SCHEDULE 23

CONCESSIONAIRE PROPOSAL EXTRACTS

See attached.

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APPENDICES

SNC·LAVALIN

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March 21, 2005

Catherine Silman, Project Liaison Officer
Partnerships British Columbia Inc.
Suite 1250 – 999 West Hastings Street
Vancouver, BC V6C 2W2

Dear Ms. Silman:

Re: Best and Final Offer – Okanagan Lake New Crossing Services

SNC-Lavalin is pleased to submit, for your consideration, our Best and Final Offer (BAFO) Submission for the Okanagan Lake New Crossing Services Project.

This BAFO Submission is made on the basis of the BAFO Concession Agreement (Concessionaire's Design). Our technical solution is still based on the Province's design for the New Crossing and is the same as that presented in our RFP submission, with appropriate revisions and updates to comply with the Technical Submission Requirements of the BAFO Instructions. Our BAFO technical submission (Package 1) is a blacklined version of our RFP technical submission that identifies changes made between the two phases. Please note that the drawings from the RFP submission (Technical Appendix B) have not been resubmitted, but should be read in conjunction with this BAFO submission.

Our commercial solution complies with the Commercial Submission Requirements of the BAFO Instructions and optimizes value for money, providing a cost-effective means of financing and delivering the project.

We appreciate having had the opportunity to engage in discussions with representatives from Partnerships BC and the Province during the BAFO stage. We look forward to further strengthening our relationship during the implementation of this key infrastructure project that will benefit not only residents of the Okanagan Valley, but all of British Columbia.

If you have any questions about this submission, please do not hesitate to contact me directly at 604-605-4955.

Sincerely,

SNC-Lavalin Inc.

James Burke, P.Eng.
Senior Vice President & General Manager
Transportation Division

1.0 PROJECT TEAM

Our Solution

- A team with the technical, financial and operational skills and resources needed to deliver the project and fulfill service obligations throughout the term, on a sound business basis
- A BC-based solution intended to serve British Columbians for generations – team consists of local expertise in construction, complemented by international technical experts in the field of floating bridge design
- SNC-Lavalin, as project sponsor, offers a single point of responsibility and accountability for the successful implementation and operation of this project over its 30-year term
- SNC-Lavalin has the corporate and financial stature to assume the appropriate level of risk, to arrange funding and to provide a cost-certain and schedule-certain bid, backed by its proven commitment to quality

1.1 PROJECT ORGANIZATION

1.1.1 Corporate and Governance Structure

The Okanagan Lake New Crossing Services Project requires a project organization that responds to the initial goals of design and construction, yet includes a long-term operating entity that will be responsible for the assets and their upkeep through the entire duration of the term. Added to these technical and operational obligations is the issue of funding, and the ability to raise sufficient capital to realize the project. SNC-Lavalin understands that from the Province's perspective it is paramount to have a single point of contractual responsibility, through whom all project issues can be addressed and resolved.

SNC-Lavalin's response to this requirement has been to create a project organization that addresses each aspect of the project. It provides a sole entity, a dedicated Special Purpose Vehicle ("the Concessionaire") to provide the Ministry the single point of contact needed to enter into a Concession Agreement.

SNC-Lavalin will draw upon its in-house financial expertise to organize the project's funding. SNC-Lavalin Capital Inc. will organize and manage the financing package, with the potential of drawing direct equity from SNC-Lavalin Inc. and by arranging debt financing from interested lenders.

Two other entities will be part of our team organization:

- "Opco," a Special Purpose Company that will be set up by the Proponent at the same stage to provide O&M services to the Concessionaire. Opco will be 100% owned by SNC-Lavalin ProFac, a wholly owned facilities management subsidiary of SNC-Lavalin Inc.
- A Design/Build Joint Venture comprising SNC-Lavalin Constructors (Pacific) Inc., a wholly owned subsidiary of SNC-Lavalin Inc., and Vancouver Pile Driving Ltd.

The strategy of the Design/Build Joint Venture will be to team with financially sound and experienced subcontractors to perform the work, such that:

- Design and construction control are maintained
- Bonus and penalty contract provisions create incentives, as a means of encouraging improved productivity and achieving schedule and financial objectives
- Risk is managed through shared responsibility and accountability

The key entities that comprise the SNC-Lavalin team, and a brief overview of their areas of responsibility to the overall organization structure, are provided below:

SNC-Lavalin Inc. (Proponent) – As the proponent for the project, SNC-Lavalin will establish the Concessionaire (a Special Purpose Vehicle) at the Selected Proponent stage of the project.

SNC-Lavalin Capital Inc. (Core Organization) – SNC-Lavalin Capital Inc., a wholly owned subsidiary of SNC-Lavalin Inc. with a mandate to structure and arrange financing in support of the international and domestic projects realized by SNC-Lavalin, will provide the financial advisory and arrangement services necessary to arrange project funding. SNC-Lavalin Capital Inc. has professionals based in Vancouver.

SNC-Lavalin Constructors (Pacific) Inc. (Core Organization) – Based in Vancouver, SNC-Lavalin Constructors (Pacific) Inc. is the construction arm of SNC-Lavalin Inc. The company specializes in the efficient and economical delivery of new or upgraded infrastructure projects. It will form the Design/Build Joint Venture with Vancouver Pile Driving Ltd., which will be responsible for all project design and construction activities. SNC-Lavalin Constructors (Pacific) Inc.'s primary role, with support from other members of the SNC-Lavalin Group of Companies, will be project management.

Vancouver Pile Driving Ltd. (Core Organization) – A joint venture between SNC-Lavalin Constructors (Pacific) Inc. and Vancouver Pile Driving Ltd. will be responsible for all project design and construction

activities. Vancouver Pile Driving Ltd.'s primary role will be construction management, as well as pile driving, marine-related construction and decommissioning of the existing bridge.

Vancouver Pile Driving has one of the largest marine fleets of cranes and barges and is one of the largest marine and pile driving general contractors in British Columbia. The company has relevant design/build experience with PPP projects and design/build experience with bridges and concrete floating structures.

Buckland & Taylor Ltd. (Core Organization) – Local Vancouver firm Buckland & Taylor Ltd., in conjunction with its sub-consultants Dr.Ing. A.Aas-Jakobsen AS, Northwest Hydraulic Consultants (nhc) and Johs. Holt A.S., will provide the technical design expertise required for the bridge design, pontoon design and hydrographics analysis. This team of experts possesses specialist knowledge in the relatively unique field of floating bridge design, with project experience that includes the Nordhordland Floating Bridge and Bergsoysundet Floating Bridge, both in Norway. Their knowledge of bridge design reaches a global clientele and includes all aspects of design and construction supervision.

Trow Associates Inc. (Core Organization) – Burnaby-based Trow Associates will provide environmental, geotechnical, quality assurance and quality control services. The company has considerable experience, including work on bridges located in similar soft ground conditions requiring long piles and engineering solutions for compressible soils.

McElhanney Consulting Services Ltd. (Core Organization) – Surrey-based McElhanney will be responsible for traffic management services. McElhanney is one of the pre-eminent traffic management consultants in British Columbia and has an extensive portfolio of projects for which it has undertaken responsibilities similar to those required for the Okanagan Lake New Crossing Services Project. These services include preparing traffic control and management plans; designing traffic management plans that safely manage traffic during construction in areas of high traffic volume and high speed facilities; analyzing expected queuing and delays associated with single lane or full lane closures; carrying out quality control review of traffic detour and traffic control drawings; assisting traffic control supervisors with traffic management; designing and monitoring minor detours and interim measures; liaising with MoT representatives and contractors; preparing traffic management sub-plans, including traffic control plans, public communication plans, incident management plans, and implementation plans; and monitoring traffic management plans during implementation for compliance.

DMD & Associates Ltd. (Core Organization) – DMD & Associates will be responsible for traffic control and monitoring systems, instrumentation and other highway electrical engineering services for the New

Crossing. DMD's traffic signalling expertise includes in-depth knowledge of traffic controllers, development and design of new signals and associated systems, intersection improvements, channelization, and signal renovations retrofits. The company's experience includes single- and multiple-lane streets, roadways and arterials with complex traffic movements. DMD has considerable experience providing electrical and communications engineering for transportation facilities.

Greyback Construction Ltd. (Core Organization) – Greyback Construction Ltd. will be responsible primarily for the construction of structural concrete works for the new bridge. Greyback Construction is a highly diversified general contractor based in the Okanagan Valley. Its skilled workforce is highly capable of carrying out the various bridge construction tasks required for the Okanagan Lake New Crossing Services Project. The company has successfully delivered projects under lump sum, negotiated, construction management, joint venture, design-build, and PPP contractual arrangements.

Emil Anderson Construction Inc. (Core Organization) – Emil Anderson Construction Inc. will be responsible for the construction of the approaches and roadworks. Emil Anderson Construction is one of the largest road-building contractors in British Columbia. Located in Hope, BC, and with a regional office in Kelowna, the company is known throughout the province for successfully completing numerous rock excavation, grading and roadworks projects. Emil Anderson Construction's project and road maintenance experience provides a wealth of knowledge on working safely and productively in difficult traffic management situations.

SNC-Lavalin ProFac Inc. (Core Organization) – SNC-Lavalin ProFac Inc., SNC-Lavalin's facilities management group, will ensure proper stewardship and effective management of the bridge asset under the long-term operating arrangement through the formation of Opco, the special purpose company responsible for the operation and maintenance element of the Okanagan Lake New Crossing Services Project.

SNC-Lavalin ProFac Inc. is a wholly owned subsidiary of SNC-Lavalin Group Inc. and one of Canada's largest facilities and operations management companies, serving leading private and public sector organizations. Its portfolio of projects includes infrastructure projects such as the Highway 407 Express Toll Route in Ontario and maintenance of the 200 km of roads and bridges serving Gatineau Park in Quebec.

The proposed Project Organization and Governance Structure is depicted in Figure 1-1, following this page.

1.1.2 Project Core Management Team Structure

To execute this project SNC-Lavalin has assembled a comprehensive team of individuals, comprising leadership, experience and technical expertise encompassing the full range of disciplines and skills needed to execute this project. Our approach of utilizing seasoned professionals, with proven track records of delivering time-constrained, complex and unique projects, establishes credibility and a management team that is both informed and innovative.

Our core management team will comprise five levels:

1. **Concession Executive** – resides at the Concessionaire level and is the prime point of contact between the MoT and SNC-Lavalin. The Concession Agreement will be managed at this level, along with all corporate, legal and policy issues

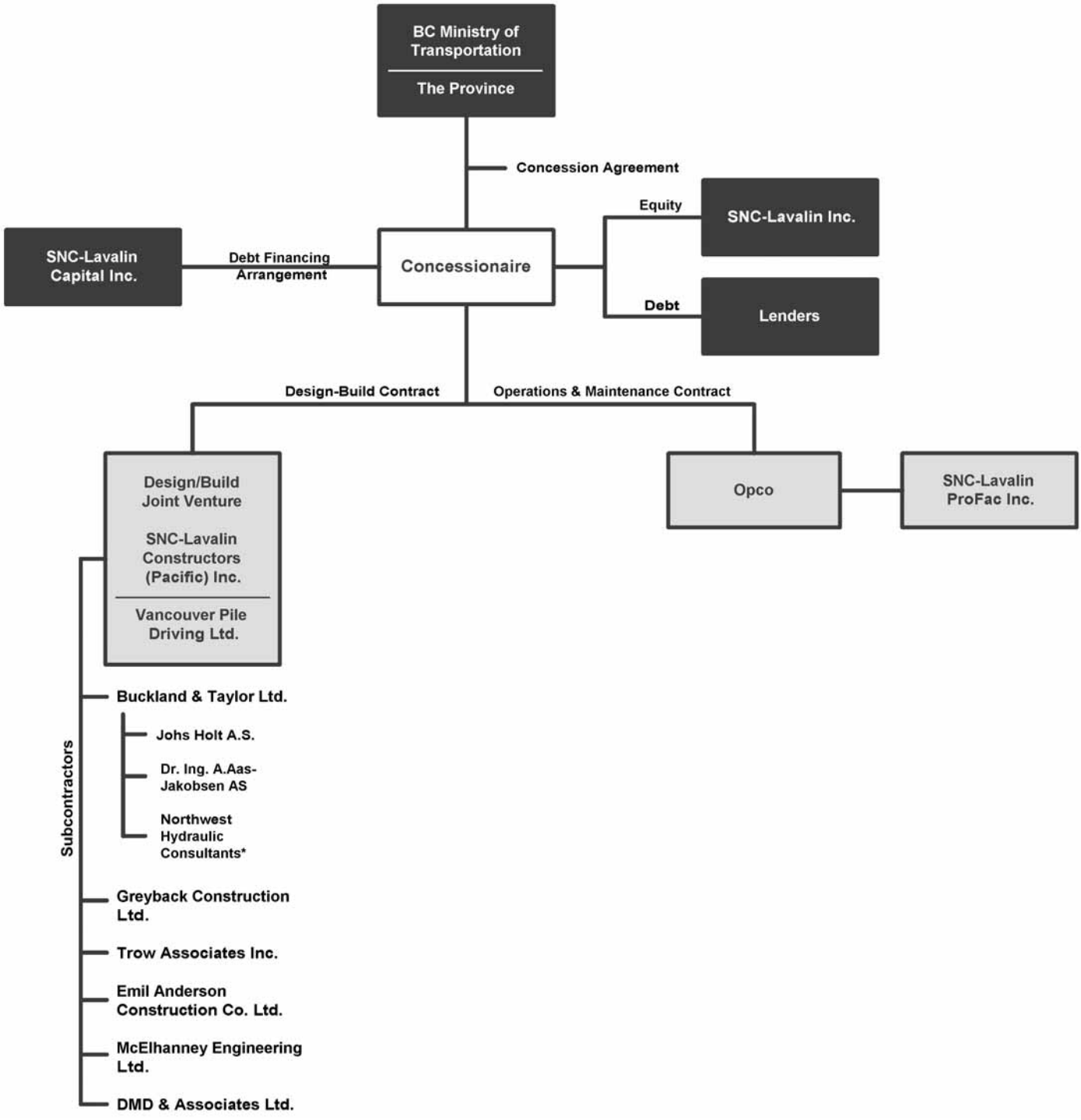
2. **Joint Venture Executive** – consists of representatives from the two Joint Venture partners, including the Project Manager of the Design/Build Joint Venture. At this level, especially during the intensity of the bridge's construction and decommissioning, we anticipate that MoT staff will coordinate directly with our Project Manager on technical design, construction and scheduling issues. Any issues that cannot be resolved at the Joint Venture executive level will be directed to the Concession Executive Level.

3. **Independent Auditors** – health and safety and project quality management functions, which have been separated from the main design, construction and operations. These staff will report directly to the Joint Venture Executive and will also liaise with MoT officials as required.

4. **Section Managers** – represent the lead management functions for the design, construction, environmental management and project controls during the design/build phase of the project, and asset management during the operations and maintenance phase of the project.

5. **Functional Managers** – represent the various design disciplines and functions during the design, construction, and operations of the project. These staff are responsible for sign-off of the design related to their respective design disciplines.

Figure 1-1: Proposed Project Organization and Governance Structure (Updated for BAFO Submission)



* Trillium Engineering and Hydrographics Inc. (named as sub-consultant in the proposal submission) has since been purchased by Northwest Hydraulic Consultants (nhc)

Figure 1-2: Project Core Management Team Structure

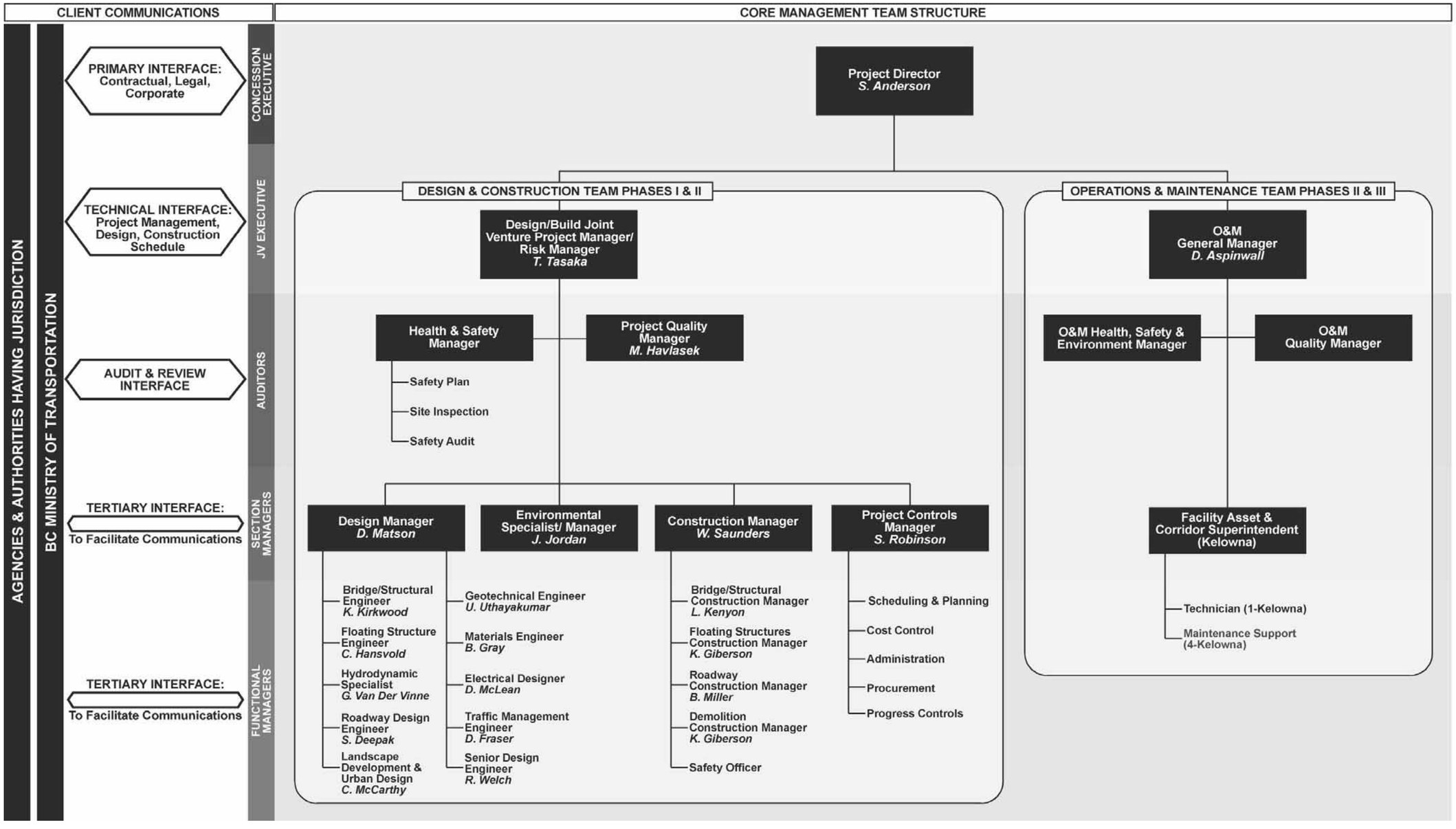


Figure 1-2: Project Core Management Team Structure, on the previous page, identifies all Core Individuals by name through the three phases of the project; their reporting relationships for each of the functions as listed in Section 3.1 of Schedule 3 of the RFP; and the number of maintenance and operations staff during the operating term of the contract, including geographic location. In addition, the primary anticipated interfaces with the client and with agencies and authorities having jurisdiction have been included. In this regard it is assumed the main project interface and formal communications function will operate at the Concession Executive and Joint Venture Executive levels. To facilitate project communications, during the design/build and decommissioning stages it is assumed that there will be daily interaction between the client and at the Section and Functional Management levels.

1.1.3 Project Signing Authority

The following identifies the Core Individuals responsible for signing off on the functions listed in Section 3.1 of Schedule 3 of the RFP. SNC-Lavalin Constructors (Pacific) Inc. will be responsible for overall project management and Vancouver Pile Driving Ltd. will be responsible for construction management.

Tom Tasaka – Design/Build Joint Venture Project Manager/ Risk Manager

- Project Management
- Risk Management

Mark Havlasek – Project Quality Manager

- Quality Management

Scott Robinson – Project Controls Manager

- Project Controls (General Management)

Darryl Matson – Design Manager

- Bridge/Structural Design
- Hydrology/Hydraulics Design
- Roadway Design
- Geotechnical Design
- Traffic Management
- Landscape Development

Wayne Saunders – Construction Manager

- Bridge/Structural Construction
- Roadway Construction
- Decommissioning
- Safety Management

David Aspinwall – O&M General Manager

- Operations Maintenance Management
- Asset Management

1.1.4 Project Task Force Approach

We propose to organize our work into two project offices: a design office located in Vancouver and a construction office located in Kelowna. A project task force approach will be adopted during the preliminary and detailed design phases, with design staff working collaboratively from the same location in Vancouver. This approach will facilitate decision-making and assist the general design process.

The location of the Kelowna construction office is yet to be determined. If possible, it will be sited close to either the main bridge construction site or the graving dock. Additional site offices will be located as required.

To facilitate seamless transfer of information, the SNC-Lavalin team will establish a project website with file transfer protocol (FTP) capability for posting and retrieving project information. The website will have the necessary security controls so that only authorized project personal will have access.

1.2 PROJECT TEAM CHANGES FROM RFP STAGE

Subsequent to being selected as one of the Proponents invited to submit a proposal for the Okanagan Lake New Crossing Services Project, and taking into consideration the requirements of the BAFO Instructions, we reviewed the Core Organizations and Core Individuals proposed for our team. As a result, certain changes were made to our Core Individuals to further strengthen our team. These changes are briefly described in the following sections.

1.2.1 Changes in Core Organization

- There have not been any deletions from the project team identified in our RFP submission. However, since our RFP submission the firm providing our team with specialist hydrodynamics services, Trillium

Engineering and Hydrographics Inc., has been purchased by Northwest Hydraulic Consultants Ltd. The principles of Trillium are now in the employ of Northwest Hydraulic and continue to provide their services to the team. Northwest Hydraulic is a well known and respected local firm specializing in the field of hydraulics. The access to additional resources within this organization provides the team with all the necessary hydraulics expertise.

1.2.2 Changes in Core Individuals

An updated list of our Core Individuals is provided below. An asterisk (*) identifies the changes we have made since our RFP submission. Further details on these changes are included in Table 1.1 at the end of this section.

1.2.2.1 Updated List of Core Individuals

Management Core Individuals

Project Director – Scott Anderson* (SNC-Lavalin Inc.)
Project Manager*****/Risk Manager – Tom Tasaka* (SNC-Lavalin Inc.)
Project Quality Manager – Mark Havlasek (Trow Associates Inc.)
Environmental Specialist/Manager – John Jordan (Trow Associates Inc.)
Project Controls Manager***** –Scott Robinson (SNC-Lavalin Inc.)

Design Core Individuals

Design Manager – Darryl Matson (Buckland & Taylor Ltd.)
Senior Design Engineer – Rodger Welch (Buckland & Taylor Ltd.)
Bridge/Structural Engineer – Keith Kirkwood (Buckland & Taylor Ltd.)
Floating Bridge/Marine Structure Engineer – Carl Hansvold (subcontractor to Buckland & Taylor Ltd.)
Hydrodynamic Specialist – Gary van der Vinne (subcontractor to Buckland & Taylor Ltd.)
Roadway Design Engineer – Satwant Deepak (SNC-Lavalin Inc.)
Geotechnical Engineer – Uthaya Uthayakumar (Trow Associates Inc.)
Materials Engineer – Brian Gray (Trow Associates Inc.)
Traffic Engineer – Dave Fraser (McElhanney Consulting Services Ltd.)
Electrical Designer – Don McLean (DMD & Associates Ltd.)
Landscape Development & Urban Design – Chris McCarthy (SNC-Lavalin Inc.)

Construction Core Individuals

Construction and Decommissioning Manager – Wayne Saunders (Vancouver Pile Driving Ltd.)

Bridge/Structural Construction Manager – Larry Kenyon (Greyback Construction Ltd.)

Floating Structures Construction Manager – Kevin Giberson (Vancouver Pile Driving Ltd.)

Roadway Construction Manager – Bruce Miller (Emil Anderson Construction Co. Ltd.)

Demolition Construction Manager* – Kevin Giberson (Vancouver Pile Driving Ltd.)

Facility Maintenance and Asset Management Core Individuals

Operations and Maintenance General Manager***** – David Aspinwall***** (SNC-Lavalin ProFac Inc.)

The following table outlines the specific changes made to the composition of our Core Individuals. These changes strengthen the respective areas of our team.

Table 1-1: Changes in Core Individuals from RFP Phase

Position	RFP Designate	BAFO Designate	Remarks
Management Core Individuals			
Project Director	Robert Tribe	Scott Anderson	Mr. Tribe has other commitments that preclude his participation on this project.
Design/Build Joint Venture Project Manager/ Risk Manager	Scott Anderson	Tom Tasaka	Mr. Tasaka has recently become available, bringing to the team his strong project management and leadership skills, coupled with his highway and marine construction experience. This addition allows Mr. Anderson to move into the Project Director's position.
Project Controls Manager	Allan Cuthbert	Scott Robinson	Mr. Cuthbert has overall responsibility for SNC-Lavalin's Project Controls. He will have an oversight role, but Mr. Robinson will be dedicated to the project.
Financial Manager	Jean-Marc Arbaud	André Dufour	Mr. Dufour returned to the project at the commencement of the BAFO stage after completing another assignment.

2.0 SCHEDULE

Intentionally deleted, including pages 10 to 12.

3.0 PROJECT DESIGN

Our Solution

- Based on the Province's bridge design, with slight modifications to improve inspection access to pontoons
- Proven technologies and materials, with state-of-the-art analysis to validate and optimize design
- Preliminary roadway design is consistent with the Province's proposed design and meets the design criteria in the Construction Output Specifications
- Design safety performance threshold met; comprehensive road safety audit will be carried out
- Pedestrians and cyclists accommodated with safe and uninterrupted pathways throughout the project, including access to existing City of Kelowna walkways
- Utility services remain uninterrupted; utility and communication ducts provided, meeting Functional Requirements
- Improved CCTV camera coverage provided for better performance and incident monitoring

3.1 PROJECT DESIGN CONCEPT

3.1.1 Introduction

The Okanagan Lake Bridge is located in the Central Okanagan Valley on Highway 97 and links the communities of Westbank and Kelowna. The bridge currently operates as a three-lane reversible flow facility to accommodate peak traffic volumes and incorporates two navigation channels. The west navigation channel allows passage of small watercraft under the transition span at the west abutment with an approximate 4 m clearance above the water level. The east navigation channel is the lift span near the east shore that allows larger marine vessels to traverse the lake.

The objectives of the Okanagan Lake New Crossing are to increase traffic capacity across the lake, eliminate the vehicle/marine conflict caused by lift span operation, minimize public inconvenience during construction and complete the work in an environmentally sensitive manner.

Note: Unless otherwise noted, the drawings referenced in this section are identical to those included in our RFP submission as Appendix B. They have not been resubmitted with this BAFO submission.

3.1.2 Overall Concept for the Proposed New Crossing

The main element proposed for the new crossing will be a floating bridge, identical in concept to the Base Design prepared for the Province by Westmar Consultants Inc. The Proponent is responsible for the design of the New Crossing in accordance with the requirements of the Concession Agreement.

The new floating bridge will be parallel to the existing bridge. The centreline of the new crossing will be approximately 27 m to the north of the centreline of the existing bridge. The overall general arrangement of the new crossing is shown in drawing 865800-1000-42DD-3101 in Appendix B of the RFP submission.

The existing bridge will be decommissioned after substantial completion of the new crossing. Commissioning of the new crossing and decommissioning of the existing will be sequenced such that there is no significant impact on vehicular traffic using the crossing and only a winter season interruption of the marine navigation channel. Decommissioning of the existing bridge will include dismantling and disposal of its components, and reconditioning of the existing causeways.

3.1.3 General Description of New Crossing Structures

The new crossing, described from west to east, will comprise the following structures:

- West approach embankment
- West approach ramp, which includes the navigation span
- West transition span
- Floating bridge, consisting of concrete pontoons and elevated deck structures
- East transition span, including the east anchorage of the floating bridge

These structures are described in more detail in the subsections below.

3.1.4 West Approach Embankment

The west approach embankment starts at Sta. 26+60 and ends where the bridge structure meets the abutment of the west approach ramp. Refer to the roadway drawing and structural drawing 865800-1000-42DD-3102 in Appendix B of the RFP submission for the general arrangement of this structure.

The west approach embankment will consist of lightweight fill contained between pre-cast concrete wall panels on either side of the embankment. The embankment will be constructed using a granular fill

causeway from the lakebed and an expanded polystyrene (EPS) embankment from the top of the granular fill causeway up to the granular fill beneath the roadway pavement structure.

3.1.5 West Approach Ramp

The west approach ramp of the proposed Okanagan Lake Bridge will be a five-span elevated structure situated between the west abutment and the transition pier and includes the span across the new navigation channel. Refer to drawing 865800-1000-42DD-3103 in Appendix B of the RFP submission for the general arrangement of this structure. The substructures will be reinforced concrete piers supported on deep pile foundations.

The superstructure will be continuous spans of composite steel girders and concrete deck. The depth of the superstructure measured from the roadway profile control line to the underside of the steel girders is proposed to be 3.0 m.

3.1.6 West Approach Ramp Navigation Span

The easternmost span of the west approach ramp will accommodate the new navigation channel with the following parameters:

- Air draft: 18 m clearance above high water level
- Water draft: 4 m below low water level
- Channel width: 44 m

The 44.0 m required navigational clearance and the detailing of the fenders will be addressed in the final design.

The new crossing, including the bridge piers, will be designed to meet the vessel collision requirements of the CHBDC for a Class I bridge. The design vessel for marine traffic using the new navigation channel under the west approach ramp will be one barge with a tugboat, as indicated in Section 3.2.4.3.

3.1.7 West and East Transition Spans

The west and east transition spans will connect the floating structure to the fixed structures on either side. Please refer to drawing 865800-1000-42DD-3104 and drawing 865800-1000-42DD-3107 in Appendix B of the RFP submission for the general arrangements of these structures.

The transition span superstructures will consist of composite steel girders and reinforced concrete deck. Both structures are 54 m simply supported spans that permit seasonal fluctuations of the lake water level without not noticeably affecting the roadway profile.

3.1.8 Floating Bridge – West and East Elevated Deck

Elevated decks supported on the floating pontoons provide the change in elevation between the roadway pontoons and the transition spans. Refer to drawing 865800-1000-42DD-3106 in Appendix B of the RFP submission for the general arrangements of these structures.

The elevated deck superstructure will consist of continuous spans of composite steel girders supported by concrete or steel bents. The bents will be located at pontoon walls.

3.1.9 Floating Bridge – Concrete Pontoons

The general arrangement of the floating bridge concrete pontoons is shown in drawing 865800-1000-42DD-3105 in Appendix B of the RFP submission.

The floating bridge will consist of concrete pontoons that are designed and detailed using a watertight cellular construction. Bottom slabs, exterior walls and end walls will be cast in place. Interior walls and top slabs may be cast in place or constructed using pre-cast concrete components or tilt-up construction methods. The longitudinal reinforcement of the concrete pontoons, which resists horizontal and vertical bending of the continuous structure, will be post-tensioned strands supplemented with mild steel reinforcement. Individual pontoon sections will be connected at joints by post-tensioned bolts.

The pontoons will be hollow and include access to every watertight compartment for regular maintenance and integrity monitoring. The only permissible use of EPS (expanded polystyrene) in the floating section will be in areas where future access for maintenance activities is not practical.

Draft and weight control of the pontoon sections will be ensured via provision of permanent ballast material in the design and implementation of special weight control monitoring procedures during construction.

The layout of the watertight compartments of the pontoons, termed compartmentation, is designed to ensure that the structure is capable of flooding one compartment without exceeding crack control limits. In addition, adequate access will be provided for each compartment for maintenance and monitoring the integrity of the pontoon structure.

Dynamic analysis of floating structures will be an essential part of the final design, to determine and account for the effects of wind and waves on the concrete pontoons, anchor cables and anchors during both the staged construction and operation of the new crossing.

The existing bridge anchors will be incorporated into the new crossing. An additional four new anchors will be installed where required to provide anchorage for the new floating bridge up to the east shore.

3.1.10 East Abutment and East Approach Structures

The east abutment structure supports the end of the east transition span and provides longitudinal anchorage for the floating bridge using a concrete dead-man buried in the east approach embankment.

The east approach includes provision for a pedestrian passage either in front of the abutment or on a promenade walkway through a tunnel. The pedestrian structures include provision for lighting that will be protected from vandalism.

3.1.11 General Bridge Details

3.1.11.1 Superstructure Steelwork

The superstructure steelwork of the west approach ramp, the west and east transition spans and the elevated decks on the floating pontoon bridge will be constructed using weathering steel. The exposed weathering steel surfaces will be uncoated, except within the proximity of the deck expansion joints. The concrete substructures or pontoons at the interface with the weathering steel elements will be sealed to prevent rust staining of the concrete surfaces.

3.1.11.2 Bridge Deck Design

The roadway decks for the bridge structures will use a wearing surface that is monolithic with the structural concrete deck. The deck design will use silica fume concrete mix design. The minimum design cover provided from the top of the concrete road surface to the reinforcing steel will be 70 mm, with a specified placing tolerance of +5 mm/-5 mm. Using these design parameters the predicted service life of the deck using the ACI Life 365 model, Version 1.1 is 77.5 years.

Additional dead load for a future overlay has not been considered on any portion of the new crossing.

3.1.11.3 Deck Expansion Joints

The deck expansion joints at the west abutment, the west approach ramp transition pier, the west elevated deck transition bent, the east elevated deck transition bent and the east abutment will be steel finger joints. These joints will includes a trough drainage system to catch and collect the deck runoff water that passes through the finger joints. The trough drainage system will be designed to provide access for maintenance cleaning.

In addition, the finger joints at each end of the west and east transition spans are designed with a rotational capacity to permit these spans to articulate as lake levels fluctuate.

On the floating bridge, the deck joints at the transitions of the elevated decks to the roadway pontoons will be neoprene compression seals, to provide a waterproof joint.

3.1.11.4 Barriers, Parapets and Railings

The standard MoT steel bicycle fence (Reference Drawing No. 2891-2C) will be used along the south edge of the sidewalk. A concrete wave wall with a steel bicycle fence, similar to Reference Drawing No. 2891-2C, will be used along the south edge of the sidewalk over the length of pontoon subjected to wave overtopping.

The standard MoT pre-cast concrete median barrier (Specification Drawings SP941-02.01.01 and SP941-02.01.02) will be used along the centreline of the roadway.

A 450 mm wide parapet similar to the standard Ministry of Transportation concrete parapet (Reference Drawing No. 27844P) with standard Ministry parapet steel bicycle railing (Reference Drawing No. 2785-3) will be used between the sidewalk and the roadway. The standard Ministry pre-cast concrete roadside barrier (Specification Drawings SP941-01.02.01 and SP941-01.02.02), with a standard Ministry parapet steel bicycle railing, will be used between the sidewalk and the roadway on the west approach embankment.

The standard MoT concrete parapet with steel railing (Reference Drawing No. 2785-2B) will be used along the north edge of the roadway. The standard pre-cast concrete roadside barrier will be used along the north edge of the roadway on the west approach embankment. A pipe railing fence consisting of top and intermediate rails will be used along the top of the north retaining wall on the west approach embankment.

A pipe railing fence consisting of top and intermediate rails will be used along the exterior edge of the pontoons supporting an elevated deck or a transition span.

3.1.11.5 Drainage

Direct discharge of roadway run-off into the lake will be allowed. Run-off from the elevated roadway and sidewalk on the floating section will be collected and discharged clear of the pontoons. The design of drainage on the deck will be determined by estimating the volume of spray water landing on the deck during a 100-year return period storm event and selecting the appropriate capacity of the drains to prevent a build-up of water on the deck. All drainage details will take into consideration maintenance and clean-out operations.

3.1.11.6 Approach Slabs

Approach slabs will be used at both abutments. Design of approach slabs will be in accordance with Section B. 1.8 of the MoT Bridge Standards and Procedures Manual.

3.1.11.7 Electrical and Utilities

The electrical design will include continuous roadway lighting along the length of the bridge and the length of the approaches included within the project scope. Illumination will be provided for overhead signing mounted on the bridge and approaches. All electrical equipment on the bridge will be fed from the bridge service. Electrical equipment on the east and west approach will be fed from the service located in that area.

The design will provide for navigational aids, including navigational lighting and pier lighting as required. The east and west ends of the floating pontoon section will be lit with navigational marking on both the south and north side of the bridge. Aviation marker lights will be provided on the top of the luminaries over the navigation channel.

Provision will be included to move all the utilities currently on the existing bridge to the new crossing.

3.2 DESIGN CRITERIA

3.2.1 Codes and Standards

The design and construction of the new crossing will be in accordance to the latest versions of the codes and standards listed in the Definitive Concession Agreement, 2004 November 22, Part 1 of Schedule 5, Article 5.2.

The primary design code for the new bridge design will be CAN/CSA-S6-00, Canadian Highway Bridge Design Code (CHBDC). However, the CHBDC does not specifically apply to the design of floating

structures or cover all aspects of the design of long span bridges. The Bridge Design Criteria supplements the provisions of the CHBDC for specific aspects of new crossings, in particular long-span floating bridges. In addition to the CHDC, the following references will be used:

- National Building Code of Canada (NBCC), 1995. The NBCC will be referenced for environmental loads.
- Recommended Design Loads for Bridges, American Society of Civil Engineers (ASCE) Committee on Loads and Forces on Bridges, July 1981. The ASCE Recommended Design Loads for Bridges will be referenced for traffic on loaded lengths greater than 100 m.
- ACI 357 Guide for the Design and Construction of Fixed Offshore Concrete Structures. ACI 357 will be referenced for the serviceability requirements in the design of the pontoons interior walls.

3.2.2 Design Life and Service Life

The new crossing bridge structures will be designed to have a minimum design life and expected service life of 75 years in accordance with the requirements of Part 1 of Schedule 5 of the Definitive Concession Agreement.

Design calculations for corrosion allowances will use a 100-year service life.

3.2.3 Materials

3.2.3.1 Structural Steel

- Plate Girders and welded attachments for the West Approach Ramp, Elevated Decks and Transition Spans: CAN/CSA G40.21, Grade 350AT, Category 3.
- Bracing and Diaphragm members: CAN/CSA G40.21, Grade 350A or 350W coated.
- High Strength Bolts, Nuts and Washers: ASTM A-325, Type 3.
- Welding Electrodes: CAN/CSA W48.1.
- Coatings: In accordance with the Standard Specifications for Highway Construction, BC. All steel located within a distance of 1.5 h (where h is the overall depth of the superstructure), but not less than 3 m, of all deck joints is required to be coated. The colour of the coating will match the finished colouring of the weathering steel.

3.2.3.2 Concrete

Concrete mixes will be designed in accordance with the requirements of CAN/CSA A23.1. Concrete mix components, and the standards with which they will comply, will be as follows:

- Portland Cement: Type 10 Portland Cement to CAN/CSA-A5 but with tricalcium aluminate (C3A) content less than 8.0%, and total alkali content not greater than 0.60% sodium oxide equivalent
- Supplementary cementing materials: Type F Fly Ash and type U Silica Fume to CAN/CSA A23.5
- Water: CAN/CSA-A23.1
- Aggregates: CAN/CSA-A23.1, normal density
- Air entraining admixtures: CSA CAN3-A266.1
- Chemical admixtures: CSA CAN3-A266.2.
- Super plasticizing admixtures: CSA CAN3-A266.6

The concrete quality used will conform to the minimum concrete strength, maximum water/cement ratio, and minimum air content requirements for structural concrete as specified in Table 8.11.2.1 of the CAN/CSA-S6-00 for the appropriate combination of deterioration mechanisms and environmental exposures. Generally, concrete mix proportions will be selected in accordance with CAN/CSA-A23.1 Alternative 1, to meet the requirements identified in Table 3-1 below. Specific requirements will be determined during the Final Design.

Table 3-1: Concrete Requirements

Use	Min. Comp. Strength, 28 days (MPa)	Max. Nom. Aggregate (mm)	Air Content (%)	Slump (mm)	Max. Water/ Cement Ratio by Mass	Fly Ash (% of CM)	Silica Fume (% of CM)
Deck Slab, Barriers	45	28	5 +/- 1	30 +/- 20	0.38	20	5
Pontoon Top Slab and Exterior Walls	45	14	5 +/- 1	50 +/- 20	0.38	20	5
Pontoon Bottom Slab and Anchors	45	14	5 +/- 1	50 +/- 20	0.40	20	0
Pontoon Interior Walls	35 - 45	14	5 +/- 1	50 +/- 20	0.40	20	0

Pre-cast Wall Panels	45	28	5 +/- 1	30 +/- 20	0.40	20	0
Elev. Deck Bents	35	28	5 +/- 1	50 +/- 20	0.40	20	0
Approach Slab	35	28	5 +/- 1	50 +/- 20	0.40	20	0
Abutments	35	28	5 +/- 1	50 +/- 20	0.40	20	0
Piers, Footings	30	28	5 +/- 1	50 +/- 20	0.40	20	0
Filling Pipe Piles	30	28	5 +/- 1	50 +/- 20	0.50	20	0

Note: For 28 mm aggregate, 100% will pass through the 40 mm sieve and a maximum of 5% by mass of the total sample will be retained on the 28 mm sieve. The maximum proportion of fine aggregate in deck slab concrete will be 32% of the total mass of aggregate. The water/cement ratio is the mass ratio of water to total cementitious materials.

3.2.3.3 Reinforcing Steel

Reinforcing steel will be CAN/CSA G30.18, Grade 400R.

All reinforcing steel will be uncoated, with the exception of the reinforcing steel in the bridge parapets and median barriers, which will be epoxy-coated.

The cover from the face of concrete to any reinforcing steel will be as shown in Table 3-2 below. The minimum concrete covers will generally be as specified in Table 8.11.2.2 of the CAN/CSA-S6-00 for the appropriate environmental exposure. In addition, Table 3-2 defines special cases not included in Table 8.11.2.2 of the CAN/CSA-S6-00, such as the exterior and interior surfaces of the pontoons. In general, the placing tolerances specified in Table 8.11.2.2 of the CAN/CSA-S6-00 will be applied. In special cases, the bridge design will require the rebar placement to be more strictly controlled than the standard requirements of CAN/CSA-S6-00, for example: the construction of the pontoon walls and the top surface of the road deck.

Table 3-2: Minimum Concrete Cover and Placing Tolerance

Top Surface of Roadway Slabs	70 mm	+5 mm, -5 mm
Bottom Surface of Roadway Slabs	40 mm	+10 mm, -10 mm
Exterior Surfaces of Pontoons Except Roadway Slab	40 mm	+ 8 mm, -2 mm

Interior Surfaces of Pontoons	30 mm	+ 8 mm, -2 mm
Abutments, Piers, Foundations	60 mm	+10 mm, -10 mm
Submerged Surface of Pile Caps	60 mm	+10 mm, -10 mm
Surfaces Cast in Contact with Soil	85 mm	+10 mm, -10 mm
Parapets and Side of Roadway Slab	50 mm	+10 mm, -10 mm
All Other Surfaces	25 mm	+10 mm, -10 mm

3.2.3.4 Grout

The minimum compressive strength of grout used in the pontoon-to-pontoon connection will be equivalent to that defined for pontoon concrete, f'c = 45 MPa.

3.2.3.5 Piling

Steel pipe piles will be in accordance with CAN/CSA Z245.1, Grade 300.

3.2.3.6 Anchor Cable

Anchor cables will have a minimum breaking strength: Fu = 1,380 MPa.

3.2.4 Loads and Load Combinations

Load factors and load combinations for the bridge structures will be in accordance with CHBDC, Clause 3.5, except as amended for the design of the floating pontoons as described in subsection 3.2.6.1, Floating Pontoon Design Loads and Load Combinations.

3.2.4.1 Dead Loads

Dead loads will be derived in accordance with the provisions of CHBDC, Clause 3.7. Additional dead load for a future overlay will not be considered on any portion of the new crossing.

The weight of all reinforced concrete within the pontoons will be calculated on the basis of 26 kN/m^3. A density of 26 kN/m^3 will also be used for all reinforced concrete supported by floating elements including the elevated and transition span decks.

3.2.4.2 Live Loads

Live loads for the design of the fixed structures and the elevated decks will be in accordance with CHBDC, Clause 3.8, for a CL-625 loading. In addition, for the floating bridge pontoon design, the effects of unsymmetrical loading will be determined using Figure 2 of ASCE Recommended Design Loads for Bridges.

The new crossing will be designed to accommodate an 85-tonne special permit vehicle using the provisions of CHBDC, Clause 14.8.2.4 with the highway rated as Class A.

The sidewalk area, the hatch covers in the sidewalk area and the top deck of the pontoon under the elevated roadway deck will be designed for a maintenance vehicle as specified in the CHBDC, Clause 3.8.11. The maintenance vehicle load will include an allowance for dynamic effects.

Dynamic load allowances will be applied when computing local stresses in the bridge decks and superstructure only, and will not be included when computing global pontoon stresses.

3.2.4.3 Vessel Collision Loads

The new crossing will be designed to meet the vessel collision requirements of the CHBDC for a Class I bridge.

The design vessel for marine traffic using the new navigation channel under the west approach ramp will be one barge with tugboat. For design, the following parameters will be used:

- Design barge length: 45.7 m
- Design barge width: 9.75 m
- Design barge loaded draft: 1.83
- Design vessel transit velocity: 3 knots

3.2.5 Environmental Effects and Loads

In general, the new crossing will be designed to withstand environmental loads generated by a 100-year return period event, based on codes and standards referenced in subsection 3.2.1 of this proposal.

Environmental loads will be in accordance with the data published in the supplement to the NBCC, 1995 version. The relevant data, together with other site-specific information, is included in this section.

3.2.5.1 Lake Levels

For navigation channel purposes, the lake levels, as published by the Hydrographic Service of Canada on Chart 3052, are:

- High Water Level (HWL): 342.52 m (geodetic)
- Mean Water Level (MWL): 341.92 m (geodetic)
- Low Water Level (LWL): 341.32 m (geodetic)

Historical data for the lake levels included daily water level readings from 1944 to 1997. Based on this data the extreme water levels are:

- Maximum daily level in period of record: 343.126 m
- Minimum daily level in period of record: 341.254 m

3.2.5.2 Wind Effects on Structures

Wind pressures on the fixed structure and the elevated deck will be determined in accordance with CHBDC, Clause 3.10.2. (Hourly mean wind pressure for 100 year return period, q_{100} = 0.53 kPa). Wind forces on live loads will be in accordance with CHBDC, Clause 3.10.2.4.

The storm load conditions during construction will be assessed on the basis of the 25-year return period event. It should be noted that this requirement exceeds the minimum requirements of the CHBDC, which would require a 10-year storm event. The more severe condition was selected by the Proponent to provide an additional level of safety during the period when the new pontoon string shares the anchors with the existing floating bridge. The reduced return periods used for construction conditions are consistent with the probabilistic approach used by the design codes. For example, it is much less likely that a 25-year storm event will occur during the period the bridge is exposed in its most critical construction stage than a 100-year storm event will occur in the 75-year design life of the structure. In other words, from a probability standpoint, the bridge will be safer during construction than during its service life. Because of the increased safety derived from using the 25-year storm event and the impracticality of placing additional temporary anchors of sufficient size to have any effect, there are no additional mitigation measures planned during the construction period to account for an extreme storm event.

3.2.5.3 Wind and Wave Effects on the Floating Bridge

As the floating bridge pontoon is a unique structure, site-specific wind data defines the expected wave conditions and the basis for calculating the combined wind and wave forces on the pontoons.

A summary of the wind and wave force analysis is presented in Tables 3-3 and 3-4 on the following page (refer to BC Ministry of Transportation and Highways, Okanagan Lake Bridge Project, Technical Bulletin No. 1, Wind and Wave Regime, October 2000, prepared by Westmar Consultants Inc., for additional detail).

The maximum design condition was determined on the basis of a 100-year return period event. The construction design conditions were determined on the basis of a 25-year return period event.

Table 3-3: Wind and Wave Conditions for a 100-Year Return Period

Wind Direction[1]	Wind Speed (km/h)	Significant Wave Height[2], H_s (m)	Peak Wave Period[3], T_p (s)	Mean Wave Direction	Spreading Index[4], s
340	71	0.70	3.0	348	12.2
0	71	0.70	3.0	354	11.7
20	71	0.67	2.9	0	10.6
170	88	1.11	3.6	179	5.5
190	88	1.14	3.8	187	5.9
210	88	1.14	3.7	190	5.9
230	88	1.01	3.4	201	4.0

Table 3-4: Wind and Wave Conditions for a 25-Year Return Period

Wind Direction[1]	Wind Speed (km/h)	Significant Wave Height[2], H_s (m)	Peak Wave Period[3], T_p (s)	Mean Wave Direction	Spreading Index[4], s
340	64	0.61	2.8	348	12.4
0	64	0.62	2.9	354	11.8
20	64	0.59	2.8	0	10.7
170	78	0.93	3.4	180	5.6

190	78	0.96	3.6	187	6.0
210	78	0.97	3.5	191	6.0
230	78	0.85	3.2	201	4.1

Notes:
1. Wind direction is the compass bearing (true) direction from which the wind blows.
2. The significant wave height is defined as the average height of the highest 33% of the waves.
3. The peak wave period is defined as the period of the most energetic waves.
4. The directional spreading function is of the form c(s) cos'(0).

3.2.5.4 Ice Loads

The design ice loads on the structures are based on the BC Ministry of Transportation and Highways, Okanagan Lake Bridge Project, Technical Bulletin No. 3, Ice Loads, October 2000, prepared by Westmar Consultants Inc.

Ice regime summary:

- 100-year return period ice thickness: 560 mm
- Annual probability of ice thickness greater than 100 mm: 0.56
- Annual probability of complete freeze-up: 0.15
- 100 year event wind speed concurrent with complete freeze-up: 66 kph

Table 3-5: Forecast Ice Thickness

Return Period (Years)	2	3	4	5	6	7	8	9	10	15	25	50	100
Extreme Ice Thickness (mm)	230	270	300	320	340	350	360	370	380	410	450	510	560

The forces generated on the bridge were calculated on the basis of a 100-year return period event, defined by the combined probability of wind recurrence and the annual lake ice freeze-up probability of 0.15. This event consists of a 66 km/h wind blowing over a 5 km long ice sheet to develop a transverse ice load on the floating bridge of 4.4 kN/m, acting over the entire length of the pontoon.

Local ice loads were determined using a range of wind speeds and ice thickness, as follows:

- Transverse ice load on floating bridge: 24 kN/m local, for one cell length
- Longitudinal ice load on floating bridge: 156 kN applied as a single maximum load on the floating structure and as a friction force on the side of the pontoon over a 10 m length
- Ice load on west approach piers: 240 kN (transverse) applied over 45 degrees to a perpendicular to the longitudinal bridge axis
- Ice load on west approach piers: 156 kN (longitudinal)

3.2.5.5 Snow Loads

NBCC: Appendix C

3.2.5.6 Temperature Loads

NBCC: Appendix C

3.2.5.7 Temperature Effects on Pontoon Hull

The pontoon hull will be designed to accommodate the differential temperatures that occur through the depth of the pontoon.

For the purposes of calculating the thermal forces in the pontoons, the following criteria will be used:

- Temperature Differential: 10 ^{o} C varying linearly from the bottom of the pontoon to the underside of the top deck of the pontoon. A sixth-power algebraic relationship will be utilized to model the temperature variation from the underside of the top slab to the top side of the top slab. The temperature difference through the top slab will be ± 10 ^{o} C. The total variation from the bottom of the pontoon to the top surface of the pontoon will be ± 20° C. The equation of the temperature variation through the slab will be derived so that the slope of the temperature curve at the underside of the top slab is equal to the slope of the linear portion of the temperature differential below the top slab.
- Thermal coefficient: 8 X 10^{-6} per ^{o} C.
- For longitudinal displacement, an axial temperature differential of ± 10 ^{o} C will be used.

3.2.5.8 Rainfall

NBCC: Appendix C

3.2.5.9 Seismic Loads

The seismic design of the new crossing structures will be in accordance with the provisions of the CHBDC, using the following parameters:

- Importance category: Emergency Route
- Seismic Performance Zone: 2
- Structure type: Irregular Bridge
- Design earthquake: 475-year return period event (10% probability of exceedance in 50 years)

In addition to the CHBDC seismic design requirements, the new crossing structures will accommodate the predicted soil movements resulting from the 1,000-year return period event without collapse.

The peak horizontal ground accelerations most recently stated by the Geological Survey of Canada for the site have been used for this proposal and will be used for the final design. These design values are as follows:

- Design earthquake (475-year return): 0.054 g
- 1,000-year return: 0.075 g

The proposed design values for the design earthquake and the 1,000-year return period event are in accordance with Part 1 of Schedule 5, Section 3.9.2.1, which requires the geotechnical design to use site-specific zonal acceleration ratios obtained from the Geological Survey of Canada (GSC); and Section 5.6, which requires that the structure design use the peak horizontal ground acceleration as most recently stated by the GSC for the site. The proposed design values for the design earthquake and the 1,000-year-return- period earthquake are the values most recently stated by the GSC. Notwithstanding the above, it is known that the Geological Survey of Canada is updating its seismic modelling of the peak horizontal ground accelerations for the 2005 National Building Code of Canada and that these design values may be affected. In addition, it should be noted that the MacLeod geotechnical design, used to develop the MoT Proposed Design, was based on site-specific zonal acceleration ratios provided by the GSC at the time. However, at that time the GSC was using a different seismic model for developing seismic design recommendations. Also, Byrne and Anderson (September 22, 2004) discuss values derived from a different seismic model than either the current GSC model or the earlier GSC model. This seismic model is in development by GSC for the next edition of the National Building Code of Canada (NBCC), but has not been officially adopted. Preliminary analyses have been made to investigate the effect that seismic

parameters derived from the GSC seismic model proposed for the new NBCC would have on the design of the Okanagan Lake Crossing. These analyses show that the bridge and approach structures would be able to tolerate the resulting displacements without severe consequences because all of the design acceleration values as discussed above are relatively small. As a result, the seismic load combinations generally do not govern the design of the bridge structures and foundations.

The displacements of the existing anchors in the design seismic event will be investigated and, if required, fuse devices will be installed on the anchor cables to limit damage to the floating bridge should the anchors displace. Restraint devices will be attached on either side of the fuse so that the anchor cables do not part.

3.2.6 Pontoon Analysis and Design Provisions

3.2.6.1 Floating Pontoon Design Loads and Load Combinations

The load combinations and the load factors for the design of the floating pontoon bridge have been developed based on the requirements of:

- CHBDC, Clauses 3.5.1, Table 3.5.1 (a) and (b)
- BC Ministry of Transportation, Project Design Criteria for: Okanagan Lake Bridge Project Pontoon Redesign, September 2003, prepared by Westmar Consultants Inc. (Westmar)
- European codes and practice

Tables 3-6 and 3-7 below provide the Ultimate Limit State (ULS) and Serviceability Limit State (SLS) load combinations used for the floating pontoon bridge. The load cases indicated in the tables are defined as follows:

- D = Dead load, including the self weight of the pontoons, barriers, and elevated deck
- L = Live load effects
- LF = Longitudinal force from braking of the live load per CHBDC
- LP = Pedestrian live load effects per CHBDC
- W = Wind effects on the structure during a 100 year "event" wind on the structure
- V = Wind on the live load per CHBDC
- WA = Wave loading concurrent with wind effects (wave loading from a separate analysis)

- T = Temperature, including differential effects
- F = Wind driven ice load effects during a 100 year "event", not including wind on the structure, or the live load
- H = Water-filled compartment, refer to the detailed discussion of ULS provisions below

Table 3-6: Serviceability Limit State Load Combinations

	SLS 1		SLS 2		SLS 3		SLS 4		WSLS 5	
LOAD CASE	**11+**	**11-**	**12+**	**12-**	**13+**	**13-**	**14+**	**14-**	**15+**	**15-**
D	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.00	0.00
LF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.00	0.00
LP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.50	0.50	0.35	0.35	0.35	0.35	1.00	1.00
V	0.00	0.00	0.50	0.50	0.35	0.35	0.35	0.35	0.00	0.00
WA	0.00	0.00	0.35	0.35	0.50	0.50	0.00	0.00	1.00	1.00
T	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80
F	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00
							Load Divisor		1.25	1.25

- SLS 1: Traffic and temperature dominating
- SLS 2: Traffic and wind dominating with concurrent wave effects
- SLS 3: Traffic and waves dominating with concurrent wind effects
- SLS 4: Traffic and ice dominating with concurrent wind effects
- WSLS 5: Wind/wave dominating with temperature included

The Serviceability Limit State SLS 1 combination is taken from CHBDC.

The Serviceability Limit States SLS 2, 3 and 4 are developed from a combination of CHBDC and European codes. The load factor for traffic of 0.9 is taken from CHBDC and the load factor of environmental loads of 0.5 is based on a return period of one year.

The Serviceability Limit States load combinations also include one of the combinations taken from the BC Ministry of Transportation, Project Design Criteria, Table 5 Clause 3.7.1.2 (WSLS 5 is SLS2 in this table). This SLS combination applies a load divisor to reduce the total load.

The Serviceability Limit States SLS 2 to 4 are considered conservative compared to European practice, since both traffic and one of the environmental loads are treated as dominant. For example, a Serviceability Limit State combination by the Norwegian bridge code would be:

- Permanent: 1.0
- Dominant variable 0.5
- Other Variable: 0.35

It should be noted that there are no specific serviceability checks for cracking or further leakage of pontoons due to water-filled compartments. This is because the water-filled compartment condition is not a serviceability limit state. The pontoons are required to be designed not to leak. Hence, the floating pontoons are not permitted to be in a service condition with a compartment filled with water. However, the pontoons are designed for the water-filled compartment loading as ultimate limit states in combination with loadings due to wind, waves and live loads. The ultimate limit states assume the pontoon is damaged from an external source, resulting in a water-filled compartment while the bridge is in service and/or in storm conditions. The through-thickness crack width for the ultimate limit states is limited to 0.25 mm. This criterion prevents the conditions that can cause the “pumping” of water through cracks due to the flexing of the pontoons in storm conditions. Consequently, the exposure to progressive failure of the pontoon string during these extreme conditions is controlled. In addition, preliminary design indicates that in comparison to the Province’s design, using this criterion will enhance the ductility and post-cracking behaviour of the pontoons. The improved performance of the pontoons will be achieved by decreasing the amount of longitudinal pre-stessing while increasing the amount of mild steel reinforcement in the bottom slab and walls.

Table 3-7: Ultimate Limit State Load Combinations

	ULS 1		ULS 2		ULS 3		ULS 4		ULS 6a		ULS 6b		ULS 8a		ULS 8b		ULS 9	
LOAD CASE	**1+**	**1-**	**2+**	**2-**	**3+**	**3-**	**4+**	**4-**	**6a+**	**6a-**	**6b+**	**6b-**	**8a+**	**8a-**	**8b+**	**8b-**	**9+**	**9-**
D	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.2	0.9	1.35	1.35
L	1.7	1.7	1.6	1.6	1.4	1.4	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0
LF	1.7	1.7	1.6	1.6	1.4	1.4	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0
LP	1.4	1.4	1.3	1.3	1.1	1.1	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.8	0.8	0.0	0.0
W	0.0	0.0	0.0	0.0	0.5	0.5	1.65	1.65	1.3	1.3	0.5	0.5	1.0	1.0	0.5	0.5	0.0	0.0
V	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.5	0.5	0.0	0.0
WA	0.0	0.0	0.0	0.0	0.5	0.5	1.65	1.65	0.0	0.0	0.0	0.0	1.0	1.0	0.5	0.5	0.0	0.0
K	0.0	0.0	1.2	1.2	1.0	1.0	1.25	1.25	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.0
F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
H	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0

- ULS 1: Traffic dominating, taken from CHBDC
- ULS 2: Traffic dominating with temperature included, taken from CHBDC
- ULS 3: Traffic dominating with wind, wave and temperature included, taken from CHBDC
- ULS 4: Wind/wave dominating with temperature included, taken from CHBDC.
- ULS 6a: Wind/ice dominating with temperature, taken from MoT – Westmar Criteria
- ULS 6b: Traffic dominating with wind, ice and temperature, taken from MoT–Westmar Criteria
- ULS 8a: Compartment collapse with wind, wave and temperature, taken from MoT–Westmar Criteria
- ULS 8b: Compartment collapse with traffic, temperature, wind and wave; per MoT–Westmar Criteria
- ULS 9: Dead load with upper load factor, taken from CHBDC

3.2.6.2 Basic Structural System for the Floating Pontoon Structure

The floating structure, consisting of watertight pontoons, is considered as a continuous beam on an elastic foundation for vertical and torsional loads. Horizontally, the floating structure is considered as a continuous beam with elastic supports (cables anchored to the lake bottom).

3.2.6.3 Serviceability Limit States

The pontoon will be pre-stressed for through thickness membrane effects of global loadings only. The allowable concrete stresses after all losses have occurred will be in accordance with pre-stressed concrete design provisions of CHBDC, with the following clarifications:

- Compression: 0.4 fc
- Tension in exterior elements located below 500 mm above the design waterline of the pontoons: zero
- Tension in exterior elements located 500 mm or more above the design waterline of the pontoon and exposed to roadway surface runoff: 0.25 $(fc)^{-1/2}$
- Tension in interior elements or exterior elements located 500 mm or more above the design waterline of the pontoons and not exposed to roadway surface run off: 0.5 $(fc)^{-1/2}$
- The coupling of global load and local load effects need not be considered

For exterior members below the waterline, reinforcement stresses, fs, due to sustained hydrostatic (local) forces will not exceed 95 MPa, which is presumed to create a crack width of 0.1 mm. This limit applies to local hydrostatic forces only.

For members above the waterline, reinforcement stresses, fs, due to sustained hydrostatic forces or live loads on the top slab will be in accordance with serviceability limit states of CHBDC.

For non-pre-stressed elements above the waterline, the design will be in accordance with the provisions of CHBDC.

3.2.6.4 Ultimate Limit States

For the design of the floating concrete elements below the waterline, the limit condition under global forces is a maximum through-thickness crack width of 0.25 mm. In addition, the pontoons will have sufficient reinforcing to resist the lesser of 1.33 times the factored load effect or 1.2 Mcr at the limit condition. Mcr will be calculated using a limit-tensile stress in the precompressed tensile zone of the concrete equal to the modulus of rupture, 0.6 $(fc)^{-1/2}$.

3.2.6.5 End Walls

End transverse walls (end bulkheads) will be designed by service load method to resist hydrostatic pressure at 100 percent basic allowable stresses. In addition, end bulkheads are to be designed to withstand grout pressure. The grout pressures will be specified in the construction specifications to limit stresses to acceptable levels without requiring additional structural capacity.

3.2.6.6 Interior Walls

Interior walls will be checked for strength and serviceability, and the governing condition will be used in selecting wall thickness and reinforcement. Strength requirements are assumed to be related to a short-term event, which is obvious and will subsequently be repaired. Serviceability requirements are assumed to be related to slow, undetected leakage of an exterior element.

Interior walls will be designed to meet the ultimate strength provisions of CHBDC. The design forces will be the hydrostatic pressure arising from water filling a cell to the bottom of the lowest opening; higher water levels need not be considered. If a wall has no opening, or has a watertight door, then the water level will be assumed to be full height of the pontoon cell. The load factor will be 1.2.

Interior walls will be designed to meet the serviceability requirements of ACI 357 Guide for the Design and Construction of Fixed Offshore Concrete Structures. This standard limits reinforcement stress to 120 MPa. The hydrostatic pressures used in evaluating serviceability will be those due to flooding to exterior lake level.

3.2.6.7 Hydrostatic Pressure

To account for construction tolerances, hydrostatic pressures will be based on a design water level equal to the theoretical draft, plus allowances indicated in Section 3.2.6.12, Freeboard.

3.2.6.8 Shrinkage

Differential shrinkage will be considered, as applicable, between the different components of the pontoon. The ultimate differential shrinkage strain will be 0.0002. The construction subcontractor will be directed to adjust the plan length of each pontoon as necessary to compensate for shrinkage. The effect of shrinkage will be considered to occur in the dry condition only. This shrinkage rate can be assumed to be zero upon launching of the pontoon.

3.2.6.9 Potential Damage

The design will make appropriate provisions for damage to the floating pontoon structure that could result from collision, flooding of a portion of the pontoon during construction or service or severing of anchor cables. The pontoon structure will have sufficient capacity to resist the following damage conditions:

- Application of a 45 kN horizontal collision load as a service load to the pontoon exterior side wall panels.
- Application of a 135 kN horizontal collision load as a factored load to the pontoon exterior side wall panels (assume collision loads are applied to a 0.3 m x 0.3 m area).
- Flooding (loss of buoyancy):
  - Flooding of all hollow cells within a single watertight compartment, in one location only, to the exterior lake level. This load condition will be investigated in the damage ultimate limit states load combinations.
  - Flooding of all hollow cells within a single watertight compartment, in one location only, to the underside of the pontoon top slab. This load condition will be investigated for the damage ultimate limit state load combination to ensure that the pontoon will not break.
  - Flooding of all hollow cells over two adjacent watertight compartments, in one location only, to the exterior lake level. This condition could potentially arise if the integrity of a pontoon exterior wall is breached. This load condition will be investigated for the damage ultimate limit state load combination to ensure that the pontoon will not break.
  - Flooding of the six end cells of an isolated pontoon during towing.

- Flooding of the six outboard end cells at the end of pontoon structure during pontoon assembly on the lake.

- Severing of any one anchor cable. Analysis for factored load combinations only.
- Complete separation of the pontoon structure by a transverse or diagonal fracture. Analysis for factored load combinations only.

Only one damaged condition and location are to be considered at any one time.

A pontoon watertight compartment is defined as any set of pontoon cells contained within watertight walls. Watertight walls contain either no openings or an opening that is sealed by a watertight door. A summary of pontoon compartment sizes is summarized in Table 3-8 below:

Table 3-8: Pontoon Compartmentalization Summary

Pontoon Category	Pontoon(s) in Category	Compartment Type	Number of Cells	
			Pontoon Width	Pontoon Length
Deep	1	A	2 Cells	1 Cell
Elevated Deck	2, 3, 4, 5, 12	B	3 Cells	1 Cell
Roadway	6, 7, 8, 9, 10, 11	C	6 Cells	1 Cell

3.2.6.10 Wall Openings

If space permits, the threshold of all wall openings between compartments will be located 500 mm above the equilibrium waterline resulting from the flooding damage conditions on an intact pontoon structure.

3.2.6.11 Catwalks

The elevation of the top of the catwalks will provide a minimum of 2.1 m of headroom to the roadway slab or top slab. A step must be provided at doorways where the doorsill is more than 800 mm above the catwalk level.

3.2.6.12 Freeboard

Freeboard and pontoon draft will be calculated based on the following criteria:

- Structure dead load as defined above

- No live load on the pontoon
- Vertical component of the anchor cable force
- A 25 mm allowance for water within hollow cells
- Weight of catwalk, ladders and other hardware included
- Unit weight of water is 9.81 kN/m^3
- Construction tolerances
- Weight of reserve ballast

The final pontoon draft will be verified to within 1% by independent computations.

3.2.6.13 Wave Walls

Wave walls will be constructed along the outboard edges of the pontoon deck where the roadway is located on the top slab of the pontoon.

The height of the wave walls will be the same height as the standard parapet (810 mm).

3.2.6.14 Construction Tolerances

The theoretical draft of the pontoons will be increased 4% to include an allowance to accommodate possible construction inaccuracies.

3.2.6.15 Reserve Ballast

Pontoons will be designed to accommodate an amount of ballast that will displace the pontoon 50 mm vertically. This ballast is intended to compensate for unforeseen (unplanned) increases in pontoon draft and will be in addition to the effect described under construction tolerances.

Ballast material may be a granular material such as pea gravel or drain rock, provided that it is free-draining.

3.2.6.16 Pontoon Joints

In computing reinforcement requirements and grout (concrete) stresses at pontoon joints, the effective grout bearing area of the joint will be utilized. The effective grout bearing area will include all areas of the joint with the specified high strength grout, but will exclude ungrouted areas, such as rubber gaskets and metal connectors.

Sufficient high strength connectors will be placed across the joint to provide zero tensile stress under all service load combinations. The ultimate strength at the joints will be equal to or greater than the ultimate strength of the remainder of the pontoon.

The temporary clamping force at pontoon joints during grouting will be sufficient to resist D+H1+0.30W or D+H1+T, assuming only one pontoon at a time is attached, where: D is dead load effects, H1 is vessel collision, W is wind load and T is temperature effects.

3.2.6.17 Pontoon Shear Design

Shear design will be in accordance with the Limit States Design provisions of CHBDC. Reinforcement required for shear will also be sufficient to resist all forces that are expected to occur simultaneously with shear, i.e., torsion, bending, etc.

3.2.6.18 Pontoon Launching

The pontoon launching draft will be based upon the weight of the basic intact pontoon structure, including the weight of the elevated roadway superstructure where required, plus the weight of temporary ballast required to make the pontoon float level. The 4% construction tolerance will be included in the weight.

3.2.7 Anchorage System

The existing anchorage system will be reused to support both the new floating bridge structure during construction and the existing floating bridge structure until construction is complete. Upon completion of the new crossing, the existing floating bridge structure will be demolished and the existing anchorage system used to support the new floating bridge structure.

The existing anchorage system consists of the anchors, the anchor cables and the cable attachments to the pontoons. The existing anchorage system will be checked against the following criteria:

- The design strength of the cable adjustment device is 890 kN.
- The existing anchors were load tested to 1.4 times their working load as part of a test program in 1986, as shown in Table 3-9 on the following page.

Table 3-9: Anchor Test Loads – 1986 Breaking Strength of Anchor Cable = 2,850 kN

Existing Pontoon	Anchor	Test Load (kN)	Percent of Breaking Strength
A	N S	1225 1400	43% 49%
B	N S	1200 1310	42% 46%
C	N S	1135 1155	40% 41%
D	N S	980 1155	34% 41%
E	N S	980 1155	34% 41%
F	N S	980 1155	34% 41%
FF	N S	980 1155	34% 41%
EE	N S	980 1155	34% 41%
DD	N S	980 1155	34% 41%
CC	N S	980 1155	34% 41%
BB	N S	1135 1335	40% 47%
AA	N S	1200 1425	42% 50%
		Average	40%
		Maximum	50%

Based on the above results, the anchors are capable of resisting a maximum cable load of 1,425 kN. To maintain a factor of safety of 1.4, the maximum calculated anchor load cannot exceed 1,020 kN unless load testing confirms a higher capacity.

3.3 STRUCTURAL DESIGN

3.3.1 Structural Concept Selection

The site of the New Crossing is at a narrows near the centre of the Okanagan Lake, where the width of the lake is approximately 1.4 km. The lakebed at the narrows is relatively shallow on the western shore, but it drops sharply to 50 m in depth at the middle of the lake. The geotechnical conditions at the site of the new crossing provide generally poor conditions for the construction of bridge foundations. The length of the crossing, the depth of the lake and the poor foundation conditions led the designers of the existing crossing to select a floating bridge. For similar reasons the proposed New Crossing includes a floating pontoon bridge for most of the crossing in combination with fixed structures at each shore.

The general arrangements and configurations of the fixed and floating structures that comprise the new crossing are described in subsection 3.1.

The fixed structures include the west approach embankment, the west approach ramp, the east and west transition spans and the east abutment/longitudinal anchorage. The design and construction of these structures will use proven technologies and materials commonly applied to bridges in British Columbia. The selection of these proven systems will ensure the construction of reliable, durable structures that can be maintained through the 75-year service life of the new crossing.

Similarly, the design and construction of the floating structures will use proven methods and materials for construction. While floating highway bridge structures are not common in British Columbia, or the world, the existing bridge has demonstrated the excellent performance and reliability of this structural system for crossing Okanagan Lake.

3.3.2 General

As discussed above, the design and construction of the fixed structures will use proven technologies and materials, commonly applied to bridges in British Columbia. Specifically, the design and construction will be in accordance with subsection 3.2, Design Criteria, of this proposal, which is based on the Canadian Highway Bridge Design Code (CHBDC).

The design criteria identified in subsection 3.2 have expanded on the requirements of the CHBDC where necessary to address special issues related to a long span floating structure and to incorporate site-specific environmental data. The description and derivation of site-specific load conditions to be used for the design of the bridge structures is included in subsection 3.2.

The materials used for the design of the bridge structures are specified in subsection 3.2. Here again materials and techniques common to bridge construction in British Columbia are specified. In particular, note that the CHBDC provisions for durability and fatigue will be applied to the design of these structures.

Special care will be used during construction to ensure that the concrete produced does not use aggregates that produce deleterious expansion due to alkali-aggregate reactions. Sources of aggregates will be appropriately tested and certified before being used in the production of concrete for the bridge structures.

3.3.3 Foundation Design

3.3.3.1 Geotechnical Issues

Okanagan Lake is in a glacier-formed valley that has been filled with very soft soils overlying dense glacial till and rock at a considerable depth, greater than 200 m. In addition, the eastern shore has very loose delta deposits mixed with and overlaying the lake sediments. As a result, the deep soft soils and the steep slopes of the lake bottom provide bridge foundation conditions that have:

- Marginal stability
- Limited capacity
- Susceptibility to movement and settlement if disturbed

The design of bridge foundations for this site must address these issues. In addition, while the seismic demands at this site are very low, the geotechnical conditions are very poor. This combination requires that the bridge design provide measures to mitigate potential foundation instabilities during and after extreme seismic events.

3.3.3.2 Foundation Details

The west approach embankment will be constructed of lightweight fill placed on a preloaded granular fill causeway to minimize, if not eliminate, long-term settlements of the embankment. Refer to drawing 865800-1000-42DD-3102 found in Appendix B of the RFP submission for the general arrangement of the west approach embankment.

The west approach ramp substructures and the east abutment will be supported on deep piled foundations. Steel pipe piles for these foundations will be driven closed-ended and filled with water, typically up to an elevation of 324.0 m, above which the piles are filled with reinforced concrete. The load capacity of the

piles is derived primarily from friction. The piles will be battered at the west approach ramp piers to provide lateral capacity for wind and ice loads. The piles for the foundations will extend to similar depths, which minimizes the potential for differential settlements between the piers. In addition, the continuous steel superstructure will have sufficient flexibility to accommodate differential pier settlements without requiring adjustment in the height of the bridge bearings. Refer to drawing 865800-1000-42DD-3103 in Appendix B for the general arrangement of the west approach ramp and drawing 865800-1000-42DD-3107 in Appendix B of the RFP submission for the general arrangement of the east abutment.

The floating bridge will be transversely anchored to the lakebed by reusing the existing bridge anchors and installing four new anchors of a similar configuration on the east side of the crossing. The longitudinal anchorage of the floating bridge is provided by dead man anchors buried in the east approach embankment. The capacity of the existing anchors has been demonstrated by load tests carried out by the MoT. These results will be used as the basis for the anchor capacity in the design. Refer to drawing 865800-1000-42DD-3306 found in Appendix B of the RFP submission for details of the anchor system.

3.3.3.3 Seismic Considerations

The foundations and anchors of all structures will be designed to resist the force effects of the 475-year return earthquake event and the predicted soil displacements of the extreme 1,000-year return earthquake event.

Notwithstanding the above, there are some potential effects of the extreme earthquake event, which may require measures in the design to mitigate these effects.

First, the steep slope and loose soils of the lakebed indicate a potential for the loss of one or more pontoon anchors in a lakebed slide during an extreme earthquake event. To mitigate this potential effect the pontoon design will ensure that a temporary loss of some anchors will not affect the stability of the floating structure for the expected environmental and operational conditions immediately after an earthquake. Where applicable, frangible links in the anchor cables may be used to ensure that an anchor carried away in a lakebed slide cannot damage the pontoon structure.

Second, there is potential for a slope failure at the east abutment that could cause a large displacement of the abutment westward towards the lake. In this case, the floating pontoon structure will have the flexibility to permit this displacement and temporary loss of capacity of the longitudinal anchorage. The details of the east transition span will be designed to ensure that the floating pontoons remain longitudinally tied to the east abutment during and immediately after such an event.

3.3.4 Design of Fixed Structures

The fixed structures apply structural solutions that have been commonly used for bridge structures in British Columbia and Canada. The application of these proven technologies and materials will ensure efficient designs that will produce durable long lasting structures.

Drawing 865800-1000-42DD-3201 in Appendix B of the RFP submission shows the typical cross-section and arrangement of the west approach ramp superstructure. The superstructure cross-section of the transitions spans will be similar.

3.3.5 Floating Bridge Design

3.3.5.1 Floating Bridge Analysis

The analysis and design of the floating bridge will be in accordance with subsection 3.2 ”Design Criteria,” developed for this project using the CHBDC as a basis.

The analysis of the floating bridge will include a dynamic wave analysis that will model the floating bridge with linear beam elements. Natural frequencies of the structure and dynamic wave-induced responses will be analyzed to determine the governing shear, bending and torsion along the bridge during an extreme sea state. In addition, the structural integrity of both the new and existing pontoon bridge structures during erection/decommissioning will be analyzed.

A global analysis of the floating bridge will model every structural component between the expansion joints at the bridge approaches. The global analysis will account for all relevant loads and construction phases as described in detail in subsection 3.2, Design Criteria, including both intact and damaged/flooded conditions.

The results of the dynamic wave analysis will be combined with the results from the global analysis of the pontoon structures to determine the governing load effects for design. Detailed design of the pontoons will use finite element analysis methods. A selection of finite element models will be developed to represent components of the structure. The combined load effects from the dynamic wave and global models will provide the input to the finite element analysis for the detailed structural design.

3.3.5.2 Pontoon Design

The floating bridge consists of concrete pontoons that will be designed and detailed using a watertight cellular construction. Typical arrangement and details of the pontoons are shown on drawings 865800-1000-42DD-3202, 3301, 3302 and 3303 found in Appendix B of the RFP submission.

The longitudinal reinforcement of the concrete pontoons, which resists horizontal and vertical bending of the continuous structure, will be post-tensioned strands supplemented with mild steel reinforcement. The longitudinal post-tensioning strands will be distributed in the top and bottom slabs and the exterior walls of the pontoons. Similarly, the end walls of the pontoon string will include horizontal post-tensioning.

Individual pontoon sections will be connected together using post-tensioned bolts. The interface between the two pontoon end walls will be filled with grout after the connection bars are installed and grouted.

Drawing 865800-1000-42DD-3303 in Appendix B of the RFP submission, illustrates the typical compartmentation of a pontoon. The interior transverse walls separate the pontoon into watertight compartments that extend the full width of the pontoon. Each watertight compartment is accessible through a watertight hatch in the top slab. Each cell of a watertight compartment will be accessible through a man-way door in the longitudinal walls, and in certain cases catwalks will be provided in the compartments to ensure cells are accessible. The Design Criteria in subsection 3.2 above include load conditions that assume a pontoon is damaged and compartments are filled with water. The permissible stresses for the damaged and water-filled condition will be limited to prevent damage to and flooding of adjacent compartments which could otherwise lead to a progressive sinking of a pontoon string.

3.3.5.3 Anchor System and Construction Sequence

The permanent anchor system for the new floating bridge is shown in drawing 865800-1000-42DD-3306 in Appendix B of the RFP submission. A temporary anchor system for when the new pontoons are supported laterally from the existing bridge is shown in drawing 865800-1000-42DD-3307 in Appendix B of the RFP submission.

The construction sequence for the new pontoon is shown in drawings 865800-1000-42DD-3304 and 3305 in Appendix B of the RFP submission.

3.3.5.4 Floating Bridge Details

Where the roadway and pedestrian sidewalk are on the top slab of the pontoon, the bridge parapets and railings are used as wave walls to manage wave overtopping the road and sidewalks.

As described above, access for maintenance is provided to every cell of every watertight compartment of the pontoons. Procedures to monitor the integrity of pontoons will include regular maintenance inspections of the interior of each watertight compartment.

3.4 GEOTECHNICAL DESIGN

3.4.1 Introduction

This section presents our geotechnical design concept for the proposed Okanagan Lake Bridge. It is understood that the existing bridge is to be replaced by a new five-lane bridge. Our proposed bridge location is to the immediate north of the existing bridge and would include a west approach embankment, an elevated fixed bridge structure with a navigation channel near the west abutment of the current bridge, a floating central section, an east abutment and east approach embankment.

We have reviewed the geotechnical design reports and drawings for the MoT Base Design. Our geotechnical specialist, Trow Associates Inc. (formally Macleod Geotechnical Ltd.), carried out the original geotechnical design and analyses for the MoT Base Design and is therefore very familiar with the design considerations. The relevant geotechnical design issues are as follows: the presence of soft compressible soils and their low shear strength; the potential liquefaction of subsoils together with deformation of slopes and the lake bottom during a large seismic event; the capacity of pontoon anchors in loose or soft soils; and the selection of a possible graving dock for construction of pontoons.

Any added loading from new fill or foundations will cause large settlements due to consolidation of the compressible soils, found especially on the west side of the lake. Also, the soft soils have very low bearing capacity to support the bridge foundations. The following subsections address these design issues and provide brief description of our design concepts.

3.4.2 Subsoil Conditions

The Macleod Geotechnical report dated June 30, 2001 (MGL report) indicates that the subsoils below the lake bottom consists of soft compressible normally consolidated lacustrine deposits followed by glacio-lacustrine sediments. The bedrock could be deeper than 180 m below the proposed bridge alignment.

The available test hole data indicates that the near-surface soil profile along the west approach consists of 3-13 m of thick-soft to firm-low plastic compressible silt followed by 7-12 m of thick-firm to stiff-low plastic silt, followed by 10-15 m of thick-medium-dense to dense-silty sand, followed by dense to very dense silty sand.

Subsoils near the east abutment consists of 5-15 m of thick, very loose to loose-silty sand and very soft to soft silt and clay, followed by 5-10 m of thick-medium-dense silty sand, followed by 5 to 10 m of thick-soft to

firm clayey silt; followed by 8-10 m of thick-medium-dense to dense silty sand, followed by 0-5 m thick-soft-sandy silt to clayey silt, followed by more than 45 m of thick-stiff-silty clay and clayey silt.

The existing west causeway and the east approach embankments were constructed using granular fill with silty sands, gravel, cobbles and boulders. Test hole logs and existing drawings indicate that this granular fill embankment has settled more than a metre over 40 years.

The silts and clays are compressible and have low shear strength. Any added loading from the new fill for the approach embankment or foundations will cause large settlements, which may be unacceptable. Also, the soft soils have very low bearing capacity to support the bridge piers on shallow foundations. Piling to support the bridge piers will require long embedment depths to achieve the desired capacity. Response of the lake bottom sediments and the slopes would have to be assessed for seismic design.

3.4.3 Geotechnical Investigation

Our proposed bridge location is to the immediate north of the existing bridge, similar to the MoT Base Design. A reasonable number of test holes have been drilled along this proposed bridge alignment in the past, and therefore, no additional subsoil drilling or geotechnical investigation is anticipated for this proposal.

3.4.4 Seismicity

The design criteria provided in the RFP documents state that the new crossing and the permanent works would be considered “Class I Facilities” that should remain open to emergency vehicles immediately after the design 475-year return period earthquake event and should not suffer sudden loss of load carrying capacity at the 1,000-year event.

Peak Ground Acceleration (PGA) values for firm ground at the bridge site, provided by the Geological Survey of Canada (GSC), are: 0.054g for 475-year event and 0.075g for the1,000-year return period earthquake. We are aware that a new GSC seismic model has been developed for the 2005 National Building Code. Our preliminary analyses with this new model indicate a marginal increase in liquefaction extent. Calculated displacements for the 1,000-year event are about two to three times more than those calculated for the 475-year return period earthquake. Our preliminary analyses also show that the bridge and approach structures would be able to tolerate these larger displacements without severe consequences or collapse. We will review the revised seismic parameters in more detail after formal release of the seismic model by GSC.

For the Base Design, representative earthquake time histories for the 475-year event were obtained using a seismic de-aggregation analysis. Similar procedures will be used for obtaining five representative 1,000-year event for both near and far field events. These time histories will then be used in the dynamic analysis of the soil structures and slopes, and to confirm that the 1,000-year event will not cause sudden loss of capacity of the foundations.

We have carried out a preliminary assessment of subsoil liquefaction using the seismic parameters provided in the GSC OF 4459. The extent of subsoil liquefaction is still somewhat limited and sporadic. Dr. Byrne recommends that for the 1,000-year seismic event the design displacements be increased by a factor of 2.4 from those calculated for the 475-year seismic event. We have reviewed these displacements and are in agreement with the recommendations. Our assessment indicates that the bridge components and the approach structures would be able to tolerate the resulting displacements without significant damage.

3.4.5 Design Methodology

3.4.5.1 West Approach Embankment

The proposed approach embankment will be similar to the one described in the MoT Base Design. This embankment will reduce the overall cost of the structure, as the cost of the embankment is less than a bridge structure. The height of the proposed embankment will be in the order of 10 m above the lake bottom near the west abutment. If the embankment is constructed using earthfill, very large settlements – more than a metre – will occur over the long term. Further, there are concerns with the stability of a high embankment during construction, and the required time for staged construction. To resolve these concerns, a lightweight fill such as expanded polystyrene (EPS) will be utilized. The proposed construction procedure for the embankment includes the placement of a rock fill embankment up to the high water level (staged construction may be required in order to avoid failure), preloading of the embankment with a surcharge of 2.5 m for at least six months, the removal of surcharge to approximately high water level and the construction of EPS fill with vertical protective pre-cast concrete panels.

It is understood that construction and monitoring of the preload for the west approach embankment will be carried out by others and not included within the scope of this proposal. However, we will have to review all engineering reports and site instructions related to the construction and monitoring of the preload and settlement. The schedule for preload removal will be determined following a review of settlement records.

3.4.5.2 Foundations for the West Abutment and Bridge Piers

As the foundation soils are too weak to support the bridge piers on spread footings, we propose to support the west abutment and piers on pile foundations. The required size and embedment depth of the piles will be calculated based on structural demand and settlement tolerances. Results of the pile load test and the recommendations given for the Base Design will be reviewed for the pile design. The axial capacity of the piles will be calculated using the "LCPC procedure (using cone penetration test data)," as it has closely matched the results of the load test, and reviewed with other methods, such as "beta" and "wave equation" analyses. Reduction in axial capacity due to potential subsoil liquefaction will be assessed, although the reduction is expected to be marginal. Lateral loading response analysis of the pile foundations for seismic inertial, wind, wave and ice loading will be carried out using the 3D computer program GROUP. Potential down-drag on the piles near the new fill will also be assessed.

3.4.5.3 Lake-Bottom Slope and Pontoon Anchors

Stability and potential movement of the lake bottom slope due to seismic loading are likely to be critical for the west side piers. Limit equilibrium and dynamic numerical analyses will be carried out and the earlier analyses for the Base Design reviewed. Dynamic analysis will be carried out with representative 1,000-year return period time histories, with concurrent liquefaction triggering evaluation to ensure that sudden collapse of the bridge will not take place under this severe design event. Soil parameters for the analyses will be obtained from the existing cone penetration test (CPT), cyclic simple shear, shear wave velocity and standard penetration test (SPT) data.

The passive capacity of the pontoon anchors and the movement of the lake bottom during the design seismic event may be critical for the performance of the bridge. The existing anchors are founded in the lake bottom, which has slopes of up to 16 degrees. Seismically induced slope movement of up to 300 mm was calculated for the design 475-year event. Calculations will be carried out to estimate the movements for the 1,000-year event.

3.4.5.4 East Abutment and Approach Fill

Our proposed location of the east abutment is to the immediate north of the existing abutment and will require an approach embankment. The subsoils in this area consist of very loose to loose silty sand and very soft to soft silt and clay of 5-15 m near the surface. Foundation bearing capacity and settlement of the new approach embankment are of concern. We propose to use pile foundations to achieve the required foundation capacity. A preloading program with a three-to-six-month duration will be used to reduce the

post-construction settlement of the embankment. Our preliminary assessment indicates that the preload program described in the Base Design will be sufficient for this purpose.

3.4.5.5 Pavement Design Criteria/Methodology

The pavement design will be carried out in accordance with applicable sections of AASHTO (1993) "Guide for Design of Pavement Structures," "Technical Circular T-01/01 Pavement Structure Design Guidelines" and design criteria as defined in Section 3.8, Part 1 of Section 5 of the Definitive Concession Agreement, dated November 22, 2004. Our analysis indicates that the pavement design for the Base Design is satisfactory. All pavement sections will be constructed to the MoT Standard Specifications for Highway Construction (2004 - latest edition) and "Section 3, Paving" of the Special Provisions for the Okanagan Lake Bridge No. 1458 Contract B/C.

3.4.5.6 Graving Dock

A graving dock will be required at Bear Creek North for the construction of pontoons. Excavation and sheet pile shoring for the graving dock and dredging of the lake bottom will be carried out in accordance with the applicable environmental authorization requirements. A geotechnical design for the graving dock will be prepared following a review of the test pit and drill hole data.

3.5 ROADWAY DESIGN

3.5.1 Design Criteria

The preliminary roadway design, in general, conforms to the Transportation Association of Canada (TAC), Geometric Design Guide for Canadian Roads (1999), BC Supplement to TAC Geometric Design Guide 2001 Edition, Pedestrian Crossing Control Manual for British Columbia (2nd edition, 1994), and the Standard Specification for Highway Construction, Volumes 1 and 2, 2004. Table 3-10 Design Criteria shows the minimum roadway design criteria specified in the Functional Requirements and the achieved design criteria for the preliminary roadway design. Where the design criteria deviates from the reference guidelines, the minimum criteria are shown in brackets in the table. These variances are necessary due to geometric constraints associated with the available construction right-of-way.

Drainage design criteria conforms to CAN/CSA S6-00 and Table 1010 A in the BC Supplement to TAC Geometric Design Guide, except as follows:

- Storm water design flows will be calculated using Kelowna Airport Rainfall Intensity Curves, produced by Atmosphere Canada, with the 10-year return period curves increased by 10%

- Ponding for bridge roadway, from abutment to abutment, will be limited to a maximum of 1.8 m beyond the parapet face or 1.2 m beyond the lane line
- Ponding for approach roadway will be limited to a maximum of 1.2 m beyond the face of parapet
- Sidewalk drainage on the bridge, from abutment to abutment, will drain back to the parapet and not be directed over the outboard edge of the sidewalk

3.5.2 Traffic Analysis

In preparing the preliminary roadway design, we have reviewed the traffic analysis carried out on behalf of the MoT; in particular, the Comprehensive Traffic Report dated May 2004 prepared by Halcrow Group Limited with TSi Consultants. No additional traffic analysis is proposed except for minimal traffic counts at Abbot Street intersection as necessary for design.

Table 3-10: Design Criteria

Criteria	Station 26+60.00 to 28+40.00 Design Speed 60 km/h		Station 28+40.00 to 43+25.00 Design Speed 60 km/h		Station 43+25.00 to 45+77.00 Design Speed 50 km/h	
	Specified in RFP	Achieved in Proposal	Specified in RFP	Achieved in Proposal	Specified in RFP	Achieved in Proposal
Classification	UAD	UAD	UAD	UAD	UAD	UAD
Minimum Radius	130 m	200 m	130 m	145 m	90 m	135 m
Minimum K Factor	C:8 S:9 [C:13 S:17]	C: n/a S: 37.7	C:8 S:9 [C:13 S:17]	C: 13.0 S: 11.7	C:8 S:6 [C:8 S:12]	C: 37.0 S: 15.5
Maximum Grade	6% on 'L' line	0.9%	6% on 'L' line	6%	6% on 'L' line	1.87%
Maximum Superelevation	6% Intersections 4%	6%	6%	6%	6% Intersections 4%	6% Intersections 4%
Minimum Stopping Sight Distance (Crest or Sag)	85 m	90 m	85 m	85 m	65 m	150 m
Decision Sight Distance	115 m [170-230m]	115 m (n/a within the given Sta. range)	115 m [170-230m]	115 m	110 m [140-190m]	110 m
Lane Width	3.6 m	3.6 m	3.6 m	3.6-4.0 m	3.6 m	3.3-4.0 m
Outside Shoulder Width	2.0 m	0.6-2.0 m	0.6 m	0.6 m	0.6 m	0.6 m
Inside Shoulder Width	1.0 m	0.6-1.0 m	0.6 m	0.6 m	0.6 m	0.6 m

Median Width	1.8-2.6 m	1.8-2.6 m	1.8-4.6 m	1.8-4.6 m	Varies to 7.10 m	1.5-7.1m
ROW Width (Minimum)	Utilize existing	Utilize existing	N/A	N/A	3.0m Outside Toe on North side and 2.0m Outside Toe on South side	3.0m Outside Toe on North side and 2.0m Outside Toe on South side
Design Vehicle	WB-20	WB-20	WB-20	WB-20	WB-20	WB-20 and as per Dwg A-TURN 2 at Abbott St. intersection

3.5.3 Roadway Concept

The Okanagan Lake Crossing will provide a five-lane divided roadway for three westbound lanes and two eastbound lanes, with a single 3.0 m sidewalk for pedestrian and cyclists on the south side of the bridge structure. The limits of construction are from STA. 26+60, east of the Campbell Road intersection, to STA. 45+77 east of the Abbott Street intersection. Center median barriers and concrete curb and gutter raised medians are provided to separate opposing traffic flows. Pedestrians and cyclists will be separated from traffic by a bridge parapet, or roadside barriers with a safety fence that meet the Ministry's standards.

3.5.3.1 West Approach

The west approach will tie in to the Province's section to the west, which will be constructed by others. The west approach is a 60 km/h design speed section with five 3.6 m lanes, a 1.8 m divided median, and 0.6 m shoulders with roadside barriers. Pathways are provided on both sides of the highway. The causeway fill and preload for the west approach will be completed by others. Embankment in the preload area will be constructed using EPS lightweight fill from STA. 27+80 to STA. 29+45 and retained by concrete panel walls on the north and south side of the embankment. The embankment height is approximately 10 m at the west abutment, located at approximately STA. 29+47.

3.5.3.2 Navigation Channel Crossing

There will be uninterrupted traffic flow with a navigation channel crossing at STA. 32+00. The vertical crest curve at the summit of a 6% grade will provide a navigation channel clearance envelope 44 m wide by 18 m high above the high water elevation of 342.52 m. The roadway on the bridge structure will have five 3.6 m lanes, a 1.8 m divided median, and 0.6 m shoulders, and a 3.0 m sidewalk located on the south side.

3.5.3.3 East Approach and Roadway

The east approach is a 60 km/h design speed section transitioning to 50 km/h beyond STA. 43+25. The east roadway will consist of five lanes with concrete curb and gutter and a 1.5 m to 7.1 m wide raised median. Pathways will be provided on both sides of the highway with an underpass located at approximately STA. 40+72.

3.5.3.4 Abbott Street Intersection

The existing signalized intersection at Highway 97 and Abbott Street will be improved to provide the following lane configurations:

- A dedicated right-turn lane, two dedicated left-turn lanes, and two through lanes for eastbound Highway 97 traffic
- One shared through and right-turn lane, two through lanes, and no left-turn lane for westbound Highway 97 traffic
- Two dedicated right-turn lanes for the southbound Abbott Street approach, with no left-turn or through movements
- One dedicated right turn for the northbound Abbott Street approach, with no left-turn or through-traffic lanes

Intersection turning movements will accommodate design vehicles BU-5 and WB-15 for the two left-turn lanes for eastbound Highway 97 traffic, and the two right-turn lanes for southbound Abbott Street traffic, as shown in the laning and geometrics drawing. A pedestrian-actuated crossing on the east side of the intersection will be coordinated with the left-turn signal phase.

3.5.3.5 Drainage

Storm water runoff will be collected by a storm sewer system comprising catch basins, storm sewers, manholes and clean outs. The storm sewers are from 200 mm to 450 mm diameter in size. At the west approach the storm water will flow through a sediment and oil interceptor before discharging out to Okanagan Lake. Sizing of the west approach storm sewer, including the sediment and oil interceptor, will take into account runoff from the Province's section as required. The east approach storm sewers will tie in to the City of Kelowna storm sewer system.

3.5.3.6 Roadway Right-of-Way

The roadway will be constructed within the proposed highway right-of-way shown in the drawing prepared by Patrick Ringwood Corporation supplied by the Ministry. The configuration of the Campbell Road

intersection and land negotiations with First Nations have not been finalized by MoT, but we understand that construction of the west approach can be accommodated within the right-of-way.

3.5.4 Accommodation of Pedestrians and Cyclists

The preliminary roadway design provides free, safe and uninterrupted pedestrian and cyclist traffic throughout the entire project, from the west approach to the Abbott Street intersection on the east side. Starting at the west approach, pathways will be provided on both sides of the highway for access to the Campbell Road intersection. A pathway crossing under the bridge structure at the west abutment will allow pedestrians and cyclists access to the sidewalk on the south side of the bridge. The sidewalk provided on the bridge is on the south side only, 3.0 m wide and extends from the west abutment to the east abutment. Bridge parapets and bicycle railings will be provided on both sides of the sidewalk to protect pedestrians and cyclists. Where required, the sidewalk will be protected from wave overtopping by a concrete wave wall.

Access at the east end of the new crossing will be via pathway along each side of the highway, accommodating pedestrian and cyclist from the underpass at approximately STA. 40+70 to the sidewalks at the Abbott Street intersection. The access will also tie in to the existing promenade walkways within Kelowna City Park. The underpass will have minimum cross-section dimensions equivalent to the Province's proposed design. Lighting will be provided for the underpass.

3.5.5 Safety

3.5.5.1 Design Safety Performance Analysis

Our design for the Okanagan Lake Crossing meets the "Design Safety Performance" threshold level estimated by De Leur Consulting Ltd. in March 2004 for the "Base Design" scenario. Paul de Leur's analysis applies collision prediction models and collision modification factors to estimate the safety performance of the Province's design. The techniques for evaluating safety performance allow for a systematic and objective evaluation of the relative impact of several traffic and design parameters. Our design provides the same parameters as that of the input data for the Base Design. These parameters include traffic volume, lane width, shoulder width, shoulder type, horizontal curve data, spiral data, super-elevation, grade, access frequency, number of lanes, roadside hazard index and median treatment.

3.5.5.2 Road Design Safety Audit

The safety audit will typically be conducted in a six-step process. Step 1 will consist of a start-up meeting, bringing together the road owner, the design team and the safety audit team. Information will be exchanged

during this meeting and the design drawings that are to be audited will be handed over to the audit team, along with any supporting reports and data. Steps 2 to 4 will involve the safety audit, starting with a site visit and finishing with an audit report that highlights safety issues and provides alternatives that may be considered by the design team to improve the safety performance of the design. Step 5 will be a presentation of the audit findings and report. In Step 6, the design team and road owner will jointly review the audit report in detail to assess the need to make any changes to the design. A brief report will then be prepared by the design team, outlining what action will be taken in response to each audit finding. Road safety audits will be performed at preliminary submission, 60% design, 100% design, and pre-opening stages.

3.6 ELECTRICAL DESIGN (INCLUDING UTILITIES)

3.6.1 Introduction

All electrical designs will be undertaken in accordance with the Canadian Electrical Code (CEC) and the Ministry of Transportation Electrical and Traffic Engineering Design Manual.

This section is to be read in conjunction with the drawings contained in Appendix B of the RFP submission, in particular drawings 865800-1000-47DD-4101, 4102 and 4201.

3.6.2 Power Supply

We anticipate a new pad mount utility transformer at the east end of the bridge to replace the primary service and reuse of the existing utility transfomers100A-120/240V service at the west end. The new utility transformer will be a 150kVA to 300kVA, three-phase, pad-mount type, depending on utility requirements.

3.6.3 Lighting Levels and Arrangement

Lighting on the roadway will be designed to IESNA RP-8-00 using the illuminance design method. Illumination levels and uniformity will be in accordance with Part 1 of Schedule 5, subsection 3.14, “Lighting and Electrical,” from the Definitive Concession Agreement. Lighting levels and uniformity ratios are defined on the electrical drawings. Lighting may be adjusted to suit IESNA levels (from IESNA RP8-00) for the actual pedestrian conflict level (high, medium or low) and pavement type (R1, R2, etc). Pole spacing will be staggered, with poles mounted on the parapets, generally at the locations as shown in the electrical drawings. Lighting on the bridge sidewalk will be to an average maintained illumination not less than the IESNA recommendation of 4 Lux (Table 7, IESNA RP-8-00). Roadway lighting will be provided using high-pressure sodium luminaires.

Pedestrian and cyclist access from the promenade walkway entrance at the Kelowna City Park to the sidewalk on the bridge will be illuminated to an average horizontal maintained level of 5 Lux as per Figure 22-10 in the IESNA Lighting Handbook. Full cut-off optics will be used to reduce offsite obtrusive lighting impacts on local residents. The pedestrian tunnel will be illuminated to an average maintained level 43 Lux as per Figure 22-10 in the IESNA Lighting Handbook. Lighting in the pedestrian underpass tunnel and park promenade walkway will be via metal halide for improved color rendition and visibility. Lighting fixtures will be a vandal resistant type.

The navigational channel will be marked via red and green LED lights channel marker lights. Floodlights will be used to illuminate the piers at each end of the navigable channel and end of floating pontoon section. Daymarker signs will be mounted on pier faces at end of the navigable channel. Every second set of piers on the pontoon sections will be marked with 10W LED markers.

3.6.4 CCTV

The CCTV system is an important element of the bridge operations system. The number of cameras to be provided will ensure adequate coverage for gathering data log information and add a level of redundancy in the event of a camera failure. The CCTV system will perform the following multiple functions:

- Be used by maintenance personnel to detect incidents and improve response times
- Record performance elements such as lane availability and safety for Ministry audit
- Offer the capability for still images to be posted on the Ministry Highway Conditions website to provide road condition information for the general public

The CCTV system riser diagram defines system components in drawing 865800-1000-47DD-4201 found in Appendix B of the RFP submission. The CCTV system will consist of 12 east-facing day-night cameras and one pan-tilt-zoom (PTZ) camera mounted on special arms on the luminaire poles. CCTV coverage will extend from Campbell Road to Abbott Street. Cameras will be connected via fibre cable, which will run to the camera head end equipment. The head end camera equipment will be housed inside a kiosk located at one end of the bridge. The system will store approximately 45 days worth of digital video from every camera, which will be permanently archived for long-term storage and offsite review. Digital images will be recorded every 90 seconds and time- and date-stamped for permanent record. This will allow both the Concessionaire and the Province to review and audit performance elements such as lane availability and safety.

The system will also be capable of posting still images to the MoT public website. This will allow the public to view real-time images of road conditions.

Authorized maintenance personnel will be able to monitor traffic, review incidents, and control the PTZ camera from a remote location. Password-authenticated user groups could be created to provide various personnel different types of access rights. Access to cameras could also be provided to the MoT Provincial Highway Communications Centre to allow monitoring of operations as part of their province-wide program.

3.6.5 Traffic Signals

Traffic signals will be designed to MoT standards. The existing signal at Harvey will be modified to suit roadworks and widening. Preliminary pole locations are shown in the electrical drawing 865800-1000-4700-4202 in Appendix B of the RFP submission.

3.6.6 Measurement and Monitoring

3.6.6.1 Traffic Detection and Monitoring

Measurement and monitoring will include recording of traffic volumes via detector count stations as well as lane availability and safety, which will be provided by the CCTV camera system as described above.

Traffic volumes will be recorded via two permanent traffic count stations. Loops will be installed in each lane on Highway 97 west of Harvey and east Campbell Rd. The loops will measure traffic volumes and since traffic can neither enter nor exit the Highway between these points these detection stations will detect and record volume. Lane availability and safety performance will be recorded, and time and date stamped on still images captured from the CCTV system. In the event of power outages traffic count stations and CCTV system will be backed up via a UPS system.

The proposed system will use a field-proven video detection technology to process real-time video images captured from the pole-mounted CCTV cameras. The detection zones will be located along the bridge surface within the 400 m maximum spacing specified. The detection system will collect time-stamped data, including vehicle counts, speed, lane occupancy, volumes, vehicle classification, and incident detection. This data can be remotely collected to an off-site computer via the Internet. The collected data can then be correlated back to the recorded digital video for incident review/analysis. The data can also be exported into a Microsoft Excel spreadsheet format for different types of performance analysis.

Digital records of traffic counts and digital images will be stored and maintained by the Concessionaire and made available to the Province for audit purposes.

3.6.6.2 Strong Motion Seismograph Instrumentation

Strong motion seismograph instrumentation that is Internet-capable will be installed to monitor and record seismic activity on a continuous basis. This equipment will include a recorder and four sensors, with one sensor located at each of the two approaches and the remaining two at locations on the New Crossing structure. Actual locations will be determined in conjunction with the Province. Data will be recorded and will be accessible to offsite locations via the Internet.

3.6.6.3 Anemometer

An anemometer will be installed at mid-span on the New Crossing to record wind speed. This device will be mounted on a custom bracket on a luminaire pole such that it will be 10 m above the bridge deck. A datalogger will be installed in a weatherproof enclosure on the bridge adjacent to the pole. A 12 V power supply will be provided for the logger and communications for data retrieval will be via cellular or landline telephone.

3.6.7 Communications

Communications will include 2-50 mm conduits for the entire length of the structure. Junction boxes will be cast into parapets for easy access and a 32 mm conduit will tie into each luminaire pole from the communications system junction box.

3.6.8 Utilities

Existing utilities include telephone, hydro, cable TV, gas, water lines and sewer lines. The existing utilities affected by the roadworks will be relocated to a standard location within the proposed right-of-way, in accordance with MoT utilities policy. All utility companies will be contacted at the preliminary design stage, and approvals will be obtained prior to any relocation or adjustments. Appropriate protection measures will be implemented to avoid damaging utilities during construction. During construction, temporary utility requirements will include hydro and telephone to service the construction trailers. Sources for these temporary utility requirements will be existing utilities in the vicinity. Utility ducts will be provided in the bridge structure, and will accommodate utilities required for the New Crossing, for communications, and for future utilities.

3.6.9 Signing

Guide signage will include a new davit mounted sign at sta 42+00 EB (approx.) indicating “City Centre”. Service and Attraction signage will be relocated. Regulatory and warning signage will be relocated and where required new signage will be installed to meet the requirements of the Ministry Manual of Standard Signs and Pavement Markings.

3.6.10 Lane Control Devices

No lane control devices are anticipated on the New Crossing structure.

3.6.11 Interior Pontoon Lighting and Power

As a minimum, lighting will be provided in accordance with WCB requirements. Any additional requirements will be determined and addressed during the detailed design stage. Electrical outlets will be provided at each pontoon for convenient use by maintenance personnel.

3.7 AESTHETICS

The Okanagan Lake Bridge represents the western gateway to the City of Kelowna. The visual experience it offers to travellers as they approach from the western shore of Okanagan Lake is memorable, offering vistas of the lake, the City and its surrounding countryside. Views from the City, its eastern shore line and watercraft on the lake are equally important, given the visual prominence of the bridge and its floating pontoons as it stretches across the lake to provide this vital transportation link.

Our approach to the aesthetic treatment of the bridge is to recognize the many experiences the bridge and its approaches offer. This requires consideration of the macro level impacts in terms of overall form and scale, through to the micro level in terms of component design and the tactile experience. Of equal aesthetic significance is the urban repair associated with the new roadway approaches. In particular, the east side approach between the lake shore and Abbott Street, where the new alignment will encroach into City Park, and areas where decommissioning of the existing roadway will offer opportunities to create a new landscaped buffer with a shaded pedestrian walkway along Mill Creek, are of particular interest and require careful attention.

Our design submission follows the design basis provided in the RFP documentation. We concur with the decision to locate the navigational clearance spans on the west side of the lake. Not only does this location offer engineering advantages, but aesthetically, it sets the taller fixed span structure against the steeper

topography of the lake's west bank, thereby reducing the visual impact of the bridge's eastern approach in juxtaposition with the City of Kelowna.

It is our intention and expectation to work closely with our project partners both at the provincial and municipal level to further develop the aesthetic expression of the detailed design. Consistent with the design principles set forth in the Manual of Aesthetic Design, the Official Community Plan, Downtown Area Plan and other supporting design guideline publications, it is our intent to design and construct a bridge that is in harmony with Kelowna and its natural environment. To achieve this objective we plan to focus our design aesthetic effort on the following issues:

3.7.1 East Approach

City Park Restoration – The new road alignment will, among other things, encroach on the existing athletic track. Relocation of the track is not addressed in current plans and will require design coordination with respect to its interface with the new roadworks.

Underpass Design – Crime Prevention Through Environmental Design (CPTED) principles will need consideration for the new underpass. Currently its narrow width creates an inhospitable environment that, if not treated properly, will deter pedestrians. Since it is the main pedestrian connection from the north to the walkway on the bridge, its importance and design must not be overlooked.

Mill Creek Buffer Restoration – Restoration of the decommissioned section of road offers opportunity to introduce new landscaping and a new pedestrian pathway that will run along Mill Creek to Abbott Street. Lighting and CPTED issues will be considerations during the final design

Gateway Articulation – The east approach represents a gateway both to Kelowna and the downtown. Although the Downtown Plan calls for Abbott Street to be expressed as a gateway, articulation of how this might be achieved is not indicated. We propose to coordinate with the City and Province to explore the opportunities that may be realized.

3.7.2 Bridge Section

Lighting – Lighting along the bridge must respond to both vehicular and pedestrian needs.

Materials and Finishes – Detailing of the roadway and the pedestrian realm will consider maintenance and lifecycle costs, yet should aim to be more than utilitarian in nature and aesthetic expression.

3.7.3 West Approach

Shoreline – Realignment of the west approach will raise issues similar to the east. Care must be exercised in the design treatment of the restored areas and embankments.

3.8 RIGHT-OF-WAY

As outlined in Section 3.0 of this proposal, our Base Design is identical in concept to the Province's Base Design. Accordingly, all facilities for the New Crossing will be constructed within the proposed right-of-way, and our design will not require any land outside this proposed right-of-way.

3.9 DURABILITY

3.9.1 Bridge Deck Design

The roadway decks for the bridge structures will use a wearing surface that is monolithic with the structural concrete deck. The deck design will allow for milling and the application of a concrete overlay if needed in the future to rehabilitate the wearing surface.

For the purpose of this proposal, a Base Case concrete road deck design was prepared as described below. This Base Case deck design has a predicted service life of 77.5 years using the ACI Life 365 model, Version 1.1, using the following parameters:

- Exposure – Urban Highway Bridge, Kelowna
- Maximum surface chloride concentration = 0.68% by weight of concrete at 35 years
- Type of rebar: uncoated for both upper and lower layers of deck reinforcement
- Design water cement ratio for deck concrete: 0.38
- Design supplementary cementing materials: 20% fly ash, 5% silica fume
- Cover and specified placing tolerance: 70 mm per CHBDC, Table 8.11.2.2, specified tolerance for placing the top mat will be +5 mm/–5 mm – hence, minimum cover is 65 mm
- Corrosion inhibitors: not used
- Deck membrane and overlay: not used
- Volumetric percentage of deck reinforcing: 2%

Higher proportions of supplementary cementing materials, such as silica fume and fly ash are permitted, and may be used in the final design. However, for the purpose of service life predictions, the maximum fly ash content will be 25% of total cementing material and the maximum silica fume content to be considered will be 5% of total cementing material.

The 70 mm cover is the minimum permitted by CHBDC, Table 8.11.2.2. However, the final design may allow larger placing tolerances than the +/-5mm indicated based on the final concrete mix design.

The deck design described above uses low permeability, low diffusity concrete with adequate cover as the method of protection against corrosion of the reinforcement. Using a high performance concrete mix design further enhances the protection provided. As indicated above, the service life predicted by the ACI Life model indicates that this deck design should not require repairs due to corrosion of steel reinforcement and resulting concrete delaminations during the 75-year service life of the structure.

The ACI Life model recognizes some benefit in the use of epoxy-coated bars, specifically that the propagation life of the epoxy-coated bars after initiation of corrosion is estimated to be 20 years in comparison to six years for uncoated bars. The requirements of Part 1 of Schedule 5, Section 3.3.1 (c) specifically negate this benefit, which reflects previous findings that epoxy-coated bars do not perform significantly better than uncoated bars. If this requirement of Part 1 of Schedule 5, Section 3.3.1 (c) is omitted from the ACI Life prediction model, the use of the high performance concrete would still be required with epoxy-coated bars to provide the 75-year service life. Consequently, using epoxy-coated bars, if requested by the Province, will have no effect on the proposed deck design, other than increased supply and installation costs.

3.9.2 Roadway Design

The proposed asphalt pavement thickness is in agreement with MoT's current guidelines for a Type A Road with a 20-year ESAL value of more than 1 million. MoT typically expects to provide an overlay after 10 to 15 years in its lifecycle costing. Due to the course of natural surface wear over time, we expect that a minimum 40 mm hot mix asphalt overlay or mill and infill will be required approximately every 15 years to bring the surface back to an acceptable condition.

Asphalt and aggregate construction materials and placement procedures will be used in accordance with MoT requirements, which have been shown to reasonably control issues such as premature surface wear, rutting, surface roughness and potential stripping problems.

4.0 CONSTRUCTION METHODOLOGY

Our Solution

- Construction team with extensive experience in concrete floating structures, graving docks, bridges and road construction
- Proven construction methods and practices to enable efficient, on-time construction delivery, to MoT quality standards
- Construction of the pontoons considered a critical path activity – dry-dock construction optimized using traditional and pre-cast construction and then float the pontoons to a temporary mooring for completion, prior to towing and installation
- Planned traffic lane closures limited to evening and overnight periods, to minimize traffic impacts
- Major lifts predominantly from the water, to avoid traffic impacts

4.1 GENERAL APPROACH

The proposed new crossing of the Okanagan Lake is of relatively unique construction, and the SNC-Lavalin team has the expertise and experience within its construction team members to complete this project. Our team experience is derived from the completion of many projects of similar construction types, including concrete floating structures, major bridges and roadworks. The construction methods identified in this proposal are consistent with past practices and in many cases have been developed or undertaken by members of the team.

4.1.1 Foundation Preparation

4.1.1.1 East Abutment

The east abutment consists of a pile-supported reinforced concrete footing and abutment wall. The footing detail includes four pairs of Dywidag anchors tied back to a concrete deadman buried in the bridge end fill material. The bridge end fill material will meet MoT specifications (75mm minus) and will be placed and compacted to 100% std. proctor density. The anchor tiebacks will be supplied by Dywidag Systems, who will also provide construction supervision for the installation and tensioning. Access to the east abutment worksite will be along the edge of Kelowna Park, which is the same route used previously to place causeway fill material (see subsection 4.2, Construction Staging).

4.1.1.2 West Abutment

The west abutment consists of a pile-supported reinforced concrete footing and abutment wall. The abutment wall meets at its north and south sides with a pre-cast concrete wall system in-filled with expanded polystyrene (EPS) blocks and retained with horizontal anchor ties. The EPS-filled wall and the abutment footing are constructed on the previously placed causeway fill and preload material. After the preload is removed, construction of the EPS wall footings, pile driving and abutment footing work can proceed. Access for all of the work on this west abutment is via Highway 97, as described in the Traffic Management Plan (subsection 4.3 below) for the west abutment.

4.1.1.3 Piling

Pile installation is required at the east and west abutments and for the five piers supporting the fixed portion of the bridge. Pile driving for the abutments will be completed with a land-based crawler crane utilizing suitable diesel hammers to achieve penetration and capacities required. Bridge pier piles will be installed into prefabricated pile templates placed and secured by waterborne equipment. The long piles will be installed in lengths suitable to satisfy both equipment limitations and lakebed elevation and penetration requirements. Once the piles have been started and driven down to template level, additional pile lengths will be spliced on until the overall length is achieved. Upon completion, piles will be cut in preparation for pier construction. We anticipate a diesel hammer in the range of a Delmag D80 will be required to achieve final set and tip elevation.

4.1.2 Extent of Prefabrication

To expedite the construction schedule, extensive use of prefabrication will be employed. This approach will enable work to proceed concurrently at several worksites and will also facilitate quality control. The following items are proposed for prefabrication:

- Floating pontoon sections complete with superstructure
- Pre-cast concrete elements for abutment side walls and pontoons as applicable
- Structural steel for west approach and transition spans
- All embedded metal, railings, fences and other miscellaneous steel items
- Anchors, anchor cables and pendants

4.1.3 Major Lifts

Major crane and barge lifts are required both in the construction of the new bridge and in the decommissioning of the existing bridge. Equipment and lift sequencing will be coordinated to avoid crane booms from encroaching over the existing bridge deck, thereby avoiding potential road closures. Operations will be conducted using a combination of both land-based and water-based cranes, with the latter located on derrick barges.

Major lifts on the new bridge involve erection of major steel components on the west approach and pontoon sections, pitching and pile driving of large-diameter piles for the west approach, installation of new anchors and counterweights, and miscellaneous components of both steel and concrete in the transition sections of the new bridge.

During decommissioning of the existing bridge structure, sequencing of the major lifts will be carefully engineered and planned. This work will include such tasks as removal of the transition steel truss span on the west approach, involving barges and hydraulic jacks, and demolition of the lift span steel bridge sections and towers. We intend to remove these components in large sections, both to reduce time and ensure the safety of the new bridge structure.

4.1.4 Use of Floating Equipment

Because of deep water across most of the lake, floating equipment needed during the construction and demolition will be secured by temporary anchors attached to wires and manoeuvred by winches on the derrick barges. These barges will be fully manoeuvrable. In shallower water, spuds or pipe piles will be used to secure the barges.

Derrick barges will be fully equipped workstations, complete with cranes, winches, compressors, welders, lunchrooms, generators and other necessary equipment. These barges will support operations at the graving dock and other offsite operations, as well as pile driving and servicing of all the marine-based operations onsite.

At least two derrick barges are required, especially during installation and removal of the new and old anchor cables. For the purpose of this operation, one derrick will be located on the north side of the bridge and one on the south side. In particular, it will be important to have one derrick positioned south of the bridge, just before the last pontoons are installed and navigation from the north side of the bridge is blocked. The southern derrick will be needed to commence dismantling of the existing bridge.

4.1.5 Concrete Forming Techniques

Forming techniques for this project can be divided into two sections. The first is traditional bridge construction on the west and east approaches to the floating pontoon sections, and the second is the construction of the floating pontoon sections.

4.1.5.1 Traditional Bridge Construction

The east and west abutments will be formed and poured using traditional wood forming techniques common to such structures. The west approach structure will be constructed from the water, utilizing water-based and shore-based equipment to form and pour the piers. The pier shafts will utilize steel forms that will function as form support, and falsework. Pier formwork will consist of prepared falsework and wooden soffit forms for the pile caps, which will be just above the water line. The pier skirts, which will extend below the water level will be pre-cast units, will be attached to the pier cap above the water line. The bridge deck will be formed and poured in place utilizing both pre-cast deck panels or wooden forms suspended from the steel girders and set to the elevations required to accommodate deflections and grades required in the bridge profile. Once the bridge deck has been completed, the parapets will be formed and poured, accommodating all ducting for utilities.

4.1.5.2 Pontoon Construction

Pontoon construction will be a critical path schedule item; care has been taken to streamline construction methods and adopt strategies that maximize concurrent working. Since the graving dock facility can handle only one pontoon at a time, our approach is to complete all pontoon elements in the dock to a point where the pontoon is ready to float out. The unit can then be towed to an adjacent temporary mooring and completed, while work on the next pontoon begins in the dock facility.

The graving dock facility will be laid out to accommodate both free-forming and pre-cast construction. Traditional concrete construction will be utilized for the outer shell of the pontoon where overall integrity and water tightness of the structure is most critical. The focus will be to use gang forms and other prefabricated panellized forming techniques to minimize forming durations. Pre-cast construction will be used as much as possible elsewhere, in order to meet the schedule demands. Where pre-cast methods are utilized, proper joint preparation and concrete placement will be used as previously developed by the construction team to ensure water tightness. This will involve the use of key-ways, waterstops, bonding agents and other necessary procedures.

The perimeter walls and base slab of the pontoons will be constructed using traditional forming techniques. Interior walls will be pre-cast to the maximum extent possible, set in place and cast in with the base slab

and perimeter walls. Upon completion of the planned work in the graving dock, the pontoon units will be floated and towed to a temporary mooring location, where the remainder of the work will be performed. This may include a combination of installation of pre-cast concrete deck panels and poured-in-place concrete. Once the concrete has achieved its strength, the final post-tensioning and other superstructure elements will be completed as required, as well as some column and pier cap formwork construction similar to the traditional bridge construction on the west approach. Subject to final detailed scheduling, we have planned to erect the structural steel onto those pontoons requiring elevated decks. This may be completed at the temporary mooring location prior to final installation. The concrete road deck and parapets will be completed once the pontoons are in place, with the deck pours proceeding from west to east.

Gang forms and specialty forms will be pre-assembled in a prefabrication yard adjacent to the graving dock. The prefabrication area will consist of a pre-casting area, wood mill shop, welding area, and miscellaneous storage shops. Overhead cranes, forklifts and cranes will be required in this area to store and rotate forms and pre-cast elements to and from the graving dock.

4.1.6 Pontoon Connection and Installation

The pontoons will be constructed with keyways at either end to match up the adjacent pontoons and to facilitate the line-up and ballasting requirements. Connection will involve installing neoprene seals, ballasting the pontoon sections to similar levels, pulling the two pontoons together and connecting and torquing connection bolts located on the top section of the pontoons. Once the tops are connected, ballast will be placed on the opposite end sections of the pontoons to be connected to close the gap on the bottom surfaces, after which bolts will be installed to finalize the alignment and connecting details. Once the first two pontoons are connected, the two units will be towed into position and gently moored adjacent to the existing bridge, separated by spreader bars and moored by temporary barge positions to hold the units in place. The anchor installation and connection details will proceed as identified in Drawings 865800-1000-42DD-3304 and 3305 in Appendix B of the RFP submission. Connections to anchors will consist of a series of pendant wires prefabricated to predetermined lengths to minimize the time to install and adjust anchor wire tension. We plan on utilizing existing anchors and anchor wires where possible, with the exception of the east end of the bridge where new anchors and cables are required.

4.1.7 Paving Technology

Asphalt concrete pavement for surfacing on the bridge approaches will be produced from Emil Anderson Construction's modern asphalt plant and facility located approximately 6 km west of the bridge. Close

proximity of the plant will offer haulage efficiencies and will make it easier to keep the asphalt warm prior to laydown. Our team will make use of their own fleet of tandem truck and trailer haul units, complete with insulated boxes and automatic tarp rollers for supplying asphalt to the laydown operation.

The current asphalt mix design for Class 1 Medium Mix Asphalt Concrete Pavement using asphalt binder supplied by the Imperial Oil Company was used on the recent 2004 City of Kelowna Overlay Project, and to date has performed exceptionally well under high traffic volumes.

Laydown will be achieved through the use of two Barber Greene BG265 asphalt finishers, complete with the latest TopCon automatic grade controls, and extend-a-mat screeds. Compaction will be attained through the use of a modern pneumatic tire and tandem vibratory steel combination roller and a 20-tonne pneumatic tire roller, and finished with a static steel roller.

4.1.8 Coating Systems

The use of weathering steel will largely limit the requirement for steel coatings, except in vicinity of deck joints, as specified in the subsection 3.2.3.1 Structural Steel. Painting will be performed in the fabrication shop with touch-up as required on site.

All steel reinforcement will be uncoated, other than the use of epoxy for the bridge parapets and median barriers, as described in subsection 3.2.3.3.

All exposed miscellaneous metal, light poles and other traffic signage posts will be galvanized.

4.1.9 Engineering Field Inspections

The testing, inspection and monitoring procedures during construction are more fully described in subsection 8.4.

4.1.10 Preliminary List of Major Equipment Required for Construction

Table 4-1 on the following page itemizes the types of major equipment anticipated to be required in the construction of this project.

Table 4-1: List of Major Equipment Classified by Equipment Type

Cranes	Floating Equipment	Earth Moving and Paving Equipment	Miscellaneous
1. 20-to-22-ton R.T. hydraulic crane 2. 150-ton crawler crane 3. 230-ton crawler crane 4. Tower crane	1. Derrick barge for 230 ton crane 2. Derrick barge for 150 ton crane 3. Pontoon barge sections 4. Material/anchor barge 5. Tugboat 6. Boom boat 7. Survey boat	1. Backhoes 2. Front end loaders 3. Off- and on-highway trucks 4. Compactors/rollers 5. Paving machine 6. Grader	1. Pile driving hammers – Delmag D62 and D80 2. Vibratory hammer 3. Welding machines 4. Stinger truck 5. Hoe rams 6. Compressors 7. Winches

4.1.11 Protection of Existing Bridge

During installation of the new bridge, the existing bridge must continue to operate and maintain the traffic flow as required in the RFP document. Cranes and derrick barges will be positioned to not only help secure the pontoon sections and bridge during installation of the new and decommissioning of the old, but also to minimize any possible reaching across the existing bridge during construction and anchoring of the new bridge. To provide for uninterrupted operation of the bridge, the installation of the new bridge and sequencing of the anchor installation, including removal and tensioning of the cables to minimize loads into the existing pontoon sections and lift span structures, will be carefully engineered. Weather conditions will play a major role in the installation of the new bridge, as well as in the sequencing of the anchoring. Close liaison with Environment Canada is planned during these critical phases in order to anticipate and take measures against unfavourable weather conditions. Utilizing this expert input on weather patterns, we will strategically select our weather windows for the critical operations, thereby reducing the risk of delays caused by inclement weather.

4.2 CONSTRUCTION STAGING

After the essential agreements and approvals are received, construction will commence immediately on the west approach fills, west approach pier construction and the graving dock area. The west approach fills and abutment works require suitable weather conditions for construction, but access must be provided for pier construction. Pier construction and graving dock construction can commence independent of the west

approach fills due to the piers being constructed from the water and the graving dock facility being constructed offsite. For the actual staging and sequencing of the work, see the Construction Schedule in Section 2.0 of this proposal.

The staging and laydown areas required for the embankment and abutment works are identified in the traffic management objectives and overview (subsection 4.3) and in drawing 865800-1000-41DD-2801 found in Appendix B of the RFP submission. The laydown areas and temporary construction facilities for the majority of the works will be located in close proximity to the graving dock site. This will reduce the potential of extended right-of-ways as outlined in the proposal. In the graving dock (see drawing 865800-1000-41DD-3401 in Appendix B of the RFP submission), forms will be assembled, structural steel loaded out, and all materials loaded for final installation via barge and floating cranes on derrick barges. This load-out site will be critical to the schedule of the water-based operation and must be located close to the actual site and readily accessible from roads and highways.

In choosing the location of the graving dock, several factors are important: size of the area, location, orientation of the waterfront, ground conditions, environmental concerns, ownership, and many other factors that need to be considered. The SNC-Lavalin team has investigated the preferred sites as identified in the RFP and BAFO documents and has chosen the Bear Creek North site as the preferred location for the graving dock and the temporary moorage. Further details concerning the Graving Dock can be found in Section 14 of this BAFO submission.

4.3 TRAFFIC MANAGEMENT

4.3.1 Overview

Our team considers the traffic management and related construction staging for the Okanagan Lake New Crossing Services Project a key component to the success of the project. We will implement an integrated Traffic Management Plan (TMP) that will achieve:

- Maintenance of traffic flows through the worksite with minimal traffic disruptions
- Safety of the construction workforce, pedestrians, cyclists, and motorists
- Mobility of labour, equipment, and material in and out of the work zone

The TMP will strictly follow the MoT “Traffic Management Guidelines for Work on Roadways (TMG – Sept 2001 Edition),” supplemented by MoT’s Traffic Control Manual for Work on Roadways (TCM – 1999

Edition). All workers will be instructed through the team's Safety Orientation Program. A certified traffic control supervisor (TCS) and assistant will be assigned to the project to implement and monitor the TMP. We will utilize only trained traffic control personnel.

According to the TMG, we will prepare the TMP in accordance with the requirements of Category 5, which will include the following sub-plans:

- *Traffic Control Plan* – to provide safe and effective traffic control plans and procedures during all operations required to construct the project
- *Public Information Plan* – to facilitate communication between the TCS, public and key stakeholders of unforeseen traffic pattern changes, including lane closures, incidents, accidents, schedule changes, and other traffic control procedures
- *Incident Management Plan* - to move traffic safely through or around an incident to provide access for emergency vehicles
- *Implementation Plan* – to ensure that the Traffic Control Plan, Incident Management Plan, and the Public Information Plan are implemented efficiently and appropriately

4.3.2 Maintenance of Traffic During Construction

Our goal during the construction of this project is to minimize traffic disruptions to the travelling public while maintaining safety. To accomplish this objective, we will strictly adhere to the lane closure and detour restrictions outlined in the Construction Output Agreement, and perform the bulk of the work at night – after the afternoon peak traffic period and before the morning peak traffic period. Shift hours will typically be 7:00 p.m. to 5:30 a.m. Where required, we will install screens to shield drivers from viewing the construction activities, so that the drivers can focus on the task of driving and not be distracted. We will also install advance construction signs to warn drivers of the construction zone. To enhance safety in the construction zone, a construction zone speed limit of 50 km/h is recommended.

We also propose to implement a project website to provide construction updates and lane closure information. Using the existing CCTV, real-time traffic still images can be displayed on the website. Motorists can use this information to plan ahead, avoiding unnecessary delays and minimizing traffic flow during construction periods.

4.3.2.1 West Side Construction Access of West Side

Access to the construction areas on the west side will be via Highway 97 just east of the eastbound centre lane closure arm. At this point, the centre-raised median terminates and an eastbound left turn can be made across the westbound lane and onto the west approach fill area. At this access point, on the north side of the existing causeway, a paved pullout exists behind a string of concrete roadside barrier. By removing this barrier, access to the west approach is easily accommodated. In addition, this paved pullout area provides for a westbound on-ramp to Highway 97 for haul units and other construction vehicles departing the site westbound. Again, as much of the pre-load, sub-grade fills, granular and asphalt materials will be acquired from the west side, this access is well suited for the incoming loaded haul units and departing westbound empties. As there are no signalized, controlled intersections at this west approach access, traffic control persons (TCPs), along with appropriate signage, arrow boards and delineation, will be used to ensure eastbound traffic remains moving in the curb lane past the left turning vehicles. TCPs and appropriate signage will also be positioned to ensure gaps in the westbound single lane of traffic are adequate to allow a safe left turn into the construction site, as well as the safe merging of the westbound traffic departing the site.

4.3.3 Lane Closure and Detour Restrictions Compliance

We have conducted manual calculations of the expected traffic delays and queue length of the following traffic control operation to ensure compliance with the RFP requirements. Additional traffic control plans to suit the specific site and construction requirements, such as lane shifting or shoulder work, will be prepared in the detailed design stage and during construction.

Single Lane Closure of the Existing Bridge: In the evening, only one lane in each direction is typically required, thus enabling the potential closure of the westbound curb lane when work on the east approach is encroaching along this lane. Single lane closure will be executed based on the permitted timeframes outlined in the Definitive Concession Agreement, Part 1 of Schedule 5, subsection 3.7.2. During the non-summer months, traffic volumes in the EB and WB directions are expected to drop to less than 900 vehicles per hour (vph) in each direction after 8:00 p.m. and reduce considerably to less than 250 vph after midnight. During the summer months, traffic volumes are estimated to be less than 700 vph in each direction after 10:00 p.m. Based on these volumes, closing the westbound curb lane is expected to produce only minor traffic interruptions. Drawing 865800-1000-41DD-2604 in Appendix B of the RFP submission illustrates a conceptual traffic control layout of the westbound curb lane closure. Portable changeable message signs (PCMS) will be deployed to warn motorists of the lane closure. Typical messages may include “right lane closed” and “work zone ahead.”

Single Lane Alternating Traffic: In order not to exceed the 900 vph, two-way traffic threshold, we plan to implement the single lane alternating traffic procedure (if required) after 11:00 p.m., at which time traffic delays are expected to be less than six minutes, with a queue length of less than 400 m, meeting the RFP requirements. We have prepared a conceptual traffic control layout to illustrate this operation, as shown in Drawing 865800-1000-41DD-2605 in Appendix B of the RFP submission. PCMS will be used to warn motorists to prepare to stop. Typical messages may include “single lane traffic” and “prepare to stop,”

Total Closures (5 minutes or 20 minutes): In the event that we need to implement full closures, we have estimated a suitable weekday implementation time associated with a five-minute closure and a 20-minute closure. Under average weekday conditions, a five-minute closure can be accommodated after 10:00 p.m. without exceeding the allowable queue length of 500 m (60 vehicles) or 700 vph arrival rate. For a 20-minute closure, we plan to implement the closure after midnight (12:00 a.m.) when traffic volumes are expected to be less than the 175 vph threshold in any direction. After the total closure is complete, traffic lanes shall be opened to clear traffic queues in both directions simultaneously. Drawing 865800-1000-41DD-2606 in Appendix B of the RFP submission illustrates a conceptual traffic control layout of this operation. PCMS will be positioned to warn motorists to prepare to stop. Typical messages may include “stop ahead” and “work zone.”

4.3.3.1 Emergency Vehicle Access

An Incident Management Plan will be prepared to move traffic safely and expeditiously through or around an incident and provide access for emergency vehicles. To achieve this objective, our team will meet with local police, fire department and ambulance services prior to project commencement to explain the project details and the proposed lane closure plans. This will provide an excellent opportunity to introduce the primary contacts from each side that will be managing incidents. We will solicit their input and amend the plans as necessary to best meet their emergency response requirements.

Prior to each night of construction activities involving lane closure, our Traffic Control Supervisor (TCS) will notify the emergency services of construction location and type of activities.

4.3.4 Quality Control of TMP

All the traffic control procedures described above will be executed under the supervision of our TCS, who will be responsible for monitoring the closure at all times after it is fully implemented. If the traffic is delayed beyond the allowable limits, the closure plan will be adjusted or removed immediately. The TCS will also

provide daily and weekly documentation of traffic control inspections and monitor processes. We anticipate that the TMP will be fine-tuned during the construction stage to optimize safety and efficiency.

4.4 LIFT SPAN CLOSURE RESTRICTIONS

As identified on SNC-Lavalin's suggested pontoon string construction (drawings 865800-1000-41DD-3303 and 3304 in Appendix B of the RFP submission), the existing boat channel must be closed when pontoons 11 and 12 are complete and ready for installation. The allowable closure period is stated to be October 15 to April 15 of any year. This is the period of time that boat navigation is somewhat limited on the lake for sailboats or other over-height vessels.

This six-month closure window is of the utmost importance to the overall completion of the project. The final installation of pontoons 11 and 12 must be completed, as must all other items prior to the opening of the new bridge and the commencement of the demolition of the old. The demolition of the old bridge will start on the west side and proceed so that the new navigation channel can be opened. The scheduling of the project is critical to hit this navigation closure period. A delayed start on the design and construction process due to any issue at the start of the project could result in limitations due to this restrictive navigation window, thus jeopardizing the completion date. This lift span closure period is of primary importance to the overall construction schedule of the new bridge.

4.5 KELOWNA CITY PARK

The proposed SNC-Lavalin design does have significant impacts on the City of Kelowna Park adjacent to the east approach. To mitigate these impacts and to ensure safety for the public who will still have access to the park during construction, SNC-Lavalin will provide security/safety fencing between the park and the worksite. As shown on the drawings, the use of the existing oval track and recreation field located within the oval will be lost once construction of the east approach begins. This work will be completed as late in the construction schedule as possible and in off-seasons when the field and oval area is in lower demand.

The location of the fence will be along a line 4 m offset north from the north edge of the right-of-way acquisition line shown in drawing 865800-1000-41DD-2801 in Appendix B of the RFP submission. The worksite will be accessed from the park entrance off of Abbott Street as described in the Traffic Management and Construction Staging Plan (subsection 4.3 above) for the east abutment. A security gate will be located where the fence, the access and the parking lot meet.

4.6 DECOMMISSIONING OF EXISTING BRIDGE

4.6.1 Demolition of Existing Bridge

Demolition of the old bridge structure will involve several techniques: hoe ramming, concrete cutting, jack hammering, steel burning, jacking and, possibly, blasting or fracturing of concrete sections. Demolition and concrete cutting experts will be utilized, following the work methods and guidelines established by the team to protect the new bridge, the public, the environment, and all the team's employees and equipment. De-tensioning and careful sequencing of the removal and reinstallation of new cable anchoring systems from the old bridge is essential to the demolition plan for the pontoon sections of the old bridge and must be monitored and engineered on a daily basis.

Demolition will begin at the west side transition steel truss span section, which will be jacked up and removed intact onto barges for final disposal. Upon removal of this steel truss section, the pontoons must be secured, and careful planning of anchoring and removal of pontoons will begin. The pontoon sections will be removed in specific lengths to ensure tension is maintained in the new and old bridge anchor system. Cutting of the pontoons will be necessary due to the inability to remove the pontoon connection bolts, and due to the time allotted for removal of the existing pontoons. Prior to cutting, buoyancy-compensating materials (ballast, watertight closures and polystyrene) will be added to the sections for safe removal. After removal of pontoon sections, the units will be stored at a temporary moorage or towed to a final disposal location. At the same time as pontoon separation and final anchoring are completed, demolition of the lift span will commence. This will involve lowering and removing the counterweights, then removing the steel piers and steel span sections. This work will be completed with waterborne equipment, with eventual disposal after positioning on barges. The main span piers will have ballast added and removed as required to achieve buoyancy for eventual deep lake disposal, or will be demolished in place to the satisfaction of the relevant authorities.

The disposal of the pontoon sections and lift span concrete piers will depend on final habitat area balance available at the time of decommissioning of the existing bridge, as well as final evaluation of sections after dismantling and removal. Some sections may be broken up into smaller sections for eventual disposal, while others may be suitable for more convenient methods of disposal, including but not limited to deep lake disposal, temporary storage or permanent relocation. All these disposal options are very dependent on permit and habitat balance requirements, which will require refinement as the project proceeds

4.7 PERMITS AND APPROVALS

Our proposal is based on the assumption that Department of Fisheries and Oceans (DFO) Initial Authorization for the project will be received in March 2005, to enable us to achieve Commercial and Financial Close in mid-April and June, respectively. This approval must include the corresponding CEAA project approval certificate. We have also assumed that the Bear Creek North graving dock site will be available and secured for pontoon construction during this period of time. It is our understanding that the Province has already received Water Act Approval.

We recognize that it is our responsibility to obtain the following approvals:

- Authorization from DFO for construction methodology for Works and decommissioning
- Authorization from DFO for construction of the Graving Dock Construction Facility
- Authorization under the Navigable Waters Protection Act for the navigation channel in the New Crossing

Other less critical permits and approvals required for the project fall into two categories:

a) Those required in 2005 to allow early excavation and earthwork activities to proceed

b) Those required in 2006/2007 to allow tie-ins and the provision of new utilities to the new bridge, followed by removal of existing utilities to the existing bridge

We will seek early, proactive involvement of the primary permitting agencies and utilities in reviewing our design and schedule, to ensure that delays are avoided.

5.0 ENVIRONMENTAL MANAGEMENT PLAN

Our Solution

- Key environmental issues: habitat, water quality and noise impacts – committed to addressing these issues during construction, decommissioning, operations and maintenance
- Comprehensive Environmental Management Plan, wherein compliance monitoring will be integral to our success
- Will work closely with the Province and approving agencies to obtain environmental approvals in a timely manner to meet our schedule, which is crucial to project success

An Environmental Management Plan (EMP) will be prepared to help ensure the works meet the environmental protection requirements. The EMP will include:

- Sediment and drainage management (per Standard Specification SS 165)
- Codes of Practice, including road salt management of the existing structure through to its decommissioning, and for the new structure
- Noise mitigation
- Emergency and spill response
- Marsh and transplant stock health
- Guidelines for servicing vehicles and equipment and the storage of hazardous materials (fuel, lubricants, hydraulic fluid, solvents, paint, etc.)
- A monitoring program to document the elements above

The EMP is a living document that will be revised and maintained throughout the project. Our team will monitor the effectiveness of the plan through site monitoring during all phases of the project. Our monitoring results will be audited as part of the Quality Management Program, which is described in Section 10.0.

The EMP will be substantially completed within two months of contract award. The EMP will be reviewed with the MoT prior to a one-day workshop held for SNC-Lavalin team members, including field supervisors, before construction begins.

The following three subsections describe how we will address Compliance with Standards, Environmental Protection Issues and Environmental Approvals.

5.1 COMPLIANCE WITH STANDARDS

The SNC-Lavalin team is committed to complying with the environmental management requirements identified in Schedule 12 of the Concession Agreement.

Compliance monitoring to help ensure all activities meet appropriate regulatory standards will be conducted both on regular and random bases. The purpose of monitoring is to document how we are meeting our commitment to comply with environmental management requirements and the EMP. Daily reports of project conditions will be retained so all documentation is traceable and reviewable as detailed in the Quality Management Plan.

Compliance monitoring will be continuous from the onset of construction until completion of the decommissioning and restoration works. Major works such as causeway modifications, graving dock construction and openings and compensatory works will be monitored by full-time, onsite Environmental Monitors. Compliance with aesthetic standards, landscaping guidelines and noise will be included in the monitoring program.

The EMP will detail all standards and guidelines applicable to this project. These include standards such as the BC Water Quality Standards for the Protection of Aquatic Life, which are typically more stringent than standards for drinking water.

The Quality Management Plan will include Major Project Process Checklists. These checklists will address all EMP requirements, including permitting, approvals, monitoring and testing. All checklists require both a QC and a QA sign-off to ensure compliance.

5.2 ENVIRONMENTAL PROTECTION ISSUES

Based on our knowledge of the Kelowna area generally, and the Okanagan Lake New Crossing specifically, we feel that the primary project-related environmental protection issues are habitat, water quality and noise during construction, operations and maintenance and decommissioning. Each issue, and our approach to dealing with it, is described in more detail below.

5.2.1 Habitat

The Province anticipates Department of Fisheries and Oceans (DFO) Authorization (s. 35(2) of the Fisheries Act, R.S. 1985 c. C-14) for:

- East and west causeway fill
- East and west pocket dredging
- Pier footprints
- New anchors
- Deep disposal of six pontoons
- Marsh salvage and replanting
- Graving dock placement

Remaining issues to be resolved by the SNC-Lavalin team for DFO authorization include the following:

- Any additional habitat alteration or destruction resulting from design changes or construction methods
- Construction of Graving Dock Construction Facility

SNC-Lavalin recognizes the need to comply with Fisheries Habitat Policy. If habitat impacts occur, proper compensation must be determined and authorized by DFO.

We anticipate that environmental issues related to the graving dock site will be habitat, construction, operation and abandonment. This last point offers an opportunity for potential habitat enhancement. If the graving dock site requires dredging, the quality and disposal of dredgeate must be addressed.

5.2.2 Water Quality

Water quality issues are primarily sedimentation (increased total suspended solids) and the introduction of deleterious substances from a spill. Both issues will be incorporated into the EMP and monitoring plan.

We are aware of the Westbank First Nation water intake and its proximity to the site. Construction activities will be closely monitored, and when necessary, appropriate measures will be implemented to protect water quality.

5.2.3 Noise

Noise during construction (generated by machinery and equipment), operations and maintenance (generated by bridge traffic) and decommissioning (generated by machinery and equipment) is the third primary environmental protection issue we have identified. The noise mitigation plan will include, but not be limited to:

- Scheduling activities, where practicable, to reduce disturbance to residential neighbours
- Physical methods to quiet or isolate equipment
- Public notification prior to unavoidable noise generation

5.3 ENVIRONMENTAL APPROVALS

Our strategy in the design and construction of the bridge and approaches is to stay within the area that currently has approval in principle from the DFO. Our team recognizes it has full responsibility for any environmental approvals for construction that deviates from the existing MoT design and construction methodology. In this case, environmental approvals required include the following:

- DFO for habitat alteration under the Fisheries Act
- Canadian Coast Guard (CCG) under the Navigable Waters Protection Act
- Land and Water BC Inc.

Our team is committed to obtaining environmental approvals in a timely manner to avoid schedule delays. We will work closely will federal and provincial approving authorities to anticipate and address environmental issues before they can impact the schedule. This will involve regular design reviews and construction monitoring by our team who will report back to approving authorities throughout the permitting approval process.

Mitigation and habitat compensation issues are handled by DFO, under the Fisheries Act. The same Act covers water quality in Deleterious Substances. As well, Provincial standards for the protection of freshwater aquatic life, drinking water, recreational water contact and agricultural use are administered by the Ministry of Water, Land and Air Protection.

5.3.1 Federal Approvals

We understand the Province anticipates receiving DFO Initial Authorization (authorization under Section 35.2 of the Fisheries Act) for the Project by late March 2005. Other in-water works also cited in Section 35.2 will require Fisheries' Authorization. We understand that we are responsible for obtaining authorization from DFO for our construction methodology for works and decommissioning, as well as for construction of the Graving Dock Facility. .

Another federal requirement is a permit under the CCG's Navigable Waters Protection Act (NWPA). This would be initiated with the DFO application, but the turnaround is typically less than a month. The Fisheries' Authorization triggers Canadian Environmental Assessment Act, which satisfies the CCG environmental concerns. Navigational concerns are addressed directly by the CCG and include such items as access and lighting. We will obtain authorization under the NWPA for the navigation channel in the New Crossing.

5.3.2. Provincial Approvals

In mid-2004, the Province obtained land use approvals from Land and Water BC Inc. for the Okanagan Lake New Crossing Project. Should the Concessionaire's design result in material changes to the Province's Design, we will consult with provincial staff to communicate these design changes and ensure they fit within the parameters of previously obtained approvals.

The decommissioning of pontoons has been identified as a key environmental issue for this project. We have consulted with provincial environmental staff to determine whether the relatively new Environmental Management Act is applicable to that scope of work. Based on our consultations, our knowledge and our interpretation of the Act, it appears not to apply to pontoon decommissioning, as the process does not meet the proscribed activity or industry definitions under the Waste Discharge Regulations in Schedules 1 and 2. Even though these regulations do not apply to the demolition and disposal of the pontoons, we will undertake this work in an environmentally appropriate manner, in compliance with all relevant provincial, regional district and municipal standards. For example, railings were painted with a lead paint in the 1950s, and will require testing and compliance with both the Workers Compensation Board and the Provincial Environmental Management Act.

6.0 OPERATIONS, MAINTENANCE AND ASSET MANAGEMENT

Our Solution

- Operations and Maintenance and Asset Management Plans will be ISO certifiable and will comply with all Technical Specifications
- Risk of the project to the Province minimized through an Asset Management Plan that incorporates Provincial bridge maintenance standards and achieves cost effectiveness through the use of a computerized maintenance management system

6.1 OPERATIONS AND MAINTENANCE PLAN

With issuance of the BAFO instructions, the Province has elected to retain ownership of the Existing Bridge as well as operations and maintenance of this facility. Opco will provide Operations and Maintenance (O&M) services during the Enhanced Service Period only. Further, the limits of the O&M services responsibility during the Enhanced Service Period have been redefined such that the Concession Highway is the section of the New Crossing from Sta 26 +_60 to Sta 45 + 77. This section may be generally described as the permanent works constructed by the Concessionaire, including the New Bridge structure together with the East and West Approaches.

Opco will deliver an O&M Plan for the Concession Highway through a combination of direct (in-house) activities and purchased services to ensure compliance with MoT Highway Maintenance and Corridor Management Specifications (October 2004).

The primary objective of Opco's O&M Plan will be to ensure the technical success of the Concession by:

- Providing a safe and efficient New Crossing and associated facilities, that offer a high level of availability to users and satisfy stakeholder expectations
- Improving the quality of the New Crossing and associated facilities through continual improvement in O&M delivery methods
- Achieving specified performance measures and accepting and managing operational project risk
- Implementing effective and efficient innovative program delivery methods and practices, and managing and mitigating aspects related to the effects of traffic growth

- Establishing and promoting co-operative working relationships that recognize the aspirations of the MoT, users and the Concessionaire

6.1.1 Project Specification Requirements

6.1.1.1 Highway Maintenance Specifications

The O&M Plan for each year will outline project operations and maintenance activities in accordance with the BC Maintenance Specifications (October 2004). Opco will implement a dedicated O&M field organization for the project. During the Enhanced Service Period the core-staffing group of three (3) operators and one Bridge Supervisor will patrol and inspect the facility and perform the majority of the required routine maintenance and repair activities.

These activities will increase during the Enhanced Service Period to include pavement and boulevard landscape maintenance, grass cutting, litter pick-up, sign repairs and unplanned incident management events. All resources will be stationed at a local dedicated yard. Where the annual asset inspections identify technical specialized repairs, annual subcontracts will be established. These include:

- Bridge inspections
- Pontoon inspections
- Pavement condition inspections
- Any other structural inspections that require reporting

The O&M Plan will provide a 24-hour, seven-days-per-week organization comprising the following individuals:

- Bridge Supervisor
- Operations Technician
- Four Maintenance Operators

In addition to the above project-based staff, Opco will assign as-required staff resources, including:

- Quality Assurance Manager
- Environmental Coordinator

- Systems Analyst
- Communications Coordinator
- Financial Controller

The home office staff will coordinate expert knowledge available from the extensive corporate resources of Opco, to enable our team to comply with the many unique process, systems and performance monitoring requirements of the project. The Bridge Supervisor will be the senior Opco staff resident at the project site, with direct responsibility for all aspects of the O&M Plan. The Operations Technician will have primary responsibility for all Asset Management Plans, plus the analysis and preparation of all deliverable reports as required under the Reporting Specifications for Highway Concessions (October 2004).

6.1.1.2 Highway Corridor Management Specifications

Practices will be implemented in conformance with MoT policies and sound management techniques to maximize the reliability, safety and availability of the highway corridor for users, consistent with road networks within British Columbia. Opco will monitor highway elements for compliance with the Operational Performance Measures and the specified Key Performance Measures (KPMs).

The condition of the Okanagan Lake New Crossing structure will impact customer perception of highway conditions and Opco's performance quality. Opco will utilize analytic capabilities for identifying pavement and structure needs using an ISO 9001 certified Quality Management System (QMS) to track and document the procedures to comply with the Operational Performance Measures in the Highway Corridor Management Specifications. The QMS will identify locations of deficient pavement and structures, and apply the concept of remaining service life to predict future needs. The system will set levels of service and target the required expenditures in a performance budgeting approach.

Opco will implement the Peoplesoft Enterprise One – Maintenance Module as the QMS system for this project (please refer to subsection 6.2, Asset Management Plan, of this submission). This approach will provide a maintenance strategy with consistent preventive maintenance routines, history record and standardized reports. A specific Environmental Quality Management Plan will help ensure compliance with federal and provincial environmental laws.

Facility condition monitoring will be undertaken through a series of inspection processes, including road patrol and bridge inspections as per the Maintenance Specifications Series 8-8xx, planned periodic asset component inspections with results recorded in the QMS and detailed asset inspections related to KPMs.

Patrol Monitoring

Throughout the year the facility will be inspected daily (seven days per week), with one patrol per week conducted after dark to check for highway lighting outages, sign reflectivity, pavement marking visibility, etc. The road patrol function will monitor the facility for operational and traffic safety hazards and ensure all system conditions meet the Performance Measures. Condition deficiencies will be logged by the Road Patroller and, if possible, corrected immediately. Where non-emergency condition deficiencies beyond the corrective action capability of the Road Patroller are identified, they will be immediately reported and entered in the QMS for planned corrective scheduling to meet the required response time. When emergency conditions have the potential to impact the immediate safety of the travelling public or the structural integrity of the facility, immediate corrective action will be initiated in compliance with the Emergency Response Procedures Manual.

Highway Asset Preservation Performance Measures

An annual summer maintenance plan will address planned asset inspections for each of the Highway Asset Preservation Performance Measures. This annual summer plan will relate to the annual budget allocation for each Highway Maintenance Specification component of the project, plus an expenditure tracking process for ongoing fiscal accountability. By budgeting down to the level of each highway asset maintenance activity, the Opco fiscal management system will ensure resource allocation funding of both the inspection process and the required planned remedial work plan necessary to achieve compliance with the required performance standard.

Detailed Asset Inspections Related to Key Performance Measures (KPMs)

The detailed asset inspections relate to major system components such as pavement and bridges and will usually require external expert processes and analysis. The resources for these external consultants will be budgeted annually as an individual entry in compliance with the Asset Preservation Performance Measure frequency standard.

The facility pavement will be inspected annually and analyzed under the three key performance indicators as specified under the Asset Preservation Performance Measures Section 3.2; Highway Running Surfaces for Pavement Roughness, Pavement Surface Deterioration and Pavement Rutting. This inspection program will establish the annual pavement rehabilitation program. Opco is committed to a preventative pavement program as a means of providing a high service condition and maximizing the useful life of the pavement structure. Emphasis will be placed on routine maintenance of localized pavement repair

treatments, along with restorative and preventative treatments, including crack sealing, micro-surfacing and hot-mix patching.

Opco will implement an Asset Preservation Performance Measure process for the new Okanagan Lake crossing structure in compliance with section 3.3 of the Asset Preservation Performance Measures. In addition to the Local Area Specifications Asset Preservation Performance Measures (Section 3), Opco will implement a second annual "routine" inspection as part of the summer plan. The six-month inspection cycle (spring and fall) will be performed by a qualified Bridge Structural Engineer and focus on the general condition to identify any required short-term preventative and/or remedial programs.

The detailed structure inspection program by a qualified Bridge Structural Engineer will produce a comprehensive condition assessment and, if necessary, undertake physical testing. Initially this detailed level of inspection will be every five (5) years; however the frequency will be increased over the life of the project to ensure the public and structure safety and functionality remain at an acceptable level. All inspections will comply with the MoT's Bridge Management Information System (BMIS) and the details entered into the inventory and condition data directory record of the system, for filing with the MoT in compliance with the Reporting Specification for Highway Concessions Section 4 Data. The bridge inspections and digital photo records in the BMIS system will track the performance life of every detailed element of the bridge. Should the asset inspection conclude that the required action to meet the Asset Preservation Performance Measures is beyond the scope of the routine O&M program, then the item will be transferred to the Treatment Selection and Rehabilitation Plan and related annual program funding.

6.1.1.3 Local Area Specifications

The Local Area Specifications for Okanagan Lake Crossing detail the operating requirements for the existing Okanagan Lake Bridge for the Original Service Period. These currently form part of the existing Maintenance Contract Renewal 2003/2004 for Service Area 08 South Okanagan (May 10, 2004 to May 9, 2014). Using the staffing resources outlined earlier, Opco will comply with specified Asset Preservation Performance Measures for the New Crossing over the Enhanced Service Period.

6.1.1.4 Okanagan Lake Bridge Operations and Maintenance Manual

The existing "Okanagan Lake Bridge Operations and Maintenance Manual" contains the procedures to operate the existing facility. Section 1 details the operation and inspection procedures, and Section 2 covers the maintenance and repair procedures, technical data and documentation. Opco will incorporate requirements of the existing manual into its QMS system. Upon commissioning of the new bridge, Asset Preservation Performance Measures specified for the New Crossing, plus the specific O&M parameters of

the new facility, will be incorporated into a new Okanagan Lake Bridge Operations and Maintenance Manual for ongoing use throughout the Enhanced Service Period.

6.1.1.5 Reporting Specifications for Highway Concessions

The Reporting Specifications for Highway Concessions define the minimum reporting information. Additional requirements are also contained within the Local Area Specifications. Opco will comply with all reporting requirements for each year of the project. The PeopleSoft EnterpriseOne – Maintenance Module will form the systematic basis for compiling many of these routine reports based on data records contained within the QMS. As outlined in the staffing description, the Operations Technician will have the responsibility for meeting the reporting requirements.

6.1.2 Specific Operations and Maintenance Plans

6.1.2.1 Bridge Maintenance

The Bridge Maintenance Plan will be developed to provide a measurable level of service that meets the day-to-day serviceability expectations of the users. In addition to the routine bridge patrol, Opco will perform all routine maintenance and repair activities. The key to a successful bridge maintenance program will be the monitoring of all elements by:

- Daily road patrol inspections (seven days per week), with one after-dark patrol per week to check for lighting outages, sign reflectivity, pavement marking visibility, etc.
- Planned periodic asset component inspections with a corresponding annual budget allocation, plus an expenditure tracking process for ongoing fiscal accountability
- Detailed asset inspections of major components requiring external expert processes and analysis to meet the supplemental condition guidelines contained in the Ministry Bridge Management Information Systems User Manual – Supplemental Guidelines for Floating Concrete Pontoons

In addition to the serviceability expectations of the user, the condition of the assets during the project operating period and their condition/standard at the time of project hand-back, Opco will comply with all requirements of the Local Area Specifications for both the existing and new bridge as detailed in the Asset Preservation Performance Measures Item 3. In addition to the annual cleaning and washing program (HMS 6-510), an annual Preventative Maintenance (PM) program will retain the asset in continued acceptable condition and prolong the effective safe and useful life. Due to the nature of an operational highway facility – even one with a definitive PM program – certain components of the project will, at various stages

throughout the operating period, require rehabilitation. The extent and timing of such rehabilitation will depend on many factors, in addition to the O&M programs, due to such external influences as traffic and weather cycles.

6.1.2.2 Winter Maintenance Plan

The primary objectives of winter operations standards are to maintain a safe, passable facility for project users and provide an acceptable level of service at all times throughout the winter season. The winter plan will ensure that the highway pavement surfaces roadsides are maintained to the 3-3xx Series Specifications. Key functions of winter operation plan are:

- Complement of equipment and staffing to meet the required Performance Measures for snow accumulations and snow removal
- Advanced Road Weather Information Systems (ARWIS) to constantly monitor pavement/bridge surfaces, weather conditions & forecasting service
- Proactive winter maintenance program using ARWIS road-weather forecasting and anti-icing methods in advance of snow and ice accumulations
- Global Positioning System (GPS) recording of patrol and winter equipment to record “what, where, when and how” the winter maintenance plan was carried out
- Continuous monitoring of the roadway during the winter maintenance season using ARWIS and visual patrol inspection

When so identified and requested by the patroller, the following winter equipment will be operational involving one or combination of the winter procedures:

Equipment Type	No.
Combination Anti-Icing & Pre-Wetting Spreader (7 m^3) Snowplow Truck (one–way plow and wing)	2
Sidewalk Snowplow Tractor with Material Spreader	1
Loader	1
Anti-Icing Liquid Storage Tank	1

A dedicated maintenance yard will form the base for delivery of the Opco O&M program. The yard will have a covered material storage facility in addition to outdoor storage space for equipment, materials and supplies. All winter operations will meet good housekeeping requirements to minimize potential salt contamination.

Anti-icing is a controlled practice of “preventing” the bonding of snow and ice to the road surface through the timely applications of a freeze-point depressant before storm conditions. Application of a liquid freeze-point depressant at the start of, or even substantially prior to, a winter storm, has been proven to inhibit the development of a bond between the ice and snow and the pavement surface. Opco proposes an anti-icing plan with subsequent brine pre-wetting (30%) of the dry salt applied to the roadway surface for an initial salt usage reduction of 23% versus dry salt application rates.

The patrol truck will have a display monitor for ARWIS outputs and air/pavement temperatures. All equipment will be equipped with GPS and AVL for tracking and data management, including all plowing, salt and sand quantities. Opco is committed to providing safe roadway conditions to the travelling public. Implementation of anti-icing and pre-wetting technologies are seen as a major contributor in achieving this goal, while at the same time minimizing the detrimental environmental impacts related to the use of de-icing chemicals. Please refer to the Winter and Summer Maintenance Plan Summary Tables provided at the end of this section as Attachment 6-1.

6.1.2.3 Emergency Response

Opco will put in place a project Emergency Response plan that identifies procedures for detecting and responding to unplanned events/incidents to safeguard the public and restore traffic flow as quickly as possible. The plan may be modified throughout the life of the project to address issues as they occur. Action response plans will be developed for vehicle accidents, hazardous material spills, heavy snowfall conditions, major debris on the bridge, and other impediments to traffic.

6.1.2.4 Public Relations/Customer Care

Opco will implement action plans and procedures to inform the traveling public, project stakeholders and the Ministry of current traffic operations and planned changes to traffic flows. The action will consist of a combination of print media notices, radio and TV media, project signage, changeable message signing, direct mail-outs to affected businesses and a public information telephone line.

6.1.2.5 Traffic Management

Opco will implement a detailed traffic management plan to enable the Existing Bridge and the New Crossing to be operated 24 hours per day, seven days a week, for the duration of the project, subject to closure only under the following scenarios:

- Closure by governmental authority or a Police Constable
- Closure when an event that would endanger the safety of the public has occurred
- Closure of a lane or portions of the project that does not completely restrict traffic flow

The Traffic Management Plan will include current bridge lift procedures and a counterflow lane control system, and address closures for maintenance activities and other events, such as accidents or vehicle breakdowns. Regular reviews and updates of the Traffic Management Plan will be undertaken.

6.1.3 Health, Safety and Environment

Opco will comply with pertinent federal and provincial legislation related to health and safety, and the environment. Opco has a corporate policy and detailed procedures related to workplace health and safety. A project Operations and Maintenance Workplace Safety Manual will be prepared and implemented for the project. This manual will reflect all legislative and regulatory requirements and address the unique O&M activities for the Existing Bridge and New Crossing conditions.

Environmental monitoring will be conducted as required for works around environmentally sensitive areas. A qualified environmental monitor will be on site when required to monitor water quality, monitor adherence to the mitigation plans, assess erosion potential of earthworks and be present in the unlikely event of a dangerous material spill.

All work will be completed above the water level. Routine deck cleaning will be carried out by removing the bulk of the material when dry, with minimal washing. If washing is required, filter fabric will be erected along the side rails to reduce/eliminate silts entering the water. The work will generally be completed in early summer. Bridge substructures will be cleaned of debris, and as required for structural inspection. All project vehicles and maintenance equipment will be regularly maintained and checked for compliance.

6.2 ASSET MANAGEMENT PLAN

We have developed an Asset Management Plan that addresses maintenance through the whole lifecycle of the project. A core element of our plan is a computerized maintenance management system (CMMS) that

will facilitate the collection and utilization of information on all aspects of the New Crossing structure and associated facilities. This system will help us identify, program, prioritize and deliver preventative and corrective maintenance services for the existing bridge, and eventually the new bridge and approaches.

The main objectives of our Asset Management Plan are to operate and maintain the existing and future bridges in the most cost-effective manner possible and to minimize risk to the Province by meeting the Province's own bridge maintenance standards.

As shown in Figure 1-2 in Section 1.0 of this proposal, the Asset Management Plan will be implemented by our Kelowna-based Facility Asset and Corridor Superintendent, under the direction of the Operations and Maintenance General Manager. The Asset Management Team will comprise one Technician and four Maintenance Support Staff, all based in Kelowna. The source of labour, plant, materials and facilities used in asset management will be determined through a competitive procurement process after contract award.

The following section illustrates Opco's approach to asset management and the tools and processes we would use to optimize the asset and to track and measure key performance measures. The Asset Management Plan and systems used are a key component of the overall Quality Management System. The Asset Management Plan will meet the technical objectives of MoT Asset Preservation Performance Measures for Highway Concessions (October 2004).

6.2.1 Effective Asset Management Tools

Good asset management implies a systematic, integrated approach to project selection, analysis of tradeoffs, and program and budget decisions. The principles below support the availability and application of information to make decisions in asset management.

- **Complete, current, and accurate information** on transportation infrastructure assets, including descriptions, location, usage, unique or specialized characteristics, functional and other classification, and data needed for management systems as discussed below.
- **An appropriate suite of management systems and databases** informs Opco of status, trends, and needs regarding its infrastructure assets.
- **Information on system performance** in terms of both proposed targets and values actually achieved in the field. These data may be obtained through periodic surveys and assessments of system condition or levels of service, customer surveys of satisfaction with system condition and agency

performance, and incorporation of key performance measures and associated backup information within management systems.

- **Specialized technical applications** that support an agency's asset management procedures. These may include advances such as use of geographic information systems (GIS) as a system/data integration platform, economic analysis applications (e.g., generalized lifecycle benefit-cost procedure), and decision support tools.
- **Applications that assist in program and service delivery**, including financial applications (e.g., to compute "total" or "true" cost of agency and contracted services), and management.

These principles of good practice are embodied in a strategic, integrated, systematic, and interdisciplinary approach to asset management, from policy formulation through delivery and monitoring of results. Key points to note are as follows:

- The approach is policy-driven. Applicable policies include those embodying system performance goals, and broader policies with important transportation implications.
- The analysis of options and tradeoffs is strategic, interdisciplinary, and integrated. It encompasses a number of modes and their asset classes, rather than a singular view of any one type of infrastructure. Policy goals and objectives are explicitly considered. Different types of investment or expenditure are considered, cutting across programs, to identify the strategy that provides the best performance at the lowest life-cycle cost. Quality information is applied throughout these processes.
- Decisions on allocating labour, dollar, and information resources among programs are made by managers based upon objective analyses of merit. These decisions respond to policy goals and objectives, are founded in objective analyses of costs, benefits, and other impacts, and are informed by trade-off analyses that illustrate the consequences of allocating these resources in different ways.
- Program and services projects are delivered effectively:
  - Options for delivery are continually evaluated in terms of Opco's own capabilities and those of other providers in the public or private sectors
  - Program delivery monitoring documents whether projects and services have been delivered on time and budget, and identifies causes of problems that may require remedy
  - System performance monitoring quantifies the results of past investment decisions, establishes baselines for future decisions, and identifies updates needed in project selection criteria

- System and customer surveys update information on current asset inventory, condition, and performance, and the cost and effectiveness of project treatments and service delivery methods for use in future analyses
- System performance reporting provides the information basis for future policy formulation and needed updates to goals and objectives

6.2.2 New Structure Preservation

New structure preservation is a significant component of Opco's annual capital and maintenance program. Opco will utilize analytic capabilities for identifying structural needs. It will implement a CMMS to help identify locations of deficiencies and apply the concept of remaining service life to predict future needs. It will develop service maintenance levels as part of its maintenance management system to express the current condition and other maintainable features, and to relate target conditions to required expenditures in a performance budgeting approach.

The system is used to conduct lifecycle cost analyses on high-standard facilities such as the Okanagan Lake Bridge and associated facilities. The system has engineering and economic relationships to analyze different types of maintenance, rehabilitation, and reconstruction options and their impacts on both agency costs and user costs. It also can be used to investigate the staging of projects and the effects of construction or maintenance work packaging, as well as options to limit road occupancy to particular hours of the day or to particular months or seasons of the year.

A sound asset management approach requires objective, high-quality data, presented to decision makers and other stakeholders as understandable, useful information. It is a systems analysis challenge to catalogue the many stakeholders and their information requirements, find the simplest analytical and presentation methods that meet as many stakeholder needs as possible, and design data collection processes that efficiently feed the analyses with an acceptable level of quality. In this context, information technology (IT) is a tool to support asset management, not an end in itself.

Opco will implement the PeopleSoft EnterpriseOne – Maintenance Module as the CMMS. The PeopleSoft EnterpriseOne – Maintenance Module will integrate all aspects of maintenance and operations. This consolidated approach will provide a maintenance strategy with consistent preventive maintenance routines, history record and standardized reports.

This CMMS will become the information backbone for all major assets, including:

- Highway running surfaces
- The New Crossing structure
- Major sign structures
- Drainage structures
- Electrical systems

Each major asset component will be inspected and tested according to MoT guidelines and frequencies. Components that do not meet the Operational Performance Measures will undergo a rehabilitation process to bring them back to acceptable performance standards.

The PeopleSoft EnterpriseOne – Maintenance Module will:

- Use Master Asset tables to record specification details, procedures and scheduling dates to create work orders for preventive and corrective maintenance
- Record the results of work orders, including work performed, asset condition, estimated replacement year and estimated costs
- Serve the needs of financial, human resources, payroll and procurement departments – the different departments can work independently from each other while allowing integration for specific tasks
- Generate reports that will assist with refining maintenance strategies and cost forecasts

6.2.2.1 CMMS Interrelated Components

Equipment Master

The Equipment Master (EM) is the backbone of the CMMS Module. EM information is the primary data associated with the tagging and identification of every component of the New Structure. The EM establishes the basic information about an asset, such as the following:

- Identification numbers
- Description
- Category codes
- Account coding
- Dates (installation/replacement)

- Location
- Status

After an EM is created, the information can be used to search for equipment status, location and activity online; track historical, current and planned physical locations for a piece of equipment; relocate equipment; keep detailed maintenance and project logs; view maintenance equipment individually or in groups; revise necessary equipment relationships; or revise equipment status.

To manage equipment inventory, costs, warranties, billing, preventive maintenance and so on, an EM will be created for all maintenance assets. The Maintenance Module will set up assets for maintenance processing, set up necessary relationships, track inventory, and link parts of the inventory to specific equipment.

Preventive Maintenance

A good preventive maintenance (PM) plan will mitigate the risk of further corrective maintenance activities as well as promote quality assurance and control, increasing the life expectancy of the equipment and thus allowing for reduced capital requirements or better use of capital in general.

The maintenance procedures employed by Opco provide maintenance personnel with a systematic approach to completing their work while providing the data needs of the maintenance software. During the audit phase, all preventive maintenance activities and their frequencies are input into the PM database which will generate a list of PM work orders for completion, in any combination of weekly, monthly, semi-annual or annual activities.

Tracking PM in a correct manner builds a maintenance history on the equipment in our care. When using the PM module to manage maintenance needs, the type and frequency of each maintenance task are defined for each piece of equipment in the maintenance plan.

The PM cycle consists of the following tasks:

- Working with PM schedules
- Updating PM schedule information
- Changing the status of PM to complete

A typical PM cycle will create PM schedules for each piece of equipment, schedule PM and complete PM.

Corrective Maintenance

Corrective maintenance (CM) is an activity associated with the repairs or restoration of equipment, system breakdowns, building structure, components or finishes.

CM could be planned or unplanned, depending on the urgency of the situation. All CM is considered reactive and is performed in response to unacceptable equipment conditions discovered by personnel operating the equipment or by personnel performing preventive maintenance.

Corrective maintenance of infrastructure or equipment is typically triggered by one of the following:

- PM-generated CM work order
- Operational issue
- Inspection or audits
- Code compliance
- Equipment failures
- Others

Work Order

The primary functions of the work order module are: 1) to increase productivity by readily producing all information required to complete a work order; 2) to automatically track labour and material costs to a work order and subsequently to any piece of maintenance equipment; and 3) to consolidate a repair history on each piece of equipment in order to establish predictive maintenance schedules.

The work order module accomplishes these functions by accessing extensive databases of equipment data, parts information, repair procedures and material and labour costs. These databases are built during the pre-operational phase for each piece of maintenance equipment and each spare part recommended for inventory.

Work orders are used to manage the workflow of maintenance tasks and projects, including the following information:

- Creating work orders for preventive and corrective maintenance
- Committing inventory to a work order

- Scheduling multiple tasks and crafts, such as mechanical, electrical, etc., to a work order
- Tracking the progress of a work order by status
- Tracking work order costs, such as materials, labour, etc.
- Recording unlimited detailed information about a work order
- Completing and closing a work order

In addition to these features, a work order approval process can be set up in the Enterprise Workflow Management system that can be modified to suit a variety of needs.

Workflow Management

Workflow management offers a powerful means of automating various components of the work order lifecycle. The activities are based on a set of procedural rules and triggering events and require minimal user involvement. For example, workflow management can be used to do the following:

- Route a work order for approval
- Commit inventory to a work order
- Run the capacity plan for a work order
- Send messages to appropriate personnel regarding the progress of a work order
- Define as many workflow processes as your business needs require
- Attach any workflow process to any given event with an application
- Execute conditional processing, which is logic contingent upon supplied criteria, such as currency amount, status and priority

Maintenance Planning

Maintenance planning is used to accurately forecast part and labour resources needed to complete maintenance tasks and to minimize equipment downtime by ensuring that the necessary parts, materials and maintenance personnel are available when an asset requires maintenance.

Maintenance planning defines a range of maintenance work orders, for which the system projects parts requirements and labour requirements. Additionally, this information can be integrated with forecasted (planned) work orders that the system generates when a preventive maintenance projection is run.

Reports

The types of reports and the information available from the Maintenance Module are: asset (equipment) master reports, cost reports, work order reports, maintenance planning reports and preventive maintenance reports.

The maintenance program will provide the requirements for work orders, planning and procedures, preventative maintenance, predictable maintenance, maintenance training, materials management interface, preparation of budgets for major maintenance, and purchasing and inventory control.

Materials Management Program

The Materials Management Program will provide the requirements for procuring materials and tools, warehousing, inventory levels and control, renewal of inventories, storage maintenance, staging of material and maintenance interface.

The maintenance software package contains both a purchasing and an inventory module, maintaining a record of all purchase orders, purchases and all inventory warehouse functions performed.

Summer Maintenance Plan Summary Table

Highway Maintenance Specification		Summer Maintenance Plan
No.	**Description**	
1-100	Patching & Crack Sealing	Temporary pavement repairs until scheduled hot mix patching or surface rehabilitation. Crack sealing scheduled on 4-year cycle following paving.
1-180	Pavement Surface Cleaning	Spring mechanical sweeping scheduled within 1 month of end of winter with 120 cycle for all curb lines, plus as required removal of localized accumulations. Special as required cleaning program for walkway.
1-190	Debris Removal	Routine debris removal as part of Road Patrol activity. Major site clean-up response with lane control.
1-200	Highway Structures Mtce	Mechanical debris removal with washing restricted to minimize debris infiltration into the water body.
1-220	Curb, Island and Barrier Mtce	Annual clean-up to ensure complete operating performance. On going program of repairs to meet performance measures.
2-270	Shore, Bank and Watercourse Mtce	Routine inspection as part of daily Road Patrol. Scheduled repairs as required to restore to original constructed condition.
4-350	Roadside Vegetation Control	Grass cutting and plantation maintenance as specified, including specialized services and fertilizing n initial years of growth.
2.4.4	Landscape Mtce – Local Area Specification	
4-370	Litter Collection & Graffiti Removal	Planed weekly litter pick-up with site specific response as part of Road Patrol. Proactive graffiti removal program upon discovery.
5-440	Sign System Maintenance	Sign stock inventory to replace signs as required within specified performance measures. Annual sign review and replacement program for deteriorated sign faces.
5-470	Highway Traffic Control	Internal traffic control equipment (lane controls trailers, PVMS and control equipment) as required to meet Traffic Control Manual for Work on Roadways.

6-xxx	Bridge & Structure Maintenance	A detailed annual bridge maintenance manual will be prepared in response to the unique operating conditions required for the final design of the new crossing. This manual and an annual plan will cover both the new bridge and the floating pontoon structure.
7-xxx	Emergency Maintenance	An Incident Response Manual will address the action plan to address unplanned events. To address highway incidents, a combination program of on-site tow truck and Paid-Duty police will be implemented to clear lane blocking roadway incidents as soon as possible and minimize traffic interruption. A systematic reporting of all incidents and lane blockages will be undertaken based on Police report and CCTV analysis. Facility damage repairs will be initiated as required with cost recovery processes.
8-xxx	Inspection	The daily road patrol of the entire New Crossing will be undertaken daily and conditions reported. During the winter period this will be expended to a 4 hr minimum during periods of freezing temperatures and snowfall.
	Reporting Specifications	All Operations, Maintenance and Rehabilitation Reports, Management Plans, Routine Reports and Data Records will be developed internally and submitted as per the specified schedules.

Winter Maintenance Plan Summary Table

Highway Maintenance Specification		Winter Maintenance Plan
No.	**Description**	
3-300	Highway Snow Removal	Two snow trucks with plow and wings will be staffed and dedicated to meeting the winter maintenance demands of the project. A front-end loader will be available for heavy snow accumulation removal from adjacent to barriers, curbs and along shoulder areas.
3-310	Winter Abrasive & Chemical Snow & Ice Control	Both snow plow trucks will be fitted with salt/sand spreaders both equipped with 30% liquid pre-wetting and anti-icing capability. Call out of the units will be based on a combination of RWIS weather forecasts and Road Patrol observations.
3-320	Roadside Snow & Ice Control	A dedicated tractor snowplow and sidewalk material spreader unit will be stationed on the project to address the pedestrian walkway of the new crossing. The tractor will also be equipped with a front-end loader for snow removal activities
3-340	Highway Condition Reporting	Routine road conditions reports of the project will be issued three times daily throughout the winter season, plus twice daily throughout the summer. All planned maintenance activities effecting traffic flows will be reported the preceding day.

7.0 PROJECT TECHNICAL RISK PLAN

Our Solution

- Proven risk identification process (FMEA)
- Formal corporate REC review process was used to identify, understand and mitigate all major legal, commercial, financial, technical and operations and maintenance project risks, their likelihood of occurrence and effects
- Risk mitigation measures clearly defined and practicable, to address three significant project risks: schedule, bridge decommissioning/disposal and graving dock location

7.1 INTRODUCTION

Prior to commencement of construction activities, a risk assessment will be completed for all design and construction processes and installation tasks, to assess their risk potential and determine consequences for the project. SNC-Lavalin and its design and construction subcontractors are all highly experienced in their respective disciplines, and their technical capabilities will enable our team to effectively manage the anticipated design, construction, operations and maintenance risks on this major finance, design, build, operate and maintain project.

As a policy, SNC-Lavalin conducts a risk evaluation of all projects and has a formal Risk Evaluation Committee (REC) review for all projects exceeding a capital cost of CA $10 million, and for projects that require equity placement. A formal REC review process was used for this project to identify, understand and mitigate all major legal, commercial, financial, technical and operations and maintenance project risks, their likelihood of occurrence and effects. After considering the changes made to the risk profile by the Province, a reassessment of the technical risks associated with this project was performed as part of the preparation for our BAFO submission. The three major technical risks identified in this process are discussed as part of this section.

While only technical risks are discussed in this section of our proposal, it should be recognized that there are also significant legal, commercial, operational and maintenance risks associated with this project, all of which SNC-Lavalin will be analyzing.

7.2 RISK IDENTIFICATION PROCESS

During the design, construction methodology/engineering development and construction process we will manage the technical risk using principles based on failure modes and effects analysis (FMEA). Our approach in this respect is described below.

7.2.1 Failure Modes and Effects Analysis (FMEA)

Risk relates to a loss resulting from the failure of an expected or predicted outcome to occur. Such failures can relate to any aspect of a project, including commercial, financial, technical and operations and maintenance. The use of FMEA focuses on assessment of severity; probability and detectability of each failure mode. Our analysis of failure modes will also include determination of the causal effects each individual mode may have on further failure modes.

The FMEA process we intend to apply to this project will generally be in accordance with the following steps:

1. **Identify risk elements:** Key members of our team will review the design and construction methodology and the operations and maintenance activities, breaking the project down into subsections, either lines or individual pieces of equipment, process, activity or construction methodology. Risk elements within each subsection will be determined and a list of the various risks compiled in a risk analysis worksheet.

2. **Identify failure modes**: A failure mode is defined as the manner in which a component, subsystem, system, process, etc. could potentially fail to provide an expected or predicted outcome. A failure mode in one component can serve as the cause of a failure mode in another component. Failure modes will be listed for function of each component or process step. At this point the failure mode will be identified, whether or not the failure is likely to occur

3. **Determine severity of failure mode**: The effects of each identified failure mode and the ultimate effect of such a failure mode will be described. A numerical ranking of the severity of the ultimate effect will be assigned using a common industry standard scale of 1 to represent no effect and 10 to indicate high severity, with failure affecting system operation and safety without warning.

4. **Determine probability of occurrence of failure mode**: Identify the potential causes for each failure mode and assign a probability factor that reflects the likelihood of occurrence. The probability factor is a common industry standard scale of 1 to represent not likely and 10 to indicate inevitable.

5. **Determine the likelihood of detection prior to failure**: Identify the mechanisms or processes that prevent the cause of the failure mode from occurring, or which detect the failure before it occurs. These mechanisms or processes represent the detection component of FMEA. Detection is an assessment of the likelihood that the design and process will detect the cause of the failure mode or the failure mode itself, thus preventing it from occurring. Detection is a number selected from a scale of 1 to 10, where 1 represents that detection prior to failure is not likely and 10 indicates that detection prior to failure is highly likely.

6. **Determine the Risk Priority Numbers (RPN)**: The RPN is a mathematical function of the numerical severity, probability, and detection ratings:

   RPN = (Severity) x (Probability) / (Detection)

The RPN will be used to prioritize items that require additional planning or action and determine recommended action or mitigation to address potential failures that have a high RPN. The focus of this additional analysis will be to reduce severity and probability and to increase detection, in order to mitigate risks. These actions could include specific inspection, testing or quality procedures; selection of different components or materials; de-rating; limiting environmental stresses or operating range; redesign of the item to avoid the failure mode; monitoring mechanisms; performing preventative maintenance; or inclusion of back-up systems or redundancy.

7.3 THREE SIGNIFICANT PROJECT RISKS

The three project technical risks considered to be the most significant are the following:

1. Schedule, in particular early receipt of the environmental permit, prompt completion of the design cycle and pontoon construction and installation
2. The condition and decommissioning of the existing bridge
3. Installation of the New Bridge and transfer of the existing pontoon anchors and cables

The contingency and mitigation plans for each of these risks is briefly described in the following sections.

7.3.1 Schedule Risk

Intentionally deleted.

7.3.2 Existing Bridge Decommissioning/Disposal Risk

Intentionally deleted.

7.3.3 Installation of the New Bridge and Transfer of Existing Pontoon Anchors and Cables

During the installation and anchor cable transfer procedure, the existing north anchors will be disconnected from the Existing Bridge and the new pontoons floated into position. The new pontoons will be stabilized with temporary horizontal struts to the Existing Bridge until the anchor cable system, including temporary sinkers, is reattached to the north side of the new pontoon. This process will be repeated until all new pontoons are installed. The full transfer of the anchor cables on the south side will be completed following decommissioning of the Existing Bridge.

- Risk: The anchorage transfer from the Existing Bridge to the New Bridge is a unique and critical construction activity. There is the potential for severe weather conditions, including wind and ice, as well as the loss of an anchor cable during the transfer. Due to the tight schedule for pontoon installation there will be only a nominal ability to delay installation until conditions are ideal.
- Mitigation: Careful construction planning will be undertaken to fully understand the installation and transfer process. A detailed Work Method Statement will be prepared as a collaborative effort by our engineering and construction supervision staff. Personnel with extensive floating structures experience will perform the work under the supervision of senior Construction Managers.

7.4 CONCLUSION

We have identified and provided what we believe at this time to be the three most significant risks. During the project execution we will prepare a formal Risk Management Plan for use in identifying, assessing and controlling risks that can be expected to occur on the New Crossing Services project, as well as their severity, probability of occurrence and means of detection. As part of this assessment process we will be determining means of mitigating these risks and developing design, construction, operations and maintenance processes that support the means of mitigation and follow-through.

8.0 PROJECT QUALITY MANAGEMENT PLAN

Our Solution

- SNC-Lavalin, Trow Associates and Buckland & Taylor certified to ISO 9001:2000
- Entrenched corporate quality procedures, as well as project-specific experience and expertise
- Clear quality reporting relationships established project-wide to achieve compliance and consistency

8.1 COMMITMENT TO QUALITY

The SNC-Lavalin team commits to the following:

- We will comply with the principles of ISO 9001:2000 for the design and construction component of the Quality Management System
- We will implement and maintain an ISO 9001:2000 registered Quality Management System for the operations and maintenance component of the Quality Management System; and manage and operate in conformance with the terms of that system
- We will provide written responses to the Province's audits of the performance of our team in terms of our Quality Management System and the Functional Requirements and the Concession Agreement
- We will prioritize and act on quality issues in a timely manner
- We will comply with Schedule 6 to the BAFO Concession Agreement (Concessionaire's Design) for design, construction, operations, maintenance and asset management – including the key fundamental requirements:
  - We will provide all required quality assurance and quality control services
  - We will meet the requirements of Association of Professional Engineers and Geoscientists of British Columbia, Bylaw 14(b) – Quality Management

8.2 OUTLINE DESCRIPTION OF QUALITY MANAGEMENT PLAN AND QUALITY PROCESS

8.2.1 ISO 9001:2000 Compliant

The SNC-Lavalin team confirms that quality management is an integral component of this project. Quality management will encompass all activities involving management, oversight, site investigation, engineering,

design, procurement, construction, operations and maintenance. For this reason, our team has developed and adopted a Quality Management Plan for our joint project work. This Quality Management Plan is based on the functional requirements of the International Standard ISO 9001:2000 Quality System model and outlines planned and systematic actions needed to provide confidence that all products and services provided or undertaken by our team, satisfy specific client requirements. This Quality Management Plan also recognizes and reflects the team's sole responsibility for all quality control and quality assurance activities necessary to manage its processes, including design, construction, operations and maintenance and those if its subcontractors and suppliers.

ISO 9001 requires the use of ISO 9000:2000 (Quality Management Systems – Fundamentals and Vocabulary). The project team understands the differences between quality control (ISO 9000 Clause 3.2.10), quality assurance (ISO 9000 Clause 3.2.11), and Quality Audit (ISO 9000 Clause 3.9.1) language and purposes.

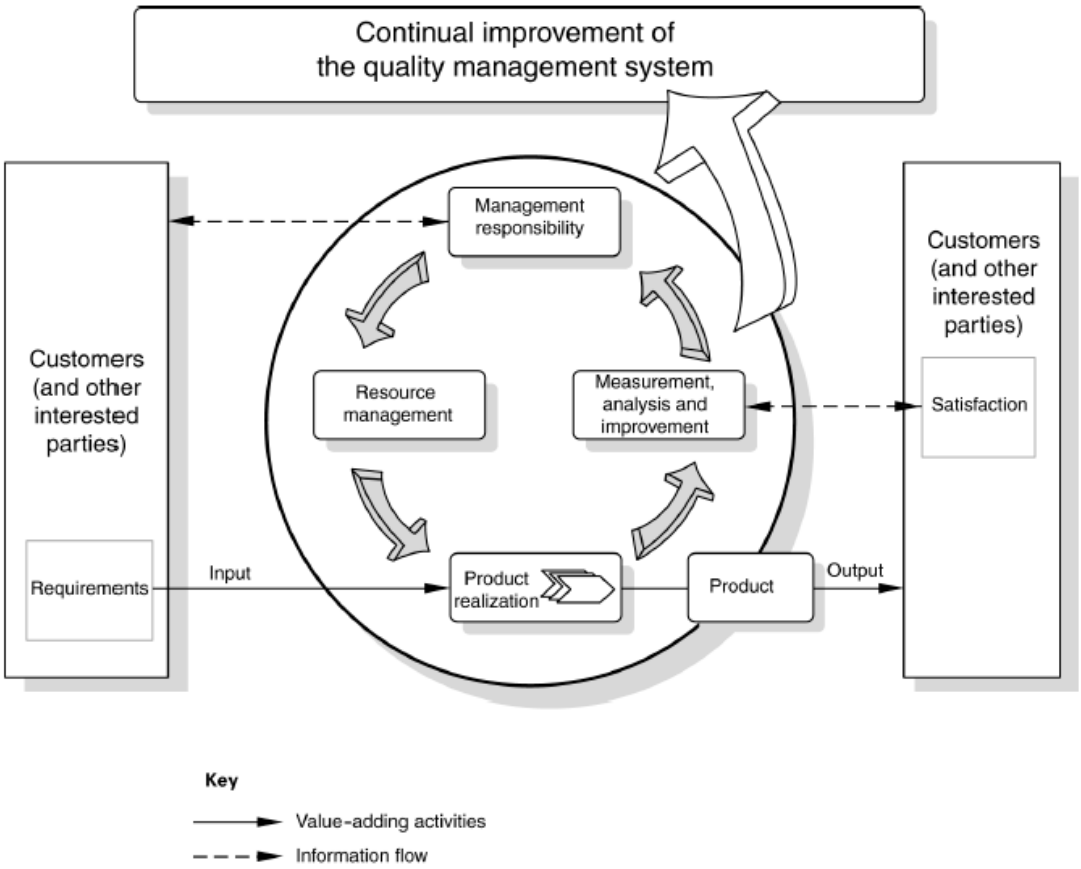
All eight quality management principles identified in the ISO 9000 series will be used – namely:

- Customer focus
- Leadership
- Involvement of people
- Process approach
- System approach to management
- Continual improvement
- Factual approach to decision making
- Mutually beneficial supplier relationships

Figure 8-1 on the following page (source: ISO 9001:2000) gives an overview of the Quality Process our team will put in place to establish quality infrastructure.

- An outline of the above quality process, demonstrating that it includes all practices, resources, and particular sequence of activities the team will use in its engineering, design and construction activities, is provided In Figure 8-1 below:

Figure 8-1: Quality Process Overview



The main system processes are those recommended in ISO 9001:

- Quality management system
- Management responsibility
- Resource management
- Product realization
- Measurement, analysis and improvement

The ability of the team to implement and develop such a Quality Management System is further demonstrated by the following:

- SNC-Lavalin, Trow and Buckland & Taylor are ISO 9001:2000 registered firms (certificates shown in Attachments 1 in Appendix C). All work performed on this project will be performed under the umbrella of SNC-Lavalin's Quality Management System and in compliance with this project-specific Quality Management Program, the creation of which is covered by the scope of SNC-Lavalin's and Trow's ISO 9001:2000 Registration
- Several Trow staff have completed the Quality Management Institute ISO 9001 Lead Auditor Training Course or an accredited equivalent.
- The International Register of Certificated Auditors (IRCA) internationally accredits Mark Havlasek, our designated Project Quality Manager, as a Quality Management System 2000 Quality Management Systems Lead Auditor (accreditation card shown in Attachment 2 in Appendix C).
- Further, our team has developed and administered full ISO 9001 Quality Management Plans for numerous recent British Columbia transportation projects, including the 200th Street Interchange Develop-Design-Build project, the Lions Gate Bridge Rehabilitation Project, the Sierra Yoyo Desan DBFO Project, the Vancouver Airport Connector Design-Build, John Hart Bridge and the Sea to Sky Highway Improvement Project.
- An edition of our proposed Quality Management Plan and its implementation on the Lions Gate Bridge Rehabilitation Project received an Award of Excellence from the MoT (award shown in Attachment 3 in Appendix C).

Our Quality Management Plan is available for review at the request of the client. The complete Quality Management Plan Table of Contents used for a similar project is shown in Attachment 4 in Appendix C. The following provides a description of a few (due to space limitations) main chapters of this Quality Management Plan that are the key quality control and quality assurance procedures the team will implement.

8.2.2 Design QA/QA Procedures (in compliance with ISO 9001:2000 Clause 7.3 – Design and Development)

Chapter 4 of the Quality Management Plan includes specific procedures for engineering and design that help minimize engineering and design errors and omissions, while meeting or exceeding construction output specifications and construction requirements during the design phase of the project. These systems include the following key elements:

- Use of independent checking of design

- Checking and back-checking processes
- 3D design tools
- Check lists
- Design procedures
- Standard designs and details
- Continuous improvement processes
- Peer review
- Design revisions during construction

8.2.3 Construction QC/QA Procedures (in compliance with ISO 9001:2000)

The Quality Management Plan includes QC/QA procedures to help ensure the successful construction, completion, commissioning and testing of the New Crossing, and the completion of the decommissioning as designed. The standards, materials and processes to be maintained and verified include but are not limited to the items shown in Table 8-1 on the following page. Note that Attachments 5 through 8 in Appendix C, the Non-Conformance Report Form, Non-Conformance Log and Opportunity for Improvement Form and Log, are key tools used to help address the last four rows of Table 8-1 on the following page.

For each project deliverable, the Quality Assurance procedures shown in Table 8-1 include, but are not limited to, the following:

- A detailed description of personnel qualifications, testing facilities, equipment, and monitoring systems including minimum sampling and testing frequencies.
- A detailed description of how and within what timeframe all test results are reported to the Concessionaire and the Province, how corrective action is implemented in the case of unacceptable results, and how borderline materials are dealt with. As a minimum, separate descriptions are to be given for the testing of compaction, aggregates, construction materials, concrete and asphaltic materials.

Table 8-1: Construction QC/QA Procedures

QC/QA Procedure	Located in QMP Chapter Number(s)
Field supervision responsibilities including drawing revision management	1, 5
Surveying	9, 10
Fabrication quality control	9,10
Material history tracking	8, 10
Material testing	10, 11
Construction procedures	9, 10
Certification of trades	15
Approval process for field changes	3, 4
Check-out procedures for electrical, mechanical, etc	9, 10
Identification and use of independent testing firms per the Quality Management System	6, 10, 11
Delivery/placement of the materials and products on site in the correct locations or structures during the day to day works on the Project and a description of the methods that will be employed to track and report these operations to the Quality Manager	9, 10, 15
A detailed description of how the team proposes to inspect and document the workmanship and methods of construction to comply with the Province and industry standards	9, 10, 11, 13 (Refer to Figs 10-6 & 10-7)
A description of reporting mechanisms to be utilized and how results will be reported to the Province	9, 10, 13, 17 (Refer to Figs 10-6 & 10-7)
A description of how the Concessionaire will work with the Province to achieve a level of quality that conforms to the Province's standards	9, 13 (Refer to Figs 10-6 & 10-7)
An approach to resolution of differences in assessment of quality of workmanship and materials between the Concessionaire and the Province as if it were a knowledgeable owner	13, 14 (Refer to Figs 10-6 through 10-9)

8.2.4 Operations, Maintenance and Asset Management

The details of these portions of the Quality Management System have been previously described in Section 6 (Operations and Maintenance) of this Technical Proposal.

8.2.5 Quality Audits

Our team understands that the Province will perform quality audits throughout the duration of the project. Therefore, the Quality Management Plan procedures will provide the Province with full access to all project quality records. Our team will also cooperate with the Province to allow it access to the test results and testing facilities to verify adherence to the Quality Management System. Our team will ensure the Province has unimpeded access to all quality management records, test results and reports during normal working hours.

Our Quality Auditor will conduct audits of our team's quality system implementation practices throughout the term of the project. Chapter 17 of the Design Quality Management Plan provides details of the Quality Audit system, and includes a copy of the audit checklist that will be used for internal audits.

8.3 TESTING/INSPECTION/MONITORING PROCEDURES

The quality control and quality assurance procedures described above also address the testing, inspection and monitoring required to help ensure the end product meets the Functional Requirements.

Of particular significance, Chapter 9 of the Quality Management Plan describes the process controls utilized on this project. Appendix A of the Quality Management Plan provides the Major Processes Inspection Checklists prepared and utilized by the project team for monitoring the quality review during all aspects of project construction and maintenance.

Inspection checklists have been prepared for 68 construction processes, including hot mix asphalt pavement; sewer construction; installation of bearings; reinforcing steel; pre-cast concrete; installation of expansion joints and bridge deck waterproofing, etc. All have been developed in compliance with the MoT Standard Specifications for Highway Construction, 2004 Edition.

A sample quality control and quality assurance procedure/checklist taken from another similar project is shown in Attachment 9 in Appendix C – note the procedure outlined in the "Description" column and then the "Quality Control" and "Quality Assurance" signoffs.

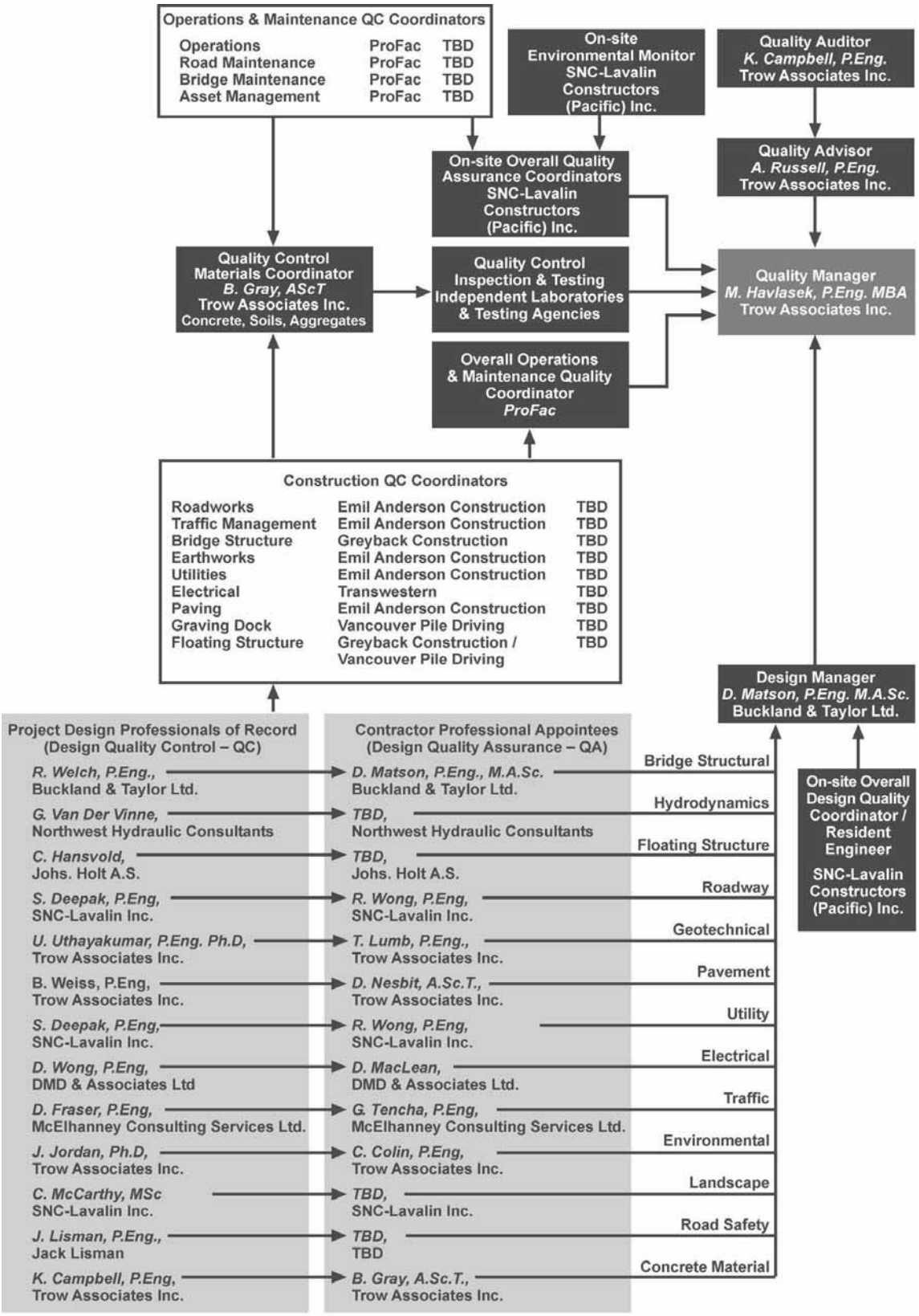
Appendix B of the Quality Management Plan provides the testing schedule to be implemented for each of these same 68 construction processes. A sample from another similar project is shown in Attachment 10 in Appendix C.

8.4 TEAM ORGANIZATION

Chapter 1 of the Quality Management Plan describes the corporate objectives, organization, and responsibility of project team personnel.

Our team organizational structure is described in Section 1.0 of this volume. In keeping with the intent of ISO 9001:2000, all project staff also have a quality reporting relationship to the Quality Manager. The Quality Organization Chart on the following page, Figure 8-2, illustrates these reporting relationships. Figure 8-2 has been updated for this BAFO submission.

Figure 8-2: Quality Management Organization Chart (Updated for BAFO Submission)



8.5 DEVELOPMENT AND IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM

The Quality Management Plan fully documents all aspects of the undertakings. Our team will carry out all activities in accordance with the Quality Management Plan and will put in place processes to ensure continuous improvement of the system during the Contract Period. Our team will comply with the ISO requirements of the implemented Quality Management System during the Contract Period. Quality management staff will be restricted to quality management functions only and will not undertake other project responsibilities.

The process that the team will follow for developing and implementing the Quality Management System, including the defined deliverables to show the implementation process are shown in Attachment 11 in Appendix C.

8.6 MEETING MoT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

The following examples serve to demonstrate that our team has a clear understanding of the transfer of responsibility for the quality assurance functions that were previously performed by the Ministry. They also show how our team intends to incorporate the quality control and quality assurance requirements currently contained in the material, work methodology and end product MoT Standard Specifications for Highway Construction, 2004 Edition, into its own inspection and testing planning process:

- Section 317: P.E. Plastic Drainage Pipe – the quality assurance role previously performed by the Ministry as per SS 317.09 “Quality Assurance” will now be performed by the Quality Manager (or one of his inspection staff)
- Section 421: Structural Steelwork – the quality assurance role previously performed by the Ministry as per SS 421.06 “Quality Assurance” will now be performed by the Quality Manager (or one of his inspection staff)

9.0 PROJECT SAFETY PLAN

Our Solution

- Comprehensive corporate safety programs to be used as basis for the Project Safety Plan
- Safety of the public, workers and all other onsite participants takes precedence over any other activity or consideration, during all project phases

9.1 INTRODUCTION

The Concessionaire will have overall responsibility for the occupational health and safety program for the Okanagan Lake New Crossing Services Project.

SNC-Lavalin Constructors (Pacific) Inc. and Vancouver Pile Driving Ltd. (the members of the Design/Build Joint Venture) and their team of Designated Subcontractors all have comprehensive corporate safety programs that will be used as the basis for a Project Safety Plan governing our operations on the project.

9.2 GENERAL POLICY ON OCCUPATIONAL HEALTH AND SAFETY

SNC-Lavalin's General and Construction Safety Policy will be the basis for the Project Safety Plan and will apply to the construction and decommissioning, as well as the operations and maintenance phases of the project. A proactive accident prevention approach will be used, through the application of the following procedures:

1. Compliance with the requirements of authorities having jurisdiction, as well as Worker's Compensation Board regulations, Section 9 of the Definitive Concession Agreement and Section 135 of the Standard Specifications for Highway Construction, 2004, WHMIS standards, and good construction practice
2. Establishment of a safety committee with designated safety officer, with a signed commitment to the safety policy signed by senior management and all core staff
3. Requirement for all consultants, subcontractors and suppliers/vendors to comply with the Safety Plan and the Functional Requirements
4. Management and operation of the project in conformance with the terms of the Safety Plan
5. Regular site meetings with site personnel at which safety issue feedback will be encouraged
6. Regular site inspections

7. Compulsory Safety Orientation Program, training, and procedure review with site personnel
8. Site safety and maintenance procedures, including prioritizing and acting on safety issues in a timely manner
9. Site visitor control
10. Regular follow-up

Included in our approach is a commitment to providing written response and action on the Province's audits of the safety performance of the Concessionaire.

9.3 CONSTRUCTION AND DECOMMISSIONING/DEMOLITION PHASE

There will be a specific policy used to develop the integrated Safety Plan for the Okanagan Lake New Crossing Services Project and the protection of the public, the major elements of which are as follows:

1. The safety of the public, workers and other participants on the site takes precedence over any other activity or consideration. Elimination of causes of danger to workers' health, safety and physical integrity is our highest priority.
2. Safety on the construction site will be everyone's business: the Design-Build Joint Venture, the Concessionaire, contractors, subcontractors, the Project Manager, the Construction Manager, worksite supervisory personnel, security agents, the workers themselves and the organizations representing them. The integration of various safety policies and procedures submitted by individual participants will be integrated into the Safety Plan to ensure a comprehensive document to which all will adhere.
3. SNC-Lavalin will do a comprehensive analysis to identify major areas of risk relating to construction, identify the means for eliminating such risks.
4. Indication of Frequency and Indication of Seriousness reports will be compiled on a monthly basis, and procedures and activities related to follow-up and reporting will be mandated in accordance with WCB requirements or SNC-Lavalin's corporate policy, whichever is more stringent.
5. The Project Manager and Construction Manager will be directly responsible for the performance of the project where safety is concerned.
6. SNC-Lavalin will provide the Project Manager and Construction Manager with means and instruments that enable them to apply this plan on the project; such means may include, among others, contractual provisions, inspections, audits and a safety committee.

7. SNC-Lavalin will require that the organization of site work and the methods and techniques used are safe and not prejudicial to the health of staff and personnel on the worksite. In particular, the Design-Build Joint Venture will be required to maintain the proper upkeep of the worksite and the provision of adequate sanitary facilities.
8. SNC-Lavalin will arrange for worksite personnel to receive adequate orientation, training and information regarding health and safety risks arising from work, means for avoiding a health or safety risk and onsite first aid services.
9. Each contractor or subcontractor whose Indication of Frequency or Indication of Seriousness is deemed to be unacceptable may be required, if deemed necessary by SNC-Lavalin, to submit a recovery plan aimed at eliminating health and safety risks on its worksite. It must then apply this recovery plan to the worksite.
10. Monthly reports from all participants will be required describing the frequency and seriousness of accidents. The plan will describe the mechanism of reporting accidents, together with a periodic safety audit review procedure.
11. Specific design, construction, demolition, operating and working methods and procedures will be developed to ensure that occupational health and safety objectives are achieved. There will be individual plans where appropriate.
12. Specific safety and work methods, procedures and planning, together with instructions and training, will be developed and undertaken for all areas, and specifically for areas of above-normal construction risk; for example:
    a. Marine environments
    b. Confined spaces or isolated work spaces – special care with entry and communications will be incorporated here
    c. In a dry-dock
    d. On elevated structures – will include fall protection
    e. On demolition and decommissioning of the Existing Bridge
    f. On operations and maintenance of the New Crossing
    g. In collision, spill and traffic control environments – specific care required regarding multi-vehicle and large vehicle incidents

h. Hazardous waste and environmentally sensitive conditions

i. In excavations

j. Under overhead construction

k. During the use of cranes and special lifting devices

l. In inclement weather conditions

m. With fire or potentially flammable substances

13. For general and specific tasks such as those above, operational site communication, emergency and rescue procedures in the event of an accident will also be developed.

9.4 OPERATIONS AND MAINTENANCE PHASE

The Safety Plan to be developed for the operations and maintenance phase of the project will follow the same General Policy as that outlined in subsection 9.2 above.

Please refer also to subsection 6.1.3 of this proposal for the safety regime to be implemented for the operations and maintenance phase of the project during the Enhanced Service Period.

9.5 CONSULTANT, SUBCONTRACTOR AND SUPPLIER EMPLOYEE SAFETY ADHERENCE OVERVIEW

For all phases of the project, consultants, subcontractors and suppliers will be responsible for assigning employees with the knowledge and expertise to perform required job functions in a safe and professional manner. Subcontractor employees, vendor employees and agents will also be subject to the same safety and disciplinary action program as our employees.

It will be contractually established and clearly communicated that while on our worksites, subcontractor and vendor employees are under the authority of, and must be responsive to, the general directions and specific instructions of the Project Manager or his designate with respect to all matters, but in particular, safety.

9.6 CORPORATE SAFETY POLICY STATEMENTS

As evidence of our firm commitment to a safe working environment during the execution of the works for the Okanagan Lake New Crossing Services Project, copies of Corporate Safety Policies, signed by senior

management, are provided in Appendix D for SNC-Lavalin Group Inc. and the following Core Organizations:

- Vancouver Pile Driving Ltd.
- Greyback Construction Ltd.
- Emil Anderson Construction (EAC) Inc.

10.0 PROJECT DELIVERABLES PLAN

Our Solution

- Internal project management system, PM+, will ensure delivery of project documents – has modules for drawing control, progress monitoring and reporting
- Dedicated Project Controls Manager working closely with Project Team and Project Manager to ensure schedule adherence

A Project Deliverables Plan, including design drawings, design criteria, design folders, record drawings, design calculations and reports, will be prepared and submitted to the Province's Representative. This plan will outline how the SNC-Lavalin team will deliver documentation and drawings as required by the Concession Agreement during the various phases of the project. The delivery of these documents will allow the Province to:

- Understand the status of the project
- Review the Concessionaire's adherence to the Concession Agreement
- Confirm that the project is being materially delivered as described by this proposal

The key phases of the project may be summarized as follows:

- Design and construction of the New Crossing
- Demolition of the existing bridge
- Operations and maintenance of the New Crossing

The plan will be prepared to address each of these key phases and will also describe how deliverables pertinent to design development, contract management matters and operational and maintenance requirements will be stored, updated and transmitted to the Province's Representative.

10.1 DOCUMENTATION AND DRAWINGS

The control and management of all project documents falls under the responsibility of the Project Controls Manager. As the leader of this function, SNC-Lavalin intends to implement its Project Management System

(PM+) for this project. The document control module within this system supports the planning, definition, monitoring and tracking of four classes of documents:

- Internally produced engineering designs, drawings and specifications
- Externally produced vendor drawings
- Externally produced reference data
- Internally produced administrative documents or electronic files

Document transmission may be electronic, via email or Internet, or in paper format. A secure “ftp” site will be established for the project, accessible to the Province’s Representative, and electronic submission of documents will be maximized.

10.1.1 Primary Documents

During the planning and execution phase, the Project Manager generates and maintains the following documents which define the project:

- Project Organization Chart
- Work Breakdown Structure (WBS)
- Budget
- Detailed Schedule and milestone dates
- Scope of Engineering Services
- Project Scope Changes
- Contract Amendments
- Instructions specific to the Project

The Design Manager prepares and maintains:

- Technical Specifications
- Engineering Design
- Engineering Change Notices

- List of Drawings

The Document Controller is responsible for:

- Ensuring that documents are processed and filed utilizing the Project-specific data base system
- Maintaining the list of drawings
- Affixing routing stickers (stamps) to all technical documents requiring the review and approval
- Issuing periodic document status reports

10.1.2 Monitoring and Reporting

A Project Controls Engineer will be assigned to the project team at both the design office and the jobsite, reporting to the Project Controls Manager. These individuals are jointly responsible for developing, monitoring and updating the project schedule, verifying actual progress, forecasting cost and schedule to complete, preparing reports, and administering the Project Controls Policies and Procedures.

Following contract award and the identification of the project team, the Project Controls Engineer will coordinate the development of the Project Schedule. This schedule will be developed with the project team and will be the primary scheduling document used to control the project. The Project Schedule will contain enough detail for the engineering, procurement, construction and start-up activities to adequately identify float and control the project.

The Project Office will submit a progress report every month, reporting on work accomplished during the reporting period, work forecast for the following period, schedule, and any additional information, findings or recommendations that may assist in evaluating the status of the work. The report will also identify problem areas and outline corrective action to be taken.

10.1.3 List of Deliverables

A list of deliverables has been prepared, itemizing the documentation that will be provided to the Province's Representative and therefore demonstrating compliance with the Concession Agreement. This list is attached at the end of this section.

Description of Deliverable	BAFO CA Reference	Frequency
1. Quality Management Reports		
Quality Manual	Schedule 6	
Quality System Procedures and Process Flow Charts	Schedule 6	
Work Method Statements	Schedule 6	
Design Quality Management Plan	Schedule 6	
Construction Quality Management Plan	Schedule 6	
Operations, Maintenance and Rehabilitation Quality Management Plan	Schedule 6	
Traffic Quality Management Plan	Schedule 6	
Environmental Quality Management Plan	Schedule 6	
2. Construction Reports		
2.1 Construction Plans		
Works Schedule	Schedule 5, Part 1, para 2.	
Traffic Management Plan	Schedule 5, Part 6, para 1.3.2	
Specific Traffic Management Plan	Schedule 5, Part 6, para 1.3.3	
Decommissioning Plan (including Demolition)	Schedule 5, Part 1, para 3.19	
Environmental Protection Plan	Schedule 5, Part 1 para 4.	
Noise Mitigation Plan	Schedule 5, Part 1, para 4.1	
Occupational Health and Safety Program	CA Section 9.4	
Risk and Safety Management Plan	Schedule 5, Part 1, para 6.	
Risk Management Plan	Schedule 5, Part 1, para 7.	
Deliverables Plan	Schedule 5, Part 1, para 9.1	
2.2 Construction Reports		
Accident/Incident Investigation Reports		After each occurrence
Roadway Progress Reports	Schedule 5, Part 1, para 9.1	30% / 60% / 90% / 100%
Roadway Design Drawings	Schedule 5, Part 1, para 9.1.1.1	30% / 60% / 90% / 100%

Description of Deliverable	BAFO CA Reference	Frequency
Roadway Design Criteria	Schedule 5, Part 1, para 9.1.1.1	30% / 100%
Roadway Safety Audit Reports	Schedule 5, Part 1, para 3.1 and 9.1.1.1	Preliminary / 60% / 100% / pre-opening
Roadway Permits, Licences and Approvals	Schedule 5, Part 1, para 9.1.1.1	100%
Roadway Design Folders	Schedule 5, Part 1, para 9.1.1.2	100%
New Crossing and Structural Progress Reports	Schedule 5, Part 1, para 9.1.2.1	30% / 60% / 90% / 100%
Structural Design Drawings	Schedule 5, Part 1, para 9.1.2.1	30% / 60% / 90% / 100%
Structural Design Criteria	Schedule 5, Part 1, para 9.1.2.1	30% / 100%
Structural Design Folders	Schedule 5, Part 1, para 9.1.2	100%
Non-standard Poles & Sign Support Structures	Schedule 5, Part 1, para 9.1.2.2	Conceptual prior to detailed design, and 100% design
Retaining Wall System	Schedule 5, Part 1, para 3.9.2.5.2	Before start of design
Geotechnical Report for Retaining Walls	Schedule 5, Part 1, para 9.1.2.3	100%
Retaining Wall Progress Reports	Schedule 5, Part 1, para 9.1.2.3	30% / 60% / 90% / 100%
Geotechnical Progress Reports	Schedule 5, Part 1, para 9.1.3	30% / 60% - coordinate with roadway and structural design 100% - coordinate with 90% road and structural design
Geotechnical Design Drawings	Schedule 5, Part 1, para 9.1.3	100%
Geotechnical Test Results and other QC/QA Reports	Schedule 5, Part 1, para 9.1.3	100%
Rip-Rap Quality Test Reports	Schedule 5, Part 1, para 3.9.2.2.1	Prior to confirming selection
Geotechnical Summary Report	Schedule 5, Part 1, para 9.1.3	100%
Electrical Design Progress Reports	Schedule 5, Part 1, para 9.1.4	30% / 60% / 90% / 100%
Record Documents	Schedule 5, Part 1, para 10.1	At completion

Description of Deliverable	BAFO CA Reference	Frequency
New Crossing Record Documents QC & QA Reports Geotechnical and Groundwater Engineering Reports Concrete Inspection Report	Schedule 5, Part 1, para 10.2	After construction of New Crossing
Retaining Wall Record Documents	Schedule 5, Part 1, para 10.3	After construction of walls
Construction Completion Report	Schedule 5, Part 1, para 10.4	Prior to Completion Date
Design and Construction Monthly Reports	Schedule 5, Part 1, para 10.5	Monthly
3. Operations, Maintenance and Rehabilitation Reports		
Operations and Maintenance Plan	Schedule 7, Part 1, para 1.10	
Asset Management Plan	Schedule 7, Part 1, para 1.11	
Salt Management Plan	Schedule 15, Part 2, para 1.3	
Communications and Customer Care Plan	Schedule 15, Part 2, para 1.3	
Emergency Response Plan	Schedule 15, Part 2, para 1.3	
Safety Management and Intervention Plan	Schedule 15, Part 2, para 1.3	
Annual Asset Management Plan	Schedule 15, Part 2, para 1.3	
Five Year Management Plan	Schedule 15, Part 2, para 1.3	
4. Environmental Management Plan Reports		
Environmental Management Plan	Schedule 12	
5. Monthly Report	Schedule 15, Part 2, para 1.5	Within 10 working days after the end of each month
6. Annual Report	Schedule 15, Part 2, para 1.6	Within 30 days following the end of each Contract Year
7. Accident Reports	Schedule 15, Part 2, para 1.7	As soon as practicable but not later than 24hr after a Major Road Accident
8. Financial Reports		

Description of Deliverable	BAFO CA Reference	Frequency
Unaudited Financial Stements	Schedule 15, Part 2, para 1.8.1	60 days after the first 6 months of each financial year
Audited Financial Statements	Schedule 15, Part 2, para 1.8.2	180 days after the end of each financial year

11.0 COMMUNICATIONS PLAN

Our Solution

- Fundamental commitments: inform, involve, consult, collaborate
- A proven approach: recent communication/consultation experience for high-profile transportation projects in BC, including the Sea to Sky Highway Improvement Project
- Project-dedicated communications resources

11.1 PROJECT APPRECIATION

The Okanagan Lake Bridge is a key link between Kelowna and the Lower Mainland, with local, regional and provincial importance. Replacing the existing three-lane bridge with a new five-lane structure is not simply an engineering exercise. Diverse stakeholders have an interest in all aspects of design, construction and operations of the bridge and approach roads. These include the BC Ministry of Transportation, the Concessionaire, the West Bank First Nation, the City of Kelowna, business and property owners, the Downtown Kelowna Association, the Downtown Business Association, cycling groups, tourism organizations and the general public.

We understand that construction of the bridge is part of a larger project that includes major approach roads on both sides of Okanagan Lake, impacts on Kelowna's City Park, and First Nations issues on the west side of the bridge. Our Communications Plan addresses the need for our team to participate in and support the larger public consultation effort to be led by the Province. In addition, we have structured our plan around the four principal areas of communications identified by the Province in Part 4 of Schedule 17 of the BAFO Concession Agreement (Concessionaire's Design).

11.2 APPROACH

Successful project implementation depends on effective public consultation with a diverse spectrum of stakeholders on a broad range of issues. To achieve this objective, SNC-Lavalin will build strong two-way communications with stakeholders as the project proceeds through design, environmental approvals, construction and operations.

Throughout all phases of consultation, SNC-Lavalin will utilize proven practices in public consultation, cognizant of the need to deliver the project on time and on budget. We will be guided by the following four fundamental commitments to our partners, our stakeholders and the public:

1. *Inform* proactively, with balanced and factual information to assist people in understanding issues, alternatives and solutions.
2. *Consult* broadly and inclusively to gain the feedback needed to make the best decisions.
3. *Involve* by working together to ensure that concerns are understood and that ideas and opinions are considered.
4. *Collaborate* by seeking advice and insight to achieve innovative and cost-effective solutions.

11.3 EXPERIENCE AND RESOURCES

Our team brings significant public consultation and communications experience to the project. We have been involved in several high-profile transportation projects in British Columbia that involved working closely with the Ministry of Transportation and other project partners to ensure the public and stakeholders were informed and consulted on a broad range of project issues. These projects include the Sea to Sky Highway Improvements, SkyTrain, the Vancouver Airport Connector, Westview Interchange and the Cassiar Connector. Our team will include public consultation and media relations specialists who will work with our technical team and the Province to develop and execute our Communications Plan.

11.4 COMMUNICATIONS PLAN OUTLINE

11.4.1 Traffic Communications

Our approach to traffic communications will be proactive, not reactive. We will keep the travelling public and all stakeholders informed of traffic-related issues as required through media advisories, advertising, project website, newsletters and a 24-hour project information phone line. Traffic advisories to be communicated include: traffic delays, rerouting of traffic from the existing to the new roadways, and, if necessary, unforeseen temporary bridge closures.

The Province will lead the Traffic Communications Plan in the first year of the project, with the Concessionaire playing a supporting role. Afterward, the Concessionaire will take over lead responsibility for traffic communications. We will create a Traffic Communications Plan that addresses how we will deal with traffic issues as they arise during construction and operations. In addition, we will work with the Province and other stakeholders to develop protocols for dealing with crisis management issues.

11.4.2 Community Relations

Community relations will be the main interface between the project proponents and the public. It is important to provide the community with easily accessible, up-to-date information about the New Crossing through the design, construction and operations phases. We will share this responsibility with the Province and will assist in implementing a comprehensive community relations program to provide the public and stakeholders with information relating to the New Crossing on a regular basis. We will participate with the Province in stakeholder meetings, helping create and maintain a project website, project newsletters and media advisories; hosting special events, etc. We will also handle public inquiries and concerns, working closely with the Province to respond to issues and questions from the community.

11.4.3 Public and Stakeholder Consultation

Our public and stakeholder consultation program will focus on obtaining input on our design solution, and explaining our construction methods and impact mitigation measures to the public. We anticipate that the following issues will need to be addressed in our consultation efforts: supporting the Province and City of Kelowna in addressing modifications to the City Park, issues raised by business owners regarding the proposed one-way couplet, decommissioning the existing bridge, First Nations issues and the pedestrian underpass at the east end of the bridge.

We will support the Province's consultation lead during the first year of the project, after which we will take lead responsibility. We will utilize workshops, open houses, stakeholder meetings and close coordination with project partners to execute the consultation program. Design input will be managed through a process of issue identification, prioritization, assignment to relevant person for response, draft resolution, review of draft resolution, and reporting back to the public and stakeholders to communicate the status of the issue.

11.4.4 Media Relations

The Province will take the lead on media relations throughout the project. Our team will include a Press Representative who will work closely with the Province to develop media protocols and who will liaise with our technical team to respond to media queries. In addition, at the request of the Province, our team will provide media tours, updates and briefings on this high-profile project.

12.0 LABOUR RELATIONS PLAN

Our Solution

- Strong base in the Okanagan Valley: Core Organizations with long-term commitment to the region who are well respected employers in the area
- Commitment to avoiding disruptive workplace issues: agreement preventing strikes or lockouts for the duration of the project
- Labour relations and safety committee to be established as a forum for employees to express concerns

12.1 INTRODUCTION

A unified and harmonized labour force is fundamental to the successful delivery of a project with the duration and complexity of the Okanagan Lake New Crossing. To achieve the ambitious schedule for this project, the various tradespeople and supervisory staff must all be focused on its execution, avoiding the disruption of workplace issues. All personnel involved must take pride in their work and satisfaction in their achievements.

It is our strong commitment to:

- Provide all of our employees with safe working conditions that are alcohol and drug free
- Provide an environment free from discrimination and harassment, including sexual harassment
- Maximize employment of local residents with special emphasis on providing opportunities for members of the Westbank First Nations
- Train and develop our workforce, and provide a work environment that encourages individuality and personal growth, and promotes teamwork and employee commitment to attaining good workmanship so that specified standards of quality are maintained at all times
- Strict compliance with labour agreements and fair wage policies
- Comply with federal, provincial, WCB, and local laws and regulations
- Incorporate policies to minimize potential disruption

We recognize that a stable labour environment is critical to our success, and where possible we will implement appropriate measures to facilitate and maintain such an environment. We will work towards this goal not just during the design and construction phase of the Original Service Period, but also over the life of the Concession while performing operations and maintenance during the Enhanced Service Period.

12.2 ORIGINAL SERVICE PERIOD APPROACH

During the Original Service Period the primary activities to be performed are design and construction of the New Crossing.

12.2.1 Design and Construction

The majority of the design activities will be performed in the Vancouver offices of SNC-Lavalin, Buckland & Taylor, Trow, McElhanney and DMD & Associates. All of these firms have a stable, dedicated team of professionals with a strong history of completing projects on time and on budget. These professionals will bring that same dedication and commitment to the Okanagan Lake New Crossing Services project.

Our construction team, led by Vancouver Pile Driving and SNC-Lavalin Constructors (Pacific) Inc., has a similar record for employee satisfaction. Greyback Construction and Emil Anderson Construction, two of our Core Organizations that will carry out the majority of the construction activities, are based in the Okanagan Valley. Both of these firms have a long-term commitment to the region and are well respected employers in this area. Over the years they have undertaken numerous projects in the Okanagan Valley, earning a reputation for being fair and reasonable. As a result, and in addition to their regular employees, Greyback and Emil Anderson have firsthand knowledge of the local labour force, and access to this labour and other specialist trade contractors in the Kelowna area.

It is SNC-Lavalin/Vancouver Pile's policy to adhere to applicable provincial and federal labour standards, statutes, local laws and regulations with respect to collective agreements and fair wage policies. We anticipate that both labour-certified and uncertified subcontractors will be utilized on this project.

The labour-certified subcontractors will be required to be signatory to the applicable labour agreements, with project specific agreements which include an article prohibiting strikes or lockouts. It would be our intention, in negotiating extensions to these agreements, to maintain this provision throughout the duration of the Okanagan Lake New Crossing Services Project, with both the subcontractors and their prospective trade contractors. Similarly, the uncertified subcontractors will be required to be signatory to an agreement preventing strikes or lockouts for the duration of the project.

The combined workforces of SNC-Lavalin, Vancouver Pile Driving and the subcontractors will include people under training as apprentices and as professionals, including minorities, First Nations, women, and persons with disabilities. All new employees and apprentices will receive appropriate training and will be assigned to experienced, qualified supervisors, enabling them to develop and perfect their skills over the course of the project.

A forum for employees to bring forward and express issues of their concern, particularly those related to site safety, will be an important part of the onsite teaming process. To provide this forum, a labour relations and safety committee will be established and chaired by the Project Manager. This committee will appoint officers to manage labour relations and safety issues. The team will be empowered to act appropriately on any labour or safety issue that may affect the efficient and safe execution of the project, and would ultimately be answerable to the Project Director.

12.3 ENHANCED SERVICE PERIOD APPROACH

Upon commencement of the Enhanced Service Period, O&M services will begin, and will continue for the duration of the Concession. The existing bridge will be decommissioned during the first eight months of the Enhanced Service Period.

12.3.1 Existing Bridge Decommissioning

The decommissioning will be undertaken primarily by Vancouver Pile Driving and Greyback using the most skilled and experienced members of their workforce. The same labour relations processes used during the Original Service Period for the construction will carry over into the Enhanced Service Period.

12.3.2 New Crossing O&M

SNC-Lavalin ProFac's extensive experience in operations and maintenance has shown that the key to a successful program is to have sufficient staff of the correct capabilities and experience in place early in the process. The first person to be appointed will be the O&M Manager, identified in Section 1 of this Proposal as a Core Individual. This appointment will be made as soon as practicable after the conclusion of the procurement process and our team being designated as the Selected Proponent.

SNC-Lavalin ProFac has well established processes for the identification, selection and recruitment of staff. We will match qualifications and experience to requirements, and provide the training necessary to bridge gaps and achieve proper qualification. All staff will receive instruction on SNC-Lavalin ProFac's culture and its way of doing business. They will also receive general instruction on the operations of the Okanagan

Lake Bridge as a whole, health and safety training and the specialized training on operations, systems and maintenance appropriate to their task.

SNC-Lavalin ProFac is accustomed to deciding whether or not to use a unionized workforce for new contracts, and to the advantages and disadvantages associated with the choice for the particular contract. We intend to implement a labour relations model for our Okanagan Lake New Crossing employees similar to that of our highly successful Highway 407 in Toronto, Ontario. Our approach will be to engage with potential employees, their associations and unions well before the start of operations.

13.0 WESTBANK FIRST NATION EMPLOYMENT INCENTIVE PLAN

Our Solution

- SNC-Lavalin and its subcontractors have notable qualifications in the implementation of Employment Incentive Plans in large projects
- Ann Dumyn (Rheault), a committed and experienced consultant with in-depth knowledge and understanding of Westbank First Nation will prepare the Employment Incentive Plan
- Major elements of the Employment Incentive Plan have been scoped – communications and public relations; employment, business and contracting opportunities; capacity assessment and remediation; monitoring and reporting
- The Employment Incentive Plan will be effective, measurable and ensure significant efforts are made to enhance the benefit of the project to Westbank First Nation and its members

13.1 PROPONENT'S QUALIFICATIONS

SNC-Lavalin and its subcontractors have extensive experience in the design, implementation and management of Aboriginal inclusion programs for large-scale projects. They have successfully incorporated broad regional benefit initiatives targeting the participation of Aboriginal contractors, suppliers and employees into their work. The project team has a multidisciplinary approach to doing business in Aboriginal communities, providing excellence in engineering and construction, while incorporating the values, needs and aspirations of affected Aboriginal governments and their members.

A sample of SNC-Lavalin's qualifications and experience in engaging Aboriginal communities in joint ventures, business alliances and project execution is included as Attachment 13-1 at the end of this section. These competencies are reinforced by those of its subcontractors, who share similar values and expertise in working with Aboriginal communities. In particular, Greyback Construction and Emil Anderson Construction each have extensive experience collaborating on various projects with First Nations in British Columbia, and with Westbank First Nation specifically.

The project team recognizes the Province's intent to ensure that Westbank First Nation contractors, suppliers and employees have full and fair access to contracting, business and employment opportunities generated by the project. SNC-Lavalin and its subcontractors are confident their plan will be satisfactory to both the Province and Westbank First Nation.

13.2 EMPLOYMENT INCENTIVE PLAN MANAGEMENT

SNC-Lavalin will retain the services of a committed and experienced consultant to prepare the Westbank First Nation Employment Incentive Plan.

Ann Dumyn (Rheault) has over 37 years of relevant experience in business development, contract negotiation and facilitation, as well as project management. She spent 11 years working exclusively in Aboriginal communities across Canada: from 1993 to 2000 with Bank of Montreal as National Director of Aboriginal Banking and from 2000 to 2004 as Vice-President, Aboriginal and Northern Affairs for SNC-Lavalin. Ms. Dumyn continues to work with SNC-Lavalin and Aboriginal communities in her private practice. Her resume is included at the end of this section as Attachment 13-2.

Ms. Dumyn has an in-depth understanding and knowledge of Westbank First Nation. This affiliation originated in the mid-1990s during her tenure with Bank of Montreal, when a branch of the bank was opened on the Nation's reserve lands and a unique housing loan program for members was introduced. She spent extensive time in the community, and knows many of the Nation's past and current political, administration and business leaders well. Ms. Dumyn has an exceptional understanding of the cultural, political and social sensitivities of Westbank First Nation and its members.

SNC-Lavalin is strongly committed to safeguarding the Westbank First Nation Employment Incentive Plan objectives that the Province has established for the project. As evidence of this commitment, SNC-Lavalin has accorded significant importance to the management of the Employment Incentive Plan, and will engage Ms. Dumyn as an advisor to the Project Manager. She will be responsible for the design, preparation and initial follow-up of the Employment Incentive Plan, with the primary responsibility for management, implementation and ongoing monitoring resting with the Project Manager.

13.3 COMMUNICATIONS AND PUBLIC RELATIONS PLAN

Westbank First Nation adopted a Self-Government Act in 2003, invoking the Westbank First Nation Constitution. It is one of only a few Indian Act Bands to have done so. This unique governance structure, and the historical practices of the Nation, prescribe a multifaceted approach for the communication and public relations plan.

Standard protocols within First Nation communities direct that the project team present its credentials to Chief and Council and request a liaison relationship be established between the Director of Economic Development for the Nation and Ms. Dumyn. A request will also be made for the appointment of a Council

official to liaise with the Project Manager, instituting a higher-ranking level of interaction when appropriate and necessary.

Concurrently, a communications and public relations plan will be developed for the independent contractor, supplier and employment provider sectors of the Nation's membership. Historically, many members of the Nation have successfully engaged in business opportunities outside of the authority of Chief and Council and prefer a direct approach that does not imply reliance on other parties for success.

The project team will discuss its concept for the Communication and Public Relations Plan with the Nation's liaison appointees and business leaders prior to drafting and implementation. Tasks and activities within this phase of the project could include:

- Determining critical dates and milestones to guide participation and management of investments
- Designing information sessions on the project features at various stages
- Sourcing effective communication vehicles i.e. mail drops, radio and television, posters, Internet and email messaging
- Incorporating local customs, languages and communication styles into all communication mediums
- Establishing processes for identifying and resolving issues

The project team has previous experience in designing and conducting communication and public relations activities in Westbank First Nation and is confident this will ensure a well executed plan that provides timely and pertinent information for aspiring project participants.

13.4 EMPLOYMENT, BUSINESS AND CONTRACTING OPPORTUNITY STRATEGY

The project team will encourage Westbank First Nation and its members to build on existing contracting, supplier and employment competencies rather than create new ones, especially those that have little guarantee of work beyond the project. The strategy will be to leverage opportunities from the proficiencies existing in the Nation.

Two specific tactics will be initiated to maximize Westbank's participation. One will be the identification, from existing data and solicitation, of the competencies of contractors, suppliers, and employees specific to the project. The other will be the identification of project components that are most likely to be available for these entities. While this will not preclude businesses or individuals from pursuing any aspect of the

project, it will highlight the best opportunities and help to direct investments where they are the most productive. Tasks and activities within this phase of the project could include:

- Meeting with the Director of Economic Development for the Nation and business leaders to develop the strategy
- Compiling a list of known qualified contractors, suppliers and employees
- Soliciting expressions of interest from the Nation's contractor and supplier sectors
- Identifying the opportunities that are most applicable to the competencies identified in the preliminary scoping activities
- Assessing the requirement for remediation activities to increase participation opportunities

The project team has successfully instituted similar strategies for other projects and is confident this proactive approach will advance the participation of Westbank First Nation and its members.

13.5 CAPACITY ASSESSMENT AND REMEDIATION ACTIVITIES

SNC-Lavalin and its subcontractors have, from previous contracting experience in the region and with Westbank First Nation specifically, a good understanding of the capacity of businesses and people to participate in the project. This knowledge will be reinforced by the findings of the employment, business and contracting opportunity strategy activities.

The project team anticipates that employees, goods and services can be sourced from Westbank First Nation and its members. However, there may be components of the project that are conducive to participation but lack corresponding capacity in the Nation. For example, heavy equipment operators may not be licensed for the particular equipment necessary for the work or suppliers may not have the financial capacity to secure their bid bonds.

The assessment of capacity constraints and the implementation of remedial actions is an important component of ensuring fair participation in the project. Tasks and activities within this phase of the project could include:

- Identifying education and training requirements for construction phase jobs
- Engaging the Employment and Training department of Westbank First Nation in designing remediation programs for interested parties

- Enlisting the support of the financial sector in designing bonding and bid guarantees for contractors and suppliers
- Soliciting the participation and contribution of subcontractors for training initiatives
- Sourcing funding from government, industry and/or education authorities to support upgrading or new skill development

The project team will solicit the support of Westbank First Nation's Employment and Training department for these Employment Incentive Plan activities. The department is experienced in identifying and developing capacity for members and has extensive relationships with other agencies to complement their own capabilities.

13.6 MONITORING AND REPORTING

SNC-Lavalin has excellent credentials in designing and managing systems to monitor and report on Participation Incentive Plans. Both the Diavik Diamond Mines and the Voisey's Bay Nickel projects require extensive and timely monitoring and reporting on the participation of diverse stakeholders, including many subcontractors, for training, employment, procurement and contracting statistics. This data is gathered to satisfy regulatory and contractual agreements and is published for a wide audience of interested parties.

The information gathered from these activities can be used to identify gaps in participation and take remedial action where appropriate, and could serve as a resource for Westbank First Nation in planning for other major projects in their territory. Tasks and activities within this phase of the project could include:

- Establishing processes for identification of Westbank First Nation members and businesses that respect the sensitivities of the community
- Designing a database to track training, employment and procurement statistics
- Instituting reporting protocols with Westbank First Nation
- Developing guidelines for publishing results under the Communication and Public Relations Plan
- Cataloguing initiatives and results for future projects in Westbank First Nation

The project team believes the success of the Employment Incentive Plan will be as much dependent on statistical evidence as on intent. It will be transparent and open in sharing information so that the success of the Westbank First Nation Employment Incentive Plan can be easily measured.

13.7 CONCLUSION

SNC-Lavalin and its subcontractors have the experience and qualifications to implement a successful Employment Incentive Plan on the Okanagan Lake New Crossing Services Project for the benefit of Westbank First Nation. The Westbank First Nation Employment Incentive Plan will be lead by a committed and experienced manager who has in-depth knowledge and understanding of the Nation and its members. Major elements of the Employment Incentive Plan will be developed to ensure the maximum participation of Westbank First Nation, contractors, suppliers and employees. The Employment Incentive Plan is measurable and will be transparent and open for interested parties.

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Aboriginal and Northern Affairs

To strengthen the ties between SNC-Lavalin (SNC-Lavalin Inc. and its affiliates) and its various partners doing business with Aboriginals and in Northern Communities, it established in 1998 an Aboriginal and Northern Affairs office. Its primary role is to design solutions that result in agreements unique to the parties, including but not limited to, capacity development plans and a share buy-back clause. These partnerships are built on the premise that it is important to treat each other as full business partners and to pursue projects that can be of mutual benefit.

SNC-Lavalin strives to tailor its engineering and planning services to the exact needs of Aboriginal and Northern Communities, developing solutions that result in cost effective and focused product delivery. Also, as part of the ongoing commitment to skills development and exchange between SNC-Lavalin and its clients; training, affiliations with academic centers and practical experience for Aboriginal peoples are key objectives explored at the outset of each project.

The Aboriginal and Northern Affairs office works to promote and facilitate Aboriginal community involvement in the engineering management and construction services it provides, to produce a significant positive impact on local economies.

Services and mandates tailored to every situation:

- Structuring bids to permit clear identification of project components directed to Aboriginal and local business participation;
- Building capacity within the communities by incorporating features that facilitate the transfer of knowledge and experience valued for future economic and self-sufficiency benefits;
- Establishing a forum where participants are encouraged to consult throughout the project;
- Maximizing mutually beneficial economic gain for the participants;
- Incorporating into the project, in co-operation with employment and training specialists, skill-acquisition programs appropriate for current and future employment and business opportunities;
- Promoting apprenticeship and mentoring programs for interested individuals amongst the project participants;
- Cooperating with the participants to enhance existing or create new business opportunities;and
- Contributing expert financial advice and guidance if required.

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JOINT VENTURES AND ALLIANCES

The creation of joint ventures and business alliances with Aboriginal groups has proven to be mutually beneficial for all parties. Listed below are some of the agreements that SNC-Lavalin has formally entered into.

Nishi-Khon/SNC-Lavalin Inc. (NKSL) is 51% owned by Nishi-Khon Engineering and Environmental Services Limited, a wholly-owned subsidiary of The Dogrib Nation Group of Companies, the economic arm of the Dogrib Treaty 11 Council; and 49% by SNC-Lavalin Inc. NKSL was formed to foster a mutually beneficial long term relationship for the provision of engineering and environmental services within the Dogrib North Slave Region of the Northwest Territories. The joint venture has completed many projects, for example: owner's representative for the Dogrib Power Corporation for the Snare Cascades 4.3 MW hydro-electric power plant project; design engineers responsible for the provision of all on-site labour for the upgrading of Highway 3 between Rae and Yellowknife; and manager of the engineering, procurement and construction services contract for the Diavik Diamonds Project.

Kaska SNC-Lavalin Inc. is a joint venture between Kaska Minerals, a company owned by the Kaska Nation, and SNC-Lavalin. It was established as a private Corporation under the Yukon Business Corporations Act to pursue business opportunities related to the decommissioning and reclamation of mine sites. The Corporation is a unique example of a private/public partnership within an identified sector, allowing for an effective working relationship between Federal and Territorial governments and other private industry participants in a major regional development initiative.

In addition, the joint venture company concluded an agreement in April 2003 to complete a Capital Framework Plan for the five member First Nations. The work will define strategies for community infrastructure, housing and transportation, and prepare capital plans for the near and medium term. Community consultations are an integral part of the work and are directed by an articulate Kaska Nation consultation protocol.

Kaska SNC-Lavalin Inc. is owned 51% by Kaska Minerals Inc., a valid corporation existing under the laws of the Yukon Territory and owned by the five First Nations that constitute the Kaska Nation – Liard First Nation, Ross River Dena Council, Lower Post First Nation, Kwadacha First Nation and Dease River First Nation. SNC-Lavalin Holding Inc., a corporation formed under the laws of Canada as a wholly-owned subsidiary of SNC-Lavalin Inc. owns 49% of Kaska SNC-Lavalin Inc.

The Corporation is committed to supporting Aboriginal economic development through the provision of long term training, employment and business opportunities. On the business side, the Corporation is committed to support Kaska Nation corporate entities, Kaska businesses and alliances in developing long-lasting and sustainable business capabilities.

Epcom Resources Inc., is a corporation whose shareholders consist of the Development Corporations of four Yukon First Nations (Kluane, Kwanlin Dun, Ta'an Kwach'an and White River) and local and national industry partners (ACR Systems Inc., MacMillan Mining Contractors, and SNC-Lavalin Inc.). Epcom was created to pursue business ventures in the engineering, procurement and construction sectors in the Yukon and throughout the world, and to support First Nations' economic development through the provisions of meaningful training, employment and business opportunities.

Moose Cree First Nation/SNC-Lavalin/Tembec Memorandum of Understanding (MOU)
The Moose Cree First Nation, located at the southern tip of James Bay in northern Ontario, SNC-Lavalin and Tembec have negotiated an MOU to work cooperatively towards re-development of four hydro power generation stations on the Mattagami River. Each partner is expecting to hold a 30% equity interest in the project which involves refurbishment/reconstruction of four existing hydro generation stations to produce approximately 800 MW of power for sale to the Ontario Government. To help move the project forward, SNC-Lavalin is assisting with financial modeling and conceptual and preliminary engineering.

SNC-Lavalin and Membertou First Nation Memorandum of Understanding (MOU) (February 2001) was negotiated to explore mutually beneficial efforts to develop projects in the maritime provinces, including engineering and related services for both the offshore gas sector and the onshore construction and design business.

Tsuu T'ina/SNC-Lavalin/EPCOR Memorandum of Understanding (MOU) The Tsuu T'ina First Nation, located adjacent to the City of Calgary, SNC-Lavalin and EPCOR Power Development Corporation have negotiated an agreement to explore the feasibility of jointly developing a gas-fired, combined cycle, electricity generating power plant, of approximately 250 MW capacity on Tsuu T'ina lands located south-west of the city of Calgary.

James Smith First Nation/SNC-Lavalin/Peter Kiewit & Sons Memorandum of Understanding (MOU)
The James Smith First Nation (JSFN), SNC-Lavalin and Peter Kiewit & Sons have negotiated an agreement and formed an alliance to explore the feasibility of jointly developing a hydro electric project on the Saskatchewan River in or near JSFN territory. Saskatchewan Power has expressed an interested in receiving a proposal to develop new capacity (max 100 MW) with a new generating station on the Saskatchewan River, west of the existing Nipawin dam. The alliance is currently completing the Pre-Feasibility Study, Phase I of the project. The JSFN traditional lands have diamond development potential.

ALLIANCES UNDER NEGOTIATION

A number of other alliances and joint ventures in the Northwest Territories, Nunavut and various regions of southern Canada, are currently in the early to advanced stages of negotiation.

Project Experience
SNC-Lavalin is well positioned to work with local, aboriginal, and indigenous communities, and has a proven track record. Its professional and technical excellence, complemented by an unique and effective Aboriginal and Northern Affairs office and supported by a Training and Development Services group can offer clients a highly accomplished team and resources to obtain positive results in the community where the project is located.

SNC-Lavalin works with its clients to respond to challenges posed by the need to distribute socio-economic benefits of the project into local and aboriginal communities to produce a significant positive impact on local economies. It has the knowledge and experience to develop community-driven, cost-effective and sustainable job readiness, business participation and community support programs to meet clients' needs.

Omushkego Ishkotayo is a First Nation owned and operated 135 kV transmission line in northern Ontario developed by the Mushkegowuk Tribal Council to provide stable, efficient and affordable hydro power through a transmission line along the western coast of James Bay. The new 270 kilometre line, operational in 2003, connects the First Nation communities of Fort Albany, Kashechewan and Attawapiskat to the main grid at Moosonee.

The project is unique in that it is the first time the First Nation communities, the private sector and various government and funding institutions worked together to develop an energy project of this magnitude. The venture was made possible by the formation of a working partnership between Five Nations Energy Inc., SNC-Lavalin, Ontario Hydro Services Company and the Department of Indian Affairs and Northern Development.

SNC-Lavalin Capital Inc. acted as financial advisor for Five Nations Energy in structuring the construction financing package. SNC-Lavalin Services Ltd. was contracted for a fixed price turnkey contract to conduct an Environmental Assessment, complete design, manage construction and assist with the operation of the line. The partnership created new jobs for First Nation residents both during and after construction resulting in economic benefits to the local communities.

Victor Diamond Mine Power Supply Environmental Assessment
De Beers Canada, Hydro One and Five Nations Energy Inc. retained SNC-Lavalin in 2004 to conduct an environmental assessment for the expansion and extension of the Omushkego Ishkotayo transmission line. The transmission line will provide electrical power to the proposed diamond mine, located near the James Bay coast in northern Ontario, approximately 100 km from the Attawapiskat First Nation. The environmental assessment process included an extensive community consultation program and a comprehensive program to collect and analyze traditional knowledge from the six First Nations communities that could potentially be affected by the project. SNC-Lavalin is sub-contracting the services of the Mushkegowuk Tribal Council Lands and Resources group to undertake the Traditional Knowledge collection program.

Diavik Diamond Project, Northwest Territories, Canada
Nishi-Khon/SNC-Lavalin Inc. a joint venture between SNC-Lavalin and a company of the Dogrib Nation was awarded the engineering and procurement services contract for the $1.3 Billion Diavik Diamond Mines Inc (DDMI) project in March 2002. The work was successfully executed within the requirements of an extensive Northern Business Participation Policy which incorporated Impact and Benefit Agreements with affected Aboriginal groups and a Socio-Economic Agreement with the Government of the Northwest Territories. DDMI summarized the results from mine construction as achieving 44 per cent northern employment, 22 per cent Aboriginal employment and of the C$1.2 billion in contracts issued: C$874 million (74%) was in contracts with northern firms and C$604 million with Aboriginal firms.

Polaris Mine Reclamation
SNC-Lavalin was retained by Teck Cominco Inc. as the general contractor to complete a $32 million project to decommission, remove and dispose of all facilities and structures at Teck Cominco's Polaris Mine in Nunavut. The project also included excavation and disposal of contaminated soils. Several Inuit-owned sub-contracting companies participated as partners in the project.

Cape Dyer Reclamation
SNC-Lavalin Inc. was retained by Defense Construction Canada to undertake the decommissioning of the DYE-MAIN Radar Station at Cape Dyer in Nunavut. The approximately $50 million project involved environmental clean-up, facility demolition (buildings, fuel storage tanks, communications equipment, utilities, etc.), closure and remediation of 23,288 acres of land used for the station. Several Inuit-owned sub-contractors participated as partners in the project.

Manitoba-Nunavut Road
The Governments of Manitoba and Nunavut together with the Kivalliq Inuit Association retained Nishi Khon/SNC-Lavalin Inc. (NKSL) to conduct a study to determine the most suitable location for a surface transportation route linking the community of Rankin Inlet to the existing all-weather road network in northern Manitoba. The study included extensive community consultation, socio-economic and environmental impact analyses and an assessment of community benefits. The NKSL team worked closely with a Technical Advisory Committee made up of First Nations and government agency representatives.

Bathurst Inlet Port and Road Project
Nishi Khon SNC-Lavalin Inc. (NKSL) was retained by Nuna Logistics Ltd. to conduct a feasibility study for an estimated $215 million all-weather road and deep sea port facility in Nunavut. The project consisted of a marine port on Bathurst Inlet, connected to the mines and mineral deposits in Nunavut and the Northwest Territories by an all-weather road. The road will be approximately 300 km long. The project included preliminary design engineering services, detailed mapping and route selection and geotechnical investigations. In addition, the project involved the development of a financial model and recommended financing techniques, including a tariff structure. NKSL used a variety of Inuit service companies and provided training of local community members, with a view to employing Inuit personnel.

Hwy No.3 Design-Build, Yellowknife, NWT
Nishi-Khon/SNC-Lavalin Inc. was retained to complete detailed design and re-construction of 15 km of NWT Hwy No.3, including the Stagg River bridge, signage and pavement markings.

Ingraham Trail (Hwy No.4), Yellowknife NWT
Nishi-Khon/SNC-Lavalin Inc. completed the detailed design for the reconstruction of approximately 5.5 km of Hwy No. 4, located 1.5 km northeast of Yellowknife, Northwest Territories. The highway extends through the Giant Mine Properties to just one kilomtre west of the Yellowknife River and the project cost was approximately $7 million.

Aqsarniit Middle School Addition/Renovation, Iqaluit, Nunavut
SNC-Lavalin undertook the construction of a new 2,328 square metre addition (approximately $10 million) to the Aqsarniit Middle School facility in Iqaluit, Nunavut. The project included significant involvement of the local Inuit community as well as partnerships with, and sub-contracting to a number of Inuit owned companies.

Gjoa Haven Air Terminal Building, Gjoa Haven, Nunavut
SNC-Lavalin undertook the construction of a new 206 square metre air terminal building including associated site works (approximately $2 million). Construction was undertaken in phases to facilitate continued use of the existing terminal building while phasing in the new building. The project included significant involvement of the local Inuit community as well as partnerships with, and sub-contracting to a number of Inuit owned companies.

Qikiqtani General Hosptial, Iqaluit, Nunavut
SNC-Lavalin undertook the construction of a 2-storey, 5,400 square metre, 36 bed expansion to the hospital facility in Iqaluit, Nunavut, incuding upgrades to the mechanical systems. The project also provided logistics management, procurement and construction supervision (approximately $36 million). The project included significant involvement of the local Inuit community as well as partnerships with, and sub-contracting to a number of Inuit owned companies

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Fact sheet references (PFS) for a number of other related projects:

Project title and capacity	Client and Project location	Year of completion	Services provided	Ref. no.
Kaska Nation Infrastructure Development Strategy	Kaska Tribal Council and Department of Indian Affairs and Northern Development Yukon Territory and British Columbia, Canada	Ongoing	Community servicing; infrastructure planning; community consultation.	TORO-0717
Phase I - Property Transfer Assessment Whitefish River First Nation	Public Works & Government Services Canada (PWGSC) Ontario, Canada	1998	Phase 1 Environmental Site Assessment involving data, ownership review, aerial and site reconnaissance, direction to the First Nation regarding environmental conditions and liabilities associated with owners transfer.	TORO-0512
Risk Assessments for 25 First Nation Sites	Indian and Northern Affairs Canada Ontario, Canada	1997	Site-specific human health and ecological risk assessments for all 25 sites provided quantitative risk values for hydrocarbon contaminated sites and site-specific remediation action plan.	TORO-0513
Risk Assessment Ontario First Nations	Ontario First Nations Technical Services Corporation Ontario, Canada	1997	Human health and ecological risk assessments to set remediation objectives & site-specific criteria for contaminant remediation, developed an original method for evaluating the risks associated with hydrocarbon mixtures.	TORO-0506
Detailed Site Assessment and Remedial Options Study - Beausoleil First Nation	Public Works & Government Services Canada (PWGSC) Christian Island, Ontario, Canada	1997	Environmental study began with field test pitting, geophysical surveys and other tests which lead to detailed subsurface investigations and analyses of risks to human health.	TORO-0510
Ambient Air Monitoring Program for a First Nation Reserve	Fort William First Nation Ontario, Canada	1995	Identification of sampling parameters, site inspection, assembly and operation of three ambient air monitoring stations, on-site monitoring for sulphur compounds and volatile organic compounds.	TORO-0484
Biomedical Waste Incinerator Weeneebayko General Hospital	Weeneekayko General Hospital Moose Factory, Ontario, Canada	1995	Preliminary and detailed engineering, review and tabulation of tenders for construction, periodic field inspections and final inspection. Conducted environmental assessment and secured regulatory	TORO-0496

Project title and capacity	Client and Project location	Year of completion	Services provided	Ref. no.
			permits and approval.	

OTHER SERVICES

Through its Aboriginal and Northern Affairs office, SNC-Lavalin is in a position to offer a broad array of support services to internal Divisions and to Client's to facilitate project execution where significant aboriginal community and economic interests are at stake.

Job-Readiness Programs
SNC-Lavalin understands the prerequisites to managing education and training within an owner's budget, engaging professional, experienced advisors and maximizing the contribution of others. In some instances, in order for local and aboriginal participation levels of employment to be achieved in a project, education capacity must be built to permit workers to acquire the knowledge and skills necessary to compete and perform successfully. Implementing training programs may not be sufficient, therefore the development of basic education, to move beyond entry-level jobs, is often required during the early construction phases to prepare for the production phase of the project.

Business Participation
SNC-Lavalin designs projects to promote and support opportunities, cultivate qualified business entities and implement a contracting process to ensure the maximum inclusion of local and aboriginal businesses. It takes an active and progressive role in the business opportunity identification and planning process so more local and aboriginal people can access the resources to develop and/or expand their businesses to service the project. SNC-Lavalin Aboriginal and Northern Affairs works closely with all mandated groups and agencies and is open to exploring new methods to achieve the greatest degree of participation that is politically, technically and financially feasible.

Community Support
SNC-Lavalin Aboriginal and Northern Affairs understands that projects need to incorporate socio-economic factors into the design processes and to integrate features which solicit continued community support. It also understands the significant function which community support will pay in contributing to the successful participation of local and aboriginal workers. It's work fosters an aura of maximum transparency, within accepted corporate practices, to be inclusive of communities and to share knowledge and experience to promote the active and supportive participation of local and Aboriginal peoples.

SNC-Lavalin has the proven track record, and the unrivalled expertise to contribute to the success of clients' projects. Its professional and technical excellence, complemented by an unique and effective Aboriginal and Northern Affairs unit and an experienced and successful Training and Development Services group, provides clients with a highly accomplished team that can achieve positive results in the community where the project is located.

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REFERENCES

SNC-Lavalin has over the past years formed numerous alliances with Aboriginal groups to pursue engineering, procurement and construction management business opportunities. Please feel free to confirm the references with the following partners:

Nishi-Khon/SNC-Lavalin Limited
Owned 51% by the Dogrib Nation Group of Companies, Northwest Territories
contact: Dan Marion, Executive Director, 867-392-6381 email: dmarion@tlicho.com

Epcom Resources Inc.
Owned 51% by 35403 Yukon Inc. (four First Nation owners – White River, Kluane, Ta'an and Kwanlin Dun)
contact: Ruth Massie, President, 867-668-3613 email: rmassie@taan.ca

Five Nations Energy Inc./Moose Cree – Memorandum of Understanding
Tri-party agreement to pursue hydro electric development on the Mattagami River in Ontario. Also partners on the Western James Bay transmission line project (completed).
Contact: Ed Chilton, Project Coordinator, Five Nations Energy Inc., 519-529-3632; e-mail: echilton@hurontel.on.ca

Fort à la Corne/SNC-Lavalin/Peter Kiewit – Teaming Agreement
Tri-party agreement to pursue hydro electric development in James Smith First Nations territory (Saskatchewan)
contact: Terry Sanderson, Project Coordinator for Fort à la Corne Development Corporation 306-864-3636

FIRST NATIONS ADVISOR

Name:

ANN DUMYN

Title/Position:

Consultant; former Vice-President, Aboriginal and Northern Affairs, SNC-Lavalin Inc.

Primary Location:

Arrawac Associates Inc.
1325 Olde Base Line Road, RR # 1
Terra Cotta, ON L0P 1N0

Roles & Responsibilities:

- Oversee and manage the design, follow-up and monitoring of the Westbank First Nation Employment Incentive Plan.

Qualifications:

National Director, Aboriginal Banking, Bank of Montreal – 1993 to 2000; directed Bank of Montreal teams soliciting and acquiring high-value Aboriginal business opportunities

Vice-President, Aboriginal and Northern Affairs, SNC-Lavalin – 2000 to 2004; designated Aboriginal Affairs advisor on SNC-Lavalin project teams

Years of Experience:

Consultant – 1 year

SNC-Lavalin Inc. – 4 years

Bank of Montreal – 32 years

Relevant Experience:

1) Memorandum of Understanding with Membertou Band, Sydney, Nova Scotia

Developed and concluded a Memorandum of Understanding (MOU) with Membertou Bank to collaborate on projects within the Maritime Provinces

Roles and Responsibilities:

- Initiator and Project Team leader in the negotiations for an agreement to pursue business opportunities; MOU Committee member

Client Contact:

Bernd Christmas, President and Chief Executive Officer
Membertou Development Corporation
1969 Upper Water St., Suite 1703
Halifax, NS B1S 2M9
Tel: 902-564-6466 ext. 229

Email: berndchristmas@membertou.ca

2) Epcom Resources Inc.

Developed and concluded a joint venture agreement between SNC-Lavalin Inc., four First Nations and two commercial entities in the Yukon to collaborate on projects

Roles and Responsibilities:

- Initiator and Project Team leader in the negotiations for an agreement to pursue business opportunities; Member, Board of Directors and Vice-President Finance

Client Contact:

Ruth Massie, President
Ta'an Kwach'an Council
117 Industrial Road
Whitehorse, YT Y1A 2T8
Tel: 867-668-3613
Email: rmassie@taan.ca

3) Nishi-Khon/SNC-Lavalin Ltd. (NKSL)

Managed NKSL, a partnership with the Dogrib Nation, Northwest Territories while it completed projects in the power, infrastructure and mining sectors

Roles and Responsibilities:

- Director and Secretary/Treasurer of NKSL working with appointees from the Dogrib Nation in the pursuit and execution of business opportunities

Client Contact:

Dan Marion, Executive Director, Dogrib Trustco
c/o Dogrib Treaty ll
Box 412
Rae Edzo, NT X0E 0Y0
Tel : 867-392-6381
Email: Deanna_marion@hotmail.com

14.0 GRAVING DOCK PLAN

Our Solution

- Selection of Bear Creek North for the Graving Dock location
- Pontoon construction and fit-out activities after floating can be performed at the same site
- As an existing log booming ground, environmental impacts, both on land and in the lake, will be minimized
- Communication with the Park Operator will be initiated to minimize disruption to park users

14.1 GRAVING DOCK LOCATION

The location of the graving dock and associated facilities is one of the most critical parts of the overall construction and implementation plan for the Okanagan Lake New Crossing Services Project. As previously stated in Section 4.0, the SNC-Lavalin Team has chosen the Bear Creek North Site for the location of both the graving dock and temporary moorage. A preliminary layout for this site is as shown in drawing 865800-1000-42DD-3403 in Appendix B of this BAFO submission (supersedes and replaces drawings 865800-1000-42DD-3401 and 3402 from Appendix B of the RFP submission). This site is preferred over the previously identified site at Bear Creek South because it is larger and therefore offers more flexibility for use as a staging area as well as a receiving area for prefabricated materials. It allows us to provide a temporary moorage location adjacent to the graving dock, providing access for completion of pontoons prior to installation, together with a loading or unloading location for barges and pontoon accessories. With the selection of this site we are able to eliminate the need for a separate fit-out site and will no longer require the Old Ferry Dock Site for this purpose.

Immediately following Commercial Close we will prepare our application to DFO to obtain authorization to use this site as a graving dock construction facility.

While we do not plan on using the Bear Creek South Site for the Graving Dock, we wish to preserve the option of utilizing that site as a possible staging and laydown area.

We also recognize that the Bear Creek North Site is in very close proximity to the existing Bear Creek Provincial Park campground, and that appropriate measures must be implemented to minimize disturbance to recreational users of the Park during the summer season.

14.2 GRAVING DOCK SITE ACCESS

Primary access to the Graving Dock Facility will be directly from Westside Road via an existing access road, as shown in Drawing No. 865800-1000-42DD-3403 in Appendix B of this BAFO submission. This access road will be upgraded and maintained throughout the construction period. A security gate, together with appropriate signage, will be installed at the location shown in the drawing to prevent unauthorized vehicles from entering the site. Procedures for the control of construction traffic entering and leaving the site will be incorporated into the Traffic Management Plan.

14.3 GRAVING DOCK SITE ACTIVITIES

As shown in the drawing, the graving dock will be a cofferdam consisting of sheet pile walls on three sides with soil anchor retention at the top and a removable gate on the lakeside end of the dock. The size of the dock will be approximately 30 m x 70 m to accommodate the construction of one pontoon at a time. Sheet pile driving, excavation and concrete placing activities will be curtained off from the lake through the use of proper silt control devices.

The Province has provided bathymetric information for the lake bottom at Bear Creek North but the elevations are interpolated only and require verification by sounding. It is anticipated that some dredging will be required to provide the necessary draft for float-out as well as mooring of the pontoons. Since this site is an existing log boom storage site for Riverside Forest Products, we expect to find wood debris on the lake bottom. If suitable for restoration the dredged and excavated material will be stockpiled for future use. Disposal of unsuitable materials will take place in accordance with the Environmental Management Plan.

The Graving Dock Site will also be used as a staging and fit-out area. Consideration is being given to setting up a batch plant, and structural steel will be delivered to the site for erection on the pontoons before the pontoons are towed to the bridge site.

14.4 PONTOON SEQUENCING

Construction of the pontoons in the graving dock will be completed to the stage that the pontoon is suitable for float out, including post-tensioning and completion of concrete works on the pontoon itself. Once the post-tensioning anchorages have been grouted and completed, the pontoon will be floated out and secured alongside the temporary mooring location. At this location other operations, such as installation of hatches, completion of miscellaneous concrete items and topside construction, temporary ballasting and preparation

for either connection to other pontoons or tow to temporary moorage prior to final installation, will be undertaken.

14.5 ACCOMMODATION OF ADJACENT LAND OWNERS

The Bear Creek Provincial Park campground is located adjacent and to the south of the Graving Dock Site. The campground is open from April 1 to October 15 of each year, with the peak period use during the school vacation months of July and August. We recognize that the park is a popular recreational area, particularly for campers during the summer holiday months. A temporary safety and security fence will be erected on the south side of the property to isolate the construction site from the campground. Consideration will be given to screening of this fencing with a green or earth-toned fabric to soften the visual impact

With the close proximity of the recreational area and campground to the Graving Dock Site, noise from construction activities will be controlled in general accordance with the measures outlined in Section 5, “Environmental Management Plan,” Clause 5.2.3. Our Noise Mitigation Plan will address the particular concerns at the Graving Dock Site for the October April 1-15 period. Where practical, activities will be scheduled such that disturbance of park users is kept to a minimum. The unique characteristics of the park will also be addressed in the Communications Plan so that recreational users are informed of the activities that will be taking place.

Certain deliveries to the site may require access through the Bear Creek Park campground entrance. The route from the entrance gate to the Graving Dock Site follows the road to the day use area and boat ramp, approximately parallel to Westside Road and circumventing the campground. It is intended that this route be used only for special long loads or special deliveries such as structural steel girders. After discussions with the park operator, these deliveries will be scheduled to minimize any interference with park operations. Application for a Park Use Permit requesting approval for this use will be made as soon as possible after Commercial Close, and immediately following the application to DFO for authorization to construct the Graving Dock Facility.

We understand that the lakeside will continue to be used by Riverside Forest Products as a log booming ground. We will coordinate with Riverside to arrange for a clear channel when pontoons are floated out, and also when they are towed to the bridge site.

14.6 SITE DECOMMISSIONING AND RESTORATION

Upon conclusion of the use of the graving dock and temporary moorage location, all temporary structures and materials (sheet piles and concrete) will be removed and the site restored. This work will be scheduled to minimize impacts to fish and wildlife habitats, particularly during spawning periods. Allowances have been made to dredge certain areas of the site to facilitate the water depths required for pontoon construction. If necessary upon removal of these structures, the lake bottom will be backfilled and returned to previous grades with selected materials, and the site restored to its former usage in accordance with the requirements of the Environmental Plan.

PROJECT DIRECTOR

Name:

SCOTT ANDERSON

Title/Position:

Vice-President, Transportation Division

Primary Location:

SNC-Lavalin Inc.
1800-1075 West Georgia Street
Vancouver, BC V6E 3C9

Roles & Responsibilities:

- Finalize structuring of the Concession Company, the contracting strategy of the Concession Company with regard to major subcontracts, partners responsibilities and their subcontracted work, and establishment of a maintenance and operations framework
- Liaise with the Province's Representative
- Liaise with financial institutions
- Administer the Concession Agreement
- Ensure responsive public relations are in place and followed
- Oversee project in its entirety, including administration of the Design-Build JV and Opco

Qualifications:

B.Sc., Civil Engineering, University of Alberta, Canada, 1979

B.Sc., Geology, University of Alberta, Canada, 1976

Years of Experience:

Senior Level project Management: 12 years

Intermediate level Project Management: 8 years

Junior Level Project Management: 5 years

Relevant Experience:

1) Airport Connector Design-Build Project, Richmond, BC

The goal of this $27-million design-build project was to twin the Moray Channel Swing Bridge and develop an east-west connector directly to/from the Airport and Highway 99. The project entailed the construction of a new high-level bridge crossing the Middle Arm of the Fraser River, a new overpass over Russ Baker Way and a total of over three kilometres of new road construction and tie-ins. The project was undertaken in the heart of one of the busiest commuter routes between Richmond and Vancouver without shutdowns and with minimal disruption.

Roles and Responsibilities:

- Developed Joint Venture Agreement between SNC-Lavalin Constructors Pacific Inc. and Walter Construction Canada Inc. for the execution of the Project
- Instrumental in assembling the team and developing roadway and structural concept designs leading to the award of this project
- Responsible for design team management and coordination
- Provided design advice for the Russ Baker Way Overpass and the floating pier protection for the Moray Channel bridge over the Fraser River
- Joint Venture Management Committee Member

Approximate Time Commitment to Roles and Responsibilities:

Finalization of Joint Venture Agreement: 80 Hours

Team Management: 600 Hours

Client Contact:

John Lenahan, P.Eng., Project Manager
Vancouver International Airport Authority
PO Box 23750, APO
Richmond, BC V7B 1Y7
Tel: 604-276-6048 Fax: 604-276-6565
Email: john_lenahan@yvr.ca

2) Manila LRT1 South Extension Project, Manila, Philippines

Project Director located in Manila responsible for a turnkey (finance, design and build) contract for a US$650 million (Capital) 12-km extension to the existing Manila LRT Line 1. The extension will operate on a fully elevated, dual-track Guideway and use technology compatible with the existing LRT Line 1. It includes 10 passenger stations and a satellite depot.

Roles and Responsibilities:

- Capital cost estimate for Philippine “on-shore” construction works including civil works, trackwork and locally supplied E&M Systems
- Development of Project Implementation organization and schedule
- Assessed local contractors and consultant capability and capacity. Awarded key design contracts to Manila based firms
- Development of major works form of contract based on FIDIC Contract documents
- Development and negotiation of Joint Venture for the Guideway construction (contract value US$125 million)
- Negotiation and finalization of the Guideway construction contract
- Key team member negotiating the Project Implementation Agreement with the LRTA, DOTC and Government of the Philippines

- Directed the Advance Work Team undertaking Design Development, Land Acquisition, Utility Relocations and overall construction permits and approvals from City and local governments and Barangay
- Part of the negotiating team for the Settlement Agreement for the final execution of the Project

Approximate Time Commitment to Roles and Responsibilities:

5000 Hours

Client Contact:

Danilo Tolentino, Project Manager
Light Rail Transit Authority
Administration Building, LRTA Compound
Aurora Boulevard, Pasay City, Manila, Philippines
Tel: 632-854-0980 Fax: 632-831-6449
Cell: 0918-917-0973

3) Westview Interchange Design/Build Project, Richmond, BC

Project Manager working in association with Walter Construction to develop the winning design in a design-build competition to provide a new $22 million interchange on the Trans-Canada Highway in the City of Vancouver in British Columbia.

Roles and Responsibilities:

- Managing and overseeing the design development for the Design/Build submission
- Input into and review of the bid estimate
- Review, comment and negotiation of the Design/Build Contract documents
- Design/Construction Manager participating with the Site Management team coordinating all site engineering, traffic management planning and construction engineering

Approximate Time Commitment to Roles and Responsibilities:

2200 Hours

Client Contact:

Doug Hyde, Regional Project Manager
BC Ministry of Transportation
Metrotower II
4720 Kingsway
Burnaby, BC V8W 3E6
Tel: 604-453-3031 Fax: 604-453-3021
Email: Doug.Hyde@gems8.gov.bc.ca

4) SkyTrain Millennium Line Preliminary Design, Vancouver, BC

This project comprises 17 km of elevated guideway, two kilometres of tunnel and approximately two kilometres of at-grade construction for the new $1.2-billion SkyTrain expansion in Vancouver, BC. The assignment required

the design team to work within the public consultation process to develop preferred alignments into mathematized alignments suitable for the detailed design of all civil, electrical and mechanical works and to develop contract documents for construction of the project using the design-build project delivery method.

Roles and Responsibilities:

- Engineering Team (Civil and E&M Systems) Manager
- Contracts team member studying potential Project Delivery Methods

Approximate Time Commitment to Roles and Responsibilities:

Engineering Team management: 1400 Hours

Contracts: 200 Hours

Client Contact:

John Eastman
Suite 1700, 409 Granville Street
Vancouver, BC V6C 1T2
Tel: 604-484-6710 Fax: 604-484-6709

FINANCIAL MANAGER

Name:

ANDRÉ DUFOUR

Title/Position:

Vice-President, Investment

Primary Location:

SNC-Lavalin Investment
455 boul René-Levesque Ouest
Montréal, QC H2Z 1Z3

Roles & Responsibilities:

- Financial Manager

Qualifications:

Chartered Accountant, Canadian Institute of Chartered Accountants, 1980

B.A., University of Montréal, École des Hautes Études Commerciales, Montréal, Quebec, Canada, 1978

Years of Experience:

20 years

Relevant Experience:

1) San Jose-Caldera Toll Road, San Jose, Costa Rica

A 25-year concession to finance, design, build approximately 78 km road, including upgrades and new construction. The total project cost was $145 million.

Roles and Responsibilities:

- Involved in financial feasibility studies, general coordination, negotiation with Government and supervised negotiations of agreements with all parties involved.

Approximate Time Commitment to Roles and Responsibilities:

3 years

Client Contact:

Rocio Aguilar Mantoya
Secretaria Tecnica
Consejo Nacianal de Concesiones
Apdo 1808 – 1002
San José
Costa Rica
Tel: 506-253-0211 Fax: 506-253-0852

2) Great Man Made River Project in Libya

$330-million contract for the design, supply and construction of Wells at Tazerbo, Libya, with the Management and Implementation Authority of the Great Man Made River Project

Roles and Responsibilities:

- Director, Finance, Administration and Logistics
- Participated in the negotiation of the opening and confirmation of the Letters of Credit for payment of the works, services and materials
- Designed and implemented the cost control structure of the contract
- Ensured adequate currency hedging for all cash inlays and outlays to minimize currency fluctuation risks
- Revised budget on a monthly basis with Project Director
- Designed, implemented and managed complex drawings on multiple currency Letters of Credit for the payment of the works and materials
- Negotiated commercial arrangements and terms of payment with suppliers
- Designed and implemented appropriate financial controls on operations in Libya
- Ensured compliance with all Libyan laws and regulations
- Implemented the custom clearance and forwarding system for $200 million of cargo from Benghazi port to Tazerbo
- Ensured that company remunerated in a timely fashion

Approximate Time Commitment to Roles and Responsibilities:

5 years

Client Contact:

Great Man Made River Authority
Benghazi, Libya

PROJECT CONTROLS MANAGER

Name:

SCOTT ROBINSON

Title/Position:

Senior Construction Manager

Roles & Responsibilities:

Responsible for construction management, estimating, contract administration, procurement, cost control, scheduling and planning, progress controls, and document control

Primary Location:

SNC-Lavalin Inc.
1800-1075 West Georgia Street
Vancouver, BC V6E 3C9

Qualifications:

Bachelor of Business Administration, Newport University, USA, 1990

Higher National Diploma in Civil Engineering (four-year technical program), Witwatersrand Technicon, South Africa, 1975

Application for registration in process with Association of Professional Engineers and Geoscientists of British Columbia.

Member – AACE (Association for the Advancement of Cost Engineers)

Years of Experience:

30 years

Relevant Experience:

1) Shengang Residential Complex, Singapore, Singapore

Engineering, procurement and construction for a 12-tower, 18-storey high-rise residential piled foundation structure design-build complex, with two multi-storey car park buildings, in Singapore.

Roles and Responsibilities:

- Project Manager

Approximate Time Commitment to Roles and Responsibilities:

4,000 hours

Contact:

Robert Tribe, Former Vice-President, SNC-Lavalin Inc.
29750 Taylor Street
Vancouver, BC V4X 2E2
Tel: 604-856-1125 Fax: 604-856-3548

2) Five High-Rise Residential Buildings, Vancouver, Canada

Construction, including value analysis, of multi-storey basement residential structures in the downtown core.

Roles and Responsibilities:

- Project Manager

Approximate Time Commitment to Roles and Responsibilities:

9,600 hours

Contact:

Kerry Gillis, General Manger
Ledcor Industries
1000-1066 West Hastings
Vancouver, BC
Tel: 562-743-2932_Fax: 604-681-5372

3) Westshore Terminals, Vancouver, Canada

Fast tracked dismantling of a Canadian 200-tonne rail dumper and installation of a U.S./Canadian rail dumper at the Westshore marine terminal.

Roles and Responsibilities:

- Site engineering and construction management services

Approximate Time Commitment to Roles and Responsibilities:

1,120 hours

Contact:

David Crook, Engineering Manager
Westshore Terminals
1 Roberts Bank
Delta, BC
Tel: 604-946-4491

4) Various Consulting Assignments, Vancouver, Canada

Project Management Consulting

Roles and Responsibilities:

- Provided scheduling and project control services, including analysis of the engineering, purchasing and construction planning of the Cuajone copper mine project in Peru, and institutional buildings in Vancouver

Approximate Time Commitment to Roles and Responsibilities:

4,000 hours

Contact:

Tim Kempe, Principle
Pacific Project Services
3775 Privateers Road, RR2
North Pender Island, BC V0N 2M2
Tel: 250-629-3893

5) Civil Infrastructure Construction, Johannesburg, Republic Of South Africa

Construction of civil infrastructure projects, including:

- Cut-and-cover tunnel construction for the City of Johannesburg's main sewer outfall
- Eight coal silos, including cut-and-cover construction of the silo rail loading facilities and slip forming of silos
- Construction of reservoir
- Construction of wastewater treatment plant
- Civil construction of an industrial reduction and processing plant, including rail access, rail-loading facilities, and pipelines
- The rehabilitation and rebuilding of 65 km of road in Malawi, Central Africa

Roles and Responsibilities:

- Provided project, construction management and value engineering services

Approximate Time Commitment to Roles and Responsibilities:

15,000 hours

Contact:

Andrew Wilson, Former Director
Murray and Roberts
Republic of South Africa
Email: norsandy@iafrica.com

DESIGN/BUILD JOINT VENTURE
PROJECT MANAGER/RISK MANAGER

Name:

TOM TASAKA

Title/Position:

Vice President, Transportation Division

Primary Location:

SNC-Lavalin Inc.
1800-1075 West Georgia Street
Vancouver, BC V6E 3C9

Roles & Responsibilities:

- Oversee and manage the development of the Design/Build bid
- Finalize the Joint Venture Agreements
- Oversee Design and Construction
- Responsible for execution of the Design/Build contract on schedule within budget

Qualifications:

1960 BASc., Civil Engineering, University of British Columbia

Professional Engineer registered with the Association of Professional Engineers and Geoscientists of B.C. Licence 4653

Member, Civil Application Committee, APEGBC

Member, Western Dredging Association

Member, Pacific Coast Association of Port Authorities

2001 Lifetime Achievement Award, Greater Vancouver Section of the Canadian Institute of Transportation Engineers

Years of Experience:

44 years

Relevant Experience:

1) Sea to Sky Corridor – Project Owner's Engineer:

SNC-Lavalin, as Owner's Engineer, is part of the Project Management team with the Ministry of Transportation Sea to Sky Highway Improvement Team. The mandate of the Project Management Team is to explore, analyze and develop options to provide needed infrastructure improvements along the Sea to Sky Highway, develop the project as a concession and manage the construction to completion. SNC-Lavalin is responsible for providing all engineering and technical components of the project by providing the Project Team with the necessary engineering and technical expertise to manage issues and considerations though to the completion of construction. The estimated capital value is $600 million.

Roles and Responsibilities:

- Lead Owner's Engineer

Approximate Time Commitment to Roles and Responsibilities:

120 hours per month (will be significantly reduced after award of DBFO contract)

Client Contact:

Peter Milburn, Executive Project Director
Sea to Sky Project Office
1300-1075 West Georgia Street
Vancouver, British Columbia V6E 3C9
Tel: 604-669-8848 Fax: 604-605-5936
Email: Peter.Milburn@gems5.gov.bc.ca

2) Kincolith Extension Project:

The $34-million Kincolith Extension Project involves the design and construction of a new 30 km, 50 km/h, two-lane road along the coastal estuary of the Nass River in north-western British Columbia through rugged terrain and faced significant environmental and geotechnical risks. The Ministry of Transportation (MoT) opted to complete the project using an "alliance" delivery method in which the construction contractor has partnered with MoT design and SNC-Lavalin's project management team to deliver the project to a Target Price. Construction commenced in June 2001 and was substantially completed in early December 2002, within budget and three weeks prior to the scheduled substantial completion date of December 31, 2002. This successful project was the MoT's first highway construction project utilizing the alliance delivery method. The project was substantially completed as of December 2002

Roles and Responsibilities:

- Project Director

Approximate Time Commitment to Roles and Responsibilities:

Project Management: 3,000 hours

Client Contact:

Dirk Nyland, P.Eng., Chief Engineer, BC Ministry of Transportation
PO Box 9850
STN PROV GOVT
5th Floor, 940 Blanshard St.
Victoria, British Columbia V8W 9T5
Tel: 250-387-2310 Fax: 250-387-7735
Email: Dirk.Nyland@gems2.gov.bc.ca

3) Lytton Bridge:

Completed in 2001 for the Ministry of Transportation, this $14-million project included a new bridge across the Thompson River, approach roadwork, retaining wall structures, utility works and reconstruction of Lytton's main street.

Roles and Responsibilities:

- Project Director

Approximate Time Commitment to Roles and Responsibilities:

Project Management: 1,000 Hours

Client Contact:

Dan Doyle, Deputy Minister, BC Ministry of Transportation
PO Box 9850
STN PROV GOVT
5th Floor, 940 Blanshard St.
Victoria, British Columbia V8W 9T5
Tel: 250-387-3280 Fax: 250-387-2860
Email: Dan.Doyle@gems2.gov.bc.ca

4) Kootenay Lake Ferry

As the Owner's Representative, SNC-Lavalin (through its subsidiary Pacific Liaicon) managed the $23 million design-build replacement of the 40-car ferry with a new 80-car, 250-passanger ferry. Special project features include the on-site building of the ferry in Nelson and upgrading of the docking facilities in Balfour and Kootenay Bay terminals. The project was completed in 2000.

Roles and Responsibilities:

- Project Director

Approximate Time Commitment to Roles and Responsibilities:

Project Management: 200 Hours

Client Contact:

Dan Doyle, Deputy Minister, BC Ministry of Transportation
PO Box 9850
STN PROV GOVT
5th Floor, 940 Blanshard St.
Victoria, British Columbia V8W 9T5
Tel: 250-387-3280 Fax: 250-387-2860
Email: Dan.Doyle@gems2.gov.bc.ca

5) Vancouver Wharves Berth 4/5 Redevelopment

SNC-Lavalin coordinated, on behalf of the Owner, work for expansion and upgrades to the agricultural products facilities and the sulphur storage and loading facilities, which included a new shiploader, rail car dumpers, conveying systems, 10 2,500-tonne steel agri-storage bins and a rail loop track. Client: Vancouver Wharves Limited. Capital value: $110 million.

Roles and Responsibilities:

- Project Director

Approximate Time Commitment to Roles and Responsibilities:

Project Management: 4,500 hours

Client Contacts:

Bill Weymark, P.Eng., President and CEO, Vancouver Wharves Ltd.
BC Rail Marine
1995 West First Ave.
North Vancouver, British Columbia V7P 1A8
Tel: 604-985-3177 Fax: 604-980-5213

Stan Cowdell, President, Westmar Consultants Inc.
#400-233 West 1st Avenue
North Vancouver, British Columbia V7M 1B3
Tel: 604-985-6488 Fax: 604-985-2581

6) Barnett/Hastings People Moving Project

The overall capital cost for the 18-km HOV express lane corridor from Port Moody to Vancouver was $105 million. The project was completed in 1996.

Roles and Responsibilities:

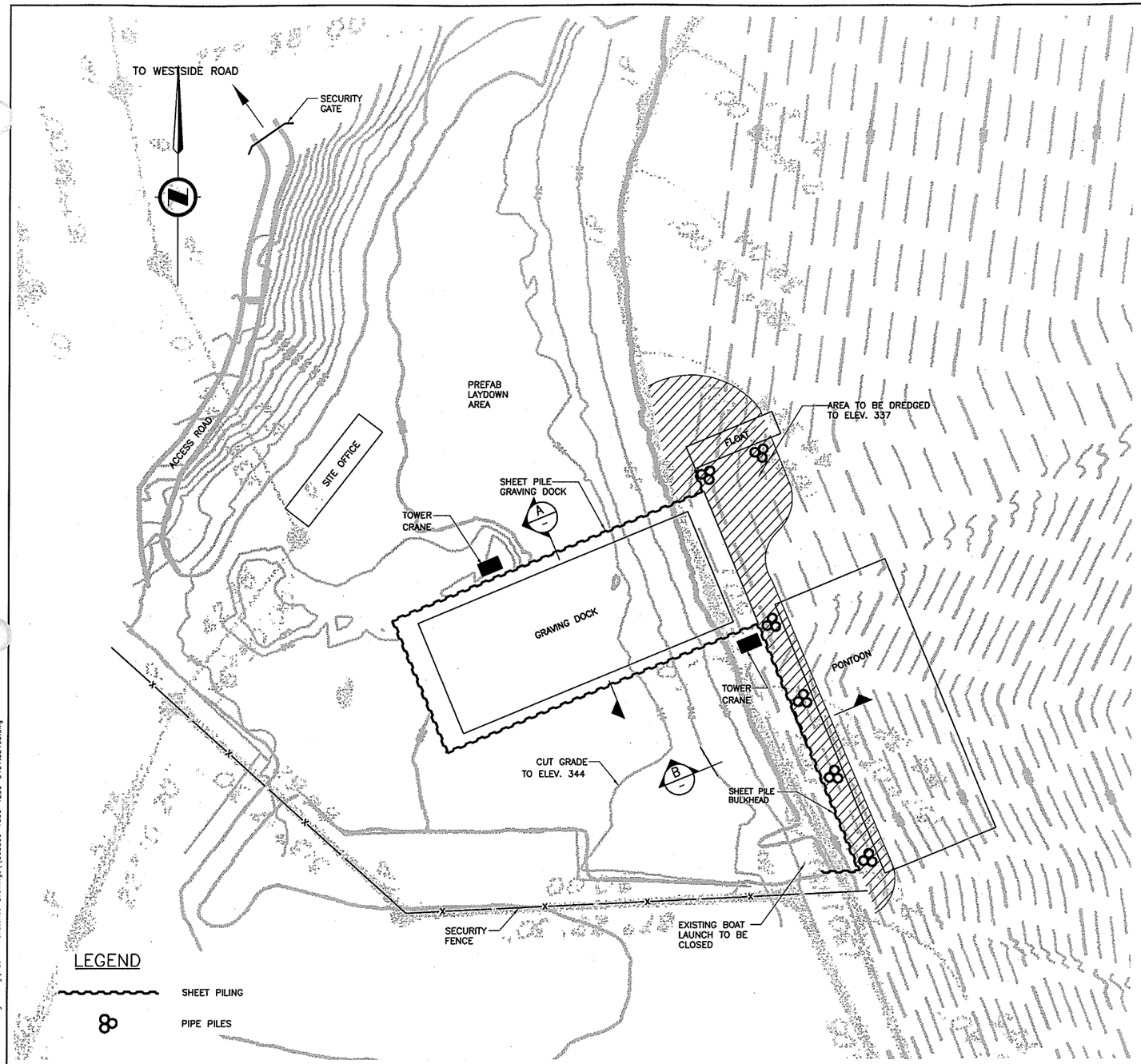
- Project Director

Approximate Time Commitment to Roles and Responsibilities:

Project Management: 8,000 hours

Client Contact:

Dan Doyle, Deputy Minister, BC Ministry of Transportation
PO Box 9850
STN PROV GOVT
5th Floor, 940 Blanshard Street
Victoria, British Columbia V8W 9T5
Tel: 250-387-3280 Fax: 250-387-2860
Email: Dan.Doyle@gems2.gov.bc.ca



BEAR CREEK NORTH PLAN

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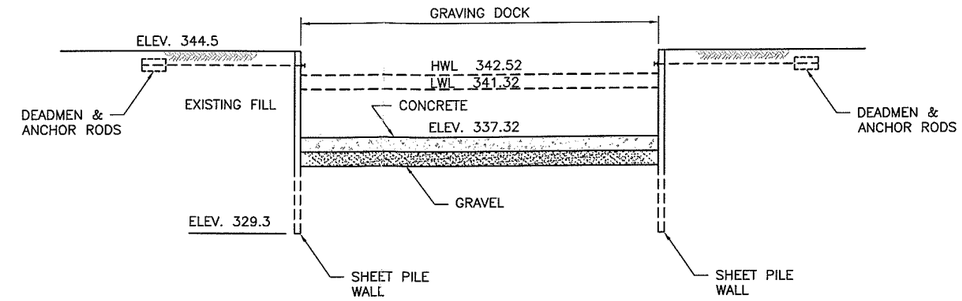

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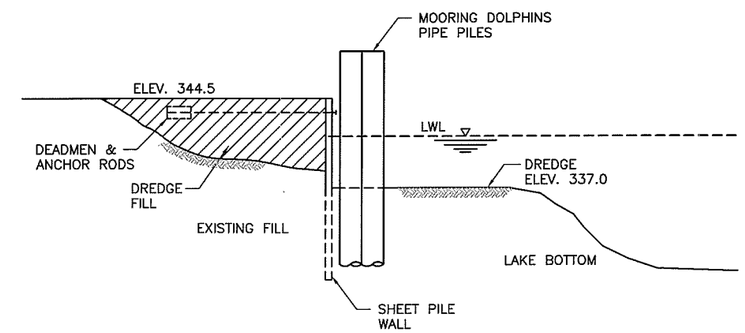
SECTION

SCALE = 1:250



B

SECTION

SCALE = 1:250

NOTE:

1. THE GRAVING DOCK LAYOUT SHOWN IS PRELIMINARY TO ILLUSTRATE CONCEPT FOR THE BAFO SUBMISSION ONLY. THIS CONCEPT WILL BE DEVELOPED FURTHER AFTER OUR SELECTION AS THE PROPONENT.

PRELIMINARY
FOR INFORMATION ONLY
2005-03-18

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 - 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9
Certified ISO 9001

PREPARED BY:
VANCOUVER PILE DRIVING
MARINE GENERAL CONTRACTORS

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED W. SAUNDERS	
DRAWN K. WONG	PROJECT MANAGER
CHECKED	DATE (YY-MM-DD) 2005-03-16

OKANAGAN LAKE NEW CROSSING SERVICES
BEAR CREEK NORTH
GRAVING DOCK & TEMPORARY PONTOON
MOORING FACILITY - SITE PLAN

SCALE AS NOTED | CONTRACT | DRAWING 865800-1000-42DD-3403
DATE 05-03-16

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2005/03/18 - 4:32
PATH: H:\DATA\865800 - Lake Bridge\42 - Structural Engineering\42DK - Sketches-Drawings\\865800-1000-42DD-3401to3403.dwg

Attachment 1: Trow Certificate of ISO 9001:2000 Registration

CERTIFICATE OF REGISTRATION

Quality Management System

This is to certify that:

Trow Associates Inc.
7025 Greenwood Street
Burnaby
British Columbia
Canada
V5A 1X7

Hold Certificate No: **FM 63158**
and operate a Quality Management System, which complies with the requirements of BS EN ISO 9001:2000 for the following scope:

Provision of construction materials, building science, quality, geotechnical and environmental design engineering, consulting, testing and management services.

For and on behalf of BSI, Inc.:

Robert G. Perry
President

Originally Registered: **20 Sep 2000** *Latest issue:* **28 Jul 2003** *Expiry Date:* **19 Sep 2006** *Page:* 1 of 1

This certificate remains the property of BSI, Inc. Validity is maintained through a process of continual assessments and strategic reviews. To check validity call 703 437 9000 or visit www.bsiamericas.com. To be read in conjunction with the scope of registration shown above or on the attached appendix.

Americas Headquarters: BSI, Inc. 12110 Sunset Hills Road, Suite 140, Reston, VA 20190, USA.

BSI Management Systems

A507 (USA) Issue 2

Attachment 1: SNC-Lavalin Certificate of ISO 9001:2000 Registration

ENREGISTREMENT DE SYSTÈMES

Warnock Hersey

SYSTEMS REGISTRATION

Certificate of Registration

This is to certify that the Quality Management System of :

SNC ♦ LAVALIN Inc.

Transportation Division

Vancouver, British Columbia

has been assessed and registered by

Intertek Testing Services NA Ltd.

as conforming to the requirements of the following standard :

ISO 9001 : 2000

The Quality Management System is applicable to the following activities :

Full Range of Project Management, Engineering, Procurement, Construction and Commissioning Services for Various Rapid Transit and Other Transportation Projects Worldwide

Further clarifications regarding the scope of this certificate and the applicability of ISO 9001:2000 requirements may be obtained by consulting the organization.

The registration is subject to the company maintaining its quality system to the required standard, which will be monitored periodically.

This certificate is valid as long as the company name will appear on our web site. www.itsintertek.com

ITS Intertek

Certificate number :	*2570-2*
Original Registration Date :	*May 30, 1997*
Issue Date :	*May 13, 2003*
Expiration Date :	*May 31, 2006*

Registration Officer

Attachment 1: Buckland & Taylor Certificate of ISO 9001:2000 Registration

A DIVISION OF CSA GROUP

QMI
90 Burnhamthorpe Road West, Suite 300
Mississauga, Ontario, Canada L5B 3C3
Telephone: (905) 272-3920
Facsimile: (905) 272-3942

CERTIFICATE OF REGISTRATION

QMI issues this certificate to:

BUCKLAND & TAYLOR LTD.

101 - 788 Harbourside Drive
North Vancouver, British Columbia
V7P 3R7 Canada

which has demonstrated that its Quality Management System is in compliance with:

ISO 9001:2000

The following scope of registration applies:

Provision of bridge design services.
Engineering services including design engineering, construction engineering, preparation of engineering documents and drawings; and engineering studies.

** Further clarification regarding the scope of this certificate and the applicability of ISO 9001:2000 requirements may be obtained by consulting this organization*

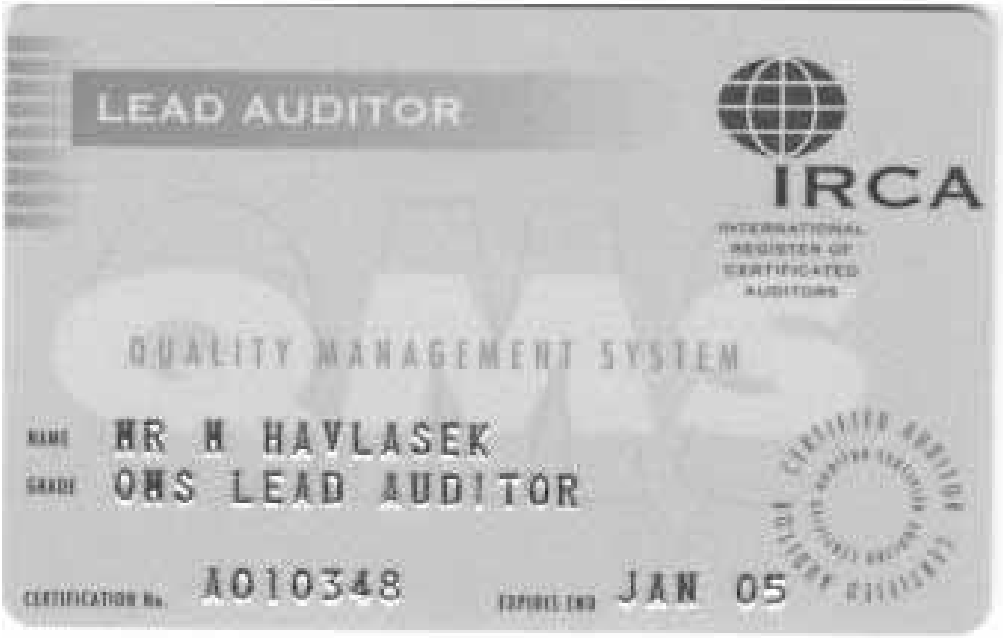
Certificate Number:	**008477**
SIC Number:	**8711**
Date of Original Registration:	**December 17, 2003**
Date of Current Registration:	**December 17, 2003**

Standards Council of Canada Accredited Registrar
Conseil canadien des normes Registraire accrédité

QMI REGISTERED MANAGEMENT SYSTEM

Wendy J. Tilford
President

Attachment 2: Quality Manager's IRCA Accreditation Card



Attachment 3: Trow MoT Quality Management Award

Attachment 4: Sample Quality Management Plan Table of Contents

v. **TABLE OF CONTENTS**

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Attachment 5: Non-Conformance Report Form

NON-CONFORMANCE REPORT

(for Major Non-Conformance)

NCR Report No:	Date:	**Page 1 of 2**
Client: MOT	Project No.: MOT 08879	
P.O. No.:	Vendor/Subcontractor:	
NCR Item Identification:		
NCR Item:		
Description of Non-Conformance:		
Type or Print Name	NCR Originator	Date
Proposed Disposition:		
Root Cause – Why did this problem occur?		
Recurrence Prevention Measures – What must be done to ensure a similar problem does not happen again?		
Check one ☐ a) No action beyond disposition recommended		
☐ b) Take additional action as follows to reduce risk of recurrence:	Due Date:	_____
Type or Print Name	Owner's Representative (if required*)	Date
***For Acceptance of Non-Standard Work by Owner (if applicable)**		
Adam Tartaglia		
Type or Print Name	QC Coordinator	Date
Gary Bale		
Type or Print Name	Contractor Professional Appointee/Project Manager	Date

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NCR Report No:	Date:	**Page 2 of 2**
Disposition Complete and Accepted By:		
Adam Tartaglia		
Type or Print Name	QC Coordinator	Date
Gary Bale		
Type or Print Name	Contractor Professional Appointee/Project Manager	Date
Allan Russell		
Type or Print Name	Quality Manager	Date
Recurrence Prevention Measures Complete and Accepted by:		
Gary Bale		
Type or Print Name	Contractor Professional Appointee/Project Manager	Date
Allan Russell		
Type or Print Name	Quality Manager	Date

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Attachment 6: Non-Conformance Log

NON-CONFORMANCE LOG
(for Major Non-Conformances)

Project No.:			Location:	
			Disposition	
NCR No.	Date	Description	By	Date

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Attachment 7: Opportunity for Improvement Form

OPPORTUNITY FOR IMPROVEMENT (OFI) FORM

OFI Report No:	Date:
Client: MOT	Project No.: MOT 08879
P.O. No.:	Vendor/Subcontractor:
OFI Item Identification:	
OFI Item:	

Description of Suggested Improvement or Potential Problem:

Change to Documentation/Drawing Required? **Yes** _____ **No** _____

Indicate Document/Drawing Number and Title: _____

Type or Print Name	OFI Originator	Date

Recommendation Accepted:

Yes X No _____ (indicate why)

Type or Print Name	QC Coordinator	Date
A. Tartaglia		
Type or Print Name	Contractor Professional Appointees/Project Manager	Date
G. Bale		

Recommendation Implemented and Verified by:

Type or Print Name	QC Coordinator	Date
A. Tartaglia		
Type or Print Name	Contractor Professional Appointee/Project Manager	Date
G. Bale		
Type or Print Name	Quality Manager	Date
A. Russell		

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Attachment 8: Opportunity for Improvement Log

OPPORTUNITY FOR IMPROVEMENT (OFI) LOG

Project No:			Location:	
			Closed	
OFI No.	Date	Description	By	Date

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Attachment 9: Sample Quality Control/ Quality Assurance Procedure/ Checklist

A.6 Subbase and Base Construction

Location:

Date:

Item	Description	Frequency (see legend)	Completed Item		Date
			Quality Control	Quality Assurance	
			Site Foreman/ Superintendent	Quality Inspector	
1	***Documentation***				
	Review relevant Project Documents, Property Right-of-Way Drawings, Project Drawings, Quality Documents, Site Safety Plan and Reference Criteria	S			
	Verify that Traffic Control Plan has been approved	S			
	Review location of fibre optic cable, potential conflict with work and applicable special procedures	S			
2	***Protection of the Environment***				
	Ensure that the requirements of the Manager of Environment are established, understood and followed in accordance with the Environmental Plan	S			
3	***Subbase and Base Construction***				
	Verify that source acceptance tests completed and acceptable	Once			
	Verify Engineer has accepted subgrade preparation and that loose, organic and other deleterious materials have been removed	Once			
	Record and document construction operations in accordance with Quality Documents	Once			
	Verify favorable weather conditions for construction	Once			
	Verify that Traffic Control requirements have been implemented for this element	E			
	Ensure grades and thicknesses meet specified tolerances	Once			
	Verify grades of subgrade, subbase, and base layers prior to placing overlaying material lifts (15mm tolerance for subbase, 10mm tolerance for base)	Once			
	Verify testing agencies have been notified	Once			
	Ensure base and subbase materials comply with Project Document Specifications	Once			
	Ensure material is not segregated, contaminated or degraded	Once			
	Ensure subbase and base material placed and compacted to at least 100% Standard Proctor Density in accordance to the Project Documents	Once			
	Ensure adequate control of water for compaction and dust control purposes	Once			
	Proof-roll prepared base gravel layer and verify acceptable rutting/displacement	Once			
	Verify and record work limits and grades to ensure work is completed in accordance with the Project Documents and Drawings	E			

Comments:

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A.6 Subbase and Base Construction

Check ONE of (A), (B) or (C) below:

☐ **(A) CONFORMANCE SIGNOFF,** work to proceed: _____ Quality Control Coordinator _____ Month/Day/Year

Comments:

_____

_____

_____

☐ **(B) INTERIM SIGNOFF, work to proceed (see comments)** (Released Under Remedial Action Request # _____) _____ Quality Manager _____ Month/Day/Year

Comments:

_____

_____

_____

☐ **(C) NON-CONFORMANCE, stop work pending follow-up actions:** (NCR # _____ issued) _____ Quality Manager _____ Month/Day/Year

Follow-up Actions:

_____

_____

_____

Disposition of NCR acceptable, work to proceed: _____ Quality Manager _____ Month/Day/Year

Legend:

Frequency:	**S =**	once at start of process	**W =**	weekly
	Once =	once during process	**M =**	monthly
	E =	once at end of process	**See Description =**	for other Special Frequencies, note the detailed requirement in the Description column
	D =	daily		

Attach additional copies of this Checklist to verify events occurring more than once.

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Attachment 10: Sample Test Plan

B.16 Curb and Gutter/Sidewalks

B.16.1 Source Acceptance Tests

B.16.1.1 Cast-In-Place Concrete Elements

TEST DESCRIPTION	TEST METHOD	BCH METHOD	QUALITY CONTROL FREQUENCY	QUALITY ASSURANCE FREQUENCY
Review mix design submittals for each proposed concrete mix	Conformance to CSA A23.1	n/a	One (1) review for each mix design mix submitted, 1 review of each mix change	Not required

B.16.2 Construction Quality Control Tests During Production, Delivery and Placement

B.16.2.1 Cast-In-Place Concrete Elements

TEST DESCRIPTION	TEST METHOD	BCH METHOD	QUALITY CONTROL FREQUENCY	QUALITY ASSURANCE FREQUENCY
Sample and test to determine compressive strength (7 and 28 days), air content, slump and temperature	CSA A23.2-1C CSA A23.2-4C CSA A23.2-3C CSA A23.2-5C CSA A23.2-9C ASTM C1064	n/a n/a n/a n/a n/a n/a	One (1) sample obtained and tested for every 50m^3 placed; no less than one (1) test per mix class per day	One (1) sample obtained and tested for every 1,000m^3 placed; no less than one (1) test per mix class per week

B.16.2.2 Precast Concrete Elements

TEST DESCRIPTION	TEST METHOD	BCH METHOD	QUALITY CONTROL FREQUENCY	QUALITY ASSURANCE FREQUENCY
Random sample and tests on plastic concrete as produced for casting precast concrete elements. Sample and test to determine compressive strength (7 and 28 days), air content, slump and temperature	CSA A23.2-1C CSA A23.2-3C CSA A23.2-4C CSA A23.2-5C CSA A23.2-9C ASTM C1064	n/a n/a n/a n/a n/a n/a	One (1) sample obtained and tested at random for every 50m^3 manufactured; minimum of one (1) test per mix class per day of manufacture	Not required

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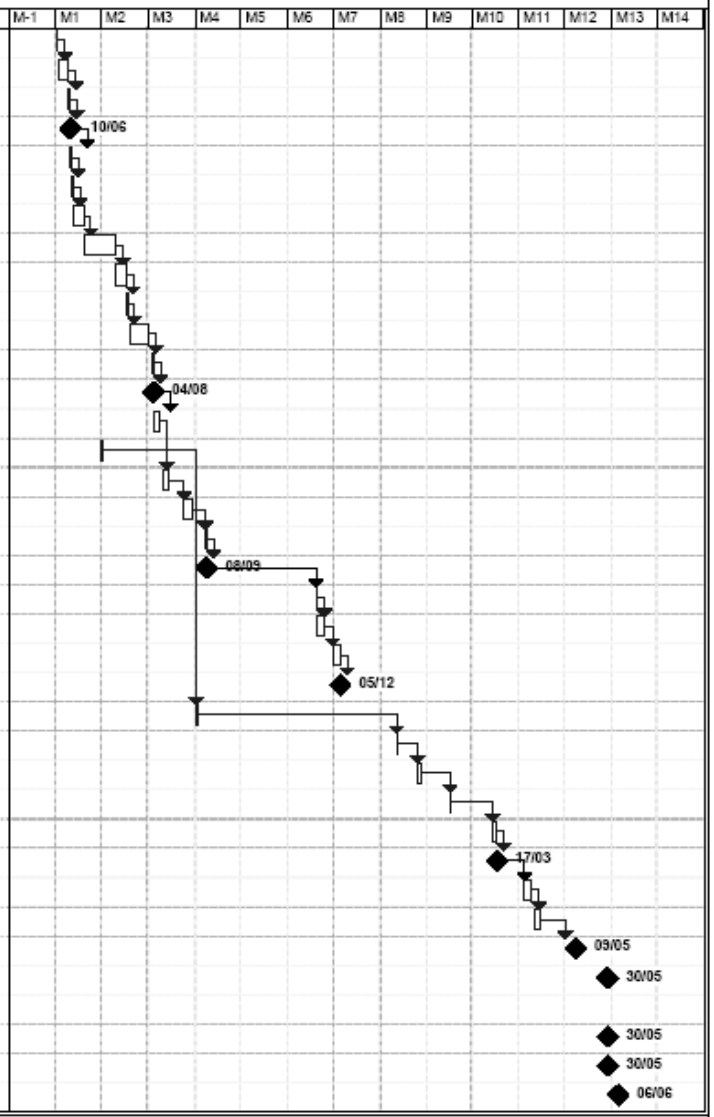
Attachment 11: Documentation, Implementation and Deliverable Schedule

ISO 9001:2000 Implementation OLC

ID	Task Name
1	Meeting with Project Manager
2	Prepare first draft of QMP
3	Receive approval of first Draft from Project Manager
4	**DELIVERABLE: QMP Version 1.0 - Project Manager Approved**
5	Hold executive ISO 9001 briefing (Project Manager and Direct Reports)
6	Form ISO 9001 steering committee (i.e assign Quality Coordinators)
7	Meet with all of Project Manager's Direct Reports & Quality Coordinators
8	Prepare Second Draft of QMP
9	Compile Master Lists of Existing Lower Tier Documents
10	Advise Quality Coordinators of Doc Gaps in their System
11	Help QC Coordinators to Complete Doc Gaps in their System
12	Receive Approval of Second Draft of of QMP From Project Manager
13	**DELIVERABLE: QMP Version 2.0 - Management Team Approved**
14	Hold ISO 9001 0.5 day awareness sessions max 15 people
15	Request quotes from registrars
16	Hold QMP Review Sessions max 15 people
17	Prepare QMP V 3.0
18	Receive Approval of QMP V 3.0
19	**DELIVERABLE: QMP Version 3.0 - Project Team Approved**
20	Select Internal Audit Team
21	Conduct Training of Internal Audit Team
22	Perform Full Internal Audit on entire Design & Construction (D&C) portion of Quality Management System (QMS)
23	**DELIVERABLE: Audit Report - Proof of Level of Implementation - D&C**
24	Select Registrar for O&M (Operations and Maintenance) portion of QMS
25	Registrar Document Review for O&M portion of QMS
26	Implement changes resulting from Registrar DR
27	Receive Registrar approval of documented system
28	Perform Internal Audit on O&M portion of QMS
29	**DELIVERABLE: Audit Report - Proof of Level of Implementation - O&M**
30	Implement changes resulting from internal audit
31	Implement changes resulting from Registrar audit
32	Receive Certificate of Registration for O&M portion of QMS
33	**DELIVERABLE: ISO 9001:2000 Certificate of Registration**
34	
35	**DELIVERABLES: Ongoing Internal Audits - D, C, O & M**
36	**DELIVERABLES: Ongoing ISO 9001 Registrar Surveillance Audit Reports - O & M**
37	**DELIVERABLES: Ongoing Updates to QMP Documents**



Project: ISO 9001:2000 Implementatio
Date: Mon 18/10/04

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary | External Milestone | External Milestone | Deadline

SNC·LAVALIN

General Policy on Occupational Health and Safety*

1. As an engineering-construction and manufacturing company operating worldwide, the SNC-Lavalin Group and its subsidiaries make occupational health and safety a primary objective in all of their activities both in Canada and abroad.
2. The Board of Directors established the Occupational Health and Safety Committee and mandated it to monitor the general Policy on Occupational Health and Safety. Each business unit, operating division or wholly-owned subsidiary is responsible for enforcing the laws and regulations under this general policy, along with the operating guidelines issuing therefrom, which are applicable to all employees without exception.
3. Measures implemented by the company include, among other things:
   - 3.1. training employees so that they can help integrate the occupational health and safety standards into SNC-Lavalin activities;
   - 3.2. developing construction, operating and working methods to ensure that occupational health and safety objectives are part of SNC-Lavalin project quality criteria;
   - 3.3. producing an annual report on SNC-Lavalin's progress in attaining its occupational health and safety commitments and objectives.
4. SNC-Lavalin, with regard to all the establishments where it is assigned a mandate or responsibility in occupational health and safety matters, has an objective of zero (0) accidents in the workplace and the elimination at source of any risk or danger.
5. All units, divisions and subsidiaries are responsible for reporting any fatal or serious accident resulting in lost time or property damage and to present their reports on such matters to the company's Occupational Health and Safety Committee.
6. SNC-Lavalin has identified measurable objectives which are specific and adapted to each type of operation in which it is involved which will be subject to periodic review.
7. SNC-Lavalin favours a return-to-work policy to assist those who have been involved in a workplace accident at any of its worksites or facilities.
8. The Director, Occupational Health and Safety, is responsible for verifying official directives regarding occupational health and safety and to assure that all offices, plants and worksites comply with laws, regulations and operating policies. Status reports are submitted to the company's Occupational Health and Safety Committee.

* This general policy is supplemented by another organizational health and safety policy specific to construction work sites.

SNC·LAVALIN

Specific policy regarding occupational health and safety on constructions sites

This is a specific policy statement issuing from the SNC-Lavalin Group regarding occupational health and safety on worksites where our firm acts as prime contractor (turnkey contracts), as the representative of the prime contractor, as the owner's agent with a mandate for occupational health and safety or as a contractor.

1. This specific policy constitutes the minimum requirement in such matters as it applies to all our construction sites. If applicable, it will become the object of a specific prevention program.

2. The safety of workers and other participants on SNC-Lavalin Group construction sites is a priority objective and takes precedence over any other activity or consideration.

On all its construction sites, the SNC-Lavalin Group aims at eliminating the very causes of dangers to workers' health, safety and physical integrity.

3. Safety on construction sites is eveyone's business: SNC-Lavalin Group, contractors, sub-contractors, the project manager, the construction manager, worksite supervisory personnel, security agents, the workers themselves and the organizations representing them.

4. On each worksite where we have a mandate regarding occupational health and safety, the SNC-Lavalin Group agrees to:

   a) identify risks relating to construction work;

   b) identify the means for eliminating such risks;

   c) identify the person in charge of management regarding occupational health and safety matters.

The SNC-Lavalin Group will see to it that on each worksite the indications of frequency and seriousness be compiled on a monthly basis.

These indications are to be compiled according to the local methods and usages and in the absence of such usage, then in the following way:

Frequency: $\frac{\text{Number of lost time accidents x 200,000}}{\text{Total number of hours worked}}$

Seriousness: $\frac{\text{Number of lost days x 200,000}}{\text{Total number of hours worked}}$

5. With regard to occupational health and safety matters on worksites where we have a mandate, the SNC-Lavalin Group agrees to a minimum standards of procedures and activities related to follow-up and reporting:

a) a written report on the nature of worksite risks and the identification of means for eliminating them, plus the identification of the manager in charge;

b) a quarterly report on the frequency and seriousness indications from the worksite;

c) a report relating to every serious or mortal accident including the circumstances surrounding the accident, causes as identified and recommendations for avoiding a repetition of such an accident.

6. The project manager and construction manager are directly liable for the performance of their projects where safety is concerned. Performance regarding safety on a given project will be used in the annual evaluation of project managers and construction managers.

7. The company agrees to provide itself with the means and instruments enabling it to apply this policy on worksites; such means may include, among other things, contractual provisions or other means such as inspections, audits, safety committee, etc.

8. The decision to carry out an audit, and the decision regarding its location, shall be made by the Health and Safety Officer and by the members of the Health and Safety Committee. The project's director shall be notified of the audit approximately three (3) weeks before it is carried out.

9. The SNC-Lavalin Group ensures that the organization of work on worksites and the methods and techniques in use are safe and do not prejudice the health of anyone.

In particular, the company ensures the proper upkeep of the worksite and the providing of adequate sanitary facilities.

10. The SNC-Lavalin Group ensures that the emission of a contaminant or other hazardous substance on the construction site does not prejudice the health or safety of anyone working on such site.

11. The SNC-Lavalin Group ensures that worksite personnel has received adequate training and information regarding:

a) risks arising from work;

b) means for avoiding a risk;

c) on-site first aid services.

12. Each contractor or sub-contractor whose indication of frequency or indication of seriousness is deemed to be unacceptable, may be required by the SNC-Lavalin Group to submit a recovery plan aimed at eliminating the life or health threatening risks for anyone on its worksite. It must then apply this recovery plan to the worksite.

Vancouver Pile Driving Ltd.

Occupational Health and Safety Policy Statement

Vancouver Pile Driving Ltd. is committed to providing a safe work environment wherein the health and well being of its employees is the fundamental objective.

The management of Vancouver Pile Driving Ltd. is responsible for developing a comprehensive health and safety program that meets or exceeds the minimum standards as established by the Workers' Compensation Board of British Columbia. The Supervision of Vancouver Pile Driving Ltd. is committed to implementing the safety program on the job sites, and our employees are willing to accept the responsibility to adhere to the terms and conditions of the Occupational Health and Safety Program.

Wayne Saunders – General Manager

POLICY STATEMENT

The management of Greyback Construction Ltd. is committed to providing safe and healthy working conditions and to promote positive attitudes towards health within the jurisdictions of the company and its construction work sites.

Greyback Construction Ltd. believes that all reasonable measures should be taken to prevent accidents and injuries in the workplace. An effective occupational safety and health program will establish work attitudes and procedures to achieve that objective.

Ultimately, it is the responsibility of Greyback Construction Ltd. for the implementation and execution of this program. Everyone is expected to participate in eliminating unsafe conditions and activities, and to work cooperatively toward the prevention of accidents.

Greyback Construction Ltd. is responsible for ensuring that workers are properly instructed to do their work safely; for enforcing safe work procedures and regulations; and for correcting all unsafe activities. Workers and sub-contractors have the responsibility to work safely, and to know and follow all rules and safe work procedures.

Larry Kenyon
President

OCT 29 2004
DATE

Bryan Wallich
TQS Manager

OCT 29, 2004
DATE

EMIL ANDERSON
CONSTRUCTION (EAC) INC.

HEALTH AND SAFETY POLICY

Management of EMIL ANDERSON CONSTRUCTION (EAC) INC. is committed to providing and maintaining a safe and healthy working environment for all its employees through the implementation of a comprehensive health and safety program that meets the requirements of the Workers' Compensation Board of British Columbia's Occupational Health and Safety Regulation.

It is our policy to provide first quality service to clients while taking all necessary steps to prevent injury to our employees, employees of other companies on the job site, the customer and the public, and to prevent damage to all property within the influence of the job site.

To achieve this objective, we will comply with all applicable regulations. We cannot meet this attainable goal without full cooperation from all personnel; therefore, cooperation is required from all site and office personnel in the compliance with all rules and regulations governing safe operating procedures for the prevention of injury, disease and property damage.

Our health and safety program is designed in the best interests of all personnel, subcontractors, visitors and customers. We believe accident prevention and efficient production can go hand in hand and, accordingly, insist on a dedicated participation in the program requirements.

JANUARY 5, 2004
Date

EMIL ANDERSON CONSTRUCTION (EAC) INC.
Principal MICHAEL JACOBS, P. ENG
PRESIDENT

QUESTION NUMBER	TECHNICAL SUBMISSION SECTION	CLARIFICATION ISSUE AND RESPONSE
SNC6	6.1.1.3, Pg 92	**Issue:** Please confirm that you will also comply with the Operational Performance Measures as defined in the Local Area Specifications during the Enhanced Service ***Response:*** *We confirm that we will comply with the Operational Performance Measures.*

Signed on behalf of SNC-Lavalin Inc.:

QUESTION NUMBER	SUBMISSION SECTION	CLARIFICATION QUESTION
SNC 10	Technical Submission, Clause 5.2.1, Pg 84, Paragraph 3	Environmental issues related to the graving dock site also include the potential for archaeological resources and as such the Heritage Conservation Act applies. Heritage Conservation Act Permits are the responsibility of the Concessionaire, although in accordance with the Province's letter of March 16, 2005 the Province will be responsible for any additional costs resulting from the permit requirements. Please confirm your acceptance of the foregoing and advise of any cost and/or schedule adjustments to your BAFO submission.

SNC 10 Response:

We accept the responsibility to obtain the Heritage Conversation Act Permits, without adjustment to cost or schedule provided the Province, on Concessionaire's request where a delay is anticipated not due to a failure of Concessionaire, will take an active role (but bear no responsibility for success or failure) in obtaining the approval required in order to maintain schedule.

BRITISH COLUMBIA

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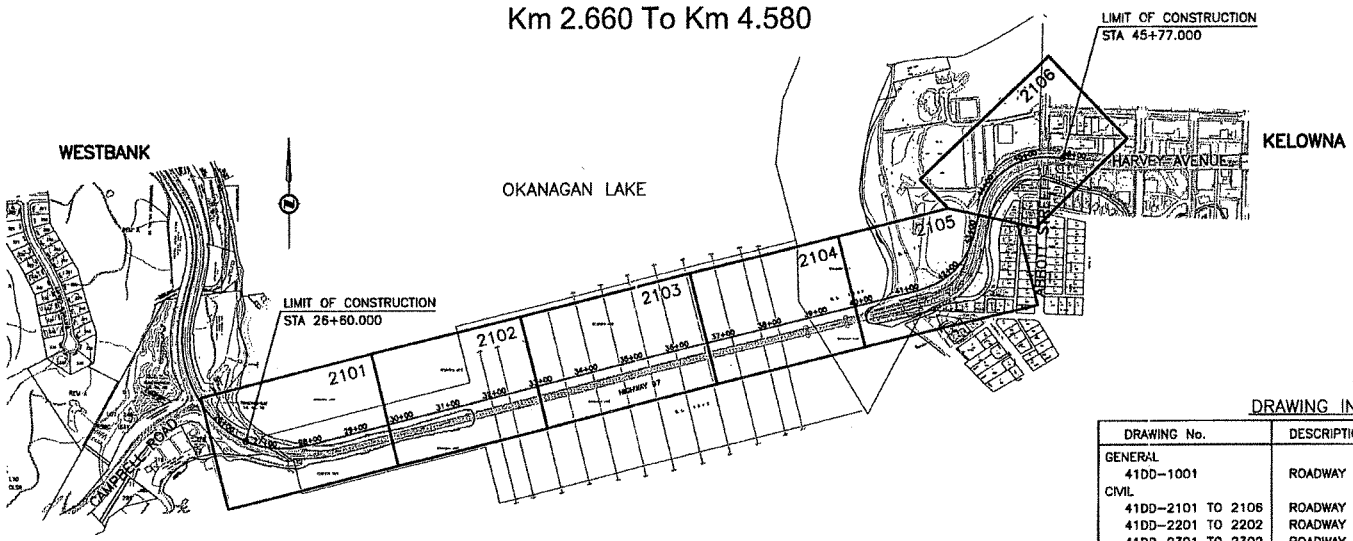
British Columbia

MINISTRY OF TRANSPORTATION

OKANAGAN LAKE NEW CROSSING SERVICES

Km 2.660 To Km 4.580



KEY PLAN
1:5000

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

DRAWING INDEX

DRAWING No.	DESCRIPTION
GENERAL	
41DD-1001	ROADWAY KEY PLAN & DRAWING INDEX
CIVIL	
41DD-2101 TO 2106	ROADWAY PLANS
41DD-2201 TO 2202	ROADWAY PROFILES
41DD-2301 TO 2302	ROADWAY TYPICAL SECTIONS
41DD-2401 TO 2406	LANING AND GEOMETRICS PLANS
41DD-2501 TO 2502	PEDESTRIAN & CYCLIST ACCESSIBILITY PLANS
41DD-2601 TO 2603	TRAFFIC MANAGEMENT PLANS
41DD-2701 TO 2706	UTILITIES PLANS
41DD-2801	CONSTRUCTION STAGING
STRUCTURAL	
42DD-3101 TO 3107	GENERAL ARRANGEMENTS
42DD-3201 TO 3202	TYPICAL DECK SECTIONS
42DD-3301 TO 3307	FLOATING BRIDGE
42DD-3401	BEAR CREEK SOUTH – GRAVING DOCK
42DD-3402	OLD FERRY DOCK – FIT-OUT SITE
ELECTRICAL	
47DD-4101 TO 4102	SITE PLANS
47DD-4201	SCHEMATICS

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	R/P TECHNICAL SUBMISSION	PA

KEY PLAN

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British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 250

PREPARATION	APPROVAL
DESIGNER R. WONG	
DRAWN M. KWOK	PROJECT MANAGER T. WACHNAHN
DESIGN S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY KEY PLAN & DRAWING INDEX

SCALE 1 : 5000 | CONTRACT | DRAWING 865800-1000-41DD-1001
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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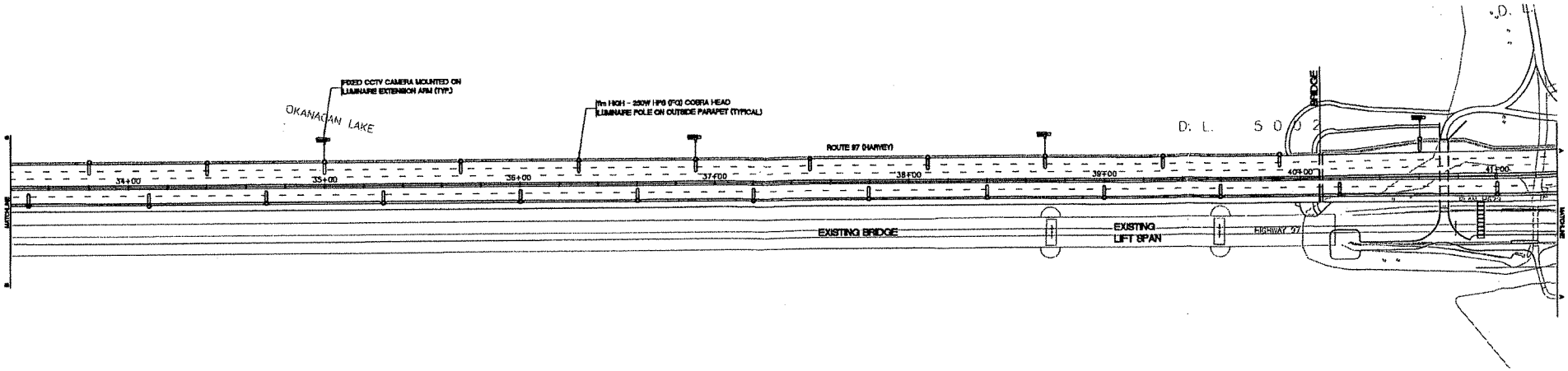

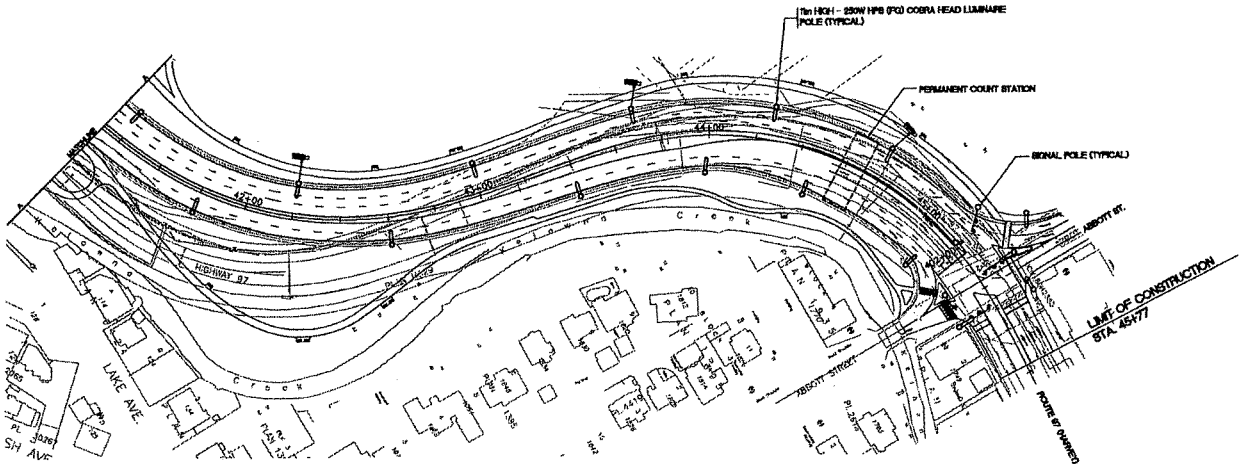

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RF	RFP TECHNICAL SUBMISSION	PA

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PREPARED BY: DMD & Associates Ltd.
DMD
18 18044 95A Avenue
Surrey, BC, Canada V4N 4P2
www.dmdeng.com 604/888-9010
office@dmdeng.com Fax 604/888-9011
DMD PROJECT No. P952

BAR SCALE(S):

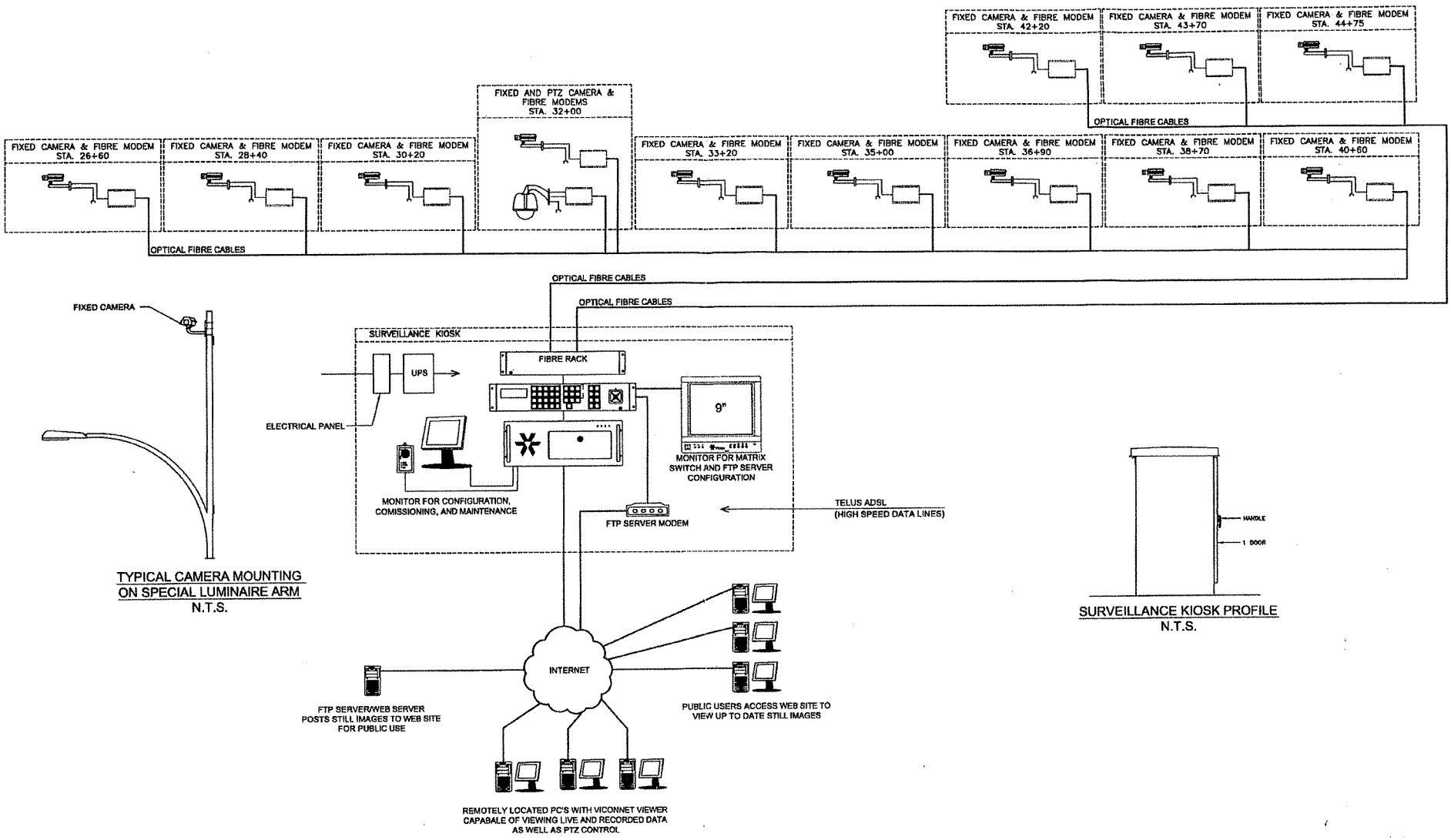
PREPARATION	APPROVAL
DESIGNED D. MOLEIN	
DRAWN C. EDGAR	PROJECT MANAGER D. MOLEAN
CHECKED D. WONG	DATE (YY-MM-DD) 2004-11-16

OKANAGAN LAKE BRIDGE PROJECT
ELECTRICAL SITE PLAN

SHEET 2

SCALE 1:1000 | CONTRACT | DRAWING 865800-1000-47DD-4102
DATE 04-11-16

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → F



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No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RF	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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SNC·LAVALIN
1500 – 1075 West Georgia Street
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PREPARED BY: DMD & Associates Ltd.
18 15044 55A Avenue
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www.dmdeng.com
office@dmdeng.com
604/888-9010
Fax 604/888-9011
DMD PROJECT No. P952

BAR SCALE(S):

	PREPARATION	APPROVAL
DESIGNER	C. EDGAR	
DRAWN	C. EDGAR	
PROJECT MANAGER	D. MCLEAN	
DATE (YY-MM-DD)	2004-11-16	
DESIGNER	D. WONG	

OKANAGAN LAKE BRIDGE PROJECT
CCTV SYSTEM
RISER DIAGRAM
SHEET 1

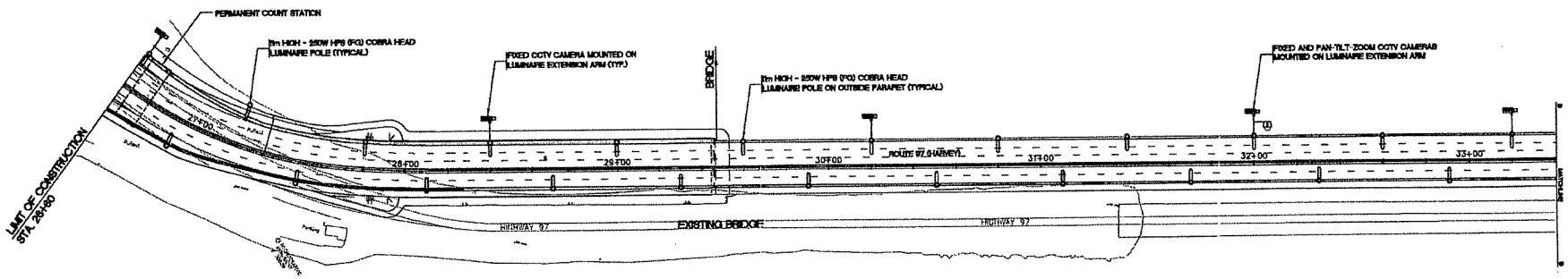
SCALE N/A | CONTRACT | DRAWING 865800-1000-47DD-4201
DATE 04-11-16

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

ILLUMINANCE DESIGN CRITERIA		
ITEM	DESIGN REQUIREMENTS	DESIGN ACHIEVED
STREET NAME(S)	HWY. 97 OE. BRIDGE ABUTMENT TO ABBOTT	
PEDESTRIAN CONFLICT AREA		
ROAD CLASSIFICATION	ARTERIAL	
ILLUMINATION TYPE	250W HPS	
SPACING (MAX)	27m TO 40m STAGGERED	
ILLUMINATION LEVEL (AVG)	13.0 LUX	13.1 LUX
UNIFORMITY RATIO (AVG/MIN)	3:1	2.7:1

5.0 ELECTRICAL DESIGN REQUIREMENT	
LIGHTING ARRANGEMENT	✓
LIGHTING LEVELS	✓
TRAFFIC SIGNAL LAYOUT	✓
CCTV	✓

ILLUMINANCE DESIGN CRITERIA		
ITEM	DESIGN REQUIREMENTS	DESIGN ACHIEVED
STREET NAME(S)	HWY. 97 OE. BRIDGE ABUTMENT TO JUST E. OF CAMPBELL	
PEDESTRIAN CONFLICT AREA		
ROAD CLASSIFICATION	ARTERIAL	
ILLUMINATION TYPE	250W HPS	
SPACING (MAX)	30m TO 50m STAGGERED	
ILLUMINATION LEVEL (AVG)	17.0 LUX	17.3 LUX
UNIFORMITY RATIO (AVG/MIN)	3:1	2.3:1



REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RF	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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SNC·LAVALIN
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PREPARED BY: DMD & Associates Ltd.
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Surrey, BC, Canada V4N 4P2
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office@dmdeng.com Fax 604/888-9011
DMD PROJECT No. P952

BAR SCALE(S):

	PREPARATION	APPROVAL
DESIGNED	D. MCLEAN	
DRAWN	C. EDGAR	PROJECT MANAGER D. MCLEAN
CHECKED	D. WONG	DATE (YY-MM-DD) 2004-11-16

OKANAGAN LAKE BRIDGE PROJECT
ELECTRICAL SITE PLAN

SHEET 1

SCALE 1:1000	CONTRACT	DRAWING 865800-1000-47DD-4101
DATE 04-11-16		

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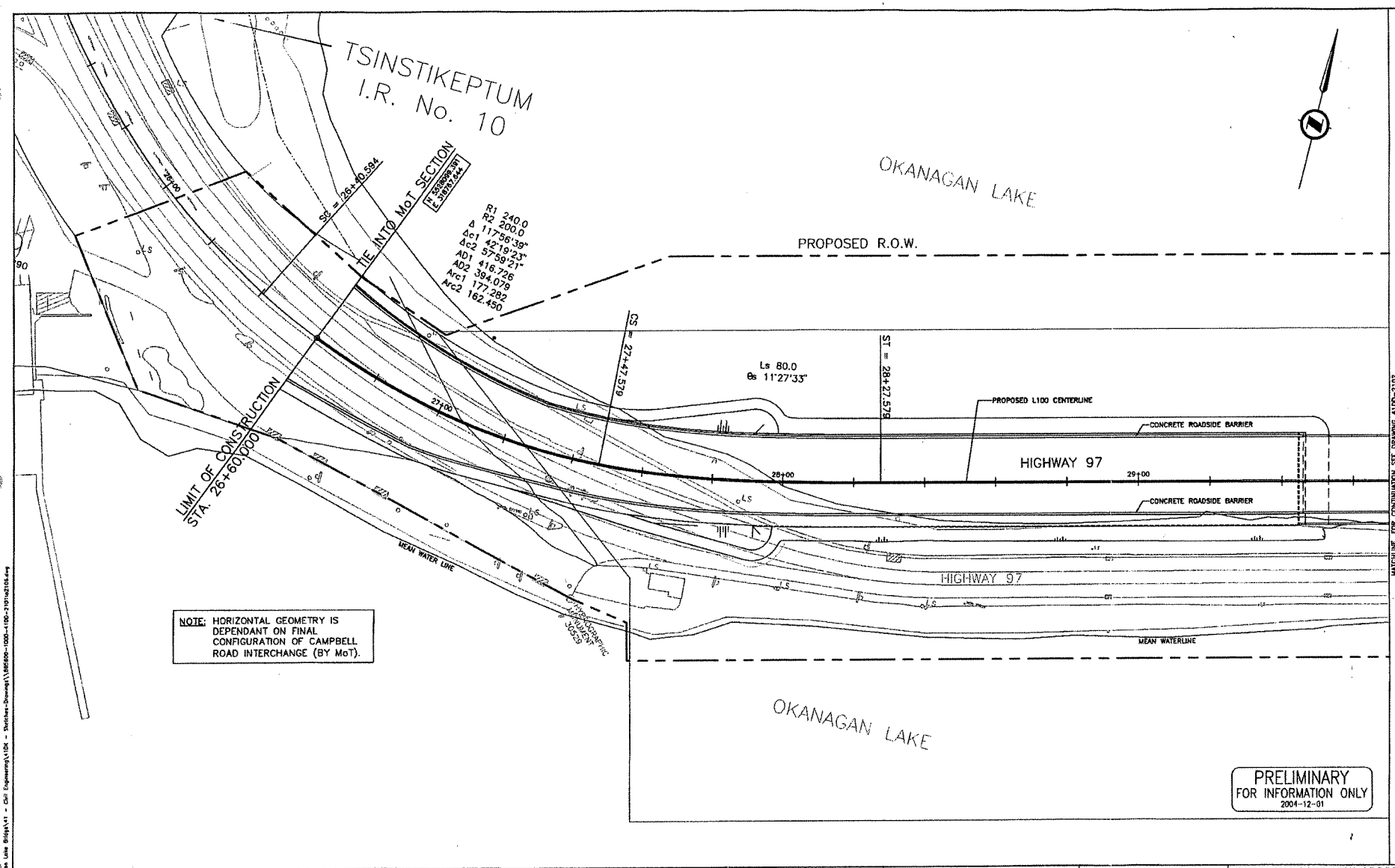

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No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN: 2101 2102 2103 2104 2105 2106

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SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KNOX/C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (DD-MM-YR) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY PLAN
STA. 26+60.000 TO STA. 29+68.000
SHEET 1 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2101
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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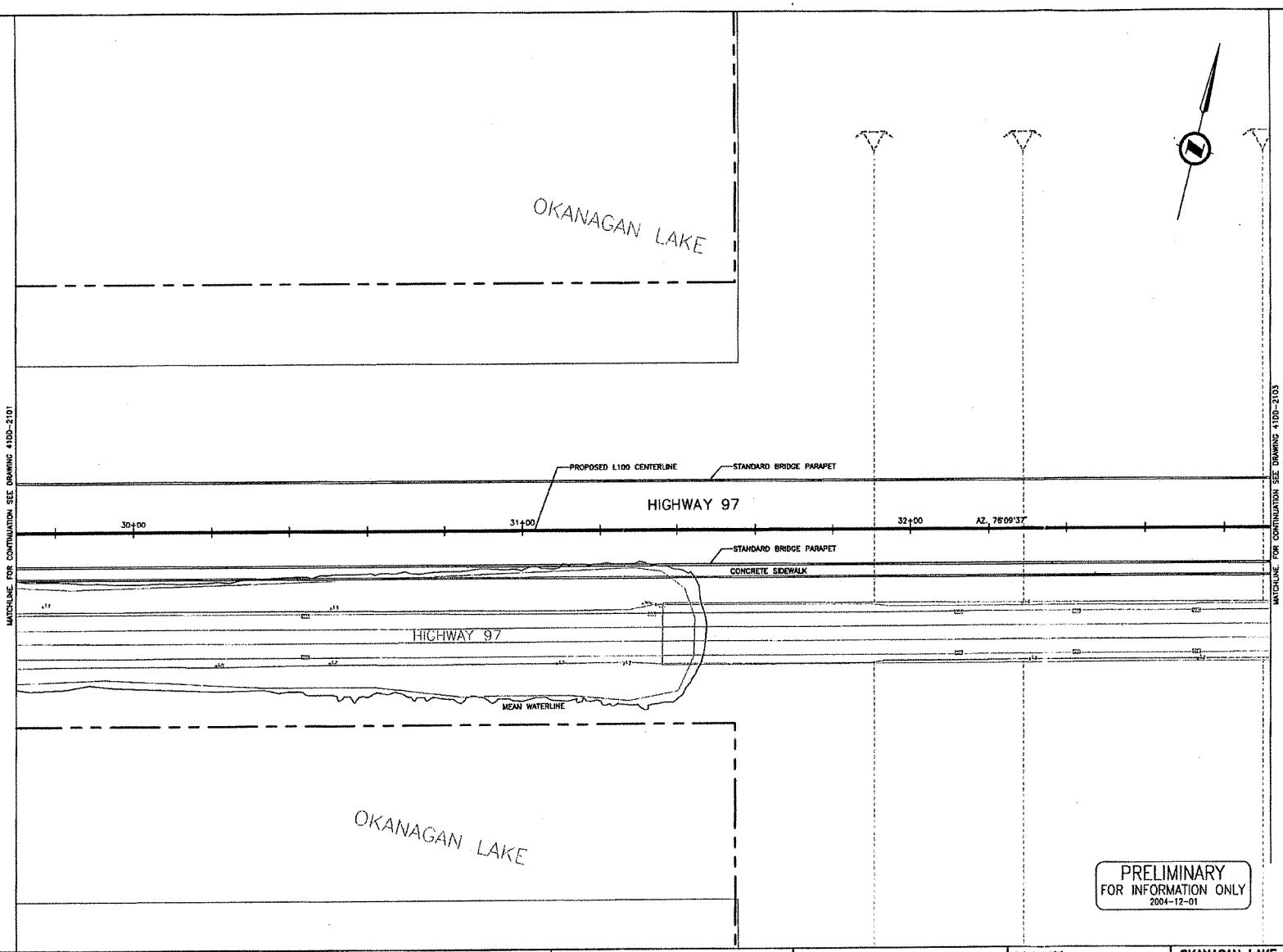

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-04	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

2101 2102 2103 2104 2105 2106

partnerships
British Columbia

SNC·LAVALIN
1600 – 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	PROJECT MANAGER T. WACHMANN
DRAWN N. KWOK/C. LAM	DATE (YY-MM-DD) 2004-11-25
CHECKED S. DEEPAK	

OKANAGAN LAKE NEW CROSSING SERVICES

ROADWAY PLAN

STA. 29+68.000 TO STA. 32+92.000

SHEET 2 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2102

DATE 04-11-29

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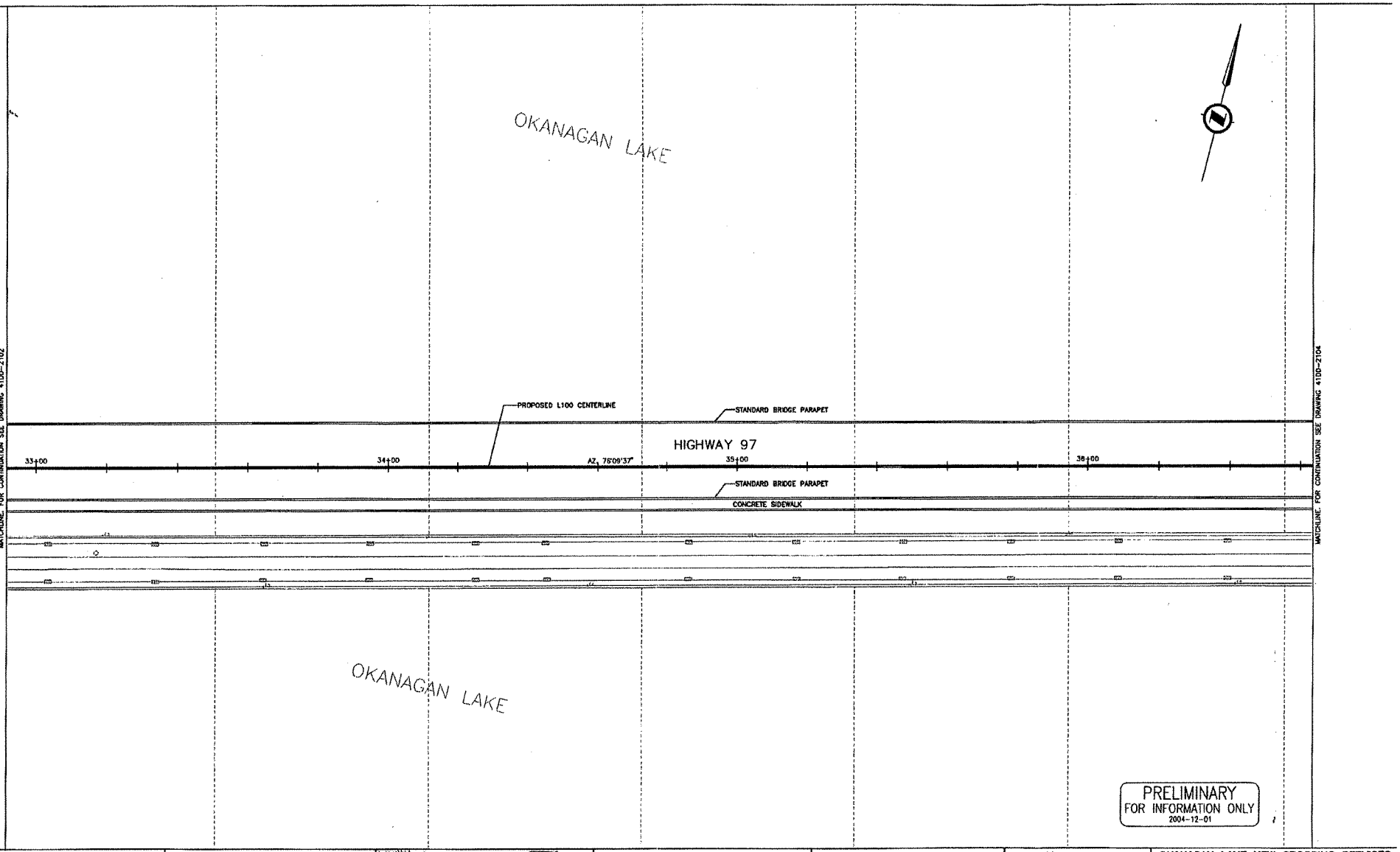

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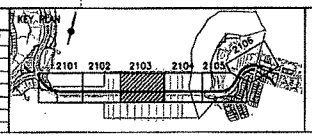

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Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK/C. LAM	PROJECT MANAGER Y. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY PLAN
STA. 32+92.000 TO STA. 36+64.000
SHEET 3 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2103
DATE 04-11-23

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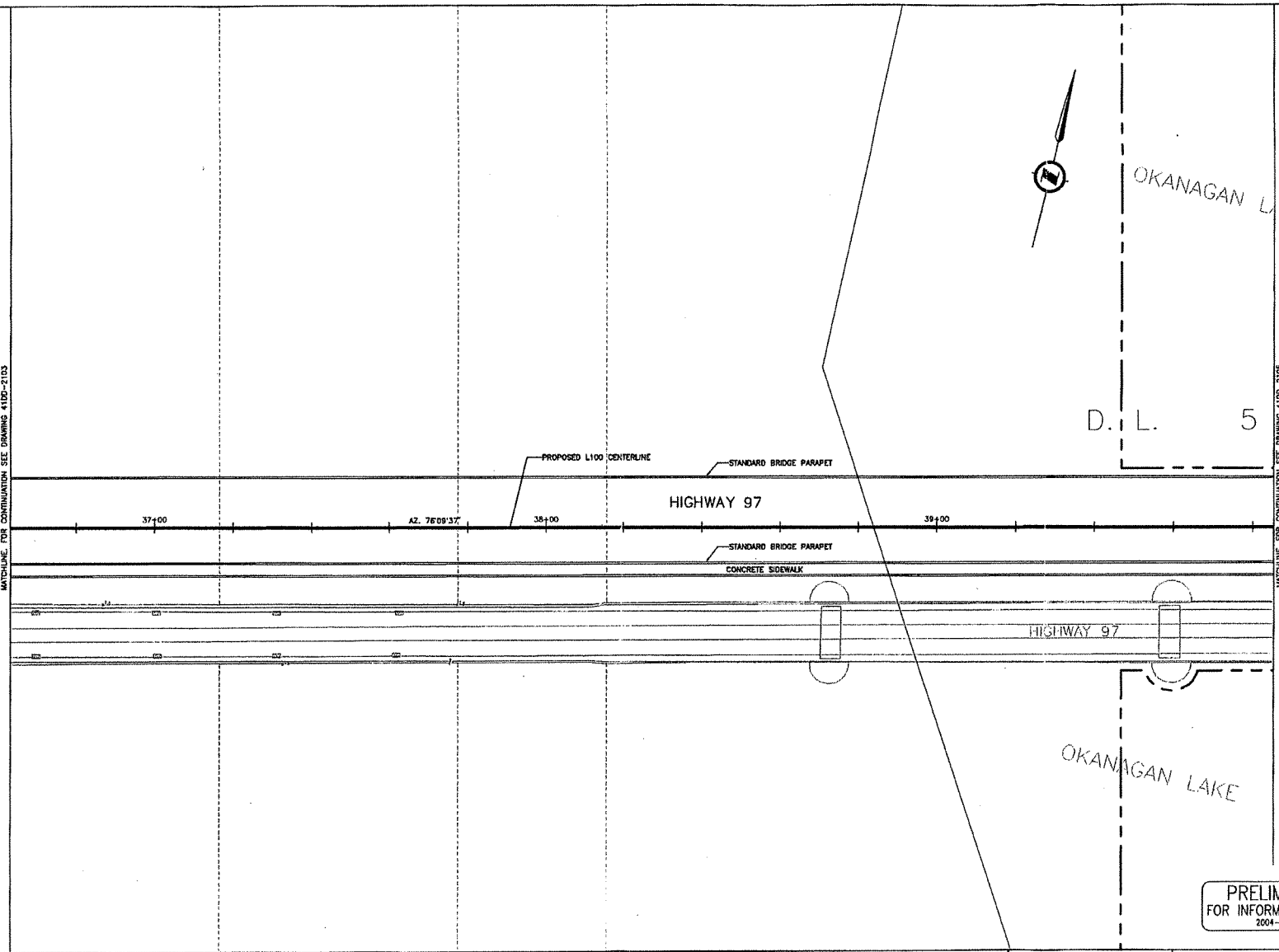

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REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-04	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada V6E 3C9
ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWON/C. LAM	PROJECT MANAGER T. WACHSMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY PLAN
STA. 36+64.000 TO STA. 39+83.000
SHEET 4 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2104
DATE 04-11-25

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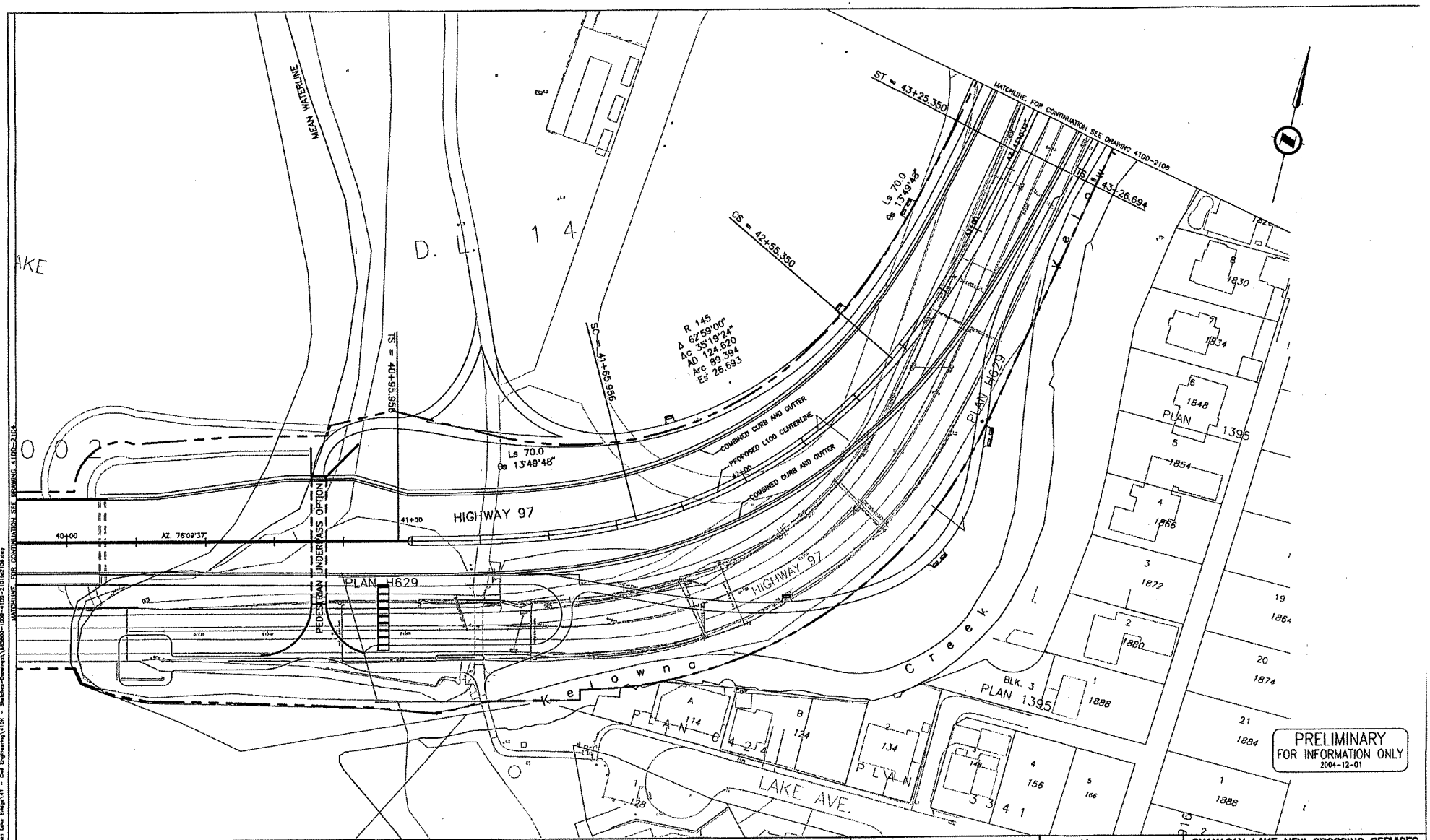

REFERENCE DRAWING		
No	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-04	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK/C. LAM	PROJECT MANAGER T. WACHNIANI
CHECKED S. DEEPIK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

ROADWAY PLAN

STA. 39+83.000 TO STA. 43+38.000

SHEET 5 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2105

DATE 04-11-25

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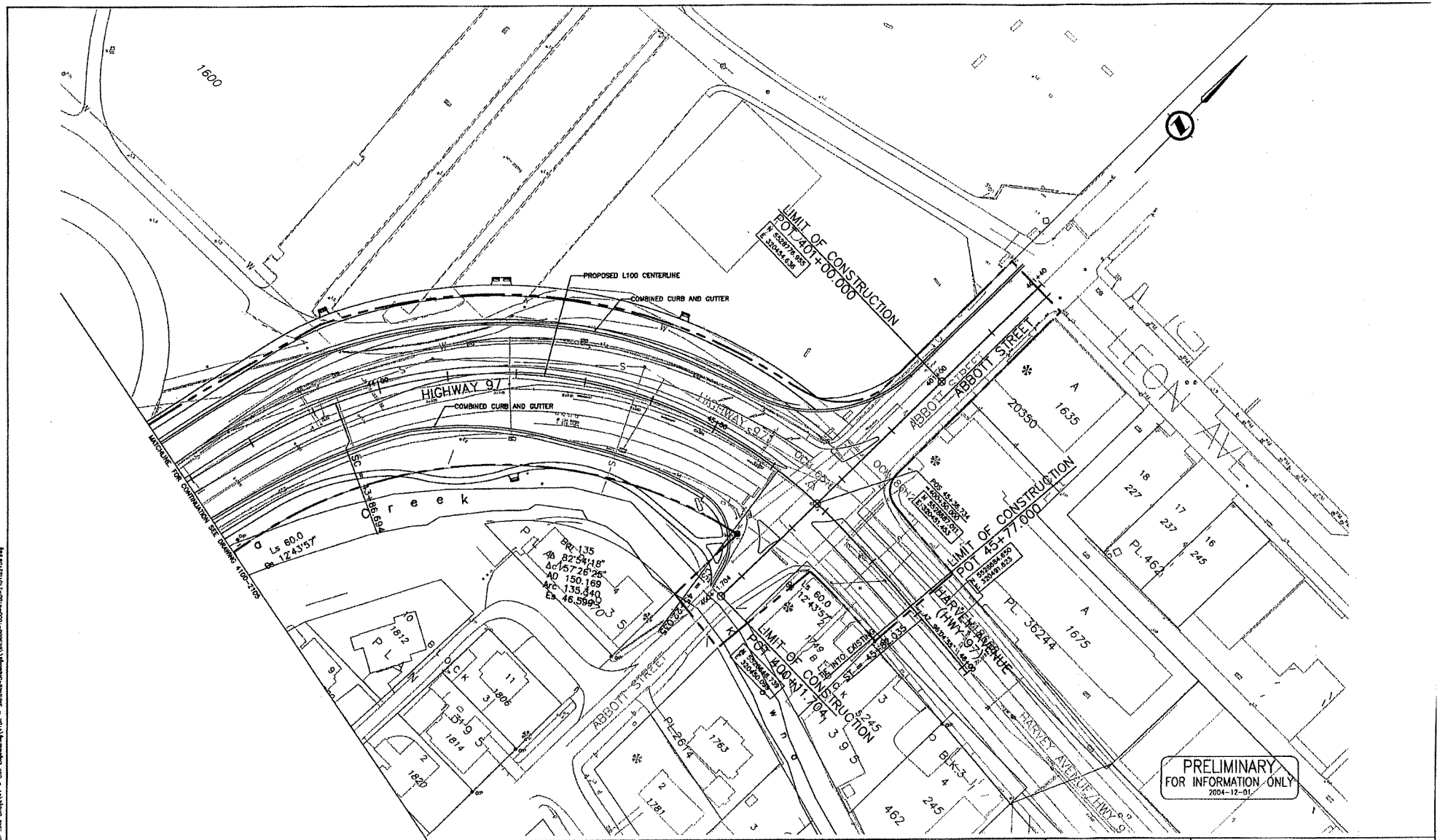

REFERENCE DRAWING			REVISIONS			
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			04-12-04	RHW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

2101 2102 2103 2104 2105 2106

partnerships
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SNC·LAVALIN

1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAFT M. KWOK/C. LAM	PROJECT MANAGER T. MACHLEHNN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

ROADWAY PLAN

STA. 43+38.000 TO STA. 45+77.000

SHEET 6 OF 6

SCALE 1:1,500 | CONTRACT | DRAWING 865800-1000-41DD-2106

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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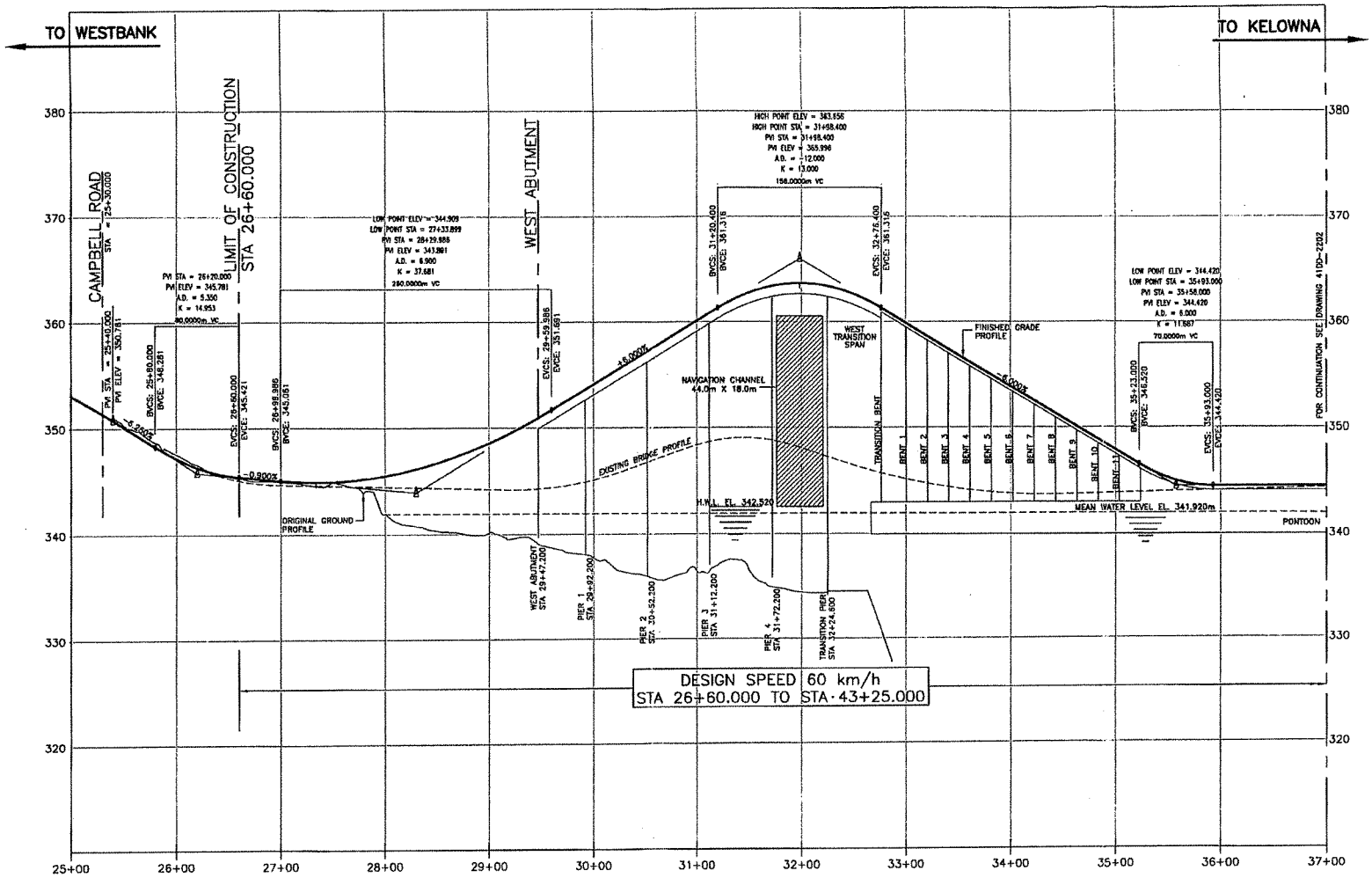

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2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RMW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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SNC·LAVALIN
1600 - 1070 West Georgia Street
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Canada, V6E 3G9
ISO 9001

PREPARED BY:

BAR SCALE(S):
0 Horiz. 1:2000 100
0 Vert. 1:200 10

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK	PROJECT MANAGER T. WATCHUANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY PROFILE
STA 26+60.000 TO 37+00.000
SHEET 1 OF 2

SCALE - | CONTRACT | DRAWING 865800-1000-41DD-2201
DATE 04-11-25
SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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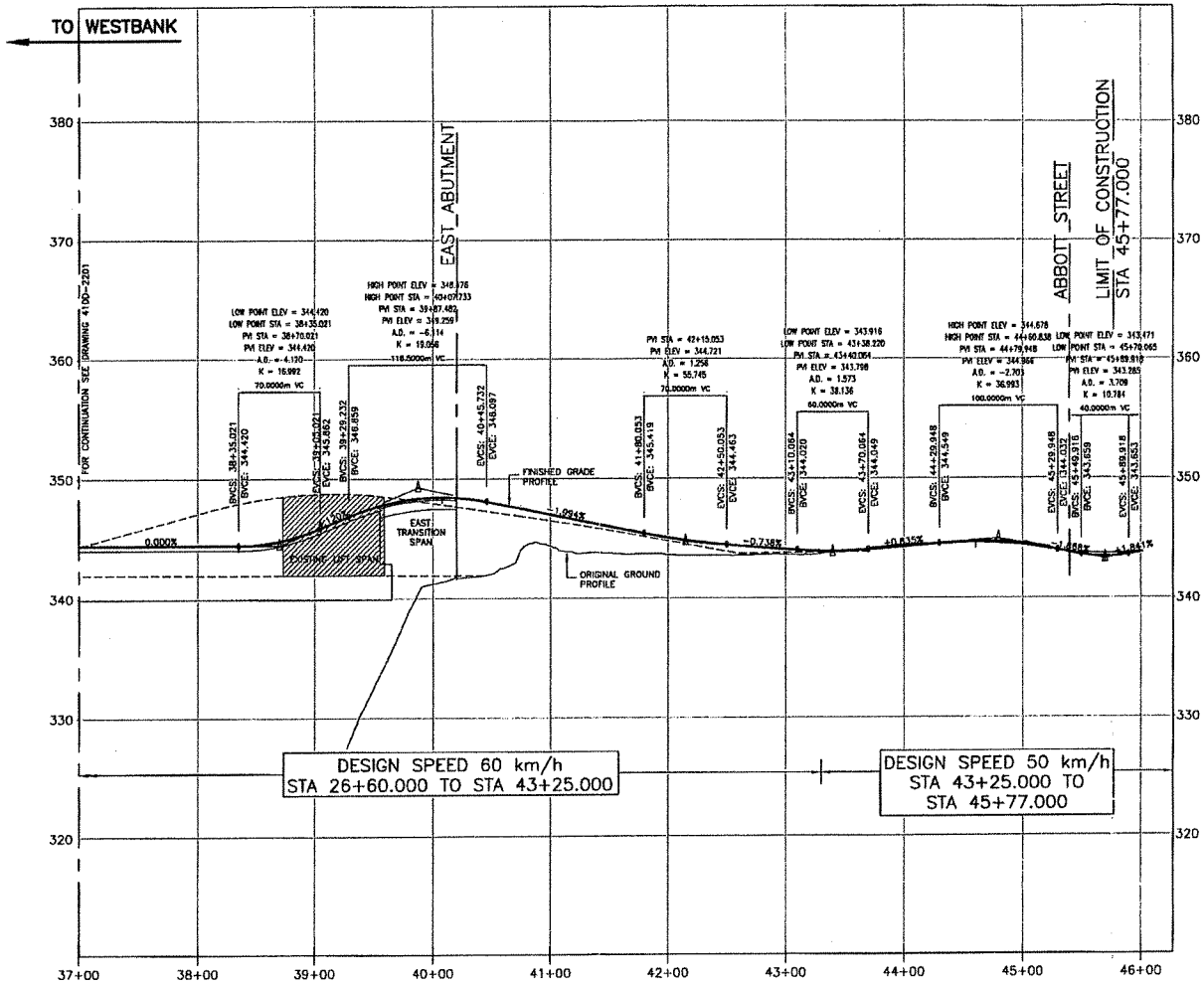

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RHW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
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SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada V6E 3C9
PREPARED BY:

BAR SCALE(S):
0 Horiz. 1:2000 100
0 Vert. 1:200 10

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. HWOK	PROJECT MANAGER T. WATCHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY PROFILE
STA 37+00.000 TO STA 45+77.000
SHEET 2 OF 2

SCALE – | CONTRACT | DRAWING 865800-1000-41DD-2202
DATE 04-11-25
SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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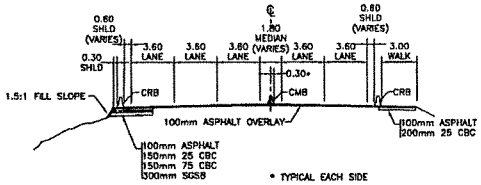
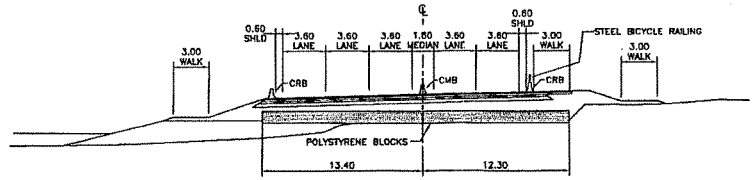
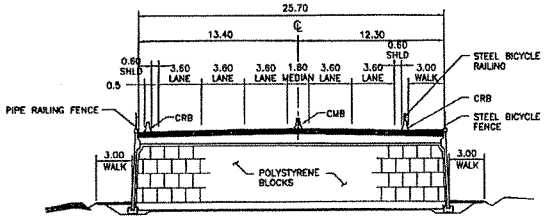
SHOWN AT STA. 27+60.000



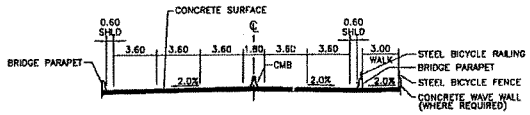
TYPICAL WEST APPROACH
FROM STA 26+60.000 TO 27+80.000
LOOKING EAST



TYPICAL WEST APPROACH
FROM STA 27+80.000 TO 27+92.000
LOOKING EAST



TYPICAL WEST APPROACH
FROM STA 27+92.000 TO 29+44.765
LOOKING EAST



TYPICAL ROADWAY ON NEW CROSSING
FROM STA 29+47.200 (WEST ABUTMENT) TO 40+10.000 (EAST ABUTMENT)
LOOKING EAST

PRELIMINARY
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2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RMW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 10

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY TYPICAL SECTIONS

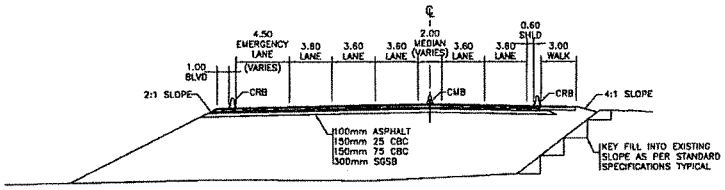
SHEET 1 OF 2

SCALE 1 : 200 | CONTRACT | DRAWING 865800-1000-41DD-2301
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

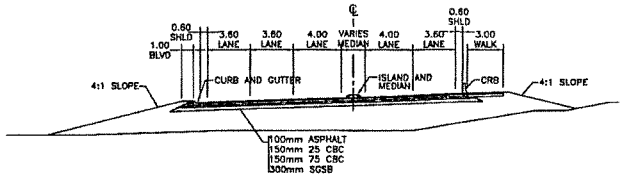
DATE: 2004/11/30 – 4:31pm
PATH: H:\DATA\865800 – Okanagan Lake Bridge\41 – Civil Engineering\41DK – Sketches-Drawings\865800-1000-41DD-2301rev2302.dwg

SHOWN AT STA. 40+80.000



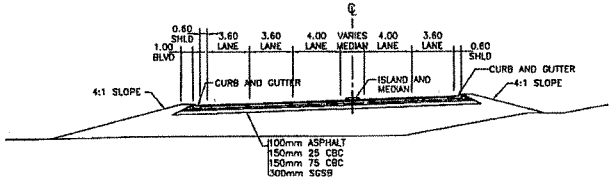
TYPICAL EAST APPROACH ROADWAY
FROM STA 40+10.000 TO 41+00.000

SHOWN AT STA. 41+30.000



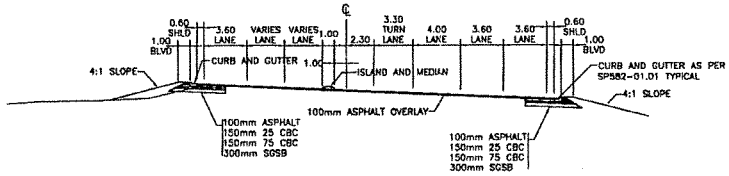
TYPICAL FROM STA 41+00.000 TO 41+34.000

SHOWN AT STA. 43+00.000

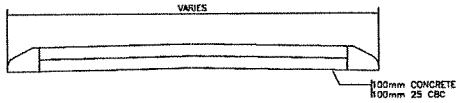


TYPICAL FROM STA 41+34.000 TO 44+00.000

SHOWN AT STA. 45+00.000



TYPICAL FROM STA 44+20.000 TO 45+20.000



TYPICAL ISLAND AND MEDIAN SECTION
1:20

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 10

	PREPARATION	APPROVAL
DESIGNED	R. WONG	
DRAWN	M. KWOK	PROJECT MANAGER T. WACHMANN
CHECKED	S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
ROADWAY TYPICAL SECTIONS

SHEET 2 OF 2

SCALE 1 : 200 | CONTRACT | DRAWING 865800-1000-41DD-2302
DATE 04-11-29

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 - 4:34pm
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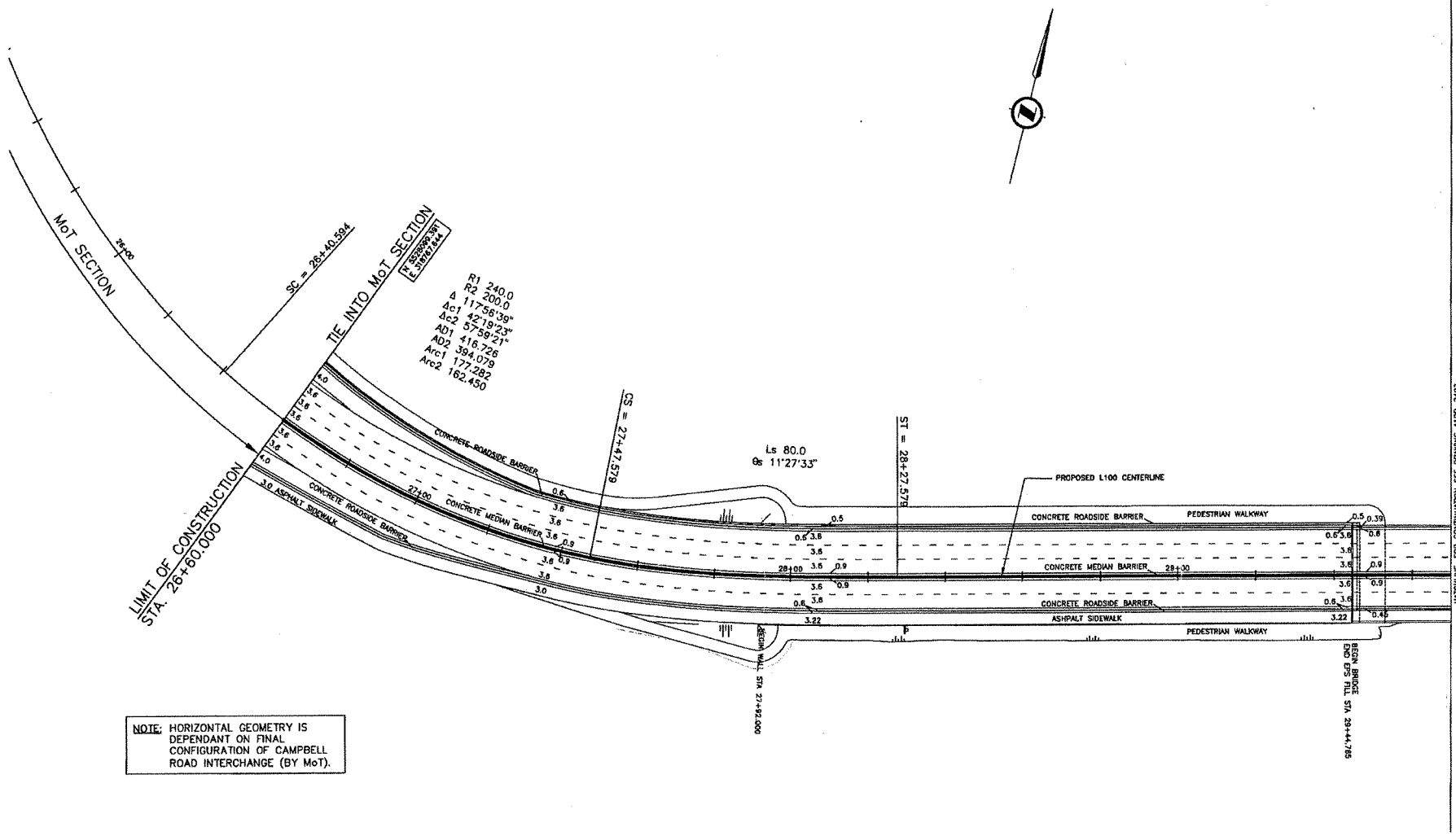

NOTE: HORIZONTAL GEOMETRY IS DEPENDANT ON FINAL CONFIGURATION OF CAMPBELL ROAD INTERCHANGE (BY MoT).

DESIGN SPEED 60 km/h
STA 26+60.000 TO STA 43+25.000

ALL MOVEMENTS WB-20

PRELIMINARY
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2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN C. LAM	PROJECT ENGINEER T. WACHLMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

LANNING AND GEOMETRICS
STA. 26+60.000 TO STA. 29+68.000
SHEET 1 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2401
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/29 - 4:34pm
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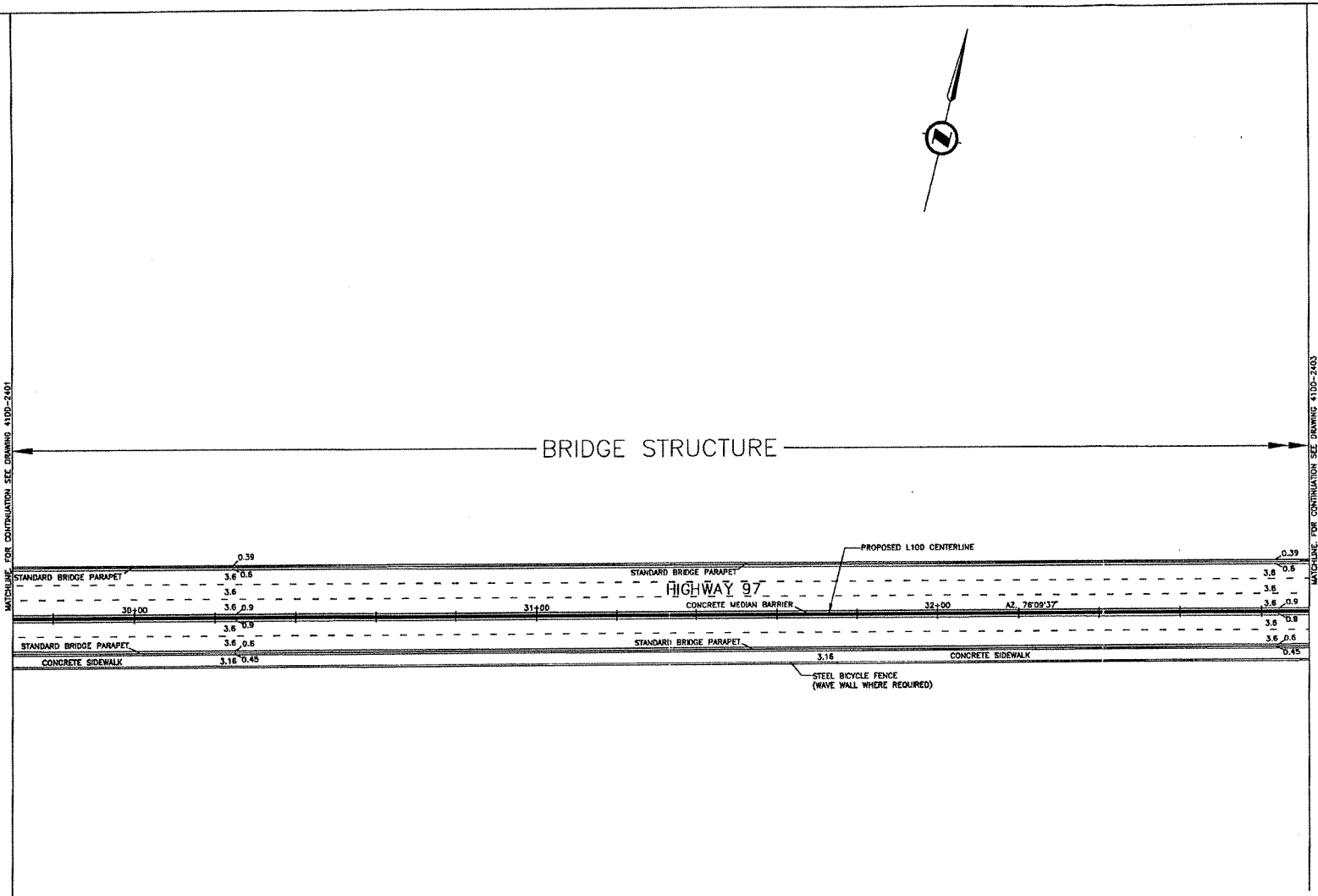


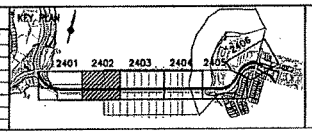
DESIGN SPEED 60 km/h
STA 26+60.000 TO STA 43+25.000

ALL MOVEMENTS WB-20

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RHM	RFP TECHNICAL SUBMISSION	PA



partnerships
British Columbia

SNC·LAVALIN
1600 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN C. LAU	PROJECT MANAGER T. WACHNIAN
CHECKED S. DEEPAK	DATE (DD-MM-YR) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

LANNING AND GEOMETRICS

STA. 29+68.000 TO STA. 32+92.000

SHEET 2 OF 5

SCALE 1 : 300 | CONTRACT | DRAWING 865800-1000-41DD-2402

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 – 4:34pm
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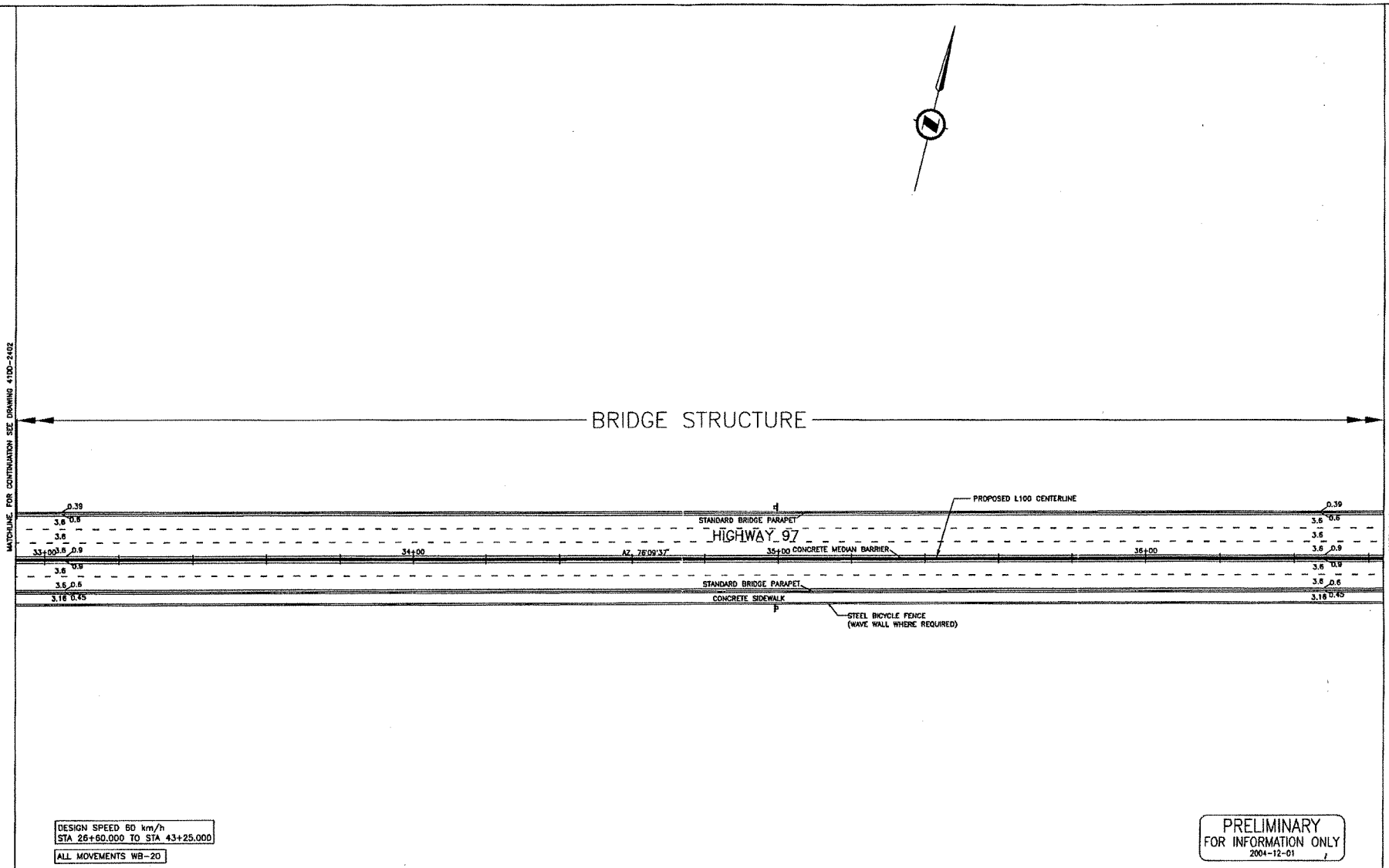

DESIGN SPEED 60 km/h
STA 26+60.000 TO STA 43+25.000

ALL MOVEMENTS WB-20

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

2401 2402 2403 2404 2405 2406

partnerships
British Columbia

SNC·LAVALIN
1800 - 1075 West Georgie Street
Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
LANNING AND GEOMETRICS
STA. 32+92.000 TO STA. 36+64.000
SHEET 3 OF 6

SCALE 1 : 200 | CONTRACT | DRAWING 865800-1000-41DD-2403
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 - 4:35pm
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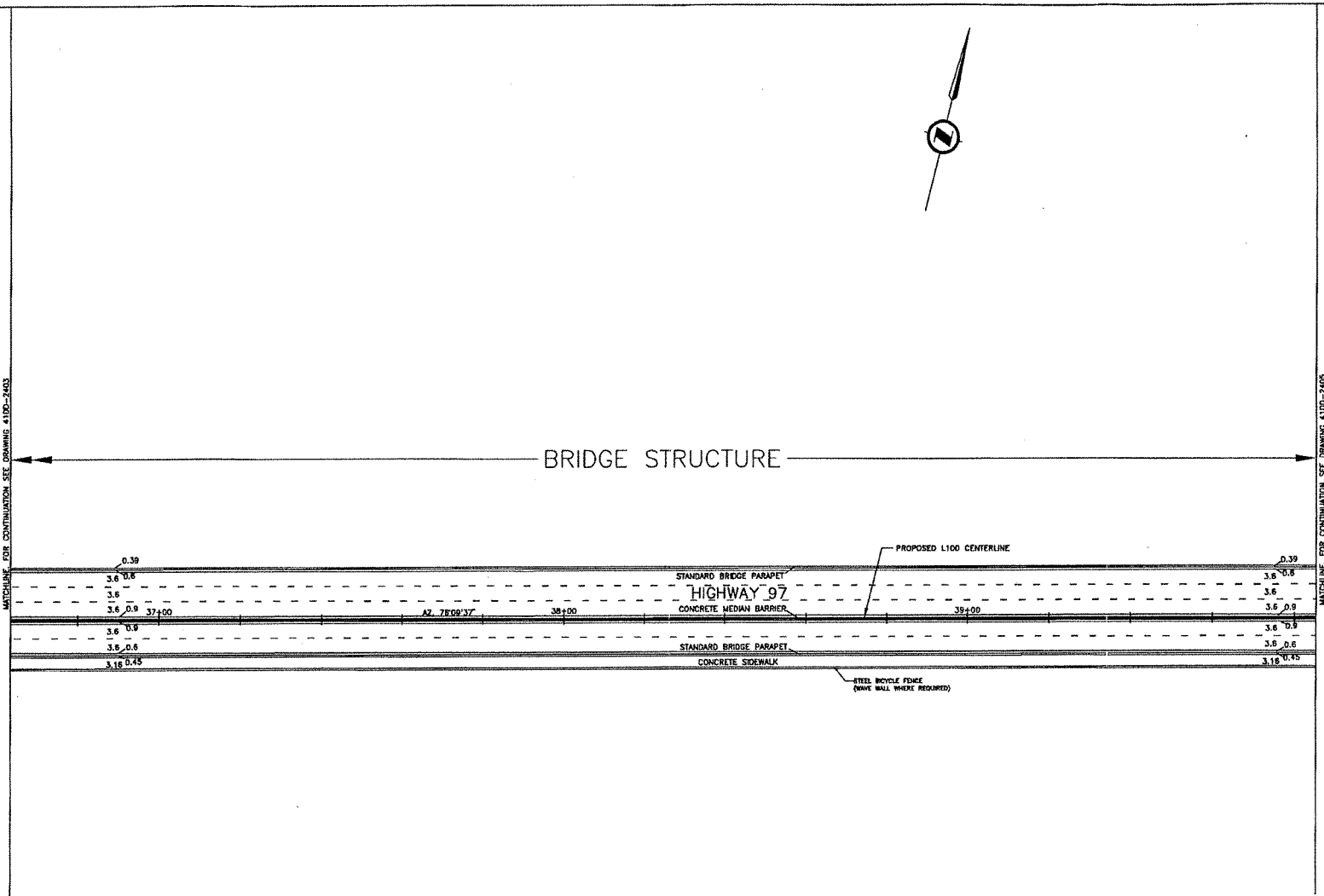


DESIGN SPEED 60 km/h
STA 26+60.000 TO STA 43+25.000

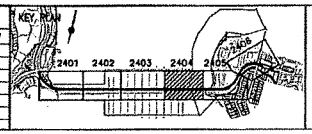
ALL MOVEMENTS WB-20

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN



partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
LANNING AND GEOMETRICS
STA. 36+64.000 TO STA. 39+83.000
SHEET 4 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2404
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 – 4:35pm
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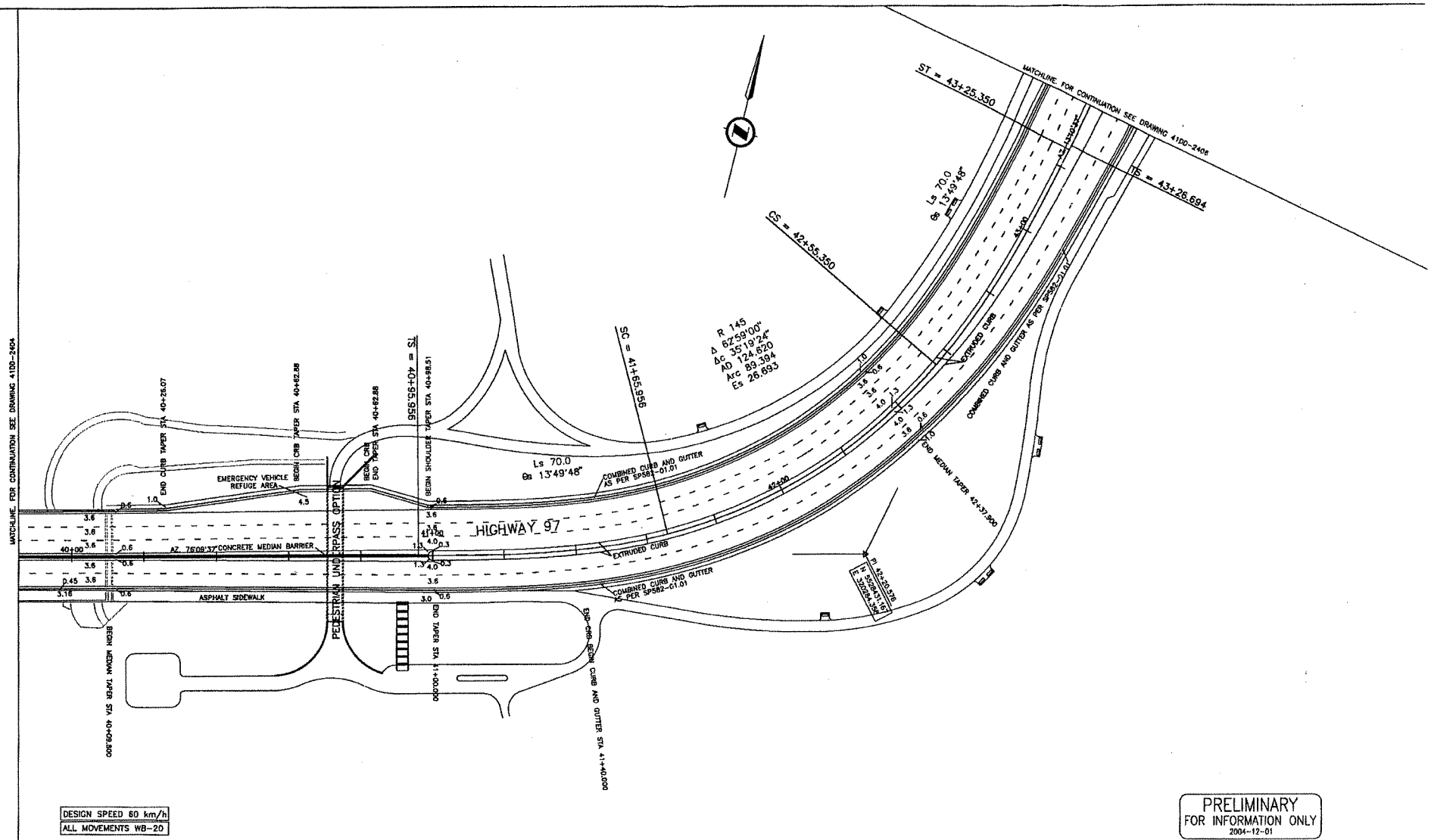

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2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN: 2401 2402 2403 2404 2405 2406

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNER A. WONG	
DRAWN C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
LANNING AND GEOMETRICS
STA. 39+83.000 TO STA. 43+38.000
SHEET 5 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2405
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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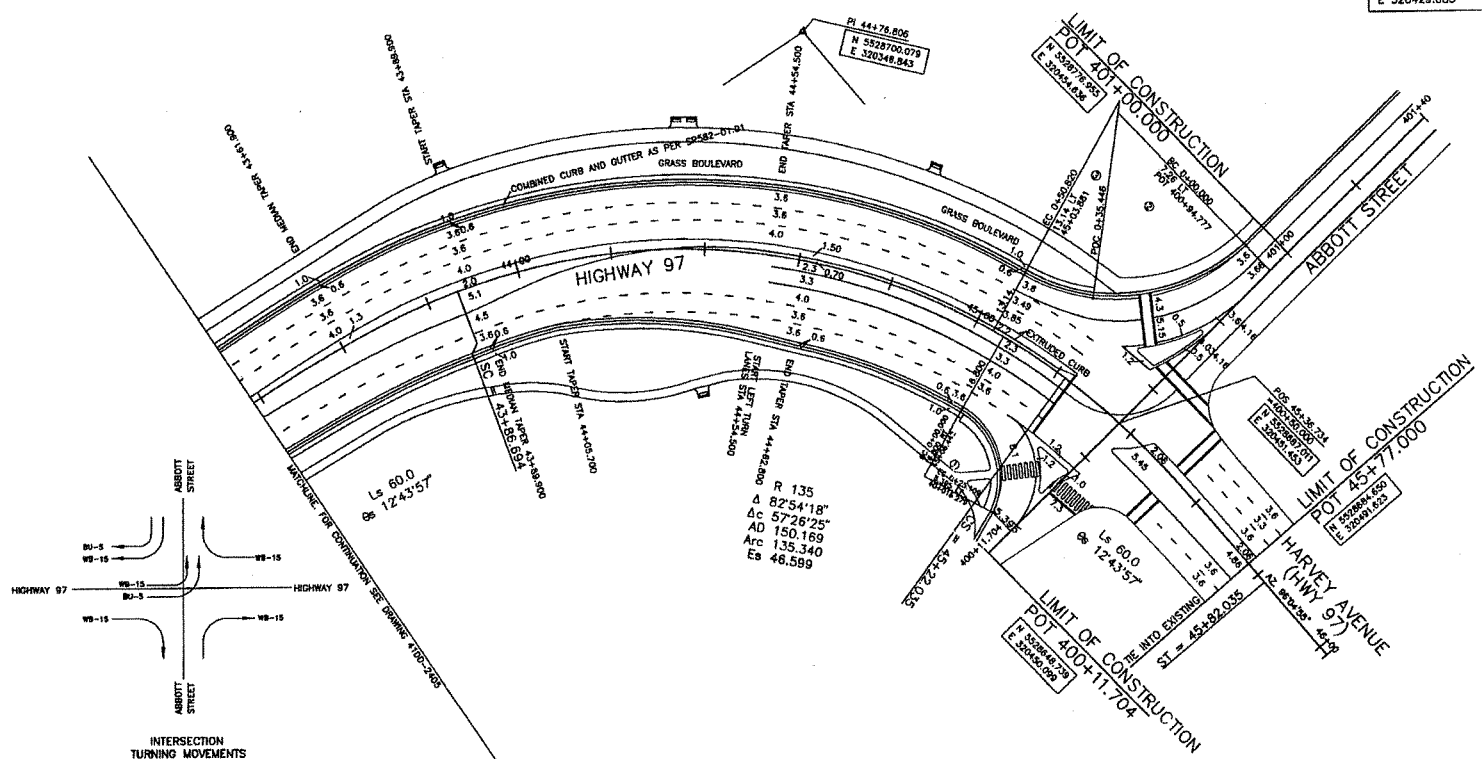
INTERSECTION CURVES		
1	2	3
R 16.5 Δ 87°11'29" Tc 15.710 Arc 25.109 Ec 6.283	R 38.736 Δ 52°24'38" Tc 18.986 Arc 35.322 Ec 4.438	R 41.100 Δ 21°25'56" Tc 7.778 Arc 15.374 Ec 0.729
PI 0+15.710	PI 0+18.986	PI 0+43.224
N 5528650.935 E 320429.085	N 5528733.414 E 320407.058	N 5528735.327 E 320405.691



DESIGN SPEED 50 km/h
STA 43+25.000 TO STA 45+77.000

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN: 2401 2402 2403 2404 2405 2406

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
PREPARED R. ROHNI	
DRAWN C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

LANING AND GEOMETRICS
STA. 43+38.000 TO STA. 45+77.000
SHEET 6 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2406
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 – 4:25pm
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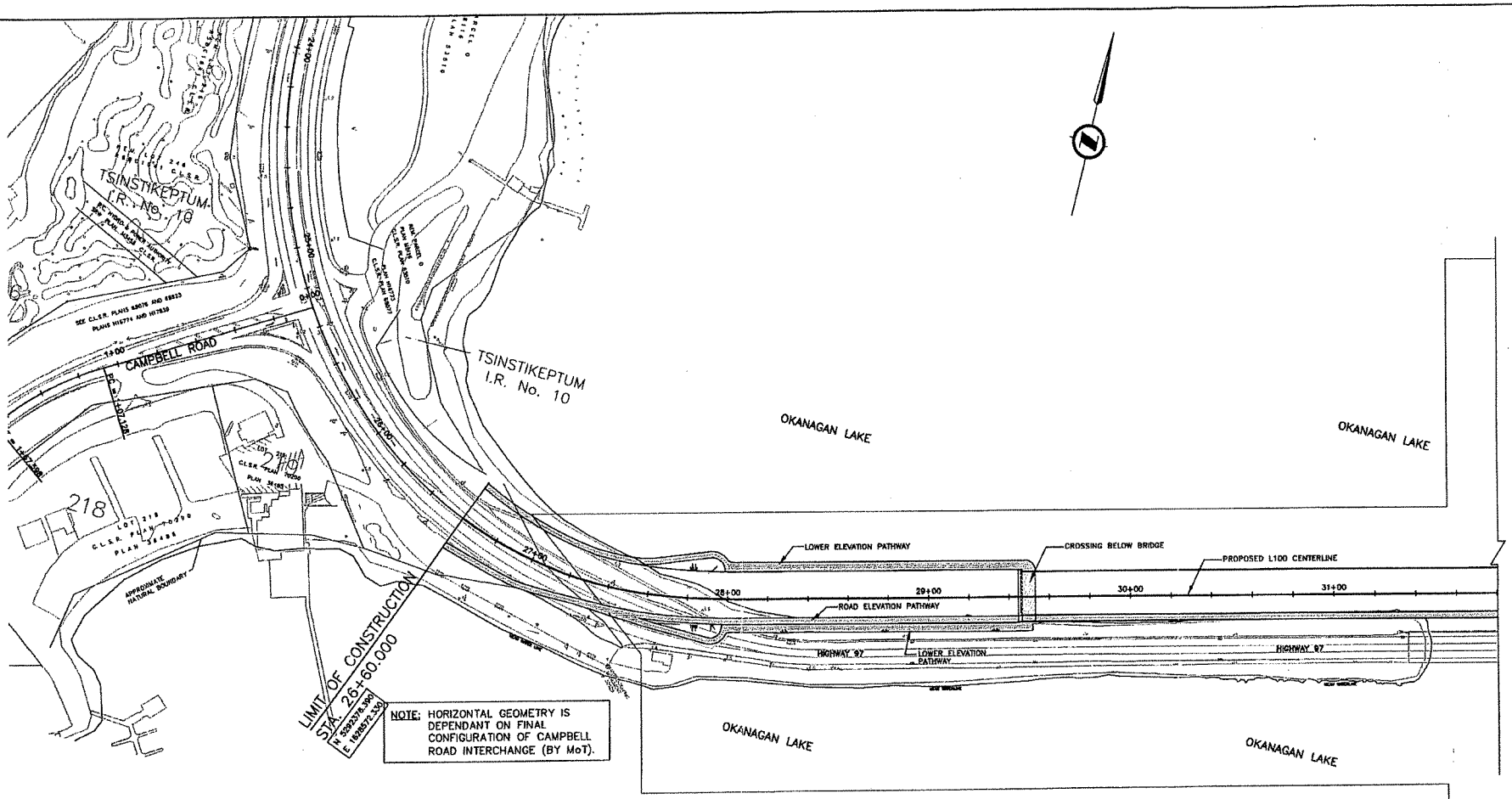

LEGEND

PEDESTRIAN AND CYCLIST PATHWAYS

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RMW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 - 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9

PREPARED BY:

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. WKON/C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

BAR SCALE(S): 0 50

OKANAGAN LAKE NEW CROSSING SERVICES

PEDESTRIAN AND CYCLIST ACCESSIBILITY PLAN

STA. 26+60.000 TO 31+80.000

SHEET 1 OF 2

SCALE 1 : 1000 | CONTRACT | DRAWING 865800-1000-41DD-2501

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/25 - 4:25pm
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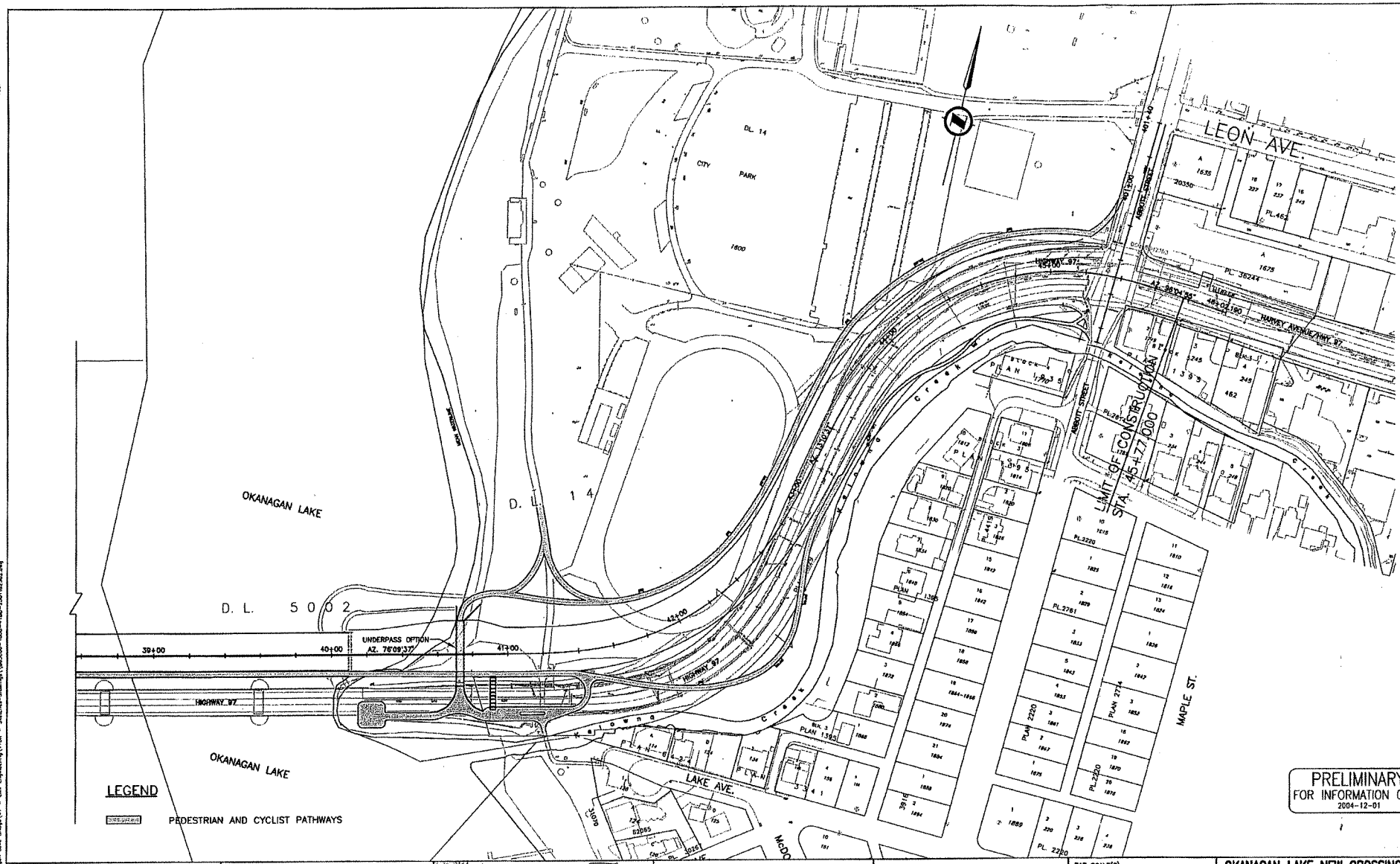

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RMW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada. V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 50

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. WONG/C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
PEDESTRIAN AND CYCLIST ACCESSIBILITY PLAN
STA. 38+56.644 TO STA. 45+77.000
SHEET 2 OF 2

SCALE 1 : 1000 | CONTRACT | DRAWING 865800-1000-41DD-2502
DATE 04-11-29

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/29 - 4:35pm
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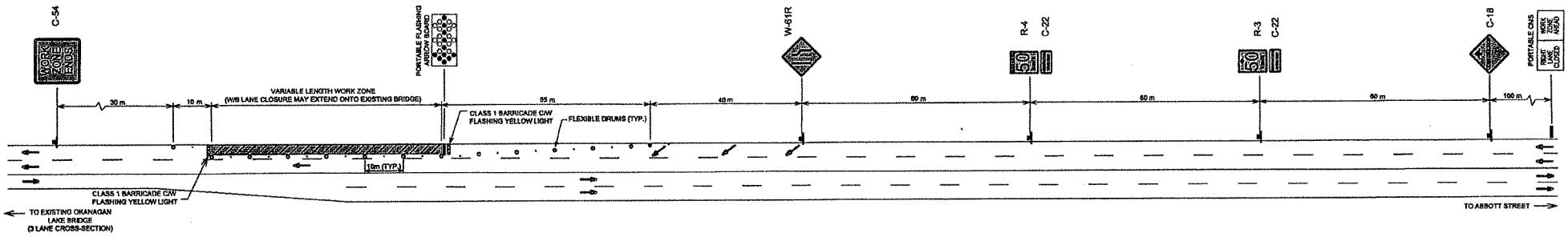

50 km/h CONSTRUCTION SPEED ZONE

TYPICAL WESTBOUND CURB LANE CLOSURE

LEGEND

- PUBLIC TRAFFIC
- FLEXIBLE DRUM (10m SPACING) c/w DOUBLE FLASHER
- TUBULAR MARKERS (10m SPACING)
- FAB (FLASHING ARROW BOARD)
- CLASS 1 BARRICADE c/w FLASHING YELLOW LIGHT
- TEMPORARY SIGN

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	DWL	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships British Columbia

SNC·LAVALIN
1500 – 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY: McElhanney

BAR SCALE(S):

	PREPARATION	APPROVAL
DESIGNED	D. LEUNG	
DRAWN	M. CHANG	PROJECT MANAGER
CHECKED	D. FRASER	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
TRAFFIC MANAGEMENT PLAN
CURB LANE CLOSURE

SCALE NTS | CONTRACT | DRAWING 865800-1000-41DD-2601
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2005/11/29 – 3:11
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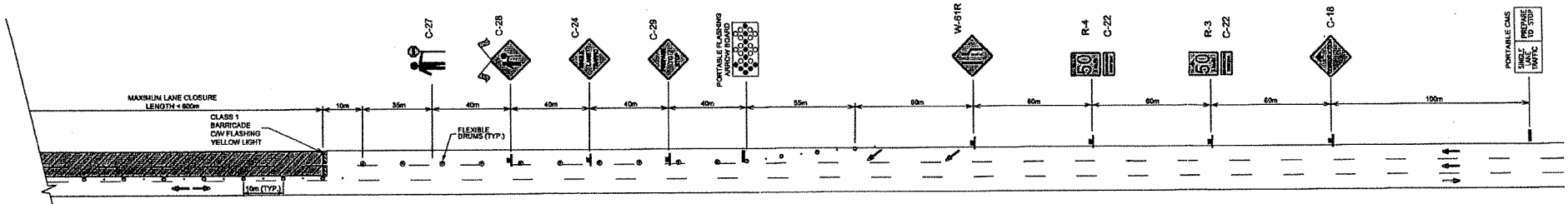
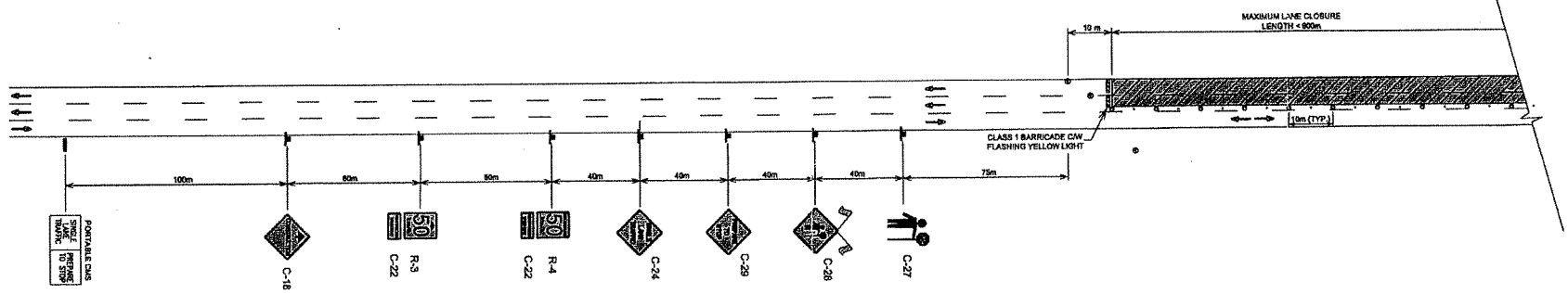


EAST OF CLOSURE



WEST OF CLOSURE

50 km/h CONSTRUCTION SPEED ZONE

TYPICAL SINGLE LANE ALTERNATING TRAFFIC CONTROL

LEGEND

- PUBLIC TRAFFIC
- FLEXIBLE DRUM (10m SPACING) c/w DOUBLE FLASHER
- TUBULAR MARKERS (10m SPACING)
- FAB (FLASHING ARROW BOARD)
- CLASS 1 BARRICADE c/w FLASHING YELLOW LIGHT
- TEMPORARY SIGN

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	DWL	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY: McElhanney

BAR SCALE(S):

PREPARATION		APPROVAL
DESIGNED	D. LEUNG	
DRAWN	M. CHANG	PROJECT MANAGER
CHECKED	D. FRASER	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
TRAFFIC MANAGEMENT PLAN
SINGLE LANE ALTERNATING TRAFFIC CONTROL

SCALE NTS | CONTRACT | DRAWING 865800-1000-41DD-2602
DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/25 – 8:34am
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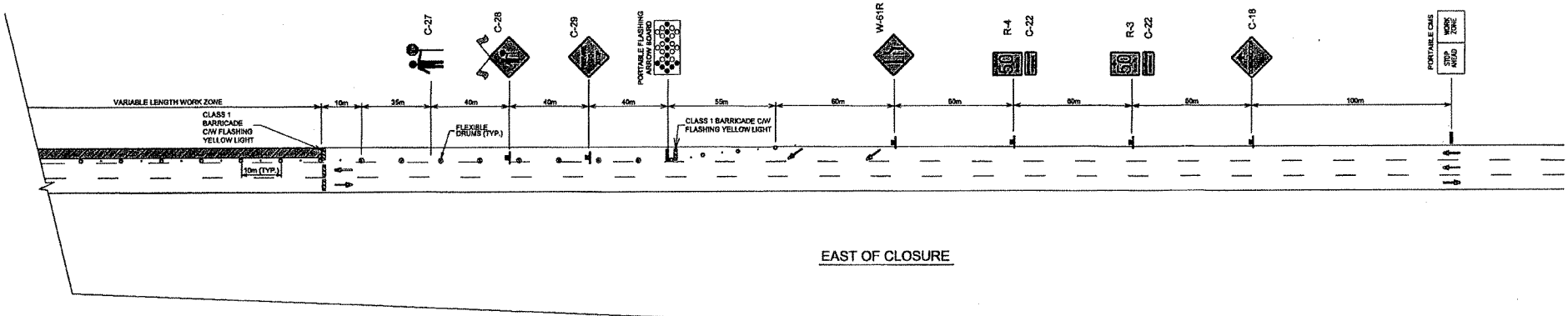
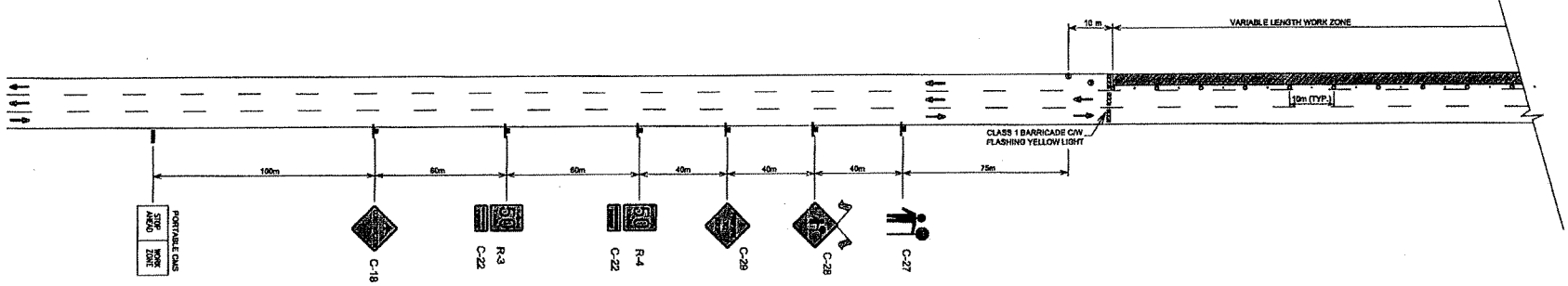


EAST OF CLOSURE



WEST OF CLOSURE

NOTE:
CLOSING THE WESTBOUND CURB LANE PRIOR TO THE FULL CLOSURE WILL BE HELPFUL TO THE TRAFFIC CONTROL PERSON IN STOPPING ONE LANE OF WESTBOUND TRAFFIC INSTEAD OF TWO THUS ENHANCING SAFETY.

50 km/h CONSTRUCTION SPEED ZONE

TYPICAL FULL CLOSURE

LEGEND

- PUBLIC TRAFFIC
- FLEXIBLE DRUM (10m SPACING) c/w DOUBLE FLASHER
- TUBULAR MARKERS (10m SPACING)
- FAB (FLASHING ARROW BOARD)
- CLASS 1 BARRICADE c/w FLASHING YELLOW LIGHT
- TEMPORARY SIGN

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	DML	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9

PREPARED BY:
McElhanney

BAR SCALE(S):

	PREPARATION	APPROVAL
DESIGNED	D. LEUNG	
DRAWN	M. CHANG	PROJECT MANAGER
CHECKED	D. FRASER	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES
TRAFFIC MANAGEMENT PLAN
FULL CLOSURE

SCALE NTS | CONTRACT | DRAWING 865800-1000-41DD-2603
DATE 04-11-25
SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/29 – 3:19p
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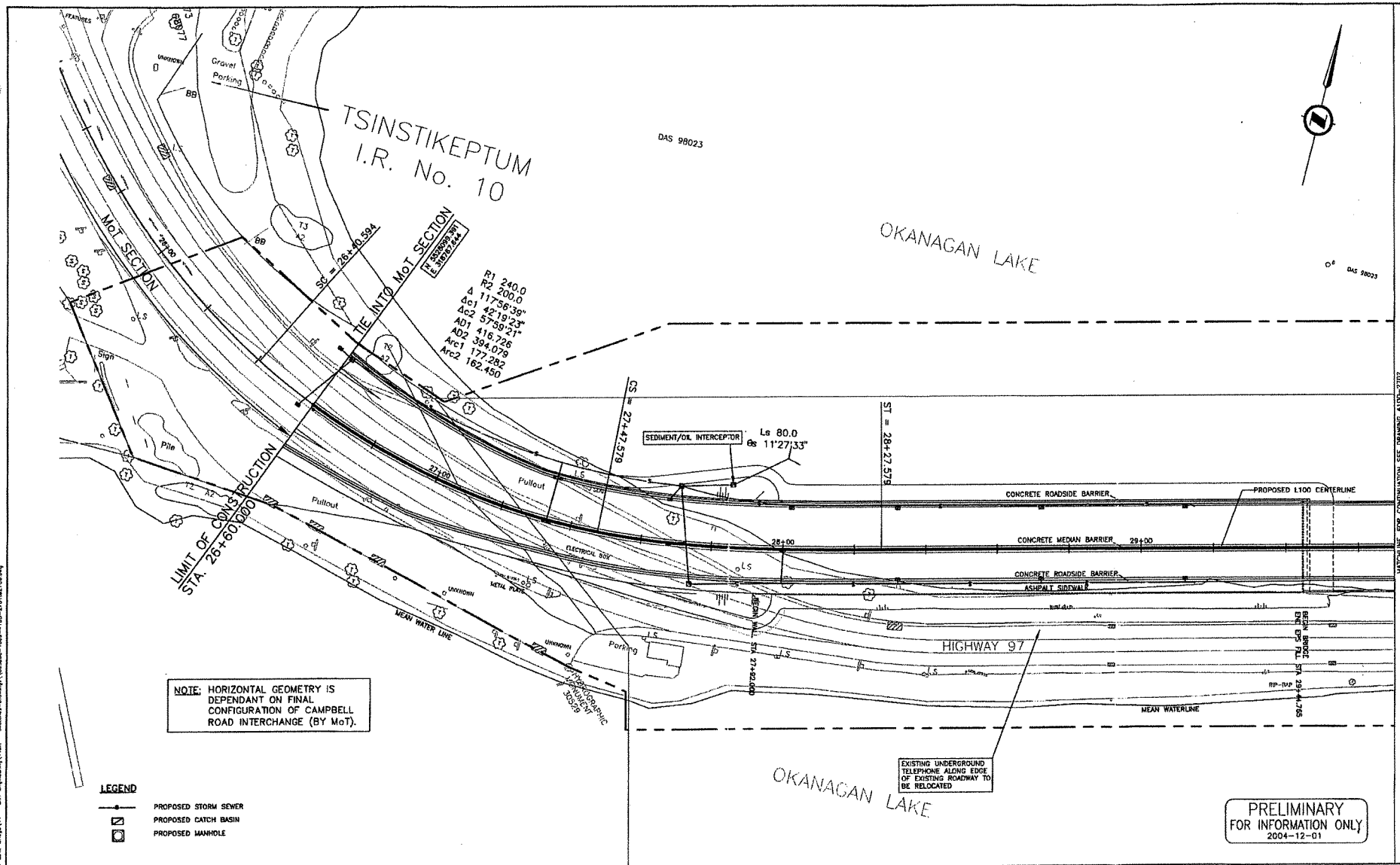

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN: 2701 2702 2703 2704 2705 2706

partnerships
British Columbia

SNC·LAVALIN
1500 – 1075 West Georgia Street
Vancouver, B.C.
Canada V6E 3C9
Certified 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK/C. LAM	PROJECT MANAGER T. MACFARLANE
CHECKED S. S. DEEPAK	DATE (YY-MM-DD) 2004-11-23

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 26+60.000 TO STA. 29+68.000

SHEET 1 OF 6

SCALE 1:1,500 | CONTRACT | DRAWING 865800-1000-41DD-2701

DATE 04-11-23

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/23 – 4:35pm
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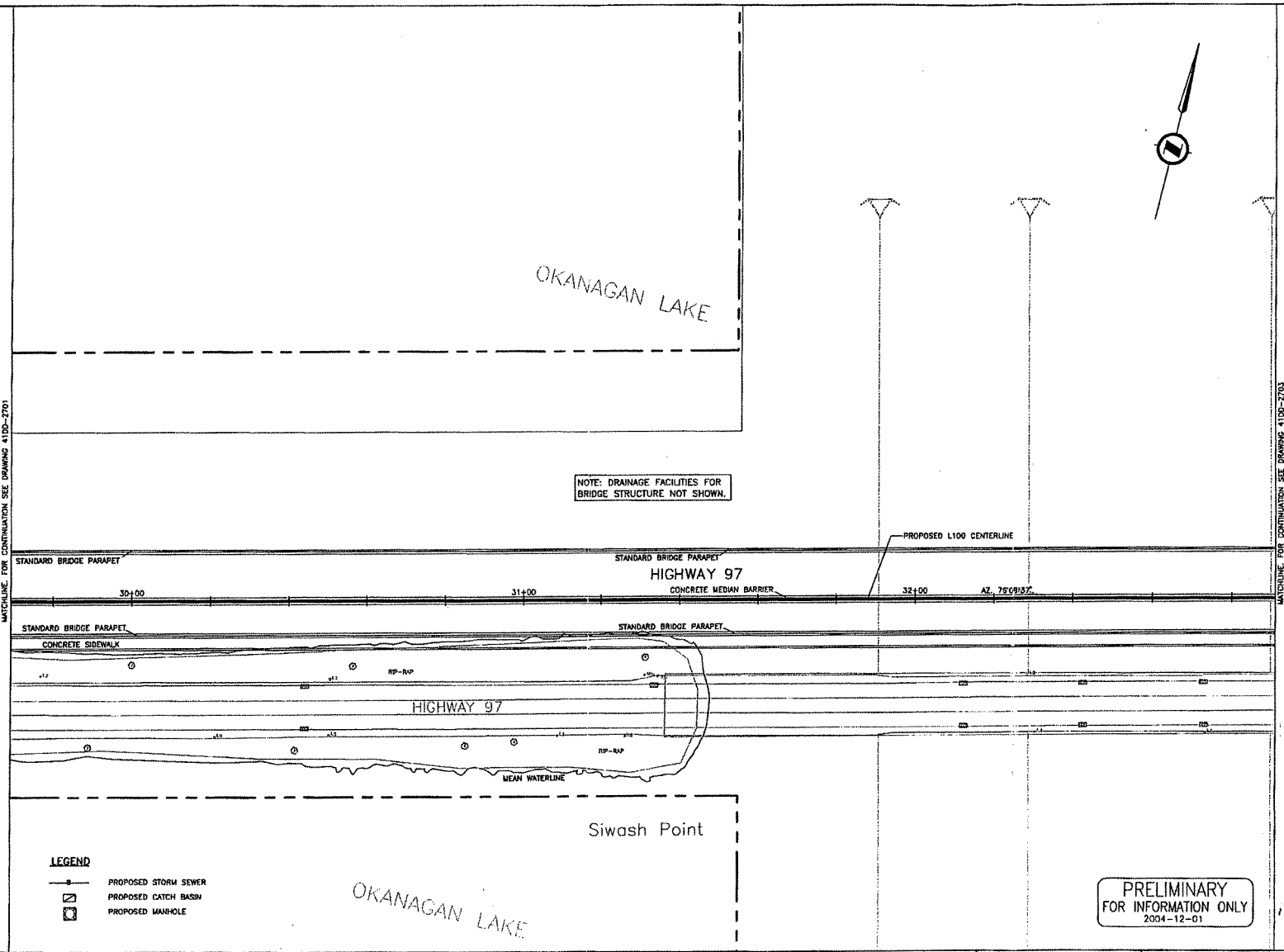

LEGEND

- PROPOSED STORM SEWER
- PROPOSED CATCH BASIN
- PROPOSED MANHOLE

PRELIMINARY
FOR INFORMATION ONLY
2004-12-01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04-12-01	RHW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

2701 2702 2703 2704 2705 2706

partnerships
British Columbia

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Vancouver, B.C.
Canada, V6E 3C9
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PREPARED BY:

BAR SCALE(S): 0 25

PRE-PARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. KWOK/C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 29+68.000 TO STA. 32+92.000

SHEET 2 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2702

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 – 4:38pm
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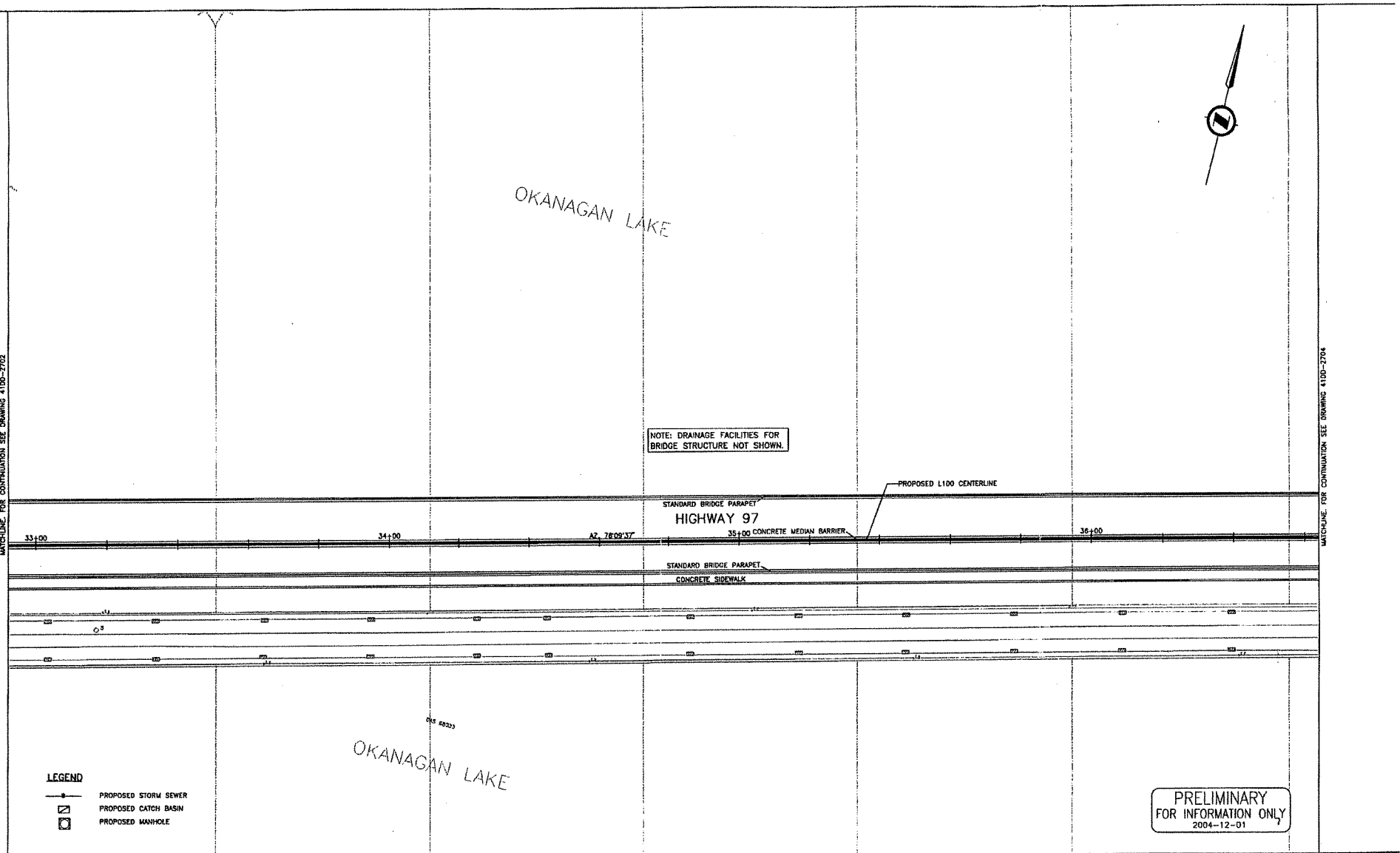

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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British Columbia

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1800 - 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. MWOK/C. LAM	PROJECT MANAGER T. WACHMANN
CHECKED S. S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 32+92.000 TO STA. 36+64.000

SHEET 3 OF 6

SCALE 1 : 500	CONTRACT	DRAWING
DATE 04-11-29		865800-1000-41DD-2703

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

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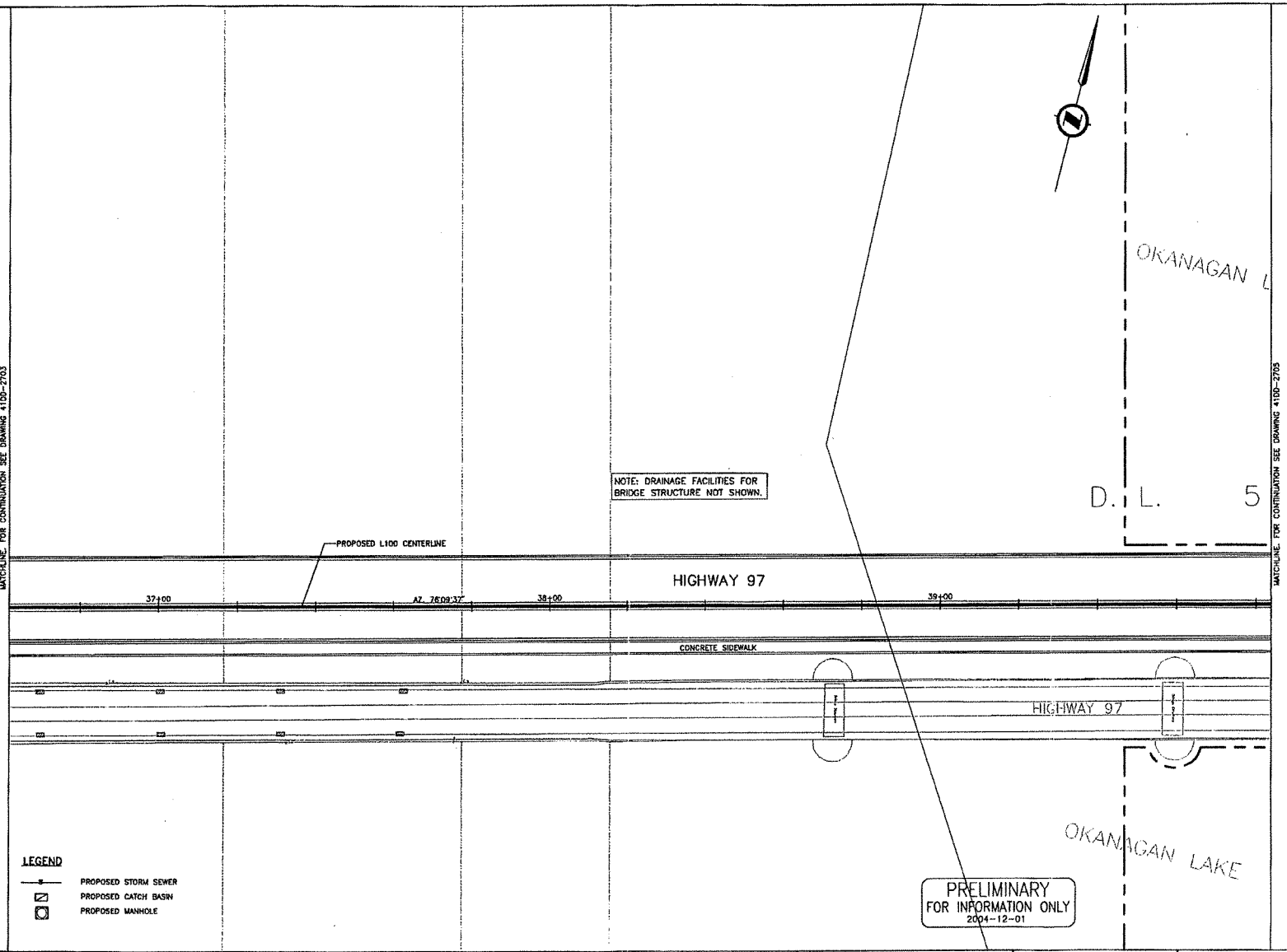

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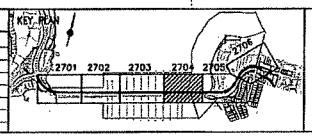
KEY PLAN



partnerships
British Columbia

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1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada. V6E 3C9

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. WHOK/C. LAM	PROJECT MANAGER T. WACHSMANN
CHECKED S. S. DEEPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 36+64.000 TO STA. 39+83.000

SHEET 4 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2704

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 – 4:36pm
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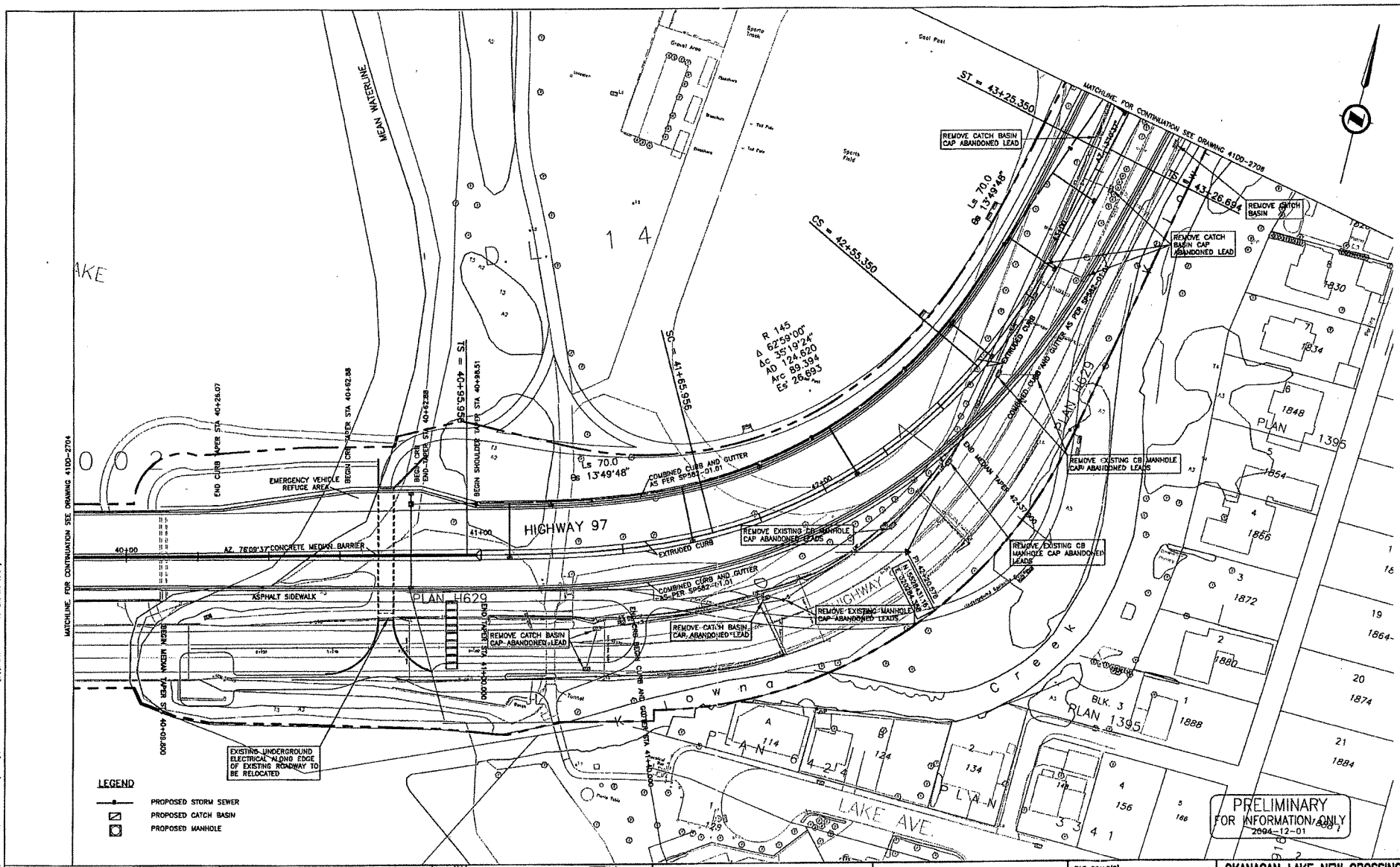

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No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RNW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN: 2701 2702 2703 2704 2705 2706

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British Columbia

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1500 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 25

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. WKOH/C. LAW	PROJECT MANAGER T. WACHMANN
CHECKED S. S. DESPAK	DATE (YY-MM-DD) 2004-11-25

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 39+83.000 TO STA. 43+38.000

SHEET 5 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2705

DATE 04-11-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/26 – 4:37pm
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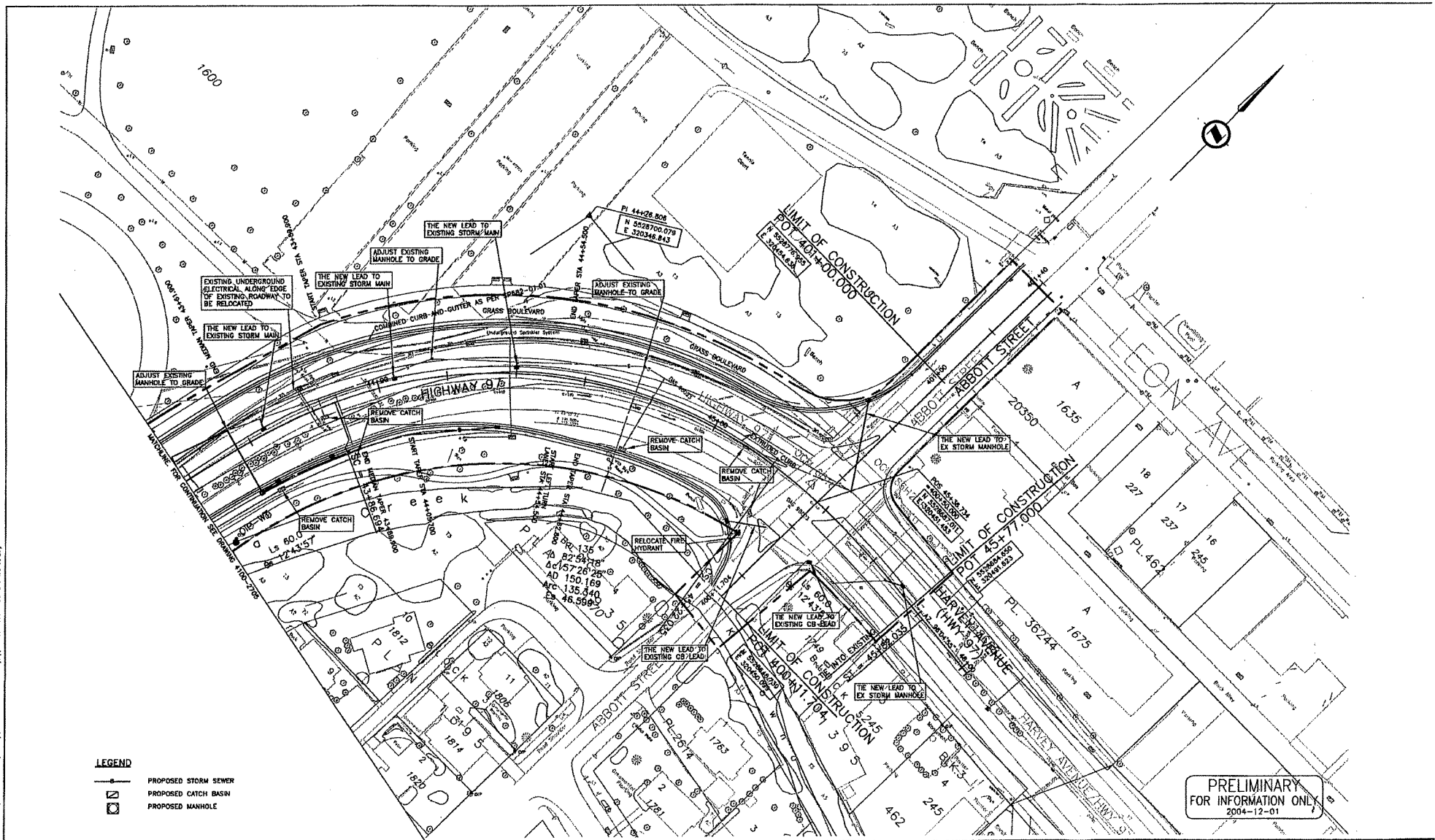

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9

PREPARED BY:

PREPARATION	APPROVAL
R. WONG	
M. WWOH/C. LAM	T. WACHMANN
S. S. DEEPAK	2004-11-25

BAR SCALE(S): 0 25

OKANAGAN LAKE NEW CROSSING SERVICES

UTILITIES PLAN

STA. 43+38 TO STA. 45+77

SHEET 6 OF 6

SCALE 1 : 500 | CONTRACT | DRAWING 865800-1000-41DD-2706

DATE 04-10-25

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/26 – 4:37pm
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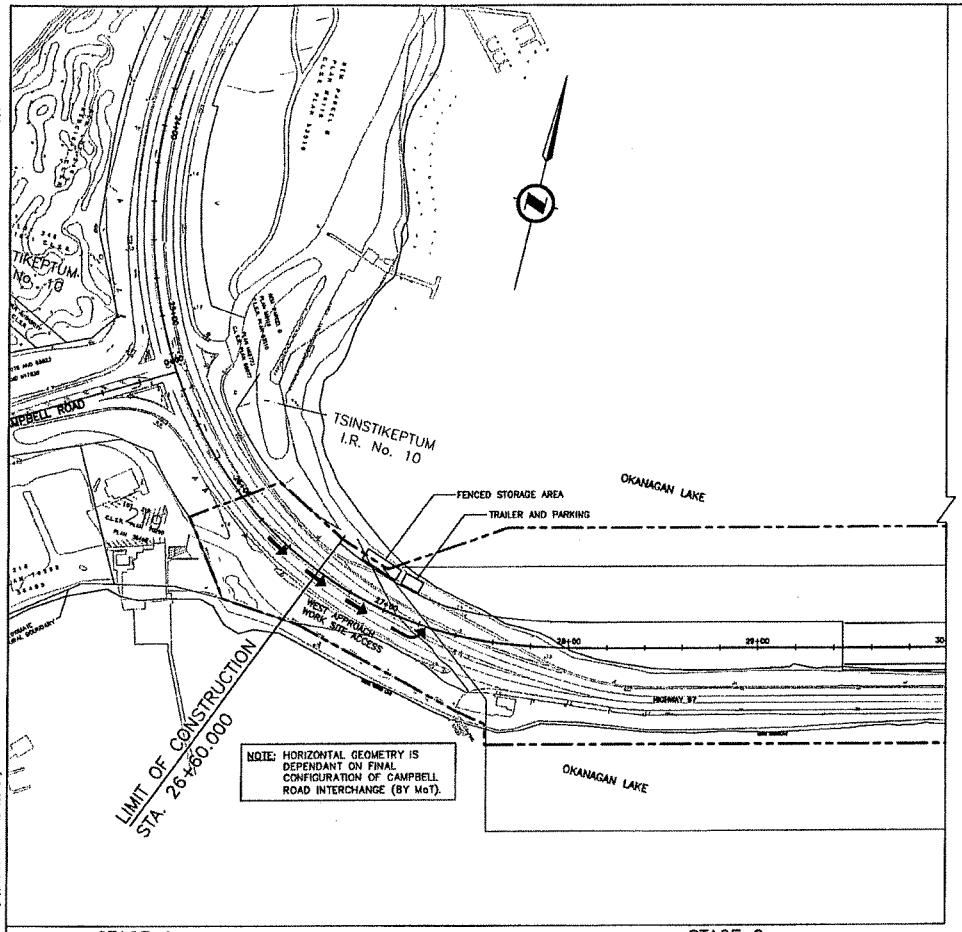

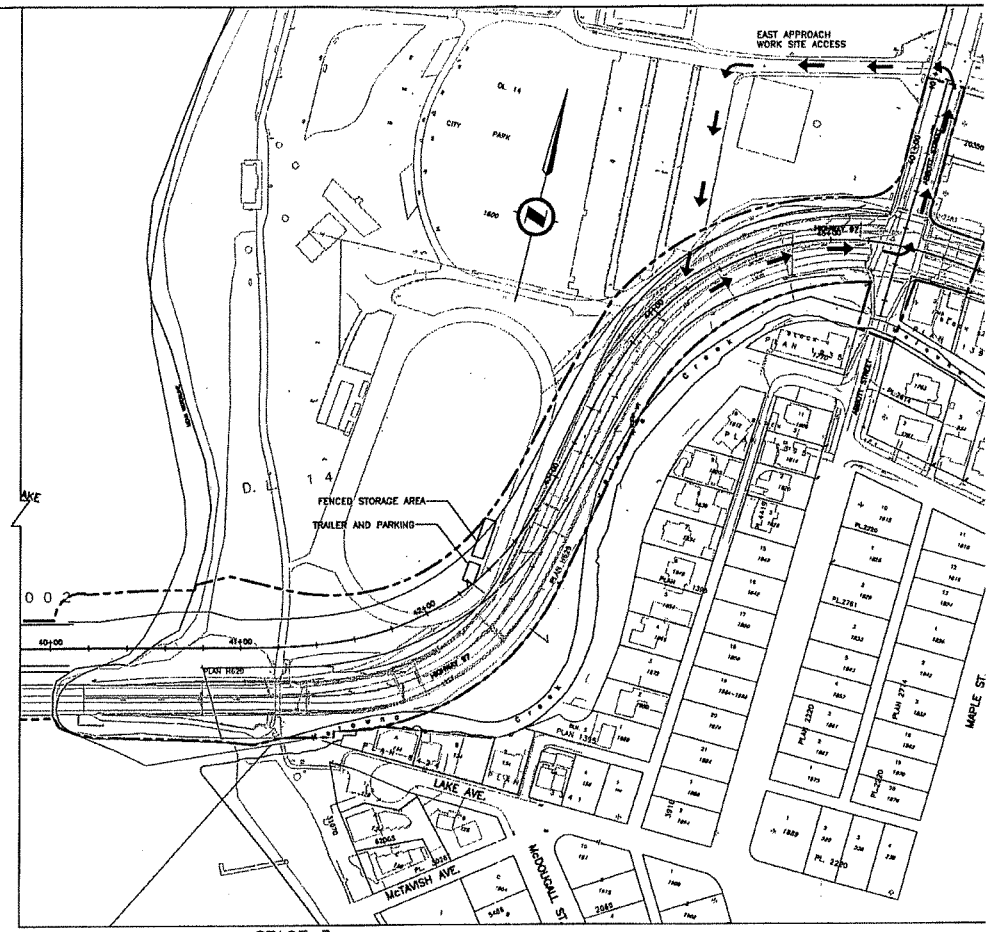

STAGE 1

STAGE ONE WORKS WILL FACILITATE THE CONSTRUCTION OF FILLS AND STRUCTURAL ROADWORKS FROM EDGE OF EXISTING HIGHWAY 97 TRAVEL LANES TO TOP OF CUT/TOE OF FILL.

ALL NEW CONSTRUCTION TO BE SEPARATED FROM TRAVELED PORTION OF HIGHWAY 97 BY A MINIMUM OF 1.0m.

CONSTRUCTION ZONE TO BE SEPARATED FROM ADJACENT HIGHWAY WITH A VISUAL BARRIER.

ALL LANE CLOSURES AND CONSTRUCTION SIGNAGE TO BE IN ACCORDANCE WITH MoT TRAFFIC CONTROL MANUAL FOR WORK ON ROADWAYS.

STAGE 2

STAGE 2 WORKS WILL FACILITATE THE CONSTRUCTION OF NEW ROADWORKS AND OVERLAY OF EXISTING HIGHWAY 97.

NIGHT WORK INCLUDES MILL AND FILL OF EXISTING HIGHWAY.

ALL LANE CLOSURES AND CONSTRUCTION SIGNAGE TO BE IN ACCORDANCE WITH MoT TRAFFIC CONTROL MANUAL FOR WORK ON ROADWAYS.

STAGE 3

STAGE 3 WORKS WILL FACILITATE THE TRANSITION FROM THE EXISTING BRIDGE TO THE NEW BRIDGE.

NIGHT WORK INCLUDES MILL AND FILL OF EXISTING HIGHWAY.

ALL LANE CLOSURES AND CONSTRUCTION SIGNAGE TO BE IN ACCORDANCE WITH MoT TRAFFIC CONTROL MANUAL FOR WORK ON ROADWAYS.

PRELIMINARY
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2004-12-01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04-12-01	RHW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:

BAR SCALE(S): 0 — 50

PREPARATION	APPROVAL
DESIGNED R. WONG	
DRAWN M. WROK	PROJECT MANAGER T. WACHSMANN
CHECKED S. S. DEEPAK	DATE (YY-MM-DD) 2004-11-23

OKANAGAN LAKE NEW CROSSING SERVICES
CONSTRUCTION STAGING

SCALE 1 : 1250 | CONTRACT | DRAWING 865800-1000-41DD-2801
DATE 04-11-23

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA

DATE: 2004/11/30 - 4:37pm
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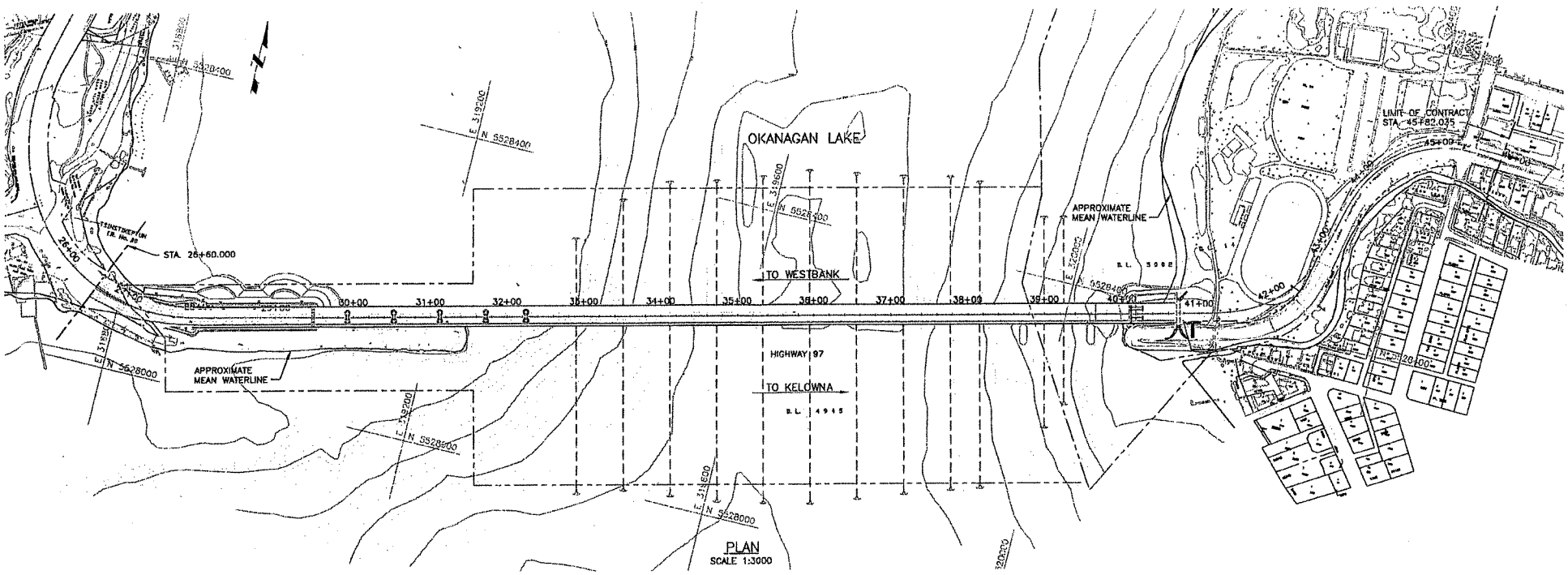
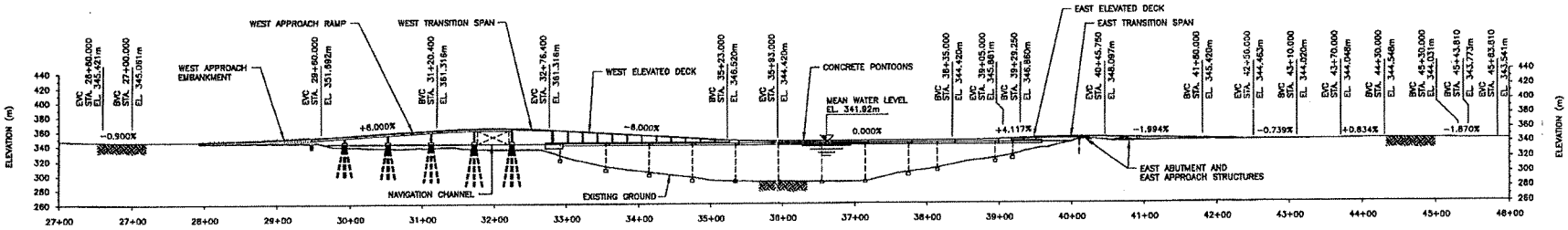




PROFILE ON CENTRELINE OF NEW ROADWAY
SCALE 1:3000

PRELIMINARY
FOR INFORMATION ONLY
2004 DECEMBER 01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04 DEC 01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
Certified ISO 9001

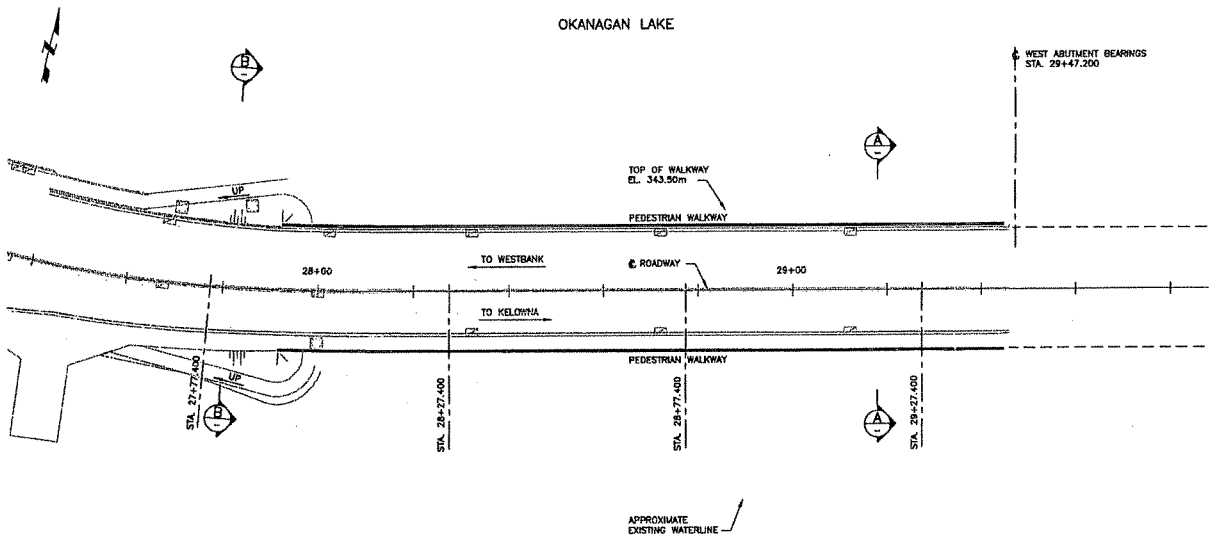
PREPARED BY: BUCKLAND & TAYLOR LTD.
Bridge Engineering

BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN LMB	PROJECT MANAGER RWW
CHECKED DGM	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
GENERAL ARRANGEMENT

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3101
DATE
SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA



PLAN
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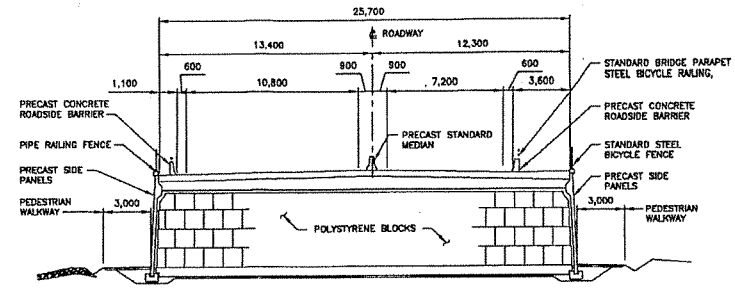

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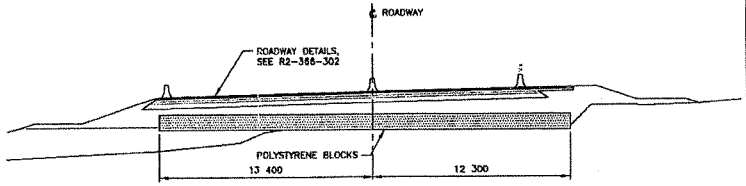

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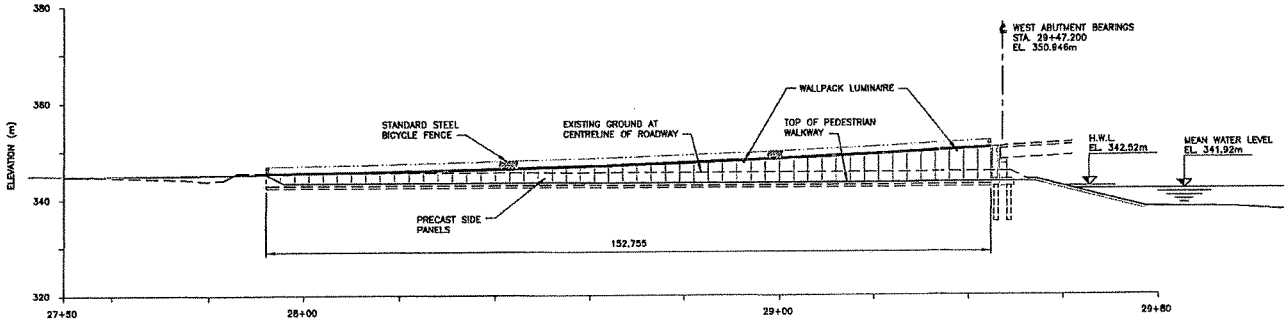

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SCALE 1:500

PRELIMINARY
FOR INFORMATION ONLY
2004 DECEMBER 01

REFERENCE DRAWING		
No.	DWG No.	DESCRIPTION

REVISIONS			
DATE	BY	DESCRIPTION	REV
04 DEC 01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada V6E 3C9
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PREPARED BY:
BUCKLAND & TAYLOR LTD.
Bridge Engineering

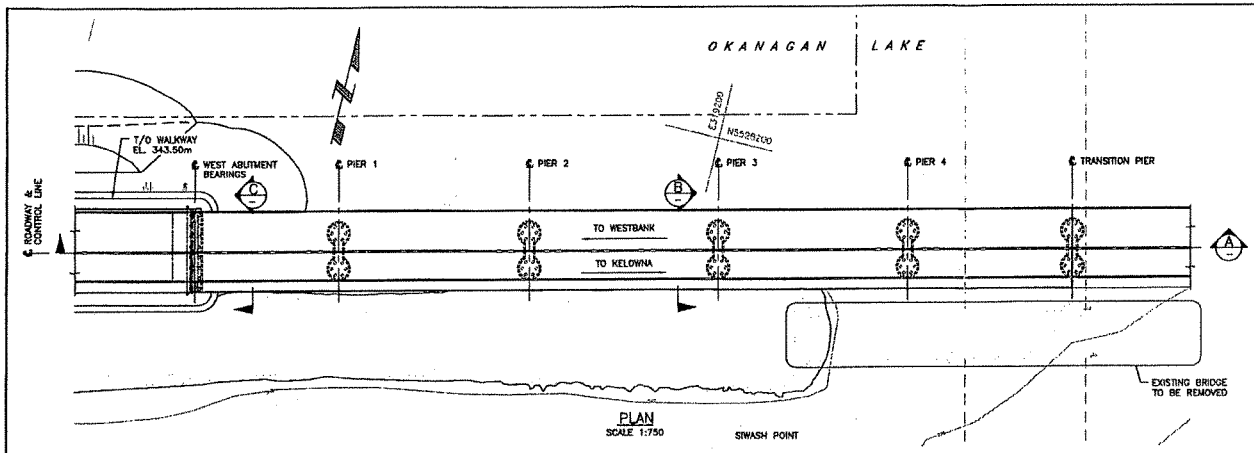
BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN LWB	PROJECT MANAGER RWW
CHECKED DON	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
WEST APPROACH EMBANKMENT
GENERAL ARRANGEMENT

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3102
DATE

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA



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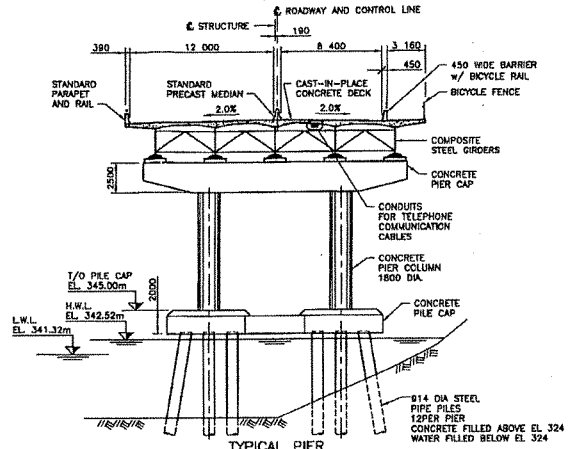

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SECTION B
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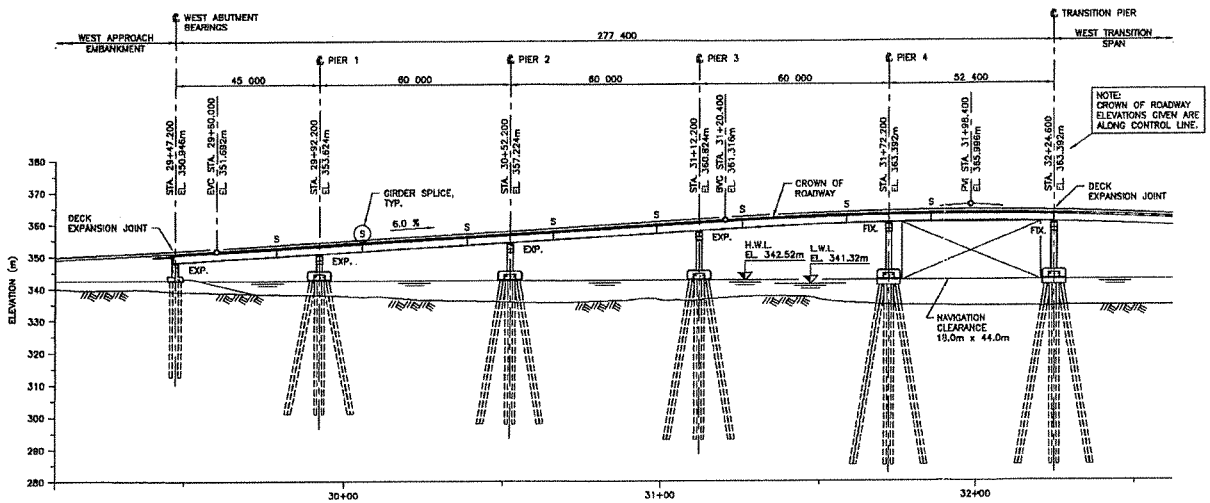

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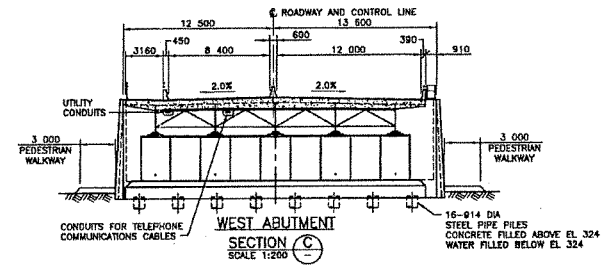

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SECTION C
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PRELIMINARY
FOR INFORMATION ONLY
2004 DECEMBER 01

REFERENCE DRAWING		REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04 DEC 01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
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1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada V6E 3C9
ISO 9001

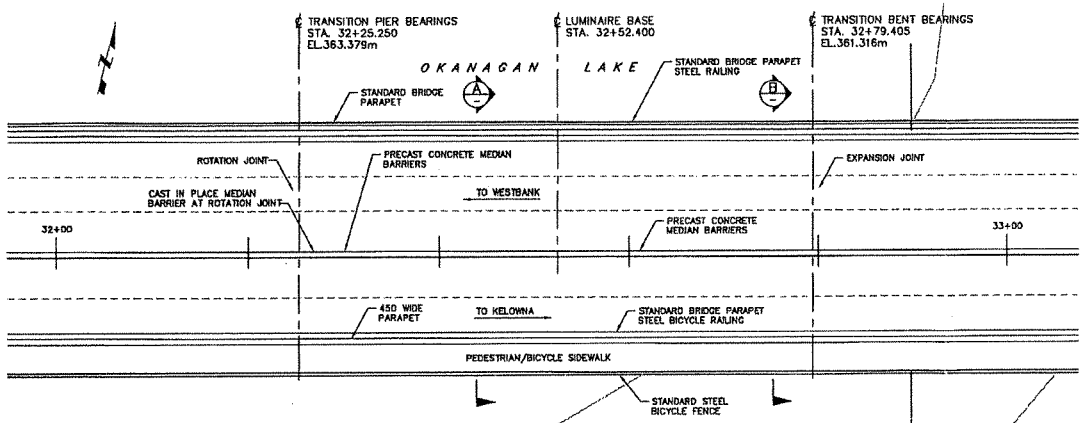
PREPARED BY:
BUCKLAND & TAYLOR LTD.
Bridge Engineering

BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN CTL	PROJECT MANAGER RWW
CHECKED DDM	DATE (YY-MM-DD) 04 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
WEST APPROACH RAMP
GENERAL ARRANGEMENT

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3103
DATE
SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA



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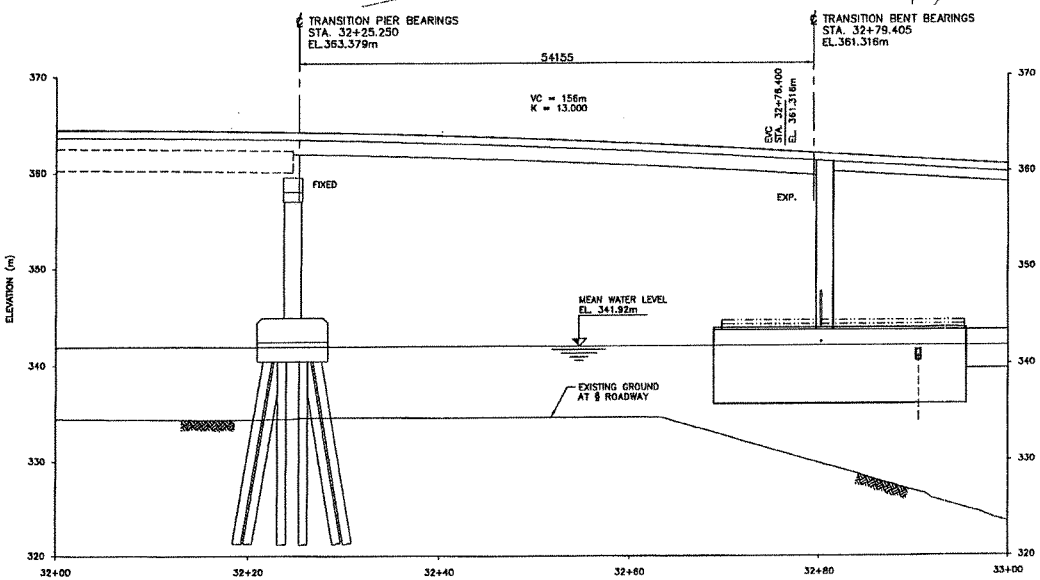

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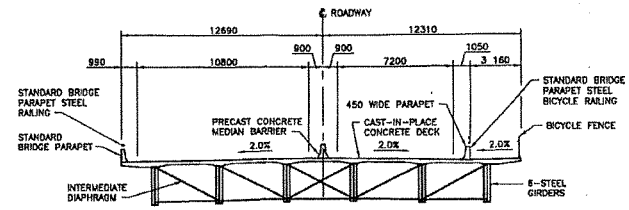

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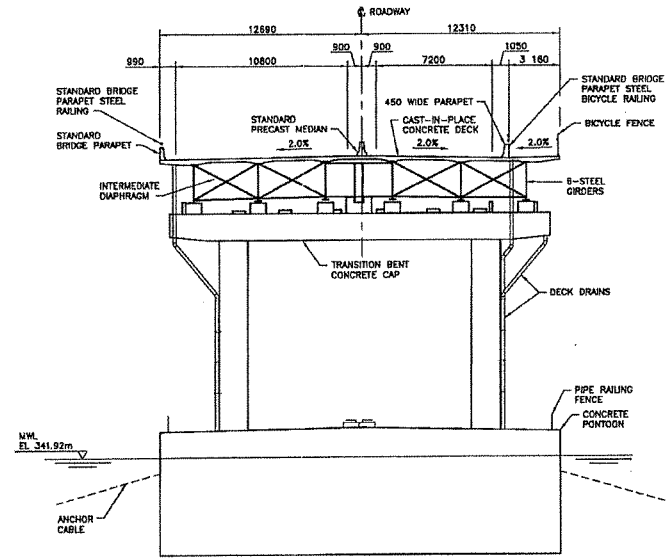

SECTION B
SCALE 1:150

PRELIMINARY
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2004 DECEMBER 01

REFERENCE DRAWING			REVISIONS				
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04 DEC 01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

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SNC·LAVALIN
1600 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
Quality ISO 9001

PREPARED BY:
BUCKLAND & TAYLOR Ltd.
Bridge Engineering

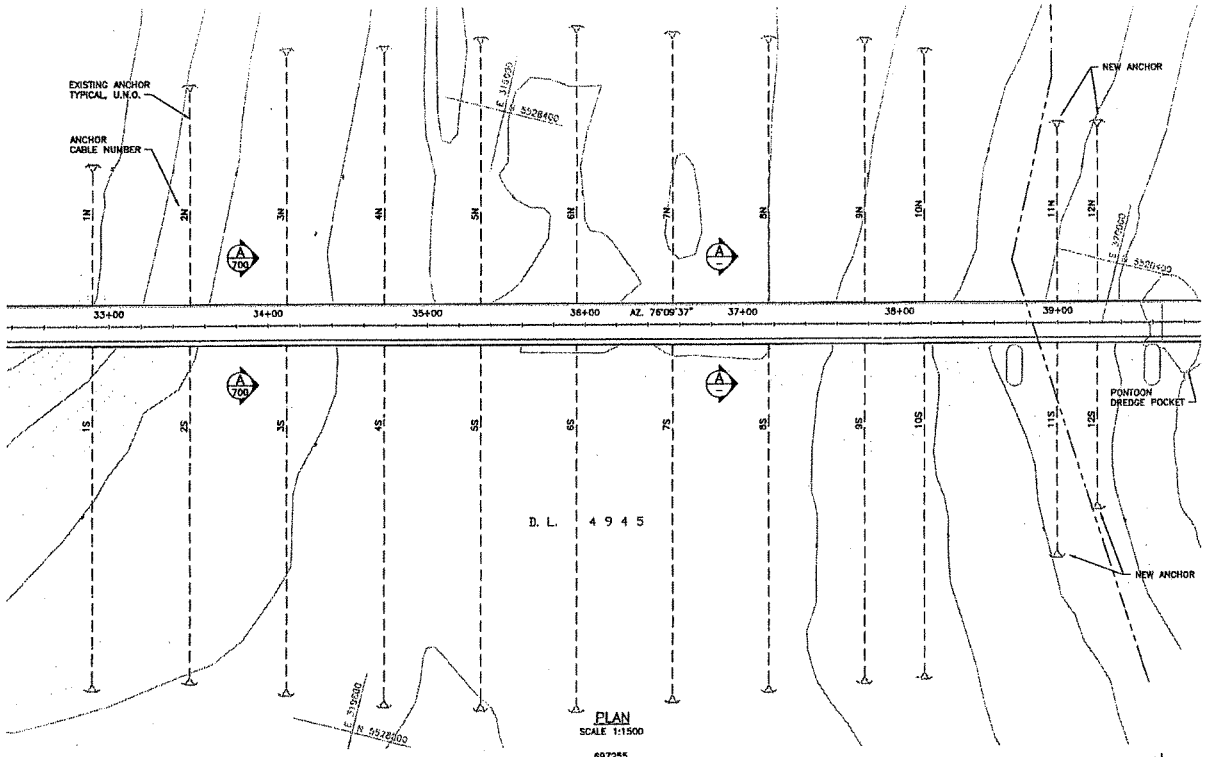
BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN JJS	PROJECT MANAGER RWW
CHECKED DDM	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
WEST TRANSITION SPAN
GENERAL ARRANGEMENT

SCALE 1 : 250 | CONTRACT | DRAWING 865800-1000-42DD-3104
DATE 04-11-01

SUPERSEDES PRINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO → PA



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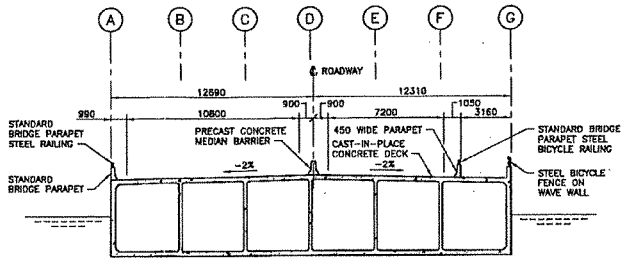

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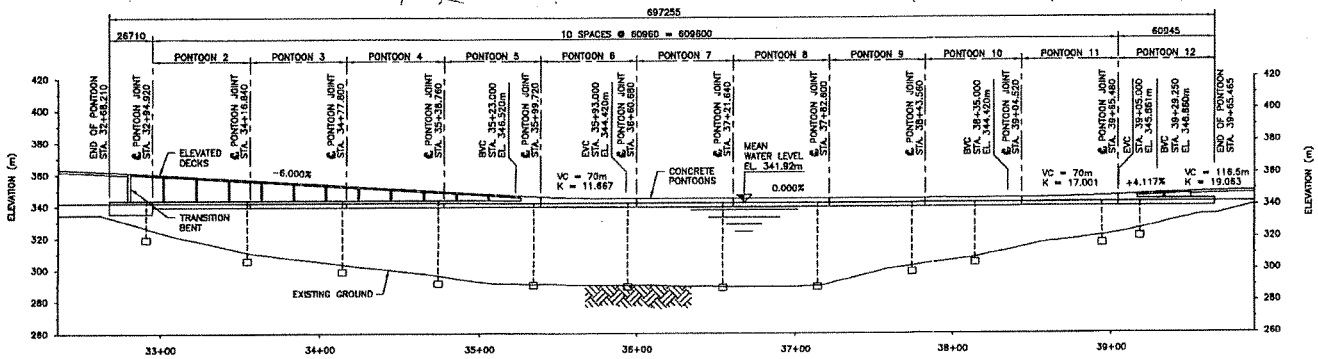

ELEVATION
SCALE 1:1500

PRELIMINARY
FOR INFORMATION ONLY
2004 DECEMBER 01

REFERENCE DRAWING			REVISIONS			
No.	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
			04 DEC 01	RWW	RFP TECHNICAL SUBMISSION	PA

KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 - 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
ISO 9001

PREPARED BY:
BUCKLAND & TAYLOR Ltd.
Bridge Engineering

BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN CTL	PROJECT MANAGER RWW
CHECKED DOM	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE PONTOONS
GENERAL ARRANGEMENT

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3105
DATE
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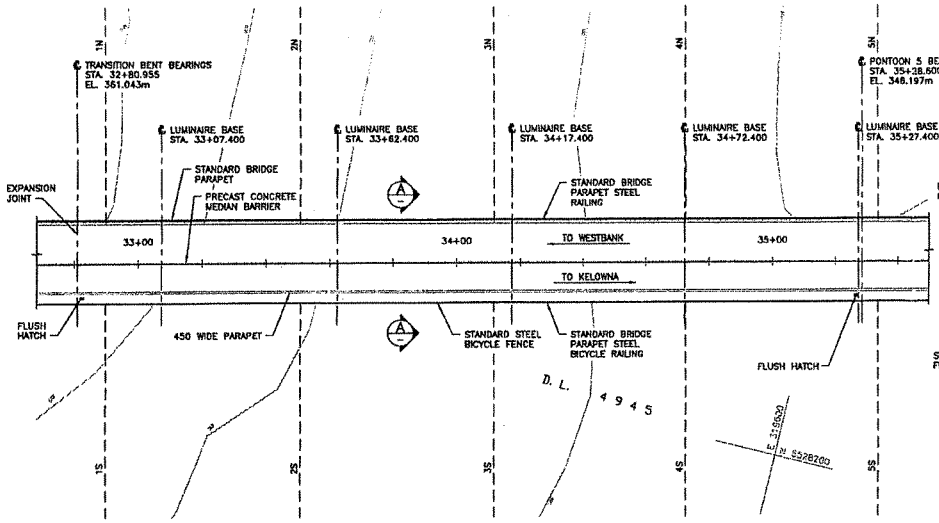
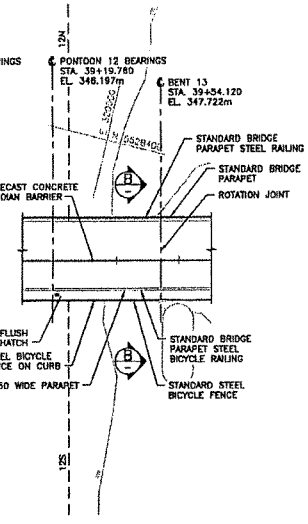


PLAN
WEST ELEVATED DECK
SCALE 1:750



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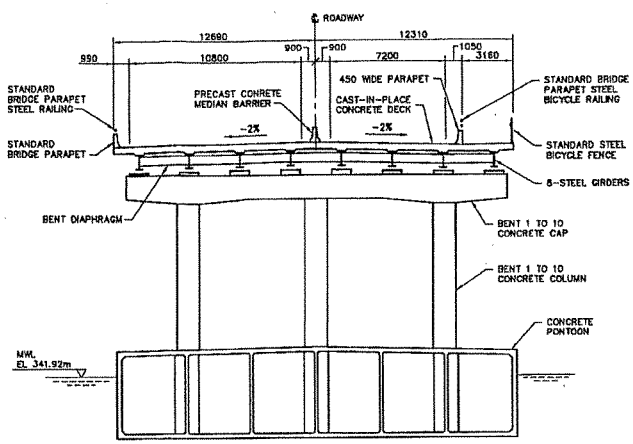
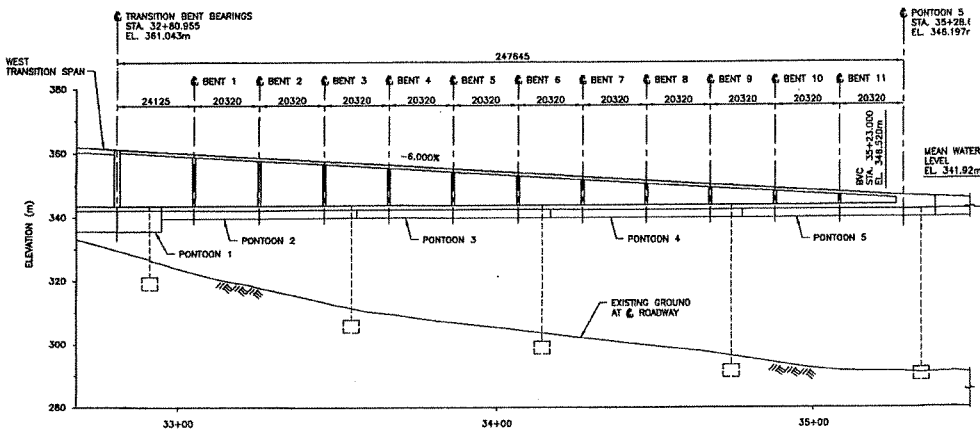
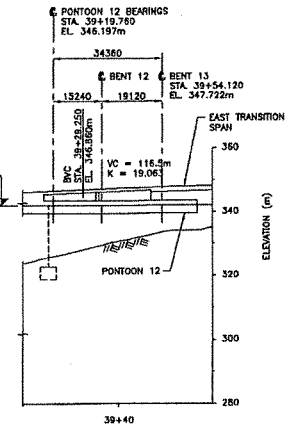
SCALE 1:750



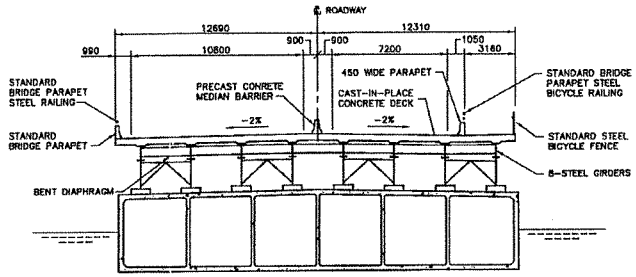
ELEVATED DECK
SCALE 1:150



ELEVATION LOOKING NORTH
WEST ELEVATED DECK
SCALE 1:750



ELEVATION LOOKING NORTH
EAST ELEVATED DECK
SCALE 1:750



SECTION A
SCALE 1:150

PRELIMINARY
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2004 DECEMBER 01

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KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B. C.
Canada, V6E 3C9
Certified ISO 9001

PREPARED BY:
BUCKLAND & TAYLOR LTD.
Bridge Engineering

BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN CTL	PROJECT MANAGER RWW
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OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE ELEVATED DECKS
GENERAL ARRANGEMENT

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3106
DATE

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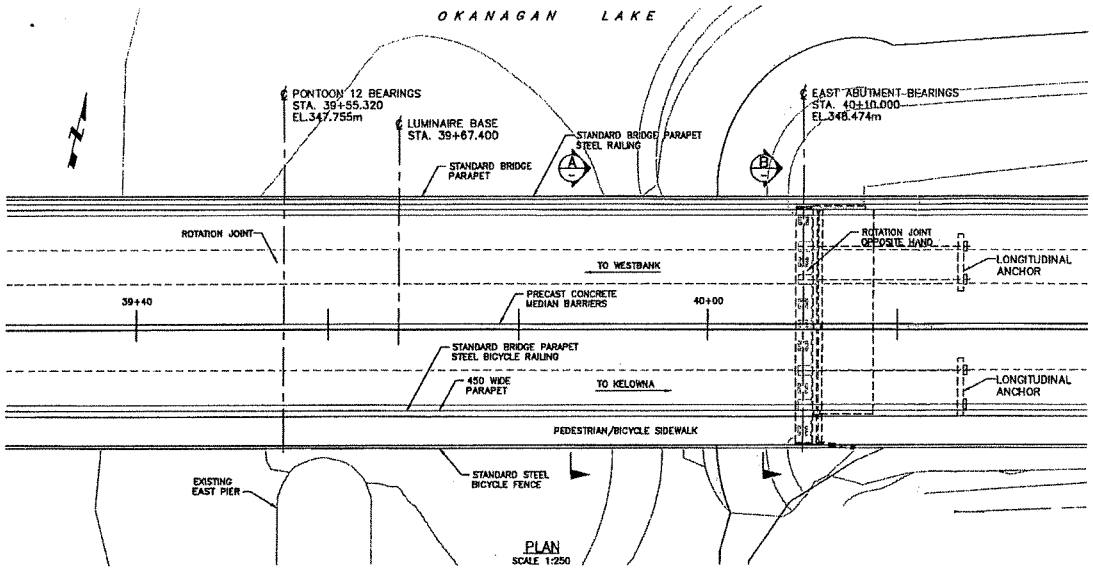

PLAN
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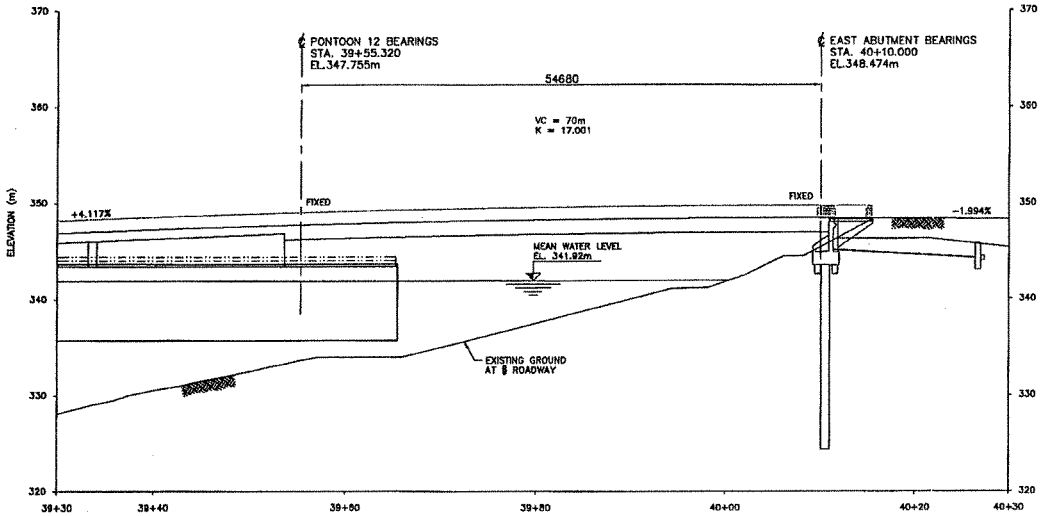
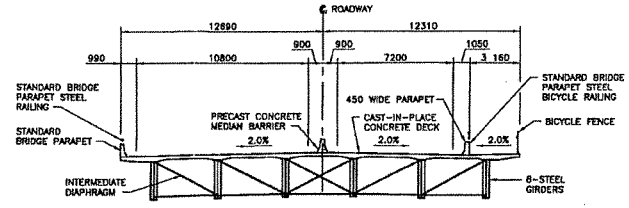


ELEVATION LOOKING NORTH
SCALE 1:250



SECTION A
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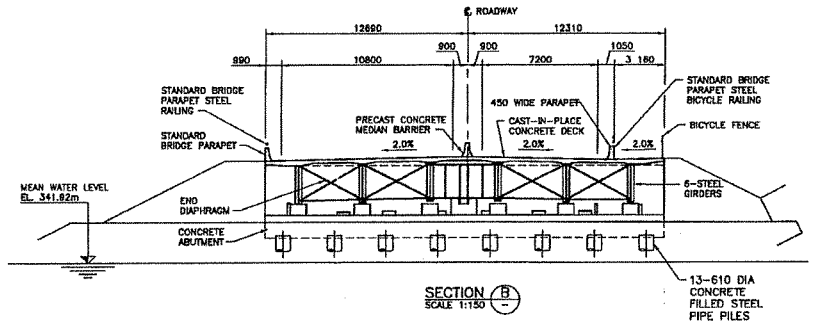

SECTION B
SCALE 1:150

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2004 DECEMBER 01

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OKANAGAN LAKE NEW CROSSING SERVICES
EAST TRANSITION SPAN
GENERAL ARRANGEMENT

SCALE 1 : 250
DATE 04-11-01
CONTRACT
DRAWING 865800-1000-42DD-3107

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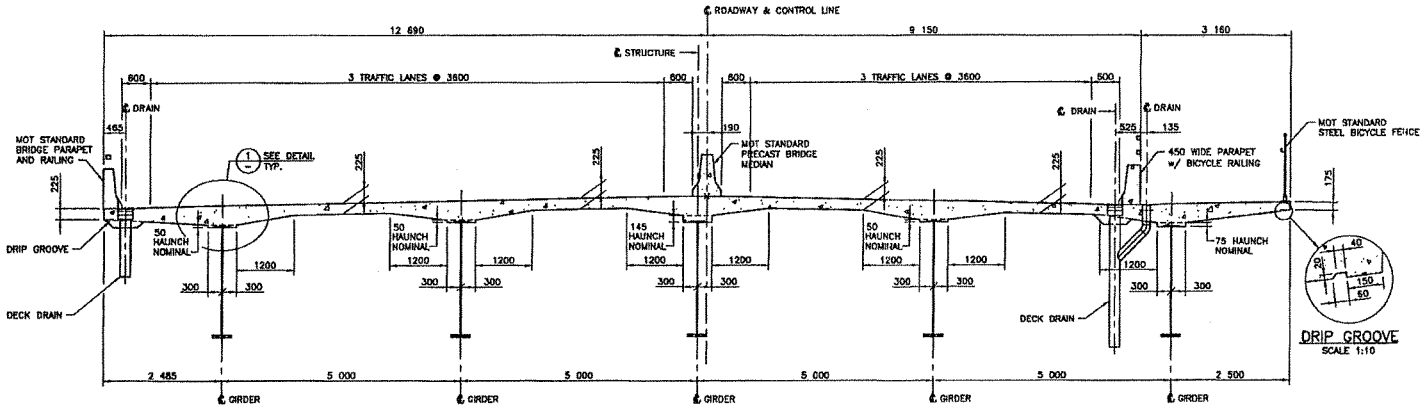
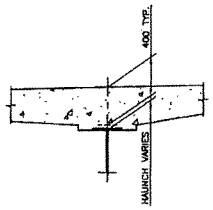
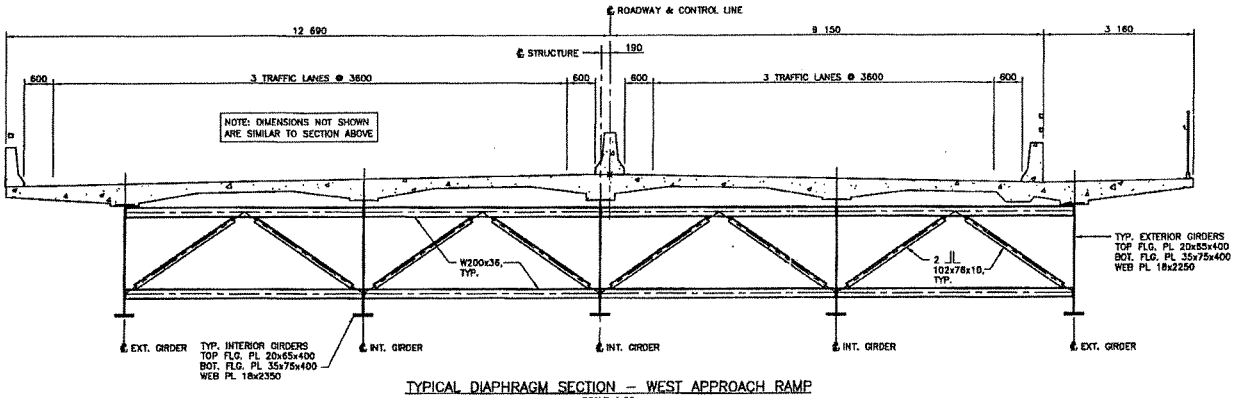


TYPICAL DECK CROSS SECTION – WEST APPROACH RAMP
SCALE 1:50



DETAIL 1
SCALE 1:25



TYPICAL DIAPHRAGM SECTION – WEST APPROACH RAMP
SCALE 1:50

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ISSUED: RWW	
DRAWN: LMB	PROJECT MANAGER: RWW
DESIGNED: DOM	DATE (YY-MM-DD): 04 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
WEST APPROACH RAMP
TYPICAL CROSS SECTIONS
OUTLINE

SCALE: AS SHOWN | CONTRACT | DRAWING: 865800-1000-42DD-3201
DATE

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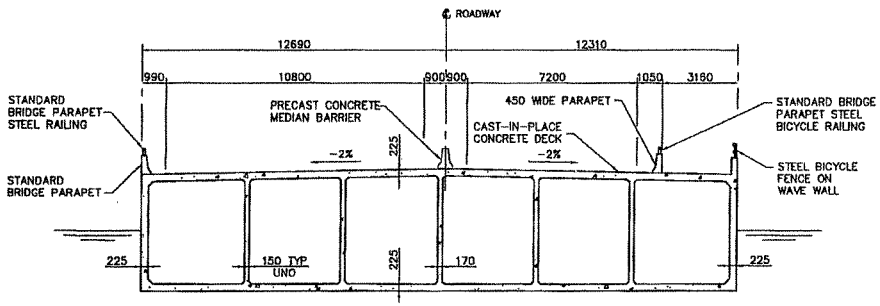
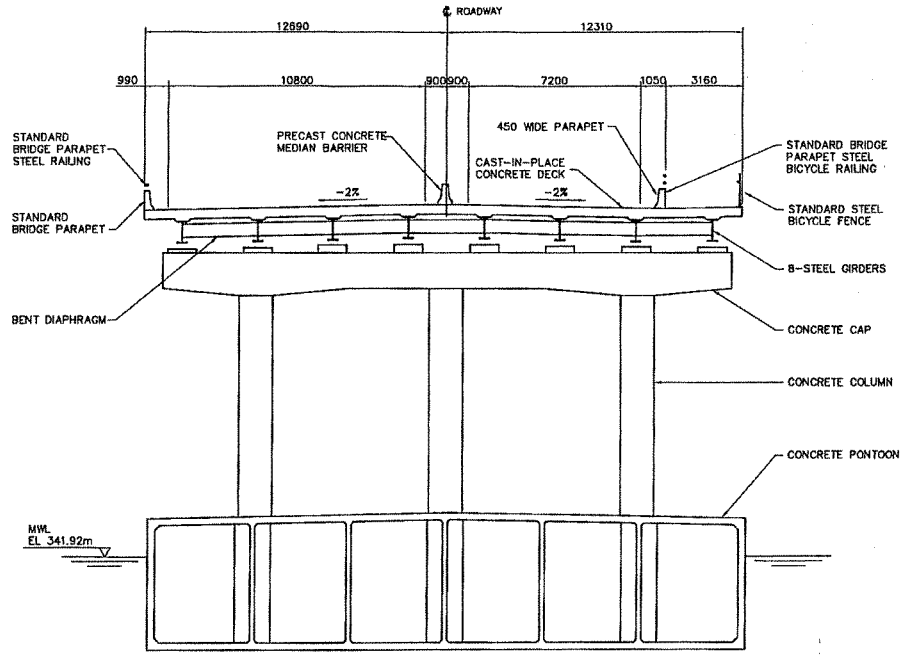


TYPICAL SECTION – FLOATING BRIDGE ROADWAY PONTOON

1:100



TYPICAL SECTION – WEST ELEVATED DECK

1:100

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BAR SCALE(S):

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DESIGNED	RWW	
DRAWN	LVB	PROJECT MANAGER RWW
CHECKED	DCM	DATE (YY-MM-DD) 04 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE PONTOONS & ELEVATED DECK
TYPICAL CROSS SECTIONS

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3202
DATE

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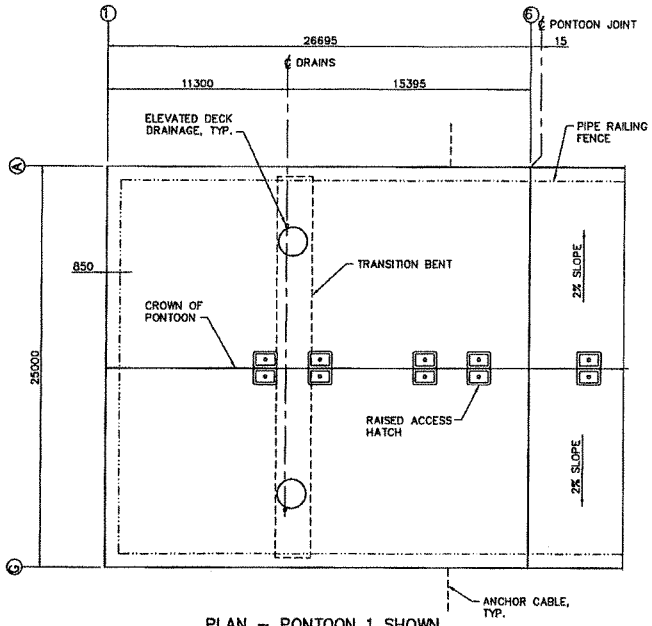
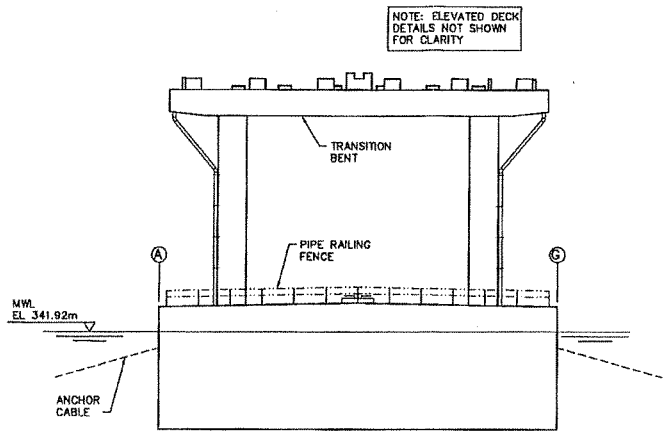
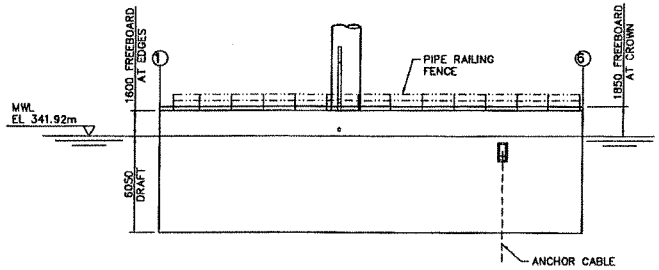


PLAN – PONTOON 1 SHOWN
(ELEVATED DECK PONTOONS 2 TO 5 & 12 SIMILAR)
1:150



ELEVATION LOOKING EAST
1:150



ELEVATION LOOKING NORTH
1:150

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2004 DECEMBER 01

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CHECKED CDM	DATE (YY-MM-DD) 04 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE
TYPICAL PONTOON OUTLINE – SHEET 1 OF 2

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3301
DATE

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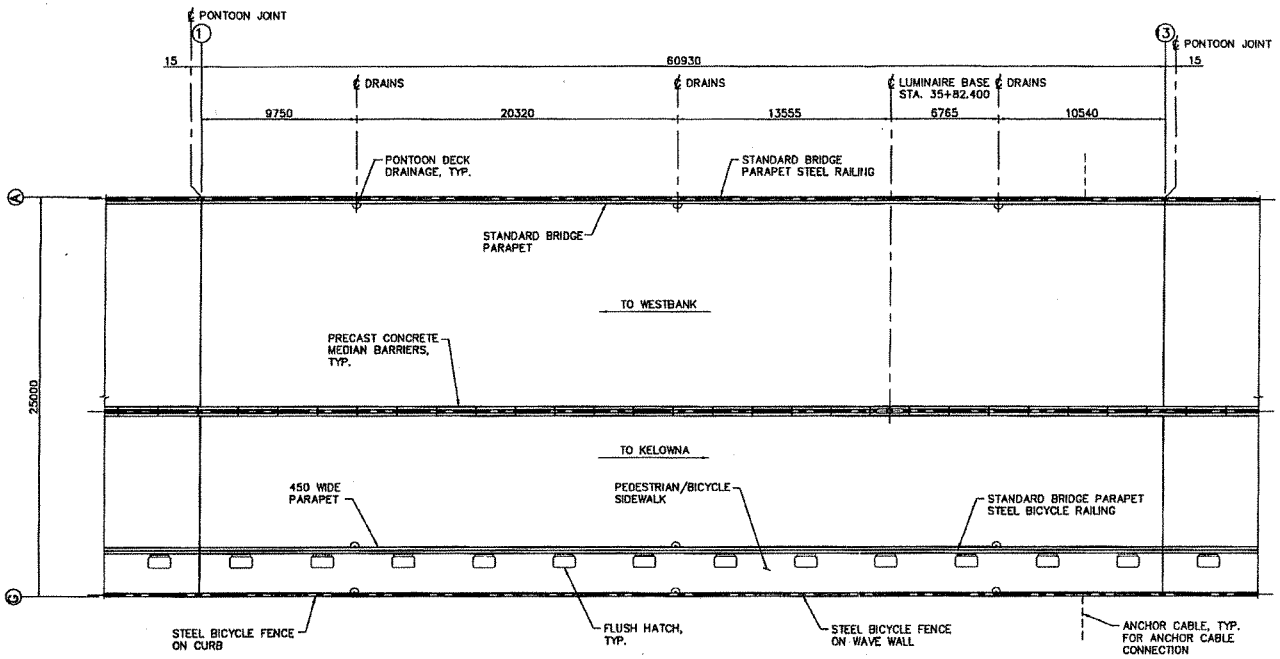
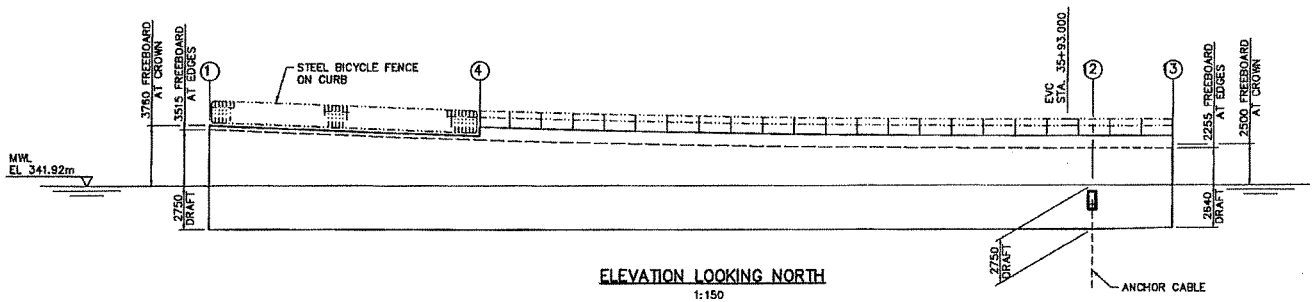


PLAN – PONTOON 6 SHOWN
(ROADWAY PONTOONS 7 TO 11 SIMILAR)
1:150



ELEVATION LOOKING NORTH
1:150

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OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE
TYPICAL PONTOON OUTLINE – SHEET 2 OF 2

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3302
DATE

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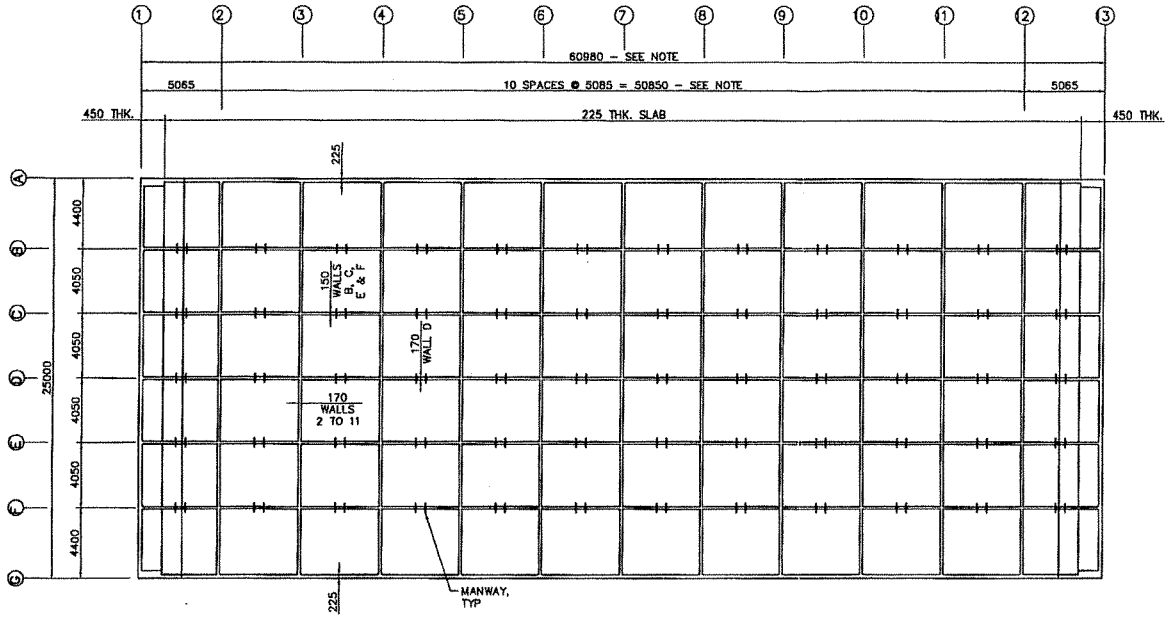
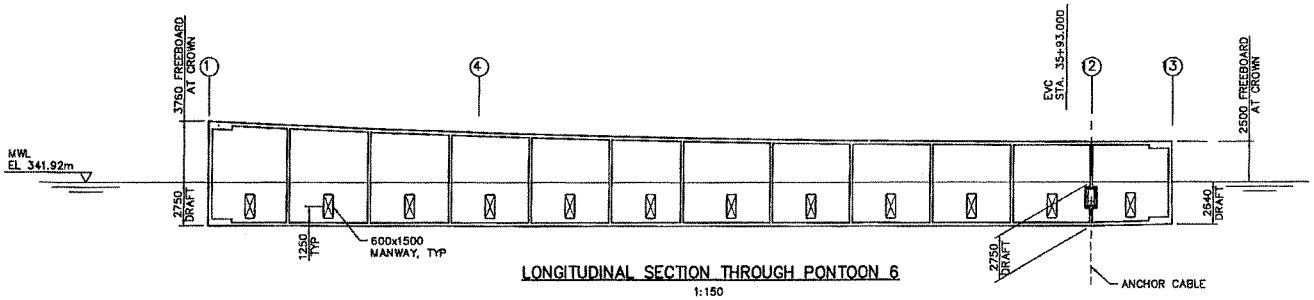


HORIZONTAL SECTION THROUGH PONTOON 6
(ROADWAY PONTOONS 7 TO 11 SIMILAR)
1:150



LONGITUDINAL SECTION THROUGH PONTOON 6
1:150

NOTES:

1. THIS DRAWING INDICATES CONSTRUCTION DIMENSIONS. THE ADDITIONAL LENGTH IS ESTIMATED TO ALLOW FOR ELASTIC SHORTENING, SHRINKAGE AND CREEP. SEE SPECIAL PROVISIONS.

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OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE
TYPICAL PONTOON COMPARTMENTATION

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-420D-3303
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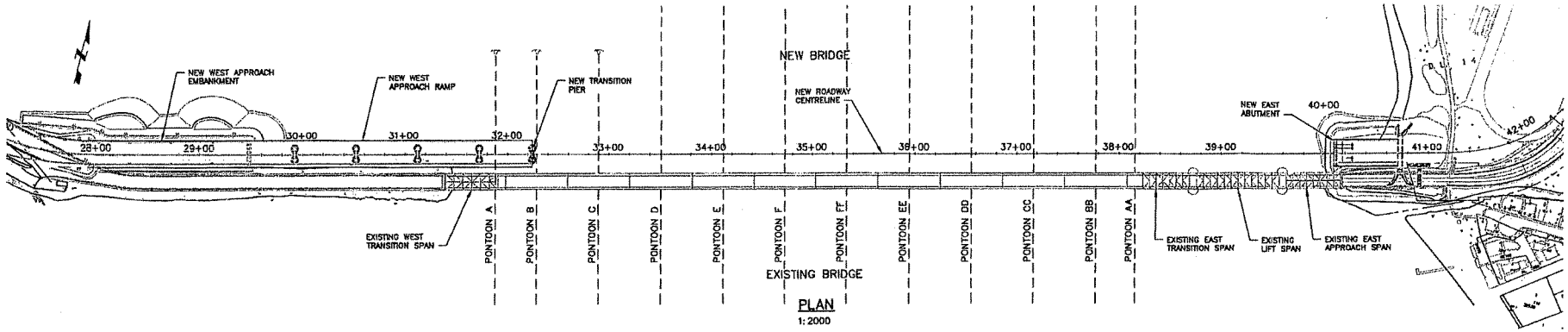
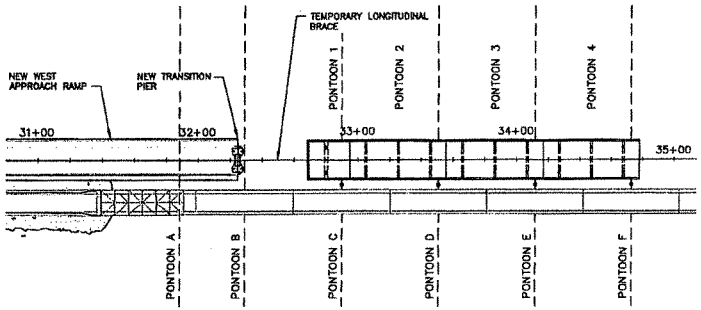
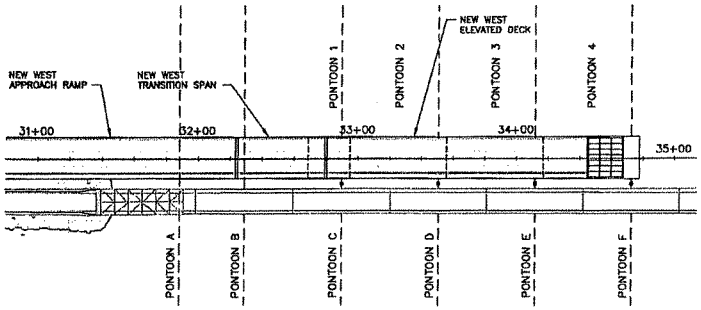


PLAN
1:2000



PLAN – STEP C1
1:1500



PLAN – STEP C2
1:1500

STEP C1
PONTOONS 1 THROUGH 4

1. CONSTRUCT PONTOONS 1 THROUGH 4 COMPLETE WITH BENTS AND PERMANENT BALLAST.
2. BALLAST PONTOON 2 LEVEL. BALLAST PONTOON 1 LEVEL WITH FREEBOARD MATCHING PONTOON 2.
3. CONNECT PONTOON 1 TO PONTOON 2.
4. DISCONNECT NORTH CABLES FROM PONTOON C AND PONTOON D.
5. FLOAT PONTOON 1 AND 2 INTO LOCATION. INSTALL TEMPORARY STRUTS, PENDANTS, SINKERS AND CABLES BETWEEN THE NORTH SIDE OF THE EXISTING PONTOONS AND THE SOUTH SIDE OF PONTOON 1 AND 2.
6. INSTALL TEMPORARY LONGITUDINAL BRACE RUNNING FROM THE TRANSITION PIER TO PONTOON 1. SEE NOTES.
7. MODIFY AND ATTACH NORTH CABLES TO PONTOON 1 AND 2.

STEP C2
WEST ELEVATED DECK, WEST TRANSITION SPAN

1. PROVIDE TEMPORARY LONGITUDINAL RESTRAINT FOR WEST ELEVATED DECK STEEL UNTIL PERMANENT LONGITUDINAL RESTRAINT AT PONTOON 5 IS COMPLETED.
2. INSTALL ELEVATED DECK STEEL ON PONTOONS 1 THROUGH 4.
3. INSTALL WEST TRANSITION SPAN STEEL.
4. PLACE CONCRETE FOR WEST ELEVATED DECK AND WEST TRANSITION SPAN. DURING PLACEMENT OF CONCRETE, REMOVE AND/OR RELOCATED BALLAST FROM PONTOONS 1 THROUGH 4 AS REQUIRED TO PREVENT OVERLOADING OF THE STRUCTURE. DO NOT INSTALL EXPANSION JOINT AT PONTOON 1 UNTIL EAST TRANSITION SPAN STEELWORK IS ERECTED.
5. PLACE ADDITIONAL TEMPORARY BALLAST ON PONTOONS 1 THROUGH 4 TO CONNECT PONTOON 5.
8. TIGHTEN NORTH AND SOUTH CABLES AND REMOVE TEMPORARY STRUTS FROM BETWEEN PONTOON 1 AND 2 AND THE EXISTING PONTOONS.
9. ADD TEMPORARY BALLAST TO BRING PONTOON 3 LEVEL WITH FREEBOARD MATCHING PONTOON 2.
10. DISCONNECT NORTH CABLE FROM PONTOON E AND FLOAT PONTOON 3 INTO LOCATION.
11. INSTALL TEMPORARY STRUTS, PENDANT, SINKER AND CABLES BETWEEN THE NORTH SIDE OF THE EXISTING PONTOONS AND THE SOUTH SIDE OF PONTOON 3.
12. CONNECT PONTOON 3 TO PONTOON 2. MODIFY AND ATTACH NORTH CABLES TO PONTOON 3.
13. TIGHTEN NORTH AND SOUTH CABLES AND REMOVE TEMPORARY STRUTS.
14. REPEAT STEPS 9 THROUGH 13 FOR PONTOON 4.

PONTOON STRING CONSTRUCTION NOTES:

1. FOR TEMPORARY SINKERS, PENDANTS, STRUTS AND CABLES BETWEEN THE NEW AND EXISTING PONTOONS. SEE DRAWING 865800-1000-42DD-3307.
2. BALLAST ADDITION AND REMOVAL SHALL BE CONDUCTED IN A MANNER WHICH DOES NOT DAMAGE OR OVERLOAD THE PONTOONS. MOMENTS, SHEARS AND TORSION RESULTING FROM PLACEMENT OF BALLAST SHALL NOT EXCEED THE FOLLOWING VALUES:

MAXIMUM SHEAR	1 450 kN
MAXIMUM MOMENT	71 500 kNm
MAXIMUM TORSION	46 600 kNm

BALLASTING PROCEDURES SHALL INDICATE THE TYPE, LOCATION, AMOUNT AND SEQUENCE OF BALLAST PLACEMENT ON THE PONTOONS. THE WEIGHT AND LOCATION OF ANY EQUIPMENT OR OTHER MATERIALS ON THE PONTOONS DURING BALLASTING SHALL BE NOTED IN THE BALLASTING PROCEDURES.

3. THE TOLERANCE ON THE STATIONING OF THE WEST FACE OF PONTOON 1 WHEN INITIALLY INSTALLED IS ±10mm ALONG THE NEW ROADWAY CENTRELINE.
4. THE TEMPORARY LONGITUDINAL BRACE SHALL BE CAPABLE OF PROVIDING ADJUSTMENT IN EACH DIRECTION ALONG THE NEW ROADWAY CENTRELINE TO ALLOW FOR FINAL POSITIONING OF THE EAST TRANSITION SPAN BEARINGS ON PONTOON 12. THE BRACE ADJUSTMENT IS INTENDED TO ALLOW FOR TOLERANCE IN THE FABRICATION OF THE EAST TRANSITION SPAN, INITIAL POSITIONING OF PONTOON 1 AND SURVEY ERROR. THE BRACE SHALL BE DESIGNED FOR A SPECIFIED TENSION OR COMPRESSSION LOAD AND BE CAPABLE OF ACCOMMODATING VERTICAL, TRANSVERSE AND ROLLING MOTIONS OF THE PONTOON STRING. THE BRACE SHALL BE CLEARLY VISIBLE TO MARINE VESSELS AT ALL TIMES.
5. THE NEW ANCHORS FOR PONTOONS 11 AND 12 SHALL BE INSTALLED PRIOR TO PONTOON 11 BEING FLOATED INTO LOCATION.
6. DUE TO CONSTRUCTION TOLERANCES, SOME OF THE BALLAST USED DURING PONTOON STRING CONSTRUCTION MAY BE REQUIRED PERMANENTLY.

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KEY PLAN

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PREPARED BY:
BUCKLAND & TAYLOR Ltd.
Bridge Engineering

BAR SCALE(S):

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DESIGNED RWW	
DRAWN LJB	PROJECT MANAGER RWW
CHECKED DDW	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
PONTOON STRING CONSTRUCTION
SHEET 1

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3304
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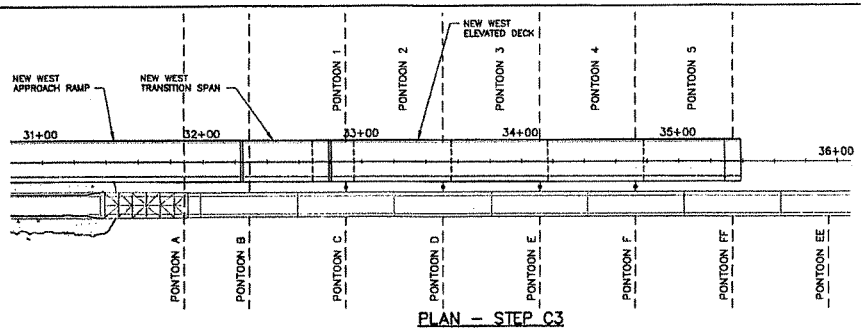
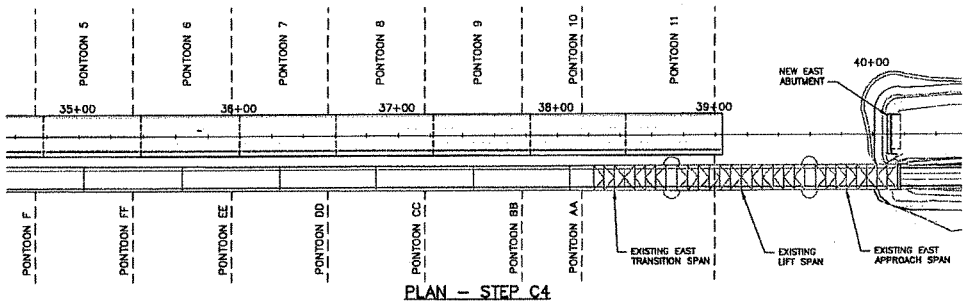


PLAN – STEP C3

1:1500

STEP C3
PONTOON 5, WEST ELEVATED DECK

1. CONSTRUCT PONTOON 5 COMPLETE WITH BENT 10 AND A PORTION OF THE ELEVATED DECK. EXTENT OF COMPLETED ELEVATED DECK ON PONTOON 5 SHALL BE THE CONTRACTOR'S PREFERENCE.
2. BALLAST PONTOON 5 AS REQUIRED TO CONNECT WITH PONTOON 4.
3. DISCONNECT NORTH CABLE FROM PONTOON FF.
4. INSTALL TEMPORARY STRUTS, PENDANT, SINKER AND CABLES BETWEEN THE NORTH SIDE OF THE EXISTING PONTOONS AND THE SOUTH SIDE OF PONTOON 5.
5. CONNECT PONTOON 5 TO PONTOON 4. MODIFY AND ATTACH NORTH CABLE TO PONTOON 5.
6. TIGHTEN NORTH AND SOUTH CABLES AND REMOVE TEMPORARY STRUTS FROM BETWEEN PONTOON 5 AND THE EXISTING PONTOONS.
7. INSTALL REMAINING WEST ELEVATED DECK STEEL ON PONTOON 4 AND 5.
8. PLACE REMAINING CONCRETE FOR WEST ELEVATED DECK AND REMOVE BALLAST AS REQUIRED TO COMPENSATE FOR ADDITIONAL WEIGHT. REMOVE TEMPORARY LONGITUDINAL RESTRAINT FOR WEST ELEVATED DECK.

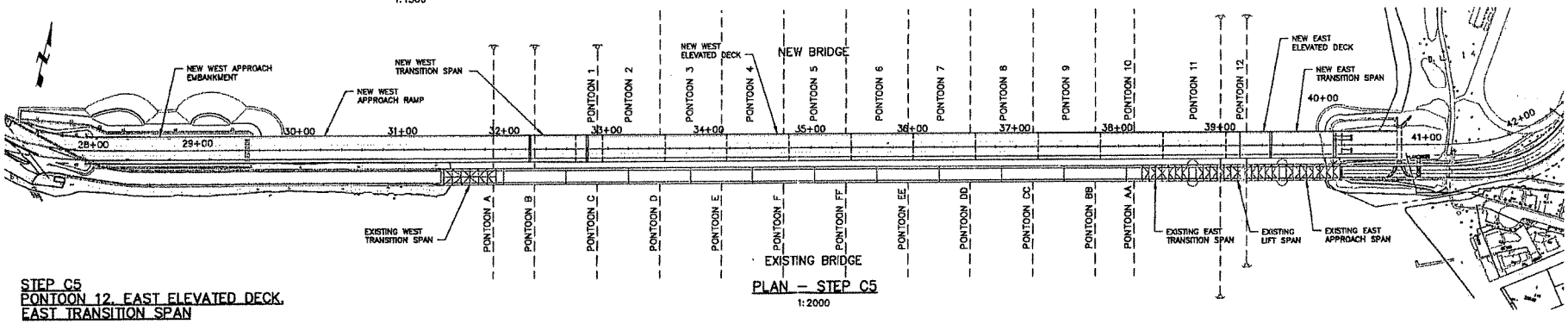


PLAN – STEP C4

1:1500

STEP C4
PONTOON 6 THROUGH 11, EAST ABUTMENT

1. BALLAST PONTOON 6 TO MATCH THE FREEBOARD OF PONTOON 5.
2. DISCONNECT NORTH CABLE FROM PONTOON EE.
3. FLOAT PONTOON 6 INTO LOCATION AND INSTALL TEMPORARY STRUTS, PENDANT, SINKER AND CABLES BETWEEN THE NORTH SIDE OF THE EXISTING PONTOONS AND THE SOUTH SIDE OF PONTOON 6.
4. CONNECT PONTOON 6 TO PONTOON 5. MODIFY AND ATTACH THE NORTH CABLE TO PONTOON 6.
5. TIGHTEN NORTH AND SOUTH CABLES AND REMOVE TEMPORARY STRUTS FROM BETWEEN PONTOON 6 AND THE EXISTING PONTOONS.
6. REPEAT STEPS 1 THROUGH 5 FOR PONTOON 7 THROUGH 10.
7. COMPLETE CONSTRUCTION OF EAST ABUTMENT.
8. AFTER INSTALLATION OF EACH PONTOON (7,8,9,10 AND 11), SURVEY THE AS-BUILT DISTANCE FROM THE EAST END OF THE PONTOON STRING TO CENTRELINE OF BEARINGS AT THE EAST ABUTMENT. THE SURVEYED DISTANCES SHALL BE ACCURATE TO WITHIN 20mm.
9. DETERMINE ANY REQUIRED CHANGES TO PONTOON LENGTHS TO SUIT THE DISTANCES SURVEYED IN STEP 8. SEE SPECIAL PROVISIONS.
10. BALLAST PONTOON 11 TO MATCH THE FREEBOARD OF PONTOON 10. FLOAT PONTOON 11 INTO PLACE AND ATTACH NEW ANCHORS. CONNECT PONTOON 11 TO PONTOON 10.



PLAN – STEP C5

1:2000

STEP C5
PONTOON 12, EAST ELEVATED DECK, EAST TRANSITION SPAN

1. CONSTRUCT PONTOON 12 WITH A PORTION OF EAST ELEVATED DECK. EXTENT OF COMPLETED ELEVATED DECK SHALL BE THE CONTRACTOR'S PREFERENCE.
2. BALLAST PONTOON 12 TO MATCH FREEBOARD OF PONTOON 11.
3. FLOAT PONTOON 12 INTO LOCATION AND ATTACH NEW ANCHORS.
4. CONNECT PONTOON 12 TO PONTOON 11.
5. ADJUST THE TEMPORARY LONGITUDINAL BRACE AS REQUIRED TO INSTALL EAST TRANSITION SPAN STEEL.
6. INSTALL EAST TRANSITION SPAN STEEL AND REMOVE TEMPORARY LONGITUDINAL BRACE AT PONTOON 1.
7. COMPLETE EAST ELEVATED DECK. PLACE EAST TRANSITION SPAN CONCRETE, AND REMOVE BALLAST FROM PONTOON 12 AS REQUIRED.
8. COMPLETE EXPANSION JOINT AT PONTOON 1.
9. REMOVE TEMPORARY BALLAST USED DURING CONSTRUCTION OF THE PONTOON STRING. ADD PERMANENT BALLAST.

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KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada, V6E 3C9
ISO 9001

PREPARED BY:
BUCKLAND & TAYLOR LTD.
Bridge Engineering

BAR SCALE(S):

PREPARATION	APPROVAL
DESIGNED RWW	
DRAWN LMB	PROJECT MANAGER RWW
CHECKED DCM	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
PONTOON STRING CONSTRUCTION
SHEET 2

SCALE AS SHOWN | CONTRACT | DRAWING 865800-1000-42DD-3305
DATE

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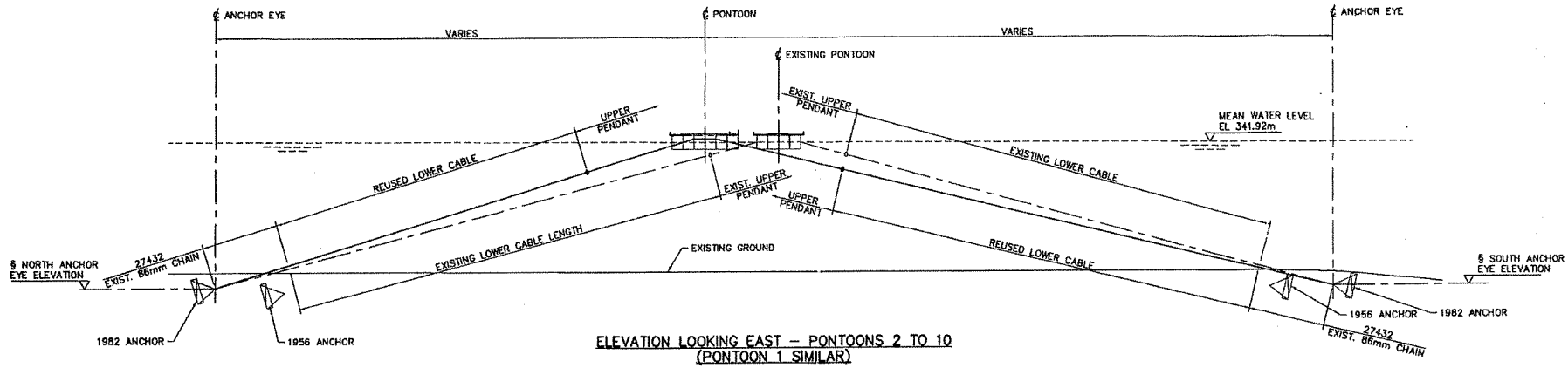
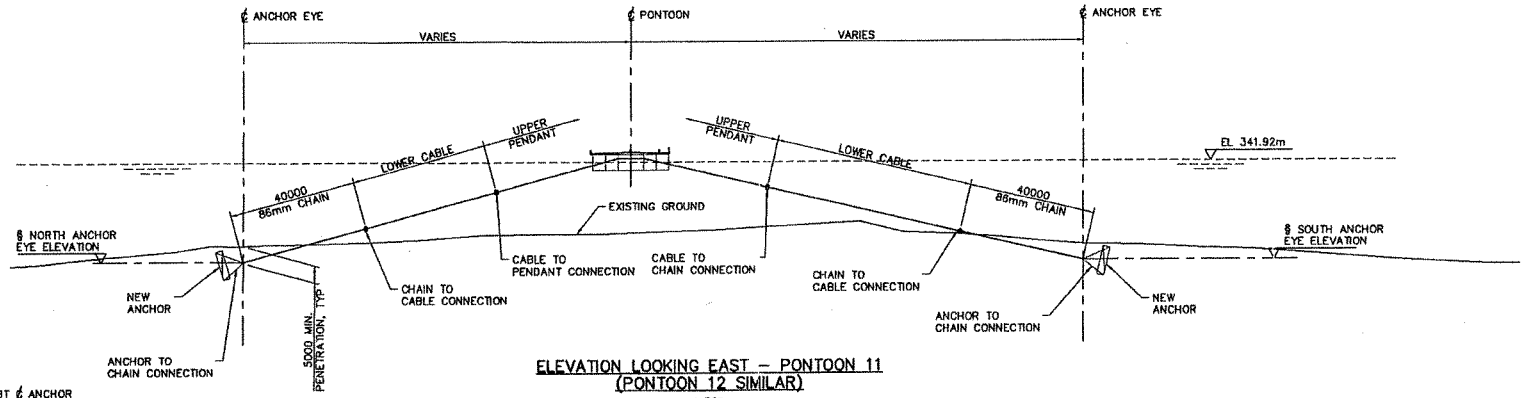
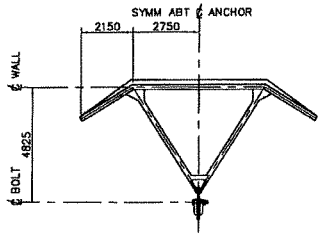


ELEVATION LOOKING EAST – PONTOONS 2 TO 10
(PONTOON 1 SIMILAR)
1:750



ELEVATION LOOKING EAST – PONTOON 11
(PONTOON 12 SIMILAR)
1:750



PLAN–1982 ANCHORS
NEW ANCHORS (SIMILAR LOAD CAPACITY)
1:100

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DESIGNED RWW	
DRAWN LTG	PROJECT MANAGER RWW
CHECKED DOM	DATE (YY-MM-DD) 2004 DEC 01

OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE
ANCHOR SYSTEM

SCALE AS NOTED | CONTRACT | DRAWING 865800–1000–42DD–3306
DATE 04-11-16
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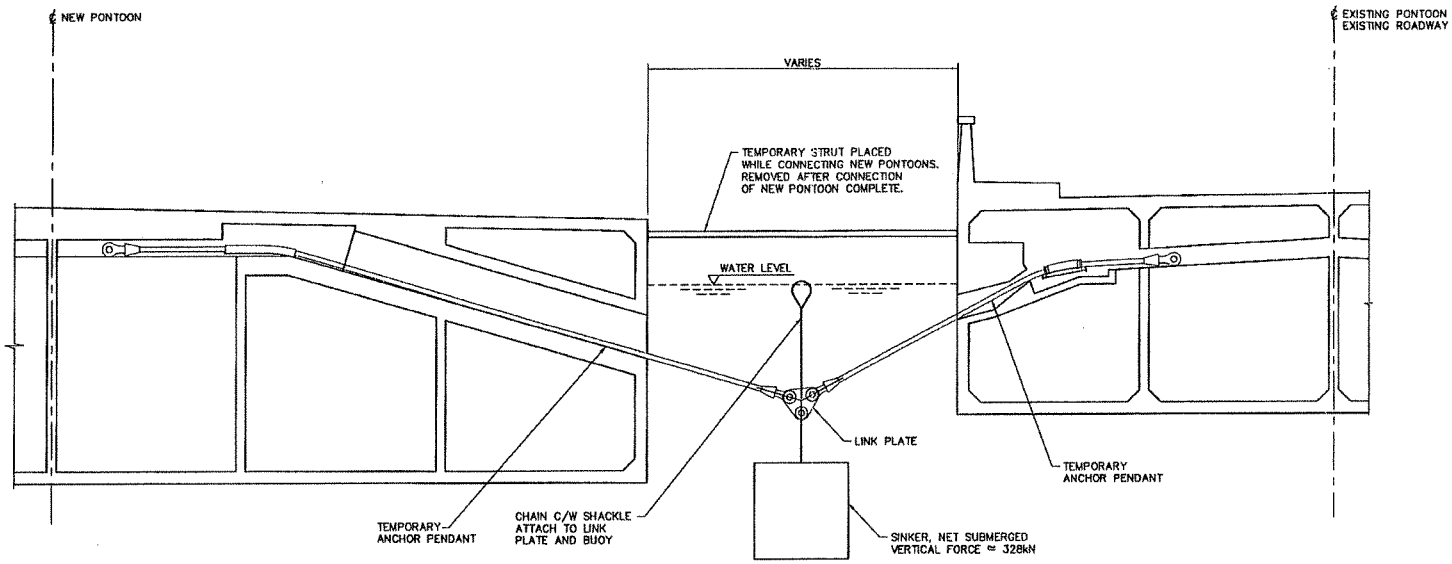

SECTION LOOKING EAST
TEMPORARY TIES IN NEUTRAL POSITION
1:50

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Certified ISO 9001

PREPARED BY:
BUCKLAND & TAYLOR Ltd.
Bridge Engineering

BAR SCALE(S):

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DRAWN LTO	PROJECT MANAGER RWW
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OKANAGAN LAKE NEW CROSSING SERVICES
FLOATING BRIDGE
TEMPORARY TIE SCHEME

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DATE 04-11-16
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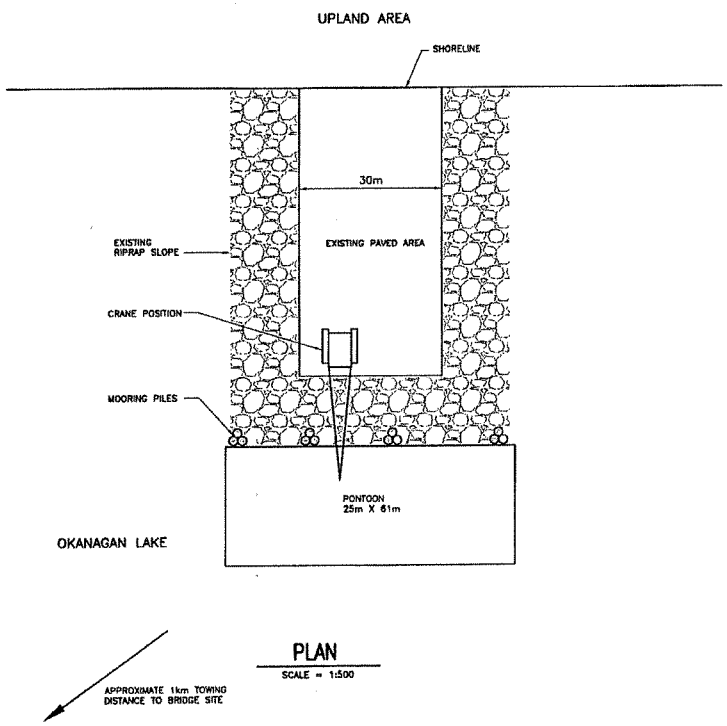
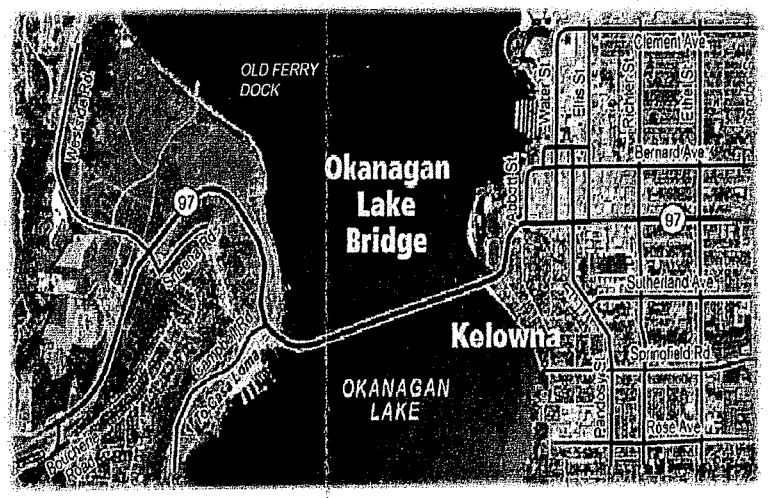


PLAN

SCALE = 1:500



KEY PLAN

N.T.S.

NOTES:

1. FOR ACTIVITIES TO BE PERFORMED AT THE FIT-OUT SITE PLEASE REFER TO TECHNICAL PROPOSAL SECTION 4.0 – CONSTRUCTION METHODOLOGY.
2. THE "OLD FERRY DOCK" IS SHOWN HERE TO ILLUSTRATE THE GENERAL ARRANGEMENT OF THE FIT-OUT SITE. FORMAL ARRANGEMENTS TO USE THIS SITE HAVE NOT BEEN MADE.

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KEY PLAN

partnerships
British Columbia

SNC·LAVALIN
1800 – 1075 West Georgia Street
Vancouver, B.C.
Canada V6E 3C9
ISO 9001

PREPARED BY:
VANCOUVER PILE DRIVING

	PREPARATION	APPROVAL
DESIGNER	W. SAUNDERS	
DRAWN	W. KWOK	PROJECT MANAGER
CHECKED		DATE (YY-MM-DD) 2004-11-25

BAR SCALE(S): 0 25

OKANAGAN LAKE NEW CROSSING SERVICES

OLD FERRY DOCK
FIT-OUT SITE
GENERAL ARRANGEMENT

SCALE AS NOTED | CONTRACT | DRAWING 865800-1000-42D0-3402
DATE 04-11-25

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DATE: 2004/11/29 - 5:47:
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