the east side lands and, from the south, by the natural landscape that emerges in the background further north of the project site location to Highway 401. This could then help mitigate the visual impacts of the bridge on the surrounding landscape. As such, the key views and viewsheds were based on the bridge height above water being roughly 3 m starting at the west end and then gradually rising to 10 m over the canal's navigable channel to tie into existing elevations and topographic features at the east end.

.2 Bridge Design Objectives and Guidelines

The bridge design objectives built on the 'Mission Statement, Vision and Guiding Principles' that were prepared at the outset of Stage 1 of this EA study. The objectives are outlined in Table 4.17 below.

Table 4.17
Bridge Design Objectives

A.	**Vision**	1.	Through innovative planning, design, and consultation, the bridge will display community leadership that reinforces the City's proud historic association with the Rideau Canal and its goal of becoming Canada's most sustainable City.
B.	**Guiding Design Objectives**		
B.1	Cultural and Natural Heritage Integrity	1.	Complement the heritage values of the Rideau Canal as a UNESCO World Heritage Site, National Historic Site of Canada and Canadian Heritage River.
		2.	Respect the customs and traditions integral to the distinctive cultures of First Nations communities.
		3.	Respect the history of engineering innovation with the Rideau Canal within a 21st Century design context.
		4.	Enhance the natural landscape of the corridor shore lands.
		5.	Ensure that impacts on Species at Risk are minimized and that there is no net loss of fish habitat and no net loss of wetland structure and function.
B.2	Healthy Community	1.	Provide safe, cost-effective (in terms of capital, maintenance and lifecycle costs), convenient and accessible pedestrian, cycling, public transit and automotive circulation and connections.
		2.	Ensure through-navigation as a valued means by which to promote public understanding, appreciation and enjoyment of the Rideau Canal and Kingston's unique heritage and cultural character.

Table 4.17
Bridge Design Objectives

B.2 Healthy Community	3. Achieve a design that is appropriate to and compatible with adjacent land uses, the immediate natural setting and the broader Belle Island and Rideau Canal contexts. 4. Provide functional and attractive lighting for motorists, public realms and bridge accentuation and which also mitigates light impacts on the immediate natural environment. 5. Enhance day and night views towards the bridge by river users, non-motorists and motorists and maximize day and night viewing opportunities to the setting from the bridge for non-motorists and motorists. 6. Maximize opportunities for bridge users to learn about the Rideau Canal, Belle Island and the Greater Cataraqui Marsh through such means as interpretive signage and public art.

Parks Canada also prepared bridge design guidelines. The guidelines supplemented the bridge design objectives and further articulated the aforementioned heritage values of the lower Cataraqui section of the Rideau Canal that Parks Canada prepared in 2010. The essence of the bridge design guidelines are as follows:

1. The Rideau Canal warrants a world-class bridge design that:
   a) Respects the natural and cultural heritage values of this part of the canal as well as First Nations customs and traditions;
   b) Is appropriate to and compatible with its natural setting, adjacent land uses and the Belle Island context;
   c) Responds to the canal's history of engineering innovation and bridge design, but is an expression of its own time; and
   d) Supports a safe, enjoyable and memorable experience for bridge and canal users.
2. Aesthetically, the bridge should respond to the significance of the Rideau Canal by achieving a landmark quality that is aesthetically pleasing and not just a typical highway bridge. In more particular terms, it should:
   a) Be an honest expression of its function;
   b) Have a simple, economical form;
   c) Be in scale with and compatible with its surroundings;
   d) Minimize visual impact by maximizing transparency and lightness;
   e) Use order, symmetry and rhythm to create harmony and visual balance;
   f) Provide contrast and complexity through surface textures, colour and the play of light and shadow;
   g) Use high-quality, durable and compatible materials;
   h) Consider opportunities to introduce local stone and wood, particularly limestone; and
   i) Achieve timelessness through regular maintenance and by avoiding extremes of fashion or overt historicist references.
3. Key views should be taken into consideration, including:
   a) Views to the bridge from the Rideau Canal's navigable channel and from north and south;
   b) Views to the Cataraqui Marsh and the slopes of the river valley from the canal's navigable channel; and
   c) Views from the bridge to the canal's navigable channel, the Cataraqui Marsh, the slopes of the river valley, Belle Island, the northern entrance to the Inner Harbour and the Kingston skyline.
4. The bridge design should take advantage of interpretive opportunities and new views of the Cataraqui Marsh and the northerly portion of the Rideau Canal's navigable channel using signage, public art, viewing nodes and interpretive media along the bridge to educate and enhance the visitor experience.

5. The bridge design should maximize viewing opportunities from the bridge, including:

   a) Providing lookout vantage points or nodes along the bridge deck with seating, interpretive signage and public art;

   b) Providing minimum height barriers and open railings; and

   c) Investigating the possibility of providing interpretation for boaters passing under the bridge.

6. The bridge design should enhance the pedestrian experience of the bridge by:

   a) Providing continuous open railings to optimize views;

   b) Using custom design to provide distinctive enhanced visual effects;

   c) Enhancing barrier-free design by providing lower inner barriers, custom-designed railings and innovative barrier wall terminations;

   d) Providing functional, high-quality and well-designed diffuse lighting that is simple and subtle; and

   e) Ensuring that signage is well-integrated and planned with no overhead signs, both on the bridge and its approaches.

.3 Catalogue of Bridges

The catalogue of bridges is shown on Drawings 4.16 to 4.17. Its purpose was to help narrow down the list of possible bridge types and options in order to engage the alternative bridge design work. As these Drawings illustrate, the catalogue focused on optimum span alternatives and signature structures. The main bridge design elements from the catalogue include:

1. For structural reasons, the girder depth must increase as the spans increase. With this in mind, having less piers means that the girder depth would have to increase, leading to a 'bulkier' visual bridge effect. On the other hand, having a more slender girder means that more piers are needed, which could lead to an on-water 'wall' visual bridge effect. Thus, a basic bridge design rule is to achieve appropriate span-length-to-girder-depth proportions.

2. The use of box girder piers provides a slender look but can have the visual effect of a 'wall' noted above, depending on the shore-to-shore crossing distance and the number of in-water piers.

3. The use of v-shaped piers allows for an open viewscape and provides two structural supports for the bridge girders but only one in-river foundation for each pier, thereby reducing associated in-water disturbances and capital costs.

4. The open spandrel arch allows for repetitive geometric design and cost-effective structural fabrication as well as an open viewscape. The use of a half-arch at the abutments on either shore can also accommodate public walkways and observation areas along the waterway.

5. Arch spans use arch-like piers from which all or part of the bridge deck is supported by cables/trusses. This can provide a slender look and open viewscape and can also be used to augment or highlight a specific feature.

6. Cable stayed and suspension bridges are signature structures, in that they are more prominent and visible because their elements tend to be larger, taller and/or higher above the water. These bridges require fewer piers than the other bridge types but they have a significant visual impact on the landscape due to the required height of the cable stayed / suspension towers from which cables connect to and support the bridge deck. Given their use of prominent tower and cable infrastructure, these bridges require major capital investments and cannot be easily widened in the future.

   Based on the above, the cable stayed / suspension bridge option was deemed a non-viable design alternative at the project site location, given that:

   a) As shown on Drawing 4.18, the cable stayed / suspension towers would have significant visual impacts as they would have to be in the range of 250 m high to support a shore-to-shore crossing distance of roughly 1,150 m;

   b) A major capital investment in the order of $0.5 billion would be required; and

   c) The bridge could not be easily widened in the future.

Girder Pier

The Girder Pier option can provide a slender look but also an on-water 'wall' visual effect, depending on the shore-to-shore crossing distance and the number of in-water piers

Susquehanna River Bridge, PA

Mid-Bay Bridge, FL

Victory Bridge, NJ

Clearwater Bridge, FL

V-Shaped Pier

The V-Shaped Pier option provides 2 structural supports for the bridge deck but only 1 in-water foundation for each pier. This can reduce the number of piers required and allow for a more open viewscape.

Woodrow Wilson Bridge, DC

Trinity River Bridge, TX

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-16 & 4-17 Bridge Catalogue.dwg

PROJECT:
CATARAQUI RIVER THIRD CROSSING
EA - STAGE 2
ENVIRONMENTAL STUDY REPORT

DRAWING:
BRIDGE CATALOGUE: GIRDER PIER AND V-SHAPED PIER BRIDGES

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:
DRAWN:
CHECKED:
PLOTTED: 25-Jan-12

DRAWING NO.: **4-16**

JLR NO: 23446-02

Arch Span

The Arch Span option uses curved arch-like piers from which all or part of the bridge deck is supported via cables/trusses. Arch spans can provide a slender look and open viewscape and can also be used to highlight a specific feature.

President Juscelino Kubitschek Bridge, Brasilia

Lake Champlain Bridge, NY

Cable Stayed

The Cable Stayed option is made up of 1 or more tall towers (175 metres high in the picture) from which cables connect to/support the bridge deck. Less piers are needed but the bridge has a major visual impact, high capital/maintenance costs and cannot be easily widened. This is considered a 'signature' structure.

New Cooper River Bridge, SC

The Bandra-Worli Seak Link, India

Suspension Span

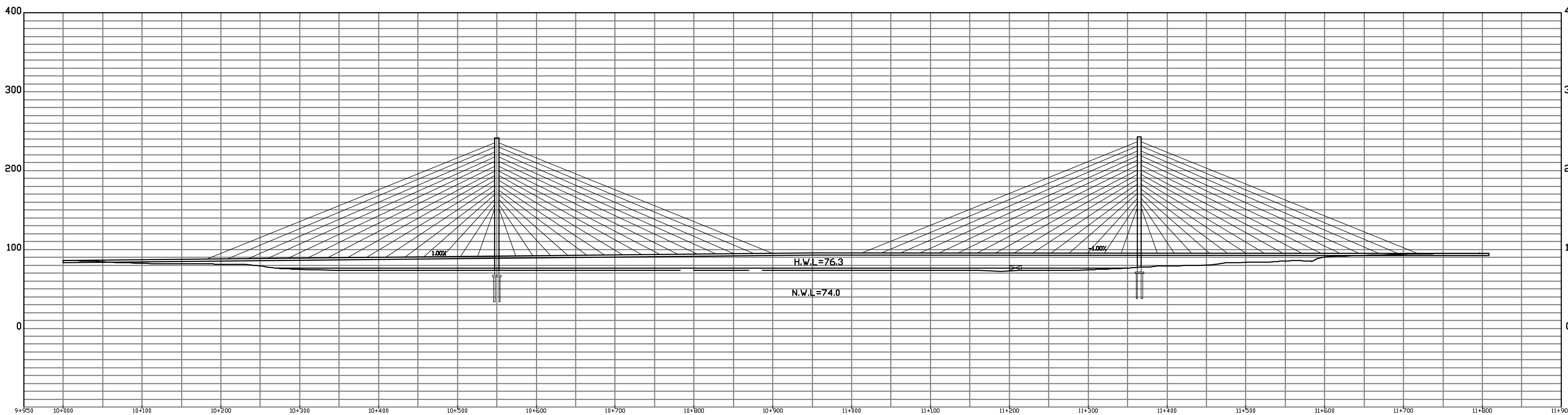
The Suspension Span option is made up of suspension cables between 2 or more tall towers (more than 200 metres high in the pictures) from which vertical cables connect to/support the bridge deck. Similar to the Cable stayed option, less piers are needed but the bridge has a major visual impact, high capital.maintenance costs and cannot be easily widened. This is also considered a 'signature' structure.

Dunvegan Suspension Bridge, AB

Golden Gate Bridge, CA

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-16 & 4-17 Bridge Catalogue.dwg

PROJECT:	DRAWING:				DRAWING NO.:
CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	BRIDGE CATALOGUE: ARCH SPAN, CABLE STAYED AND SUSPENSION BRIDGES	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS	J.L. Richards & Associates Limited 203-863 Princess Street Kingston, ON Canada K7L 5N4 Tel: 613 544 1424 Fax: 613 544 5679	DESIGN:	4-17
				DRAWN:	
				CHECKED:	JLR NO: 23446-02
				PLOTTED: 31-Jan-12	



File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-18 Cable Stayed Alignment.dwg

PROJECT:

CATARAQUI RIVER THIRD CROSSING
EA - STAGE 2
ENVIRONMENTAL STUDY REPORT

DRAWING:

CABLE STAYED ALIGNMENT

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:
DRAWN:
CHECKED:
PLOTTED: 31-Jan-12

DRAWING NO.: **4-18**

JLR NO: 23446-02

4.2.2 Alternative Bridge Designs

.1 Bridge Concepts

The next step in the iterative design work plan was to develop three alternative bridge designs. The main components and structures common to each alternative are highlighted below:

1. The shore-to-shore crossing distance at the project site location is roughly 1,150 m.

2. As shown on Drawing 4.19, the bridge alignment is a constant gradual s-curve that lands north of the Point St. Mark residential neighbourhood.

3. As noted earlier, the CHBDC requires the bridge deck to have a minimum 1 m vertical clearance above the design high water level, which is at 76.3 m elevation at the project site location. The bridge clearance above the water is as follows:

   a) It is 3 m along most of its westerly portion (or at 78.8 m elevation) to accommodate existing topographic conditions on the west shore and then gradually rises to 14 m over the Rideau Canal's navigable channel (or at 90 m elevation) near the east shore and adjacent rowing lanes; and

   c) It then descends to 12 m (or at 88 m elevation) at the east shore to tie into existing elevations and topographic features.

4. The first off-shore bridge pier would be located over 30 m from either shoreline.

5. As shown on Drawing 4.19, a 22.9 m wide bridge deck is ultimately proposed (for a total shore-to-shore bridge deck area of roughly 26,500 SM based on a crossing distance of 1,150 m) that is comprised of the following:

   a) A four-lane vehicular roadway (two 3.5 m wide lanes for westbound travel and two 3.5 m wide lanes for eastbound travel) with a 1.8 m wide median;

   b) A 3.6 m wide multi-use trail provided on the south side of the bridge for active transportation;

   c) A 1.5 m wide commuter cycling lane provided on both sides of the bridge; and

   d) A 0.5 m wide area for a barrier separating the multi-use trail and commuter cycling lane on the south side of the bridge.

   A series of observation look-out/interpretive areas (or 'Belvederes') are also provided along the south side of the bridge.

   As also shown on Drawing 4.19, it is recognized, based on the Stage 2 capacity analysis discussed earlier, that an initial bridge configuration could be a three lane, centre lane reversible, cross section with a four-lane bridge substructure. Under this scenario, one westbound lane and two eastbound lanes of vehicular traffic would operate in the AM peak hour and vice-versa in the PM peak hour. The three vehicular lanes along with the two commuter cycling lanes and multi-use trail could be accommodated on a 17.6 m wide bridge deck. It has been determined that this bridge configuration could operate from opening day up to approximately 2029, subject to interim monitoring of traffic volumes and other related conditions by the City. When or if ultimately required, the bridge deck could then be widened equally on both sides by 2.65 m, while maintaining the original foundation structure of the bridge, to ultimately achieve the required 22.9 m width to accommodate the four-lane vehicular roadway, commuter cycling lanes and multi-use trail described above[32].

6. Drawing 4.20 shows an example of barrier, railing and lighting details on the bridge, which serve to address public and traffic safety requirements and accentuate public realm and bridge features.

7. It is anticipated that the bridge would take up to three years to build. As noted earlier, the CHBDC requires a design life for new bridges of at least 75 years. New bridges having similar shore-to-shore characteristics to those within the project site location typically have a design life of at least 100 years.

8. In regards to the landscape improvements for the east and west side lands:

   a) The use of native plant materials reflective of the Deciduous Forest Region Species Association are envisioned to provide landscape variety and hardiness;

   b) Bridge abutments and retaining walls are conceptualized as large limestone 'cap rock' blocks in reference to both the Rideau Canal lock walls and the City's heritage buildings;

   c) The intent of the observation look-out/interpretive areas is to:

      i. bring attention to the waterfront trail system at an appropriate scale with the bridge and gateway elements;

[32] Note Drawing 4.19 does not show a two-lane bridge with a substructure to accommodate its widening to four lanes in the future, given that the 2030 to 2034 trigger for a four-lane bridge would impact its viability. The reason for this is that there would be a diminishing return on the initial capital investment, as the need for bridge twinning (with the two-lane bridge scenario) or widening (with the two-lane bridge-four-lane-substructure scenario) could be triggered shortly after the two-lane bridge would be built. However, neither scenario should be ruled out completely at this time. The future monitoring of traffic conditions by the City, particularly if the aforementioned improvements to the LaSalle Causeway-Highway 2 corridor are implemented, could confirm the viability of either scenario or even delay the timeline for engaging the Project Implementation Phase of the Class EA process for the bridge itself.

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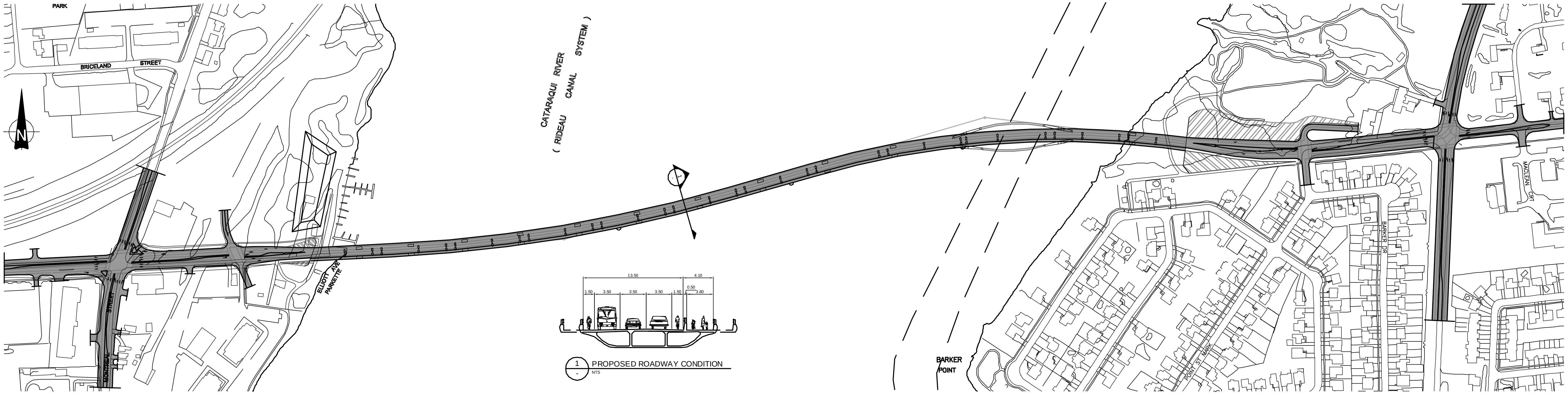
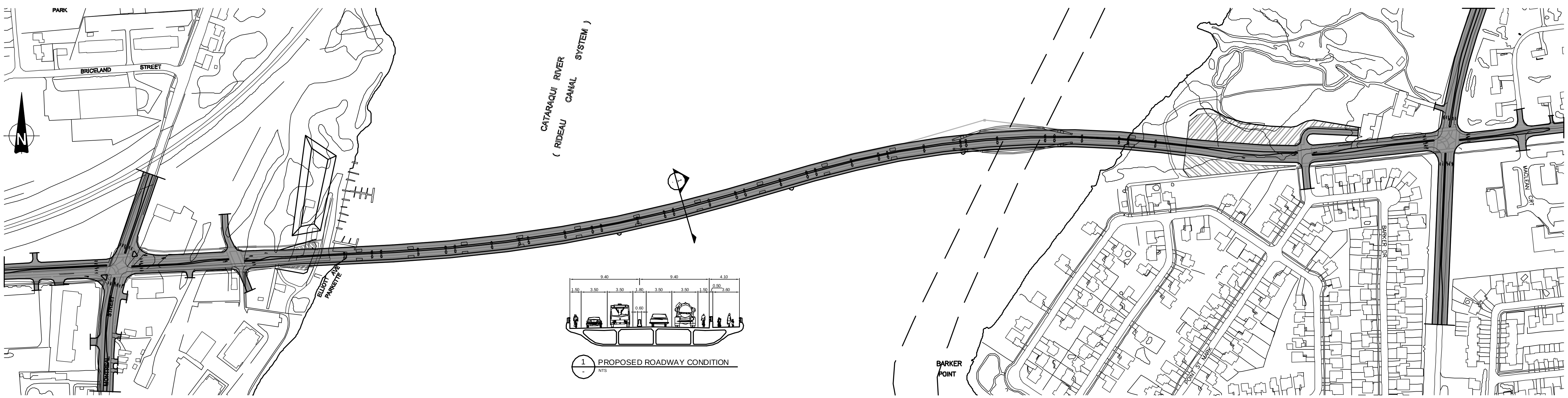


A: 3-LANE BRIDGE DECK STAGING OPTION



B: 4-LANE BRIDGE DECK

PROJECT:
CATARAQUI RIVER THIRD CROSSING
EA - STAGE 2
ENVIRONMENTAL STUDY REPORT

DRAWING:
BRIDGE ALIGNMENT AND
DECK CONFIGURATIONS
(3-LANE AND 4-LANE OPTIONS)

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS
J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:
DRAWN:
CHECKED:
PLOTTED: 25-Jan-12

DRAWING NO.: 4-19
JLR NO: 23446-02

PROJECT: CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	DRAWING: BRIDGE BARRIER AND LIGHTING DETAIL EXAMPLE (NEW RICH STREET BRIDGE)

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:	DRAWING NO.: 4-20
DRAWN:	
CHECKED:	JLR NO: 23446-02
PLOTTED: 25-Jan-12	

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-20 Bridge Barrier.dwg

ii. provide a natural destination, resting place or rendezvous; and

iii. accentuate the public realm by accommodating:

(a) interpretive signs or plaques about the Rideau Canal, Belle Island and the marsh as well as public art installations;

(b) overhead pergolas and trellises that include mounted light sources and use materials that reflect the Rideau Canal lock station elements such as large timber and black coloured steel or cast iron; and

(c) site furniture such as benches, waste receptacles and bike racks that also use materials that reflect the Rideau Canal lock station elements such as wood and black metal;

d) The gateway elements are intended to clearly demark the junction of bridge structure to land and impart an iconic character by being contemporary in form and by using materials and proportions that reference the cultural landscape without overt imitation of heritage architecture; and

e) The purpose of the active travel and commuter cycling provisions is to connect with existing non-automotive networks on both sides of the Cataraqui River.

9. In regards to stormwater management provisions:

a) Stormwater quantity control is not required for the water falling on the bridge over the Cataraqui River, as 100 percent of that water would have reached the river under pre-development conditions;

b) Stormwater quantity control is required for the water falling on the approaches to ensure that post-development peak flow rates are not greater than pre-development conditions;

c) Stormwater generated by the bridge is to be released to the Cataraqui River using existing stormwater outlets;

d) All stormwater released to the Cataraqui River is to meet the ‘enhanced’ level of treatment guideline used by OMOE and the CRCA; and

e) Alternative eco-friendly de-icing chemicals would be required on the bridge, as road salt cannot be effectively removed from stormwater once it is in solution.

The stormwater management infrastructure for the approaches to the bridge would be identical to those for a typical road development. Catchbasins along the curb lines would collect the stormwater which would then be piped to a stormwater management facility (either above grade or underground) on-land, where the release rate of the water would be limited to pre-development conditions. Treatment of the water could be achieved using a variety of permanent infrastructure (vortex grit removal systems, extended detention stormwater pond, grassed swales, etc.), either individually or in combination. This infrastructure would be located adjacent to the approaches on each side of the river, discharging via existing overland channels or sewer outlets. Runoff from the bridge surface would be collected in similar catch basins and would be piped to the downstream approach for treatment with the water.

The three alternative bridge designs are as follows:

1. As shown on Drawing 4.21, the ‘Arch With V-Piers’ design, which:

a) Provides two structural supports for the bridge girders but only one in-river foundation for each v-pier;

b) Uses up to 13 v-piers at 83 m spans and incorporates a 100 m arch span over the Rideau Canal’s navigable channel and adjacent rowing lanes (for a total 131 m distance pier-to-pier);

c) Each double v-pier above the mud-line is 51.5 SM (four legs each at 3.3 m long by 3.9 m wide), for a total in-water footprint of 669.5 SM;

d) Provides an arch over the Rideau Canal’s navigable channel; and

e) Does not require a girder under the arch portion as the arch-cable structure and skewed double v-pier at the arch provide the necessary structural support for the bridge deck, as shown on Drawing 4.22.

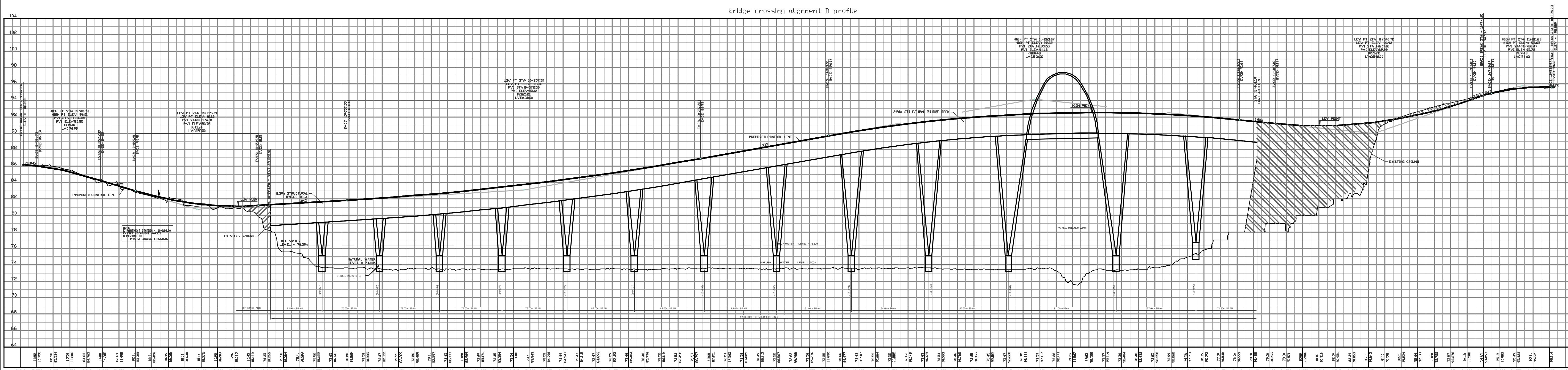
2. As shown on Drawing 4.23, the ‘Tube’ design, which:

a) Uses rounded/smooth steel truss work that forms a tube around the bridge for additional structural support;

b) Uses 11 piers at 100 m spans with a 120 m span over the Rideau Canal’s navigable channel and adjacent rowing lanes;

c) Each pier above the mud-line is 17.5 SM (8.75 m long by 2 m wide), for a total in-water footprint of 192.5 SM; and

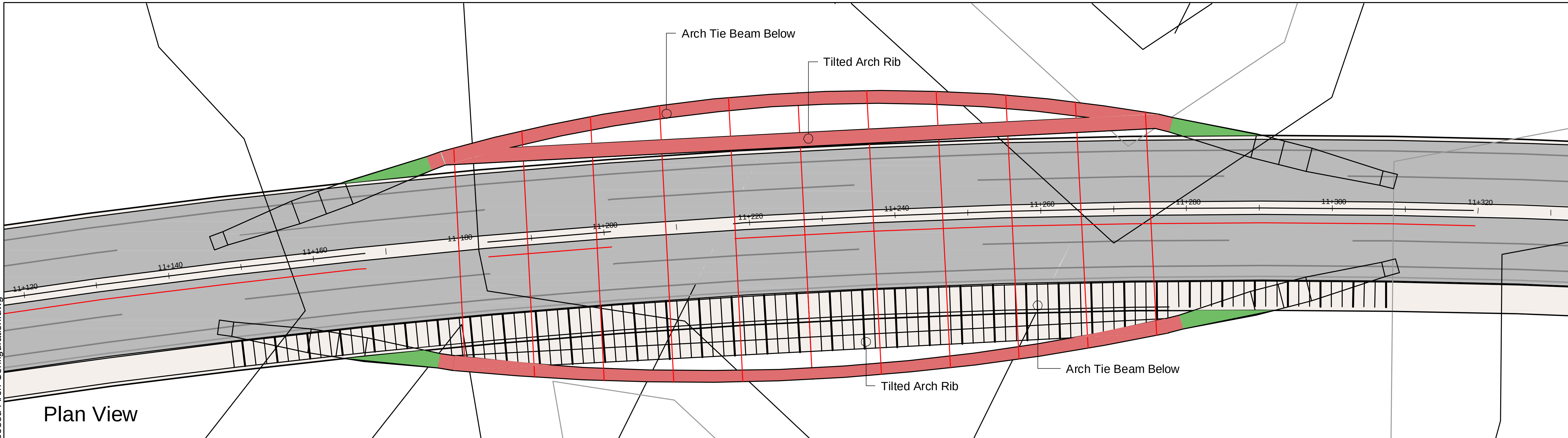
A: RENDERING (LOOKING SOUTH)

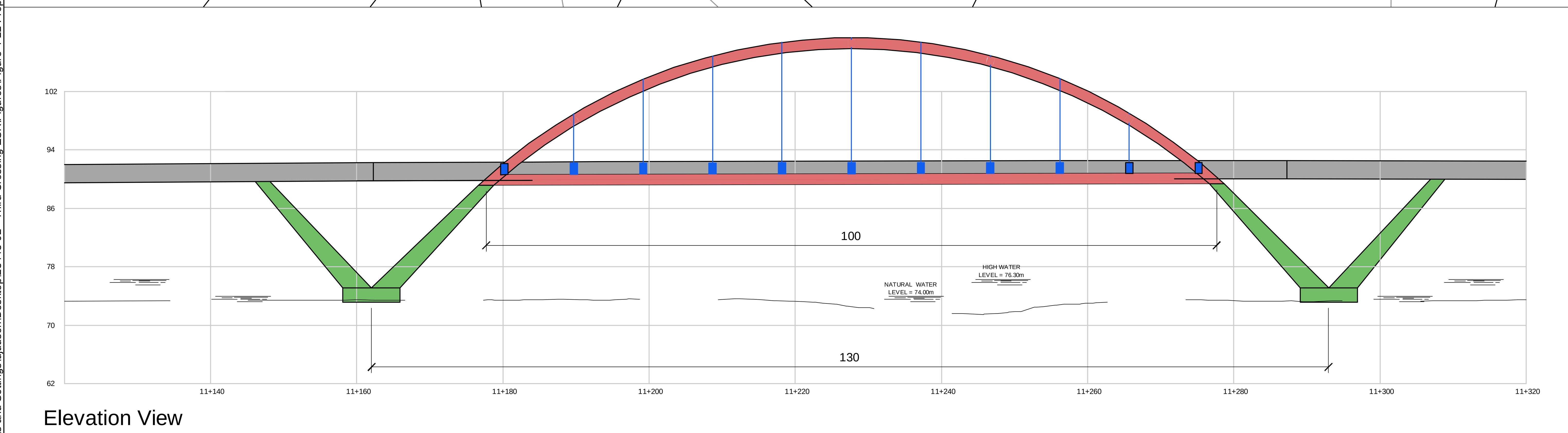


B: PROFILE AND PIER LOCATIONS (LOOKING NORTH)

PROJECT:	DRAWING:		DESIGN:	DRAWING NO.:
CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	ARCH WITH V-PIERS CONCEPT PLAN VIEW	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS — J.L. Richards & Associates Limited, 203-863 Princess Street, Kingston, ON Canada K7L 5N4, Tel: 613 544 1424, Fax: 613 544 5679	DRAWN:	4-21
			CHECKED:	JLR NO:
			PLOTTED: 26-Jan-12	23446-02

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-21 Arch with V-Piers Concept.dwg





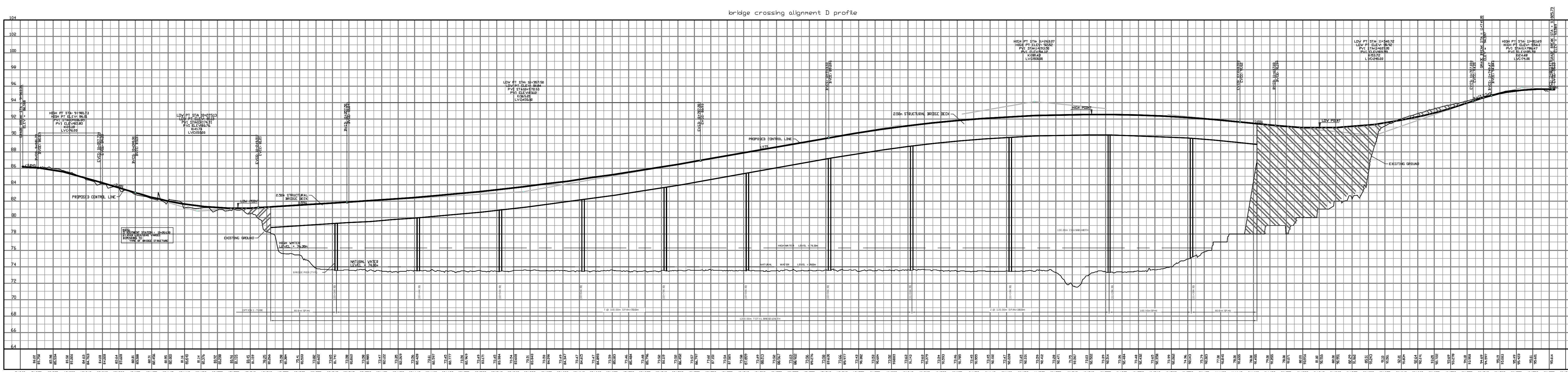
File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-22 Proposed Arch Configuration.dwg

PROJECT: CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	DRAWING: PROPOSED ARCH CONFIGURATION	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS	DESIGN:	DRAWING NO.: 4-22
			DRAWN:	
			CHECKED:	JLR NO: 23446-02
			PLOTTED: 26-Jan-12	

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-23 Tube Concept.dwg

A: RENDERING (LOOKING SOUTH)



B: PROFILE AND PIER LOCATIONS (LOOKING NORTH)

PROJECT:	DRAWING:		DESIGN:	DRAWING NO.:
CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	TUBE CONCEPT PLAN VIEW	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS	DRAWN:	4-23
			CHECKED:	JLR NO:
			PLOTTED: 26-Jan-12	23446-02

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

d) Would be the first bridge of its kind in the world for vehicular use and is considered avant garde due to its shape, aesthetics, robustness (there is less deflection and vibration) and lighter weight (it uses a third less structural steel and concrete compared to a conventional bridge with the same spans).

3. As shown on Drawing 4.24, the ‘Box Girder’ design, which:

   a) Requires 23 piers at 50 m spans in order to maintain appropriate span-length-to-girder-depth proportions;

   b) Each pier above the mud-line is 17.5 SM (8.75 m long by 2 m wide), for a total in-water footprint of 402.5 SM;

   c) Has a 65 m span over the Rideau Canal’s navigable channel only, thereby excluding the adjacent rowing lanes; and

   d) Is considered a more conventional bridge, particularly in comparison to the other alternative designs noted above.

As shown on Drawing 4.25, roadway and landscape improvements for the west side lands include:

1. For westbound travel:

   a) Two 3.5 m wide vehicular lanes along with a 3.25 m wide by 20 m long left-turn bay at the Village On The River apartment access on the south side of John Counter Boulevard and shared through/right-turn access into the River Park subdivision on the north side of John Counter Boulevard; and

   b) A 3.25 m wide by 60 m long left-turn bay and right-turn bay at Montreal Street.

2. For eastbound travel, two 3.5 m wide vehicular lanes along with a 3.25 m wide by 20 m long left-turn bay at the River Park subdivision access and shared through/right-turn access into the Village On The River apartments.

3. Provisions for a median barrier separating the eastbound and westbound vehicular lanes.

4. Two shoreland observation look-out/interpretive areas are shown on the north and south sides of the bridge.

5. The 3.6 m wide multi-use trail and 1.5 m wide commuter cycling lane on the south side of the bridge continuing along the south side of John Counter Boulevard to Montreal Street and connecting with the existing Elliott Avenue Parkette recreational trail on-land by a 3.6 m wide multi-use trail.

6. The 1.5 m wide commuter cycling lane on the north side of the bridge continuing along the north side of John Counter Boulevard to Montreal Street and also connecting with the existing Elliott Avenue Parkette on-land by a 3.6 m wide multi-use trail under the bridge.

7. A 1.5 m wide sidewalk on the north side of John Counter Boulevard extending from the multi-use trail access to Montreal Street.

As shown on Drawing 4.26, roadway and landscape improvements for the east side lands include:

1. For westbound travel, two 3.5 m wide vehicular lanes along with a 3.25 m wide by 20 m long left-turn bay at Point St. Mark Drive and a right turn option at the Gore Road Library.

2. For eastbound travel, two 3.5 m wide vehicular lanes along with:

   a) A 3.25 m wide by 60 m long left-turn bay, through lane/left-turn lane and right-turn lane option east of Point St. Mark Drive at Kingston Road 15;

   b) A 3.25 m wide by 20 m long left-turn bay at the Gore Road Library; and

   c) A right-turn option at Point St. Mark Drive.

3. Provisions for a median barrier separating the eastbound and westbound vehicular lanes.

4. The 3.6 m wide multi-use trail on the south side of the bridge:

   a) Continuing along the south side of Gore Road west of Point St. Mark Drive and connecting to the existing trail into the Point St. Mark residential neighbourhood; and

   b) Extending under the bridge to connect with the trail network on the Gore Road Library property.

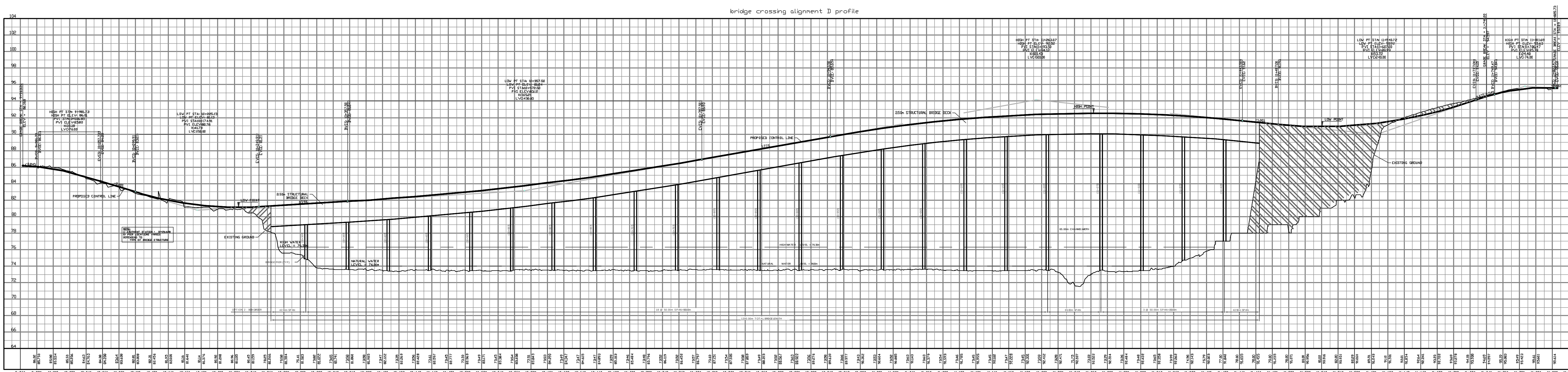
5. A 1.5 m commuter cycling lane on both sides of Gore Road.

6. The existing 1.5 m wide sidewalk on the south side of Gore Road east of Point St. Mark Drive to Kingston Road 15.

7. A proposed on-land observation look-out/interpretive area is shown on the north side of the bridge on the Gore Road Library property.

8. The two drainage routes that collect groundwater from the Point St. Mark residential neighbourhood and direct it to the Cataraqui River are incorporated into the landscape design as a ‘naturalized’ feature.

A: RENDERING (LOOKING SOUTH)



B: PROFILE AND PIER LOCATIONS (LOOKING NORTH)

PROJECT:
CATARAQUI RIVER THIRD CROSSING
EA - STAGE 2
ENVIRONMENTAL STUDY REPORT

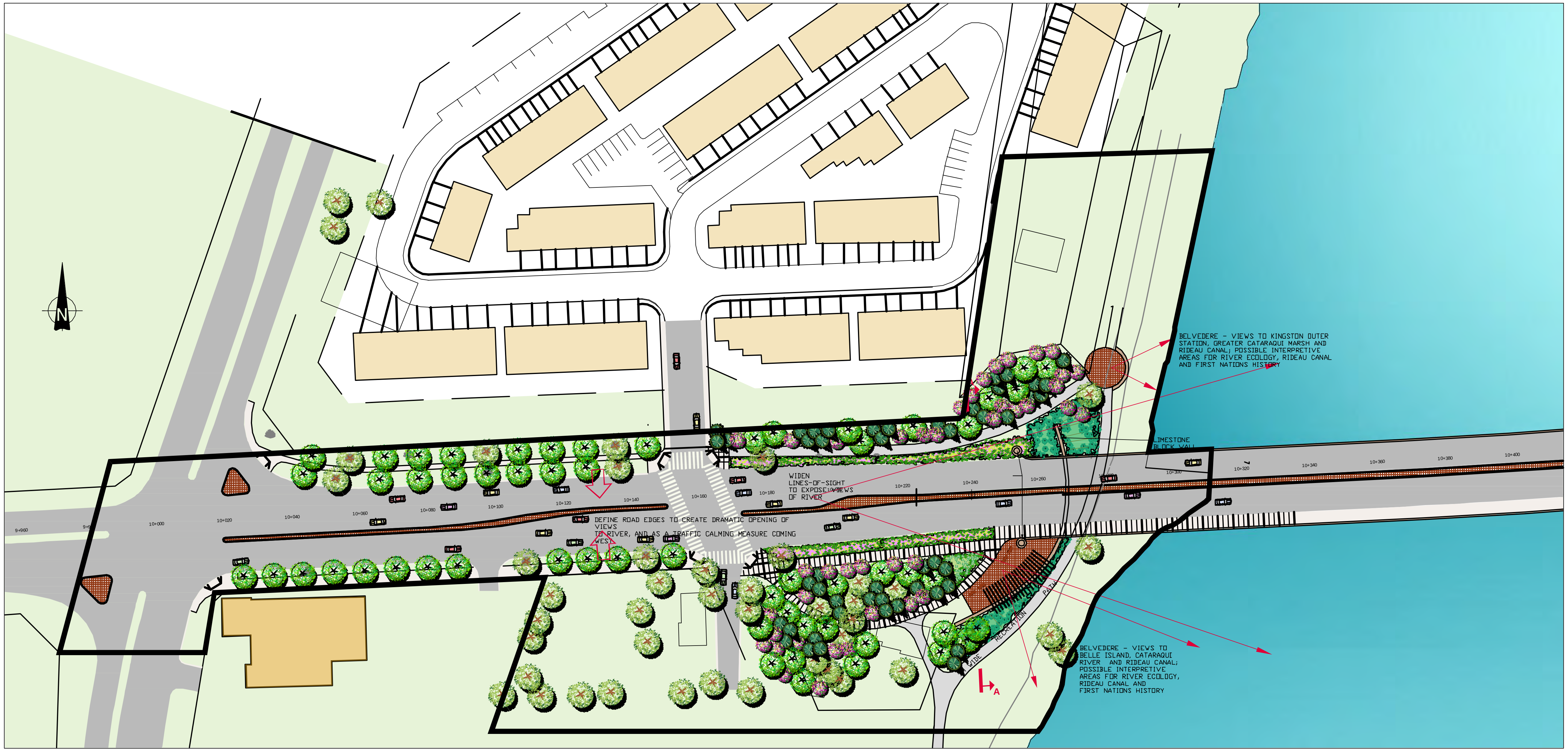
DRAWING:
BOX GIRDER CONCEPT
PLAN VIEW

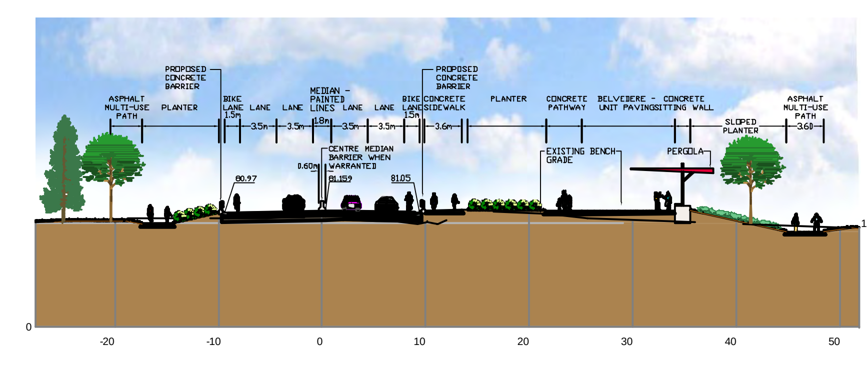
J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS

J.L. Richards
& Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679

DESIGN:	DRAWING NO.: 4-24
DRAWN:	
CHECKED:	JLR NO: 23446-02
PLOTTED: 26-Jan-12	

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-24 Box Girder Concept.dwg





Tentative Property Requirements

File Location: C:\Documents and Settings\djudson\Desktop\23443-02 - Third Crossing ESR\Figures\Figure 4-25 West Side Road and Landscape Concept.dwg

PROJECT: CATARAQUI RIVER THIRD CROSSING EA - STAGE 2 ENVIRONMENTAL STUDY REPORT	DRAWING: WEST SIDE ROAD AND LANDSCAPE CONCEPT	J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS	DESIGN:	DRAWING NO.: 4-25
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J.L. Richards & Associates Limited
203-863 Princess Street
Kingston, ON Canada
K7L 5N4
Tel: 613 544 1424
Fax: 613 544 5679