British Columbia Ferry Services Inc.

Application to the
British Columbia Ferries Commissioner

Pursuant to
Section 55 (2) of the Coastal Ferry Act

For
Buckley Bay to Denman Island (Route 21)
Cable Ferry Project

December 20, 2013

Note: In this copy of the application information of a confidential and commercially sensitive nature has been redacted.
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Section 1 – Introduction

1.1 Overview

Arising from extensive research and analysis that commenced in March 2008, British Columbia Ferry Services Inc. (“BC Ferries” or the “Company”) has determined that replacing the conventional ferry service on the route connecting Buckley Bay with Denman Island (“Route 21”) (see Appendix 1) with a cable ferry service (the “Project”) will provide significant cost savings to offset pressure on future fare increases for all ferry users, while still allowing the Company to maintain its high standard of safety and reliability of service. BC Ferries has undertaken significant public and stakeholder consultation, the results of which have shaped key elements of the Project. The Company believes that the Project is in the best interests of British Columbia taxpayers and all of its customers, given the opportunity to realize significant savings that will help keep fares across the ferry system as low as possible, and has moved forward with the objective of bringing the cable ferry into service by the spring / summer of 2015.

The Project significantly pre-dates recent changes to the Coastal Ferry Act (“CFA”) which made mandatory the requirement to seek the approval of the Commissioner prior to undertaking expenditures for major capital projects. Prior to the legislative changes, the seeking of such pre-approval had been at the option of the Company. Specifically, Bill 47, the 2012 Coastal Ferry Amendment Act, repealed the previous section 55 of the CFA and replaced it with a new section 55 that requires BC Ferries to obtain advance approval of a “major capital expenditure”. The term “major capital expenditure” was left undefined for the Commissioner to interpret. Bill 47 came into force on June 25, 2012. By Order 12-04, issued September 30, 2012, the Commissioner defined a “major capital expenditure” for the purposes of section 55(2) as any capital expenditure which exceeds $30 million or any new vessel, regardless of cost. As Bill 47 did not provide for retrospective application to projects already underway, the new requirement in section 55(2) to obtain the Commissioner’s pre-approval for “major capital expenditure” does not apply to the Project or the expenditures undertaken to date.

The Company did not exercise its option to seek pre-approval of the Project under the former section 55 of the CFA as the forecast expenditures for the Project were reviewed by the Commissioner through other regulatory mechanisms. In this regard,
the Commissioner had agreed in Memorandum 32, dated January 19, 2009, that "If the feasibility project leads to implementation of a cable ferry, BC Ferries is entitled to recover all of its costs, including the feasibility project costs, over the associated assets’ useful lives and to earn 50% of the savings..." (see Appendix 2). As well, the forecast Project costs were included in the Commissioner’s Performance Term Three ("PT3") price cap determination issued by Order 12-02 on September 30, 2012. BC Ferries had incurred Project costs of approximately $<<> million by the time the CFA was amended to make it mandatory for the Company to obtain advance approval of major capital expenditures, and a further $<<> million from then until the Commissioner defined those projects which constitute a major capital expenditure requiring pre-approval. To the date of this filing, the Company has incurred Project costs of $<<> million.

The Company has been studying the Project since 2008 and has engaged numerous independent engineering and naval architectural firms, as well as environmental consultants and other independent experts, to ensure that it has conducted a thorough review of all areas of the Project (see Appendix 3). In fact, the Company believes it has likely done more “due diligence” on the Project than was done for the other 65 cable ferries currently operating in Canada combined.

BC Ferries has proceeded with the Project in an open and transparent way. It has conducted extensive consultation with stakeholders and has made a number of changes to the Project in key areas, and other commitments, as a result of the feedback obtained through this process. This includes the following:

- **Crew Complement**
  Cable ferries generally operate with a crew of one or two. The Company will apply to Transport Canada to determine the final crew size for the Project. To address local concerns about safety, and potential job loss in the communities, BC Ferries has committed to crew the vessel with a minimum complement of three, regardless of whether Transport Canada authorizes a lower crew complement. In addition, BC Ferries’ crew members will be trained to a much higher standard than is understood to be the case for crew members of other cable ferry operators in Canada.

- **Home Port Location**
  Relocating the home port from Denman Island to Buckley Bay offers the potential for savings through greater efficiencies in crewing the vessel. The Denman and Hornby Island residents, together with employees and the BC Ferry and Marine
Workers’ Union ("BCFMWU"), expressed concern about the potential negative impact of such a move on the availability of and responsiveness to emergency and after hour call out, as well as on the economy of Denman Island. In response to these concerns, BC Ferries agreed to forego the potential efficiencies that could be realized through a move of the home port and committed to continue to home port and crew the vessel from Denman Island.

- **Operational Availability**

  Arising from concerns expressed by residents about the reliability of a cable ferry on Route 21, BC Ferries committed to ensuring the same level of service reliability as is provided by the vessel now deployed on the route (Quinitsa). The service reliability of the Quinitsa on Route 21 is among the highest of BC Ferries’ fleet, with very few weather-related service disruptions. A less rigorous service standard would meet the requirements of the Coastal Ferry Services Contract with the Province of British Columbia ("CFSC"). However, in response to concerns raised during the consultation process, BC Ferries has conducted significant incremental engineering and analysis to design the vessel, terminals and cable system to replicate the standard of service now provided by the Quinitsa. The Company also feels that this higher engineering standard is appropriate, as this is the first cable ferry in its fleet.

- **Alternative Service Provider**

  The potential existed to realize savings through the involvement of an alternative service provider in the Project. Significant opposition to this concept was expressed by the local communities and the BCFMWU. The Company tested the market through a Request for Proposals ("RFP") process to determine if another operator under contract to BC Ferries would provide the cable ferry service to a similar level of safety and quality, at a lower cost. The results of the first phase of the process did not support the case to move forward with an alternative service provider to “design, build, acquire and operate” the service. In view of the stakeholder concerns about involving an alternative service provider in the Project, the Company agreed to forego investigating the potential opportunity to realize savings through issuance of an “operate only” RFP and committed to operating the service itself.

Despite BC Ferries’ responsiveness to the issues and concerns raised through its consultation process, some apprehension remains in the affected communities about the Project, and a desire on the part of some stakeholders that it be subject to further review by the Commissioner. BC Ferries is willing to bring forward the expenditures
incurred on the Project from the date of this filing as a “major capital expenditure” for pre-approval under section 55(2) of the CFA. BC Ferries submits that it would not be appropriate for the Commissioner to characterize the expenditures to date as part of that “major capital expenditure”, because BC Ferries incurred those expenditures in good faith under the old legislative framework (where pre-approval of the expenditures was not mandatory), with the full knowledge of the Commissioner, and in reliance on Memorandum 32 and the PT3 price cap determination.

BC Ferries is submitting this Application with some reservations. Firstly, the Company does not feel that pre-approval of the Project was or is required by the CFA for the reasons cited above. Secondly, the delay associated with the Commissioner’s review process has real potential to escalate the costs of the Project. Thirdly, the Company understands that many of the objections to the Project now raised by stakeholders do not pertain to matters within the Commissioner’s jurisdiction. Nevertheless, BC Ferries understands there is a desire on the part of some stakeholders to have the Commissioner conduct an additional review of the capital expenditures beyond the reviews undertaken in the context of Memorandum 32 and in determining price caps for PT3. There is a compelling rationale for the Commissioner to be as expeditious as reasonably possible, while still allowing sufficient time for meaningful input from interested parties.

1.2 Request

By this Application, BC Ferries seeks the following determinations:

1. Notwithstanding anything in Order 12-02 establishing the definition of “major capital expenditure”, with regard to this Project it is only expenditures incurred from the date of this filing that constitute a “major capital expenditure”.

and,

2. Approval, pursuant to 55(2) of the CFA, for Project capital expenditures of up to $<> million, including interest during construction (“IDC”).
1.3 Organization of Application

This Application is organized as follows:

- Section 2 describes the Project, including the expected improvements in service that will result from the Project. Also discussed are the regulatory processes and the significant public consultation that have been undertaken in regard to the Project.

- Section 3 provides a financial assessment of the Project as compared to the continuation of a conventional ferry service. Included is a discussion on the expected impact on price caps should the Project be approved, as well as scenarios for reducing the capital cost of the Project.

- Section 4 addresses matters related to procurement and risk mitigation.
Section 2 – Project Description

2.1 Project Overview

BC Ferries is an independent company providing ferry services on the west coast of British Columbia. The Company provides frequent year-round transportation service with 35 vessels operating on 25 routes out of 47 terminals spread over 1,000 miles of coastline. In the year ended March 31, 2013, BC Ferries carried 8 million vehicles\(^1\) and 20 million passengers on 183,800 sailings.

BC Ferries’ operations are among the largest and most complex of ferry systems in the world. Its fleet, however, is among the oldest. The Company delivers service in accordance with the requirements of the CFSC. Over the period 2004 to 2009, BC Ferries conducted a substantial renewal of its fleet, with the acquisition of seven new vessels. Of these new vessels, three were deployed on the Major Routes, comprising the three routes connecting Greater Vancouver with mid and southern Vancouver Island plus the route connecting Horseshoe Bay and Langdale, and two were deployed on the Northern Routes, which serve the coastal communities north of Port Hardy. Only two were deployed on the Minor Routes, which primarily serve the Northern and Southern Gulf Islands and the Northern Sunshine Coast.

To ensure continued ability to deliver safe, reliable and cost effective service that meets the requirements of the CFSC as they currently exist, BC Ferries will need to replace (or life-extend) 10 vessels over the next seven years. All but one of these vessels will be required for deployment on the Minor Routes. By Order 13-01, dated July 19, 2013, the Commissioner approved the Company’s application to acquire the first three of the new vessels for the Minor Routes. New intermediate class vessels will replace the Queen of Burnaby, providing service on the route connecting Comox with Powell River (“Route 17”), and the Queen of Nanaimo, providing service on the route connecting Tsawwassen with the Southern Gulf Islands (“Route 9”). A third intermediate class vessel will augment peak season service on Route 9, plus provide refit relief for other vessels, primarily on Route 9 and Route 17, plus the route connecting Earls Cove with Saltery Bay (Route 7).

At this time, the Company intends to implement a cable ferry service on Route 21. The Project is included in the Company’s current rolling five-year capital plan approved

\(^1\) Equivalent to 8.9 million AEQs.
by the Company’s Board of Directors. Implementing the cable ferry service will enable the Company to redeploy the Quinitsa, the vessel currently serving the route, as a refit relief vessel for a number of the Minor Routes, thereby enabling the retirement of another vessel in the fleet without replacement.

The cable ferry will be unique to the BC Ferries fleet. While the Project does not, as such, meet the Company’s general policy objectives of standardization and interoperability of its vessels and terminals, the Company believes that pursuance of the cable ferry service is in the best interests of British Columbia taxpayers and all of its customers, given the opportunity to realize significant savings that will help keep fares across the ferry system as low as possible.

**Project Scope**
The Project includes the procurement of a new open vehicle deck vessel equipped with a drive wheel system to propel the ferry along submarine cables deployed between the two berth locations. Equivalent in size to the Quinitsa, the vessel will have a vehicle capacity of 50 automobile equivalents (“AEQs”)\(^2\). It will be equipped to carry a complement of 150 passengers and crew. The vessel capacity has been determined based on historical utilization and forecast growth rates for traffic demand derived by Urban Futures in its 2012 report (see Appendix 4).

The Project also includes the construction of two new berths – one at the Buckley Bay terminal and the other at the Denman Island West terminal – as well as the expansion of the Denman Island West terminal to incorporate a vehicle holding compound and general reconfiguration of the shore side terminal. The existing berths will be retained for conventional ferry use. Some modification of the existing Denman Island West trestle will also be required to integrate into the new berth arrangement. BC Ferries’ terminal concept uses overwater docks in lieu of the more typical beach/ramp configurations of other cable ferry operations. This concept is expected to be advantageous for high tidal range with less environmental impact.

**Service Reliability**
Pursuant to the guidelines established by the Commissioner, this Application is made within the context of the service level requirements set out in the current CFSC. While it is expected that changes to the service profile may be made by the provincial government upon finalization of its long term vision for coastal ferry services, until such changes are made, the Company must plan based on the service profile as set out in the current CFSC. The cable ferry service will meet and exceed the service

\(^2\) One AEQ is defined as 5.34 metres length by 2.60 metres width (minimum).
requirements of the CFSC. It should be noted that the cable ferry service will also meet the service requirements contemplated by the provincial government in its recent public engagement process, and that the business case remains solid, even with the contemplated reductions in service for Route 21.

The cable ferry has been designed to provide a comparable level of service to that now provided by the Quinitsa. Extensive dynamic analysis (physical modelling and computer simulation) has validated the design. BC Ferries expects there to be minimal weather related disruption with the cable ferry, with it being expected that there will be five sailings per year (0.04 percent) on average that may be cancelled due to adverse weather conditions. It should be noted that this is much better projected service availability compared to the three year average weather-related cancellation rate of 0.32 percent for the rest of the routes (excluding all Northern routes as they have an even higher weather-related cancellation rate).

To ensure added assurance of its ability to deliver the required service under the CFSC, the Company will leave the marine infrastructure in place that currently exists for the conventional service for the remainder of its useful life (approximately 20 years for Buckley Bay and seven to 10 years for Denman Island West) after the cable ferry enters service. This will enable the Company to provide conventional ferry service in the very unlikely event of a prolonged disruption in the cable ferry service.

**Emergency Service**

The cable ferry will be equipped with a rescue craft for person overboard incidents or to respond to marine rescues. The current after-hours call-out capability will continue to be provided in the event of a medical emergency on Denman Island requiring an ambulance run during non-operational hours.

**Service Improvements**

The Project will improve service in the following key areas:

- Refit drydocking and maintenance period once every 10 years as compared to once every four years currently for the Quinitsa;
- Modern fire suppression technology (hi-fog and remote operated fire monitors) which provide for instantaneous firefighting capabilities in the machinery spaces, passenger accommodations and on the vehicle deck;
- Two lane offloading with future two lane loading possibilities at both terminals;
- Faster loading and unloading for vehicles and foot passengers;
- Gated pet area on board;
• Covered and uncovered outside seating;
• Greater disabled accessibility;
• Modern marine ramps and pontoons;
• Simple and efficient equipment with reduced maintenance requirements;
• Enhanced security with cameras; and
• Expanded Denman Island West terminal - more efficient, more parking and a proper traffic lane for passenger drop off.

**Business Case**
The business case for the Project presents a compelling reason to proceed with a cable ferry service. From a capital cost perspective, the cable ferry system is significantly less expensive than a conventional ferry system due to less complexity in the design of the vessel. As well, significant savings are expected in operating a cable ferry. Labour and fuel costs are each expected to be approximately half of those incurred for a conventional ferry. Maintenance costs will also be significantly less. Assuming a 2 percent annual inflation factor, average annual maintenance costs for the cable ferry will be $0.3 million, compared to $1.2 million for the current service. The difference is mainly due to the cable ferry having significantly fewer and simpler systems to maintain than the conventional vessel, and the drydocking of the cable ferry only once every 10 years, compared to once every four years for the current vessel. When these savings are combined, they more than offset the required capital cost to perform the modifications necessary at the two terminals to support the cable ferry. Overall, assuming a 2 percent annual inflation factor, the Project is expected to generate average annual savings of $2.8 million over the 40 year life of the cable ferry ($1.9 million per annum on average, assuming no inflation) or $27.8 million on a net present value (“NPV”) basis ($18.4 million assuming no inflation). These savings will have a positive impact in terms of helping to keep fares affordable for all customers across the ferry system. Reduced fuel consumption will result in the added benefit of reduced greenhouse emissions.

**Regulatory Approvals**
The potential environmental impacts of the Project have been considered and all associated regulatory approvals required to continue to move the Project forward towards implementation have been received. An extensive environmental assessment for modifications to the Buckley Bay and Denman Island West terminals and the new construction to support the proposed cable ferry service was completed in 2010 for an application under the *Canadian Environmental Assessment Act*. The environmental assessment concluded that not only will the cable ferry service not have adverse environmental impacts, it is expected to have positive environmental impacts due to
reduced fuel consumption, lower air and water emissions, reduced waste generation and reduced noise. BC Ferries conducted extensive stakeholder consultation as part of this application, including consultations with customers of Route 21, First Nations and Baynes Sound user groups (see Appendix 6). The application was reviewed by and received the approval of the required federal and provincial regulatory bodies, specifically:

- The Department of Fisheries and Oceans approved the cable ferry under the *Canadian Environmental Assessment Act*;
- Transport Canada approved the cable ferry under the *Navigable Waters Protection Act*; and
- The provincial Land Management Branch granted the Licence of Occupation for the cable ferry service.

BC Ferries will apply to Transport Canada to determine the crewing level once the vessel has been built and inspected. BC Ferries has made a commitment that the cable ferry will operate with a minimum of three (half the present crew of the *Quinitsa*) or the level determined by Transport Canada, whichever is greater.

**Public and Stakeholder Consultation**

BC Ferries has conducted extensive public and stakeholder consultation and engagement with respect to the Project, and has listened carefully to input provided. This is evidenced by several changes to the Project and other commitments made by the Company, including:

- Engineering the Project to provide an equivalent standard of weather-related service reliability as is provided by the existing vessel, even though this standard exceeds both the requirements of the CFSC and the standard generally available to all other routes in the coastal ferry system;
- Committing to maintaining a crew level that is higher than that of other cable ferry operations in Canada;
- Committing to home-porting the vessel on Denman Island, foregoing potential staffing efficiencies of home-porting the vessel in Buckley Bay; and
• Committing to having the Company operate the cable ferry, thus not further pursuing operating efficiencies that may have been available from an alternative service provider.

More information on the public and stakeholder consultation process conducted by BC Ferries in respect of the Project is contained in Appendix 6.

**Timeline**

The timeline for the Project is described in section 4.1. The target in-service date for the cable ferry service is spring / summer 2015. BC Ferries plans to have the terminals and berthing systems installed, tested and fit with cables, ahead of vessel delivery. Vessel delivery is planned to follow approximately three months in advance of the in-service date in order to enable comprehensive integrated systems trials and testing. As well, during this period the Company will undertake crew training and other activities necessary to ensure the cable ferry’s successful entry into service.
Section 3 – Analysis of Options

3.1 Options Analysed

BC Ferries has analysed the following options for Route 21:

- Option 1: Conventional Ferry Service (Status Quo)
- Option 2: Cable Ferry Service

The analysis includes an annual escalation for inflation of 2 percent applied to all capital and operating costs. A discount rate of 7 percent has been used for NPV analysis.

The options are discussed below.

3.2 Option 1: Conventional Ferry Service (Status Quo)

This option involves continuing to provide conventional ferry service on Route 21 with the Quintsa and upgrading berth and terminal infrastructure, as well as expanding the holding compound at the Denman Island West terminal. This option also includes the acquisition of a new Minor Route vessel with vehicle capacity of 30 - 40 AEQs. This vessel acquisition is required as a result of the Quintsa not being available for redeployment and the need, therefore, to replace an existing Minor Route vessel by fiscal 2016.

Vessel Acquisition Costs

The cost estimate for the Minor Route replacement vessel was derived from a study conducted for BC Ferries by STX Canada Marine ("STXM") and validated using recent shipyard pricing for similar vessels constructed in the Pacific Northwest for inter-island service in Alaska. The capital cost estimate is based on a 30 AEQ vessel configured similar to the Quadra Queen II and Tachek, and assumes the purchase of a new vessel at current fair market value as identified by STXM.

Berth and Terminal Upgrades

This option includes berth and terminal upgrades at the Denman Island West terminal comprising the following:

- trestle life extension - fiscal 2015;
- replacement of marine structures - fiscal 2023;
• expansion of vehicle holding compound to accommodate 50 AEQs (similar in scope to that envisaged under Option 2) - fiscal 2023; and
• dolphin replacement – fiscal 2033.

The capital costs for the berth and terminal upgrades have been derived by BC Ferries’ terminal engineering staff based on condition surveys of existing infrastructure and the Company’s decades of experience in terminal asset management.

**Operating Costs**

This option reflects the current operating costs for Route 21 using the Quinitsa. These costs exceed those projected for the cable ferry service due, primarily, to the higher crew complement, greater fuel consumption and higher refit and maintenance costs associated with the continued operation of the Quinitsa as compared to a cable ferry.

**Project Costs and NPV**

Total Project costs for this option are estimated as follows:

<table>
<thead>
<tr>
<th>Option 1: Conventional Ferry Service (Status Quo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Cost (including IDC):</td>
</tr>
<tr>
<td>$&lt;&gt; Million</td>
</tr>
<tr>
<td>40-Year NPV:</td>
</tr>
<tr>
<td>-$95.82 Million</td>
</tr>
</tbody>
</table>

### 3.3 Option 2: Cable Ferry Service

This option involves procuring a cable ferry, converting the terminals at Buckley Bay and Denman Island West to accommodate the cable ferry and expanding the vehicle holding compound at the Denman Island West terminal. Under this option, the Quinitsa would be redeployed as a refit relief vessel for a number of the Minor Routes, enabling the retirement of an existing Minor Route vessel without replacement in fiscal 2016.

**Vessel Configuration and Capacity**

The cable ferry will be an open deck vehicle ferry using a traction cable system. It will be capable of transporting 50 AEQs and have a maximum complement of 150 passengers and crew.

Vessel bulwarks and gates will be configured to accept vehicle and passenger aprons (ramps) from a floating pontoon at each berth. The drive system will be sized in concurrence with conventional design practice and will be based on one main drive
cable and two guide cables of a common size that can normally be exchanged without service interruption.

A diesel-hydraulic\(^3\) motor driven bull-wheel drive system will propel the vessel. This propulsion arrangement is the first such drive system for BC Ferries and reflects the Company's continued focus on innovation and efficiency. The hydraulic drive system is expected to be far more fuel efficient than a conventional drive which uses propellers or thrusters. Instead of running four main engines and one generator, the cable ferry will run on one prime mover driving both the hydraulic power pack and the generator. A reduction in fuel burn from the current rate of over 27,000 litres per month to less than 14,000 litres per month is expected with the introduction of the cable ferry. Assuming a 2 percent annual inflation factor, this equates to average annual operating cost savings of over $247,000, or approximately $9.9 million over the forty year designed lifespan of the cable ferry system.

At this time, the increased capital cost to fully implement liquefied natural gas ("LNG") (single or dual fuel) propulsion does not have payback and will not be implemented. The cable ferry will, however, be fitted for the potential adoption of compressed or LNG in the future. While this design feature may add to the initial capital cost, it will enable the Company to more easily, and at lower cost, convert to LNG should such conversion ultimately prove advantageous. Retrofitting the vessel at a later time to be able to adapt to LNG, without these initial provisions, would be a much more expensive undertaking due to the extensive modifications that would be required.

The arrangement of the cable ferry will result in a vessel that is less costly to build and maintain, as well as potentially be safer for the crew. The propulsion machinery requires considerably less space than a conventional ferry and is able to be located above the main deck. This will improve access to machinery for maintenance and will also result in no crew being stationed below the main deck, which is safer.

Appendix 7 provides more information on the design and operational characteristics of the vessel.

**Vessel Acquisition Costs**

The cost estimate for the vessel was derived from firm bid prices provided by the three shipyard respondents to the RFP, which was a competitive, international tendering process (see section 4.1 for information on the procurement process).

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\(^3\) Propulsion will be by diesel-hydraulic. Diesel-mechanical and diesel electric were considered but ruled out based on findings from the Power Trade Off Study prepared by KPFF and EBDG.
Berth and Terminal Upgrades
The Project includes the construction of new berths at Buckley Bay and Denman Island West. The existing berths will remain operational during the construction of the new berths and for the remainder of their useful lives (approximately 20 years for Buckley Bay and seven to 10 years for Denman Island West).

The terminals at Buckley Bay and Denman Island West will also be upgraded. The Buckley Bay terminal will be upgraded with two exit lanes and safer foot passenger paths. The Denman Island West terminal will also be upgraded with two lane off-loading as well as a full compound expansion to accommodate 50 AEQs. Some modification of the existing Denman Island West trestle will also be required to integrate into the new berth arrangement.

The estimated capital costs for the berth and terminal upgrades have been derived from detailed engineering work conducted by third party consultants and their subcontracted engineering firms. It is based on the finalized designs and current terminal construction data and contractor rates.

Operating Costs
Operating costs for this option assume that the cable ferry will be significantly more fuel and labour efficient than the Quintissa, and that refit and vessel maintenance costs will be lower. Assuming an annual inflation factor of 2 percent, average annual operating costs are approximately $2.8 million less than under the status quo (Option 1), with no compromise in terms of safety or reliability of service.

Project Costs and NPV
Total Project costs for this option are estimated as follows:

<table>
<thead>
<tr>
<th>Option 1: Cable Ferry Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Cost (including IDC): $&lt;&gt; Million</td>
</tr>
<tr>
<td>40-Year NPV: -$68.05 Million</td>
</tr>
</tbody>
</table>

3.4 Preferred Option

Option 2, involving the implementation of a cable ferry system for Route 21, has an NPV advantage of $27.76 million over the status quo (Option 1) and is preferred by BC Ferries.
3.5 **Price Cap Implications of Preferred Option**

BC Ferries modeled two sets of scenarios to determine the price cap impact of the Project. The first set involved analyzing the impact that the Project had on PT3 price caps as it was modeled for the Company’s PT3 submission to the Commissioner. This addresses what the impact of the cable ferry alternative was on the PT3 price caps. The second set involved analyzing the forward-looking impact on the Performance Term Four (“PT4”) price caps of the most up-to-date business case for the Project.

In both the PT3 and PT4 scenarios, it was assumed that all other material elements, such as ridership, would remain the same in both options. In both sets of analyses the cable ferry alternative (Option 2) resulted in lower average annual price cap increases for the ferry system. The results indicate that the price cap increases for PT3 were 7 basis points lower than they would have otherwise been if the cable ferry alternative had not been included in the PT3 submission. In addition, the PT4 price caps are approximately 10 basis points lower when a cable ferry is assumed. That equates to a system-wide price cap as of fiscal 2020 being about 1 percent (90 basis points) lower under the cable ferry option (Option 2) than under the conventional ferry option (Option 1).

3.6 **Scenarios for Reducing Capital Expenditures**

BC Ferries believes that the proposed capital expenditure for the Project is reasonable and prudent, taking into account the results of extensive consultation with stakeholders. There are no obvious opportunities to reduce the proposed capital expenditure without a significant impact on the scope of the Project.

To achieve capital cost savings in the order of 10 percent, terminal and cable ferry systems would need to be significantly de-engineered. In addition to not addressing concerns of stakeholders, this would require significant delays in the Project, and would require foregoing the benefits that the Company feels are appropriate, given this is the first cable ferry in its fleet.

Capital cost savings in the order of 20 percent would not be achievable.
3.7 Pre-Application Capital Expenditures

To the date of this Application, approximately $<> million has been spent on the Project, and the estimated additional expenditures required to complete the Project total $<> million.

3.8 Ancillary Services

Due to the short duration of the Route 21 sailing time (approximately 10 minutes), there are no catering, retail or other ancillary services provided, and, therefore, no requirement for incremental crew to support the provision of such services.
Section 4 – Procurement and Risk

4.1 Procurement

Alternative Service Delivery Initiative
An alternative service delivery initiative was undertaken by the Company in an effort to determine if savings could be realized through the involvement of an alternative service provider in the Project. As described previously, significant opposition to this concept was expressed by the local communities and the BCFMWU. The Company tested the market in 2012 through a RFP process to determine if another operator under contract to BC Ferries could provide the cable ferry service to a similar level of safety and quality, at a lower cost. The results of the first phase of the process did not support the case to move forward with an alternative service provider to "design, build, acquire and operate" the service. In view of the stakeholder concerns about involving an alternative service provider in the Project, the Company agreed to forego investigating the potential opportunity to realize savings through issuance of an "operate only" RFP and committed to operating the service itself.

Consideration of Used Vessels
BC Ferries actively monitors the market for used vessels. Several international ship brokers routinely advise BC Ferries of used vessels available for purchase. In the case of the cable ferry, used vessels were not considered a cost effective option due to the relative simplicity of a new build, isolation of any existing cable ferry routes, and the relatively large vehicle capacity required of this vessel. Conversion of a conventional ferry was briefly investigated when the Albion ferries became surplus, but this too was discarded as not being cost effective.

Procurement of Integrated Cable Ferry System
Governance
The Company has in place a Vessel Replacement Program Steering Committee chaired by the Executive Vice President & Chief Financial Officer, with membership that comprises the Operational Vice Presidents and senior technical and operational staff. The Committee is supported, as required, by external experts. All significant procurement activities with respect to the Project are undertaken under the auspices of this Committee. The Committee reports to the Executive Management Committee, which in turn reports to the Board of Directors.
Project Design

BC Ferries engaged KPFF Consulting Engineers (“KPFF”) to design the integrated cable ferry system, including engineering, tender and management services for the vessel, terminal, marine infrastructure, as well as the cable design. E.Y.E. Marine Consultants (“E.Y.E.”), along with Elliott Bay Design Group (“EBDG”), were engaged as subcontractors to the lead design agent, KPFF, to design the cable ferry. McElhanney Consulting, PBA Engineering, and Thurber Engineering were engaged as subcontractors to KPFF to design the berths and terminal upgrades.

Vessel Acquisition

Acquisition of the cable ferry entails a “build-only” procurement process. A detailed design package for the vessel developed by KPFF was included in the RFP for the construction of the cable ferry. The package has been class-approved by Lloyd’s Register Canada Ltd., which is also acting as the delegated authority on behalf of Transport Canada on all technical matters (with the exception of safe manning). The selected shipyard will be fully responsible for the construction of the cable ferry and the installation/outfitting of all equipment, including the bull-wheel and cable drive system, and for delivery of the vessel to the service location.

BC Ferries has followed best practices in vessel procurement and has structured the procurement process for the cable ferry as follows:

- Request for Expressions of Interest (“RFEOI”)
  A RFEOI for the construction of the cable ferry was issued to leading shipyards in Canada and around the world on February 22, 2013. Principal among the objectives of the RFEOI was to identify shipyard interest in and available capacity to undertake the construction of the vessel within the timeframe envisaged. The RFEOI was sent to 22 shipyards. Responses were received from 16 shipyards. Of the 16 shipyards that responded, 10 expressed interest in participating in the tendering process, while six shipyards specifically declined the invitation.

- Request for Pre-Qualifications (“RFQP”)
  A RFPQ was issued on May 2, 2013 to the 10 shipyards identified through the RFEOI process. The intent of the RFPQ was to shortlist qualified shipyards or marine contractors who were prepared to present BC Ferries with “build-only” proposals for the construction of the cable ferry. Five shipyards responded to the RFPQ and of those three were selected to proceed to the RFP stage.
• Request for Proposals
  
  A RFP was issued on September 13, 2013 to three shipyards identified through the RFPQ process. Proposals were received from the three shipyards and evaluated by an internal BC Ferries team comprised of senior technical, operational and legal staff with support by external experts. The evaluation is complete and the award of the contract to the selected proponent has been approved by the Board of Directors.

Subject to the approval of this Application, the next stage in the vessel procurement process is the execution of a shipyard contract with the selected proponent.

Berth Construction and Terminal Upgrades

The construction of the two berths and the upgrading of the terminals is also a "build-only" procurement process. A detailed design package for each terminal developed by KPFF was included in the RFP. The selected contractor will be fully responsible for the construction of the berths and terminal upgrades, including the installation/outfitting of all equipment.

BC Ferries has followed best practices in terminal construction and has structured the open tendering process for the terminals as follows:

Request for Proposals

Two RFPs were placed on the internet under BC Ferries’ business opportunities web page with possible proponents updated through a tender notifications system. The RFP for the concrete pontoons was posted on November 22, 2013 and the RFP for the terminal upgrades and berth infrastructure on December 3, 2013. The RFP for the pontoons drew interest from seven contractors and potential subcontractors, and will close January 28, 2014. Nineteen contractors and potential subcontractors requested RFP packages for the terminals set to close February 13, 2014. Once the bids close, the packages will be reviewed by an internal BC Ferries team comprised of senior technical, operational and legal staff with support by external experts from KPFF. The award of the contracts to the selected proponents will first be approved by the President and CEO.

Subject to the approval of this Application, the next stage in the terminal construction process is the execution of the construction contracts with the selected proponent(s).
Equipment to be Supplied by BC Ferries

BC Ferries will supply cables and cable equipment, as well as CCTV cameras and other information technology supplies and equipment for the Project.

In-Service Date

<table>
<thead>
<tr>
<th>Vessel Construction</th>
<th>Vessel Delivery, Training, Integration</th>
<th>In-Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cable Ferry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Finish</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construction</th>
<th>Integration</th>
<th>In-Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buckley Bay and Denman Island West Terminals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Finish</td>
<td></td>
</tr>
</tbody>
</table>

As described previously in this Application, implementing the cable ferry service will enable the Company to redeploy the *Quinitsa* as a refit relief vessel for a number of the Minor Routes, thereby enabling the retirement of another vessel in the fleet without replacement. The target in-service date for the Project of spring / summer 2015 reflects the timing for various fleet redeployments that will be required in response to the planned retirement of the *North Island Princess* at the end of its service life later in that year. The *North Island Princess* will be replaced on the route connecting Powell River with Texada Island (“Route 18”) by either the life extended *Tachek* (in turn to be replaced on the route connecting Cortes Island with Quadra Island (“Route 24”) by a life extended *Tenaka*) or by a purpose-built new vessel for Route 18. This decision will be the subject of a separate application under section 55 (2) of the CFA in due course.

The in-service date reflects information obtained from the procurement process, specifically the responses to BC Ferries’ RFP for the construction of the cable ferry. The three shipyards that responded to the RFP all provided proposed schedules for building the cable ferry to BC Ferries’ specified design. A build time of approximately twelve months from contract award was indicated by all respondents. Concurrently, the planned introduction of the new terminals and supporting systems at Buckley Bay
and Denman Island, on a separate tender process, are planned to be completed in approximately ten months. The two new terminals are planned to be completed and ready for the introduction of the cable ferry in winter 2015. At that time, a rigorous BC Ferries test and trials agenda will be undertaken to ensure that the cable ferry system is ready for service in the spring/summer of 2015. The exact in-service date will be based on contract signing and the contracted delivery schedule of the long lead item, which is the vessel, which in turn is subject to the results of this Application.

**Consequences of In-Service Date Delays**

A delay in the in-service date for the cable ferry system will result in the loss of flexibility to deploy fleet assets to other locations, and the inability to realize the maximum projected savings from implementation of the Project.

In addition, were a delay in the Project to extend beyond the timeframe that the *Quinisqa* will be available for operation on Route 21 (i.e. until April 2016), this could result in a service disruption, given the Company may not have another vessel available for redeployment.

### 4.2 Risk Identification and Mitigation

While a cable ferry system will be new to the operations of BC Ferries, the technology is established and proven. Cable ferries are in service in Canada and worldwide in both salt water and freshwater applications. In terms of distance, the Route 21 cable ferry, at 1.9 kilometres, will likely be one of the longest cable ferry operations in the world by about 300 metres. The ferry itself is also considered large by cable ferry standards. When considering these two design elements together, it can be argued that BC Ferries is advancing the current state of art in cable ferry operations. In recognition of this, the Company has undertaken extensive research and analysis to confirm the technical, operational and financial viability of the cable ferry, as well as reasonably mitigated the risks. The Company has been studying the Project since 2008 and has engaged numerous independent engineering and naval architectural firms, as well as environmental consultants and other independent experts to ensure that it has thoroughly reviewed all areas of the Project (see Appendix 3). In fact, as noted, the Company believes it has likely done more “due diligence” on the Project than was done for the other 65 cable ferries currently operating in Canada combined.

An overview of the key risks to the Project, together with BC Ferries’ mitigation strategies, is provided below.
Operating and Deployment Risks

Environmental Conditions

BC Ferries has conducted extensive wind, wave and current analyses in order to properly define the operability limits for the cable ferry and to ensure reliability of the service. In this case, wind data is particularly critical due to the fact that the wave conditions are almost entirely generated by the local wind. The sheltered configuration of Baynes Sound means that there is minimal fetch or exposure to swells generated out of the area.

BC Ferries collected wind, current and wave data over several months in both the spring 2008/winter 2009 and the fall/winter of 2012 at the location of the ferry route. This data was used to develop and validate correlations with the long term statistical databases from several of the local weather stations. The data is not used to identify statistical extreme values, but to develop the probability of occurrence of any particular combinations of wind speed and direction and wave conditions. The overall analysis did allow for the prediction of the one year, 50 year and 100 year wind, wave and current data with a high degree of certainty. The extreme values of the 100 year wave, current, and a 55 knot sustained wind (greater than the predicted 100 year wind) formed the design parameters for the cable ferry in order to emulate the service reliability of the Quinitso, a key issue raised by stakeholders during the Company’s extensive public consultation on the Project.

Winds vary in different areas. While the analysis BC Ferries undertook also looked at the Comox Airport, Chrome Island, and other nearby locations, the cable ferry will be operating in the confines of Baynes Sound. The average sustained wind speeds at Buckley Bay and Denman West were found to be 60 percent of the wind speed at Comox, which provided the best correlation to the local Baynes Sound data set collected at each terminal. The mid-channel wind speeds were increased by 20 percent above those measured at the terminals to eliminate any land effect. A long term data set was then developed from the correlation with Comox airport, which has over 53 years of data, comprising almost 525,000 observations.

The overall weather analysis confirmed that the conditions in Baynes Sound are suitable for cable ferry operation. Simply put, Baynes Sound has much reduced 100 year extreme values in comparison with Lambert Channel or other areas of Georgia Strait, largely due to the exclusion of fetch-driven wave conditions as well as reduced local wind conditions. The environmental conditions are thus similar to those encountered by other cable ferry operations in British Columbia and other parts of
Canada, with the added benefit that there are no sea or river ice conditions to be encountered.

**Vessel Design**

BC Ferries engaged KPFF as the lead company to manage the overall integration of the cable ferry system, which includes the vessel, terminal and marine infrastructure as well as the cable design.

KPFF subcontracted with E.Y.E. and EBDG to design the cable ferry. The vessel has been designed to carry 50 AEQs, including a proportion for commercial traffic. As cable ferries are lighter than conventional ferries, a shallow draft low resistance hull will be adopted, which provides excellent stability and carrying capacity for minimal power. This type of hull is suited to the generally benign conditions in Baynes Sound, where only the most severe wave conditions will initiate vessel motion that will result in a transition to heavy weather precautions. In the infrequent event that weather conditions exceed safe operating conditions in terms of vessel motion and/or cable capacity, operations would be suspended until conditions improved. This is a standard safety operating procedure that is applicable to all BC Ferries vessels and all routes. As is described elsewhere in this filing, the analyses indicate that the probability of service cancellation is extremely low.

BC Ferries engaged E.Y.E., along with Oceanic Consulting and Dynamic Systems Analysis ("DSA"), for the provision of wind tunnel testing, computational fluid dynamics ("CFD") analysis and hydrodynamic model testing. The design validation process consisted of checking weights, intact stability, and damaged stability against regulatory standards. A preliminary bulkhead arrangement was determined to confirm that floodable length standards were met. Structural calculations were performed to confirm that the weights and longitudinal strength were acceptable. Finally a preliminary resistance calculation was prepared to confirm that service demands and speed requirements would be met. The motion characteristics of the ferry were modelled using extreme wave conditions by physical and numerical methods; the results were used to identify operability limits from the available wave data sets, resulting in 99.96 percent availability described above. All of the validation work confirmed that the ferry exceeds regulatory standards and will result in a safe and seaworthy vessel.

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4 All preliminary vessel data prepared during the dynamic analysis was updated and validated during the detail design stage and submitted to Lloyd’s Register Canada Ltd. for review and approval.
Despite the unique position of the cable ferry in the BC Ferries fleet, where possible, the components for the ferry have been specified to be in common with other BC Ferries minor vessels (standardization), with local support. In addition, the machinery has been designed in modular units, for rapid change out during the overnight layover. Finally, where practical, a high level of redundancy has been specified, most notably in the form of two main engines, one of which will always be a stand-by unit while the other drives the ferry.

*Diameter of Cable*

The three cables will be 1 5/8 inches in diameter. The cable loads were modeled using an advanced time-domain simulation by DSA that simulated the transit of the ferry across Baynes Sound in various weather conditions including the 100 year storm and 55 knot sustained winds, with a gust spectrum. It is important to note that the 55 knot condition lies well outside the statistical bounds in the environmental data set, but was included as it is referenced in the Quinitsa heavy weather matrix and represents an anomalous short term wind event, such as may have occurred December 12, 2006.

The motion of the ferry was simulated, as was the geometry of the cable as it is lifted off the bottom during each transit. A scenario with a failed cable (two cables operating) was also modeled. It should be noted that BC Ferries does not intend to operate the ferry with two cables. This modeling was done to ensure that in the unlikely event a cable breaks, the vessel can safely return to dock so the cable can be changed.

The loads from the cables were safety factored using criteria scaled from (and exceeding) the American Petroleum Institute (“API”) offshore mooring design standard to identify the required breaking strength of the cables. These standards were applied in the absence of any equivalent design standards for ferry cables; the API standards are used worldwide in the design of large offshore oil and gas platforms. They are very stringent standards adopted by that industry to protect the safety of platform workers, billions of dollars of assets and adhere to strict environmental regulations. This analysis identified that 1 5/8 inch cable would be more than suitable, even in the event of a cable failure.

Third party professional engineers have scrutinized and signed off on the analysis and design.
Reliability of Cables

It is planned that the cables will be in service for a maximum of three years. Each cable will serve as a drive cable for one year and then be used in the guide cable position for the following two years. This is the pattern that is employed by other cable ferry operators which operate in areas exposed to moving ice floes, and operate a greater number of hours per year.

In the unlikely event a guide cable breaks, the cable ferry has “get-home” capability using the drive cable. In the unlikely event the drive cable breaks, the cable ferry has been designed with specific tug boat attachment points such that it can be towed into dock by a tug.

BC Ferries will have a robust planned and preventative maintenance program in place to further maximize the reliability of the cables and their useful life. The maintenance cycle for the drive and guide cables is such that the individual cables will be changed out prior to reaching failure. A cable condition monitoring system will be employed to gauge cable condition, and to ensure that necessary cable strength is maintained while the cables are in service.

Berths and Terminals

BC Ferries will have a robust planned and preventative maintenance program in place for the berths and terminals to enhance the reliability of the integrated system. A condition assessment program is in place to monitor condition and serviceability of all assets and associated systems.

Service Reliability

As indicated, the cable ferry will be designed to operate in up to 55 knots of sustained wind with gusts up to 80 knots. This is consistent with the heavy weather matrix for the Quinitsa. If sustained winds exceed 55 knots, service would be suspended. When sustained winds exceed 35 knots, heavy weather precautions will be initiated; this is expected to occur for 0.3 percent of sailings per year. Heavy weather precautions for the cable ferry are expected to escalate with the severity of conditions, from basic public address announcements, escalating to selective loading of vehicles and restriction of passenger access to specific areas of the vessel. BC Ferries expects service reliability for the cable ferry to be 99.96 percent, or an expected five cancelled sailings per year.
Service Guarantee

The Quinitsa will be available as the relief vessel for Route 21 until approximately April 2016 and intermittently thereafter, subject to its service commitments, in the unlikely event of a disruption in service following introduction of the cable ferry system. To provide a long term backup scenario, the Company will leave the existing marine infrastructure in place that currently supports the conventional service at both Buckley Bay and Denman Island West for the remainder of its useful life (approximately 20 years for Buckley Bay and seven to 10 years for Denman Island West) after the cable ferry enters service. As the ramps are located at the cable ferry berths (rather than on the ferry), there will be various options to provide long term refit relief, including barge service or with another suitable conventional ferry in BC Ferries’ fleet.

The implementation phase of the Project has been developed to avoid interruption of the existing service.

Safety

Cable ferries generally operate with a crew of one or two. BC Ferries will apply to Transport Canada to determine the final crew size for the cable ferry. To address local concerns about safety, and potential job loss in the communities, BC Ferries has committed to crew the vessel with a minimum complement of three, regardless of whether Transport Canada authorizes a lower crew complement. In addition, BC Ferries’ crew members will be trained to a much higher standard than is understood to be the case for crew members of other cable ferry operators in Canada.

Since the cable ferry will be crewed with less crew than the Quinitsa, the Company has addressed potential safety concerns regarding the requirement to fight a fire by fitting modern fire suppression technology such as a hi-fog water mist system and remote fire monitors through-out the cable ferry. Both these systems can be deployed instantaneously from the operating station on the car deck. The ferry will be fitted with two inflatable slide/platform systems that, in the unlikely event of an evacuation, can be deployed by one crew member, each with the capacity to carry the full complement (100 percent per slide). The Company will also equip the cable ferry with a rescue craft for any potential person overboard incidents or to respond to a marine rescue. In all cases of emergency response, the short duration of the transit must be considered.

Deployment

Once the cable ferry and associated dock modifications are ready for service, the Company plans to run months of operational and training exercises before the
integrated system is given a green light to commence service. During that timeframe, the existing ferry service provided by the Quinitsa will continue to operate. The Company will not put the cable ferry into service until it is absolutely confident that it can provide an equivalent level of service to that provided by the existing ferry.

**Financing Risks**

**Affordability**

Affordability is defined as the ability of BC Ferries to undertake the Project while adhering to its debt covenants. The Company has in place a financing plan (see below) that ensures the capital expenditures can be accommodated within the constraints of its key lending agreements. The analysis of the Project on a total cost of ownership ensures that affordability is considered based on the full life cycle costs of the Project.

**Financing Plan**

The Project will be financed, as part of the Company’s five year capital plan, from cash provided from operations and funds raised in the Canadian capital debt markets using BC Ferries’ common debt platform.

**Price Escalation**

The cost estimate for the cable ferry is derived based on pricing received from the RFP. Pricing estimates for the dock and terminal upgrades are based on estimates for the finalized detailed design supplied by KPFF and its subcontractors. While it represents the best available information at this time, final pricing will not be known until the tendering process for this work is completed. The Company has included a contingency in the Project budget to address unforeseen cost pressures.

**Construction & Delivery Risks**

**Project Management**

A project management strategy has been developed, including staffing, reporting and monitoring to address Project risks. This includes a change order process to reduce the risk of design changes being made by BC Ferries personnel without a clear understanding of the impact of those changes, thereby potentially increasing costs or creating delays in the Project.

**Cost Escalation**

The shipyard contract will reflect a fixed-price for the cable ferry. An adequate budget contingency, as proposed, will serve to mitigate the risk of unforeseen increases in
other costs. Terminals and berth costs will be finalized once the RFP pricing has been received from bidding contractors.

Performance Risk

Because of the relative simplicity of the cable ferry, it was determined that a “build-only” rather than the “design/build” contracting approach adopted in other recent BC Ferries’ vessel new building projects was preferred. This approach enabled the inclusion of shipyards and steel fabricators that may not have had capacity to execute a full design, but could offer a lower cost bid. Among other benefits, this approach served to generate competition with the larger shipyards. In the case of the terminals, both contracting approaches are used regularly by BC Ferries, but in this case it was deemed desirable to design the cable ferry and berths as an integrated system under the oversight of one lead design entity, which in this case is KPFF.

As a consequence of this contracting approach, BC Ferries assumes the majority of the performance risk on the Project. Some liability will fall on the integrated designer (KPFF) but the performance risk assumed by both the shipyard for the vessel and the contractor for the terminal construction will be restricted primarily to potential schedule and quality issues. The performance risk assumed by BC Ferries is largely mitigated by the extensive modeling and design effort conducted for the Project, and to a lesser extent by the plan review conducted by Lloyds Register Canada Ltd.

The trials phase of the Project will allow BC Ferries to function test the terminals and operate the vessel to assess whether they will meet the operating performance criteria as set out in the Statement of Operational Requirements (see Appendix 8) and Technical Statement of Requirements (see Appendix 9). At this stage, remedies in the event that performance is not satisfactory would be available from the designers and the contractors.

Insurance

At various stages during construction, BC Ferries will provide payments to the shipyard. These funds are at risk if an incident occurs before delivery that causes significant damage to the vessel. The shipyard contract will specify insurance requirements for the vessel during construction and delivery. Appropriate insurance coverage will also be required in respect of the contracts for dock and terminals modifications.
Defects
The initial deployment of a new vessel generally involves a break-in period, during which time defects are remedied to optimize operating performance, and the systems settle into normal extended daily operation. The trials process described above will serve to mitigate the risk of vessel and terminal defects at delivery and construction completion. In addition, traditional warranties will form part of the overall construction contracts. Typically this warranty will cover all major components, hull and superstructure and major operating systems for a period of time after acceptance. This should allow for the complete integrated system to be introduced into service and reach steady operational state with much of the construction risk and liability still remaining with the shipyard and contractors.

Vessel Delivery
The shipyard will be responsible for delivering the cable ferry to the service location and will bear all risks associated with the delivery.
CONCLUSION

BC Ferries respectfully requests the Commissioner's approval pursuant to 55(2) of the CFA, for capital expenditures incurred from the date of this filing of up to $<> million, including IDC, for the Route 21 Cable Ferry Project. BC Ferries submits that this major capital expenditure is reasonable, affordable, prudent, and is consistent with the Company's current five-year capital plan approved by BC Ferries' Board of Directors, and the current CFSC. The Company believes that pursuance of the Route 21 cable ferry service is in the best interests of taxpayers and fare payers given the opportunity to realize significant savings that will help keep fares across the ferry system as low as possible, without compromising the current high standard of safety and reliability of service that the communities currently receive.
Appendices

Appendix 1: Route 21 Overview
Appendix 2: BC Ferry Commission Memorandum 32
Appendix 3: Outside Expertise and Validation
Appendix 4: Urban Futures Report
Appendix 5: Customer Feedback
Appendix 6: Public and Stakeholder Consultation
Appendix 7: Design and Operational Characteristics of the Cable Ferry
Appendix 8: Statement of Operational Requirements
Appendix 9: Technical Statement of Requirements
Appendix 10: Index of Responses to Section 55 Guideline
Appendix 1: Route 21 Overview

Route 21 connects Denman Island with Buckley Bay, 20 km south of the Comox / Courtenay area on Vancouver Island. Route 21 is also used to access Vancouver Island from Hornby Island.

CORE SERVICE LEVELS

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<td>Peak</td>
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<tr>
<td>Off Peak</td>
<td>16 (15 on Sunday)</td>
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<tr>
<td>Minimum Hours of Operation</td>
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</tr>
<tr>
<td>Peak</td>
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<tr>
<td>Off Peak</td>
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ROUTE AND SERVICE DESCRIPTION

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VESSEL DESCRIPTION

Vessel

Quinitsa

Passenger Capacity (Max.)
294

Vehicle Capacity (Official)
50

Crew Size
6

TERMINAL DESCRIPTION

<table>
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<tr>
<th>Terminal</th>
<th>Buckley Bay</th>
<th>Denman West</th>
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<tbody>
<tr>
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<td>Denman Island</td>
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## CAPACITY UTILIZATION

The average of vehicle utilized capacity on Route 21 in the off-peak and peak seasons is set out below.

### Average of Vehicle Utilized Capacity (%)

#### Route 21 - Buckley Bay to Denman Island

| Season | Departure Terminal | Day   | 07:00 | 07:40 | 08:20 | 09:00 | 10:00 | 11:00 | 12:10 | 13:05 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:30 | 22:00 | 23:00 |
|--------|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| **Off Peak** | Buckley Bay | Sun   | 32.5% | 22.0% | 18.5% | 32.0% | 51.3% | 35.9% | 43.6% | 51.3% | 43.6% | 35.9% | 43.6% | 51.3% | 35.9% | 43.6% | 51.3% | 35.9% | 43.6% | 51.3% |
|         |       | Mon   | 19.5% | 21.0% | 18.1% | 30.9% | 34.4% | 27.8% | 46.3% | 37.9% | 57.7% | 57.7% | 69.4% | 61.1% | 53.6% | 42.6% | 28.8% | 19.5% | 28.8% | 19.5% |
|         |       | Tue   | 20.5% | 22.3% | 32.0% | 33.2% | 37.0% | 33.7% | 46.2% | 41.8% | 62.5% | 78.2% | 85.8% | 78.1% | 61.2% | 45.5% | 22.9% | 12.3% | 22.9% | 12.3% |
|         |       | Thu   | 32.3% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% | 32.0% |
|         |       | Fri   | 22.9% | 30.8% | 25.2% | 44.0% | 43.0% | 38.1% | 60.0% | 47.4% | 65.6% | 76.1% | 84.9% | 84.6% | 63.2% | 57.7% | 31.9% | 10.5% |       |       |
|         |       | Sat   | 13.6% | 13.9% | 66.0% | 64.5% | 70.8% | 74.9% | 80.6% | 75.7% | 69.1% | 61.8% | 61.1% | 53.4% | 50.2% | 36.8% | 22.0% | 16.9% | 9.6%  | 2.9%  |
| **Peak** | Buckley Bay | Sun   | 23.0% | 21.3% | 18.1% | 30.3% | 48.4% | 53.6% | 75.4% | 68.7% | 77.0% | 77.3% | 80.9% | 67.1% | 54.2% | 29.2% | 20.3% | 15.3% | 5.6%  |
|         |       | Mon   | 32.4% | 34.8% | 23.4% | 39.1% | 56.6% | 60.0% | 79.1% | 71.1% | 86.4% | 59.9% | 54.1% | 79.4% | 54.1% | 79.4% | 54.1% | 79.4% | 54.1% | 79.4% |
|         |       | Tue   | 36.7% | 47.2% | 21.0% | 54.7% | 59.0% | 57.2% | 74.8% | 66.3% | 86.5% | 96.2% | 79.0% | 74.0% | 64.8% | 56.6% | 22.1% | 10.4% | 9.6%  |       |
|         |       | Wed   | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% | 37.5% | 37.1% |
|         |       | Fri   | 41.5% | 32.9% | 25.5% | 47.4% | 76.4% | 79.5% | 97.9% | 93.1% | 92.6% | 97.5% | 94.0% | 89.1% | 98.6% | 75.6% | 66.4% | 47.4% | 11.7% |       |
|         |       | Sat   | 16.4% | 15.9% | 18.7% | 21.9% | 35.3% | 55.0% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% | 46.5% |
|         |       | DC    | 63.5% | 57.1% | 66.8% | 68.2% | 71.0% | 85.5% | 100.6% | 91.0% | 78.5% | 70.8% | 58.0% | 46.7% | 26.9% | 13.2% |       |       |       |       |
|         |       | Indefinite | 80%<100% |       |       |      |       |       |       |       |       |       |       |       |      |      |       |       |       |       |
|         |       | Current Indefinite | <10% |       |       |      |       |       |       |       |       |       |       |       |      |      |       |       |       |       |

#### Assumptions:
- Assumes any shuttle service that occurs after the scheduled departure will be averaged in the following departure time.
- DC - Dangerous Cargo sailings, no passengers permitted.
- All shuttle service averaged with the scheduled sailing prior to shuttle sailing.
The average of passenger utilized capacity on Route 21 in the off-peak and peak seasons is set out below.

### Average of Passenger Utilized Capacity (%)

#### Route 21 - Buckley Bay to Denman Island

| Season   | Departure Terminal | Day          | 06:40 | 07:00 | 08:20 | 09:00 | 10:00 | 11:00 | 12:10 | 13:05 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:30 | 22:00 | 23:00 |
|----------|--------------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Peak     | Buckley Bay        | Sun          | 1.6%  | 5.9%  | 4.2%  | 14.6% | 25.2% | 27.2% | 29.4% | 28.6% | 27.0% | 23.6% | 24.1% | 21.3% | 23.4% | 15.1% | 6.9%  | 3.7%  | 1.7%  |
|          |                    | Mon          | 2.9%  | 6.7%  | 5.2%  | 14.9% | 25.6% | 30.0% | 33.4% | 34.5% | 34.3% | 34.0% | 34.3% | 33.0% | 32.5% | 29.5% | 27.7% | 25.5% | 23.4% |
|          |                    | Tue          | 6.2%  | 8.8%  | 6.9%  | 13.5% | 25.9% | 30.2% | 35.3% | 33.5% | 31.3% | 26.9% | 19.4% | 17.7% | 8.1%  | 9.3%  | 6.2%  | 3.0%  |
|          |                    | Wed          | 8.3%  | 10.6% | 9.3%  | 15.7% | 22.4% | 21.0% | 25.6% | 22.5% | 29.1% | 30.4% | 24.9% | 26.2% | 20.6% | 11.2% | 16.6% | 7.1%  |
|          |                    | Thu          | 7.0%  | 10.8% | DC    | 20.0% | 21.3% | 22.8% | 23.2% | 23.6% | 31.7% | 29.7% | 26.6% | 19.1% | 14.7% | 16.6% | 9.8%  |
|          |                    | Fri          | 9.4%  | 8.5%  | 6.5%  | 14.9% | 25.6% | 30.0% | 33.4% | 34.5% | 33.5% | 32.5% | 29.5% | 27.7% | 25.5% | 23.4% | 21.3% | 18.1% | 15.5% |
|          |                    | Sat          | 4.1%  | 5.6%  | 7.3%  | 14.3% | 36.4% | 34.3% | 44.0% | 39.1% | 40.8% | 37.9% | 31.4% | 25.5% | 22.9% | 10.3% | 9.9%  | 5.7%  |
| Off Peak | Denman West        | Sun          | 4.6%  | 6.7%  | 5.2%  | 12.1% | 19.3% | 23.6% | 28.3% | 24.0% | 30.0% | 30.2% | 30.4% | 26.2% | 26.5% | 13.9% | 11.3% | 7.2%  |
|          |                    | Mon          | 5.0%  | 6.9%  | 5.5%  | 12.8% | 19.3% | 24.2% | 29.0% | 24.0% | 30.1% | 30.5% | 30.2% | 26.2% | 26.5% | 13.9% | 11.3% | 7.2%  |
|          |                    | Tue          | 8.2%  | 7.9%  | 8.7%  | 13.5% | 19.3% | 22.8% | 27.4% | 24.0% | 30.0% | 30.4% | 26.2% | 26.5% | 13.9% | 11.3% | 7.2%  |
|          |                    | Wed          | 8.4%  | 11.8% | 15.7% | 37.8% | 20.0% | 20.0% | 16.4% | 12.4% | 12.0% | 12.3% | 11.4% | 10.3% | 6.7%  | 4.0%  | 1.8%  |
|          |                    | Thu          | 5.6%  | 9.7%  | 15.9% | 23.2% | 16.6% | 15.0% | 15.4% | 13.4% | 14.4% | 11.7% | 9.0%  | 6.4%  | 4.7%  | 2.6%  | 2.3%  |
|          |                    | Fri          | 3.2%  | 3.8%  | 10.5% | 13.8% | 14.5% | 13.4% | 12.0% | 10.9% | 11.6% | 10.2% | 10.7% | 9.0%  | 4.1%  | 3.2%  | 1.6%  |

### Assumptions
- Any shuttle service that occurs after the scheduled departure time will be averaged in the following the departure time.
- DC - Dangerous Cargo sailings, no passengers permitted.
- All shuttle service averaged with the scheduled sailing prior to shuttle sailing.

---

**British Columbia Ferry Services Inc. - Coastal Ferry Act Section 55 (2) Application - Route 21 Cable Ferry Project**

(Redacted Version)  
December 20, 2013
# Route 21 Service Reliability

## Route 21 vs. BC Ferries Fleet Vessel Reliability Statistics

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<tr>
<th>Fiscal Year</th>
<th>Scheduled Core Round Trips</th>
<th>Controllable Core Round Trip Cancellations</th>
<th>Service Reliability</th>
<th>Cancellation Due to Weather, Medical and Rescues</th>
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Appendix 2: BC Ferry Commission Memorandum 32

BC Ferry Commission
MEMORANDUM 32

To: Mr. Rob Clarke
    Executive Vice President and
    Chief Financial Officer, BCFS

From: Martin Crilly
    BC Ferry Commissioner

Date: January 26, 2009

Re: Feasibility Costs and Risk for the Cable Ferry Project

This Memorandum 32 responds to your letter of January 19 on the same subject, which is attached.

I confirm the understanding set out in your letter.

Attachment:
Your letter of January 19 2009
January 19, 2009

Mr. Martin Crilly
British Columbia Ferry Commissioner
PO Box 1497
Comox, BC.
V9M 8A2

Dear Mr. Crilly:

SUBJECT: Feasibility Costs and Risk for the Cable Ferry Project

I am writing to follow up on our November 19, 2008 meeting regarding the recovery of costs for the cable ferry feasibility project.

As discussed, the project involves a material level of effort and spending to take place in PT2 in order to determine whether economic savings can be achieved for PT3 and beyond. Recognizing the risks associated with the timing implications of setting price caps in advance for four-year performance terms, British Columbia Ferry Services Inc. (BC Ferries) and the British Columbia Ferries Commissioner (Commissioner) have agreed on the following principles: If the feasibility project leads to implementation of a cable ferry, BC Ferries is entitled to recover all of its costs, including the feasibility project costs, over the associated assets’ useful lives and to earn 50% of the savings (versus the application of conventional service) during PT3; If the feasibility project does not lead to implementation of a cable ferry, BC Ferries is entitled to recover 50% of the external feasibility project costs over PT3.

Without prejudice to the principles above, the implications for accounting and price cap determination will be as follows:

1. If the feasibility project results in implementation:
   o all external feasibility costs will be capitalized thus forming part of the capital structure of the company, for which BC Ferries is entitled to make a full recovery plus earn its rate of return,
   o the minor route group price cap for PT3 will be set such that BC Ferries would effectively retain 50% of the PT3 cost savings resulting from the implementation of the cable ferry.
2. If the feasibility project does not result in implementation:
   o 50% of the external feasibility project costs will be treated as a regulatory asset to be recovered through a deferral account mechanism, with the remainder of costs being expensed at the time it is decided to not proceed with implementation of a cable ferry,
   o the deferral account balance will be recovered over the four year period of PT3 through the inclusion of these costs in determination of the PT3 price caps.

3. Prior to a determination of whether or not the project will result in implementation of a cable ferry, BC Ferries will account for the external feasibility project costs incurred as capital assets (construction-in-progress).

BC Ferries is prepared to accept the terms as outlined above, and requests confirmation of the same from the Commissioner.

Thank you.

Sincerely,

[Signature]

Rob Clarke
Executive Vice President
& Chief Financial Officer

cc: Sheldon Stoilen, Deputy Commissioner
    William Cottick, Executive Vice President Corporate Affairs & General Counsel
    Cynthia Lukaitis, Vice President & Corporate Secretary
    Sheldon Schmidt, Manager, Business and Economic Regulatory Affairs
Appendix 3: Outside Expertise and Validation

BC Ferries’ in-house engineering, operations and financial teams have been active participants in the decision to introduce the cable ferry into the BC Ferries inventory. In addition, BC Ferries engaged numerous independent engineering and naval architectural firms, as well as environmental consultants and other independent experts to ensure that it has conducted a thorough review of all areas of the Project. A list of the firms involved in the development of the Project follows.

Feasibility Studies

- Glosten Associates Inc. - Feasibility Review
- Worley Parsons Canada - Feasibility Study

Assessments and Surveys

- Golder Associates Ltd. - Environmental Assessment
- Golder Associates Ltd. - Archaeological Assessment
- Lloyd’s Register Canada Ltd. - HazID and Risk Assessment
- Oceanic Consulting Corporation – Wave Climate Assessment
- SLR Consulting (Canada) Ltd. - Marine Biophysical Survey and Environmental Assessment

Technical Studies and Consultation

- Capilano Maritime Design Ltd. – Preliminary Cost Estimate
- Capilano Maritime Design Ltd. – Propulsion Study
- Cascadia Coast Research Ltd. – Environmental Modelling and Studies
- KPFF Consulting Engineers & Elliott Bay Design Group – Vessel Cost Estimate
- KPFF Consulting Engineers & Elliott Bay Design Group - Propulsion Drive Trade-Off Study
- KPFF Consulting Engineers & Elliott Bay Design Group - Electrical Loads Analysis and Powering Alternatives
- KPFF Consulting Engineers & Elliott Bay Design Group - Electrical Loads Analysis
- KPFF Consulting Engineers & Elliott Bay Design Group - Cathodic Protection Study
- KPFF Consulting Engineers & Elliott Bay Design Group - Piping and HVAC Calculations
- Oceanic Consulting Corporation - Simulation for Modelling Cable Ferry Concept
- Oceanic Consulting Corporation - Environmental Study/Modelling
- Shauna McRanor - First Nations Consultations
- Roddan Engineering – Baynes Sound Environmental Monitoring
- SHM Marine International Inc. – Specification of Cable Parameters for Simulation Studies
Engineering and Design

- E. Y. E. Marine Consultants – Dynamic Analysis of a Cable Ferry System
- Capilano Maritime Design Ltd. – Preliminary Design and Specification
- DSA – Dynamic Systems Analysis
- KPFF Consulting Engineers – Detailed Design of Integrated Cable Ferry System
- KPFF Consulting Engineers, Elliott Bay Design Group, & E. Y. E. Marine Consultants – Cable Ferry Design
- KPFF Consulting Engineers – Terminal Structures Design
- KPFF Consulting Engineers & McElhanney Consulting Services Ltd. – Terminal Civil Design
- KPFF Consulting Engineers & PBA Engineering Ltd. – Terminal Electrical Design
- Ryzuk Geotechnical – Geotechnical Engineering

Legal

- Bernard & Partners LLP
- Borden Ladner Gervais LLP
- Curtis Davis Gerrard LLP

Regulatory and Class Approvals

- Lloyd's Register Canada Ltd.
Appendix 4: Urban Futures Report

BC Ferries Passenger Volume Modeling

Modeling Approach & Output for
Route 21: Denman Island - Buckley Bay &
Route 22: Hornby Island - Denman Island

Prepared for:

BC Ferries

by

URBAN FUTURES
Strategic Research to Manage Change

November 2012

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1 Introduction

1 Background

Future trip volumes for BC Ferries’ routes will largely be driven by two factors: demand from full-time residents of the destination communities, and demand from residents of other regions for summer travel, including part-time residents and day-trippers. Within this context, in 2008 Urban Futures was asked to develop a modeling approach to provide projections of trip volumes for 20 of BC Ferries’ smaller routes. As part of BC Ferries’ 2012 comprehensive review of its terminals, Urban Futures has been retained to provide projections for the Denman Island - Buckley Bay and Hornby Island - Denman Island routes.

The analysis has been broken down into four segments, each considering a specific aspect of future travel demand. The first segment considers round-trip passenger volumes for the Denman Island - Buckley Bay and Hornby Island - Denman Island routes. The second segment considers changes in the local population as per Canada’s 2011 Census and BC Stats’ most recent population estimates (from their P.E.O.P.L.E. 36 publication series). While the Census is conducted in May every five years, BC Stats provides annual estimates of population by age for various geographies within British Columbia. The trip volume data, when combined with the resident population data, provides a snapshot of current per capita trip volumes for the route. The third segment is the projection of long-range demographic change for the regions of interest (in this case, Denman and Hornby Islands and their parent region, the Courtenay Local Health Area, or LHA), which serves as the baseline demographic driver to future trip volumes.

Each of these three segments allows for the trip volume projections themselves to be developed. Combining current and projected per capita trip volumes with changes to the future resident population in each local geography yields estimates of future trip demand from local residents.

While the seasonality of travel is evident from the route volume data, little data exist upon which to assess the drivers of non-local demand. Non-local demand has been estimated through assessments of the variance between average low-season trip volumes (trips that are attributable to the local resident population) and

1 Unless otherwise stated, all population numbers referenced in this report are adjusted for the net Census undercount.
2 Note that while the 2011 Census counts will not be incorporated by BC Stats into their population estimates until the official 2011 undercount data are available from Statistics Canada in late 2013, the 2007 to 2011 population estimates contained in this report have been adjusted by Urban Futures to reflect the 2011 age specific Census counts for each geography.
actual monthly trip volumes as a way of measuring trips made by non-permanent residents for recreational purposes.

Combined, the assessment of resident-based demand and non-local demand results in a baseline estimate of future trip volumes. Several alternate scenarios around this baseline are provided, considering, for example, historical changes in the per capita trip volumes, and historical trends in the ratio of working aged-population to total trip volume (trips per residents aged 20 to 54).

The following document commences with a contextual discussion—namely a review of demographic trends for the province of British Columbia as a whole and the Courtenay Local Health Area—before turning to the specifics of historical and projected demographic change for the route geographies of interest. These discussions frame the demographic drivers of change that will characterize the route geographies and influence trip volumes in future years.

2 The Local Context

Demography. The latest Census indicated that Denman was home to 1,022 residents in 2011, seven percent fewer than in 2006 when there were 1,095 residents. Similarly, the Census data indicated that last year there were a total of 958 residents on Hornby, almost 11 percent fewer than were counted in the 2006 Census (1,074 residents). As a point of comparison, the Courtenay LHA was home to 63,535 residents in 2011, growing by seven percent, or by 4,045 residents, between the 2006 and 2011 Census counts.

While the two Islands saw their populations decline in the most recent Census period, the broader Health Area grew at the same rate as the province as a whole. If longer time periods are considered, significant variance in the annual rate of growth in Denman’s and Hornby’s populations rates are seen relative to both the broader Courtenay LHA and the province as a whole (Figure 1).

Following patterns of change at the broader LHA level, the late-1990s/early-2000s period was characterized by population decline on both Islands, as Denman’s population fell by five percent between 1996 and 2001 (a net loss of roughly 50 residents) and Hornby declined by four percent (40 residents). Following this period of population decline, both islands saw their populations grow as the LHA grew, regaining the population losses seen over previous years: between 2001 and 2006 Denman grew by eight percent (adding 79 new residents), and Hornby grew by 11 percent (adding 108 people). Since 2006, however, annual population growth rates on both Denman and Horny have fallen dramatically, with the islands experiencing a seven and nine percent decline in their populations, respectively. Interestingly, for both geographies the losses experienced since 2006 just about balanced the additions that were seen over the preceding five years of growth.
Housing. The latest Census also reported that Denman’s dwelling stock comprised 689 private dwellings, 518 of which (75 percent) were occupied on a permanent basis by usual residents. Another source that considers details of residential property on these islands is the annual assessment conducted by BC Assessment (BCA; data provided by Landcor Data Corporation) which describe the number, sales price, and assessed value of properties on Denman and Hornby for 2001 and 2011 (Tables 1 and 2).

Relative to the 689 private dwellings counted on the Census, the total number of residential properties on Denman Island in 2011 was 784, five percent greater than the 746 that were assessed a decade earlier (38 additional residential properties). This compares to a 21 percent growth in the number of residential properties BC-wide over the same period. Between 2001 and 2011 the assessed value of all residential real estate on Denman increased by 179 percent, from $170,705 to $476,235 (versus $469,441 in BC as a whole, where assessed values increased by 135 percent over the past decade).

Through 2011 the average sales price of all residential units that transacted in Denman (18 units) was $404,007. Compared to the average assessed value of all residential properties, the average sales price for residential properties that sold in 2011 was 18 percent lower than the average assessed value for all properties. That said, Denman’s average sale price was slightly higher than in BC as a whole, with 2011 sales prices averaging $390,153 province-wide (17 percent below assessments).

The predominant residential property type on Denman is a detached home, accounting for 78 percent of all residential properties in 2011 (versus 55 percent BC-wide). Assessed values for detached properties on the Island ($497,681) were higher than the overall average ($476,235) in 2011; similarly, the average sales price for the 10 detached properties that transacted in 2011 ($456,744) was also higher than the overall average ($404,007).

According to the 2011 Census, the total private dwelling stock on neighboring Hornby Island totalled 886 units, of which 504 were occupied on a permanent basis by usual residents (57 percent). In contrast to Denman, the latest estimates by BCA report a small loss (0.8 percent) in the number of residential properties, falling from the 1,053 units assessed in 2001 to the 1,045 in 2011 (Table 2). This also contrasts with the 21 percent growth in the number of residential properties BC-wide over the same period. Between 2001 and 2011 the assessed value of all residential real estate on Hornby increased by 190 percent, from $170,705 to $476,235, well above the 135 percent seen over the past decade BC-wide.

Through 2011 the average sales price of all residential units that transacted in Hornby (16 units) was $367,225, 21 percent below the average assessed value for all properties. That said, Hornby’s average sale price is lower than in BC as a whole, with provincial sales prices averaging $390,153 (17 percent below assessments) in 2011.

3 Note that while the Census counts physical dwellings (permanently occupied of otherwise), the data from Landcor describe residential properties, including vacant land zoned residential. As such, there is only a general correspondence between the two data sources.
The predominant residential property type on Hornby was also a detached home, accounting for 77 percent of all residential properties in 2011. In 2011, assessed values for detached properties on the Island were higher ($507,374) than the overall average ($467,670); similarly, the average sales price for the 12 detached properties that transacted in 2011, at $435,393 was also higher than the overall average ($367,225).

**Route Fares.** In addition to trends in the local population, historical changes to the routes’ fares also help to provide context for changing traffic volumes along the routes serving the islands of Denman and Hornby. For instance, fares for routes 21 & 22 rose from $8.50 in 1992 to $16.50 in 2002 (94 percent increase), and further to the current $31.90 in 2012 (93 percent increase over the fare in 2002). Over this entire period (1992 to 2012), fares for this route increased by 275 percent. Adjusting for the general price inflation in British Columbia over this period shows that real fares increased by 64 percent between 1992 and 2002, and by 62 percent between 2002 and 2012. Thus, real fares increased by 166 percent from 1992 to 2012.
II Projections of Demographic Change

As is the case for most smaller communities within BC, the future of both Denman and Hornby Island will be determined in part by their external context—namely, patterns of international, interprovincial, and intraprovincial migration— in part by its existing demography and in part by local land-use policies. Therefore, before presenting the local demographic and trip volume projections, it is important to begin by defining the context for them, specifically the scale of growth and change projected for the province as a whole and the Courtenay LHA.

1 A Growing and Changing Provincial Population

Over the past twenty five years, the rate of population growth in BC has generally exceeded that of Canada, averaging 1.8 percent annually versus the 1.1 percent seen nationally. Population growth in the province has broadly moved in tandem with provincial economic cycles and the flow of migrants into and out of the province. For example, Figure 2 shows that annual growth rates rose substantially through the late-1980s and early-1990s, peaking at 3.0 percent in 1994. This represented a period of provincial economic expansion, aided by slow economic growth in Ontario (as people moved west) and the influence of political and economic restructuring in Asia.

From the early-1990s’ peak, however, provincial population growth slowed considerably, with rates falling to below one percent per year through 2004. More recently, growth rates have trended back above one percent, reaching 1.6 percent in 2007 and 1.7 percent by 2009. The most recent estimates show that growth rates have again moderated, falling back towards 1.2 percent in 2011. This more recent pattern of change has been influenced by changing global economic conditions, as growth in BC’s gross domestic product (GDP) fell from 4.1 percent in 2006 to a contraction of 2.1 percent in 2009, the result of the global banking crisis.

In looking forward, historical trends (both long-term and more recent ones) point towards a relatively stable total fertility rate, continued increases in life expectancy (albeit at a slowing rate), and increasing net migration to the province in
the coming years. Annual additions from net migration are expected to increase back towards an average of 60,000 people per annum over the coming 25 years (Figure 3). By the end of 2028, net migration will become the sole driver to population growth in the province, as natural increase (the annual difference between births and deaths) will become natural decrease at this time, with BC’s population generating more deaths than births each year afterwards.

These trends, along with the aging of the province’s current residents, would see BC grow from 4.6 million people today (2011) to 5.2 million by 2021, and further to 6.2 million by 2036, representing 34 percent growth over the next 25 years (Figure 2). On average, an estimated 65,000 net new residents would be added to the provincial population each year, close to the 62,200 that were added annually over the past 25 years.

While annual additions are expected to be in the same range as those seen historically, the coming two-and-a-half decades will be characterized by a substantial increase in the size of the province’s older population, as roughly one-third of BC’s population is currently between the ages of 46 and 65. That being said, the youthful profile of migrants to the province will have a significant impact on BC’s younger age groups, which are projected to grow more rapidly than at the national level. For example, Figure 4 shows that relative to the 34 percent growth projected for BC’s population as a whole (versus 24 percent nationally), the under-15 age group is expected to grow by 24 percent (18 percent Canada-wide), the 15 to 24 population by seven percent provincially (six percent nationally), and the 25 to 34 population by 13 percent (only four percent nationally).

The most senior age groups would experience the greatest absolute and relative growth between 2011 and 2036. The 65-plus age groups in BC will grow significantly faster than the population as a whole, with the 65 to 74 group increasing by 87 percent, the 75 to 84 group by 134 percent, and the 85-plus group by 132 percent. As such, a significant shift in the province’s demography will be seen in the coming years, in large part driven by the aging of BC’s 4.6 million residents—1.3 million of whom are currently between the ages of 46 and 65.

### 2 Historical Population Change in the Courtenay Local Health Area

Over the past twenty-five years the Courtenay LHA’s population has grown from 38,798 people in 1986, to 56,914 in 1996, and further to 65,147 residents by 2011 (Figure 5). As mentioned in the Introduction, the LHA’s population growth rate has demonstrated several distinct cycles of growth and decline over the years. Influenced by provincial economic trends, Courtenay experienced high levels of growth in the early- to mid-1990s before contracting through the late-1990s and into 2000. A second period of growth (although more moderate than the previous one) was seen from 2001 to 2008. After a period of diminished growth in 2009 and 2010, the Health Area’s growth rate started to recover, reaching 1.4 percent in 2011.
As was seen for BC as a whole, the Courtenay LHA has experienced significant changes in the composition of its resident population. Over the past two and a half decades, the LHA’s age profile has been dominated by the aging and growth of the baby boom generation (Figure 6, left pane). In 1986 over 32 percent of the Health Area’s population were between the ages of 21 and 40 (the baby boom cohort; those born between 1946 and 1965). The 2011 age profile clearly shows how the aging and growth of the boom generation has impacted the composition of the population living in the Courtenay LHA, with those aged 46 to 65 now making up over 33 percent of the population.

With the typical baby boomer having aged twenty-five years over this period, the LHA’s most typical resident in 2011 was 64 years old; this compares to a typical age of 48 in the province as a whole.

Contrasting the Health Area’s age profile with the provincial one (Figure 6, right pane) highlights the fact that Courtenay’s population is older than in BC as a whole. People aged 45 and over, for example, accounted for 54 percent of the population in the LHA in 2011, versus only 45 percent provincially. The distinct “waist” seen in the profile—between the ages of 20 and 45—highlights the dearth of people of working-age in the LHA (27 percent versus 36 percent provincially).

This highlights the reality that the Courtenay LHA is, and has been for many years, a destination for relatively older migrants, as the absolute size of the post-War baby boom cohort has grown significantly in the LHA (from 12,473 people between the ages of 21 and 40 in 1986 to 21,638 between the ages of 46 and 65 in 2011). Figure 6 also points towards relatively low levels of migration into the Health Area of those in the early stages of their working careers, as there have not been enough migrants in the 25 to 30 age group to fill in for the boomers as they have aged.
3 Projected Population Change in the Courtenay Local Health Area

While migration has played a prominent role in demographic change in the Courtenay LHA historically, it will play an even more significant role in the coming years. Since 1986, net migration has generally added people to the LHA’s population (with the exception of the period from 1998 to 2002). It is important to again note the cyclical pattern inherent in the migration data. Looking back to Figures 1 and 5, migration trends were reflected in the overall growth rates for the LHA: the increase in net migration in 1994 drove the population growth rate upwards, as 3,195 people moved into the Health Area on the heels of BC’s strong economic performance at the time. This inflow resulted in the 6.8 percent population growth seen in Courtenay in that year. Conversely, the loss of 863 people in 2000 corresponded with a population that contracted by 1.4 percent.

BC Stats’ projection is for net migration to continue to increase steadily in the coming years, adding an average of 1,290 people annually over the course of the projection period (Figure 7). This is above the average of 970 people added per year through net migration between 1986 and 2011.

As mentioned earlier, the other driver of population growth is natural increase, which added an average of 197 people to the Courtenay LHA each year between 1986 and 2001. However, since 2001, natural increase has generally been negative (referred to as natural decrease: more deaths in the population than births), and has thus began taking away more people away from the LHA than it has added to it. This has been the result of three factors: first, relatively low fertility rates; second, the aging of the bulk of the Health Area’s population out of the prime family-formation stage of the lifecycle; and finally, the lower levels of migration to the LHA that served to mitigate growth in the age groups typically associated with childbearing. A growing proportion of Courtenay’s population has also been aging into higher mortality stages of the lifecycle, thereby increasing the annual number of deaths within the population.

By 2011, natural decrease was resulting in the loss of almost 100 people annually. Looking forward, natural decrease is also projected to characterize the coming 25 years as more of the LHA’s population ages into the higher mortality age groups.
By 2036, the Health Area is projected to experience the net loss of almost 400 people annually from its population due to natural decrease. It is interesting to note that, due to the Health Area being older than the rest of the province, it has achieved this natural decrease milestone far in advance of British Columbia as a whole. Looking back to Figure 3, natural decrease is not expected to be realized at the provincial level until 2028. With natural increase already resulting in the loss of people from the Health Area, net migration is—and will continue to be—the only driver to population growth in the LHA.

By combining all of these factors—the projected levels and composition of migration to and from the region, natural increase (or decrease in this instance), and the inevitable process of aging—with the LHA’s existing population, a projection of population growth and change for the Health Area can be established.

The BC Stats projection for the LHA shows a population that grows larger, albeit at a relatively slow annual rate, and experiences significant changes in its age composition. While the Courtenay LHA is projected to grow more slowly than it has in the past, changes in the composition of its population will be much more dramatic.

Over the next two and half decades, the LHA’s population is projected to grow from its 2011 base of 65,147 residents to 82,586 by 2026, and further to 92,912 by 2036 (Figure 8); this equates to a total of 43 percent growth as 27,766 people are added to the population over the next 25 years. On average, the LHA would add just over 1,092 new residents each year through 2036, with its annual rate of growth averaging 1.4 percent. In terms of compositional changes, the greatest relative growth is projected to be in the older age groups (Figures 9). Between 2011 and 2036, the 85-plus group would grow by 134 percent, followed by 116 percent growth in the number of residents aged 75 to 84, and a 56 percent increase in the 65 to 74 age group (Figures 10).

While the BC Stats-based projection for the Courtenay LHA provides a long-range, demographically-based outlook for the broader region within which Denman and Hornby Islands are situated, no such projections exist for the islands themselves. As it will largely be population growth and change on the islands that will...
determine future changes to benchmark ferry trip volumes along the Denman Island - Buckley Bay and Hornby Island - Denman Island routes, historical age-specific Census data for each island and the broader LHA were used in conjunction with the LHA projection from BC Stats to provide a long-range projection of demographic change for each island. Where available, local plans and policies were also considered in the development of the future outlooks.
III Route Projections

1 Projection Methodology

Generally-speaking, there is a good correspondence between demography and benchmark travel volumes, with changes in future passenger volumes for BC Ferries’ routes largely being driven by two factors: demand from full-time, local residents, and demand from residents of other regions for recreational travel, including both part-time residents and day-trippers. As the objective of this research is to provide long-range projections of future ridership, a demographically-based approach to projecting future passenger volumes has been used. The resident population for each route is therefore seen as the determinant of benchmark passenger volumes during the low-season months of November, December, January, and February.

As such, the first step in developing route-specific trip projections was to develop long-range population projections for each route under consideration. As indicated above, historical age-specific Census data for each Island and the broader LHA were used in conjunction with the Local Health Area projections to develop long-range outlooks for population growth and change for each Island. The second step was to develop ratios of low-season passenger trip counts from BC Ferries to the resident population on each island, and then to use these ratios, together with long-range demographic projections, to arrive at projections of future passenger volumes during the lowest four, or benchmark, months.

A second set of ratios, based on the size of the local working-aged population, were also developed for use in the projections. Considering only the working-aged population (people aged 20 to 54) focuses the analysis towards the work and commuting aspects of passenger volumes for each route. Passenger volumes on some routes will show a stronger correspondence to the working-aged population than others, specifically those routes that are in close proximity to major employment centers. It is important to note that this ratio uses the working-aged population as a proxy for all of the factors that determine passenger travel; it does not say that each person of working-age took a given number of trips, but rather that there is a ratio of passenger trips (made by people of all ages) for each person counted in the 20 to 54 population.

With the historical trip ratios established for each route, two approaches were used in the projection of benchmark travel volumes. The first was to hold per capita trip ratios constant at the levels seen in 2011; this emphasizes the role that population growth alone will have on future levels of benchmark travel demand rather than any kind of behavioral changes that may influence people’s propensity to travel. The second approach was to extend the historical patterns of change seen in per capita ridership ratios into future years. This approach acknowledges that trip ratios have changed over time, and recognizes that changing travel behavior has influenced historical travel patterns and potentially future benchmark trip volumes for each route. The historical pattern of change was extended using an exponential growth function based on the past 14 years of passenger and population data available from BC Ferries.

To generate estimates of the total number of trips made during the low season (benchmark trips), these four ratios (total population-based constant, total population-based trend, working-aged-based constant, and working-aged-based trend) were applied to the projected population (both total and working-aged) for each island annually between 2011 and 2036. The result of combining the projected ridership ratios with the base population projections is the projected number of passenger trips that would be expected during the benchmark months. When divided by four, the projected average monthly passenger level in the lowest four months of the year is achieved, a value that is referred to as the average benchmark monthly passenger volume. This was completed for each of the two passenger trip ratio vectors (total and working-aged population).
These monthly averages form the input to the final step in the projection process—the projection of the *total annual passenger trips*. To move from average benchmark monthly passenger volumes to total passenger volumes the pattern of seasonality observed in the historical monthly data relative to the benchmark was used. Deriving the seasonal patterns from monthly passenger data is somewhat complex, as it involves variance not only over a 12-month period, but also between years (in this case over 14 years of data). With the benchmark volume representing the average monthly volume during the low season, trip volumes for each month were measured against the benchmark volume and the variance documented. As would be expected, volumes in July and August were generally well above the benchmark volumes for each route, with the lowest volumes typically being seen in January and February. Compiling the seasonal variations for the past 14 years of data established the average monthly variations around the benchmark.

To move from the projection of benchmark monthly passenger volumes to average annual volumes, the average monthly pattern of variation specific to each route was applied as a percentage of the low season benchmark volume to the projected monthly benchmark volumes. The product of this is projected trip volumes for each month which, when summed, provide the projected annual traffic volumes for each route. This was done for each of the four ridership ratio scenarios (constant/trend population based and constant/trend 20 to 54 age). As a final step, the average of these four annualized projections was calculated, representing the *average projection scenario*. Finally, given a range of strategic considerations found through the research and data for each route, a *benchmark projection scenario* is also presented, which represents the final output of the research process.
2 Population Change on Denman Island

During the past 20 years, Denman Island has grown from 923 residents (in 1991) to 1,030 (by 2011). However, the annual pattern of growth has been far from constant, characterized by two periods of growth and two of decline. Despite overall growth in the Island’s population between 1991 and 2011, its share of the Courtenay LHA’s population fell continuously over this period, going from two percent in 1991 to 1.8 percent by 2001 and further to 1.6 in 2011. The declining share is indicative of faster growth being experienced throughout the rest of the Courtenay LHA; since 1991 the LHA has grown by 43 percent, while Denman has only seen 12 percent growth.

While an increasing or decreasing share of region-wide population could be postulated for the Island, a reasonable beginning point is to consider the magnitude of change if the Island were to maintain its current share of the Courtenay LHA’s population. In assuming that Denman maintains its current 1.6 percent share of the LHA population, this would see Denman’s population grow from 1,030 residents in 2011 to 1,221 in 2021, 1,390 in 2031, and further to 1,469 by 2036 (Figure 11).

Following compositional changes that have been seen on the Island over the past two decades and projected changes at the LHA level, the next 25 years would see the island’s population continue to age. For example, in 1991, 27 percent of the local population was aged 55 or older, currently they represent 55 percent, and their share is expected to grow to 57 percent by 2036. The share of the 20 to 54 age group has declined significantly from 46 percent in 1991 to its current 34 percent.

Looking forward, the population share of the working aged is projected to decline slightly, falling to 32 percent by 2036. Similarly, the share of the under-20 population would continue on a downward trend as it goes from 11 percent in 2011 (a significant decline from its 27 percent in 1991) to ten percent by the end of the projection period (Figure 12).

In considering available planning documents, Denman’s Official Community
Plan (OCP), estimates the Island’s build out capacity, given current subdivision and zoning, at slightly more than 2,000 residents.\(^4\) The projected population for Denman by 2036 falls below current zoning capacity for the Island.

It is these changes to Denman Island’s resident population, in terms of both total population growth and changes to its composition, that provide the basis for developing the projections of core ferry trip volumes. The following sections detail the data and trip projection output for the Denman Island - Buckley Bay route.

3 Denman Island - Buckley Bay Traffic

Since 1998 the total number of ferry passenger trips on the Denman Island - Buckley Bay route has declined by almost 18 percent, from 472,716 to 389,762 total trips annually (Figure 13). The peak year for travel on this route was 1998, when 472,716 trips were taken. Following this high, the number of passenger trips steadily declined for four years before experiencing a slight recovery in 2003 and 2004. This was again followed by a decline in the number of trips over the next four years. The most significant drop in trips was experienced in 2008, when volumes fell by six percent. In 2009 annual trips began to recover slightly, moving back to levels seen in 2007. Since 2010 however, the total number of passenger trips has declined again falling to 389,762 in 2011 (a four percent decline).

The benchmark measure also experienced the same pattern of decline and recovery as demonstrated in the overall number of passenger trips. Trips in these benchmark months saw its highest point in 1998 at 116,906 trips, before falling steadily until 2002 and recovering slightly in 2003/2004. From this point benchmark trips also declined; at 95,415 trips, 2008 marked the year with the lowest number of trips in the past 13 years. In 2009/2010 benchmark trips began to rise again, before a four percent decline brought trips down to 96,958 trips in 2011.

It is interesting to note that both total and benchmark trips have declined by a similar rate since their peak in 1998 (each declining by over 17 percent by 2011) for this route. Similarly, since their low point in 2008, total and benchmark trips have both increased (by 1.6 percent and 2.4 percent, respectively).

With the population on Denman declining at a slower pace (three percent) than total trip volumes (18 percent) over the 1998 to 2011 period, the Island’s per capita trip ratio has declined from 109.6 trips per resident in the benchmark months in 1998 to 94.1 by 2011 (Figure 14). From its 1998 peak, annual per capita trips during the benchmark months declined steadily to 104.7 in 2002, before rising in 2003 just to fall again to a period-low of 87.1 by 2008. With the number of people of working-age (those aged 20 to 54) declining by 32 percent on Denman...
Island over this period, the ratio of trips per working-aged resident has increased from 229.6 in 1998 to 278.9 by 2011, a 21 percent increase. It is important to re-state that the working-age trip ratio uses the working-age population as a proxy for all of the factors that determine passenger travel. It does not say that each person of working-age took a given number of trips, but rather that there is a ratio of passenger trips (made by people of all ages) for each person counted in the 20 to 54 population.

Over the past decade, the average number of passenger trips in July and August were consistently between 189 and 212 percent above the average benchmark level (Figure 15). The seasonality seen for Route 21 was seen to fall below the average variation seen for all minor routes during the peak season, as the average monthly variance for all routes during July and August was 221 and 239 percent respectively. Furthermore, this route’s seasonality was also lower than the seasonal fluctuations observed for the Hornby Island route. For instance, the average number of trips in July and August for Route 22 (Hornby Island - Denman Island) consistently reached traffic levels that were 408 and 475 percent above its average benchmark level.

Compared on a year-over-year basis, these two summer months demonstrated greater variance than other months, with an average deviation (or variance) of over nine percent for both months. In considering all months, average year-over-year deviations ranged between 1.7 percent (November) and the 9.4 percent seen in August. As with the seasonal variation, this fell below the average variation seen for all minor routes (where July and August variance was 11.3 and 13.3 percent respectively).

The number of trips in the busiest four months of travel (May to August) declined slightly less than the 17 percent decline in benchmark trips for this route, falling from a high of 206,294 trips in 1998 to 173,621 by 2011 (a 16 percent drop). It is important to note that monthly 2011 data were well above the historical monthly average: for example, while the month of July and August have historically averaged 189 and 212 percent of the average benchmark travel respectively, 2011 volumes saw July and August reach 207 and 230 percent of average benchmark travel respectively. Most months in 2011 were seen to fall at or above historical averages; to the degree that monthly volumes move back towards the historical norms, a certain amount of downward pressure on the traffic volumes.
for this route might be expected. Extending the historical pattern of change in the ratio of benchmark volumes to population into the future would see the total per resident trip ratio decline significantly, from 94.1 trips during the lowest four months today (2011) to 60.2 trips per resident by 2036. Conversely, the historical pattern of change in the working-aged trip ratio would see the benchmark number of trips per resident aged 20 to 54 increase significantly, going from 278.9 trips today (2011) to 335 by 2036 (Figure 16).

Combining the four benchmark trip ratios (constant and trended trips per resident and constant and trended trips per working-aged resident) with the projection of future population on Denman Island establishes a projection of future trip volumes generated from the resident population on the Island in the benchmark months. Combining these benchmark volumes with the average seasonal pattern of monthly trips results in a series of annual trip volume projections for the Denman Island - Buckley Bay route. Finally, averaging these four projections results in a singular assessment of future average annual trips for this route.

Denman Island’s resident population is projected to grow by 43 percent by 2036, adding almost 440 residents over the next 25 years. Its working-aged population is projected to grow more slowly than total population, increasing by 36 percent, adding almost 124 people by 2036.

Given this projection of future population, extending the historical pattern of decline in per capita trips (from 94.1 in 2011 to 60.2 by 2036) would see total annual trip volumes fall from 389,762 trips today (2011) to 347,806 trips by 2036. This would see total traffic on this route decline by 10.7 percent over the next 25 years (Figure 17). Future traffic volume of 543,332 trips would be achieved if the 2011 per resident trip ratios were to remain constant at their 2011 levels to 2036 (94.1 trips) if the projected population for the Island is achieved. This would see total traffic increase by 39 percent over the next 25 years. This would be 56 percent greater than the traffic projected for the route if the trip ratios were to follow their historical trend.

The corresponding projection based on trips per working-aged population would see 517,305 trips achieved by 2036 if the current ratio of 278.9 trips per resident aged 20 to 54 were maintained over the next 25 years. However, continuing the historical path of the working-aged trip ratio would see the ratio increase to 335 trips by 2036, resulting in 621,297 trips annually by 2036. It is worth noting that the driver behind the 621,297-trip scenario is the significant increase seen in the 20 to 54 trip ratio between 1998 and 2011 (an increase driven by a declining 20 to 54 population) and the linear function used to project the ratio into future years.

The average of these four projection series results in an average annual trip volumes for this route increasing to 507,435 trips by 2036, a 30 percent increase over the 389,762 trips in 2011. Note that this 30 percent growth in the annual number of trips is well below the 43 percent growth projected for the population on the Island over the same period, due mainly to the historical decline in per capita trips experienced in this route.
4 Strategic Route Considerations: Denman Island - Buckley Bay

Having presented historical and projected changes in population, trip ratios, and traffic volumes as they relate to the Denman Island - Buckley Bay route, a number of strategic considerations emerge. With respect to population, as with other BC Ferries minor routes, it is important to recognize that the historical context of growth and change for the Island has been one of significant variance. While annual growth rates will certainly vary around any long-range historical projection, realizing 1.4 percent average annual growth in Denman’s population over the next 25 years does present some degree of projection risk for this route. When considered against a population that by 2011 was largely about the same size as it was two decades earlier in 1991, the projection may seem robust; when considered against a population in the broader Local Health Area that is expected to grow by 43 percent over the next 25 years, it may not.

To the degree that the decline in the Island’s share of the Health Area’s population continues, the future population realized on the Island could fall below the current assessment. That said, compositional changes in both the Local Health Area and Canada-wide populations need to be recognized as a growing share of the Canadian population reaches retirement age and begins to contemplate where to spend their retirement years.

The role of municipal land use planning policies must also be recognized and the policies themselves monitored, as the degree to which the projected population—on which the traffic volume projections are based—is attained will depend upon housing availability. The current landscape of developable residential lots on Denman would see build out under current subdivision on the Island of 2,000 residents, well above the 1,469 residents projected by 2036.

While Denman’s total population has increased marginally in the last 13 years, the working-aged (20 to 54) population declined by seven percent between 2001 and 2006, and by a more substantial 16 percent between 2006 and 2011. This change in the Island’s demographic composition has specific implications for the working-aged trip scenario. While the 20 to 54-based trip ratio has increased significantly in recent years, it has not been driven by more trips being taken per se, but rather due to a decline in the number of residents between the ages of 20 to 54. To the degree that this population continues to decline and benchmark trips remain relatively constant, future increases in this trip ratio will be seen.

However, the decline in the working-aged population will, at some point in the future, moderate itself, due to both economic pressures and a baseline level of employment being required to provide basic services to the Island’s residents and visitors. This would indicate a moderation in the historical increases seen in the 20 to 54 trip ratio in the coming years. (Note again that this ratio uses the working-aged population as a proxy for all of the factors that determine passenger travel; it does not imply that each person of working-age took a given number of trips, but rather that there is a ratio of all passenger trips for each person counted in the 20 to 54 population.)

It is important to note that both total and benchmark trips have declined by a similar rate since their peak in 1998 (each declining by more than 17 percent by 2011). Furthermore, while total annual trips declined by 6.4 percent between 2007 and 2008, trips in the benchmark months declined by a similar 6.9 percent, a trend that has generally characterized this route. Thus, projection risk for this route would focus more on factors that could impact the non-benchmark trips (such as employment/unemployment rates, local incomes, changes in provincial GDP, gasoline prices, and the value of the Canadian Dollar, to name a few) rather than those driving trips in the benchmark months (such as changes in the size or composition of permanent resident population).

While there is a distinct seasonal pattern to traffic volumes on this route, a peak month (August) that is
an average of 212 percent above the benchmark level is close to other routes under consideration. The monthly variance from one year to the next for this route is also low (at only 9.4 percent for August). Both therefore suggest only moderate projection risk for this route due to seasonality when compared with other routes.

Given this range of strategic considerations, and specifically historical trends exhibited in the 20 to 54 population and trip ratios, it is expected that future passenger volumes would fall below the simple arithmetic average of the four projection scenarios presented in Figure 17. Figure 18 shows the benchmark projection for the Denman Island - Buckley Bay route, which would see future volumes increasing from 389,762 trips annually today (2011) to 413,606 in 2021, 450,825 by 2031, and 469,481 by the end of the projection period.

While trip volumes between Denman Island and Buckley Bay declined by an average of 1.4 percent annually between 1998 and 2011, the benchmark projection scenario would see the annual rate of growth in traffic for this route average 0.8 percent between 2011 and 2036. This projected growth is driven in part by a population that is expected to grow (1.4 percent annually) and a movement back towards the historical average variation in the ratio of monthly trips to benchmark trips. To the extent that Denman’s population grows at the projected 1.4 percent annually, the current trip projections will be achieved. However, if Denman Island’s population continues its downward trend (i.e. capturing a declining share of the LHA population), average annual trips would be closer to the 347,806 trips predicted by the population-based trend scenario in Figure 17.
5 Population Change on Hornby Island

Similar to the situation seen on Denman Island, the past 20 years have seen Hornby Island’s population grow only marginally (from 959 residents in 1991 to 994 by 2011), with this two-decade period being characterized by two periods of contraction and two of growth. The Island’s population grew to 1,032 residents by 1996 (an eight percent increase over 1991), before declining to 968 people by 2001 (a six percent decline). The following five years saw the population grow again, reaching 1,096 or 11 percent above 2001. The most recent period was characterized by a period of contraction, with the Island’s population declining to 994 residents by 2011.

Over this period, Hornby’s share of the Courtenay LHA’s population also varied somewhat, declining from 2.1 percent in 1991 to 1.7 percent by 2001, and increasing to 1.8 percent by 2006 as the Island’s population grew more rapidly than the broader LHA (Figure 19). The nine percent loss in population since 2006 however has seen the Island’s share of the LHA’s population fall to 1.5 percent by 2011. As with Denman, the loss in share in this most recent period is consistent with the slower rate of population growth experienced on Hornby relative to the rest of the region.

Given the historical variance in Hornby’s share of the Courtenay LHA’s population, a reasonable beginning point is to consider the magnitude of change on the Island if it were to maintain its current share of the regional population. In expecting the Island’s share of the LHA’s population to stay constant over the next 25 years, Hornby would grow from just under 1,000 residents today (2011) to 1,178 by 2021, 1,341 by 2031 and further to 1,418 by 2036. This would see the Island grow by 43 percent as an average of just under 20 people are added to the Island annually over the course of the projection period.

In terms of compositional changes, the greatest absolute and relative growth is projected to be in the older age groups. For example, between 2011 and 2036, relative to the 43 percent growth in total population, Hornby’s population 55 and older would grow by 48 percent, going from 555 residents today to 822 by 2036. The under-55 population would see below-average growth, growing by 36 percent, from 439 residents today to 596 by the end of the projection period.
Looking at the share of population by age group, the next 25 years will see the share of population 55 and older grow from 56 percent today to 58 percent by 2036, while the working-aged population’s share would fall from 33 to 31 percent and those under the age of 20 would remain relatively constant (11 percent; Figure 20).

Hornby’s Official Community Plan, adopted in 2012, anticipates a build out population of 2,452 residents based on the number of subdivided lots in 2007. The 1,418 residents estimated by Urban Futures using BC Stats’ most recent population projection for the broader Local Health Area would imply that by 2036 Hornby would have achieved two-thirds of its potential build out capacity.

It is these changes to Hornby Island’s resident population, in terms of both total population growth and changes to its composition, that provide the basis for developing the projections of core ferry trip volumes for the island. The following sections detail the data, approach, and trip projection output for the Hornby Island ferry traffic.
6 Hornby Island - Denman Island Traffic

Between 1998 and 2011 the total number of ferry passenger trips on the Hornby Island route declined by 17 percent (1.5 percent per annum), from 265,726 to 219,469 trips annually (Figure 21).6 While the peak year for travel on this route was 1998 when more than 265,000 trips were taken, total volumes approached this level in 2003 when total annual trips reached 261,367. Between these two peaks, trips fell to 227,845 in 2000. From 2003 on, the number of passenger trips declined steadily to 2008 when a low of 219,881 passenger trips were recorded. In both 2009 and 2010 the number of trips on this route increased back into the 230,000 range, before falling back to 219,469 in 2011.

The benchmark measure of passenger trips—total passenger volumes in the lowest four months of the year (November, December, January, and February)— also declined over the 1998 to 2011 period, falling by 20 percent, as trips went from 44,150 trips to 35,535 by 2011. Trips in the benchmark months saw a similar pattern of change demonstrated in the overall number of passenger trips. Trips in these benchmark months rose steadily to a peak of 45,053 in 2001 before falling to a low of 36,344 in 2008 (total trip volumes fell to a low of 219,881 in the same year). Over the following two years benchmark volumes increased, to 38,920 in 2009 and 39,564 in 2010, before falling to 35,535 in 2011.

It is interesting to note that while both total and benchmark trips declined by a similar rate between 1998 and 2011 (17 and 20 percent respectively), the most recent traffic data show that the five percent decline in total annual trips between 2010 and 2011 was accompanied by a ten percent decline in the number of trips in the benchmark months.

With the population on Hornby Island declining less dramatically than total trip volumes over the 1998 to 2011 period (a three percent decline in population versus a 20 percent decline in traffic in the benchmark months), the Island’s per capita trip ratio declined from 43.1 trips per resident in the benchmark months in 1998 to 35.7 by 2011 (Figure 22). After increasing to 46.5 in 2001 as the local

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5 Two-way traffic between Gravelley Bay (Denman Island - East) and Shingle Spit (Hornby Island).
population grew, annual per capita trips during the benchmark months declined to a low of 33.9 in 2008, before increasing to 38.9 in 2010 and declining again to 35.7 in 2011. With the number of people of working-age (those aged 20 to 54) declining by 36 percent on Hornby over this period (by a greater rate than benchmark trips), the ratio of trips per working-aged resident increased significantly from 86.2 in 1998 to 108.8 by 2011.

Over the past decade, the average number of passenger trips in August was consistently between 419 and 521 percent above the average benchmark level, or two to three times that of other routes (Figure 23). This route demonstrate one of the most noticeable seasonal patterns among all minor routes. For instance, the average monthly variance for all minor routes during July and August was only 221 and 239 percent respectively.

Comparing the monthly data on a year-over-year basis demonstrates the degree of variance each year between 1998 and 2011: monthly average deviations were greatest for July and August, each of which saw a 29 percent deviation from the average. As with volumes in these months being much higher relative to the benchmark than on other routes, the variance between July and August volumes over the past 13 years was much greater on this route, as the average monthly deviation seen for all minor routes was 11.3 percent for July and 13.3 percent for August. Furthermore, the monthly deviation seen in all other months ranged widely from a low of 3 percent (January, November) to 16 percent (June), again generally higher than the variance seen for all minor routes.

It is also interesting to note that the number of trips in the busiest four months of travel declined less significantly than total or benchmark month trips: May to August trips fell by 14 percent between 1998 and 2011 (versus the 17 percent decline in total trips and the 20 percent decline in those in the benchmark months). That said, peak month trips did follow a similar pattern of change, increasing to a peak in 2003 (150,815 trips) before declining to 124,951 in 2008, and then increasing through 2009/2010 before declining again in 2011 (to 126,724 trips).

Additionally, peak season data were found to be well above average for 2011: for example, while August has historically averaged 475 percent of the average benchmark travel, August 2011 volumes were 510 percent of average benchmark travel. July also showed a similar pattern, with July 2011’s trips being 436 percent above the benchmark versus the historical average of 408 percent.

Extending the historical pattern of change in the ratio of benchmark volumes to total population into the future would see the total per resident trip ratio decline further, from 35.7 trips during the lowest four months today (2011) to 22.3 trips per resident by 2036. Conversely, extending the historical pattern of an increase in the working-aged trip ratio would see the benchmark number of trips per resident aged 20 to 54 increase in the coming years, going from 108.8 trips today (2011) to 143.3 by 2036 (Figure 24).
Combining the four benchmark trip ratios (constant and trend trips per resident and constant and trend trips per working-aged resident) with the projection of future population on Hornby Island growing by an annual growth of two percent establishes a projection of future trip volumes generated from the resident population on the Island in the benchmark months. Combining these benchmark volumes with the average seasonal pattern of monthly trips results in a series of annual trip volume projections for the Hornby Island route. Finally, averaging these four projections results in a singular assessment of future average annual trips for this route.

Hornby Island’s resident population is projected to grow by 43 percent by 2036, adding almost 424 residents over the next 25 years. Its working-aged population is projected to grow more slowly than the population as a whole, increasing by 36 percent, adding 117 people by 2036. Given this projection of future population for Hornby, extending the historical pattern of decline in total per capita trips (from 35.7 in 2011 to 22.3 by 2036) would see total annual trip volumes fall from 219,469 trips today (2011) to 184,933 trips by 2036. This would see total traffic on this route decline by 16 percent over the next 25 years (Figure 25).

Future traffic volume of 296,005 trips would be achieved if the 2011 per resident trip ratios were to remain constant at their 2011 levels (35.7 trips) and the anticipated population achieved. This would see total traffic increase by 39 percent over the next 25 years.

The corresponding projection based on trips per working-aged population would see 281,705 trips achieved by 2036 if the current ratio of 108.8 trips per resident aged 20 to 54 were maintained over the next 25 years. However, continuing the historical path of the working-aged trip ratio would see the ratio increase to 143.3 trips by 2036, resulting in 371,021 trips annually by 2036. It is worth noting that the driver behind the 371,021-trip scenario is the significant increase seen in the 20 to 54 trip ratio between 1998 and 2011 (an increase driven by a declining 20 to 54 population) and the linear function used to project the ratio into future years.
The average of these four projection series results in an average annual trip volumes for this route increasing to 283,416 trips by 2036, a 29 percent increase over the 219,469 trips in 2011. Note that this 29 percent growth in the annual number of trips is well below the 43 percent growth projected for the population on the Island over the same period.

7 Strategic Route Considerations: Hornby Island - Denman Island

Having presented historical and projected changes in population, trip ratios, and traffic volumes as they relate to the Hornby Island - Denman Island route, a number of strategic considerations should be noted. With respect to population, as with the Denman route, it is important to recognize that the historical context of growth and change for Hornby has also been one of significant variance. While annual growth rates will certainly vary around any long-range historical projection, realizing a 1.4 percent average annual growth in Hornby’s population over the next 25 years does present some degree of projection risk. When considered against a population that by 2011 was largely about the same size as it was two decades earlier (again a similar situation to that of Denman), the projection may seem robust; when considered against a population in the broader Local Health Area that is expected to grow by 43 percent over the next 25 years, it may seem a more reasonable assessment.

An additional driver to population growth on the Islands that is not reflected in the historical trends is future compositional changes in the Local Health Area and Canada-wide populations, with a growing share of the Canadian population aging into the retirement stages of the lifecycle in the coming decades and beginning to contemplate where to spend their retirement years. As it has in the past, the climate and lifestyle afforded to residents of (and visitors to) the Islands will certainly be a draw to this rapidly growing segment of the Canadian population.

In this context, the role of municipal land use planning policies must also be recognized, as the degree to which the projected population—on which the traffic volume projections are based—is attained will depend upon housing availability. That said, the current landscape of developable residential lots on Hornby would see total build out under current subdivision on the Island of 2,452 residents, well above the 1,418 residents projected for 2036.

Brief comment about historical and projected changes in the annual trip ratios is also warranted. The increase in the working-aged 20 to 54 trip ratio in recent years is the result of a decline in the number of working-age residents on Hornby and a relatively steady volume of trips during the benchmark months. In looking forward, the historical trend would see the 20 to 54 trip ratio continue to increase, reaching levels not seen through the historical database.

Therefore, achieving the projected level of trips under the 20 to 54 trend projection scenario should be considered a projection outlier among the four projection series. (Note again that this ratio uses the working-aged population as a proxy for all of the factors that determine passenger travel; it does not imply that each person of working-age took a given number of trips, but rather that there is a ratio of all passenger trips for each person counted in the 20 to 54 population.)

Given the highly seasonal nature of this route and the annual variance demonstrated in the high volume months, projection risk for this route is also seen in the discretionary nature of both the high volume of summer travel relative to the benchmark, and the high variance experienced within these monthly discretionary flows each year. This is something not found in other routes. As an example, 2011 trip data show that June, July and August trip volumes were all significantly above historical averages when compared to the average volumes in the benchmark months. Downward pressure on traffic volumes could be seen in the short-term for this route if the peak-month volumes move back towards historical averages.
Given this range of strategic considerations (specifically the trend 20 to 54 trip scenario being an outlier), it is expected that future passenger volumes would fall below the simple arithmetic average of the four projection scenarios presented in Figure 25. Figure 26 shows the baseline projection for the Hornby route: the benchmark projection would see future volumes increase from 219,469 trips annually today to 226,163 in 2021, 244,791 by 2031, and 254,215 by the end of the projection period. This benchmark projection indicates an annual growth rate in traffic for this route of 0.8 annually over the next 25 years, below the 1.4 percent annual growth projected for total population.
Appendix 5: Customer Feedback

The attached report provides a summary of feedback from customers specific to the Quinitsa for fiscal 2007 - 2013.
Vessel Specific Customer Feedback

Fiscal 2007 - 2013

Quinitsa
Overview of customer feedback

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Total Comments Fleet-wide</th>
<th>Fleet-wide Category: “On the ship”</th>
<th>Vessel specific: Quinitsa</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>3,481</td>
<td>282</td>
<td>6</td>
</tr>
<tr>
<td>2008</td>
<td>7,880</td>
<td>784</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>9,376</td>
<td>825</td>
<td>5</td>
</tr>
<tr>
<td>2010</td>
<td>7,511</td>
<td>819</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>10,790</td>
<td>1,074</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>9,005</td>
<td>887</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>7,779</td>
<td>969</td>
<td>5</td>
</tr>
</tbody>
</table>
## Quinitsa

<table>
<thead>
<tr>
<th>Categories</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger areas</strong></td>
<td>- frequently blocked washrooms</td>
</tr>
<tr>
<td></td>
<td>- remove scented soap from washrooms</td>
</tr>
<tr>
<td></td>
<td>- passenger lounge ambient noise too loud</td>
</tr>
<tr>
<td><strong>Car deck</strong></td>
<td>- trapped in vehicle due to tight areas</td>
</tr>
<tr>
<td></td>
<td>- wheelchair customers trapped in vehicle due to tight lanes</td>
</tr>
<tr>
<td></td>
<td>- car deck capacity not sufficient during peak travel times</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>- onboard announcements too loud for residents near the Denman ferry dock</td>
</tr>
<tr>
<td></td>
<td>- excessive use of fog horn</td>
</tr>
<tr>
<td><strong>Replacement vessel</strong></td>
<td>- replacement vessel during refit period does not meet traffic demand</td>
</tr>
</tbody>
</table>
Appendix 6: Public and Stakeholder Consultation

BC Ferries has undertaken extensive public and stakeholder consultation, which has helped shape the Project in a number of key areas as described in this Application. A summary of the meetings and consultation activities follows.

FEASIBILITY STUDY PHASE

1. Meetings and Information Sessions Hosted by BC Ferries:
   - Denman-Hornby Ferry Advisory Committee (FAC) Meetings
     - June 17, 2009
     - November 4, 2009
     - October 21, 2011
   - Denman Island Events
     - August 21, 2009
     - November 4, 2009
     - September 15, 2011
     - September 23, 2011
   - Hornby Island Events
     - November 4, 2009

2. BC Ferries Meetings and Presentations with Users of Baynes Sound and Other Stakeholders:
   - Council of Marine Carriers (representing tow boat operators in Baynes Sound)
     - Meeting with Executive - August 6, 2009
   - Shellfish Growers of BC – September 2009
     - Phone and email communication
     - Letter of support received - September 28, 2009
   - Pacific Region Recreational Boating Advisory Council
     - Presentation - November 18, 2009
   - Council of BC Yacht Clubs (representing 51 BC yacht clubs)
     - Presentation - November 28, 2009
   - Extensive communications and consultations with 11 First Nations groups as part of the regulatory approvals process, including one meeting:
     - Meeting with Laich-Kwil-Tach Treaty Society Chiefs - February 3, 2010
   - CVRD - Advisory Planning Commission for Baynes Sound (to review Integrated Land Management Bureau application)
3. Regulatory Authorities Consulted by BC Ferries:
   - Canadian Environmental Assessment Agency
   - Fisheries & Oceans Canada
   - Transport Canada Marine Safety - Navigable Waters Protection Program
   - Provincial Integrated Land Management Bureau

PROJECT DEVELOPMENT PHASE (after receipt of regulatory approvals)

1. Meetings and Presentations Hosted by BC Ferries:
   - Denman-Hornby Ferry Advisory Committee (FAC) Meetings
     - April 23, 2012
     - April 5, 2013
     - October 30, 2013
   - Denman Island Events
     - October 21, 2011
     - July 5, 2012
     - November 29, 2012
     - August 8, 2013
   - Hornby Island Event
     - December 5, 2011
     - February 28, 2013
     - August 8, 2013
   - Stakeholders
     - September 6, 2013

Note: Copies of presentation documents, materials, summary notes from the consultation undertaken in this phase, as well as other key Project documents are available on the BC Ferries website at:
http://www.bcferries.com/about/publicconsultation2/FAC/dihi/presentations.html
Appendix 7: Design and Operational Characteristics of the Cable Ferry

The operational characteristics of the cable ferry, as compared to the Quinitsa, are provided in Table 1 below. Additional detail in respect of the cable ferry is provided in the Statement of Operational Requirements and the Technical Statement of Requirements which formed part of the RFP for construction of the vessel, attached as Appendices 8 and 9.

Table 1: Summary of Vessel Operating Characteristics

<table>
<thead>
<tr>
<th>Specification</th>
<th>Quinitsa</th>
<th>Cable Ferry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voyage Classification</td>
<td>Sheltered Waters</td>
<td>Sheltered Waters</td>
</tr>
<tr>
<td>Maximum Length</td>
<td>77.59m (Length Overall)</td>
<td>78.5m (Length Overall)</td>
</tr>
<tr>
<td>Draft</td>
<td>1.725m (maximum)</td>
<td>0.96m (maximum)</td>
</tr>
<tr>
<td>Service Speed</td>
<td>9.0 knots</td>
<td>8.5 knots^1</td>
</tr>
<tr>
<td>Propulsion</td>
<td>4 x 300kW; 4 x Azimuthing Thrusters</td>
<td>1 x 300kW (+1 Stand-by); 2 hydraulic motors on cable drive^3</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>332,684 litres/year</td>
<td>162,256 litres/year</td>
</tr>
<tr>
<td>Vehicle Capacity</td>
<td>50 AEQ</td>
<td>50 AEQ</td>
</tr>
<tr>
<td>Commercial Vehicle Height (maximum)</td>
<td>4.75 metres</td>
<td>4.75 metres</td>
</tr>
<tr>
<td>Passengers and Crew Licences</td>
<td>294 passengers/6 crew</td>
<td>147 passengers/3 crew (proposed)^2</td>
</tr>
<tr>
<td>Passenger Accommodation</td>
<td>Two car deck lounges on port and starboard</td>
<td>One main car deck lounge on Centreline</td>
</tr>
<tr>
<td>Passenger Facilities</td>
<td>1 male, 2 female washrooms, 1 washroom accessible for persons with disabilities; lounge seating for 86, 1 wheelchair area</td>
<td>2 uni-sex washrooms, accessible for persons with disabilities; lounge seating for 60, 2 wheelchair areas; external covered seating for ~50; pet area</td>
</tr>
<tr>
<td>Flexibility of Use on Alternative Routes</td>
<td>Yes</td>
<td>No (BC Ferries Routes)</td>
</tr>
</tbody>
</table>

Notes: (1) The stated service speed is the maximum; the winter schedule can be maintained at a speed of 7.5 knots. The cable ferry was specified to be slightly slower as there is less docking time required for a cable ferry, and the ferry can be loaded faster (double lane loading).

(2) The passenger licence has been reduced on the cable ferry compared with Quinitsa based on the passenger load factors on Route 21; the larger licence on Quinitsa has been maintained as a contingency against having to provide relief service on other routes with high passenger loads (e.g. Route 19 connecting Gabriola Island and Nanaimo Harbour).

(3) The drive system will be based on one main drive cable and two guide cables each being 1 5/8 inches in diameter.
• **Engine Size**

The engines are sized to each efficiently drive both a hydraulic drive and generator simultaneously negating the need for an additional generator system. A power trade off study and an electrical load and powering alternatives report were prepared by EBDG and KPFF which support the decision to proceed with this configuration based not only on efficiencies but low life cycle costs and local service availability. The units are modular so that in the event of a failure, a complete unit can be exchanged over night with a spare set kept stored near the facility, further mitigating possible schedule disruptions. Schedule recovery is expected more through minimal vessel manoeuvring and the faster anticipated turn-around times using more efficient two lane unloading year round and possible two lane loading during busy times.

• **Passenger Accommodations**

BC Ferries’ Minor Vessel design standard aims to provide a reasonable level of passenger comfort to support customer satisfaction, while also meeting the following criteria:

- Compliance with Transport Canada Marine Safety regulations;
- Certified by a recognized Class society;
- Durable;
- Easily cleanable; and
- Low life cycle cost.

The design standard specifies deck heads, bulkhead materials, deck surfaces, lighting, furniture and washroom outfitting and ensures that BC Ferries obtains a look that is consistent with its brand at a reasonable cost.

The passenger accommodations for the cable ferry will conform to the Minor Vessel design standard and will be consistent with the outfit of the current vessel, the *Quinitsa*, which was upgraded in 2007. The principal differences pertain to the fact that the cable ferry can be configured specifically to the needs and features of Route 21, i.e. a very short crossing period, where most passengers will choose to stay in their cars, but where there are also school children in transit. A community consultation process has taken place around layout and outfit.

The vessel design includes a simple and modest passenger lounge with standard amenities. There will be an enclosed lounge area with climate control and seating; two designated spaces for wheelchairs inside the lounge; and two washrooms that
are accessible for the disabled. Additionally, there will be an area with seating outside to incorporate a designated pet area, plus there will be space designated for bicycle storage during the crossing.

- **Branding**

BC Ferries’ brand identity is one of the many ways the Company is known and recognized in the communities it serves and throughout the world. It is anticipated that the cable ferry will be branded similar to other vessels serving the Minor Routes. In general, BC Ferries’ vessels are painted white and carry the BC Ferries logo. All vessels also carry a blue stripe in addition to carrying the vessel name and Port of Registry. There may be some unique marketing opportunities as this is understood to be the longest cable ferry route in the world.
Appendix 8: Statement of Operational Requirements

The Statement of Operational Requirements for the integrated cable ferry system (vessel/cable/berths) for Route 21 is attached.
STATEMENT OF OPERATIONAL REQUIREMENTS

Integrated Cable Ferry System
(50 Vehicle Cable Ferry And Ferry Berths)

For:

Route 21
Buckley Bay – Denman Island

Prepared by:
British Columbia Ferry Services Inc.

June 2013
(Final Rev.1.1)
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INTRODUCTION
This document is intended to provide a Statement of Operational Requirements (SOR) for an integrated cable ferry system (vessel/cable/berths) to be used to deliver cable ferry service on Route 21, between Buckley Bay on Vancouver Island and Denman Island (Denman West terminal).

The service will be provided by British Columbia Ferry Services, Inc. (BCFS). A cable ferry employs a drive wheel system to pull itself along submarine cable that is deployed between two berth locations. This technology is expected to be more reliable, more fuel efficient, and with a lower environmental impact and operational cost than a conventional propeller-driven ferry. The project involves construction of two new berths as well as the cable ferry system to accommodate the particular requirements of the project.

The project also includes an expansion of the Denman West terminal to incorporate a vehicle holding compound and general reconfiguration of the shore side terminal. The existing berths will be retained and will remain operational. The existing Denman West trestle will require some modification to integrate into the new berth arrangement.

The Statement of Operational Requirements (SOR) has been structured to define a cable ferry service on this route that can maintain the volume of traffic established by the current schedule as required in the Coastal Ferry Services Contract, with supplementary capability to accommodate current operating practices.

The SOR has been developed following an extensive program of field measurements of the environmental conditions on Route 21 [Reference 1] and a comprehensive dynamic system simulation [Reference 2]. In addition to a cable specification, a preliminary hull form and powering estimate for the ferry and a preliminary berth configuration were developed for use in the dynamic analysis that the Designer will validate in detail design phase of the project.
SUMMARY

PROPOSED FERRY CONFIGURATION

A RO/RO vehicle ferry using a traction cable system is described in the following document to meet the core service levels for Routes 21. Based on the operating profile, deadweight capacity required and the degree of cargo flexibility intended for the vessel, the following is the proposed minimal configuration:

- A roll-on-roll-off vehicle deck, capable of transporting a minimum of 50 AEQ (Automobile Equivalent units) per trip; where one AEQ is defined as 5.34 metres length by 2.60 metres width (lane allowance);
- A licence for a total complement of 150, with utilitarian accommodation;
- Configured for minimal crewing; vessel controls will be configured for single person operation.

In addition, the vessel is expected to incorporate the following features:

- An open car deck to be laid out for ease of direct loading and minimum obstruction;
  - A single open Roll-On/Roll-Off vehicle deck configured for flow through traffic with loading/unloading at each end of the vessel;
  - Four lanes based on outer vehicle lane widths of 2.6m for personal vehicles, and inboard lanes at 3.2m for commercial vehicles;
  - An unobstructed height of at least 5.0 metres on the (main) vehicle deck for over height vehicles.
- The hull will be designed for simple fabrication, with preparation and coatings to allow for extended dry dock intervals;
- Docking capability to access the berths on Route 21 where new berths will be constructed for cable service. The vessel bulwarks and gates will be configured to accept vehicle and passenger aprons (ramps) from a floating pontoon at each berth.
- A propulsion system designed to maintain the schedule on one main engine with one stand-by unit; where the main engines, PTOs, and power generating sets are to be located above the main deck and will be fully automated and fully redundant. A trade-off study of drive technology options will be undertaken as part of the design process. The equipment will be configured for maintenance with easy modular removal and replacement. Piping and cabling will be configured for quick disconnection.
- Provision will be made for conversion to either a compressed or liquefied natural gas system for the Prime Movers using a proven (off the shelf) system as an alternative to conventional diesel prime movers. The Prime Movers thus must be suited for conversion to gas propulsion. This provision will include allowances for piping, gas regulation equipment, and tankage in suitable locations. At this time this equipment will be fitted for, but not with. (FFBNW).
- The drive system will be based on one main drive cable and two guide cables, of a common size that can be exchanged without service interruption;
• Electrical requirements are to be minimized, with a preference for 24V DC power. Batteries (or other stored energy devices) and power take offs will be considered as an alternative to dedicated diesel-generator sets. Provision will also be made for shore power, based on a 600V/300A connector with appropriate transformers and rectification.

• Passenger accommodation is to comprise:
  o Seating for approximately 60 persons, in simple enclosed heated lounge;
  o External seating for a total of 30 persons, in a covered sheltered area;
  o Two uni-sex washrooms, fully accessible for disabled passengers (universal design)

• Compliance with MARPOL and Canadian environmental legislation by use of a holding tank configured for discharge by vacuum truck.

• Controls for the cable drives, brakes, and safety systems will be concentrated in a main Central Control Station above the car deck with a maximized view of the car deck, and another location on the main deck. These will be configured for single-person operation. Consideration will be given to a lighted signage system that will facilitate traffic direction onto the vessel.

• Safety systems should be configured for single person operation. The use of automated fire monitors will be investigated for suppression of fires on the vehicle deck, with provision for adequate reserve pump and electrical capacity. The machinery spaces will be fitted with a fixed fire suppression system. Consideration will be given to fitting a water-mist system in the accommodation area.

• The ship evacuation should be based on the BCF standard short-track inflatable slides into open 150 person inflatable platforms.

• Security systems will comply with Transport Canada requirements and will comprise CCTV’s and card locks on restricted spaces.

• The vessel will be Canadian-flagged and compliant with Transport Canada regulations as required for cable-driven ferries. Inspection and plan approval services will be undertaken by Class under the Delegated Ship Inspection Program (DSIP).

• Navigational lighting will be configured to comply with the Collision Regulations, with particular consideration of the route distance and the configuration of the ferry.

• Equipment selection and outfit is subject to BC Ferries approval.

PROPOSED BERTH CONFIGURATION

New berths will be constructed at Buckley Bay and Denman Island West, with the following features:

• The berths will be aligned for direct transit by cable (i.e. the existing berth orientation will be outside the cable ferry track; the existing berths will be retained for alternative service). Existing berths must remain operational throughout the construction period.

• The berths will employ floating pontoons with double lane ramps and shore aprons, complete with segregated foot passenger walkways on both sides of the ramps. Aprons will be operated using BCFS standard hydraulic cylinders. The height of the ramp and transition platform will be adjustable (overnight by Terminal Maintenance) to accommodate differing relief vessel freeboards.
• All berth components will reference the BCF Standard Berth Interface requirements [Reference 3] where appropriate, inclusive of but not limited to the ramp abutment, ramp, pontoon, pontoon transition platform, fendering, apron and hydraulic system, walkways, utilities, and cathodic protection systems.

• The vessel will be guided into the berth by the cable system, which will be integral with the pontoon; the vessel will rely on its braking system to control its docking and to hold itself into the berth during loading/unloading operations. Tie-up lines connecting bollards on each side of the vessel and pontoon will be utilized to supplement the brake in conditions of extreme weather and for overnight tie-up.

• Bollards will be located on the pontoon and will be designed for the specific requirements developed for securing the vessel. A total of two bollards will be provided; one on each side of the pontoon and located on the shoreward side of the fender panels with unobstructed tie-up with vessel bollards.

• Provision will be made to operate the shore apron from the vessel deck utilizing a pendant arm that shall also be accessible from the ramp. The ramp will be fitted with lockable security gates for vehicles and pedestrians, with security camera surveillance. A storage cab will be fitted on the ramp to provide shelter for equipment and terminal staff.

• The pontoon will be fitted with fendering to cushion vessel contact and to accommodate vessel berthing energies, where vessel braking is insufficient. To ensure the ferry is held in place on the pontoon interface during extreme wind conditions, it is expected that a form of wingwall structure and fendering attached to the pontoon will be required.

• Shore power will be arranged to provide heat, lighting, and other services on the vessel at both berths, as per the BCF Standard Berth Interface document [Ref. 3]. Shore power is provided to the existing Denman West berth, but not to the Buckley Bay berth. The cable ferry project requires shore power be added to both new berths as well as the existing Buckley Bay berth. Electrical service upgrades will be required at both terminals to provide these new feeds and to accommodate vessels docked simultaneously at both the existing and new berths. The electrical capacity for both the Denman West and Buckley Bay terminals requires confirmation. A study will determine the most efficient location for providing emergency power to operate the terminal lighting and shore aprons (vessel or shore-based emergency power generation).

• Navigation control lights will be fitted at both terminals as required in the Navigable Waters Protection Act.

• The approaches to the berths will be de-marked by buoys at each end of the route.
PROPOSED CABLE CONFIGURATION

The cable system will be configured as follows:

- One drive cable and two guide cables sized to match the environmental loading on the vessel during operation and the secured vessel/pontoon during extreme weather events;
- Cables must be functional over the extreme range of tides on the route and must remain clear of the fendering arrangement on the berth.
- Securing arrangements at each berth with the three cables directly connected to shore “deadmen” at one end and tensioning winches at the other berth. The locations will be configured for access without interference with traffic flow and for ease of cable replacement. The cables will be configured for periodic tensioning from the shore-based winches using portable hydraulic power pack from the one terminal location.
- The drive cable system on the ferry is designed to provide a high degree of control of the vessel velocity on approach. A fendering system will be provided on each side of the transition platform and act as a buffer between the vessel and the pontoon.
- The design approach speed for the purpose of designing of fendering is 0.6m/sec with an overall energy factor will be taken as 1.1 (to account for end berthing).
- The Designer will confirm the cable size and specification developed during the preliminary design. The preliminary specification is included with the TSOR (Technical Statement Of Requirements) as an attachment.
- Cable replacement process will not interfere with normal operations.

TERMINAL DEVELOPMENT

The terminal uplands at both Denman West and Buckley Bay modifications will include, but are not limited to, the following:

Buckley Bay:

- Holding compound and shoreline to be modified to suit new berth infrastructure, inclusive of shoreline fill and protection, storm drainage, utilities and street lighting
- Existing berth, waiting room/washroom and septic field to remain intact.
- Security fencing and gates at ramp abutment will be fitted.
- Traffic control electronic signage, traffic control lighting and barrier arms to be added.
- Navigational control light to be added as required by NWPA.
- Electrical Service Upgrade – shore to ship power, for two (2) vessels (existing and new berths) noting that there is no shore power at the existing Buckley Bay berth.

Denman West:

- Holding Compound to be expanded and redeveloped to meet the 50 AEQ capacity (AEQ= 5.34m x 2.6m) required by vessel and new pick-up/drop-off lane with staff parking inclusive of fill expansion, shoreline protection, storm drainage, utilities, street lighting and roadway/compound infrastructure.
• Parking to consist of eight (8) spaces for BCF Staff; public parking is to be reviewed in the design stage.

• Existing berth, trestle, waiting room/washroom and septic field to remain intact. Bays of the existing trestle are to be removed as required to suit the terminal expansion seaward, and then tied back into a new trestle abutment. Terminal operations are not to be impeded by these modifications during construction.

• Security fencing and gates at abutment will be fitted.

• Traffic control electronic signage, traffic control lighting and barrier arms to be added.

• Navigational control light to be added as required by NWPA.

• Electrical Service Upgrade – shore to ship power, for two (2) vessels (existing and new berths), noting shore power is currently fitted to the existing Denman West berth.
OPERATIONAL REQUIREMENTS

SOR-01 General Description

The cable ferry system is to provide service on Route 21: Buckley Bay (Vancouver Island) – Denman Island (West). The integrated cable ferry system described herein will be capable of providing the core service on Route 21 as specified in the Coastal Ferry Services Contract, as well as the supplementary service during peak traffic periods.

A variety of vehicles (i.e. trucks, cars, RVs, trailers and commercial traffic) are carried on the route. The cable ferry system will be designed to provide the required service on a more cost-effective basis than the equivalent services provided by the conventional propeller-driven ferry, with due regard to the environmental impacts of the respective systems.

SOR-02 Regulatory Regime

02-1 Ferry and Cable

The system will meet the relevant requirements of the “Regulations Respecting Ferry Cables in Navigable Waters” (otherwise known as the Ferry Cable Regulations) under the Navigable Waters Act.

In matters pertaining to the design of the ferry, the Designer will comply with Transport Canada requirements applicable to cable ferries. The vessel will comply fully with Transport Canada, Marine Safety Branch (TC-MS) requirements as specified in the Canada Shipping Act (CSA[2001]) and associated Regulations for vessels of this type operating on Sheltered Waters Class voyages. Inspection and plan approval services will be undertaken by Class under the Delegated Ship Inspection Program (DSIP).

02-2 Terminal

Any new Terminal construction or modifications undertaken for this project must meet or exceed BC Ferries' standards. BC Ferries' construction and maintenance standards for Terminals are based on both Canadian Standards Association (CSA) Construction and Engineering standards and BC Ferries' Design Guidelines and Standards.

In the absence of other Standards, all work is to conform to or exceed the minimum Standards of the Canadian Government Specifications Boards, the Canadian Standards Associations, and the American Society for the Testing of Materials (ASTM), or the British Columbia Building Code, whichever is applicable.

Designs will incorporate the design codes as cited in the BCFS Standardized Berth Interface document.

02-3 Cable Certification

The cables will be certified as appropriate, including but not limited to Class/Manufacturers Test Certificates.

02-4 Additional References

Attention is also drawn to the following regulations/standards/regulatory authorities for certification of specific components:
STATEMENT OF OPERATIONAL REQUIREMENTS

- WorkSafe BC
- Health Canada
- Environment Canada
- The British Columbia Waste Management Act
- IMO MARPOL Annexes 4, 5, and 6
- The Canadian Environmental Protection Act
- BC Labour Code
- IEEE Recommended Practice for Electrical Installation on Shipboard STD 45
- Canadian Standards Association
- Canadian Transportation Agency’s Code of Practice - Ferry Accessibility for Persons with Disabilities

These requirements are specific to the construction of the ferry and do not include the regulatory requirements associated with obtaining permission to operate the cable system or with modifications to the berths.

**SOR-03 Classification Standard**

The Owner intends to build the vessel to a Class that will be selected by the Owner. Transport Canada will require plan approval and inspections to be conducted by Class as a delegated organization (Registered Organization or RO).

Scantlings and equipment should be based on the appropriate Classification Society rules for this type of vessel on restricted service. The equivalent LR (Lloyd’s Register of Shipping) Rules are the 2012 Ship Rules, with particular reference to the following:

- Part 4 Chapter 5 – Barges and Pontoons
- Part 3 Chapter 9 – Special Features (Decks loaded by wheeled vehicles)
- Part 4 Chapter 1 – General Cargo Ships

In view of the restricted operating environment of the vessel, the designer should work with LR to consider a reduced "service factor" with corresponding reduction in the scantlings. An agreement to extend survey cycles will need to be concluded with LR’s Classification Group and TC.

**SOR-04 Registration**

The ferry will be registered and flagged in Canada.

**SOR-05 Design Life and Survey Cycle**

The design life of the terminal and vessel structures is 40 years.

The vessel hull and terminal pontoon will be designed, and coatings will be specified, to support an extended survey cycle, to be determined with Transport Canada. A cycle of 10 years between dry dockings is desired. The hull will be marked for underwater survey.

Coatings on the berth structures are required to last at least 15 years as per the BCFS standards [Reference 4].

The cables will be subject to continuous survey; the drive cable is expected to be renewed annually, with the replaced cable transferred over as a guide cable. Thus there will biennial replacement of the guide cables.
STATEMENT OF OPERATIONAL REQUIREMENTS

SOR-10 Transit Performance

The ferry will have a sufficient transit performance to maintain the service levels outlined in the RFP. It is expected that compliance with the following subsections will meet the service requirements; however the Designer will be expected to demonstrate compliance with the current service plan using a simulation of the proposed system.

SOR-11 Transit Speeds

The traction cable system will be designed to provide the ferry with sufficient speed and acceleration to maintain the vehicle trip capacity defined in SOR-21 with sufficient speed margin to compensate for schedule delays.

For guidance, the vessels currently operating on these routes generally perform as follows:

- Service Speed: 7.5 knots at 85%-90% MCR, full load condition, 50 AEQ
- Maximum Speed: 8.5 knots at 100% MCR, full load condition, 50 AEQ

SOR-12 Design Operating Conditions

The vessel, berth and cable system will be designed to operate in the wind, wave, and current conditions experienced on Route 21 (Baynes Sound) [Ref 1 and 2].

Table 1: Environmental Design Parameters

<table>
<thead>
<tr>
<th>Wind Speed – Sustained (knots) [mid-channel]</th>
<th>Wave Height/Period [Hs/Tm] (m; s)</th>
<th>Current [Tidal] (m/s)</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit - Normal</td>
<td>0-35</td>
<td>0.5m; 2.5s</td>
<td>0.2</td>
</tr>
<tr>
<td>Transit - Limited</td>
<td>36-54</td>
<td>0.6m; 3.0s</td>
<td>0.9</td>
</tr>
<tr>
<td>Secured</td>
<td>55</td>
<td>0.8m; 4.5s</td>
<td>0.95</td>
</tr>
<tr>
<td>Normal Docking Operation</td>
<td>0-23</td>
<td>0.64m; 3.3s</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (1) All conditions acting on the beam (side) of the ferry
(2) Wind Speeds are sustained, conditions apply to mid-channel except for the “Normal Docking Operation”
(3) “Transit- Normal” equates to unrestricted operation, as defined by the limiting roll condition of 5° (single amplitude)
(4) “Transit- Limited” equates to restricted operations where the roll condition is relaxed and the vessel adopts special operational procedures
(5) “Secured” equates to suspended operations, safety factors on cables are exceeded; heavy weather securing precautions will be applied to limit loading on the system, including moving the ferry off the berth to limit wind and impact loads.
(6) “Normal Docking Operation” is defined by the local conditions at the berth for design of the terminal structures, where the approach speed of ferry does not exceed 0.6m/s (SOR “Proposed Cable Configuration”)

The operating philosophy is based on a primary and stand-by prime mover driving the cable system. It is expected that the transit speed in average (normal) conditions can be achieved with one prime mover. For the more severe conditions, two engine operation is acceptable.
All systems will be designed to comply with the following conditions:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Temperature</td>
<td>-20C to 35C</td>
</tr>
<tr>
<td>Sea Temperature</td>
<td>-2C to 30C</td>
</tr>
<tr>
<td>Ambient Engine Room Temperatures</td>
<td>45C maximum</td>
</tr>
<tr>
<td>Salinity</td>
<td>0 – 0.02ppm</td>
</tr>
</tbody>
</table>

**SOR-13 Endurance**

The vessel will be capable of operating for five (5) days standard duty cycle without refuelling. Water will be taken daily from the Buckley Bay terminal. Sewage will be discharged by truck on a three day cycle.

**SOR-14 Performance over Range of Drafts**

The vessel will maintain the schedule over the range of drafts resulting from the duty cycle described in SOR-13.

**SOR-15 Redundancy**

It is recognised that the drive cable and traction wheel system represents a potential single point of failure. The cable will be maintained to reliability criteria developed from the wind/current/wave study identified in SOR-12 and in accordance with accepted criteria as per SOR-90. The specification for the cable system will be confirmed by the Designer, in agreement with BCFS. The cable system (comprising all cables used in the operation of the ferry) will be designed such that parting of any one cable will not cause the overload and potential parting of any other cable, even in the worst anticipated weather conditions as per SOR 12.

In addition, the ferry will be fitted with emergency brakes for clamping the guide cables, comprising a hydraulic tensioning brake that responds to a loss of cable tension. This system will allow a damaged cable to be secured, allowing the vessel to winch back on the line.

The ferry will be fitted with an anchor to secure the vessel in the event of a failure of the traction cable system or propulsion plant, and will be fitted with bollards that will allow a tug to secure alongside and provide propulsion power.

The power-generation and propulsion plant will be configured to provide a high degree of reliability and flexibility. No one fault in these systems should disable the vessel.

To demonstrate compliance with SOR-15, the following studies will be performed:

- RAM (Reliability/Availability/Maintainability) analysis of critical systems.
- FMECA (Failure Mode Evaluation/Criticality Analysis) of critical systems

These studies will be performed as part of the design process for the vessel to ensure the results are incorporated into the final design before construction. The information derived from the RAM and FMECA are fundamental to the development of a reliability-centred maintenance program that BCFS must establish for the vessel. Therefore the results of the analyses must be provided to BCFS in a common (MS Office or *.PDF) format to the satisfaction of the Owner.
SOR-20 Vehicle & Passenger Capacity

SOR-21 Vehicle Capacity

The vehicle capacities for Route 21 are:

- A roll-on/roll-off vehicle deck, capable of transporting a minimum of 50 AEQ (Automobile Equivalent units) per trip (defined as a single crossing), where one AEQ is defined as 5.34 metres length by 2.60 metres width (minimum);
- The ability to enhance the schedule to accommodate peak demand by achieving three (3) crossings per hour, referencing the speed requirements under SOR 11.

SOR-22 Lane and Access Requirements

The vessel car deck will be laid out as follows:

<table>
<thead>
<tr>
<th></th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Lane Width (P&amp;S)</td>
<td>2.6</td>
</tr>
<tr>
<td>Inner Lane Width (P&amp;S)</td>
<td>3.2</td>
</tr>
<tr>
<td>Clearance around Casing</td>
<td>915</td>
</tr>
</tbody>
</table>

The car deck will have a clear height of not less than 5.0m.

SOR-23 Vehicle Deck Layout and Loading and Unloading Rates

The vehicle deck layout will be configured to permit loading and unloading for the required vehicle transfer rate (SOR 21) for the route involved. The vessel will be configured for unobstructed traffic flow over the vehicle deck to each lane, with two lane flow (of passenger vehicles).

SOR-24 Vehicle Deck Scantlings

The scantlings for the deck structure will consider the following vehicle weights:

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Max Weight (kg)</th>
<th>Wheelbase (m)</th>
<th>Axle Load (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor Trailer B-Train (maximum)</td>
<td>63,500</td>
<td>9.85</td>
<td>9,100</td>
</tr>
<tr>
<td>Tractor Trailer (average)</td>
<td>32,000</td>
<td>9.85</td>
<td>9,100</td>
</tr>
<tr>
<td>General Commercial</td>
<td>10,000</td>
<td>3.85</td>
<td>5,000</td>
</tr>
<tr>
<td>Utility Vehicles</td>
<td>2,200</td>
<td>2.90</td>
<td>1,100</td>
</tr>
<tr>
<td>Automobiles (1 AEQ)</td>
<td>1,800</td>
<td>2.60</td>
<td>900</td>
</tr>
</tbody>
</table>

As the vessel is required to carry large commercial vehicles (e.g. semi-trailers), scantlings for the main vehicle deck will comply with highway limits for the following parameters:

**North American Tractor Trailer Load Parameters:**

- Maximum Unit Vehicle Weight / wheel width = 110 kg/cm
- Maximum Contact Pressure = 720 kpa
- Maximum Contact Area / tire = 25 cm x 25 cm

SOR-25 Passenger Capacity and Complement

The vessels will be configured to carry:

- A licence for a total complement of 150 persons (passengers plus crew);
- Accessible seating will be available for a total of at least 59 persons in an enclosed heated lounge. External seating for at least 30 under a covered shelter.
SOR-30  Vessel Deadweight Capacity

The vessels will not exceed the scantling draft at maximum deadweight with full growth margin where the maximum deadweight will be comprised of the maximum vehicle weight, full stores and consumables, and the weight of cable at the maximum channel depth.

Table 2:  Deadweight Tables (Preliminary) - Route 21 [Ref.2]

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL CARGO DEADWEIGHT</td>
<td>256 tonnes Preliminary Route 21 Vessel; 5 x Semis + 25 cars</td>
</tr>
<tr>
<td>+ CONSUMABLES</td>
<td></td>
</tr>
<tr>
<td>Fresh Water</td>
<td>2.75 tonnes Includes potable and non-potable water</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>8.4 tonnes 10 cu.m3</td>
</tr>
<tr>
<td>Lube Oil</td>
<td>2.35 tonnes</td>
</tr>
<tr>
<td>Waste Oil &amp; Sludge</td>
<td>0 tonnes</td>
</tr>
<tr>
<td>Sewage</td>
<td>9.0 tonnes 9000 Litres</td>
</tr>
<tr>
<td>Stores, Spares &amp; Misc.</td>
<td>TBD</td>
</tr>
<tr>
<td>+ VARIABLE WEIGHT</td>
<td></td>
</tr>
<tr>
<td>Traction and Guide</td>
<td>TBD Based on lifting cable at deepest point in the channel</td>
</tr>
</tbody>
</table>

SOR-40  Design Margins

SOR-41  Vessel Margins

The design documents will include a detailed weight breakdown, cable load model, and electrical load analysis to identify the margins for the proposed vessel including:

- deadweight
- power
- electrical generating capacity
- cable strength factors of safety (FOS) [Ref. 2]
- cable fatigue life.

In particular, the Designer will identify the margins associated with providing the enhanced capacity to accommodate peak demand as identified in SOR 21.

The hull structure will incorporate corrosion margins based on Class (IACS) requirements, and will consider the design life and requirements for an extended survey cycle as per SOR-05.

SOR-42  Terminal Design Margins

- Vessel/apron overlap = a minimum of 1.2 m at the point of maximum overlap; with a minimum 300mm overlap at any other point when vessel is at maximum skew to the berth.

- The pontoon must remain trim during normal operation and meet the following freeboard requirements:

<table>
<thead>
<tr>
<th>Dead Loads:</th>
<th>Minimum Freeboard</th>
<th>700 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead Plus Live Loads:</td>
<td>Minimum Freeboard</td>
<td>300 mm</td>
</tr>
</tbody>
</table>

- Vehicle Ramp: Maximum Vehicle Ramp Grades ± 15%
SOR -50 Routes & Terminal Compatibility

SOR-51 Berth Interface.

It is not required that the hull geometry conforms to other BCFS berths, and thus simplified barge geometry may be employed. The interface margins are defined in SOR-42.

The range of freeboard between lightship and operating full load departure conditions, and range of tides at the terminal locations will be taken into consideration so that an efficient match is achieved between the vessel deck and the shore pontoon apron. Allowable variation in freeboard is expected to be 400mm.

It is expected that the vessel will be secured to the berth pontoon using the drive cable and the braking system. A back-up system will be fitted comprising shore lines from the bollards on the vessel and pontoon.

The ferry will be configured to accept shore power from standard Posi-Lock 600V/300A AC power source at each end of the vessel.

SOR-52 Limiting Dimensions

The vessel will be sized to be compatible with berth fendering and shore bathymetry. No specific dimensional limitations have been identified in earlier studies [Ref 2 and 3]

SOR 60 Passenger and Crew Facilities

SOR-61 Public Spaces - Ferry

Due to the short transit distance, limited passenger facilities are required. The vessels should be fitted with a heated passenger lounge to accommodate the seating as indicated in SOR 25.

The passenger deck will be arranged such that:

1. The crew levels meet Transport Canada guidelines, with regard to maintaining crowd control and access to muster stations, as well as size of firefighting party.
2. Particular attention will be paid to location of stores spaces, method of taking stores, garbage collection and disposal, ease of cleaning and housekeeping maintenance.
3. Basic First Aid facilities are to be provided, combined with a crew room.

There should also be sufficient deck space for foot passengers, as indicated by the passenger capacities per route indicated above (SOR-25).

SOR-62 Washrooms - Ferry

Two uni-sex washrooms should be fitted, configured as per “Universal Design” principles to accommodate disabled passenger needs (SOR 63).

SOR-63 Special Needs

For any new construction vessel, washrooms and passageways will comply with the Canadian Transportation Agency’s “Code of Practice - Ferry Accessibility for Persons with Disabilities”.

All pedestrian pathways from the terminal to berth and on the vessel will be suitable for disabled access.

Wayfinding signage will include signage suitable for the visually impaired in terms of location and size, referencing BCF standard signage.
SOR-64 Crew Facilities - Ferry

The crew should be accommodated in a separate zone from all passenger spaces. The crew facilities should include a crew washroom and a crew mess with seating for three (3), compliant with WorkSafe BC requirements. The crew washroom can be adjacent to the passenger washrooms.

As noted in SOR 61(3), the crew mess should be configured to provide First Aid facilities.

SOR-65 Vehicle Traffic Management

Signage on the terminal will be fitted to direct vehicles into the appropriate lanes on the vessel. The Designer should work with the Owner on the appropriate scheme.

It is also proposed that the vessel be fitted with wireless hands-free head sets for the deck crew for direct communication with the Operator in the main control station. This would be in addition to the conventional VHF and phone systems.

SOR-66 Terminal Compound Facilities

The existing facilities at the Buckley Bay terminal will be retained, with wayfinding signage, fencing, and lanes reconfigured for the cable ferry berth.

The expanded terminal at Denman West will incorporate the existing waiting room/washroom building. Any signage will be consistent with the BCF Standardised Terminal signage requirements and terminal specific drawings.

SOR 70 Environmental

The project has obtained approvals under Canadian Environmental Assessment Act (CEAA) and the Navigable Waters Protection Act (NWPA), and the provincial Integrated Land Management Branch (ILMB). The key requirements for the project are described the Canadian Environmental Assessment Agency (CEAA) approval document.

SOR-71 Environmental Standards - Ferry

This section references the environmental standards pertaining specifically to the vessel. The vessels will comply fully with Transport Canada and Environment Canada requirements concerning overboard discharges and machinery exhaust emissions as defined by the Vessel Pollution and Dangerous Chemicals Regulations.

SOR-72 Sewage Capacity

The vessel will be fitted with a holding tank of at least 9000 litres, with provision for discharge by a vacuum truck.

SOR-73 Terminal Requirements

The design of the terminal will comply with requirements for habitat compensation as defined by the BCFS Environmental Consultant.

SOR-74 Future Emissions Management

Provision will be made for conversion to either a compressed or liquefied natural gas system for the Prime Movers using a proven (commercial off the shelf) system as an alternative to conventional diesel prime movers. It is expected that the natural gas machinery will have to comply with ESD (Emergency Shut Down) requirements due to the size of the prime movers; this must be considered in the machinery arrangement and ventilation design.
At this time this equipment will be “fitted for, but not with” (FFBNW).

**SOR-75 Inventory of Hazardous Material**

The Designer shall prepare a preliminary Inventory of Hazardous Material for the vessel. The list will be provided to the shipyard/fabricator for further development and certification, in full collaboration with material and equipment vendors. The design of the vessel shall ensure the exclusion of certain materials, as per Canadian regulation and IMO Guidelines, with adherence to be verified during the new-build inspection.

**SOR-80 Equipment Selection**

It is the sole responsibility of the Designer to ensure that equipment specified for system meets with regulatory body approval (see SOR 02). Equipment should be selected for suitability for local support and extended maintenance. BCF will review and approve all major equipment to be supplied to the project.

**SOR-90 Inspection, and Maintenance Strategy**

**SOR-91 Terminal Maintenance**

The terminals and associated berths will be maintained by BCF Terminal Maintenance. The Designer will work with the local Terminal Maintenance office to develop a Long Range Maintenance Plan (LRMP) that includes consistent inspection and maintenance routines, and minimize the amount of specialized equipment (e.g. water rigs) to maintain the berths and cables.

All of the shore based infrastructure inclusive of the ramps, pontoons, transition decks and aprons, aprons, hydraulics, piling, abutments, cables, deadmen, tension winches and all of their components will be subject to Quarterly and Annual Inspections by Terminal Maintenance crews. The Annual Inspections will include NDT inspection by a professional contracted firm. Comprehensive Level 2 Surveys will be completed and reported at least every five years.

**SOR-92 Vessel Condition – In-Service Inspection and Maintenance**

BCF must be satisfied that the hull and major systems of the proposed vessel are suitable for the service and will be maintained in accordance with the BCF Fleet Maintenance Standards (FMS) [Reference 5]. The Designer will develop the appropriate maintenance schedules working with BCF, the regulator, and OEMs.

Particular emphasis is to be placed on the following:

1. Extended survey intervals for the hull; such that a 10 year interval between scheduled dockings can be achieved (see SOR-05);
2. Effective cathodic protection systems, with particular regard to the hull/cable/berth interaction;
3. Modular design of main machinery; such that major maintenance can be performed as a complete change out of equipment;
4. Inspection and maintenance routines for the cable guide rollers, wear pads, and the drive wheel system.
5. Inspection and maintenance routines for the cable brake system.
SOR-93 Cable Condition – In-Service Inspection and Maintenance

The Designer will develop an inspection and repair strategy for the traction cable and guide cables based on the expected design life developed from the wind/current/wave study referenced in SOR-12 [Ref. 2], starting with a duty cycle referenced in SOR-05. A capability to monitor the cable by assessing the cable extension and spot checks of condition will be developed for use by the vessel crew and by BCF Terminal Maintenance.

The cable arrangements will be designed for easy access and replacement, and be developed in conjunction with BCF Terminal Maintenance input and review. The cable replacement procedure is required to utilize BCF Terminal Maintenance in undertaking this work and must be conducted without interrupting ferry service or using marine rigs.
List of References:

1. "Cable Ferry Project - Baynes Sound Environmental Characterization Study”, Roddan Engineering, November 2012 (Rev.4.1).
4. BCFS Specifications – Coatings for Terminal Structures

Other References:

Appendix 9: Technical Statement of Requirements

The Technical Statement of Requirements for the ferry component of the integrated cable ferry system (vessel/cable/terminals) for Route 21 is attached.
BC Ferry Services

TECHNICAL STATEMENT OF REQUIREMENTS

Route 21 Cable Ferry

RoRo/Passenger Cable Ferry

January 2013

(Final Rev.0)
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<th>Section</th>
<th>Title</th>
</tr>
</thead>
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<td>Passenger Spaces</td>
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<td>540</td>
<td>N/A</td>
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<td>SOLID WASTE MANAGEMENT</td>
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<td>OUTFIT</td>
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<td>DECK MACHINERY/OUTFIT</td>
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<td>PASSENGER LOUNGE AREAS</td>
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<td>PASSENGER SERVICES</td>
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<tr>
<td>650</td>
<td>PASSENGER WASHROOMS</td>
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<td>660</td>
<td>CREW ACCOMMODATION</td>
</tr>
<tr>
<td>670</td>
<td>LOCKERS</td>
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<td>700</td>
<td>LIFE SAVING EQUIPMENT</td>
</tr>
<tr>
<td>701</td>
<td>General</td>
</tr>
<tr>
<td>710</td>
<td>EVACUATION ARRANGEMENT</td>
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<tr>
<td>720</td>
<td>RESCUE CRAFT</td>
</tr>
<tr>
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<td>LIFEJACKETS</td>
</tr>
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<td>OTHER REFERENCES:</td>
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**British Columbia Ferry Services, Inc.**

**Route 21 Cable Ferry TSOR**

**Final Rev. 0 January 2013**
INTRODUCTION

This document is a Technical Statement Of Requirements (TSOR) for the ferry component of an integrated cable ferry system (vessel/cable/terminals) to be used to deliver cable ferry service on Route 21, between Buckley Bay on Vancouver Island and Denman Island (Denman West terminal).

A cable ferry employs a drive wheel system (referred herein as the bull gear or bull winch) to pull itself along submarine cable that is deployed between two berth locations. This technology is expected to be reliable with a lower environmental impact and operational cost than a conventional propeller-driven ferry. The project involves construction of two new berths as well as the cable ferry system to accommodate the particular requirements of the project.

The TSOR has been structured to define the salient characteristics for the cable ferry component of the proposed service. It is intended to provide direction and supporting documentation for the development of a detailed tender and contract specifications for the ferry.

The TSOR, and the Statement of Operational Requirements (SOR) referenced herein, have been developed following an extensive program of field measurements of the environmental conditions on Route 21 [Reference 1] and a comprehensive dynamic system simulation [Reference 2]. A preliminary hull form and powering estimate was prepared for use in the dynamic analysis that the Designer will validate in detail design phase of the project.
TECHNICAL STATEMENT OF REQUIREMENTS (TSOR)

The following is a TSOR, provided for guidance purposes to contractor for design development. It is intended to complement the SOR, which defines the functional and regulatory requirements for the ferry [Reference 3].

Deviation from the TSOR is acceptable with sufficient documentation to support the change, and the prior approval of BCF.

The TSOR is organized by system using a Work Breakdown Structure (WBS) used on previous BCF new construction projects, adapted for a Cable Ferry.

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<td>600 - OUTFIT</td>
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</table>
Table 001: NOTIONAL DIMENSIONS AND PARTICULARS – 50AEQ CABLE FERRY

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Length Overall</td>
<td>78.5 metres</td>
</tr>
<tr>
<td>Breadth Molded</td>
<td>16.00 metres</td>
</tr>
<tr>
<td>Depth (Hull)</td>
<td>2.10 metres</td>
</tr>
<tr>
<td>Draft (Maximum, Commercial Vehicles)</td>
<td>1.078 metres</td>
</tr>
<tr>
<td>Draft (Light Operating)</td>
<td>0.612 metres</td>
</tr>
<tr>
<td>Freeboard</td>
<td>1.09 metres min, 1.49m max</td>
</tr>
<tr>
<td>Speed at 100% MCR, (contract Speed)</td>
<td>8.5 Knots</td>
</tr>
<tr>
<td>Speed at 85% MCR</td>
<td>Not less than 7.5 knots</td>
</tr>
<tr>
<td>Fuel Oil Capacity (90%)</td>
<td>10.00 m³</td>
</tr>
<tr>
<td>Lube Oil Capacity (100%)</td>
<td>2.75 m³</td>
</tr>
<tr>
<td>Potable Water Capacity</td>
<td>Bottled Water Station</td>
</tr>
<tr>
<td>Non-Potable Water Capacity</td>
<td>2.75 m³</td>
</tr>
<tr>
<td>Sewage Holding Tank Capacity</td>
<td>9.0 m³</td>
</tr>
<tr>
<td>Vehicle Capacity</td>
<td>50 AEQ*</td>
</tr>
<tr>
<td>Complement</td>
<td>150 Persons</td>
</tr>
<tr>
<td>Material</td>
<td>Grade ‘A’ Steel</td>
</tr>
<tr>
<td>Accommodation</td>
<td>Main Deck Steel Passenger Lounge</td>
</tr>
<tr>
<td>Fuel Type</td>
<td>MDO (future NG conversion TBD)</td>
</tr>
</tbody>
</table>

*AEQ = "Automobile Equivalent" (i.e. 1 space at 5.34 m long x 2.6 m wide x 1.8 tonnes)  
(Tonnes = 2204 lbs.; L. Tons = 2240 lbs.) (Gallons = Imperial Gallons)

See also General Arrangement Drawing (Provisional) – E.Y.E. Drawing #12019-102 (Attachment 1)

NOTE: All details subject to validation from the Designer
100 STRUCTURE

101 General – The vessel shall be constructed to comply with the requirements of Lloyd’s Register of Shipping (LR) “Ship Rules” Part 4 Chapter 5 – Barges and Pontoons.

Additional references from the LR Ship Rules include: Part 3 Chapter 9 – Special Features (Decks loaded by wheeled vehicles); and Part 4 Chapter 1 – General Cargo Ships.

Construction methodology and workmanship standards, as a minimum, will satisfy IACS quality standards for shipbuilding.

The hull shall be of mild steel construction, open main deck and double-ended.

All structural steel used for construction of the vessel and machinery including forgings and castings, to be of shipbuilding and marine quality, tested, inspected, and certified as and when required by the Classification Society (or to an equivalent ASTM standard) and shall be physically and chemically in conformity with such requirements.

The welding scheme shall meet the approval of the Classification Society. Manual and machine butt welds, edge preparations and procedures shall be submitted and approved by Class. The Designer shall prepare a welding schedule and shall present the Class approved schedule for review by the Owner prior to the commencement of any work.

Welding sequences should be carefully chosen to reduce the welding stresses and distortion as far as possible. Electrode processes, workmanship and techniques used in this installation shall be those approved by the Class.

102 Structural Design – In general, simplified barge construction techniques are to be employed.

The structure is to be designed to avoid resonance with the cable drive machinery. Plate panels in and above the engine room are to be designed so that resonance with engine firing sequence will not occur.

Internal and external bulkheads are to be located at frames or at longitudinals as far as practical. Slots, notches, air holes, and drain holes are to be provided where necessary. Decks are to be reinforced in way of large openings. Radii of openings in corners are to be well rounded as far as practical. Scantlings are to be increased in way of the vessel ends to absorb the impact loads from shore fenders and the applied loads from the cables.

110 Hull Structure

The choice of framing system shall be at the discretion of the Designer.

Hull penetrations are to be minimized and every other effort should be made to minimize the hull survey requirements. No skegs or external keel structure are required.

111 Hull – Structural Details – Details used in simple barge construction may be adopted. Lapped joints and use of common structural sections are acceptable.

112 Hull – Structural Protection - All surfaces shall be coated in accordance with the BCF Paint Standard [Reference 4], including non-skid coatings on exposed decks and passageways.
All exposed edges are to be chamfered, and stitch welding is to be avoided. Appropriate surface preparation in way of lagged/insulated areas shall be undertaken.

The car deck shall be appropriately marked with lanes and safety markings, to the Owner’s approved scheme.

The hull will also be fitted with an active cathodic protection system, in accordance with a dedicated study to be conducted that accounts for the influence of the cables and the berth. This study shall be undertaken as part of the design development. Individual hull spaces shall be fitted with passive anodes where past experience with active protection has proven inadequate.

113 Hull – Structural Fire Protection - The hull shall be insulated in accordance with the requirements of TC MS, referencing the draft “Fire Safety Regulations” as well as the “Equivalent Standards for Fire Protection of Passenger Ships”, TP2237E (see also TP 11469E).

114 Hull – Vehicle Deck Structure - The main vehicle deck shall be designed for a maximum axle load of 9.1 tonnes/set, 4.55 tonnes/tire footprint, the local contact criteria as per SOR 24, and shall include a wear margin of 2mm [over Class requirements] for vehicle traffic with particular attention in way of the docking aprons and heavy vehicle traffic. The main vehicle deck shall form the freeboard deck.

115 Hull – Local Reinforcement – The end structures of the hull shall be designed to resist the impact loads as defined by the dynamic modelling of the vessel/berth interface (Ref. 2).

120 Superstructure

The superstructure shall consist of a single accommodation block and machinery room, located as a centre casing. A Central Control Station will be fitted above the accommodation block.

Bulwarks shall be fitted around the perimeter of the main car deck with a minimum height of 1.2m, and adequate freeing ports for drainage. The vehicle deck shall be accessible to traffic from shore aprons with an 8.5m opening for dual lane loading at each end of the vessel; see Section 130. The openings will be protected by folding gates, manually folded, of the type seen on other BCF minor and intermediate vessels. The gates will be arranged to be pinned and locked when in transit.

Mild steel is to be used throughout.

121 Superstructure – Structural Details- All details shall be developed in accordance with Class requirements, and shall consider vibration and noise effects from the deck machinery. Drainage of rainwater and spray shall be considered, with details prone to collecting water, coating breakdown, and corrosion to be avoided.

Spaces fitted with windows and doors should be designed for standardized units, consider drainage, heating for windows, as well as the required fire rating.

122 Superstructure – Structural Protection – All surfaces shall be coated in accordance with the BCF Paint Standard (Ref. 4), including non-skid coatings on exposed decks and passageways. All exposed edges are to be chamfered, and stitch welding is to be avoided.
anywhere standing water is possible. Appropriate surface preparation in way of lagged/insulated areas shall be undertaken.

123 Superstructure – Structural Fire Protection - The superstructure shall be insulated in accordance with the requirements of TC MS draft “Fire Safety Regulations” as well as the “Equivalent Standards for Fire Protection of Passenger Ships”, TP2237E (see also TP 11469E).

124 Superstructure – Machinery Room – The cable drive machinery (Section 200) will be housed in a midship compartment in the centreline casing, containing the bull gear (cable winching system) and the prime movers. An evaluation of whether at least one prime mover should be isolated to eliminate the risk of loss from fire should be undertaken.

The machinery compartment shall be fitted with the required ventilation (Section 530) and with adequate scupper arrangements to ensure water entrained on the drive cable will not accumulate.

130 Cable Guides and Fairleads

The central drive cable (Section 221) will be lead into the machinery compartment using a set of bi-directional fairleads at each end of the ferry, through a central trough under the main car deck. The cable will be supported on wear pads at specific intervals, and inspection ports fitted with removal access plates shall be provided at intervals along the cable trough to facilitate inspection of the cable. Inside the machinery compartment the deck will be recessed in way of the bull gear to allow for cable alignment, and to provide a sump for the water entrained on the cable.

The guide cables, two of (Section 222) will be supported along the sides of the vessel through reinforced struts that will support fairleads guiding the cables. These appendages will be designed with sufficient margin to withstand the maximum loadings that result from the environmental design conditions defined in SOR 12.

140 Seatings and Miscellaneous Structure

All seatings for the machinery and bull gear will be subject to a detailed design review and approval by the Classification authority, with regard to strength, fatigue, noise and vibration attenuation. [As per Class requirements and: ISO 2923 Noise Level Measurement, ISO 6954-2000 (E) Vibration Level Measurement]

Recommendations of equipment suppliers shall be followed in the design of foundations. Engines are to be mounted on continuous girders fitted with heavy top plates.

Seatings and mounting structure for deck equipment shall be adequately reinforced and tied into the main structure. Girders or extra webs are to be fitted below heavy deck machinery.

All machinery trunking shall be appropriately fire-rated and insulated for noise attenuation [as per Class requirements and ISO 2923 Noise Level Measurement].

All doors opening on the vehicle deck and embarkation areas shall comply with TCMS requirements (Fire ratings). Closing of fire doors is to be controlled by the fire detection and alarm system by means holdbacks with indication from the fire door panel (Section 440). Stairs, railings and ladders shall comply with WorkSafeBC requirements.

Masts and flag staffs shall be designed and reinforced to avoid any vibration problems, particularly affecting electronics and radars. It is expected that the mast structures will include a
“Goal Post” frame structure at each end to support navigation and traffic signal lights, and a mast above the Central Control Station for navigation lights, signals, and flags.

The vessel should be fitted with bollards at each corner of the main deck to facilitate tie-up to the shore pontoon, with appropriate under deck reinforcing to secure the vessel to the pontoon in the environmental loads in conditions as specified in SOR 12. The bollards must have sufficient strength to manage the loads from an escort tug secured to the hull, as per Class requirements.
200  CABLE DRIVE SYSTEM

210  Prime Movers

Two prime movers of approximately 300 kW (installed rating) each, shall provide power to the cable drive system, one as the primary driver and one as stand-by. The Designer shall confirm the adequacy of the prime movers for the propulsion system. See Reference 2 for the preliminary powering calculation.

Propulsion may be by diesel-mechanical, diesel-hydraulic, or diesel-electric. A propulsion trade-off study will be undertaken by the Designer. Regardless of the selected option, the capability of converting the engines to natural gas is desired (Section 260).

For the proposed arrangement, the diesel-hydraulic option shall be considered the baseline option. The bull wheel system shall be driven by hydraulic motors by means of Power Take-Off (PTO) from the main engine. A vibration damper or fluid coupling shall connect the engine to the PTO. The system should be flexibly configured such that either prime mover can drive the unit. The Designer is to investigate whether the two units can work together to drive the system in a cost-effective manner.

It is anticipated that at least one of the prime movers shall be fitted to drive an electrical generator suitable for charging the battery banks specified in (Section 310).

ASME (North American) fittings shall be installed throughout.

Emissions shall comply with Transport Canada requirements and the provisions of the North American ECA. [SOR 70].

220  Cable System

221  Cable Drive System - The cable drive system is to be sized in concurrence with conventional design practice. A single centreline drive system comprising two drive wheels is anticipated. The diameter of the bull wheels shall not be less than 1650mm (65 in.), based on a 1.625” (38mm) cable (subject to the Designer’s confirmation); ideally the diameter should be maximized within the machinery compartment to minimize bending and wear on the cable. Two drive wheels shall be fitted with hardened non-slip material on the contact area.

The drive cable will be supplied in accordance with the specification provided in References 2 and 3, to be verified by the Designer.

The cable drive shall be fitted with a redundant hydraulic brake system with sufficient holding capacity to maintain the ferry against the berth under the most severe conditions specified in SOR 12. A hydraulic tension brake shall also be fitted at each end of the drive space to secure the drive cable in the event that the cable fails and tension is lost [Reference 5].

Appropriate mounting arrangements shall be approved by the Classification authority [140]. The arrangement should allow the cable drive system to be serviced without docking, such as modular skid-mounted units, and/or the capability to lift or slide the drive unit components through access panels in the deckhouse.

The cable drive system will be fitted with a self-lubricating system for the drive wheels and the end fairleads, that (as far as is practicable) does not allow lubricant to leak into the environment. The selected lubricant shall not contravene DFO or Environment Canada requirements.
The drive arrangements will have to demonstrate fuel efficiency, reliability, and maintainability to the satisfaction of the owner.

222 Guide Cable System - In addition to the drive cable, the ferry will operate on guide cables, one per side, consisting of cables of similar diameter as the drive cable, after being cycled out of the drive cable role.

The guide cables will be supported along the sides of the ferry using a system of sheaves at each end and amidships. These will incorporate a wear factor sufficient to ensure that they will not require renewal for any less than five (5) years. Provision for lubrication as per 221 shall be made.

230 Drive Controls

Control shall be from the Central Control Station and the Main Car Deck, configured for single person operation. There shall be sufficient flexibility in control to permit transfer of control and operation from either station.

The Central Control Station shall be fitted with a complete set of engine and drive controls, brake system, main switchboard, start/stop station for all principal ships service pumps, instrumentation and alarms for effective monitoring of machinery and principal systems.

The Main Car Deck Control Station shall be fitted with a set of engine shutdowns and drive controls, brake system, start/stop station for all principal ship’s service pumps, and general alarm indication panel. The station must be in a secure area or locker.

240 Engine Cooling

Engine cooling shall be through radiators mounted above the engine compartment, with sufficient cooling capacity to match the conditions specified as follows.

| Air Temperature: | -20C to 35C |

The radiators shall be positioned and configured to minimize exterior noise, as per Section 140. Hull penetrations for cooling systems are to be avoided.

250 Fuel and Lubrication Oil Treatment

The fuel and lubrication oil treatment system shall comply with the main engine vendor’s requirements. FO overflow tanks shall be fitted, as well as a gravity tank for “black out” conditions.

260 Natural Gas Propulsion

The ferry shall be fitted for future propulsion with natural gas, either as Liquefied Natural Gas (LNG) or Compressed Natural Gas (CNG), as “Fitted For But Not With” (FFBNW).

Foundations for a future Type C gas tank (or equivalent CNG tank) shall be installed above the centre casing, and piping run to the machinery compartment.

The machinery space shall be wired for the necessary gas detection alarms and fittings to comply with an ESD standard as per Class requirements.
300  ELECTRICAL SYSTEM

310  Power Generation

The ferry shall be designed with minimal electrical power requirements. An electrical design study shall be undertaken comparing the feasibility of using DC power exclusively, or low voltage 60 Hz AC power. The study will comprise a detailed load analysis, including emergency systems, a technical risk assessment, as well as a cost/benefit analysis.

In either case, it is anticipated that the primary power source will be a stored power system (e.g. Lithium Ferrous Phosphate or Lithium polymer batteries; or capacitor technology); in the case of a DC solution, there will be rectification to AC power. The selection of the appropriate stored power technology shall comprise part of the electrical design study. It is anticipated that charging of the system will be provided by shore power (Section 320) and a Power Take-Off from at least one of the main engines (Section 210).

311  Ship Service Power - Power shall be supplied by an electrical power generating system with sufficient ship service reserve capacity to maintain service for 16 hours without re-charging. The system shall comply with Transport Canada TP 127E publication and an additional 25% capacity on calculated full load [on a Fitted for but not with (FFBNW) basis].

312  Emergency Power - Emergency electrical power generator rated for the ship systems shall be configured to maintain essential services plus take home power, and shall comply with Transport Canada TP 127E. It shall be determined if this can be provided exclusively by battery or whether small diesel/gas generator is required.

313  Power Regeneration – There is an opportunity to develop regenerative power from the cable braking system and/or a power take-off from the drive engine, to provide in-service charging of the battery bank. This shall be evaluated as part of the design of the battery power system.

320  Shore Power

There shall be Plug-in shore power connections locations at both ends of the vessel, with the connector matching the BCF standard (Posi-Lock connection), rated 600V/300A. It shall employ a lockout system and shall synchronize ship service with shore power (“bumpless transfer” is not required). The system shall incorporate the necessary transformers and rectification to suit the ship’s electrical system.

Sufficient electrical capacity is required at the berths to provide a full charge to the battery bank at the overnight layover (7 hours) while maintaining the vessel services, including heating of the machinery and accommodation spaces, and the engines. The existing shore power capacity at Denman West may be combined with a ship-based source if necessary.

The Designer is to evaluate the cost effectiveness of a ship-based shore power (Ship to Shore) in event of power loss at a berth, versus shore generator back up. The ship-shore system requires cabling for provision of three phase power from the ship service system to the shore power grid, as per the BCF standard on the M.V. Quinitsa and TP 127E. A shore connection circuit breaker shall be fitted in the main switchboard to transfer to a secondary switchboard to isolate from BC Hydro. The alternative shore based generators would eliminate this requirement for the vessel but only if it is found to be cost effective.
330 Power Distribution/Rectification

The system shall employ a power management system and a power rectification system. No single fault should jeopardize the cable drive system. Distribution switchboard(s) are to be located in suitable places for power supply for heating, lighting, communication, navigation, and automation equipment, with separate ventilation; a single main switchboard is preferred.

331 Cabling - The ships electrical systems will comprise (some of) the following distribution systems:

- 480 or 600 volt, 60 Hz, single and 3 phase, 3 wire non-grounded (as required, see 310);
- 240 volt, 60 Hz, single and 3 phase, 3 wire non-grounded (as required, see 310);
- 120 volt, 60 Hz, single and 3 phase, 3 wire non-grounded (as required, see 310);
- 120 volt, UPS clean power unit
- 24 volt DC, 2 wire ungrounded
- 12 volt DC, 2 wire ungrounded.
- Propulsion voltage (if so fitted, see 210)
- 600 volt, 60 Hz, single and 3 phase, 3 wire non-grounded Shore Power (to BCF standard, see 320);

All cabling and distribution components shall comply with TCMS TP127E requirements. Instrumentation and communication cables are to be run separately from power cables. Spare cables are to be systematically run between main distribution boards (not more than 25% of total).

332 Power Rectification – The ferry will be fitted with a mix of AC and DC distribution that will require rectification to suit the plant configuration. A variable power unit (or equivalent technology) will be fitted for this purpose; with sufficient redundancy that no one fault disables the unit. Local transformers may be fitted where this is required or most cost effective.

333 Motor Control Centres – If warranted, electric motor starters may be incorporated into a centralised motor control centre located for economy and ease of cabling, with additional local control at each motor. The MCC shall be fitted with lockable disconnects for servicing.

340 Lighting

341 Public Spaces - Lighting shall be provided in all public areas including the vehicle deck in compliance with Transport Canada regulations. North American standard power supply is to be provided for lighting and socket outlets. Open deck lighting and flood lights shall have a central switch panel in the bridges. LED lighting shall generally be fitted, in accordance with the BCF standard [Reference 6].

342 Working Spaces - Lighting shall be provided in all working spaces in compliance with TCMS and WorkSafe BC regulations. Provision shall be made to black out the Central Control Station for night navigation.

343 Navigational Lights and Searchlights - Navigation lights shall be fitted in accordance with TCMS Collision Regulations, with control in the Central Control Station for direction of travel. LED lighting in accordance with the BCF standard (Ref. 6) is preferred. Consideration must be given to access for replacement of the lights.
Two searchlight(s), minimum 1000W, shall be fitted above the Central Control Station, arranged for 360° operation. A bridge indicator shall show when the searchlights are operating.

344 Emergency Lighting - Lighting shall be provided as per TCMS (TP 127E) and WorkSafe BC regulations. Consideration shall be given to low level lighting or reflective tape in passenger areas.
400 CONTROL AND COMMUNICATIONS

401 Central Control Station Arrangement - The control station shall be laid out as an efficient command post for effective single person control of the ferry underway and particularly during docking and undocking; and for vehicle and passenger traffic management during loading and unloading. A console with good all round visibility is required and the following features shall be incorporated:

- There shall be good unobstructed access with good visibility all round from the normal operating position, including line-of-sight over the vessel ends.
- A single control console is preferred with the ability to operate in either direction with sightlines to the shore ramp aprons from the normal operating position being essential.
- The station windows shall slope outward towards the top to minimise glare and sized to give good docking visibility. At least one window each side shall open.
- Window wipers with speed control shall be located for effective look-out. There shall be a steel grate walk around the outside of the Central Control Station to facilitate cleaning of the windows.
- Furnishings such as desk, folding chart table, chair, and book shelves are required.
- Access windows and catwalk for cleaning and maintenance shall be fitted.

410 Control Electronics

In general, the Control Station shall be fitted in accordance with recommendations provided by BCF Fleet Operations [Reference 7]. The outfit shall reflect the most current equipment at time of installation.

Cable Drive Controls shall be fitted in the Control Station as per Section 230, and shall be fully integrated, including transfer of control between the Main Car Deck console (as required), and subject to final approval of the Owner. Navigation Light controls and a Fire Indication Panel shall also be located in the Control Station along with radar displays, VHF radios, and search light control.

Radio and navigation equipment shall comply with TCMS requirements and will be subject to BCF approval, along with DGPS. Signalling equipment (signalling lights, whistles) is to be fitted in accordance with TCMS requirements.

There shall be a separate electronics room below the Central Control Station for servers and the UPS.

420 Public Address System and Traffic Control

The Public Address system shall be arranged for general broadcast and selected station communication, with clarity to a standard comparable with BCFS new construction (e.g.: M.V. Kuper), and shall comply with TCMS requirements.
It is proposed to fit electronic signage on the Terminals to assist in loading the vessel. The system would be operated remotely from the Central Control Station. General traffic direction can then be managed from a single station and the deck crew can direct passengers and/or assist with packing the vehicles. The system would be bi-directional and would be shut off when in transit (possibly with an interlock to the ramp position).

440 Internal Communication and Security

- A dedicated communication system interlinking Central Control Station, Machinery compartment(s), Crew space(s), Evacuation stations, and forward and aft vehicle loading stations shall be fitted and connected for emergency use. This would be in addition to the conventional VHF and sound-powered phone systems.

- In-dock security system linking vehicle decks and passenger embarkation areas with the Central Control Station shall also be fitted as per the BCF practice for minor vessels (dock buzzer and strobe lights).

- Alarm systems shall be fitted in accordance with TCMS requirements, including monitoring of watertight integrity, fire zones, compartment status, and tank levels. The general alarm system shall be integrated with the public address system, with the capability of being directed to crew space(s) only, or the whole vessel. As required, a mimic-type indicator panel shall be provided in the Central Control Station indicating status of fire doors; this may be an electronic display.

- A Closed Circuit TV (CCTV) display system in support of docking, security and surveillance shall be fitted in accordance with the BCF Corporate Standards. As a minimum, the CCTV surveillance system shall provide full coverage of the vehicle deck, including the boarding ramps, the passenger walkways, and lounge areas, as well as the machinery space(s). A monitor system shall be fitted to the Central Control Station and in the crew space. Consideration should also be given to a link to the BCF Operations and Security Centre (OSC).

- Control Station, crew space(s), and the machinery compartment shall be fitted with keypads or card lock to restrict access to authorised personnel

450 External Communication and Networking

A computer server to shore communication system interlinking vessel and shore based computer systems from crew’s spaces and control station (optionally) shall be fitted in accordance with the BCF corporate standard.
500 AUXILIARY SYSTEMS
The Designer shall be responsible for the detailed specification of all auxiliary systems, with reference to reference 7 for owner’s approval. The following sub-sections address design issues with specific auxiliary systems.

510 Bilge/ Fire Suppression Systems
Arrangements for bilge and fire systems shall be designed to comply with TCMS requirements for discharge and transfer.

511 Piping - No black steel piping shall be fitted. For seawater systems Cupra-Nickel fittings/piping shall be installed, galvanically isolated from main structure. All steel piping shall be seamless and galvanised after welding, with stress relief to avoid force fitting. Piping should be run outside the hull except where absolutely necessary. Insulation and/or heat tracing should be fitted as required to comply with the conditions specified in the SOR [Ref.3]. Hull penetrations and sub-sea valves are to be minimized; the exception may be a sea bay/well for fire pump suction (main and emergency).

512 Bilge System - Alarm and Level Control - An automatic bilge level monitoring system is to be interfaced with central alarm system. A portable bilge stripping system for the engine and hull compartments is to be carried, with oily water to be stored and treated separate from waste oil.

513 Fire Control/Suppression - A Water Mist fire suppression system shall be fitted for fire suppression in the Machinery compartment, Emergency Generator space, the Passenger Lounge, and Crew Mess. In addition to local control, the system shall be operable from the Central Control Station and the Main Car Deck station.

The vessel is also to be fitted with an automated fire monitor system (Techsol or equivalent) at the Boat Deck Level to provide complete coverage of the main car deck. Remote control of the monitors should be from the Central Control Station and a portable console. Consideration of the location of the monitors should involve piping requirements and pump capacities; outboard locations with a dedicated pump may be more cost effective than a centralized system.

The Fire pumps shall be sized to provide coverage of one half of the car deck area. Fire mains and fire pump fittings shall be welded flange and be capable of being isolated in the event of damage.

520 Potable Water and Sewage
The potable water system shall comply with Health Canada and TCMS requirements. Remote level indication is to be interfaced with central alarm system. Low flow fixtures shall be employed; such as dual-flush toilets, and low flow sinks.

521 Piping - The fresh water system shall be laid out to avoid dead ends, i.e. water recirculates. The manifolds for the non-potable water shall be sized and located at each of the vessel in a position in accordance with the BCF Standardized Berth Interface document [Reference 8].

522 Potable Water – Potable water will be provided from a standard commercial water cooler with bottled water.
523 Non-Potable Water- The water tank shall be a Stainless steel tank, sized to meet the requirements of the SOR and galvanically isolated from main structure. A single divided tank is required, where a section must be retained for priming the water mist fire suppression system.

524 Sewage Holding Tank - The vessel shall be fitted with a Sewage Holding Tank (as per SOR 72) of 9000 litres capacity.

The sewage holding tank will be required to accept "black water" and "grey water" drains from toilet spaces and wash places. The tank shall be fitted with venting, and be capable of operating effectively during periods of low passenger loading, and shall be automatic in operation requiring a low level of maintenance. The tank may be plastic or stainless steel.

The tank shall be configured for discharge by vacuum truck.

530 Heating, Ventilation and Air Conditioning

531 General - Heating, ventilation, and air conditioning (HVAC) shall be provided and designed for the comfort requirements of various spaces onboard, and designed in accordance with Classification Society requirements and HVAC system supplier recommendations. The requirement for air conditioning in the crew mess and control station shall be evaluated as a design study.

System design shall be designed to the following conditions:

| Winter - outdoors | -15°C.          |
| Winter - indoors  | +22°C.          |
| Summer - outdoors | +30°C, 70% relative humidity. |
| Summer - indoors  | +25°C, 55% relative humidity approximately. |
| Seawater          | 20°C.           |

There shall be Centralised control and monitoring of the HVAC system from the Central Control Station. An electrically driven heat pump system is envisaged.

The design shall comply with Class and supplier requirements, and be subject to owner’s review. The ventilation trunking shall be fitted for clean out access.

532 Machinery Compartment and Battery Room - Machinery compartment ventilation will be designed to meet air consumption needs of the engines while maintaining a habitable environment. Air supply fans shall be sized to provide sufficient air to maintain a slightly positive air pressure in the machinery space(s) when the machinery is operating at full rated power and the demands of the exhaust fans required to draw exhaust air outside have been met.

Two-speed, explosion-proof fans are to be fitted in accordance with TCMS and WorkSafe BC requirements in anticipation of an ESD (Emergency Shutdown) configuration if gas is used as a fuel. Air distribution ducts in technical spaces are to be arranged such that local hot/gas pockets are avoided.

533 Central Control Station and Crew Spaces - The Central Control Station shall be sound-proofed to meet WorkSafeBC regulations, air-conditioned to maintain a temperature of 25 degrees Celsius under the summer conditions specified in 531.
534 **Passenger Spaces** – The system shall be capable of maintaining a temperature in the passenger lounge and crew space(s) at 22 degrees Celsius under the winter conditions listed in TSOR 531.

The lounge is to be provided with a thermostat/air terminal such that the temperature is adjustable.

540 **N/A**

550 **Solid Waste Management**

Garbage handling facilities will be designed on the basis that garbage will be removed daily. An efficient system is required that will not disrupt vehicle operations. Provision shall be made for recycling and removal of recycled material, in accordance with the BC Waste Management Act.

560 **Stabilizing Systems**

Not applicable.

570 **Bunkering**

571 **Diesel Oil Bunkering**

A centralised bunkering station shall be fitted with a manifold on main vehicle deck, accepting fuel and lubes, discharging sludge and waste oil. The manifold should accept a standard 50mm (2”) Hose Gun from a Tanker Truck. An oil spill kit shall be stored in close proximity. Provision shall be made for storage of waste oil for recycling, separate from oily water.

A separate hydrant shall be fitted for bunkering freshwater, for non-potable water, as per 521.

572 **LNG Bunkering**

The Designer will ensure that there is a sufficient space allocation to fit a modular LNG bunkering station on the main deck, where the LNG will be provided by a tractor trailer unit. The location and space allocation should allow for containment and/or drainage.

The Designer should also identify or develop a modular arrangement for the bunkering station itself, including the appropriate valve configurations, inputs for fuelling and nitrogen purging, and venting arrangements. Due to the small size and tank capacity of the installation, it is expected that this can be based on an automotive fuelling station rather than a larger scale marine installation.
600 OUTFIT

The Designer shall be responsible for the detailed specification of all components and systems associated with the ship’s outfit, with reference to [Reference 9] for owner’s approval. The following sub-sections address designs issues related to the ship’s outfit.

610 Deck Machinery/Outfit

Bollards shall be appropriately located on the main deck at each end for securing to the shore pontoon (see 140).

An anchor will be fitted to be operated with an electric or hydraulic windlass [TBD], with chain/cable stowed on the drum (no chain locker). The anchor weight should be about 550 kg. Each anchor assembly consists of fifteen fathoms (one shackle) of 5/8” chain between the anchor and forty-nine fathoms of 19mm (¾”) x 6/19 flexible steel wire. Any hydraulic equipment shall be compatible with biodegradable fluid.

620 Passenger Access

Provision shall be made for foot passenger access to the passenger lounge with 915mm wide path along a dedicated aisle along the exterior of the central casing on both sides. The access shall be defined by signage and marking of the vehicle lanes.

630 Passenger Lounge Areas

Seating for not less than 60 passengers shall be provided in an enclosed lounge area on the main deck. All materials and outfit shall be TCMS approved, and comply with the BCF standards for colour and appearance (Ref. 9).

The passenger area shall feature large windows for natural lighting, with required fire ratings, and provision for blackout curtains. Direct access to the passenger walkway (620) will be provided without passengers moving directly into vehicle traffic. The space shall be heated and ventilated, as per 530.

A covered passenger area shall be outfitted with aluminium or steel benches for not less than 30 passengers at the opposite end of the centre casing under the passenger shelter.

640 Passenger Services

Passenger services will comprise vending machines in the shelter area, and a public notice board in the passenger lounge. A separate pet holding area will be allocated on the main deck under the passenger shelter.

650 Passenger Washrooms

Two uni-sex public washrooms are to be located on the main car deck, and shall comply with the accessibility requirement of the Transportation Safety Agency Guidelines (SOR-02-4) and Health Canada requirements. “Universal Design” principles are to be applied to the extent possible (SOR 62 and 63). Plumbing shall be arranged such that individual fixtures can be isolated. There shall be a cleaning locker adjacent to the washrooms.

The washrooms will be fitted with one toilet and one hand basin, and hose bib. Power door access, and alarm push-button, is to be provided.
660 Crew Accommodation

The layout of the centre casing will allocate a space for the use of the crew. The space will accommodate following:

- Storage for equipment manuals/documentation;
- Crew Workstation
- Crew's Mess Table and seating for four (4);
- Half Lockers for Six (6)
- A pantry/fridge, small coffee machine, and convection microwave
- Lockable medicine cabinet and adjacent stretcher stowage (folding)
- A crew washroom; sink and toilet.

As noted in SOR 61(3), the crew mess should be configured to provide First Aid.

670 Lockers

Locker space shall be provided on the vehicle deck for basic cleaning supplies. A main cleaning locker will be fitted with running water, drainage, a deck sink, shelving, lighting and electrical outlets, and fire detection.

A locker shall be located on the main vehicle deck for containment of an oil spill containment kit.

A locker containing immersion suits, PPE, and equipment for the Emergency Boat shall be located near the boat platform. A locker for fire equipment shall be fitted on main vehicle deck, adjacent to the crew mess (660). They shall be fitted for lighting; ventilation; two plugs; and heat.
700 LIFE SAVING EQUIPMENT

Life saving equipment has a direct influence on the manning levels required for the ship. Special attention shall be paid to laying out a lifesaving system meeting applicable regulations with minimum manning and maintenance requirements. An evacuation plan based on the contracted design will be submitted to TCMS for approval early in the project.

701 General- All lifesaving equipment shall meet Transport Canada, Marine Safety Branch requirements, in accordance with Sheltered Waters standards for a complement of 150 (passengers and crew), as per the Lifesaving Equipment Regulations (LSER), as amended.

710 Evacuation Arrangements

Two evacuation stations are to be provided, one per side, each capable of evacuating 100% of the complement, such that only one station is required to be manned.

Inflatable Slide and Platforms of the 150 person capacity approved for Sheltered Waters shall be stowed readily for deployment from vehicle deck level with automatic release from bridge as well as local release. Access to the life rafts shall be by a chute system requiring minimal crew support.

*BCFS Fleet Standard is the DBC ESS (2.5m) with 150 person inflatable platform.*

720 Rescue Craft

One (1) Rigid Inflatable Boat (RIB) shall be fitted as an Emergency Boat at the side of the vessel, to be serviced by a single-point davit that can be operated remotely by the boat crew.

The rescue boat shall be positioned to not interfere with vehicle lanes; thus a small elevated platform may be required, providing sufficient clearance for under height vehicles (2.6m).

The emergency boat system shall be type approved by TCMS, and shall be sufficiently powered to tow a fully loaded Inflatable Platform, or an oil containment boom (BCF Standard supply).

*BCFS Fleet Standard is the Polaris P3 with 40hp outboard. The Polaris 166R is the current equivalent in production.*

730 Lifejackets

Lifejackets shall be provided as per TC LSER carriage requirements except that not less than 80 “Youth” sized lifejackets shall be carried to ensure adequate coverage for school children. Lifejackets shall comply with TC and CGSB standards. In addition, the crew shall be provided with TC-approved inflatable lifejackets.

The lifejackets shall be stowed in appropriate lockers in the passenger shelter area.
REFERENCES AND ATTACHMENTS

Cited References


3. “Statement Of Operational Requirements - Integrated Cable Ferry System (50 Vehicle Cable Ferry And Ferry Berths) For: Route 21 Buckley Bay – Denman Island, Prepared By: British Columbia Ferry Services Inc. January 2013, (Final Rev.0)


5. B.C Ferries Memo: Hydraulic Cable Brake Arrangement

6. B.C. Ferries Memo: List of Approved Light Fixtures

7. B.C Ferries Memo: Cable Ferry Control Station Requirements [TBD]


9. B.C. Ferries Interior Design Standard [TBD]

List of Attachments:

1. General Arrangement Drawing (Provisional) – E.Y.E. Drawing #12019-102

Other References:

TBD
Appendix 10: Index of Responses to Section 55 Guideline Questions

Project Description

a) Describe the proposal for the capital expenditure and provide a comparison to the capital currently in use, in terms, for example, of size, capacity and staff and/or crew requirements.  
See section 2 and Appendix 7

b) In the case of a new vessel, has an independent marine surveyor provided a condition assessment of the current vessel and is that assessment factored into the business case supporting the requested capital expenditure?  
Not applicable (Quinitsa will be redeployed)

c) Is there a regulatory driver for the proposed capital expenditure?  
No

d) Provide information on the operating costs of the vessel, terminal, information technology or other capital asset to be replaced and/or to be upgraded, covering the most recent three year period, including the current year.  
See Supplemental Information

e) Compare the annual maintenance costs of the existing capital asset with those expected for the replacement and explain any significant variances.  
See section 2.1

f) Have there been service disruptions due to inadequacy of the existing capital asset?  
See Appendix 1

g) If age of the existing capital asset is a factor, what is the estimate of future costs of continuing its use?  
Not applicable (Quinitsa will be redeployed)

h) Have there been complaints from the public, or other stakeholders about the existing capital asset?  
See Appendix 5

i) Provide an estimate of the total capital costs associated with the proposed investment.  
See section 3.3

j) How was the cost estimate derived? Entirely with BC Ferries’ staff or was there an external review?  
See section 3.3

k) In the case of a new vessel was the international ship broking industry contacted to determine if there are existing vessels available for purchase that may, with adaptation, be appropriate?  
See section 4.1
l) Provide an estimate of the incremental capital costs to provide "ancillary services," including catering and retail concessions, and provide estimates of the incremental operating costs to provide the ancillary services and the incremental revenue expected to be generated from those services. 

Not applicable (No ancillary services are to be provided)

m) In the case of a new vessel, demonstrate on a lifecycle cost or present value basis that the decision to build a new vessel versus the cost of acquiring a second-hand vessel, if applicable, is a net benefit. Include sensitivity analysis in case of cost overruns.

Not applicable (No suitable used vessel identified)

n) Does the proposal include significant features that are innovative or untried?

See sections 3.3 and 4.2

o) Is there an allowance in the estimate for inflation from the date of acceptance of a proposal to the completion date (escalation clause)?

See section 4.2

p) Are financing costs included in the cost estimate between first payment to the supplier and the in-service date?

Yes

q) Compare the operating costs of the existing capital asset with those expected for the replacement, to include, in the case of vessels, fuel costs, crew costs and depreciation.

See sections 2.1 and 3.3 and Supplemental Information

r) Does BC Ferries intend to capitalize any of its own internal costs with respect to the capital expenditure?

Yes, in accordance with BC Ferries' financial policies and International Financial Reporting Standards

s) Identify any parts of the capital expenditure that are to be provided by BC Ferries or its subsidiaries.

See section 4.1

t) In the case of vessels, if tenders are to be sought from foreign shipbuilders, what is the applicability of custom tariffs on importation of the vessels?

The three RFP bidders are all North American based, as such custom tariffs are not applicable.

u) In the case of vessels, will BC Ferries require the contracting shipyard to bear the design and construction risk?

See section 4.2
Timing and In-service Date

a) For new or replacement vessels what is the expected in-service or deployment date and how was it derived? See section 4.1

b) Were potential builders, for example shipyards, contacted to determine if the proposed date is reasonable? See section 4.1

c) What are the consequences of a delay in the in-service or deployment date? See section 4.1

Does the Proposed Capital Expenditure Demonstrate Good Judgment, Based on Wisdom, Experience and Good Sense?

i) Why is the proposed capital expenditure required now, and what are the consequences of any delay? See section 4.1

ii) How has this capital expenditure project been prioritized relative to other capital expenditure projects within the long term capital plan? This project is of a high priority based on the strong business case and projected operational savings

iii) What sources of expertise and experience have been relied upon in deciding to proceed with this capital expenditure? See Appendix 3

iv) Provide detail on completed and/or planned consultations, in particular with the provincial government or other stakeholders. See Appendix 6

v) In the case of new vessels, has BC Ferries considered any alternative to building and owning the new vessels? See section 4.1

vi) Will a new or replacement vessel require any modifications to any terminals? If so, at what additional cost? See section 3.3 and Supplemental Information

vii) What are the procurement cost risks and how will they be mitigated? See section 4.2

viii) What are the consequences or the alternatives if the application is rejected? The ability to retire an existing vessel in the fleet without replacement will be foregone.
Wise Use of Resources

i) Can an existing vessel be reassigned instead? No. BC Ferries has no spare vessels to reassign.

ii) For shorter routes, were non-vessel options considered, such as a fixed link? Yes, fixed link option was considered, but is cost prohibitive.

iii) Were non-vehicle vessels (e.g. passenger only ferries, barges, other) or a mix of vessel types considered? Yes, but projected requirements indicate that a Ro/Ro Pax ferry will be required for the foreseeable future.

iv) Has a used vessel option been considered? See section 4.1.

v) How does the vessel align with the concept of standardization of the fleet? See section 2.1.

vi) Would investments in technology, such as an expanded reservation system, better IT systems or a yield management program allow for a smaller sized vessel? No, Route study utilization indicates that loading is cyclical and seasonal. The vessel capacity is sized and sufficient to manage expected and future loading. See Appendix 4.

Showing Due Consideration for the Future

i) How does the proposed new vessel contribute to overall fleet flexibility? See section 2.1.

ii) What new technologies or innovations will be incorporated, and why are they considered necessary? See sections 3.3 and 4.2.

iii) Will there be provision for a conversion to an alternative to marine diesel engines, such as LNG? See section 3.3.

iv) Is dual fuel capability planned and if so provide the rationale? See section 3.3.

v) Will the new or replacement vessel be appropriate if the ratio of vehicle to foot passenger traffic changes in future? See section 2.1 and Appendix 4.

vi) Is vessel capacity sufficient to meet current and projected future demand? See section 2.1 and Appendix 4.

vii) What is the estimated impact of the proposed capital expenditure on future price caps assuming no change in non-passenger related revenues? See section 3.5.
Not Excessive

i) What passenger amenities will be provided, and why are they considered appropriate for the intended use of this vessel?

Not applicable (There are no ancillary services)

ii) Do any of the proposed passenger amenities require crewing levels to be higher than what is required by Transport Canada regulations?

Not applicable (There are no ancillary services)

iii) Is the vessel the right size and how has the capacity requirement been determined?

See section 2.1 and Appendix 4

iv) Describe the objectives of BC Ferries’ design standards for passenger accommodations for vessels of similar size and scope. Will the passenger accommodations for the replacement vessel deviate from these standards? If so, what is the rationale for the deviation and what impact, if any, will it have on the capital and operating costs of the vessel?

See Appendix 7

v) Will the application of logos or other BC Ferries’ brand images to the vessel be consistent with BC Ferries’ current practice for similar vessels. If not, how will it differ and what will be the effect on capital costs?

See Appendix 7

vi) What would have to be sacrificed to reduce total costs by 10%, and by 20%?

See section 3.6

vii) Does vessel design or expected operating speed have any impact on labour costs?

Yes, the simplified vessel design results in crew reductions, and hence lower labour costs.

viii) Are engines sized for efficient operations, fuel consumption and ability to recover schedule?

See Appendix 7
Demonstrating Good Value at a Fair, Moderate Price

i) For new vessels what alternatives were considered? Provide the rationale (cost or otherwise) for why the alternatives were not accepted.

Section 3 analysis indicates that the cable ferry is the preferred option.

ii) Has the business case been built on a full life cycle costing basis?

Yes, see section 3

iii) How fuel efficient will the new vessels(s) be?

See section 3.3

iv) Will the new or replacement vessel have any impact on efficient use of labour?

See sections 2.1 and 3.3 and Supplemental Information

v) Are the operating costs reasonable?

See Supplemental Information

vi) How do the operating costs compare with the vessel being replaced?

See section 3.3 and Supplemental Information

vii) Is there any expected impact on revenue?

No

viii) Will crew training and certification activities be in excess of that required to meet regulatory requirements? If so, explain the rationale for this approach and whether it will result in incremental operating costs.

No, crew training and certifications will be sufficient to meet regulatory requirements. Operational training will also be provided to meet service reliability goals.

Coastal Ferry Services Contract

i) Is the proposed capital expenditure consistent with the current Coastal Ferry Services Contract?

See section 2.1

Long Term Vision for Coastal Ferry Services in British Columbia

i) How does the proposed expenditure support the government approved long term vision for the future of coastal ferry services?

See section 2.1