British Columbia Ferry Services Inc.

Application to the
British Columbia Ferries Commissioner

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

For

New Salish Class Vessel and Island Class Vessels

Routes 5, 19 and 23

November 5, 2018

Note: In this copy of the Application, information of a confidential and commercially-sensitive nature has been redacted.

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Executive Summary

British Columbia Ferry Services Inc. ("BC Ferries" or the "Company") proposes to invest $<> million in the procurement of four new Island class vessels and one new Salish class vessel, including incremental terminal improvements, which will enable the retirement of the *Powell River Queen* (built in 1965), the *Bowen Queen* (built in 1965), and the *Mayne Queen* (built in 1965) in fiscal 2022[1] (the "Project").

BC Ferries plans to deploy the first two of the four Island class vessels on the route connecting Campbell River and Quadra Island ("Route 23") as a direct replacement for the *Powell River Queen.* The other two Island class vessels would be deployed on the route connecting Nanaimo Harbour and Gabriola Island ("Route 19") enabling the redeployment of the *Quinsam* to the route connecting Crofton with Vesuvius ("Route 6"), the *Quinitsa* to refit relief, and the retirement of the *Bowen Queen*. The Salish class vessel would replace the *Mayne Queen* and would be deployed, with the *Queen of Cumberland,* on the route connecting Swartz Bay with the Southern Gulf Islands ("Route 5/5A").[2]

BC Ferries is an essential transportation link that connects coastal communities and facilitates the movement of people, goods, and services. The Company understands the important role it plays in maintaining the quality of life of people who live, work, and visit British Columbia and seeks to ensure that the service it provides is safe, reliable, efficient and sustainable. This Project furthers these objectives through focusing on enhancing route resiliency and service benefits to customers and communities. The Project advances strategies that have been presented in previous applications to the British Columbia Ferries Commissioner (the "Commissioner"), namely the consolidation of vessel classes and fleet standardization and interoperability, which serve to enhance overall operational efficiency and cost-effective service. In particular, the Project will provide the following key benefits:

- Standardization / Interoperability – the proposed procurement of Island class and Salish class vessels would continue the phased construction of already-established vessel classes, reducing the number of classes in the fleet and allowing for efficiencies in the supply chain, ease of crew interoperability and training, and more flexibility in vessel deployment and relief, including during vessel outages for mechanical, maintenance or other reasons.

[1] Fiscal years are from April 1 through March 31.
[2] See Appendix A for a full listing of all regulated routes served by BC Ferries.

- Efficient and Affordable – BC Ferries' customers expect the Company to operate efficiently and invest prudently in assets and infrastructure, so that the fares they pay are put to the highest and best use. The acquisition of additional Island and Salish class vessels would support the move towards greater standardization and interoperability of the fleet which results in lower capital costs and greater operational efficiency for the ferry system overall.

- Reliable and Resilient – vessel standardization, as noted, enables flexibility in vessel deployments. This, in turn, increases reliability of services for the customers and communities that BC Ferries serves. The new Salish class vessel would replace the *Mayne Queen*, providing a consistent customer experience with vessels of the same class on both Route 5 and the route connecting Tsawwassen with Southern Gulf Islands ("Route 9/9A"), while ensuring sufficient and flexible capacity to meet changing traffic demands in the Southern Gulf Islands. On each of Routes 19 and 23, two Island class vessels would replace the single larger vessels currently in operation. Multiple smaller vessels would meet the expressed and clear preference of the communities served by these routes. It would also ensure sufficient capacity to meet demand, allow for faster loading and discharge, facilitate better on-time performance, enable continued service in the event of a vessel outage, and, overall, provide more dependable service to customers and communities.

- Reduced Community Impact – the terminals on Routes 19 and 23 are constrained by their size, which introduces congestion and safety issues in the surrounding road network. Two smaller vessels operating on each route instead of one larger one, providing service on a more frequent basis would mitigate this issue through reducing the volume of traffic discharged into the community on each arrival. Such an approach also has significantly less impact in terms of the required terminal modifications on Routes 19 and 23 and the associated capital cost.

- Environmental Stewardship – the Project further advances BC Ferries' commitment to reducing its ecological footprint through lowering emissions and adopting clean marine technology. The Salish class vessel would operate primarily on liquefied natural gas ("LNG"), which substantially outperforms vessels fueled with the Company's alternative fuel source, ultra-low sulfur diesel ("diesel"), in reduced emissions and fuel costs. The four Island class vessels would have hybrid diesel-electric propulsion and would be built to be capable of conversion to all-electric propulsion as the technology permits and the necessary electrical infrastructure is in place to support it. In addition, these newly-built vessels would introduce features to reduce the underwater noise signature, principally through revised propeller design. Overall, BC Ferries expects the Island class vessels to be amongst the cleanest, most efficient and quietest of their size in the world.

The Company has in place rigorous processes to identify, monitor, and address the risks of the Project. The Project follows the successful earlier phases of the Company's vessel replacement program and incorporates best practices and lessons learned from these previous phases.

BC Ferries has undertaken extensive analysis in support of the Project. The Company believes that the Project is reasonable, affordable, and prudent. The planned expenditure responds to community needs, and will help ensure that service remains safe, reliable, and sustainable for many years to come.

Section 1 – Introduction

1.1 Application Overview

BC Ferries submits this Application pursuant to section 55 (2) of the *Coastal Ferry Act* (the "Act") to obtain the Commissioner's approval of a major capital expenditure for the Project.

The Project represents a continuation of the Company's move towards standardization of its fleet. BC Ferries proposes to procure one additional Salish class vessel and four additional Island class vessels. The capital expenditures for the first three Salish class vessels, which now operate on Routes 9/9A and Route 17 (connecting Comox with Powell River), and the first two Island class vessels, which are under construction and are planned for deployment in January 2020 on Route 18 (connecting Texada Island with Powell River) and Route 25 (connecting Port McNeill, Alert Bay and Sointula), were approved by Order 13-01 dated July 19, 2013 and Order 17-01 dated February 27, 2017, respectively. The vessels proposed in this Application will be identical in all substantive respects to their respective sister ships.

The Salish class vessel, which would have a vehicle capacity of 138 automobile equivalents ("AEQ")[3] and carry a complement of up to 600 passengers and crew, would serve on Route 5. The *Queen of Cumberland* now serving that route would be redeployed to Route 5A, enabling the retirement of the *Mayne Queen* (58 AEQ capacity; 400 passengers and crew). The four Island class vessels, each of which would have vehicle capacity of 47 AEQs and carry a complement of up to 450 passengers and crew, would serve on Routes 19 and 23 (two on each route). Their acquisition would result in the redeployment of the *Quinsam* (63 AEQ capacity; 400 passengers and crew) from Route 19 to Route 6 (connecting Crofton with Vesuvius), and would enable the retirement of the *Powell River Queen* (59 AEQ capacity; 400 passengers and crew) and the *Bowen Queen* (61 AEQ capacity; 400 passengers and crew).

Incremental terminal improvements that are directly required in support of the operation of the new vessels are included in this Application, including modifications to Berth 5 at Swartz Bay (Route 5) and the breakwater at Campbell River (Route 23), and new tie-up berths at Nanaimo Harbour (Route 19) and Campbell River (Route 23).

[3] An automobile equivalent ("AEQ") is BC Ferries' standard unit of measure for an approximation of one car length. AEQs are calculated by using a conversion factor for each vehicle type. For example, a passenger vehicle would be one AEQ while a bus would be three AEQs. One AEQ is 6.1 metres long and 2.6 metres wide. Vessel AEQ capacities may vary from those stated in the Coastal Ferry Services Contract due a change in the standard measure from 5.34 metres to 6.1 metres.

Replacing the existing vessels on Routes 19 and 23 with two new Island class vessels on each route would enable BC Ferries to provide vessel capacities of almost 100 AEQ per round trip cycle duration for each route. This would be an increase in overall vessel capacity in the order of 35 AEQ and 100 passengers per each route's round trip cycle duration. The same capacity could be provided using a new single 100 AEQ ferry (Shuttle class vessel) on each route instead of two Island class vessels; however, community consultations show strong support for the 'two vessel option' on the routes, and both vehicle and throughput modelling show that a larger vessel would require more turnaround time affecting traditional sailing times. By comparison, the multiple smaller Island class option would serve to increase sailing frequency (and customer choice of sailing time), increase resiliency, flexibility, and interoperability, provide more flexibility in crewing, and reduce long-term operating costs associated with training and supply chain.

Overall, BC Ferries believes that the potential benefits of proceeding with the procurement of the proposed Island class and Salish class vessels are significant, and would help ensure that service for the communities remains safe and reliable for many years to come.

The Project was included in the Company's 12-year capital plan (for fiscal 2015 through 2026) submitted to the Commissioner for performance term four (April 1, 2016 – March 31, 2020) ("PT4") and is also included in the Company's 12-year capital plan (for fiscal 2019 through 2030) submitted for performance term five (April 1, 2020 – March 31, 2024) ("PT5").

Section 55 of the Act distinguishes between "capital expenditures" and "major capital expenditures". With respect to major capital expenditures, section 55 (2) of the Act requires a ferry operator to obtain the Commissioner's approval before incurring a major capital expenditure. A major capital expenditure is defined in section 55 (5) of the Act as one which:

> *"…meets the criteria (a) established by the Commissioner from time to time, and (b) most recently provided by the Commissioner to the ferry operator".*

By Order 17-02 dated March 2, 2017, the Commissioner defined a major capital expenditure for which the Company must seek approval under section 55 (2) of the Act to include any capital expenditure which exceeds $50 million for a new vessel or $25 million for terminal upgrades. Pursuant to Order 17-02, the Project constitutes a major capital expenditure. By this Application, BC Ferries seeks the approval of the Commissioner, in accordance with section 55 (2) of the Act, for a major capital expenditure for the Project of up to $<> million, inclusive of interest during construction ("IDC"), and supplemental Project expenditures of up to $<> million, for a total Project expenditure of up to $<> million.

BC Ferries submits that the total expenditure for the Project, as described in this Application, is reasonable, affordable and prudent and consistent with the Coastal Ferry Services Contract between the Company and the Province of British Columbia (the "Contract").

BC Ferries notes that the legislative requirement to seek pre-approval of the proposed capital expenditure for the Project necessitates the submission of this Application before the procurement processes for the construction of the vessels are complete. Two separate competitive procurement processes are now underway for the Project – one for the four Island class vessels and the other for the Salish class vessel (see section 6.2.2). With the processes yet to be finalized, there is a risk that certain assumptions BC Ferries has made in this Application may require subsequent amendment, with a commensurate change in the projected capital expenditures for the vessel replacements.

1.2 Organization of Application

This Application is organized as follows:

- Section 2 describes the current environment including a discussion of BC Ferries' fleet; an overview of Routes 5/5A, 19 and 23; and the community and stakeholder engagement activities related to the Project.

- Section 3 describes the Project, including an overview of the Company's fleet renewal and standardization strategy.

- Section 4 discusses the anticipated deployment of the new and existing vessels as a result of the Project, as well as alternative vessel class strategies that were considered.

- Section 5 provides an assessment of the vessel replacement options that have been considered, together with a recommended option and the expected impact on the price caps should that option be approved.

- Section 6 addresses matters related to procurement, timeline, and risk mitigation strategies for the Project.

Section 2 – Current Environment

2.1 Overview

BC Ferries is an independent company providing ferry services on the west coast of British Columbia in accordance with the requirements of the Contract. The Company provides frequent year-round marine transportation service with 35 vessels operating on 25 routes out of 47 terminals spread over 1,600 kilometres of coastline. In fiscal 2018, BC Ferries carried 8.7 million vehicles and 22 million passengers on more than 179,000 sailings. Passenger numbers were the highest BC Ferries has experienced in 20 years and vehicle traffic the highest the Company has ever experienced.

The Company understands its responsibility to provide safe, reliable, efficient, and sustainable marine transportation, as well as its important role in maintaining the quality of life of people who live, work, and visit British Columbia. BC Ferries is a significant contributor to the provincial economy, an enabler of commerce for coastal communities, and a vital connection on which coastal communities rely. Within this context, over the next decade BC Ferries will need to replace numerous vessels that are approaching retirement age. Of relevance to the Project, the Company:

- Has adopted a strategy of greater standardization and interoperability of the fleet, whose benefits include the efficient and effective deployment of vessels and reduced costs;
- Plans to build redundancy into the fleet, where appropriate, so it can be more resilient in the face of an adverse event;
- Intends to add passenger and vehicle capacity to the fleet, which is expected to reduce the frequency of overloaded sailings on affected routes; and
- Understands the importance of environmental stewardship and is focused on continuing to increase efficiency and sustainability through environmentally-conscious initiatives, including wherever possible the adoption of new marine technologies, such as LNG, hybrid diesel-electric propulsion, efficient hull design, and low noise design.

BC Ferries is committed to providing a consistent and positive customer experience that is responsive to customers' needs, regardless of the route they travel on. The Company knows that certainty of travel and service reliability is important to its customers, and it is committed to fulfilling its vision of being worthy of the public's trust and valued for the services it provides. The Project seeks to further the Company's commitment in these areas.

The Company is focused on engaging with customers and communities on the type, scale, and frequency of services they want to see. This means giving customers and communities a voice in the decisions that affect them most, and continually evaluating the services provided to ensure BC Ferries is offering a reliable, efficient and affordable experience that aligns with the needs of those who travel. This Project responds to the feedback received from customers and communities on the services that are important to them.

2.2 BC Ferries' Fleet

BC Ferries' operations are among the largest and most complex of ferry systems in the world; however, its fleet is aged and comprised of many different types of vessels. In fiscal 2018, BC Ferries' fleet of 35 vessels had an average vessel age of 31 years and was comprised of 17 classes of vessels. BC Ferries has a significant program of vessel replacement underway, which commenced in 2004 following its conversion from a Crown corporation to an independent company. In the five year period to 2009, BC Ferries acquired seven new vessels, of which three were deployed on the major routes, comprising the three routes connecting Metro Vancouver with mid and southern Vancouver Island plus the route connecting Horseshoe Bay with Langdale, two were deployed on the northern routes, which serve the coastal communities north of Port Hardy, and two were deployed on the inter-island (or minor) routes, which primarily serve the Northern and Southern Gulf Islands and the Northern Sunshine Coast.

In 2016, a new cable ferry was introduced into service on the route connecting Denman Island and Buckley Bay ("Route 21"). Three new Salish class vessels were introduced into service on the Southern Gulf Island routes and Route 17 in 2017. Also that year, under an agreement with the Province, BC Ferries purchased a used vessel and undertook vessel modifications to introduce the *Northern Sea Wolf* to the route connecting Bella Coola with the mid-coast and Port Hardy ("Route 28") in 2019. In 2017, two new Island class vessels were procured for service in the Northern Gulf Island routes (Routes 18 and 25). These vessels are expected to be in service in 2020.

To ensure continued ability to deliver safe, reliable and cost-effective service that meets the requirements of the Contract, BC Ferries will need to replace (or life-extend) a further 14 vessels over the next 10 years. The process of fleet replacement will include a transition from a fleet of many unique vessels to one that has vessels with high physical and operational commonality. The next phase in this is the proposed replacements of the *Powell River Queen, Mayne Queen,* and *Bowen Queen*, which are the subject of this Application.

2.3 History and Condition of Vessels to Be Replaced

The *Powell River Queen*, *Bowen Queen,* and *Mayne Queen* were built in 1965, and at their planned retirement dates, will be over 55 years old. Even with regular maintenance, refit, and dry-docking, service reliability concerns are prevalent with these vessels, which are costly to keep in operation. The age and overall condition of the vessels are such that a life extension is not considered a prudent investment for any of the three vessels. This view is supported by BC Ferries' assessments of the condition of the vessels and by Lloyd's Register Canada, which was contracted by BC Ferries in 2015 to provide an independent assessment of these vessels. The findings are discussed in Appendix B.

2.4 Routes 19 and 23

2.4.1. Overview

Route 19 is a short commuter route with a crossing time of approximately 20 minutes and with a schedule that permits a limited time in dock. The route connects the 3 nautical miles between Nanaimo Harbour on Vancouver Island and Descanso Bay on Gabriola Island, with the transit being in relatively sheltered waters except for a short transit between Duke Point and Descanso Bay.

The Contract requires BC Ferries to provide at least 4,898 round trips on the route per annum. Currently, the *Quinsam* operates on Route 19 and is challenged to carry all traffic during peak times. As a result of higher traffic volumes, overloaded sailings on this route have increased from 7.8 percent in fiscal 2015 to 10.3 percent in fiscal 2018, and on-time performance has declined from 90.1 percent to 88.3 percent in this period.

As discussed in further detail below, frequency of service, time of day sailings and the length of day that the service is provided are key attributes of service for this route, which has a large proportion of commuters. With limited terminal infrastructure and terminal vehicle holding space on Gabriola Island and limited options for terminal expansion, overloads at the Gabriola Island side create congestion for terminal neighbours as vehicles line up in a holding lane along the side of the road. Ferry traffic during peak periods at Nanaimo Harbour terminal

can also back up along Front Street due to the size of the terminal compound, time to process tickets and the rate at which vehicles arrive, causing congestion for local businesses.

By comparison, Route 23 connects Campbell River on Vancouver Island with Quathiaski Cove on Quadra Island, taking 10 minutes to span the 1.2 nautical miles with a short time in dock. Similar to Route 19, Route 23 is a commuter route, where specific sailing times, frequency of service and length of operating day are important attributes. BC Ferries is required by the Contract to provide at least 5,785 round trips annually on the route, which is also used by those on Cortes Island to access Vancouver Island via Quadra Island ("Route 24"). Currently, the *Powell River Queen* can be challenged to carry the peak traffic on Route 23. Overloaded sailings on this route have increased from 8.2 percent in fiscal 2015 to 13.8 percent in fiscal 2018. On-time performance during this period has remained consistent at approximately 98 percent.

Both terminals on Route 23 are constrained by high vehicle loads and face challenges offloading vehicles due to single lane loading and limited space. Due to terminal layout and the staging of overloaded vehicles on the hill in a secondary staging area, overloads at the Quadra Island terminal require additional traffic management resources to lessen negative customer experiences attributed to delayed or missed connections and congestion for the local community.

The channel between Campbell River and Quadra Island (Johnstone Strait) is extremely challenging due to tidal-induced currents and high winds. The berth at Quathiaski Cove is reasonably sheltered, but the berth in Campbell River can be subject to conditions which cause unacceptable motion of the vessel in the berth. These conditions are the most challenging of the routes covered in this Application, and pose significant engineering and operational challenges.

Additional details about Routes 19 and 23 are provided in Appendix C.

2.4.2. Public and Stakeholder Engagement

As described above, BC Ferries proposes to deploy two smaller ships instead of one larger ship on each of Routes 19 and 23. This plan would introduce increased capacity, frequency, and resiliency into the system, and ensure continuity of service with the remaining vessel when one of the vessels has an unplanned service interruption.

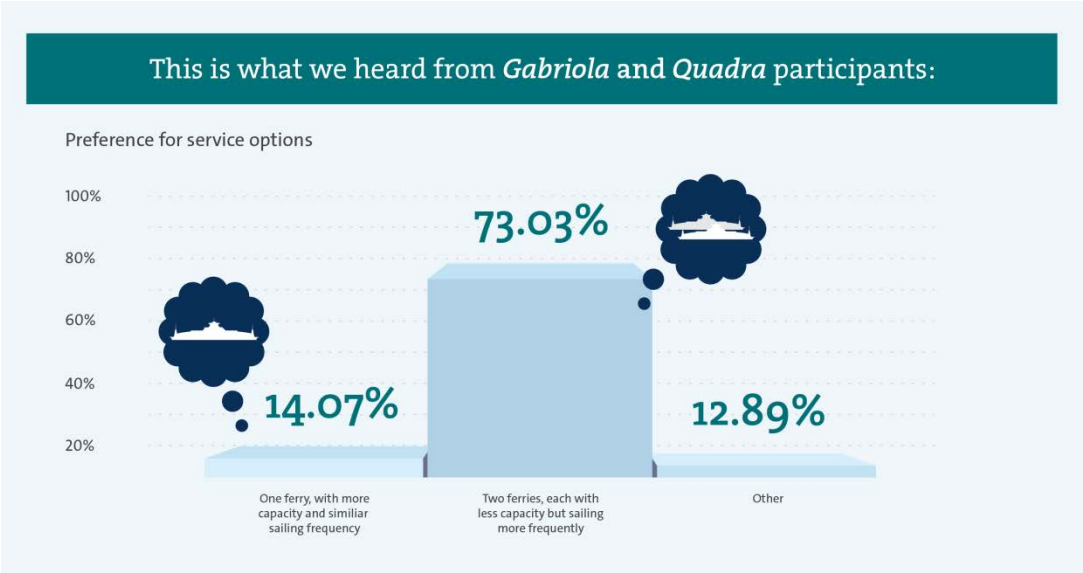
The communities on Gabriola Island and Quadra Island (including Cortes Island) have routine and direct linkages with the larger, neighbouring communities of Nanaimo and Campbell River. The nature of travel, therefore, is somewhat unusual in BC Ferries' service areas, with a higher

proportion of the population using Route 19 and Route 23 service for regular commuting, school, post-secondary education, medical visits, shopping, services, and social activity. Moreover, the nature of the travel for these purposes is more bi-directional than on other Gulf Islands routes, meaning that the level of demand is similar on both legs of a round trip. Due to the short travel distances and relatively higher populations on Quadra Island and Gabriola Island, the relationship to the adjacent cities on Vancouver Island has similarities to city suburbs or nearby rural areas. Therefore, high frequency and specific time of day sailings are important to the social and community framework.

For several years, BC Ferries has engaged with the public about replacement vessels through the Ferry Advisory Committee process. BC Ferries has also completed specific in-person and online engagement with Gabriola Island and Quadra Island residents. These sessions focused on asking stakeholders, including employees of BC Ferries on the routes affected, whether they would prefer one larger vessel that provides a similar sailing frequency as the current service, or two smaller vessels that provide increased sailing frequency.

As detailed in the figure below, about 73 percent of the over 1,400 engagement participants indicated a strong preference for two smaller ships with higher frequency sailings as is proposed in this Application. Of those who chose the 'other' category, there was also a strong preference for two ships, with respondents offering a variety of possible two-ship configurations for consideration.

The next engagement steps will focus on informing customers and community members of the vessel building process, and closer to the date of the ships entering service, will seek to gather community input on schedule preferences. More information on BC Ferries' engagement process for the vessels on Routes 19 and 23, and the results of these efforts, is provided in Appendix D.



2.4.3. Customer Feedback

Appendix E provides details regarding feedback received from customers about Routes 19 and 23. The appendix also includes the results of BC Ferries' customer satisfaction tracking survey for those routes.

2.5 Route 5 / 5A

2.5.1. Overview

Route 5/5A is a multiport route connecting Swartz Bay with terminals on Pender Island, Saturna Island, Mayne Island, and Galiano Island using the *Queen of Cumberland* and *Mayne Queen,* respectively. BC Ferries is required under the Contract to provide at least 3,461 round trips on the combined route per annum. The distance of the route depends on the destination, but varies from 8 nautical miles between Swartz Bay and Pender Island to 16 nautical miles between Swartz Bay and Saturna Island. Likewise, crossing time depends on routing and is, for example, 40 minutes between Swartz Bay and Pender Island, and two hours from Swartz Bay to Galiano Island when there are two stops. The transit is within relatively sheltered waters, with the exception of the transit of Active Pass to Sturdies Bay (Galiano Island), where tidal-induced currents can be quite strong.

The *Queen of Cumberland* generally serves Route 5 and the *Mayne Queen* generally serves Route 5A. The traffic demand on Route 5A is generally less than on Route 5 due, in large part, to different vessel capacities and service schedules.

The Route 5 schedule permits longer loading times, which allow for a larger vessel. Between fiscal 2015 and fiscal 2018, there has been a 9 percent growth[4] in total vehicles carried on Route 5/5A. With this growth, on-time performance on Route 5/5A declined from 91.3 percent in fiscal 2015 to 83.7 percent in fiscal 2018, while overloaded sailings increased over the same period from 3.0 percent to 4.4 percent.

Additional details about Route 5 are provided in Appendix C.

2.5.2. Public and Stakeholder Engagement

As described above, BC Ferries proposes to deploy a new Salish class vessel on Route 5, which would enable the redeployment of the *Queen of Cumberland* to Route 5A and the retirement of the *Mayne Queen.* BC Ferries selected a Salish class vessel for this route as its design is amenable to the route profile with its longer voyage lengths, and includes other benefits, including more customer amenities that are commensurate with the trip duration. This vessel would be the third Salish class vessel introduced into the Southern Gulf Islands, further increasing the potential for a consistent service experience to customers travelling to these islands.

While the design of the vessel will replicate that of the three existing vessels in the class, some improvements that are being applied to the existing ships, such as galley ventilation and improved external door operation, will also be included in the new vessel for Route 5. In addition to addressing these matters, which were among those raised by the Southern Gulf Islands Ferry Advisory Committee, BC Ferries has engaged with the Committee throughout the *Mayne Queen* vessel replacement process to understand and consider their specific concerns and questions.

With the design specifications for this class of vessels already confirmed, further public and stakeholder engagement will focus on familiarizing participants with the design and the attributes of the vessel. Engagement activities will also include community conversations regarding schedule changes related to the introduction of the new vessel and redeployment of the *Queen of Cumberland*. These efforts will include seeking community feedback on what schedules best meet the needs of the communities served by Route 5/5A.

2.5.3. Customer Feedback

Appendix E provides details regarding feedback received from customers about Route 5/5A. The appendix also includes the results of BC Ferries' customer satisfaction tracking survey for that route.

[4] 10 percent growth if calculated on the basis of AEQs.

Section 3 – Project Description

3.1 Vessel Replacements

As described earlier, BC Ferries has two competitive procurement processes underway - one for the construction of the four Island class vessels and another for the construction of a Salish class vessel. These new vessels will enable the retirement of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen,* all of which are near the end of their service lives and are scheduled for retirement in fiscal 2022.

The delivery of the vessels would be the responsibility of the shipyards. The five new vessels would be expected to be delivered at least three months in advance of their in-service dates to enable crew training and other activities necessary to ensure their successful deployment. The target in-service dates for the five new vessels are set out below:

Island class vessels:

- *Powell River Queen* replacements (for service on Route 23) - Spring 2021; and
- *Bowen Queen* replacements (for service on Route 19) – Winter 2021.

Salish class vessel:

- *Mayne Queen* replacement (for service on Route 5) – Fall 2021.

The timeline for the Project is described more fully in section 6.2.3. and reflects the age and condition of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* and the need to retire and replace them expeditiously in order to minimize service disruptions and ensure continuity of service.

3.2 Fleet Planning

BC Ferries has a detailed and comprehensive long-range vessel planning process. It starts with a corporate Strategic Plan based on the Company's vision of being trusted and valued, and its mission to connect communities and customers to people and places important in their lives. The Company's Fleet Master Plan translates the broad direction of the Strategic Plan into specific strategies, policies, design directives, and tactics for the development of the fleet that will help the Company progress towards its strategic goals.

As discussed above, BC Ferries will need to replace or life extend 14 vessels over the next 10 years. In support of this, the Fleet Master Plan's strategic statement indicates that the fleet will transition from a fleet of many unique vessels to a fleet of vessels that have high

physical and operational commonality. The number of unique vessels in the fleet will be minimized, and common operational and maintenance procedures will be used as far as practicable. Consistent with this, the design of the Salish class and Island class vessels currently do and will continue to emphasize safety, environmental stewardship, efficiency, standardization, and customer experience. The Company's corporate strategic drivers provide a foundation for the objectives underlying the fleet renewal program:

i. Operational Excellence

- Achieve a high-quality customer experience while supporting fare affordability;
- Achieve deployment flexibility within the service area; and
- Promote interoperability within the fleet.

ii. Financial Sustainability

- Design vessels with the lowest practicable operating and life cycle cost through the optimization of fuel consumption and labour costs;
- Assess program build opportunities for prudent and sustainable fleet investments; and
- Achieve standardization across vessels, including components, procedures and equipment.

iii. Employee Engagement

- Ensure safe, efficient and productive vessel working conditions.

iv. Environmental and Social Governance

- Balance the needs of the service and the Company's impact on the environment; and
- Consider the differing needs of local communities.

v. Innovation and Continuous Improvement

- Optimize life cycle costs and seek improved operational efficiency; and
- Build vessels for a long life to extract maximum value and flexibility.

These objectives were fundamental to the approach proposed for the Island class vessels and Salish class vessels, and specifically for the replacements of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen*.

3.3 Standardization

3.3.1 Overview

A key objective of BC Ferries' fleet renewal program, and the proposed acquisition of the four Island class vessels and one Salish class vessel as set out in this Application, is to achieve efficiencies in BC Ferries' fleet of vessels through an over-arching vessel class and standardization strategy that delivers better service, provides resiliency of operations and reduces crewing, training and supply chain costs.

BC Ferries' customers expect the cost of travel to be reasonable for the services they receive. They are concerned about fare affordability and expect BC Ferries to operate efficiently and invest prudently in assets and infrastructure, ensuring that the fares they pay are put to the highest and best use. Central to achieving this is the strategy to move towards greater standardization and interoperability of the fleet. Reducing the degree of fleet diversity brings significant benefits, including the prospect of significant savings in asset acquisition and other capital costs as efficiencies are realized through a series-build program.

Improved operational efficiencies are also expected from standardization, including those realized through lower crew training costs as a result of standardized bridge, engine room and accommodation layouts, and lower maintenance and inventory costs through more commonality or standardization of parts and critical spares. Standardization enables greater consistency of service and service expectations across routes, as relief vessels are more likely to be identical and provide an identical service level to the community. Higher customer and community satisfaction will result. Standardization enhances interoperability across a variety of routes, lowering redeployment costs such as training, management effort, technical support and berth fits. Greater flexibility in scheduling can be realized through standardization, since vessel assets can be better managed if their capabilities are the same. Further, standardization helps ensure seamless and efficient emergency deployments in cases of unforeseen fleet operational issues. This should also enhance operational safety as a greater number of employees in the fleet will operate across fewer classes of vessels.

Taken together, these factors will enable the Company to make further advances in efficient and effective service delivery, which will help to keep fares affordable going forward.[5]

[5] Standardization and interoperability of vessels and terminals were recognized as desirable policy objectives to optimize the efficiency of the fleet and to achieve cost savings in the Commissioner's report of January 24, 2012 entitled *Review of the Coastal Ferry Act*. As well, the results of the public opinion poll conducted as part of the provincial government's 2012 community consultation process on coastal ferries found that 59 percent of respondents strongly agreed and 24 percent of respondents somewhat agreed (for a total of 83 percent of respondents in agreement) with the concept of standardizing vessels and docks to allow flexibility to switch ferries and crews between routes.

3.3.2 Salish Class Vessels

The Company currently has three Salish class vessels in operation. The *Salish Orca* replaced the *Queen of Burnaby* on Route 17, while the *Salish Eagle* replaced the *Queen of Nanaimo* on Route 9. The *Salish Raven* provides service to the Southern Gulf Islands in addition to providing refit relief for other intermediate class vessels. This Application envisages the procurement of a fourth Salish class vessel which, in design, would replicate the current vessels in the class, incorporating the improvements made to-date such as galley ventilation, improved external door operation, and LNG system modifications. The new vessel would provide service on Route 5, but would be interoperable on various routes. BC Ferries' vessel replacement plan envisages a further two Salish class vessels being added to the fleet within the next 16 years, bringing the total vessels in the class to six.

To meet the standard design and achieve interoperability within the Salish class, the new vessel would be built with amenities that would support a full scale hot food service as is currently offered onboard the existing Salish class vessels operating on Routes 9 and 17. However, while operating on Route 5, the new Salish class vessel would offer a "basic plus" food service, consisting of self-serve items such as pre-packed cold food and limited hot food, as well as retail services. These service offerings would be an enhancement to those now provided on Route 5 by the *Queen of Cumberland*. No crew incremental to minimum safe manning levels would be required specifically to support the catering and retail service offerings.

Unlike the 'two ship' Island class solution proposed for the relatively shorter Routes 19 and 23, the longer duration crossing and multiport nature of Route 5/5A make it difficult to address changes in demand with increased frequency of sailings, and instead make this route better suited to an increase in vessel capacity.

Deploying a Salish class vessel (138 AEQ) on Route 5 would provide for service enhancement through both increased capacity and onboard amenities. The use of a Salish class vessel on Route 5 would allow for the redeployment of the *Queen of Cumberland* (112 total AEQ with a main car deck capacity of 76 AEQ) to Route 5A which has lower traffic demand, enabling the retirement of the *Mayne Queen* (58 AEQ). In contrast to the *Queen of Cumberland*, Salish class vessels are built without hoistable vehicle ramps, which reduces any negative impacts that the *Queen of Cumberland's* hoistable ramps have had on-time performance on Route 5. On Route 5A, it is expected that the *Queen of Cumberland* would rarely need to use the hoistable ramps to increase vehicle capacity above its main deck capacity, which is 18 AEQ greater than the *Mayne Queen* capacity. This is expected to result in an improvement in on-time performance for the route.

The characteristics of the Salish class vessels were described in BC Ferries' application to the Commissioner dated May 22, 2013, for a major capital expenditure for New Intermediate Class Vessels – Routes 9 and 17, approved by Order 13-01. An overview of the vessel characteristics is provided in Table 4-B in section 4.1. Appendix F provides further information.[6]

3.3.3 Island Class Vessels

BC Ferries expects that the Island class will eventually replace what are today six classes of vessels encompassing 13 ships.[7] Ultimately, the Island class vessels will be the smallest-sized standardized class in the Company's fleet.

The Company currently has two Island class vessels under construction, which will be deployed on Routes 18 and 25. This Application envisages the acquisition of a further four vessels in this class. By replacing the *Quinsam* (63 AEQ) and the *Powell River Queen* (59 AEQ) each with two Island class vessels (combined 94 AEQ) on Routes 19 and 23, the Company would be better able to scale capacity to the daily traffic pattern on each route. Each route would have increased frequency of service and capacity through a two-ship operation during the peak demand times of the day, while the use of a single vessel will provide the capacity needed during the periods of low demand in the early morning and late evening. A two-vessel service is also expected to improve the loading and unloading time, thereby increasing throughput of traffic during the most desired times of travel.

The characteristics of the Island class vessels were described in BC Ferries' application to the Commissioner dated January 3, 2017, for a major capital expenditure for New Minor Class Vessels - Routes 18 and 25, approved by Order 17-01. An overview of the vessel characteristics is provided Table 4-C in section 4.1. Appendix F provides further information.[8]

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[6] The actual Salish class vessel capacity is the same as was proposed in the May 22, 2013 application. However, due a change in BC Ferries' standard AEQ measure from 5.34 metres to 6.1 metres, Salish class vessels are currently listed as having a capacity of 138 AEQs, while the proposed intermediate class vessels in the May 22, 2013 application had a capacity of 145 AEQs.

[7] The Bowen class consists of the *Bowen Queen, Powell River* Queen and *Mayne Queen*; the K class consists of the *Klitsa, Kahloke, Kuper* and *Kwuna*; the T class consists of the *Tachek* and *Quadra Queen II (*the *Tenaka* was retired in 2015 as part of the cable ferry program); the Q class consists of the *Quinitsa* and *Quinsam*; and the *North Island Princess* and the *Howe Sound Queen* are each single ship classes.

[8] Since BC Ferries' January 3, 2017 Application, the Island class design has been refined and finalized. The final design accommodates 47 AEQ as opposed to 44 AEQ and passenger and crew capacity is now up to 450, compared to 300.

3.3.4. Summary

BC Ferries believes that there are significant benefits with proceeding to acquire Island class vessels and building an additional Salish class vessel to address the pending retirements of the *Mayne Queen*, *Bowen Queen*, and *Powell River Queen*. In particular, continuing to renew the fleet with common classes of vessels should enable lower capital costs through series-build programs; lower crew training costs through standardization of bridge, engine room and accommodation layouts; and lower maintenance costs through standardization of components. In addition, such standardization results in improved ease of deployment, interoperability and resilience of service on and between routes, and enhanced operational safety with a greater percentage of employees in the fleet operating across fewer classes of vessels. The envisaged size, configuration, and deployment of the Island class and Salish class vessels is intended to enhance the customer experience and support community needs, while ensuring that all regulatory, operating and Contractual requirements will be met effectively, efficiently and in a manner that demonstrates the Company's commitment to strong environmental stewardship and the sustainability of the ferry system.

Section 4 – Vessel Deployments

4.1 Overview

As described above, this Application envisages the deployment of a new Salish class vessel on Route 5, which would enable the redeployment of the *Queen of Cumberland* to Route 5A, and the retirement of the *Mayne Queen*. As well, it is envisaged that two new Island class vessels would be deployed on Route 23 as a direct replacement for the *Powell River Queen,* while a further two vessels of this class would be deployed on Route 19, enabling the redeployment of the *Quinsam* to Route 6. The *Quinitsa,* which will be assigned to Route 6 following the retirement of the *Howe Sound Queen*, would return to refit relief enabling the retirement of the *Bowen Queen.*

BC Ferries currently uses the *Bowen Queen* as a dedicated refit relief vessel. With the replacement of this vessel, refit relief on the Southern Gulf Island routes would be provided by a Salish class vessel (off-peak from Route 9A service). The *Quinitsa* would provide refit relief for Route 19, while an Island class vessel from Route 19 would be redeployed as refit relief on Route 23, as the *Quinitsa* is not suited for the environmental conditions (wind/wave/current) on that route.

The retirement of the *Bowen Queen* and the change to the makeup of the fleet will have implications for refit relief availability. This is discussed in more detail in section 6.4.5, regarding operational and deployment risks.

The anticipated vessel deployment strategy is summarized in Table 4-A. Given that the proposed deployments will not occur until fiscal year 2022, this deployment strategy is tentative and subject to change based on operational imperatives.

Table 4-A: Vessel Deployment Strategy

Route	Current Vessel Deployments	Proposed Tentative Vessel Deployments
Regular Service		
5	*Queen of Cumberland* – 112 AEQ	New Salish class vessel - 138 AEQ
5A	*Mayne Queen – 58 AEQ*	*Queen of Cumberland* – 112 AEQ total / 76 AEQ main deck
6	*Howe Sound Queen – 52 AEQ*	*Quinsam* – 63 AEQ
19	*Quinsam* – 63 AEQ	New Island class vessel – 47 AEQ New Island class vessel – 47 AEQ
23	*Powell River Queen* – 59 AEQ	New Island class vessel - 47 AEQ New Island class vessel - 47 AEQ
Refit Relief		
5	*Bowen Queen* – 61 AEQ	Salish class vessel – 138 AEQ
5A	*Bowen Queen* – 61 AEQ	Salish class vessel – 138 AEQ
6	*Bowen Queen* - 61 AEQ	*Quinitsa* - 44 AEQ
19	*Bowen Queen* - 61 AEQ	*Quinitsa* - 44 AEQ
23	*Bowen Queen* - 61 AEQ	New Island class vessel – 47 AEQ

Table 4-B and Table 4-C below set out the operational characteristics of the *Powell River Queen, Bowen Queen* and *Mayne Queen* as compared to the Island class and Salish class vessels which BC Ferries proposes will replace them.

Table 4-B: Summary of Operating Characteristics for Route 5/5A Current and Replacement Vessels

Specification	*Queen of Cumberland*	*Mayne Queen*	Salish class
Current	Route 5	Route 5A	Route 9, 9A, 17
Future	Route 5A	Retire	Route 5
Voyage classification	Sheltered Waters	Sheltered Waters	Near Coastal 2
Overall Length	96m (314'9")	84.96m (278'9")	107m (351')
Draught	3.768m	2.45m	4.65m
Service Speed	12.5 knots	14 knots	15.5 knots
Propulsion	Diesel-Electric/4 x CPP azimuthing thrusters	Geared Diesels driving 4 FP thrusters	(LNG) Gas-Electric/2 x Twin-Prop Thrusters
Vehicle Capacity	112 AEQ	58 AEQ	138 AEQ
Commercial Vehicle Height (maximum)	4.5m	4.3m	4.75m
Crew licences & Passengers	Crew/Passengers A 12/450 = 462 B 10/385 = 395	Crew/Passengers A: 8/392 = 400 B: 7/193 = 200	Crew/Passengers A 15/585 = 600 B 14/386 = 400
Passenger Decks	Overhead / 2 Decks	Overhead / 2 Decks	Overhead / 2 Decks
Passenger Facilities	Coast Cafe Express, Kids Zone, work/study stations, elevators, accessible washrooms	Passenger lounge with washrooms and vending; access to passenger area is via stairs only	Coastal Cafe, Passages Gift Shop, Kids Play Area, Pet Area, work/study stations, accessible washrooms, induction loop hearing system, 2 elevators
Flexibility of Use on Alternative Routes	Sheltered Waters routes with BC Ferries' standardized minor/ intermediate berth configuration. Redeployment constrained by vessel service speed limitations.	Sheltered Waters routes with BC Ferries' standardized minor/ intermediate berth configuration. Redeployment constrained by vessel size limitation.	Sheltered Waters or Near Coastal Class 2 routes with BC Ferries' standardized minor/ intermediate berth configuration

Table 4-C: Summary of Operating Characteristics for Route 6, Route 19 and Route 23 Current and Replacement Vessels

Specification	*Bowen Queen*	*Quinitsa*	*Quinsam*	*Powell River Queen*	Island class
Current	Relief	Route 6	Route 19	Route 23	
Future	Retire	Relief	Route 6	Retire	Routes 18, 19, 23 and 25
Voyage classification	Sheltered Waters Seasonal Near Coastal class 2	Sheltered Waters	Sheltered Waters	Sheltered Waters	Near Coastal 2
Overall Length	84.96m (278'9")	77.59m (254'7")	89.84m (294'9")	84.96m (278'9")	80.80m (265'09")
Draught (keel)	2.45m	1.725m	1.80m	2.45m	3.13m
Service Speed	14 knots	10 knots	12 knots	14 knots	14 knots
Propulsion	Geared Diesels driving 4 FP thrusters	Diesels driving 4 FP thrusters	Diesels driving 4 FP thrusters	Geared Diesels driving 4 FP thrusters	Hybrid Diesel-Electric, 2 Twin Prop Thrusters
Vehicle Capacity	61 AEQ	44 AEQ	63 AEQ	59 AEQ	47 AEQ
Commercial Vehicle Height (maximum)	4.3m	4.57m	4.7m	4.72m	4.75m
Crew licences & Passengers	Crew/Passengers A: 10/390 = 400 B: 8/292 = 300 C: 7/193 = 200	Crew/Passengers A: 6/294 = 300	Crew/Passengers A: 8/392 = 400 B: 7/293 = 300	Crew/Passengers A: 8/392 = 400 B: 7/193 = 200	Crew/Passengers (TBD) A: 8/442 = 450 B: 7/293 = 300 C: 6/144 = 150
Passenger Decks	Overhead / 2 Decks	Main Deck/ 1 Deck	Main Deck/ 1 Deck	Overhead / 1 Deck	Main Deck / 1 Deck; external sun deck with solarium
Passenger Facilities	Passenger lounge with washrooms and vending; access to passenger area is via stairs only	Accessible car deck lounges, accessible washrooms	Accessible car deck lounges, accessible washrooms	Passenger lounge with washrooms and vending; access to passenger area is via stairs only	Accessible main lounge on car deck, accessible washroom, vending, pet area; stair lift to Sun Deck
Flexibility of Use on Alternative Routes	Sheltered Waters or Near Coastal class 2 routes with BC Ferries' standardized minor/ intermediate berth configuration	Sheltered Waters routes with BC Ferries' standardized minor/ intermediate berth configuration. Redeployment constrained by vessel size and service speed limitations.	Sheltered Waters routes with BC Ferries' standardized minor/ intermediate berth configuration. Redeployment constrained by vessel size and service speed limitations.	Sheltered Waters routes with BC Ferries' standardized minor/ intermediate berth configuration	Sheltered Waters or Near Coastal class 2 routes with BC Ferries' standardized minor/ intermediate berth configuration

4.2 Alternative Vessel Class Strategy

With the higher capacity proposed for Routes 19 and 23 (in total 94 AEQ for each route), and the deployment of a Salish class vessel on Route 5, the possibility of introducing a new vessel class, the Shuttle class, to serve all three routes (Routes 19, 23 and 5/5A) was considered.

The Shuttle class concept reflects a scaled-up (approximately 100 AEQ) version of the Island class in terms of general layout and equipment, but with some features and design attributes in common with the Salish class. It is envisaged that the engineering and propulsion design would be optimized for short routes (i.e. less than 30 minute transit duration). The Shuttle class would include an open car deck, quick to load/unload, with a main deck passenger lounge equipped with a modular kiosk to provide food amenities on routes where this type of passenger offering is desired and expected. The vessels in this class would encompass a simple hybrid diesel-electric solution which would be highly similar to the Island class design and would be ideally suited for future conversion to an "all-electric" standard configuration.

The Shuttle class concept was conceived to be optimized for the operational requirements of short crossing routes with high frequency (also known as shuttle routes) and minimal in-port time. In that respect, the Shuttle class was considered a possible candidate to meet the service requirements of Routes 19 and 23. However, due to several factors, including the large AEQ capacity of the vessel relative to the staging and offloading capacity of the affected terminals, it was determined that the Shuttle class may not provide the ideal solution for these routes. This is discussed in more detail in section 5.

The possibility of fueling Shuttle class vessels with LNG was also considered. While a hybrid Shuttle class vessel with diesel-electric propulsion is considered appropriate for short crossings such as Routes 19 and 23, the same is not true for LNG propulsion, where the incremental cost of the LNG bunkering infrastructure and a gas-fueled power plant is not offset by the lower cost of LNG (relative to diesel). Analysis undertaken by BC Ferries, with input from an externally-conducted propulsion study, indicates that there would be insufficient fuel consumption savings on a typical short route such as Routes 19 or 23 to justify the incremental cost of configuring the propulsion systems of the Shuttle class to enable the ships to operate on lower cost LNG. Bunkering LNG on smaller islands overnight would be problematic due to the need to deliver the LNG road tankers on dangerous goods ("DG") sailings. This could result in the LNG delivery contractor having stranded assets until a DG sailing is scheduled; or result in additional cost to BC Ferries if dedicated DG sailings were implemented to deliver the LNG tanker. Further, an LNG propulsion system would significantly impact the design flexibility to revert the Shuttle class to an all-electric propulsion system in the future due to competing weight and space constraints.

Given its capacity of approximately 100 AEQ, the possibility of deploying a hybrid diesel-electric Shuttle class vessel on Route 5/5A was also analyzed; however, the operating characteristics of this route preclude its consideration as a viable option for the following reasons:

- Route 5/5A includes multiple ports with longer voyage lengths (up to approximately four hour round trips) that are similar to Route 9/9A where the *Salish Eagle* and *Salish Raven* currently operate. In contrast, the engineering and propulsion design of the Shuttle class would be optimized for service on short, frequent, direct crossings (i.e., less than 30 minutes).

- To attempt to design a Shuttle class vessel so it could deliver both high volume, short voyages (i.e., Routes 19 and 23) and long voyage, enhanced amenities (i.e., Route 5/5A) would compromise the efficiency of the ship, whereby it would not do either to full potential, including optimizing fuel consumption and providing customer amenities.

- Building a Shuttle class vessel solely for Route 5 out of sequence for other vessels in its class would forego efficiency and would create an 'orphan vessel' as the next shuttle-route ferry replacements are not anticipated for another 10 years. Given the potential for technological innovation and change over the next 10 years, it is likely that there would be changes to the design of the next vessel(s) in this class, which would mean the vessel built now would be different from others in the class, thereby potentially offsetting the benefits of standardization.

- Due to the state of the electric supply grid in the Southern Gulf Islands, Route 5/5A is not considered suitable for all-electric propulsion, which is the ultimate vision for this class of vessels.

The advantages to deploying a Salish class vessel on Route 5 include: interoperability on various routes, including scalable food services and offerings, up to supporting a full scale hot food service; improved customer amenities consistent with the Salish class vessels operating on Route 9 and Route 17; and the ability to redeploy the *Queen of Cumberland* from Route 5 to Route 5A.

4.3 Traffic Analysis

4.3.1 Overview

BC Ferries has developed traffic growth projections for Routes 5/5A, 19 and 23. These have been compared to the capacity that would be provided with the proposed new vessels. As well, traffic simulation modelling for the terminals serving Routes 19 and 23 has been undertaken to understand the implications for terminal infrastructure of the two vessel replacement options set out in section 5. The results are discussed below.

4.3.2. Traffic Demand

For the analysis of traffic demand, BC Ferries developed annual traffic growth projections for Routes 5/5A, 19 and 23 looking out 20 to 25 years. BC Ferries' traffic forecasts have been reviewed independently by Rennie Intelligence, which has found them to be reasonable in both their approach and consideration (see Appendix G). The traffic analysis for each route is discussed below.

Route 5 - Mayne Queen Replacement Capacity

Traffic analysis conducted by BC Ferries confirms that a Salish class vessel would be of sufficient capacity to meet the current and forecast traffic on Route 5.

In fiscal 2018, Route 5/5A combined provided capacity of 630,182 AEQ and carried 284,960 AEQ; with the current Route 5/5A service levels, the Salish class vessel on Route 5 and redeployment of the *Queen of Cumberland* to Route 5A would provide annual capacity of 880,144 AEQ. Based on a review of the daily loaded AEQs on Route 5 (sailings to/from Swartz Bay Terminal, excluding inter-island sailings) in fiscal 2018, a Salish class vessel with vehicle capacity of 138 AEQ, as proposed, would carry the per-sailing traffic volumes (without a sailing wait) 99 percent of the time year-round. BC Ferries' traffic forecast suggests that traffic growth on Route 5 will be in the order of 0.7 to 1.6 percent annually over the next 25 years. In fiscal 2022 and 2032, the percentage of times per sailing traffic volumes would be carried by a vessel with 138 AEQ capacity (without a sailing wait) is forecast to be 99 percent and 96 percent, respectively. These findings are summarized in Table 4-D and suggest that a Salish class vessel would be sufficient to carry forecast demand on Route 5 for the foreseeable future. Further, if growth exceeds the high growth forecast, capacity could be added through a combination of service with Route 5A.

Table 4-D: Route 5 - Percentage of Times All Vehicle Traffic is Carried per Sailing, Year Round*

Operating – 138 AEQ Salish class vessel	Fiscal 2018	Fiscal 2022	Fiscal 2032
Current Traffic	99%		
Forecast Traffic:			
High per annum traffic growth rate: 1.6%		99%	96%
Low per annum traffic growth rate: 0.7%		99%	98%

* The Contract requires a minimum of 1,942 round trips or 3,884 departures/arrivals for Swartz Bay per year on Route 5. One percent represents approximately 39 sailings. The data is leg data to/from Swartz Bay and does not include inter-island sailings.

In the event that traffic demand on Route 5 decreased, the flexibility of the Salish class vessel design would allow BC Ferries to lower crew levels slightly, and to use only the vessel's main car deck, reducing the use of the vessel's capacity from 138 AEQ to 78 AEQ. The *Queen of Cumberland*, whose main car deck has a larger capacity than the *Mayne Queen*, would continue to operate using only that car deck.

Route 19 - Bowen Queen Replacement Capacity

Traffic analysis conducted by BC Ferries confirms that two Island class vessels would be of sufficient capacity to meet the current and forecast traffic on Route 19.

In fiscal 2018, Route 19 provided capacity of 618,010 AEQ and carried 387,540 AEQ. With the proposed two-ship service on Route 19, the annual capacity provided would increase to 803,512 AEQ. This reflects the plan to operate the second Island class vessel a single 12 hour shift per day, which would provide coverage throughout the busiest times of the day. The second vessel would provide up to 9 incremental round trips, resulting in a doubling of the existing sailing frequency (sailings approximately every half hour).

Based on a review of the daily loaded AEQ on Route 19 in fiscal 2018, two Island class vessels with vehicle capacity of 47 AEQ each, as proposed, would carry the per sailing traffic volumes (without a sailing wait, assuming customer demand splits evenly between the two sailings offered within the hour) 98 percent of the time year-round. BC Ferries' traffic forecast suggests that traffic growth on Route 19 will be in the order of -0.7 to 1.2 percent annually over the next 25 years. In fiscal 2022 and 2032, the percentage of times per sailing traffic volumes would be carried by two vessels with 47 AEQ capacity each (without a sailing wait, assuming customer demand splits evenly between the two sailings offered within the hour) is forecast to be 97 percent and 93 percent, respectively. These findings are summarized in Table 4-E and suggest that two Island class vessels would be sufficient to carry forecast

demand on Route 19 for the foreseeable future. Further, if growth exceeds the high growth forecast, capacity can be added through additional sailings with the second Island class vessel.

Table 4-E: Route 19 - Percentage of Times All Vehicle Traffic is Carried per Sailing, Year Round*

Operating – 2 x 47 AEQ Island class vessels (with second vessel providing 9 round trips per day)	Fiscal 2018	Fiscal 2022	Fiscal 2032
Current Traffic	98%		
Forecast Traffic:			
High per annum traffic growth rate: 1.2%		97%	93%
Low per annum traffic growth rate : -0.7%		98%	99%

* The Contract requires a minimum of 4,898 round trips or 9,796 sailings per year on Route 19. One percent represents approximately 98 sailings.

The current service on Route 19 sees high demand and sailing waits during peak travel times. The use of a second Island class vessel would allow for increased flexibility to align capacity (i.e., through a second vessel) with the way in which traffic presents itself at peak times of the day. In the event that traffic demand on Route 19 decreased, BC Ferries could explore a shorter service day for the second vessel, although this might result in reduced sailing opportunities during either the morning or evening commuter and school travel periods. It is how the capacity presents itself that can distinguish the customer experience, and feedback obtained during public consultations has indicated a strong preference on these routes, that are heavily commuter-based, for lower capacity, higher frequency sailings provided with two vessels.

Route 23 - Powell River Queen Replacement Capacity

Traffic analysis conducted by BC Ferries confirms that two Island class vessels would be of sufficient capacity to meet the current and forecast traffic on Route 23.

In fiscal 2018, Route 23 provided capacity of 681,865 AEQ and carried 419,040 AEQ. With the proposed two-ship service on Route 23, the annual capacity provided would increase to 886,890 AEQ. This reflects the plan to operate the second Island class vessel a single 12 hour shift per day, which would provide coverage throughout the busiest times of the day. The second vessel would provide 10 incremental round trips, resulting in a doubling of the existing sailing frequency (sailings approximately every half hour).

Based on a review of the daily loaded AEQ on Route 23 in fiscal 2018, two Island class vessels with vehicle capacity of 47 AEQ each would carry the per sailing traffic volumes (without a

sailing wait, assuming customer demand splits between the two sailings offered within the hour) 98 percent of the time year-round. BC Ferries' traffic forecast suggests that traffic growth on Route 23 will be in the order of -0.5 to 0.6 percent annually over the next 25 years. In fiscal 2022 and 2032, the percentage of times per sailing traffic volumes would be carried by two vessels with 47 AEQ capacity (without a sailing wait, assuming customer demand splits evenly between the two sailings offered within the hour) is forecast to be 98 percent and 97 percent, respectively.

These findings are summarized in Table 4-F and suggest that two Island class vessels would be sufficient to carry forecast demand on Route 23 for the foreseeable future. Further, if growth exceeds the forecast, capacity can be added through additional sailings of the second Island class.

Table 4-F: Route 23 - Percentage of Times All Vehicle Traffic is Carried per Sailing, Year Round*

Operating – 2 x 47 AEQ Island class vessels (with second vessel providing 10 round trips per day)	Fiscal 2018	Fiscal 2022	Fiscal 2032
Current Traffic	98%		
Forecast Traffic:			
High per annum traffic growth rate: 0.6%		98%	97%
Low per annum traffic growth rate: -0.5%		99%	99%

* The Contract requires a minimum of 5,785 round trips or 11,570 sailings per year on Route 23. One percent represents approximately 115 sailings.

Similar to Route 19, the current service on Route 23 sees high demand and sailing waits during peak travel times, and BC Ferries would be able to use the second Island class vessel on the route to align capacity better with the way in which traffic presents itself at peak times of the day. In the event that traffic demand on Route 23 decreased, BC Ferries could also explore a shorter service day for the second vessel, although this might result in reduced sailing opportunities during either the morning or evening commuter and school travel periods.

As noted above, it is how the capacity presents itself that can distinguish the customer experience, and feedback obtained during public consultations has indicated a strong preference on these routes, that are heavily commuter-based, for lower capacity, higher frequency sailings provided with two vessels.

4.3.3 Traffic Simulation Findings – Routes 19 and 23 Terminals

A traffic simulation model was used to understand terminal infrastructure implications of the two vessel replacement options for Routes 19 and 23 set out in section 5, specifically replacing the existing vessels with two Shuttle class vessels (Option 2), and replacing the existing vessels with four Island class vessels (Option 3).[9] The model demonstrated how the different service frequencies and vessel capacities proposed in these two options would be expected to impact traffic flow through the terminals and the travel experience of BC Ferries' customers. The high-level findings of the review are set out below and discussed further in section 5.

- ***One Shuttle class vessel per route (Option 2):***
  - Most likely will not meet the current schedule during higher demand periods even with significant terminal infrastructure investment (a revised schedule would not meet community needs); and
  - May have further implications to surrounding community infrastructure due to the larger pulses of traffic.
- ***Two Island class vessels per route (Option 3):***
  - Offers the greatest adherence to a more frequent sailing schedule operating within the current operational day, with minimal investment in terminal infrastructure;
  - Accommodates the forecasted traffic demand for all but extreme peak situations over a 20-year planning horizon (at the 95th percentile of traffic demand);
  - Reduces customer wait times through increased frequency of service during peak travel periods, saving customers on average an anticipated 15-20 minutes (although high demand sailings could experience wait times similar to the current experience if customer arrival patterns do not change); and
  - Provides possible flexibility to provide services better matched to demand in low-season conditions.

[9] The study also reviewed the option of replacing the vessels with comparative-sized 70 AEQ vessels. With forecast traffic growth, this option would result in increased overloads and schedule adherence issues, and the current peak season and peak sailing time traffic issues would continue to increase.

4.3.4 Demand Management System

The Company's Fare Flexibility and Digital Experience Initiative includes a new demand management system which, once implemented, will further improve overall AEQ capacity utilization on the routes to which it is applied. At this time, in accordance with Order 16-02 dated September 21, 2016, demand management is envisaged for only those routes currently accepting vehicle reservations, thereby excluding Routes 5, 19 and 23. Accordingly, no impact from demand management on the Project is envisaged.

4.4 Summary

Consistent with the vessel standardization strategy, vessels of the size and characteristics of the proposed Salish class for Route 5 and Island class for Routes 19 and 23 place community interests and the customer experience at the forefront by meeting service level requirements and addressing traffic growth either through increased sailing capacity (Salish class) or through higher sailing frequency and increased daily capacity (two Island class).

Section 5 – Analysis of Options

5.1 Options

Three options are presented for the replacement of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen*:

- Option 1: Life extend the three existing vessels for 10 years and then replace them with four Island class vessels and one Salish class vessel;

- Option 2: Replace the two existing vessels on Routes 19 and 23 with two Shuttle class vessels and the existing vessel on Route 5 with one Salish class vessel; or

- Option 3: Replace the two existing vessels on Routes 19 and 23 with four Island class vessels and the existing vessel on Route 5 with one Salish class vessel.

The Company believes that Option 3 – a mix of Island class and Salish class vessels – would best serve the needs of the customers on Routes 5/5A, 19, and 23. This option aligns the appropriate vessel with the given route's characteristics, provides the potential to generate operational efficiencies, appropriately addresses the travel needs of BC Ferries' customers and the communities the Company serves, and ensures the service level requirements of the Contract are met. The options are discussed in more detail below.

5.2 Key Cost Assumptions

5.2.1. Capital and Operating Costs

The vessel construction cost estimates for the replacement vessels in the options presented have been derived from the following sources:

- Salish class vessel: Non-binding commercial shipyard estimate, and recent previous contract pricing for Salish class vessels, with a 10 percent contingency on construction;

- Island class vessels: Fixed firm contract cost and identified change orders for the current Island class vessels now under construction, with a 10 percent contingency on construction; and

- Shuttle class vessels: Market study cost estimate, with a 15 percent contingency on construction.

Contingency was added to the cost estimates to account for uncertainty of shipyard selection, negotiations, pricing, foreign exchange risk, change orders during construction, and unidentified spares requirements.

Other capital and operating Project costs related to the replacement vessels were estimated based on the projects for the two Island class vessels currently under construction and the three Salish class vessels completed in 2017. Adjustments were made to reflect differences between the projects in areas such as the number of vessels constructed, vessel size, crew size, and propulsion system.

5.2.2. Crew Complement

The financial analysis assumes a crew size of 15 for the Salish class vessel, six for the Island class vessels, and eight for the Shuttle class vessels. These numbers reflect the anticipated crew and passenger licensing levels that will be most frequently used on the routes to which the vessels will be deployed.

The level of certainty over minimum crew size is highest for the Salish class vessel as it is based on Transport Canada certification of the existing Salish class vessels in BC Ferries' fleet.

The crew sizes for the Island and Shuttle classes are based on BC Ferries' analysis of minimum safe manning levels to be set by Transport Canada, but there is uncertainty because the ships are not yet built and minimum crew size has not been determined.

5.2.3. Ancillary Services

The operating costs and revenue of the Salish class vessel on Route 5 assume a "basic plus" food offering, consisting of self-serve items such as pre-packed cold food and limited hot food. This service level is supportable within the Salish class vessel minimum safe manning levels, and is consistent with plans for the deployment of an existing Salish class vessel on Route 5 for refit relief purposes in fiscal 2020.

The Shuttle class and Island class vessels envisage basic ancillary services, such as vending machines, the cost of which are minimal and which do not require incremental crew.

5.2.4. Operation of Second Ship on Routes 19 and 23

Option 3 involves the implementation of two vessel service on each of Routes 19 and 23. The smaller Island class vessels can provide a scalable capacity to increase service to a similar level offered by Option 2 (a Shuttle class vessel on each route), depending on the utilization of the second vessel. The base assumption is that the second Island class vessel will operate a

single 12 hour shift per day, which would provide coverage throughout the busiest times of the day. When the second vessel is operating, it provides a doubling of the existing sailing frequency (sailings approximately every half hour on both routes). In addition, the two-ship option allows for greater flexibility if the ratio of vehicle to foot passenger traffic changes in future. While the two Island class vessels together provide similar vehicle capacity to a Shuttle class vessel, foot passenger capacity is effectively doubled and can be utilized accordingly.

5.2.5. Shore-side Upgrades

Shore-side upgrades have been identified for each option and are included in the total Project expenditure and net present value ("NPV") analysis. The scope and timing of the upgrades differs between the options and are classified as upfront or indirect upgrades.

Upfront Upgrades

Upfront shore-side upgrades are those required to operate the vessels on the designated routes and maintain the current level of service and schedule. This includes, for example, berth fit modifications, vessel tie-ups for additional ships, and modifications to handle traffic surges associated with higher capacity vessels such as doubling lanes on ramps and expanding holding compounds.

These costs are considered to be required in advance of the new vessels commencing service and are therefore included in the total Project expenditure and NPV analysis. These shore-side Project costs were internally estimated based on conceptual designs.

Indirect Upgrades

All other shore-side work over the 45-year life of the vessels that is not deemed to be required in advance of the new vessels commencing service is considered indirect. This includes condition-based replacements as well as asset upgrades and enhancements. Indirect shore-side upgrades are not included in the total Project expenditure, but are included in the NPV analysis as lifecycle costs.

5.2.6. Fuel Prices

Forward prices (fiscal 2022) for diesel ($0.956 per litre) and LNG ($0.462 per diesel litre equivalent[10]) escalated for inflation at two percent per year were applied to the estimated annual fuel consumption over the 45-year NPV period.

[10] BC Ferries converts LNG to diesel litre equivalents, an energy equivalency measure that allows LNG consumption to be compared directly to diesel consumption in litres.

5.2.7. Inflationary Factor and Discount Rate

An annual escalation for inflation of 2 percent has been applied to all capital and operating costs and a discount rate of 7 percent is used for the NPV analysis.

5.3 Option 1: Life Extend Existing Vessels for 10 Years and Replace

This option involves upgrading the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* to enable the vessels to operate a further 10 years to fiscal 2031, at which time the vessels would be retired.

The work required to upgrade the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* for a possible further 10 years of service, and the costs to complete this work, have been estimated by BC Ferries' engineers using condition assessment reports conducted by Lloyd's Register Canada.

BC Ferries has undertaken three projects in the past decade to life extend a Company vessel by 10 or more years. These projects, for the *Tachek*, *Quadra Queen II*, and *Queen of Nanaimo,* are listed in Table 5-A and have informed BC Ferries' cost estimates for this option. Life extensions of the *Powell River Queen, Bowen Queen* and *Mayne Queen* are expected to have a higher cost and elevated risk due to their being significantly older than the three other vessels for which life extensions have been undertaken. In fact, the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* would each be over 55 years old at the time of their life extension, which would be similar to the ages of the vessels listed below when they were retired *after* their life extension:

Table 5-A: Vessel Life Extensions (+10 Years) Undertaken Since Fiscal 2006

	Tachek	***Quadra Queen II***	***Queen of Nanaimo***
Fiscal Year	2014	2012	2006
Age at Life-Extension	45 years	43 years	42 years
Age at Planned Retirement	60 years	60 years	53 years

If a major upgrade or a life extension of a vessel is carried out without sufficient scope or scale, there is significant risk to service continuity due to non-functional machinery or environmental, safety and/or regulatory issues. The scope for the life extension of the three vessels would include the replacement or renewal of many of the ships' systems, as shown in Table 5-B, at an estimated cost of at least $<> million for each vessel. It is important to note that the cost estimate includes a very high degree of uncertainty, particularly with regard to

asbestos and lead-based paint abatement and steel renewals. As such, the cost estimate is considered conservative.

Table 5-B: Scope of Life Extension for Existing Vessels

***Powell River Queen, Bowen Queen* and *Mayne Queen* Life Extension Scope**
• Engineering, Drawings and Approvals
• Blast and Paint Hull, Decks, Voids and Machinery Spaces
• Asbestos Abatement
• Steel Renewal
• Replace Shafting
• Renew Thrusters
• Install New Main and Emergency Switchboards
• Replace Electrical Cabling
• Safety Upgrades
• Replace All Fire Doors
• Upgrade Bridge Controls and Steering System
• Replace Fresh Water System

Extending the lives of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* beyond 10 years is not considered to be technically or economically prudent due to the age and condition of the vessels (see Appendix B for further information). The same factors suggest that despite an investment in the life extension of these vessels, a significant risk remains post life extension of premature asset failure, such that operational reliability and/or a full incremental 10 years of service life may not, in fact, be realized through this option. For this reason, this option is considered the highest risk in terms of ensuring service continuity.

In addition, this option would delay further progress towards the class strategy and overall fleet standardization, which affords the opportunity for more efficient and effective fleet deployment, along with safer operations. It would also prolong the traffic staging and congestion issues on Routes 19 and 23 associated with the existing vessels, which are discussed earlier in this Application.

Shore-side Upgrades:

There are no up-front shore-side upgrades required for Option 1.

Option 1 Project Expenditure

The total Project expenditure for this option is set out below.

Option 1: Life Extend Existing Vessels for 10 Years and Replace with Four Island Class Vessels and One Salish Class Vessel	
Total Project Expenditure (including IDC):	$<> Million
45-Year NPV:	-$663.2 Million

5.4 Option 2: Replace Existing Vessels with two Shuttle Class Vessels and One Salish Class Vessel

This option involves the procurement of one Salish class vessel for deployment on Route 5 in fiscal 2022, and two hybrid diesel-electric Shuttle class vessels for deployment in fiscal 2022 on Routes 23 and 19, respectively. This option injects another Salish class vessel into the fleet, bringing the Salish class total to four, and introduces the first two vessels of a new Shuttle class. This option contributes to the objectives of fleet standardization and interoperability, which will enable the Company to make further advances in efficient and effective service delivery.

BC Ferries believes a Salish class vessel would be appropriate to meet the service requirements of Route 5, and both this option and Option 3 include procuring such a vessel for service on that route. The rationale for procuring a Salish class vessel for Route 5 is described in Option 3.

The analysis of vessel replacement options for Routes 19 and 23 was focused on the type of service that would best meet the future needs of the communities of Gabriola Island and Quadra Island, respectively, and in particular, whether these routes should have one larger Shuttle class vessel with current round trip frequency or two smaller Island class vessels with increased frequency. Both of these routes are characterized by their short crossing time and high frequency of service, defined as “shuttle routes”.

As discussed in section 4.2, the Shuttle class concept was conceived to be optimized for shuttle routes and those with minimal in-port time. For these routes, the frequency at which sailings are provided during peak demand and the length of operational day providing service during the lower demand periods in the early morning and late evening are very important. Both Routes 19 and 23 are challenged to meet traffic demand during peak travel periods, resulting in an increase in overloaded sailings as discussed in section 2.4. The Shuttle class was identified as one option that provides a significant increase in capacity. With these attributes in mind, the Shuttle class was considered a possible candidate to meet the service requirements of Routes 19 and 23.

However, the Shuttle class may not provide the ideal solution for these routes primarily due to the AEQ capacity of the vessel versus the staging and offloading capacity of the affected terminals. For Routes 19 and 23, vehicle and throughput modelling indicates that a 100 AEQ Shuttle class vessel would require more turnaround time with consequential changes to important sailing times, specifically the morning commute, morning school run, afternoon school run and evening commute. These sailing times are aligned to residents' employment and school hours sailing times and are of particular importance to the users.

If this option were pursued, the preferred deployment strategy would see the *Powell River Queen* replacement (Shuttle class) operating on Route 23, the *Bowen Queen* replacement (Shuttle class) operating on Route 19, the *Quinsam* redeployed from Route 19 to Route 6 and the *Quinitsa* redeployed from Route 6 to refit relief duties. The objective of this deployment strategy would be to address increasing traffic and route congestion on both Route 19 and Route 6 through the deployment of larger vessels to these routes. The Salish class vessel would be deployed to Route 5 and the *Queen of Cumberland* redeployed to Route 5A.

Shore-side Upgrades:

With the introduction of a Salish class vessel on Route 5, seabed blasting and installation of new dolphins would be required at Swartz Bay Berth 5 to address the draft of the larger ship during extreme low water conditions and to increase resistance capacities of the marine structures.

The shore-side infrastructure on Routes 19 and 23 would be inadequate to handle the larger surge of traffic arising from the larger capacity Shuttle class vessels and continue to maintain the schedule. In order to safely move passenger and vehicle traffic and maintain the service schedule, to the extent possible, a number of up-front shore-side upgrades would need to be undertaken:

Route 19:

- Nanaimo Harbour: Berth rebuild with double lane ramps, expansion of holding compound, ticketing and terminal exit improvements, and pedestrian overpass; and

- Descanso Bay: Berth rebuild with double lane ramps, expansion of holding compound, terminal exit improvements.

Route 23:

- Campbell River: Expansion of holding compound, terminal exit improvements, and pedestrian overpass; and

- Quathiaski Cove: Acceleration of berth rebuild with double lane ramp and trestle, and terminal exit road improvements.

Based on the traffic simulation modelling undertaken (see section 4.3.3), it is expected that terminal egress may become an additional constraint with larger vessel sizes at Nanaimo and Campbell River, as additional signalized intersection cycles may be required to clear the vehicle traffic and may impact unloading times as the queue area at the terminals is limited in capacity. The ability of the local roadway at the Quathiaski Cove and Descanso Bay terminals to absorb a 100 AEQ vessel may also show additional downstream constraints.

Even with significant terminal infrastructure investment, due to the size of the vessels and the increased in-port time required to fully load and discharge, it is likely that deploying Shuttle class vessels on Routes 19 and 23 would require schedule modifications to address peak sailing demand across the day. These schedule modifications would increase time between some sailings and potentially impact specific time of day sailings that are of particular importance to island communities. On short routes, such as Routes 19 and 23, communities have indicated a preference for a high frequency of service during peak periods as opposed to more capacity at lower frequency.

Option 2 Project Expenditure

The total Project expenditure for this option is set out below.

Option 2: Replace with Two Shuttle Class Vessels and One Salish Class Vessel	
Total Project Expenditure (including IDC):	$<> Million
45-Year NPV:	-$690.7 Million

5.5 Option 3: Replace Existing Vessels with Four Island Class Vessels and One Salish Class Vessel

Option 3 involves the procurement of four Island class vessels and one Salish class vessel and is BC Ferries' preferred option. Under this option:

- Another Salish class vessel would be added, bringing the class total to four (including the *Salish Orca*, *Salish Eagle*, and *Salish Raven*); and

- Four more Island class vessels would be added, bringing the class total to six (including the two vessels currently under construction).

The Salish class vessel would be deployed to Route 5 and two each of the Island class vessels would be deployed to Routes 19 and 23.

BC Ferries believes a Salish class vessel would be appropriate to the needs of Route 5. As mentioned previously, key factors supporting this view are:

- Relatively long multi-port route; some voyage durations up to 90 minutes;
- Longer load times, as needed by a larger vessel, can be accommodated within the current schedule;
- Enhanced service through increased vehicle and foot passenger capacity, which will be sufficient to meet current and forecast peak season traffic demand on Route 5/5A;
- Potential to enhance service based on the speed design;
- Consistency in the customer experience for Route 5/5A. For Route 5, the Salish class vessel will provide a "basic plus" food and retail services, and for Route 5A, the *Queen of Cumberland* will provide its current basic food and retail offering, which represents an improved service offering as there are no food or retail services currently provided by the *Mayne Queen*; and
- Furthers fleet standardization objectives, enabling flexibility and scalability in vessel scheduling, and a consistent service offering, even during refits.

A Salish class vessel would also contribute positively to service in the Southern Gulf Islands as a whole. As Route 5 includes multiple port sailings, as well as connections and transfers to Routes 9, 9A, 5A, 1 (connecting Swartz Bay with Tsawwassen) and 4 (connecting Swartz Bay with Fulford Harbour), sailing reliability has greater relative importance as this one route can affect many. The speed, design and capacity of Salish class vessels reduces reliance on overhead ramps onboard vessels, which slow turnaround times, enhances multi-port loading, and allows for schedule resiliency to make up time.

The deployment of a Salish class vessel on Route 5 would allow for the redeployment of the *Queen of Cumberland* to Route 5A which has lower traffic demand, enabling the retirement of the *Mayne Queen*.

Deploying Island class vessels to Routes 19 and 23 would:

- Provide sufficient capacity to meet current and forecast peak season traffic demand on these routes;
- Enable an increase in scheduled sailing frequency and flexibility, and would result in an increase in annual capacity provided;
- Allow for more commuter sailings, with more capacity provided during peak travel hours when needed, and fewer sailings at either end of the day;
- Provide for greater foot passenger capacity;
- Contribute to the objectives of fleet standardization by enabling flexibility and scalability in vessel scheduling, and a consistent service offering, even during refits; and
- Support other benefits outlined in this Application regarding vessel redundancy, schedule resiliency, seakeeping, and managing the impacts of traffic demand on the volume limits of terminals.

Of added benefit, as the new Island class vessels would be identically designed and built, they would have the capability to operate on any Near Coastal 2 route and would not be limited to, nor designed specifically for, any particular region. Vessel commonality will improve interoperability, thus resulting in lower training, supply chain, procurement and operating costs.

The new standardized Island class vessels, built to the latest regulatory requirements and Transport Canada and classification society standards, are considered the most cost-effective and efficient option to ensure the Company's continued ability to meet service requirements on Routes 19 and 23 now and into the future.

As discussed in section 4, the preferred deployment strategy would see the *Bowen Queen* replacement vessels operating on Route 19, the *Quinsam* redeployed from Route 19 to Route 6 and the *Quinitsa* redeployed from Route 6 to refit relief duties. This deployment strategy is intended to address increasing traffic and route congestion on both Route 19 and Route 6 through the deployment of more capacity (through larger or more vessels) to these routes.

Shore-side Upgrades:

With the introduction of a Salish class vessel to serve Route 5, seabed blasting and installation of new dolphins would be required at Swartz Bay Berth 5 to address the draft of the larger ship during extreme low water conditions and to increase resistance capacities of the marine structures.

On Routes 19 and 23, construction of additional tie-up berths would be required to support the different hours of service with the two vessels on each route, and to keep a berth open for sailings that could be required after hours, such as for ambulance transport. Specifically, without the additional berths, a second crew would have to be called out after hours for ambulance calls, which are particularly frequent on Route 23, to move the second vessel out of the single berth in order to make way for the vessel carrying the ambulance.

This option assumes the tie-up berths would be located at Nanaimo Harbour and Campbell River as this is preferred from an operational standpoint. Due to exposure to heavy weather and rough sea states at the Campbell River terminal, an extension of the breakwater is also expected to be required to protect the vessel when tied up.

Option 3 Project Expenditure

The total Project expenditure for this option is set out below.

Option 3: Replace with Four Island Class Vessels and One Salish Class Vessel	
Total Project Expenditure (including IDC):	$<> Million
45-Year NPV:	-$721.9 Million

5.6 Financial Summary of Options

The results of the financial analyses are summarized in Table 5-C below.

Table 5-C: Project Expenditure and NPV Summary of Options

	Total Project Expenditure (including IDC)	45-Year NPV
Option 1: Life extend existing Vessels for 10 years and replace	$<> Million	-$663.2 Million
Option 2: Replace with two Shuttle class vessels and one Salish class vessel	$<> Million	-$690.7 Million
Option 3: Replace with four Island class vessels and one Salish class vessel	$<> Million	-$721.9 Million

Operating Cost Implications

The operation of two Island class ships on each of Routes 19 and 23 (Option 3) is expected to drive higher annual operating costs compared to the Shuttle class (Option 2). The financial analysis assumes approximately $0.8 million in incremental annual operating costs for Option 3, largely driven by the higher crewing requirements to staff two Island class vessels on each of the two routes. However, final crew levels are subject to 'minimum safe manning' certification, which will not be received until the vessels are delivered and regulatory testing is completed. In addition to annual operating costs, the capital upgrades over the 45-year period will be higher under Option 3 due to the incremental ships.

5.7 Preferred Option

Option 3, involving the replacement of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* with four Island class vessels and one Salish class vessel, is preferred by BC Ferries. While it is the most costly of the options, it contributes most strongly to the objectives of fleet standardization and interoperability and, as such, has the greatest potential to generate efficiencies.

Life extension of the three vessels (Option 1) is considered technically and economically imprudent, given the age and condition of the vessels. These factors also suggest that the risk of premature asset failure and a consequential risk of service disruption would remain even after life extension.

As compared to life extending the existing vessels (Option 1), newly-constructed vessels (Options 2 and 3) would meet the latest, most modern safety, environmental and other standards and requirements, and reduce operational and regulatory risk.

The Company believes a Salish class vessel would meet the key operating parameters of Route 5 (Options 2 and 3). The speed, design and capacity of a Salish class vessel would support the delivery of effective and reliable service on this relatively long multi-port route. A Salish class vessel would also support the Company's objectives of fleet standardization and would provide a consistent service offering throughout the Southern Gulf Islands.

The Company views shorter routes such as Route 19 and 23 , which might be served by either Shuttle class (Option 2) or Island class (Option 3) vessels, as prime candidates for further advances in adopting clean technology, specifically the incorporation of a hybrid and ultimately all-electric (zero emission) power plant in the vessels. This is due to the short duration and highly predictable energy consumption, which makes the used of batteries (stored energy) a viable option to conventional diesel propulsion both technically and financially.

Additionally, capacity can be delivered on Routes 19 and 23 with either one Shuttle class vessel (Option 2) or two Island class vessels (Option 3) – there is little distinction for carrying the overall daily demand as the traffic profile shows greatest demand from 0730 to 1930 and then waning demand under either service offering. Instead, it is how the capacity presents itself that can distinguish the customer experience, and feedback obtained during public consultations has indicated a strong preference on these routes, which are heavily commuter-based, for lower capacity, higher frequency sailings provided with two vessels (Option 3).
While the NPV analyses point to a $31 million lifecycle cost differential between Option 2 and Option 3, BC Ferries believes that there are opportunities to realize greater long- term financial benefits under Option 3 that have not been reflected because they are contingent on future decisions:

- As the Company continues to replace existing vessels with Island class vessels for a total of 13 including two refit relief, more operational efficiencies are expected to be generated through interoperability;

- Conversion to all electric propulsion is likely to be more feasible at an earlier stage for the smaller Island class ships compared to the Shuttle class vessels, due to the reduced charging requirements and associated shore-side infrastructure; and

- It is possible that the required scope of terminal uplands work over the 45-year lifecycle will be less with the lower traffic pulses of the Island class vessels as

compared to the traffic surges associated with a higher capacity vessel such as a Shuttle class vessel.

5.8 Price Cap Implications of Preferred Option

Using the proposed timeline to replace the *Bowen Queen*, *Mayne Queen*, and *Powell River Queen* with four new Island class vessels and one new Salish class vessel in fiscal 2022, BC Ferries has analyzed the forward-looking impact of the Project on future price caps. BC Ferries used the Project assumptions as included in the performance term four price cap forecast model ("PT4 model") as the baseline for this comparison. The analysis extends through to performance term seven, ending March 31, 2032 ("PT7").

The PT4 model assumed that the *Bowen Queen*, *Mayne Queen*, and *Powell River Queen* would be replaced with three intermediate class dual-fuel (LNG/diesel) vessels. The preferred option, which includes one Salish and four Island class vessels, reflects an increase in both capital and ongoing operating costs.

Compared to the PT4 capital plan, the Project (Option 3) has a $<> million higher capital cost and a later schedule with cash flows deferred approximately two years. The PT4 model did not assume incremental labour and maintenance costs as the design and operating implications were undefined. The overall expected crew size of the Salish class vessel and the four Island class vessels combined, reflects a lift from the existing vessels being replaced. The introduction of two incremental vessels to the fleet results in higher vessel maintenance costs.

Annual fuel costs are expected to be above what was assumed in the PT4 model due to the planned diesel consumption of the four new Island class vessels instead of two dual-fuel intermediate class vessels.

The analysis indicates that the Project results in a baseline increase in the price cap of approximately 0.09 percent per annum through PT7 from that forecast in the PT4 model. As a result, compared to the assumptions included in the PT4 model, the Project can be expected to have a slightly greater impact on price caps over the 45-year lifecycle of the four Island class and one Salish class vessels.

5.9 Scenarios for Reducing Capital Expenditures

BC Ferries believes that the proposed capital expenditure for the four Island class and the Salish class vessels is reasonable and prudent.

BC Ferries considered opportunities to reduce capital costs by a further 10 or 20 percent. For both the Island class and Salish class vessels, to achieve further capital cost savings in the order of 10 percent, substantial scope reductions would be required. While it may be possible to achieve some upfront capital cost savings through specifying less costly shipboard equipment (e.g. main engines, thrusters, navigation equipment, etc.), this is not considered a prudent approach as it would negatively impact the Company's move toward fleet standardization, with a commensurate reduction in efficiencies, and an increased risk regarding vessel reliability for both classes of vessels. Some savings in capital costs could also be realized through reducing shipboard amenities, such as eliminating the upper passenger viewing and deck area (Deck 5 on the Salish class vessel and Deck 4 on the Island class vessels); however, this would negatively affect the customer experience, which could, in turn, affect traffic demand and revenue. Both of the aforementioned capital cost-saving measures are expected to have a significant detrimental impact on the vessels' through-life reliability and the customer experience, and are not, therefore, recommended.

Capital cost savings in the order of 20 percent would not be achievable.

Section 6 – Procurement and Risk

6.1 Procurement Options

There are two basic options to procure the proposed Island class and Salish class vessels – purchase them used or new. Both options have been considered by BC Ferries and are summarized below. BC Ferries proposes to procure new vessels to replace the *Powell River Queen*, *Bowen Queen* and *Mayne Queen.*

6.1.1 Acquire Used Vessels

While the majority of BC Ferries' vessels have been built and acquired new, a number of used vessels have been purchased for the fleet. In some cases the decision has proven to be a wise investment, while in other cases the investment has not been as successful.

A key objective of BC Ferries' fleet renewal program, and the proposed acquisition of the Island class and Salish class vessels as set out in this Application, is to achieve capital and operating cost savings and efficiencies through a strategy of vessel standardization. In most cases, the used market does not provide the opportunity to purchase multiple ships with a common platform or a common standard. Accordingly, in considering the acquisition of a used vessel, any possible savings in acquisition cost must necessarily be weighed against the possible higher operating costs associated with deployment of a vessel that is unique to the fleet. There are many factors to consider in assessing the viability of a used vessel, including the following key factors:

- ***Commercial Compatibility***

  The ability of the vessel to meet traffic requirements as well as customer needs, including a vessel's speed, vehicle and passenger carrying capacity, and suitability of passenger accommodations and other amenities.

- ***Physical Compatibility***

  Important factors include the age and physical condition of the vessel. Consistent with worldwide practice, BC Ferries requires vessels to have been built and maintained to international classification standard. Consideration also must be given to the vessel's compatibility with BC Ferries' standardized berth design and, in particular, whether its length, beam, draft, freeboard and deck configuration fit the Company's terminals and docks, or whether modifications would be required. Further considerations include the compatibility of the vessel's electrical system with North American requirements and the availability of spare parts.

- ***Regulatory Compatibility***

  Transport Canada regulations with respect to Canadian-operated vessels are very stringent. Transport Canada applies 'new ship' regulations to any used vessel that enters domestic service in Canada, with some consideration of the age of the vessel. Accordingly, foreign vessels will require modification to meet these regulations. Transport Canada regulations apply to all matters related to the safe operation of vessels, including emergency evacuation, stability, firefighting systems and crew levels. An additional concern is related to the approval of equipment and materials as Transport Canada has very restrictive policies concerning acceptance of certificates from other jurisdictions.

- ***Fleet Compatibility and Standardization***

  The ability to cost-effectively redeploy a vessel across routes (referred to as 'interoperability') is important in ensuring consistency of service and operating costs, and is a principal objective underlying the Company's vessel replacement strategy. Ideally, vessels should be able to operate effectively and efficiently on different routes in order to provide supplemental service during peak periods, refits and emergencies.

  Conversely, non-standard vessels do not necessarily offer this same level of compatibility and can create inconsistencies in service, crew size and vessel capacity that may generate higher training, operating and maintenance costs and scheduling challenges.

  BC Ferries is renewing its fleet with an overall class strategy and standardization of vessels. Used vessels are typically available as single ships, or infrequently as two or more vessels of the same class. In order to achieve standardization of the same vessels for multiple ship replacements, buying used would most likely not allow for achieving this key criterion.

In general, the purchase price of a used vessel is substantially less than the price of acquiring a new vessel. However, the purchase price is just one factor when considering the suitability of a used vessel. All vessels will require some modification to enable them to operate successfully as part of BC Ferries' fleet. Any foreign purchase (even if formerly Canadian flagged) must comply with the convention for the Safety of Life at Sea (SOLAS) and Transport Canada regulations. Vessels older than 10 years must be brought into compliance with the regulations in force 10 years previous to the date the vessel enters into Canadian registry, while vessels newer than 10 years must be brought into compliance with the current regulations for newly constructed vessels (i.e., no "grandfathering"). Other incremental costs may also arise, such as required modifications to the vessel to meet service requirements and

standards of passenger comfort. The cost of these modifications, together with the imposition of import duty on the purchase price plus any modifications and/or refit work performed off-shore, must be considered.

Beyond the capital costs, all the operating costs must also be taken into account (e.g., fuel, crew and maintenance). BC Ferries' experience with recent used vessel acquisitions, such as the *Northern Adventure*, has been that maintenance and operating costs have been higher than what would have been experienced with a vessel designed specifically for the service.

BC Ferries actively monitors the market for used vessels. Several international ship brokers routinely advise BC Ferries of used vessels available for purchase and, in the past 24 months, have brought forward approximately 24 used vessels for the Company's consideration. All were reviewed, but none were determined to meet the requirements for the replacements of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* due to, for example, their age or capacity.

6.1.2 Acquire New Vessels

Procurement of new vessels allows for greater certainty that all regulatory, operating and contractual requirements will be met within the Project scope and cost. Further, the Company views the objective of fleet standardization as an important means of reducing costs and enhancing efficiency, and acquisition of new vessels is considered to meet this objective most effectively.

In the case of the replacements for the *Powell River Queen*, *Bowen Queen* and *Mayne Queen*, the intent is to enter into a build contract with a single shipyard to construct the four Island class vessels and a build contract with a single shipyard to construct the single Salish class vessel. As noted above, the Company may possibly extend this build program beyond the additional four Island class vessels to include future replacement vessels, all with an identical platform. The benefits of a build program such as this are discussed in prior sections of this Application, and include potentially lower capital costs arising from series build programs, lower crew training costs through standardization of bridge, engine room and accommodation layouts, and lower maintenance costs through standardization of components.

6.2 Procurement Process

6.2.1 Project Governance

The Company has in place a vessel replacement program for all new vessel construction projects. The vessel replacement program reports through the Strategy and Community Engagement Division and draws on expertise across the Company, as well as from external

subject matter experts. The procurement of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* replacement vessels will be undertaken under the auspices of this program.

6.2.2 Procurement Process

The procurements are being managed under separate processes and contracts – one for the single Salish class vessel, and the other for the four Island class vessels. Although managed separately, the same overarching procurement process is in progress for both classes of vessels. Both procurements are running in parallel, following the processes outlined below.

Request for Expressions of Interest ("RFEOI")

RFEOIs for the construction of the four proposed Island class vessels and the single Salish class vessel were separately issued to leading shipyards in Canada and around the world on July 26, 2018. Principal among the objectives of the RFEOIs was to identify shipyard interest and available capacity to undertake the proposed Island class and Salish class vessel projects within the timeframe envisaged. Expressions of interest in participating in the tendering process were received from 22 shipyards and prime contractors for the Island class vessels and 16 shipyards for the Salish class vessel. All respondents proceeded to the Request for Pre-Qualification ("RFPQ") stage.

Request for Pre-Qualification

Separate RFPQs for the Island class and Salish class vessels were issued August 17, 2018 to the shipyards that responded to the applicable RFEOI. Both RFPQs closed September 7, 2018 and pre-qualification proposals were received from 18 shipyards for the Island class vessels, and 12 for the Salish class vessel. An internal BC Ferries team comprised of senior technical and operational staff evaluated the proposals for the separate RFPQs based upon a set of identical, weighted criteria, and a short list of preferred shipyards was selected for participation in the applicable Request for Proposal ("RFP") for the Island class and Salish class vessels.

Request for Proposal

RFPs are expected to be issued in November 2018 to the five shipyards shortlisted from the RFPQ process for the Salish class vessel, and also in November 2018 for the nine shipyards short-listed for the Island class vessels. An internal BC Ferries team comprised of senior technical and operational staff will review and evaluate the proposals received, and a finalist shipyard(s) will be selected for final negotiations.

Contract Awards

Subject to the approval of this Application, once shipyard selection and contract negotiations are complete, contract awards will be subject to approval by the Company's Executive Management Committee and Board of Directors.

6.2.3 Timeline

The timelines shown below for the replacement of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* are conservative. As mentioned above, BC Ferries has yet to issue or receive detailed proposals from shipyards that have been shortlisted as part of the RFPQ process. These proposals, which will be provided by proponents in response to the RFP, will outline a detailed schedule with major milestones listed for each vessel being constructed, and could differ based on each proponent's shipbuilding strategy and overall approach to each vessel project. Information on the risks and mitigation strategies associated with the project timeline are provided in section 6.4.3.

Powell River Queen Replacement: Island class vessels #1 / #2

Contract Award	Construction		Delivery, Training, Integration	In-Service
	Start	Finish		
Winter 2018/2019	Spring 2019	Fall 2020	Fall 2020	Spring 2021

Bowen Queen Replacement: Island class vessels #3 / #4

Contract Award	Construction		Delivery, Training, Integration	In-Service
	Start	Finish		
Winter 2018/2019	Winter 2019	Spring 2021	Summer 2021	Winter 2021

Mayne Queen Replacement: Salish class vessel

Contract Award	Construction		Delivery, Training, Integration	In-Service
	Start	Finish		
Winter 2018/2019	Spring 2019	Spring 2021	Summer 2021	Fall 2021

6.3 Consequences of In-service Delays

Delays in the in-service dates for the replacements of the *Powell River Queen*, *Bowen Queen* and *Mayne Queen* significantly increase the possibility of service disruptions due to the following factors:

- The longer the Bowen class vessels operate, the higher the risk of unforeseen operational issues and serviceability;

- Critical spares availability, original equipment manufacturer ("OEM") knowledge and supportability for these aged vessels are already at levels that may compromise service reliability; and

- Vessel long-range maintenance plans have been "glidesloped" for the planned in-service dates of the new vessels. Extending these in-service dates could result in reduced reliability and operational availability of the existing vessels, unless significant investment was undertaken to achieve a very short life extension.

Although not fully quantifiable in either financial or engineering terms, a key consideration is that there is a greater likelihood of a service disruption, and the potential consequences of any such disruption become much more significant the longer these vessels remain in service.

6.4 Risk Identification and Mitigation

An overview of the key risks to the Project, together with planned mitigation strategies, is provided below. The risk mitigation strategies for the latter phases of the Project will receive enhanced focus as the Project proceeds.

The Project follows the first highly successful phases of the Company's vessel replacement program and incorporates best practices and lessons learned from those phases. This in itself serves to mitigate risk as the Company is implementing certain processes and procedures that have been tested and proven successful in the recent past.

6.4.1 Financial Risks

Price Escalation

The Company has included a contingency in the Project budget to address unforeseen cost pressures, including shipyard prices that might exceed current estimates. This will mitigate against potential cost escalation that may occur during the contracting process. Depending on the magnitude of the cost variance, scope changes to the Project may also need to be considered.

Currency

BC Ferries will specify in the RFP that the contract is to be negotiated to a fixed firm price in Canadian dollars, which has been the approach for the original build programs for both these

classes of vessels. Currency fluctuations between submission of this Application and contract award would be accommodated within the contingency in the Project budget.

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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 that 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 basis ensures that affordability is considered based on the full life cycle costs of the Project.

Financing

BC Ferries plans to finance the Project with cash flow from operations, draws on its credit facility and/or through the issuance of bonds in the capital markets.

BC Ferries' long-term financing instruments are secured through a capital markets platform. This platform is capable of accommodating a variety of corporate debt instruments and borrowings ranking equally, including term bank debt, revolving bank lines of credit, publicly-issued and privately-placed debt securities, commercial paper, medium-term notes and interest rate and currency swaps and other hedging instruments.

Detailed documentation associated with the capital markets platform can be viewed online through the System for Electronic Document Analysis and Retrieval (SEDAR) at www.sedar.com or on BC Ferries' website at www.bcferries.com/about/investors.

6.4.2 Design Risks

The Salish class vessel design has been proven in-service and is low risk. The Island class vessel design is complete and two ships in this class are now under construction.

The design rights to both the Salish class and Island class vessels are held by BC Ferries. The designs for these vessels will be provided to the RFP short-listed shipyards and while there may be some minor design amendments required to meet evolving regulatory requirements, these will be the responsibility of those shipyards. BC Ferries' contracting strategy is for a design and build contract. The successful shipyard(s) will be required to conduct a design check of the package(s) provided, such that design risk is contractually transferred to the shipyard. This mechanism has been used in other contracts by the Canadian government and others in situations where the design is provided.

6.4.3 Timeline Risks

The timeline for the Project reflects the need to replace the Bowen class vessels expeditiously due to their age and condition. The timeline presented in section 6.2.3 is conservative. Once the proposals from short-listed shipyards have been received, BC Ferries will review their specific timelines and milestones, and will finalize timeline requirements during contract negotiations in an attempt to align with the Company's forecast and key Project timeline assumptions. Any delay outside the presented Project timelines would put the Company at risk of not being able to meet its service level requirements under the Contract. As well, a delay could result in significant operational implications (see section 5.3). These operational risks can be mitigated through short term life extensions of the current ships in service.

6.4.4 Construction and Delivery Risks

Project Management

Experienced and qualified BC Ferries acceptance teams will be present in the successful shipyards. Their careful oversight will ensure both adherence to vessel design, and delivery of ships identical to those already in service or under construction.

Cost Escalation

Proposals from shipyards in response to the RFP will be incorporated into firm fixed price contracts in Canadian dollars. An adequate budget contingency, as proposed, will serve to mitigate the risk of unforeseen increases in other costs that may arise through the construction phase.

Performance Risk

The sea trials component of the construction phase of the Project will enable BC Ferries, prior to delivery, to operate the vessels and assess whether they will meet the operating performance criteria set out in the contract. The design has already been proven for the Salish class vessels, and will have been proven for the Island class vessels, well before delivery of these ships. In the case of the Island class, the contract will include an obligation for the shipyard to incorporate any changes/learnings from the construction of the two vessels in this class now being built, as part of a change order process. The vessel performance of the respective classes of vessels will need to meet contract requirements, independent of previous vessel construction contracts.

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. RFP responses are to identify insurance terms proposed by the shipyard for the

vessels during construction and delivery. This allows the Company to consider the amount of coverage and coverage terms relative to the Company's desire to mitigate this risk.

Delivery

The shipyards will be responsible for delivering the ships to Victoria, British Columbia.

Shore-side Infrastructure

In order to move passenger and vehicle traffic safely and maintain the service schedule, to the extent possible, a number of up-front shore-side upgrades would need to be undertaken, including additional tie-up berths. The proposed locations of the tie-up berths at Nanaimo Harbour and Campbell River are outside BC Ferries' water lots and would require new agreements.

Design definition of the tie-up berths is preliminary and contingency has been added to the Project costs to reflect the risk in design and price estimates. Additionally, the feasibility of the Campbell River tie-up berth and breakwater extension solution is still to be confirmed.

The Company is actively working to address the above issues and, while it is believed that the Project schedule adequately reflects the expected time to resolve them, there is a risk that the property acquisitions, regulatory approvals, including First Nations and community consultation processes, and construction could take longer than anticipated, causing a Project delay. The Company will actively manage these issues to ensure timely resolution. As noted above, ultimately, significant risks to the Project timeline can be mitigated through short term life extensions of the current ships in service.

6.4.5 Operational and Deployment Risks

Defects

The initial deployment of a new vessel generally involves a break-in period, during which defects are remedied to optimize operating performance, and the systems settle into normal extended daily operation. The sea trials process described above will serve to mitigate the risk of serious defects at delivery. In addition, traditional warranties will form part of the overall shipyard contract. Typically, this warranty will cover all major components, hull and superstructure and major operating systems for two years after acceptance. This should allow the vessels to enter service and reach steady operational state with the majority of the risk and liability still remaining with the shipyard. The likelihood of significant design defects is low given both designs will have been proven before delivery.

Crew Levels

The anticipated crew size for the Island class vessels is based on BC Ferries' analysis of minimum safe manning levels. However, because the Island class vessels are not yet built and minimum safe manning crew levels not yet determined and set by Transport Canada, there is some risk that required crew numbers will be incremental to those anticipated, which would increase costs. BC Ferries will work with Transport Canada to the extent possible to obtain early notification of the minimum safe manning levels for the vessels; however, a final decision by Transport Canada will not be made until the vessels have been delivered and the regulatory inspections are completed.

Crew Resourcing

With four Island class vessels, there will be a larger total number of crew required than is the case currently. The Company is considering homeporting one of the ships for each of Route 19 and Route 23 on Vancouver Island, which would provide access to a larger potential pool of workers.

Training

BC Ferries will need to train the crews prior to deployment of the vessels, leveraging the training opportunities available through the existing Island class and Salish class vessels already in the fleet. A program will be developed in advance of vessel delivery to ensure appropriate training is provided. Crew training costs form part of the Project budget. An extensive process to monitor and actively address all deployment issues will be required. These strategies will receive enhanced focus as the Project moves closer to the deployment phase.

Refit Relief

The makeup of BC Ferries' fleet will be altered by moving to a larger fleet of smaller vessels for the high frequency shuttle routes, and retiring the relief vessel *Bowen Queen*. For the Company's minor-sized vessels, the addition and deployment of standardized Island Class vessels will continue to improve the flexibility of scheduling year-round refits that will meet service requirements. For intermediate-sized vessels, refit relief will be reduced to the off peak period when the *Salish Raven* is not operating on Route 9A. This reduction in intermediate vessel refit relief availability will be managed through the alignment of refits, major projects and operational service requirements. The full impact of reduced refit relief availability will likely start to be seen when the Salish class vessels begin quarter life upgrade projects, at which time it will be important to stagger the refits, major projects, and dry dockings accordingly.

Conclusion

BC Ferries respectfully requests the Commissioner's approval for a major capital expenditure for the Project of up to $<> million, inclusive of IDC, and supplemental Project expenditures of up to $<> million, for a total Project expenditure of up to $<> million. BC Ferries submits that this expenditure is reasonable, affordable and prudent and consistent with the Company's 12-year capital plan and the Contract. In support of its vision of being trusted and valued, as well as its mission to connect communities and customers to people and places important in their lives, the Company believes the proposed expenditure will maximise route resiliency and service benefits to communities, while furthering its strategy of class consolidation, standardization, and interoperability, all of which will help ensure that ferry service remains safe, reliable and sustainable for many years to come.

Appendix A: Regulated Routes Listing

REGULATED ROUTES	
MAJOR ROUTES 1 2 3 30	 Tsawwassen – Swartz Bay Horseshoe Bay – Nanaimo Horseshoe Bay – Langdale Tsawwassen – Nanaimo
NORTHERN ROUTES 10 11 28	 Port Hardy – Prince Rupert Prince Rupert – Skidegate Port Hardy – Mid Coast – Bella Coola
INTER-ISLAND ('MINOR') ROUTES 4 5 6 7 8 9 12 13 17 18 19 20 21 22 23 24 25 26	 Swartz Bay – Salt Spring Island Swartz Bay – Outer Gulf Islands Crofton – Salt Spring Island Saltery Bay – Earls Cove Horseshoe Bay – Bowen Island Tsawwassen – Gulf Islands Brentwood Bay – Mill Bay Langdale – Gambier – Keats Islands Comox – Powell River Powell River – Texada Island Nanaimo Harbour – Gabriola Island Chemainus – Thetis – Penelakut Islands Buckley Bay – Denman Island Denman – Hornby Islands Campbell River – Quadra Island Quadra Island – Cortes Island Port McNeill – Alert Bay – Sointula Islands Skidegate – Alliford Bay

Appendix B: Overview of Vessels to be Replaced

B.1 *Mayne Queen*

The *Mayne Queen* was built in 1965 for BC Ferries and was launched the same year, with its inaugural run serving Swartz Bay to the Southern Gulf Islands starting November 2, 1965. The vessel has remained serving Southern Gulf Islands for its 56 years of service. A summary of the history of the *Mayne Queen* is set out below.

Years	Milestones[11]
1965-1979	50 car ferry serving Route 5
1979-1992	Stretched 70 car ferry (58 AEQ) serving Route 5
1992-1997	Supplemental seasonal Route 5A and refit relief
1997- Present	Route 5A year-round

Current Operating Characteristics

The current operating characteristics and on-board amenities of the *Mayne Queen* are summarized below:

Mayne Queen	
Overall Length	84.96 m (278'9")
Maximum Displacement	1,638 tonnes
Vehicle Capacity	58 AEQ
Passenger Capacity	392
Crew	8
Maximum Speed	14 knots
Horsepower	3,598
Amenities	Passenger lounge with washrooms and vending; access to passenger area is by stairs only

Vessel Reliability

Due to its vintage, the *Mayne Queen* is challenging and expensive to maintain, and the risks of unanticipated machinery failure are higher than would be the case with newer vessels. The table below shows the recent history of the vessel's mechanical incidents which have resulted in sailing delays or cancellations. While the vessel operates safely and in compliance with regulatory requirements, it is evident from the data presented that there are service reliability issues despite significant capital and maintenance expenditures.

[11] Articulated as "cars" where these vessels predated BC Ferries' use of the standard AEQ measurement.

***Mayne Queen*: History of Recorded Mechanical Incidents**

Fiscal	All Mechanical Incidents	Mechanical Incidents that impacted service	# of Sailings	# of Delays	% Delays (per sailing leg)	# of Cancels	% Cancels (per sailing leg)
2009	7	5	5,983	29	0.48%		0.00%
2010	5	2	5,450	15	0.28%		0.00%
2011	14	4	5,467	12	0.22%		0.00%
2012	12	9	5,781	53	0.92%		0.00%
2013	4	3	5,312	7	0.13%		0.00%
2014	14	9	5,344	17	0.32%	2	0.04%
2015	8	7	5,407	14	0.26%		0.00%
2016	8	7	6,013	150	2.49%		0.00%
2017	11	4	5,735	41	0.71%		0.00%
Average	9	6	5,610	38	0.67%	0.22	0.004%

Maintenance and Capital Costs

The *Mayne Queen* has been re-built/modernized several times over its operating life:

- In 1979, the vessel was extended and converted to a four-engine azimuthing thruster configuration. The lounge configuration was not modified such that overheight traffic can only be loaded over the center lanes, and underheight vehicles in outer lanes, with the lounges configured over two decks.

- The vessel underwent a life extension program in 1999 that included re-engining, to enable the vessel to operate for at least a further 10 years.

- The vessel's original lifeboats were removed and replaced with life rafts in the mid-1990s. In fiscal 2010 the vessel had its lifesaving systems upgraded to short-track slides and inflatable platforms, with canister life rafts retained for the largest passenger license.

- Beginning in fiscal 2011, the vessel had an upgrade of its passenger lounges, with some asbestos abatement. A sewage pump-ashore system was fitted.

- In fiscal 2014, the vessel was dry docked for its scheduled major docking.

- In fiscal 2015, the vessel has its three main engines overhauled.

- In fiscal 2018, an extensive refit was undertaken to enable the vessel to continue in service through fiscal 2022.

At its planned retirement date in fiscal 2022, the *Mayne Queen* will be over 55 years old.

Significant maintenance effort continues to be planned and executed to keep the vessel in class, and fully operational, until its proposed replacement in fiscal 2022. The following table summarizes historic and forecast refit and maintenance expenditures and capital projects for the *Mayne Queen* for the period fiscal 2009 – 2021.

Mayne Queen: **Refit, Maintenance and Capital Projects ($ Millions)**

	Actual (fiscal)										Forecast (fiscal)		
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Refit, including Major Overhauls and Inspections			< >	< >		< >	< >			< >	< >		
Vessel Maintenance	0.5	0.3	0.4	0.2	0.3	0.2	0.2	0.5	0.7	0.3	0.4	0.4	0.4
Capital Projects:													
Life Saving Equipment Replacement		0.1											
Internal Passenger and Safety Upgrades			1.0										
Replace Seating in Upper Passenger Lounge					0.01	0.03							
Total	**0.5**	**0.4**	**< >**	**< >**	**0.31**	**< >**	**< >**	**0.5**	**0.7**	**< >**	**< >**	**0.4**	**0.4**

End of Life

While the *Mayne Queen* operates safely and in compliance with all regulatory requirements, as with the other Bowen class vessels it is at the end of its useful service life as evidenced by obsolescence, maintenance and refit costs, and service reliability issues. This conclusion is supported by a vessel condition survey conducted by Lloyds Register Canada in 2015, which indicates that the vessel condition is not ideal for a life extension. This report further indicated that substantial steel renewal was required to permit continued safe service to fiscal 2022, which is in progress.

Overall, in recent refits, the *Mayne Queen* has had further unforeseen steel repairs well above what would normally be expected at refit, suggesting that the vessel is at the end of its useful service life. A further life extension is not considered economically or technically prudent, due to the overall material state of the vessel and the obsolescence of the majority of systems. The issues to support this conclusion are as follows:

- The *Mayne Queen*'s hull and, in particular, the car deck and casings, and rub strake have had extensive steel repairs to keep the vessel in operation.

- The vessel was re-engined in 1999 with CAT 3512B series engines with an expected life of 80,000 to 100,000 operating hours. Despite being extensively de-rated,[12] with the vessel operating for approximately 5,500 hours annually, the engines will have accumulated over 100,000 operating hours at its retirement. In addition, the thrusters are an older Mariner model that are supported primarily at BC Ferries' maintenance facility as the OEM is no longer in business, and will be increasingly unsupportable as spares are consumed.

- The vessel's electrical and electronic systems are dated and are increasingly difficult to support.

- The vessel is not fitted with an elevator to provide access to the overhead lounges.

- The vessel contains asbestos and, while some abatement has been effected to ensure that the vessel meets all safety and health requirements, it becomes ever more difficult to conduct repairs and maintenance when the potential for asbestos exists. In addition, there will be other hazardous materials associated with vessels of this vintage, such as lead paint, and Polychlorinated Biphenyls ("PCB's") in transformers.

[12] "De-rating" occurs when a device is modified to operate at less than maximum capacity, in order to prolong its life. In this case, the engines were over-specified to address a stalling problem with the thrusters.

B.2 *Powell River Queen*

The *Powell River Queen* was built in 1965 for BC Ferries. Some of the vessel's major milestones are set out below:

Years	Milestones
1965	Inaugural run August 25, 1965 Earls Cove to Saltery Bay (Route 7)
1973	Superstructure lifted at Burrard Dry Dock (for overheight vehicles)
1979	Stretched from 50 car ferry to 70 car ferry
1991	Deployed to Route 23 from 1991 until anticipated retirement

Current Operating Characteristics

The current operating characteristics and on-board amenities of the *Powell River Queen* are summarized below:

	Powell River Queen
Overall Length	84.96m (278'8")
Maximum Displacement	1,638 tonnes
Vehicle Capacity	59 AEQ
Passenger Capacity	392
Crew size	8
Maximum Speed	14 knots
Horsepower	3,598
Amenities	Passenger lounge with washrooms and vending; access to passenger area is by stairs only

Vessel Reliability

Due to its vintage, the *Powell River Queen* is challenging, time-consuming and expensive to maintain, and the risks of unanticipated machinery failure are higher than would be the case with newer vessels. The table below shows the recent history of the vessel's mechanical incidents which have resulted in sailing delays or cancellations. While the vessel operates safely and in compliance with regulatory requirements, it is evident that there are service reliability issues despite significant capital and maintenance expenditures:

***Powell River Queen*: History of Recorded Mechanical Incidents**

Fiscal	*All Mechanical Incidents*	*Mechanical Incidents that impacted service*	*# of Sailings*	*# of Delays*	*% Delays (per sailing leg)*	*# of Cancels*	*% Cancels (per sailing leg)*
2009	2	1	9,160	0	0.00%	2	0.02%
2010	11	1	11,392	0	0.00%	2	0.02%
2011	6	2	12,320	11	0.09%		0.00%
2012	8	0	11,174	0	0.00%		0.00%
2013	6	1	11,583	2	0.02%		0.00%
2014	11	2	11,024	17	0.15%	12	0.11%
2015	14	5	11,632	6	0.05%	22	0.19%
2016	16	4	10,444	7	0.07%	10	0.10%
2017	6	4	10,509	8	0.08%		0.00%
Average	9	2	11,026	6	0.05%	5.33	0.048%

Maintenance and Capital Costs

The *Powell River Queen* has been rebuilt/modernized several times over its operating life:

- In 1979, the *Powell River Queen* was extended and converted to a four-engine azimuthing thruster configuration. The vessel's lounge configuration was also extensively modified compared to its sister ships such that overheight traffic could be loaded over all vehicle lanes.

- In 2000, the *Powell River Queen* underwent a comprehensive life extension project that involved re-engining and a new propulsion train, extensive steel renewal, installation of a fixed fire-fighting ($C0_2$) system and upgrades to structural fire protection, and modernization of lifesaving equipment. The objective of the project was to extend the vessel life for at least 10 years.

- In fiscal 2009, due to the advanced deterioration of its car deck resulting from heavy vehicle loads and the exposed conditions on Route 23, the vessel was taken out of service to have its car deck completely reconstructed.

- In fiscal 2010, the vessel's lifesaving systems were upgraded to short-track slides and inflatable platforms.

- In fiscal 2012, the vessel had an upgrade of its passenger lounges and a sewage pump ashore system was fitted.

- In fiscal 2014, the vessel was dry docked for its scheduled major docking.

- The last major upgrade of the *Powell River Queen* was completed in fiscal 2016, enabling the vessel to operate through fiscal 2019. Another refit is planned in fiscal 2019 to ensure the vessel operates until its planned retirement in fiscal 2022, at over 55 years old.

Significant maintenance efforts continue to be planned and executed to keep the vessel in Class, and fully operational, until its proposed replacement in fiscal 2022. The following table summarizes the *Powell River Queen*'s historic and forecast refit and maintenance expenditures and capital projects for the period fiscal 2009 - 2021:

***Powell River Queen* Refit, Maintenance and Capital Projects ($ Millions)**

	Actual (fiscal)										Forecast (fiscal)		
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Refit, including Major Overhauls and Inspections				< >		< >		< >			< >		
Vessel Maintenance	0.4	0.2	0.2	0.3	0.4	0.2	0.4	0.4	1.1	0.8	0.4	0.4	0.4
Capital Projects:													
Life Saving Equipment Replacement		0.2											
Refurbishment of Car Deck	5.2												
Various Upgrades				1.0									
Total	**5.6**	**0.4**	**0.2**	**< >**	**0.4**	**< >**	**0.4**	**< >**	**1.1**	**0.8**	**< >**	**0.4**	**0.4**

End of Life

While the *Powell River Queen* operates safely and in compliance with all regulatory requirements, it is at the end of its useful service life as evidenced by obsolescence, escalating maintenance and refit costs, and service reliability issues. This conclusion is supported by a vessel condition survey for the *Powell River Queen* conducted by Lloyd's Register Canada in 2015, which indicated that the vessel's condition is not ideal for a life extension. This report further indicated that substantial steel renewal was required to permit continued safe service to fiscal 2022 which was undertaken in an extended refit window.

Overall, in recent refits, the *Powell River Queen* has had unforeseen engineering repairs well above what would normally be expected at refit, suggesting that the vessel is at the end of its useful service life. A further life extension is not considered economically or technically prudent, due to the overall material state of the vessel and the obsolescence of the majority of systems. The issues to support this conclusion are as follows:

- As noted above, the *Powell River Queen*'s hull and, in particular its car deck and rub strake, have had extensive steel repairs. Even with regular steel renewals, the exposure of the deck and casings to salt spray and green water, and the loading of logging trucks and construction equipment particular to this route requires constant monitoring and maintenance. The vessel refits since the 2008 car deck renewal have had unanticipated scope additions due to the diminishing overall material state of the vessel.

- The *Powell River Queen* was re-engined in 2000 with CAT 3512B series engines with an expected life of 80,000 to 100,000 operating hours. Despite being extensively de-rated, with the vessel operating for approximately 5,500 hours annually, the engines will have accumulated over 100,000 operating hours at its retirement in fiscal 2022.

- In addition, the thrusters are an older Mariner model that are supported primarily at BC Ferries' maintenance facility as the OEM is no longer in business, and will be increasingly unsupportable as spares are consumed.

- The vessel's electrical and electronic systems are dated and are increasingly difficult to support.

- The vessel is not fitted with an elevator to provide access to the overhead lounges, although this is mitigated by the short transit duration (people stay in their cars) and a small "bus shelter" on the car deck for those unable to climb stairs.

- The vessel contains asbestos and, while some abatement has been effected to ensure that the vessel meets all safety and health requirements, it becomes ever more difficult to conduct repairs and maintenance when the potential for asbestos exists. In addition, there will be other hazardous materials associated with vessels of this vintage, such as lead paint, and PCB's in transformers.

B.3 *Bowen Queen*

The *Bowen Queen* was built in 1965 for BC Ferries and was launched the same year. The *Bowen Queen* initially operated on the route connecting Horseshoe Bay and Bowen Island (Route 8), but was later assigned a refit relief role for other intermediate vessels. In the late 1990's, the *Bowen Queen* began summer service between Tsawwassen to the Southern Gulf Islands (Route 9A), which involved re-certification to a higher coastal voyage class (redefined as Near Coastal 2 in 2007). This role ended in 2017 with the introduction of the Salish class vessels on that route and the *Bowen Queen* now serves as a refit relief vessel. Some of the vessel's major milestones are set out below:

Years	Milestones
1965	Vessel launched
1966-1971	Upon entering service, assigned to its namesake route (Route 8: Horseshoe Bay - Bowen Island)
1971	Replaced *Pender Queen* and provided service on Routes 4 and 5
1974	Took over Route 4 from *Salt Spring Queen*
1979	Stretched from 50 car ferry to 70 car (61 AEQ) ferry
1979-1997	Returned to Route 4
1997-2017	Deployed to refit relief and Route 9A service
2017- Present	Deployed to refit relief

Current Operating Characteristics

The current operating characteristics and on-board amenities of the *Bowen Queen* are summarized below:

Bowen Queen	
Overall Length	84.96 m (278'9")
Maximum Displacement	1,637 tonnes
Vehicle Capacity	61 AEQ
Passenger Capacity	390
Crew	10
Maximum Speed	14 knots
Horsepower	3,598
Amenities	Passenger lounge with washrooms and vending; access to passenger area is by stairs only

Vessel Reliability

Due to its vintage, the *Bowen Queen* is challenging, time-consuming and expensive to maintain, and the risks of unanticipated machinery failure are higher than would be the case with newer vessels. The table below shows the recent history of the vessel's mechanical incidents which have resulted in sailing delays or cancellations. While the vessel operates safely and in compliance with regulatory requirements, it is evident that there are service reliability issues despite significant capital and maintenance expenditures:

***Bowen Queen*: History of Recorded Mechanical Incidents**

Fiscal	All Mechanical Incidents	Mechanical Incidents that impacted service	# of Sailings	# of Delays	% Delays (per sailing leg)	# of Cancels	% Cancels (per sailing leg)
2009	10	7	8,615	39	0.45%		0.00%
2010	10	3	8,050	26	0.32%		0.00%
2011	16	5	5,116	29	0.57%	3	0.06%
2012	18	9	5,514	43	0.78%	4	0.07%
2013	8	5	4,601	21	0.46%	1	0.02%
2014	8	3	5,416	9	0.17%		0.00%
2015	8	1	3,556	1	0.03%		0.00%
2016	19	9	6,528	39	0.60%	2	0.03%
2017	13	5	4,152	18	0.43%		0.00%
Average	12	5	5,728	25	0.44%	1.1	0.019%

Maintenance and Capital Costs

The *Bowen Queen* has been re-built/modernized several times over its operating life:

- The vessel was extended and converted to a four-engine azimuthing thruster configuration in 1979. The lounge configuration was not modified such that overheight traffic can only be loaded over the center lanes, and underheight vehicles in outer lanes, with the lounges configured over two decks.

- The vessel underwent a life extension program in 1999 that included re-engining, to enable it to operate for at least a further 10 years.

- In 2007, the vessel's passenger accommodations were updated and accessibility improved.

- In fiscal 2010, the vessel had its lifesaving systems upgraded to short-track slides and inflatable platforms, with the canister life rafts retained for the largest passenger license.

- In fiscal 2012, the vessel had an upgrade of its passenger lounges and small onboard cafeteria; and a sewage pump-ashore system fitted.

- In fiscal 2013, the vessel was removed from service for annual maintenance, inspection and certification of major systems.
- In fiscal 2014, the vessel was dry docked for its scheduled major docking.

- In fiscal 2017, an extensive refit was undertaken to enable the vessel to continue in service through fiscal 2019. Another refit is planned in fiscal 2019 to ensure the *Bowen Queen* operates until its planned retirement in fiscal 2022, at over 55 years old.

Significant maintenance efforts continue to be planned and executed to keep the vessel in Class, and fully operational, until its proposed replacement in fiscal 2022. The following table summarizes historic and forecast refit and maintenance expenditures and capital projects for the *Bowen Queen* for the period fiscal 2009 – fiscal 2021.

***Bowen Queen* Refit, Maintenance and Capital Projects ($ Millions)**

	Actual (fiscal)										Forecast (fiscal)		
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Refit, including Major Overhauls and Inspections	< >			< >	< >	< >			< >		< >		
Vessel Maintenance	0.4	0.2	0.7	0.6	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.5
Capital Projects:													
Internal Passenger and Safety Upgrades		0.1	0.2	1.4									
Upgrade Right Angle Drive (RAD) Controls					0.1								
Spare Gearbox Purchase								0.1					
Total	**< >**	**0.3**	**0.9**	**< >**	**< >**	**< >**	**0.4**	**0.6**	**< >**	**0.4**	**< >**	**0.5**	**0.5**

End of Life

While the *Bowen Queen* operates safely and in compliance with all regulatory requirements, it is at the end of its useful service life as evidenced by obsolescence, escalating maintenance and refit costs, and service reliability issues. This conclusion is supported by a vessel condition survey conducted by Lloyds Register Canada in 2015, which indicates that the vessel condition is not ideal for a life extension. This report further indicated that substantial steel renewal was required to permit continued safe service to fiscal 2022, which was undertaken in an extended refit.

Overall, in recent refits, the *Bowen Queen* has had further unforeseen steel repairs well above what would normally be expected at refit, suggesting that the vessel is at the end of its useful service life. A further life extension is not considered economically or technically prudent, due to the overall material state of the vessel and the obsolescence of the majority of systems. The issues to support this conclusion are as follows:

- The *Bowen Queen*'s hull and, in particular car deck and casings, and rub strake have had extensive steel repairs to keep the vessel in operation.

- The *Bowen Queen* was re-engined in 1999 with CAT 3512B series engines with an expected life of 80,000 to 100,000 operating hours. Despite being extensively de-rated, with the vessel operating for approximately 5,500 hours annually, the engines will have accumulated over 100,000 operating hours at its retirement.

- In addition, the thrusters are an older Mariner model that are supported primarily at BC Ferries' maintenance facility as the OEM is no longer in business, and will be increasingly unsupportable as spares are consumed.

- The vessel's electrical and electronic systems are dated and are increasingly difficult to support.

- The vessel is not fitted with an elevator to provide access to the overhead lounges, and there is no access from the car deck to washroom facilities for persons with accessibility needs.

- The vessel contains asbestos and, while some abatement has been effected to ensure that the vessel meets all safety and health requirements, it becomes ever more difficult to conduct repairs and maintenance when the potential for asbestos exists. In

addition, there will be other hazardous materials associated with vessels of this vintage, such as lead paint, and PCB's in transformers.

B.4 Summary

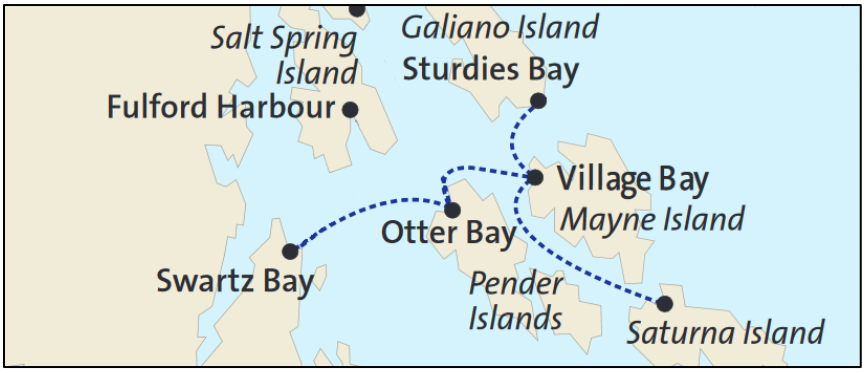
While there is no specific regulatory requirement to retire the *Powell River Queen*, *Bowen Queen* and *Mayne Queen*, as most systems and materials fitted to these vessels are regulated to the original regulations applicable to them (so-called "grandfathering"), there are significant gaps as compared to modern safety and fleet standards.

As discussed above, the longer the Bowen class vessels operate, the higher the risk of unforeseen operational issues and serviceability. Service reliability might be compromised if critical spares are not available, or if OEM knowledge and supportability are not at adequate levels.

The option to life extend the three Bowen Class vessels by another 10 years would not be a prudent investment. Their long-range maintenance plans have been "glidesloped" for the planned in-service dates of the new vessels. Life extensions would push out the age of the ships at retirement to 65 to 66 years. As discussed in section 5.3, there is a high degree of uncertainty and associated budget risk with this approach. Post life extension, a significant risk of premature asset failure would remain, such that operational reliability and/or a full incremental 10 years of service life may not be realized through this option.

Appendix C: Overview of Routes 5, 19 and 23

C.1 Route 5/5A: Swartz Bay to Outer Gulf Islands



Scheduled Gulf Islands service commenced in 1918, and was eventually taken over by the Province in 1961. By 1969, the *Queen of Sidney* was operating as a supplementary vessel both on the Gulf Islands to Mainland and Vancouver Island service. A summary of the historic capacity of the vessels operating on Route 5/5A is set out below:

Years	Vessel	Capacity[13]
1961	*Motor Princess*	40 car ferry
1965	*Mayne Queen*	50 car ferry
1972	*Mayne Queen* *Pender Queen* (supplementary)	50 car ferry 40 car ferry
1979	*Mayne Queen* *Pender Queen* (supplementary)	70 car ferry 40 car ferry
1981	*Mayne Queen* *Vesuvius Queen* (Swartz Bay-Fulford Harbour-Pender Island	70 car ferry 32 car ferry
1981	*Mayne Queen* *Quinitsa* (Supplementary)	70 car ferry 50 car ferry
1985	*Queen of Tsawwassen* *Mayne Queen**	138 car ferry 70 car ferry
1992	*Queen of Cumberland* *Mayne Queen*	127 car ferry (112 AEQ) 70 car ferry (58 AEQ)

**Sometime between 1985 and 1991, the Mayne Queen began operating year round*

[13] Articulated as "cars" where these vessels predated BC Ferries' use of the standard AEQ measurement.

The key service characteristics of Route 5/5A are described below:

Route 5 / 5A Service Characteristics	
Route distance	Depends on destination. Nautical miles from Swartz Bay: Pender Island (8), Mayne Island (10), Galiano Island (14), Saturna Island (16)
Crossing time	Depends on destination. Swartz Bay to Pender Island is 40 minutes; Swartz Bay to Galiano Island with two stops is two hours.
Minimum hours of operation*	12-14 hours
Minimum round trips per day	4-5 in peak, 4-7 in off-peak
Minimum round trips per year	3,461

** Hours of operation are defined by the time from the first departure at the start of the day to the last departure of the day, from the same terminal on the same route.*

Route 5 is currently served by the Queen *of Cumberland* and Route 5A by the *Mayne Queen*. The *Mayne Queen* currently operates two schedules, one for the peak season and one for the off peak season, with four to five departures from Swartz Bay on Route 5A. Both ships are homeported at Swartz Bay, meaning the maximum length of a same-day return journey is longer for travelers originating from the Vancouver Island side than for travelers originating from the Southern Gulf Islands side. With the planned deployment of a Salish class vessel on Route 5, the *Queen of Cumberland* will be redeployed to Route 5A, enabling the retirement of the *Mayne Queen.*

The average vehicle utilized capacity on Route 5 in the off-peak and peak seasons in fiscal 2018 is set out below:

		Off Peak							Peak						
Departure Terminal	Departure (by Round Trip)	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa
Swartz Bay	1	8%	11%	14%	15%	14%	8%	5%	7%	10%	14%	18%	20%	13%	10%
	2	39%	30%	34%	38%	35%	31%	57%	22%	21%	31%	29%	31%	36%	55%
	3	36%	31%	31%	30%	34%	41%	59%	54%	72%	88%	92%	102%	100%	29%
	4	22%	64%	73%	80%	81%	73%	43%	30%	45%	61%	65%	100%	79%	50%
	5	13%	55%	73%	72%	80%	86%	22%	23%	52%	81%	86%	75%	69%	29%
	6		57%	63%	68%	74%	61%	17%					15%	12%	27%
	7					23%	14%								
Southern Gulf Island	1	44%	62%	78%	76%	79%	53%	61%	51%	72%	107%	112%	111%	70%	54%
	2	79%	55%	58%	63%	58%	54%	48%	40%	86%	80%	82%	95%	74%	19%
	3	55%	54%	57%	57%	59%	49%	37%	46%	38%	36%	45%	50%	34%	31%
	4	13%	33%	32%	35%	35%	26%	5%	40%	24%	24%	21%	30%	18%	31%
	5	14%	21%	24%	20%	20%	18%	25%	18%	6%	3%	5%	14%	12%	30%
	6		3%	2%	3%	2%	6%	5%					3%	2%	4%
	7					0%	1%								

C.2 Route 19: Nanaimo Harbour – Gabriola Island

Government-subsidized scheduled ferry service on the route connecting Nanaimo and Gabriola Island (Route 19) commenced in August 1931. The Ministry of Transportation took over operation of the route in 1961. A summary of the historic capacity of the vessels operating on Route 19 is set out below:

Years	Vessel	Capacity[14]
1961	*Etna*	12 car ferry
1963	*Westwood*	16 car ferry
1972	*Klatawa*	26 car ferry
1973	*Kahloke*	30 car ferry (26 AEQ)
1977	*Quinitsa*	50 car ferry (44 AEQ)
1982 - Present	*Quinsam*	70 car ferry (63 AEQ)

The key service characteristics of the route are described below:

Route 19 Service Characteristics	
Route distance	3 nautical miles
Crossing time	20 minutes
Minimum hours of operation*	12 to 14 hours
Minimum round trips per day	11-13
Minimum round trips per year	4,898

** Hours of operation are defined by the time from the first departure at the start of the day to the last departure of the day, from the same terminal on the same route.*

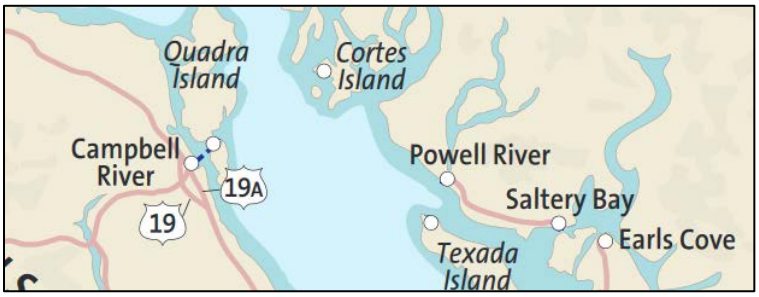
[14] Articulated as "cars" where these vessels predated BC Ferries' use of the standard AEQ measurement.

Route 19 is now served by the *Quinsam*. Currently there are peak and off-peak schedules for Route 19, with fourteen to seventeen departures from each end of the route. The *Quinsam* is homeported at Descanso Bay (Gabriola Island), meaning the maximum length of a same-day return journey is longer for travelers originating from the Gabriola Island side than for travelers originating from the Nanaimo Harbour side. With the introduction of new Island class vessels on this route, it is currently intended that the *Quinsam* will be redeployed on Route 6.

The average vehicle utilized capacity on Route 19 in the off-peak and peak seasons for fiscal 2018 is set out below:

		Off Peak							Peak						
Departure Terminal	Round Trip	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa
Gabriola Is (Descanso Bay)	1	28%	77%	77%	61%	69%	56%	38%	45%	82%	90%	71%	83%	70%	45%
	2		88%	96%	91%	97%	82%	47%		89%	112%	111%	112%	94%	45%
	3	86%	94%	105%	103%	104%	97%	85%	108%	106%	112%	115%	113%	108%	80%
	4	74%	96%	105%	108%	109%	99%	86%	98%	112%	113%	115%	115%	106%	81%
	5	81%	102%	106%	105%	111%	99%	84%	100%	105%	118%	115%	115%	102%	79%
	6	87%	86%	100%	96%	102%	91%	76%	97%	117%	119%	114%	120%	105%	76%
	7	34%	75%	81%	75%	90%	69%	37%	81%	103%	115%	97%	118%	97%	60%
	8	86%	70%	81%	76%	79%	68%	81%	78%	87%	99%	97%	107%	85%	62%
	9	61%	62%	70%	72%	76%	64%	43%	75%	70%	91%	76%	92%	74%	57%
	10	36%	35%	33%	21%	35%	35%	32%	56%	55%	53%	24%	60%	52%	43%
	11	30%	26%	19%	34%	17%	17%	21%	53%	36%	34%	54%	17%	23%	38%
	12	21%	15%	11%	13%	12%	13%	18%	45%	31%	27%	22%	29%	21%	44%
	13	7%	5%	4%	4%	5%	5%	8%	17%	13%	12%	11%	15%	13%	21%
	14	4%	3%	3%		3%	4%	6%	8%	4%	5%		5%	5%	11%
Nanaimo Harbour	1		49%	55%	53%	62%	44%	16%		43%	53%	48%	76%	54%	20%
	2	20%	53%	68%	76%	74%	64%	35%	34%	64%	78%	83%	79%	76%	48%
	3	24%	53%	62%	66%	67%	55%	46%	41%	64%	79%	86%	93%	64%	72%
	4	34%	48%	51%	22%	58%	52%	59%	68%	63%	79%	23%	94%	93%	89%
	5	44%	53%	61%	85%	60%	58%	59%	67%	77%	87%	109%	91%	88%	87%
	6	67%	66%	76%	70%	79%	77%	88%	73%	87%	95%	103%	103%	108%	98%
	7	43%	72%	77%	82%	89%	80%	55%	60%	78%	103%	105%	112%	100%	75%
	8	98%	96%	103%	106%	108%	104%	106%	86%	96%	113%	110%	110%	109%	97%
	9	64%	88%	101%	102%	107%	104%	88%	68%	95%	111%	110%	112%	109%	79%
	10	54%	67%	79%	81%	93%	93%	57%	62%	86%	97%	95%	104%	109%	60%
	11	40%	43%	42%	49%	55%	59%	40%	44%	49%	55%	59%	69%	85%	42%
	12	41%	40%	45%	52%	58%	61%	40%	55%	42%	52%	68%	56%	68%	44%
	13	14%	13%	14%		24%	23%	17%	20%	18%	24%		38%	38%	22%
	14	8%	13%	8%	27%	10%	23%	11%	10%	16%	11%	35%	13%	25%	11%

C.3 Route 23: Campbell River – Quadra Island



Car ferry service on the route connecting Campbell River and Quadra Island (Route 23) commenced on April 8, 1960 with the 16 car ferry *Quadra Queen*. A summary of the historic capacity of the vessels operating on Route 23 is set out below:

Years	Vessel	Capacity[15]
1960	*Quadra Queen*	16 car ferry
1969	*Quadra Queen II*	30 car ferry (26 AEQ)
1980	*Quadra Queen II and Tachek (2-ship service seasonally)*	2 x 30 car ferry (26 AEQ each)
1991	*Powell River Queen*	70 car ferry (59 AEQ)

The key service characteristics of the route are described below:

Route 23 Service Characteristics	
Route distance	1.2 nautical miles
Crossing time	10 minutes
Minimum hours of operation*	13 hours
Minimum round trips per day	13-16
Minimum round trips per year	5,785

** Hours of operation are defined by the time from the first departure at the start of the day to the last departure of the day, from the same terminal on the same route.*

Route 23 is currently served by the *Powell River Queen*, which operates on the same schedule year round, with 14 to 17 departures from each side of the route. The ship is homeported at Quathiaski Cove (Quadra Island), meaning the maximum length of a same-day return journey is longer for travelers originating from the Quadra Island side than for travelers originating

[15] Articulated as "cars" where these vessels predated BC Ferries' use of the standard AEQ measurement.

from the Campbell River side. With the introduction of new Island class vessels on this route, it is currently intended that the *Powell River Queen* will be retired.

The average vehicle utilized capacity on Route 23 in the off-peak and peak seasons for fiscal 2018 is set out below:

		Off Peak							Peak						
Departure Terminal	Round Trip	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa
Campbell River	1		32%	42%	47%	33%	30%			36%	52%	64%	46%	40%	
	2	18%	48%	47%	66%	59%	58%	33%	25%	45%	60%	79%	72%	68%	53%
	3		52%	61%	67%	72%	57%	25%		51%	61%	76%	85%	73%	37%
	4	29%	38%	43%	47%	56%	43%	31%	61%	56%	71%	79%	71%	67%	61%
	5	34%	48%	21%	47%	47%	50%	43%	60%	73%	29%	83%	88%	86%	88%
	6	33%	45%	75%	52%	46%	49%	51%	74%	86%	100%	83%	85%	92%	92%
	7	47%	61%	63%	64%	69%	75%	60%	90%	93%	103%	96%	99%	102%	95%
	8	46%	58%	66%	64%	68%	74%	59%	91%	86%	101%	95%	100%	101%	90%
	9	57%	82%	91%	89%	92%	91%	69%	91%	89%	105%	102%	107%	110%	101%
	10	65%	80%	92%	90%	95%	95%	87%	97%	91%	110%	108%	108%	106%	104%
	11	59%	94%	102%	102%	105%	106%	81%	90%	89%	108%	112%	111%	98%	96%
	12	42%	78%	94%	93%	95%	100%	56%	63%	82%	108%	106%	109%	103%	67%
	13	35%	53%	63%	66%	74%	83%	51%	42%	62%	91%	75%	90%	106%	51%
	14	36%	40%	45%	46%	51%	66%	39%	47%	59%	70%	60%	75%	90%	60%
	15	26%	28%	31%	33%	38%	42%	29%	35%	39%	42%	39%	42%	64%	37%
	16	22%	21%	24%	31%	30%	37%	25%	24%	31%	31%	35%	41%	57%	35%
	17						15%	14%						17%	17%
Quathiaski Cove (Quadra Island)	1		26%	27%	29%	25%	22%			31%	40%	43%	31%	29%	
	2	30%	57%	72%	59%	60%	51%	26%	51%	57%	73%	65%	65%	55%	45%
	3		85%	89%	87%	87%	72%	35%		92%	108%	101%	113%	93%	52%
	4	61%	99%	104%	103%	110%	101%	80%	105%	110%	115%	114%	113%	108%	95%
	5	56%	93%	101%	103%	105%	101%	65%	84%	113%	105%	116%	115%	113%	75%
	6	80%	97%	103%	103%	107%	99%	79%	104%	107%	112%	107%	113%	108%	97%
	7	68%	82%	87%	92%	98%	89%	63%	101%	106%	112%	112%	112%	110%	87%
	8	76%	80%	85%	89%	92%	86%	72%	99%	104%	109%	111%	108%	106%	96%
	9	61%	61%	68%	69%	76%	68%	48%	100%	107%	107%	111%	110%	93%	55%
	10	73%	74%	76%	81%	78%	79%	67%	104%	106%	97%	110%	112%	100%	88%
	11	47%	59%	21%	68%	66%	63%	44%	79%	85%	27%	90%	100%	88%	64%
	12	55%	62%	94%	66%	66%	64%	43%	104%	96%	108%	101%	100%	95%	57%
	13	28%	26%	35%	27%	30%	28%	26%	72%	56%	76%	57%	50%	57%	39%
	14	40%	27%	27%	23%	32%	23%	28%	90%	56%	52%	54%	49%	47%	40%
	15	18%	11%	8%	10%	8%	9%	14%	33%	25%	22%	24%	18%	20%	29%
	16	13%	10%	8%	11%	8%	9%	15%	27%	24%	24%	23%	18%	20%	34%
	17						4%	7%						8%	11%

Appendix D: Public and Stakeholder Engagement for Routes 19 and 23

D.1 Introduction

The Island class vessel is a relatively small and simple vessel with limited amenities and services. The communities they would serve are highly dependent on ferry service for regular bi-directional travel, and, as such, have distinct needs related to frequency and specific time-of-day sailings. Reflecting this, the introduction of the proposed four new Island class vessels on Routes 19 and 23 would enable increased sailing frequency and new schedules. Engagement with these communities is an important part of ensuring the service offered by the new vessels accommodates community needs.

D.2 Engagement

Engagement Events

BC Ferries recently completed in-person and online engagement for the vessel replacements for Routes 19 and 23. These sessions focused on engaging with Gabriola Island and Quadra Island residents, including employees of BC Ferries on the routes receiving or closely affected by the four new Island class vessels proposed in this Application.

BC Ferries held a total of six engagement events and posed the following central question to stakeholders:

> *Would you prefer one larger vessel that provides similar sailing frequency as the current vessel, or two smaller vessels with increased sailing frequency?*

The events included:

Location	Date	Activity
Onboard the *Quinsam* (Nanaimo Harbour to Gabriola Island)	Monday, July 23	Onboard outreach
Gabriola Community Arts Centre	Monday, July 23	Open house
Onboard the *Powell River Queen* (Campbell River to Quadra Island)	Tuesday, July 24	Onboard outreach
Quathiaski Cove Terminal	Tuesday, July 24	Pop-up booth
Quathiaski Cove, Tru-Value Foods	Tuesday, July 24	Pop-up booth
Project webpage	July 16 to July 26	Online survey

Outreach Activities

Outreach activities occurred on the vessels servicing Routes 19 and 23, focusing on informing customers of the upcoming vessel replacements and the opportunity to participate in the online survey, and answering questions.

Open House

An open house was held at the Community Arts Centre on Gabriola Island to introduce customers and community members to the upcoming vessel replacements, gather their feedback on vessel preference, and answer any questions. Display panels were used to convey information and representatives of BC Ferries attended to answer questions and address concerns. Paper copies of the survey were also available for people to complete.

Pop-up Booths

Pop-up booths were erected at Quathiaski Cove terminal and at the nearby Tru-Value Foods parking lot in Quathiaski Cove on Quadra Island. Customers and community members were invited to stop by to discuss the vessel replacements, to provide their feedback on vessel preference, and to ask questions. Paper copies of the survey were also available to complete.

Online Survey

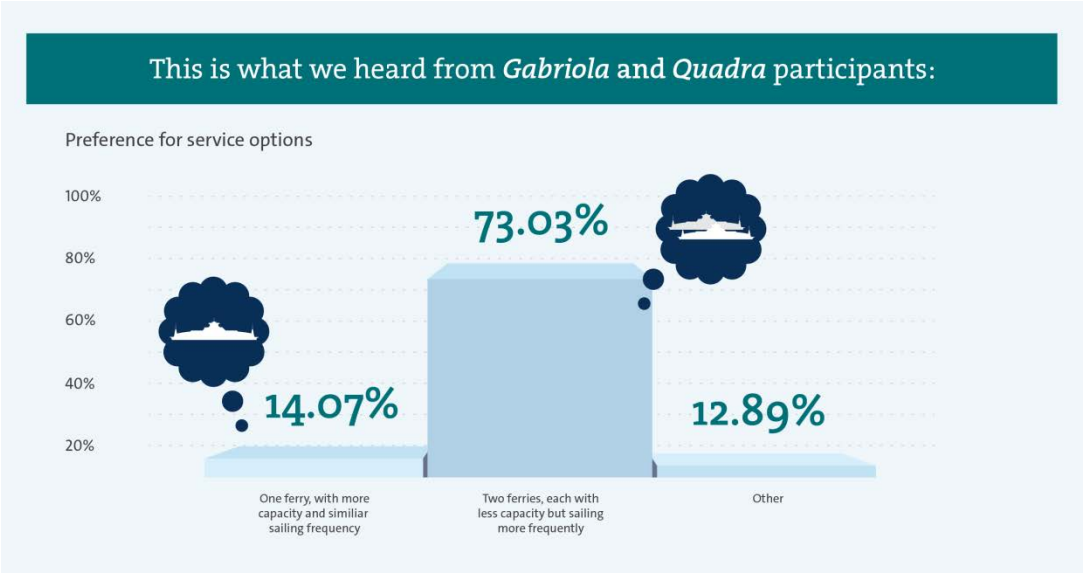
An online survey was available for two weeks via BC Ferries' website. The survey was promoted on BC Ferries' social media channels.

D.3 Engagement Results

Through these events, BC Ferries heard from over 1,400 people. Engagement participants originated mainly on Gabriola Island and Quadra Island:

- 54% Gabriola Island residents;
- 30% Quadra Island residents;
- 3% Cortes Island residents; and
- 13% residents of other areas.

When asked to identify their preference for one larger vessel or two smaller vessels, participants indicated a strong preference for the two smaller Island class vessels.



Of those who chose the 'other' category, there was also a strong preference for two ships with participants offering a variety of possible two-ship configurations for BC Ferries' consideration.

Other key feedback themes included:

Capacity

Feedback included comments related to minimizing wait times by ensuring vessels can handle capacity during peak times, the ability to scale down capacity to meet lower winter-month demands, and ensuring enough capacity is available to handle connections to/from Cortes Island.

Costs

Feedback included comments related to the costs of crew, maintenance and operation of the vessels, particularly with regard to any impact on fares.

Vehicle Traffic Congestion

Feedback included comments related to vehicle traffic congestion at the terminals, particularly during peak summer months, and how this congestion impacts the ability for community members to move around their road networks. Comments also focused on the need to ensure adequate capacity at terminals to handle vehicle queuing for larger/more frequent ferry service to avoid undue impact on communities.

Schedule

This included comments related to schedule times with some requests for later and/or earlier scheduled sailings. Comments also noted the need to ensure frequent sailings during peak times, and for Quadra Island residents, the impact of weather conditions on ferry service and how the choice of larger or smaller vessels would impact these sorts of delays.

D.4 Next Steps

In anticipation of the four Island class vessels entering service, the next engagement steps will focus on informing customers and community members of the vessel building process, and closer to the date of implementation, will seek to gather community input on schedule preferences.

Appendix E: Customer Feedback

E.1 Customer-Initiated Feedback

BC Ferries receives customer-initiated feedback through letters, emails, phone calls, tweets, Facebook posts and the online feedback form. The tables below provide an overview of feedback from customers specific to Routes 5/5A, 19 and 23. While these tables summarize comments by route, not by vessel, it is reasonable to assume that for most of the year the *Powell River Queen* operates on Route 23 and vessels of the similar size and configuration (*Bowen Queen, Mayne Queen* or *Quinsam*) operate on Routes 19 and 5/5A (along with the *Queen of Cumberland*).

E.1.1 Overview of Customer Feedback

Fiscal Year	Total Comments	Category: Northern Islands/Southern Gulf Islands	Route 23 Specific	Route 19 Specific	Route 5/5A Specific
2010	6,014	231/460	34	43	141
2011	9,260	362/724	55	101	195
2012	8,351	616/673	47	89	163
2013	7,653	333/503	26	56	138
2014	8,273	511/714	43	129	151
2015	7,319	632/658	67	115	140
2016	7,371	604/757	40	60	170
2017	8,089	676/720	40	46	133

E.1.2 Route 23

Category	Details
Delays	• Concerns with sailing delays due to vessel reliability and increased loading and offloading times.
Frequency of Sailings	• Customers would like sailings returning to Quadra Island later in the evening from Campbell River without having to travel the following day.
Overloads	• Repeated overloads resulting in increased commute times for residents on Quadra Island.
Making Connections	• Delays on Route 23 resulting in missed connections from Quadra Island to Cortes Island (Route 24). • Lack of connecting sailings between Route 23 and Route 24.
Cancellations	• Cancellations are contentious and customer inquiries increase.

E.1.3 Route 19

Category	Details
Overloads	• Island residents concerned with overloads and find it is having a negative impact on their businesses located on Gabriola Island. • Customers would like increased sailings to decrease wait times, especially in the peak season.
Safety	• Customers not satisfied with current schedule and related safety implications of having too many vehicles parked near terminal.
Frequency of Sailings	• Island residents would like later sailings returning from Nanaimo Harbour to attend activities on Vancouver Island without having to stay overnight.
Cancellations	• Cancellations are contentious and customer inquiries increase.

E.1.4 Route 5 / 5A

Category	Details
Frequency of Sailings	• Customers concerned with frequency of sailings from Swartz Bay to various ports on the Southern Gulf Islands. • Customers concerned that inter-Southern Gulf Island travel is not convenient or adequate when planning a return voyage on same day.
Overloads	• Customers are not able to plan adequately for overloads when departing from Southern Gulf Islands and cannot make their planned connections. • Residents unable to guarantee spot on specific sailings.
Vessel Safety / Amenities	• With high traffic volumes, customers concerned with ability to get out of their vehicles when loaded too close together. • Elevator not provided onboard for access to overhead lounges. • *Mayne Queen* has fewer amenities than the *Bowen Queen* or the *Queen of Cumberland*.
Cancellations	• Cancellations are contentious and customer inquiries increase.

E.2 Customer Satisfaction Tracking

BC Ferries has commissioned an independent professional consulting organization to conduct and document a comprehensive customer satisfaction tracking ("CST") survey across the ferry system. This survey has included Routes 5/9 and 19, and Route 23 was added this year. The satisfaction scores from the CST survey for Routes 5/9 and 19 for the years 2015 to 2017, as well as the first two survey 'waves' for 2018, inclusive of Route 23, are shown below.

MUSTEL GROUP
MARKET RESEARCH

BCFerries

Customer Satisfaction Tracking

Satisfaction Scores
Route 19, 5/9 & 23

Presented to:

British Columbia Ferry Services Inc.
Victoria, British Columbia

402 – 1505 West Second Avenue Vancouver BC V6H 3Y4
general@mustelgroup.com www.mustelgroup.com Tel 604.733.4213 Fax 604.235-1359

Average Satisfaction Ratings by Route

	Total Routes					Route 19					Route 5/9					Route 23	
	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Jun '18	Aug '18
OVERALL EXPERIENCE																	
Trip overall	4.14	4.18	4.16	4.27	4.19	3.98	4.14	3.99	4.11	3.85	4.15	4.24	4.14	4.09	4.31	4.33	4.29
BEFORE ARRIVING AT TERMINAL																	
Usefulness of BC Ferries website	4.09	4.13	4.10	4.08	4.07	3.92	4.06	4.02	3.85	4.04	3.99	4.09	4.02	3.85	4.01	3.77	3.84
Ease of using online reservations	3.97	3.93	4.00	4.00	3.93	3.71	3.69	3.81	-	-	3.90	4.05	4.00	3.68	3.98	-	-
Usefulness of BC Ferries phone service	3.60	3.61	3.61	3.21	3.45	3.19	3.25	3.28	3.50	3.23	3.89	3.95	3.75	2.83	3.48	3.00	2.79
Ease of using automated phone system	3.30	3.35	3.46	2.95	3.26	2.88	3.10	3.21	2.93	3.15	3.55	3.52	3.48	2.57	3.14	2.96	3.15
Highway signage	3.99	4.04	4.06	4.06	4.06	3.77	3.86	3.77	-	-	3.85	3.92	4.07	3.97	4.12	-	-
TERMINAL EXPERIENCE																	
Terminal overall	4.07	4.08	4.07	4.07	4.05	3.96	3.95	3.97	3.97	3.80	4.12	4.16	4.09	4.06	4.17	4.23	4.27
Outside appearance of the terminal	4.04	4.05	4.06	4.05	4.05	3.87	3.96	3.96	3.77	3.87	4.09	4.07	4.05	4.15	4.07	4.16	4.22
Ticket Purchase																	
Efficiency of the transaction	4.42	4.43	4.44	4.38	4.39	4.40	4.46	4.44	4.35	4.30	4.49	4.42	4.40	4.33	4.47	4.49	4.60
Staff customer service	4.40	4.40	4.41	4.40	4.43	4.49	4.53	4.54	4.43	4.37	4.45	4.44	4.45	4.46	4.52	4.57	4.68
Clarity of staff directions	4.36	4.37	4.38	4.39	4.43	4.46	4.45	4.49	4.44	4.28	4.33	4.35	4.35	4.43	4.48	4.37	4.53
Food & Beverage Services at the Terminal																	
Food beverages offered	3.60	3.68	3.63	3.60	3.59	-	-	-	-	-	3.57	3.46	3.57	3.51	3.69	-	-
Vending machines	3.28	3.37	3.38	3.40	3.39	2.91	2.96	3.15	2.65	2.84	3.12	3.03	3.09	3.14	3.17	2.73	3.41
Value for money	3.02	3.09	3.09	3.13	3.15	2.62	2.79	2.72	2.90	3.15	3.14	3.00	3.07	3.04	3.29	2.72	3.23
Gift Shop/ News Stand at the Terminal																	
Variety/ selection of merchandise	3.88	3.89	3.87	3.87	3.88	-	-	-	-	-	3.72	3.59	3.46	3.64	3.65	-	-
Value for money	3.34	3.32	3.34	3.35	3.39	-	-	-	-	-	3.43	3.24	3.08	3.26	3.51	-	-
Outdoor Market Area at the Terminal																	
Variety/ selection of merchandise	3.55	3.58	3.54	3.45	3.47	-	-	-	-	-	3.61	3.69	3.46	3.57	3.65	-	-
Value for money	3.30	3.30	3.29	3.30	3.28	-	-	-	-	-	3.47	3.29	3.37	3.27	3.31	-	-
Play area for children	3.75	3.79	3.76	3.75	3.92	-	-	-	-	-	3.51	3.50	3.44	3.34	4.25	-	-
Pet area	3.41	3.01	3.49	3.16	3.59	-	-	-	-	-	3.67	3.06	3.22	3.39	4.00	-	-
Other Terminal Services																	
Clarity of public address system	3.60	3.70	3.64	3.71	3.73	3.24	3.34	3.60	3.64	3.55	3.57	3.66	3.61	3.67	3.73	-	-
Announcements when you need to be informed	3.79	3.90	3.84	3.87	3.88	3.50	3.58	3.85	3.75	3.48	3.75	3.84	3.80	3.82	3.87	3.75	4.00
Overall look & décor inside terminal	3.87	3.88	3.87	3.86	3.89	-	-	-	-	-	3.95	3.83	3.85	3.92	4.00	-	-
Availability of washrooms	4.08	4.09	4.07	4.10	4.09	3.93	4.06	4.01	4.02	3.85	4.12	4.03	4.05	4.10	3.99	4.05	4.24
Cleanliness of washrooms	3.99	3.98	3.94	4.03	3.96	4.02	4.01	3.91	3.88	3.78	4.14	4.06	4.01	4.07	3.97	4.25	4.18
Procedures for loading	4.06	4.10	4.06	4.07	4.10	4.01	4.08	4.04	3.97	3.82	3.98	4.02	3.95	4.05	4.16	4.15	4.28
Professionalism of terminal staff	4.21	4.22	4.24	4.24	4.27	4.30	4.38	4.4	4.25	4.12	4.20	4.26	4.29	4.30	4.37	4.55	4.46

continued

Average Satisfaction Ratings by Route	Total Routes					Route 19					Route 5/9					Route 23	
	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Jun '18	Aug '18
Foot Passenger Services at the Terminal																	
Usefulness of TV info screens	3.71	3.81	3.75	3.80	3.71	-	-	-	-	-	-	-	-	-	-	-	-
Availability of parking spaces	3.63	3.63	3.56	3.59	3.55	2.68	2.69	2.45	2.50	1.87	4.04	3.36	3.55	4.11	3.99	-	-
Parking value for money	2.87	3.00	3.00	2.92	3.11	3.34	3.32	3.14	4.67	2.85	3.17	2.53	3.13	3.02	3.51	-	-
Ease of using passenger drop-off/ pick-up area	3.95	4.01	3.94	3.97	4.01	3.58	3.31	3.15	3.17	2.72	4.10	3.67	3.75	4.08	4.12	4.18	4.32
Availability of seating in pre-boarding lounge at terminal	3.61	3.67	3.54	3.73	3.74	3.82	3.79	3.59	3.97	2.92	4.00	3.84	3.50	3.48	3.67	4.21	4.33
Comfort of seating in pre-boarding lounge at terminal	3.60	3.62	3.58	3.66	3.62	3.41	3.39	3.20	3.45	2.69	3.87	3.65	3.42	3.40	3.51	3.68	3.98
Cleanliness of pre-boarding lounge	3.96	3.99	3.98	4.00	3.99	3.95	3.95	3.87	3.89	3.69	4.12	4.05	3.94	4.14	3.77	4.32	4.25
ONBOARD EXPERIENCE																	
Onboard overall	4.10	4.14	4.12	4.19	4.15	3.96	4.07	4.07	4.02	4.01	4.17	4.16	4.06	4.21	4.18	4.21	4.24
Gift Shop/ News Stand																	
Variety/ selection of merchandise	4.02	4.05	3.99	4.06	4.00	-	-	-	-	-	3.88	3.92	3.79	3.84	3.84	-	-
Staff customer service	4.18	4.20	4.15	4.21	4.19	-	-	-	-	-	4.22	4.21	4.02	4.20	4.31	-	-
Ease of moving around inside shop	3.57	3.64	3.61	3.65	3.68	-	-	-	-	-	3.73	3.64	3.25	3.58	3.38	-	-
Value for money	3.37	3.37	3.38	3.39	3.34	-	-	-	-	-	3.59	3.45	3.27	3.29	3.40	-	-
Food Services																	
Length of time in line for food services	3.64	3.67	3.63	3.69	3.57	-	-	-	-	-	3.74	3.86	3.70	3.92	3.82	-	-
Food/ beverages offered	3.65	3.69	3.63	3.73	3.65	-	-	-	-	-	3.38	3.49	3.45	3.69	3.46	-	-
Staff customer service	4.14	4.18	4.20	4.20	4.21	-	-	-	-	-	4.20	4.13	4.24	4.27	4.26	-	-
Availability of seating	4.04	4.10	4.04	4.04	4.05	-	-	-	-	-	4.13	4.15	4.11	4.19	4.19	-	-
Comfort of seating	3.88	3.93	3.89	3.89	3.92	-	-	-	-	-	3.96	3.97	3.90	3.88	3.88	-	-
Cleanliness of seating area	4.06	4.09	4.07	4.10	4.03	-	-	-	-	-	4.13	4.19	4.12	4.22	4.09	-	-
Vending machines	3.50	3.49	3.51	3.45	3.53	-	-	-	-	-	3.23	3.27	3.19	3.29	3.22	3.18	3.35
Value for money	3.16	3.19	3.19	3.29	3.22	-	-	-	-	-	3.26	3.18	3.25	3.05	3.25	2.76	3.30
Washrooms																	
Availability of washrooms	4.10	4.13	4.12	4.18	4.18	3.95	4.01	4.03	4.02	3.94	4.14	4.13	4.15	4.26	4.28	4.31	4.32
Cleanliness of washrooms	3.96	3.96	3.93	4.03	3.99	3.91	3.91	3.91	3.83	3.82	4.14	4.13	4.09	4.20	4.16	4.25	4.13
Lounge Seating																	
Comfort of indoor lounge seating	3.99	4.03	4.01	4.01	4.02	3.55	3.68	3.84	3.49	3.71	4.06	4.06	4.09	4.17	4.03	4.19	4.32
Cleanliness of indoor lounge seating area	4.13	4.15	4.15	4.15	4.16	3.97	3.91	4.05	3.82	3.96	4.23	4.22	4.25	4.29	4.32	4.25	4.28

continued

Average Satisfaction Ratings by Route

	Total Routes					Route 19					Route 5/9					Route 23	
	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Total '15	Total '16	Total '17	Jun '18	Aug '18	Jun '18	Aug '18
Other Onboard Facilities/ Services																	
Play area for children	3.51	3.40	3.55	3.45	3.17	-	-	-	-	-	3.07	2.92	2.92	2.34	3.02	-	-
Pet area	2.32	2.56	2.77	2.31	2.63	-	-	-	-	-	1.91	1.24	2.11	-	3.00	-	-
Video arcade	3.33	3.31	-	-	-	-	-	-	-	-	3.44	3.62	-	-	-	-	-
Work stations	3.63	3.65	3.71	3.63	3.74	-	-	-	-	-	3.62	3.61	3.83	4.02	4.02	-	-
Outside decks	4.01	4.04	4.01	4.06	4.10	3.80	3.89	3.95	3.88	3.75	3.98	4.01	3.98	4.12	4.14	4.09	4.23
Outside appearance of the vessel overall	3.95	4.00	4.00	4.04	4.09	3.86	3.91	3.90	3.82	3.81	3.88	3.94	3.97	4.15	4.20	3.95	4.02
Availability of tourist and travel information	4.01	4.04	4.11	4.09	4.14	3.42	3.63	3.68	3.35	3.26	4.03	4.05	4.08	4.11	4.13	2.79	4.12
Ease of access, overall, for people with disabilities	3.67	3.72	3.66	3.70	3.84	3.19	3.41	2.75	3.02	2.93	3.70	3.61	3.22	3.54	3.73	2.79	3.15
Ease of finding facilities/ services	3.92	3.95	3.96	3.93	3.97	3.68	3.90	3.76	3.70	3.71	4.02	3.91	3.99	4.07	4.04	3.88	4.00
Clarity of public address system	3.73	3.80	3.76	3.79	3.87	3.17	3.24	3.59	3.66	3.44	3.77	3.79	3.66	3.79	3.93	3.53	3.48
Announcements when you need to be informed	3.88	3.96	3.90	3.95	3.98	3.51	3.57	3.82	3.69	3.58	3.97	3.95	3.85	3.89	4.01	3.71	3.78
Atmosphere/ environment	3.94	4.00	3.97	3.96	4.01	3.73	3.87	3.90	3.74	3.71	4.04	4.00	3.99	4.05	4.18	3.90	4.00
Procedures for unloading	3.98	4.04	4.01	4.03	4.06	3.86	3.96	3.98	3.90	3.92	3.99	4.06	4.01	3.94	4.14	3.90	4.02
Professionalism of onboard staff	4.22	4.24	4.26	4.26	4.28	4.26	4.27	4.32	4.19	4.30	4.22	4.26	4.29	4.31	4.34	4.41	4.31
Experience with the Sailing Schedule																	
Earliest ferry earliest enough	3.97	3.94	3.98	4.01	4.04	3.55	3.57	3.68	3.54	3.56	3.89	3.81	3.83	3.69	4.02	4.02	4.00
Latest ferry late enough	3.52	3.51	3.54	3.76	3.83	3.49	3.55	3.69	3.74	3.78	3.59	3.54	3.55	3.32	3.88	3.00	3.09
Ferry sailing frequent enough	3.49	3.40	3.36	3.33	3.52	3.24	3.30	3.28	3.12	3.18	3.16	3.00	2.95	2.91	3.24	3.67	3.48
Ability to get onto desired ferry	3.78	3.70	3.62	3.64	3.52	3.44	3.42	3.34	3.15	3.17	3.91	3.91	3.72	3.71	3.90	3.57	3.37
Ability to connect with other sailings (based on those connecting)	3.10	3.15	3.12	3.17	3.41	2.92	2.70	2.55	2.17	2.91	3.52	3.81	3.46	3.16	3.16	3.65	1.53
Ferry departing on time	3.82	3.80	3.73	3.96	3.75	3.78	3.75	3.43	3.53	2.78	3.64	3.83	3.60	3.85	3.84	4.11	3.80
Safety																	
Safety of ferry operations	4.21	4.25	4.25	4.27	4.28	4.12	4.26	4.26	4.21	4.27	4.18	4.26	4.29	4.29	4.31	4.40	4.39
Safety of loading/unloading	4.22	4.26	4.26	4.28	4.29	4.16	4.24	4.21	4.20	4.26	4.17	4.26	4.26	4.30	4.32	4.23	4.35
OVERALL VALUE																	
Value for money of fares	2.86	3.03	3.11	3.36	3.32	2.66	3.07	3.04	3.24	3.55	2.96	3.16	3.11	3.57	3.59	3.29	3.47

Appendix F: Overview of Proposed Vessels

F.1 Salish Class Vessels

Vessel Capacity

Salish class vessels have a vehicle capacity of 138 AEQs and carry a complement of up to 600 passengers and crew. This class of vessel was designed to operate on BC Ferries' intermediate routes (4, 5, 5A, 7, 9, 9A and 17), where they would provide regular service or refit relief. The analysis for the design of the class was completed during the replacement of the *Queen of Nanaimo* and *Queen of Burnaby*,[16] and at the time identified that the service areas with the highest existing traffic demand were Routes 9 and 17. In support of the procurement and operating benefits of a standardized fleet, capacity sufficient to carry the forecast traffic on these routes set the initial threshold of maximum size needed for the Salish class vessels.

Vessel Characteristics

The Salish class vessel is an intermediate vessel outfitted for full passenger amenities and ancillary services. These vessels include innovative features which, among other things, assisted in keeping crew sizes at minimal yet safe levels when Transport Canada set minimum safe manning levels. The key characteristics of this vessel class are highlighted below. Table 4-B in section 4 provides a summary.

Vessel Design

- Double-ended hull with a lower enclosed deck and a semi-open main deck configuration incorporating high bulwarks and enclosed ends, allowing for vehicle and passenger protection from inclement weather, carriage of scheduled dangerous cargo and ease of fueling operations on deck;
- Roll-on/roll-off vehicle deck having 842 lane-metres with minimum lane width of 2.6 metres allowing unimpeded traffic flow;
- Commercial vehicle stowage lanes of 3.2 metres in width;
- All lower deck vehicle lanes have a clear height of 2.9 metres over them;
- All main deck vehicle lanes have a clear height of 4.75 metres over them;

[16] The proposed major capital expenditure for the three vessels to enable the retirement of the *Queen of Nanaimo* and *Queen of Burnaby* was approved by Order 13-01, dated July 19, 2013.

- Capable of carrying a normal complement of 600 passengers and crew;

- Compatible with BC Ferries' standardized berth interface and capable of loading/unloading at either end in any of the Company's standardized berths;

- Vehicle deck laid out for ease of loading / discharge so that the vessel is capable of achieving desired in-dock times, including on the routing required on Route 5/5A;

- Seakeeping suitable for winter transit in coastal British Columbia without excessive motion, spray ingress, or deck immersion issues;

- Vessel is optimized for a service speed of 15.5 knots at 85 percent machinery continuous rating, hence reserve power is available for schedule recovery if required; and

- All systems designed for low energy consumption and cleanest practical environmental performance.

Fuel

- Dual-fuel propulsion with the capability to run primarily on LNG or entirely on diesel.

Crew Accommodation

- Outfitted for live-aboard crew accommodations.

Passenger Accommodations and Amenities

- Passenger accommodation deck above the main vehicle mezzanine deck accessible by four corner stairwells and two elevators on the main casing, compliant with current accessibility requirements;

- Foot passenger access to the lounge(s) configured to interface with passenger walkways on BC Ferries' standardized berths, so as to minimize the potential for pedestrian interaction with moving vehicles;

- Accommodation deck consisting of a passenger lounge and a cafeteria area outfitted to enable hot and cold food service;

- Ancillary services such as vending machines, study carrels, bank machines (ATMs), Wi-Fi and satellite television;

- Adherence to BC Ferries' interior design standard, which aims to provide a reasonable level of passenger comfort to support customer satisfaction and revenue generation, while also being durable, commuter friendly, easily cleanable and with a low life cycle cost; and

- Four passenger stairwells that ascend three deck levels, configured to European design standards and meeting Class and Transport Canada standards. After feedback from ferry users about the stairwells, the Company investigated and implemented enhancements such as improved lighting and markings. Due to the design impact, it is not realistic to change the pitch or landing configurations on the fourth vessel in this class.

Branding

- Branding is similar to other BC Ferries vessels. In general, BC Ferries' vessels are painted white and carry the BC Ferries logo and, in most cases, the funnel wave graphic on port and starboard sides. All vessels also carry a blue stripe in addition to carrying the vessel name and Port of Registry. As with the other vessels in this class, the sides of the new Salish class vessel will be adorned with First Nations artwork reflecting the name of the vessel.

Environmental Stewardship

- LNG-fueled, significantly reducing sulphur (SOx) and nitrous oxide (NOx) emissions, as well as particulates and carbon dioxide (CO_2);

- Low wake wash hull form;

- Low friction hull coating to reduce fuel consumption;

- All black/grey water disposed of ashore in accordance with environmental policies and none will be discharged overboard;

- Electrical propulsion system (two electrical propulsion motors) allowing greater flexibility in the selection of number and efficiency of main engine generators;
- Reverts to shore power connection during layovers and after daily operational service;

- Designed to minimize noise and vibration, including with the objective of reducing impacts to cetaceans and other marine mammals by addressing noise resulting from propeller cavitation (generating high frequency noise) with a specialized propeller

design, and by placing ship's equipment on resilient mounts to reduce structure-borne noise; and

- While not currently fitted with stored energy (battery) systems, the potential exists to be retrofitted to a hybrid LNG/battery configuration if/when conditions and the business case warrant.

F.2 Island Class Vessels

Vessel Capacity

Island class vessels have a vehicle capacity of 47 AEQs and can carry a complement of up to 450 passengers and crew. The size of the Island class vessel was based on a review of the forecast sailing demand for each of the routes on which this vessel class could potentially operate.

Island class vessels are optimized to the operational requirements of routes with short crossings and are designed to operate efficiently with high frequency sailings and minimal in-port time. In addition to being suitable for service on Routes 18, 19, 23 and 25, this class of vessel is suitable for regular or refit relief operations on Routes 6, 12 (Mill Bay to Brentwood Bay), 20 (Chemainus – Thetis Island – Penelakut Island), 21, 22 (Denman Island to Hornby Island) and 24.

Vessel Characteristics

The Island class vessel is a relatively simple vessel with limited amenities and ancillary services. These vessels include innovative features which, among other things, are expected to help to keep crew sizes at minimal yet safe levels, in accordance with Transport Canada requirements. The key characteristics of this vessel class are highlighted below. Table 4-C in section 4 provides a summary.

Vessel Design

- Double-ended hull with open car deck configuration incorporating high bulwarks and enclosed ends, allowing for carriage of scheduled dangerous cargo, and for ease of fueling operations on deck;

- Single roll-on/roll-off vehicle deck having 290 lane-metres with minimum lane width of 2.6 metres allowing unimpeded traffic flow;

- Inclusive of one truck lane of 3.2 metres in width;

- All vehicle lanes have a clear height of 4.75 metres over them;
- Capable of carrying a complement of up to 450 (passengers and crew), an increase from the maximum passenger and crew capacity of the vessels being replaced;
- Compatible with BC Ferries' standardized berth interface and capable of loading/unloading at either end in any of the Company's standardized berths;
- Vehicle deck laid out for ease of loading/discharge so that the vessel is capable of achieving desired in-dock times;
- Seakeeping suitable for winter transit in coastal British Columbia without excessive motion, including high bulwarks to prevent spray ingress or deck immersion issues;
- Deck scantlings (structure comprising plates and framing) of sufficient strength to carry heavy commercial loads including logging trucks and construction equipment;
- Vessel is optimized for a service speed of 14 knots at 85 percent machinery continuous rating, hence reserve power is available for schedule recovery if required; and
- Hybrid diesel-electric propulsion, with all systems designed for low energy consumption and cleanest practical environmental performance.

Fuel and Propulsion

- Diesel-electric power generation using two generator sets, where the schedule can generally be met with one generator set providing power;
- A redundant DC-power main electrical bus employing AC/DC conversion technology for power consumers; and
- Stored energy (batteries) feeding the main DC-bus.

Battery technology is rapidly evolving and the cost per kilowatt hour reduces annually as this technology achieves wider use in the transportation and industrial sectors. In general, BC Ferries' strategy is to phase in the battery storage capability for the Island class vessels from an initial limited installation to an expanded stored energy capability when warranted, on a route-by-route basis, by conditions, evolution in stored battery energy technology and the business case. The routes in question (Routes 19 and 23) are sufficiently short that it is

expected that the power management system will be configured to run with the batteries as the primary power source ("hybrid mode") that initially will be re-charged by a diesel generator when the charge is depleted.

To achieve full electric battery operation most cost-effectively will require the development of some shore infrastructure in the form of rapid charging installations at the berth, a method to deliver shore electrical energy to the vessel, and an interface with BC Hydro. Discussions with BC Hydro in regard to this matter are under way, including network capacity, terminal infrastructure requirements, and options for terminal energy storage. The outcome of these discussions will inform the further internal analysis that will be required to confirm the feasibility of and timing for transitioning to full electric operation.

Crew Accommodation

- Not outfitted for live-aboard crew accommodations. The Company's analysis suggests that at this time, live-aboard operations for the Island class vessels will not provide a financial payback.

Passenger Accommodations and Amenities

- Passenger lounge arrangement located on and accessible from the main vehicle deck that complies with current accessibility requirements, arranged without a need for passenger elevators;

- Foot passenger access to the vessel's interior lounge is configured to interface with passenger walkways on BC Ferries' standardized berths so as to minimize the potential for pedestrian interaction with moving vehicles;

- Basic ancillary services, such as vending machines; and

- Adherence to BC Ferries' interior design standard, which aims to provide a reasonable level of passenger comfort to support customer satisfaction and revenue generation, while also being durable, commuter friendly, easily cleanable and with a low life cycle cost.

Branding

- Branding is similar to other BC Ferries vessels. In general, BC Ferries' vessels are painted white and carry the BC Ferries logo and, in most cases, the funnel wave graphic on port and starboard sides. All vessels also carry a blue stripe in addition to carrying the vessel name and Port of Registry.

Environmental Stewardship

- Stored energy capability configured to run as the primary power source to be supplemented and charged by diesel generator sets. Initially, this will reduce diesel consumption and emissions, with the intent to fully offset diesel generator use with an expanded battery system, for possible "zero-emission" operation, when/where the infrastructure and the business case warrants (see 'Fuel and Propulsion', above);

- Generators to be operated with ultra-low sulfur content diesel fuel and exhaust treatment to reduce nitrous oxide emissions (NOx) in compliance with International Maritime Organization Tier III requirements;

- Low friction hull coating to reduce fuel consumption;

- All black/grey water disposed of ashore in accordance with environmental policies, and none will be discharged overboard;

- Reverts to shore power connection during layovers and after daily operational service; and

- Designed to minimize waterborne and interior noise and vibration, including with the objective of reducing impacts to cetaceans and other marine mammals by addressing noise resulting from propeller cavitation (which generates high frequency noise) by specialized propeller design, and by placing the ship's equipment on resilient mounts to reduce structure-borne noise.

Appendix G: Independent Validation of Traffic Forecasting Approach and Results

A letter from Rennie Intelligence dated November 3, 2017, confirming BC Ferries' traffic forecast methodology and results for Routes 5, 19 and 23, is attached.

Market INTELLIGENCE

Memorandum

November 2017

Date: 3 November 2017
For: David Hendry, Director, Strategic Planning BC Ferry Services Inc.
Suite 500 – 1321 Blanshard Street, Victoria, BC V8W 0B7
From: Andrew Ramlo, Vice President, Rennie Intelligence
Re: Forecasting Approach for BC Ferry Services Inc. Small-Area Traffic Estimates

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1 Background

This letter is a response to a request by BC Ferry Services Inc. ("BCFS") to review and provide commentary on the current approach being used by BCFS to estimate future ferry traffic volumes as part of the Section 55 Submission for the replacement of vessels for routes 5, 19 and 23. Comments have been provided for two aspects of the projections: **a)** the current methodology used by BCFS to develop the estimates; and **b)** the results derived from the application of that methodology. Before commenting on the methodology or results, however, some background will provide a better context to the comments that follow.

In 2008, Urban Futures was retained by BCFS to develop long-range projections (to 2031) of ferry passenger volumes for 20 destination communities in south-western British Columbia as part of BCFS's strategic infrastructure planning. Given the relevance of the local population in generating ferry passenger traffic for these smaller routes, a demographically-based approach to projecting future passenger volumes was used. The 2008 series of projections was updated by Urban Futures in 2012 to incorporate more recent traffic volume data, 2011 small-area Census population data, and BC Stats' latest long-range demographic projections for Local Health Areas. Following this, Andrew Ramlo, as Executive Director of Urban Futures, was asked in 2016 to provide a review of the methodology being used to estimate future traffic volumes for the Section 55 Submission for routes 6, 18, and 25. BCFS has revised its methodology for estimating future traffic volumes for its smaller routes and, as part of its current Section 55 Submission, has requested a review of the current methodology and output.

2 Methodological Review

The trip volume estimates developed for routes 5, 19 and 23 for the Section 55 Submission are reasonable in both their approach and consideration. The general approach adopted for this series of estimates uses data on per capita trip ratios in benchmark (low season) months and, along with a range of scenarios for future of resident population, are a fundamental driver to future annualized traffic volume estimates. This population-based approach is similar to the modeling approach developed by Urban Futures for the 2008 and 2012 series of projections for BCFS small routes.

Several scenarios have been considered in the current BCFS estimates in regard to both the geographic extent of what is deemed to be local resident-generated traffic demand, as well as trends in how these local populations are expected to grow over time. This yielded a range of population-based traffic volume estimates that were based on BC Stats assessment of future population growth.

Different combinations of BC Stats projection data, Census data, and the two scenarios for the number of trips per resident generated multiple forecasts for each route. A low, medium, and high forecast was detailed for each routes, with the low representing the 1st quartile of the estimates were 25% of projections fell below this level. Similarly, the high projection represents the 3rd quartile of estimates were 25% of the projection runs were higher than that value. In addition to the per capita trip ratios being applied to the total population, a series of model runs have been compiled a that focus on the working-aged population, an approach also used in the 2008 and 2012 Urban Futures series of projections.

Further refinement to the current approach might consider in more detail historical patterns of change in per capita trip volume ratios for each route under consideration. Similarly, while the most recent data available for small areas from the 2016 Census can be used in the current calculation of base (undercount adjusted) population and per capita trip ratios, BC Stats will not be providing updates to their Local Health Area population projections that reflect the 2016 Census Counts until mid-2018. As such, the data and methodology, as they are, appear to be suitable for their intended use.

3 Review of the Results

Based on the described methodology as outlined above, and the Census information available at this time, the results for each route appear to be reasonable, with traffic growth rates for each route generally reflecting currently observed short-term volume changes, with acknowledgment that longer-term changes will largely be driven by patterns of underlying population change within each route area.

In terms of comments for specific routes, as the geographic extent considered for each route in BCFS's current estimates is an amalgam of both geographic areas and various population outlooks for them, in order to consider the range of population estimates driving volume changes in each region the arithmetic average of the various population estimates for each route was calculated. The historical and projected growth rates for this average population scenario were calculated and compared to changes in historical and projected traffic volume estimates.

Comments on specific routes for the historical 2001 to 2017, and projected 2017 to 2041, periods include:

Route 5: Relative to a 1% total growth in this route's baseline resident population and an associated 11% growth in passenger volumes between 2001 and 2017, the 2017 to 2041 period is expected to see much more robust population growth (8%) and passenger volume growth (16%). As with Route 4, this implies either an increase in per capita ridership in future years, an increase in non-baseline volumes, or both.

Route 19: Relative to a baseline resident population that has grown by 18% historically, passenger volumes declined by 14%. A more balanced outlook is expected for this route in future years, with both baseline resident population and future traffic each growing. Future baseline resident population growth of 31% is expected to result in a 6% growth in passenger volumes for this route. Given the magnitude of projected baseline resident population, any further consideration for this route should focus on the extent to which the population targets could be achieved.

Route 23: When compared to a baseline resident population that is expected to grow by 15% over the course of the projection period (2017-2041), passenger volume is expected to grow by 12%. Historically, in the face of moderate population growth (4% between 2001 and 2017), total passenger volumes for this route declined by 13%. While average per capita trips from the baseline population are expected to continue to decline for this route, they are expected to do so at a much slower pace than has been seen historically. Any further consideration for this route should focus on the drivers to historical traffic declines, such as falling per capita trips from the baseline population, total trips in the benchmark months, or total trips in the high-season months.

One final note should be made in regard to comparing BCFS's current estimates for the Section 55 Submission to those made by Urban Futures in 2008 and 2012. In the time since Urban Futures' projections were developed, significant changes to the population outlooks relevant to many of BCFS's smaller routes have been made by BC Stats. While the current methodology adopted by BCFS considers various geographic amalgamations and trends in population growth for each route, further consideration of the probability of BC Stats population projections being achieved may be warranted. Further to this, consideration may be given to the range of local area plans for the routes under consideration to verify if planning policy directions are reflected in the range of population estimates being used by BCFS in the current modeling framework.

Appendix H: Index of BC Ferries' Responses to Section 55 Guidelines

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 sections 1.1 and 4.1*
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?	*See sections 2.3 and 5.3, and Appendix B, and supplemental information*
c) Is there a regulatory driver for the proposed capital expenditure?	*See section 5.3 and Appendix B*
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 5.8, Appendix B and supplemental information*
f) Have there been service disruptions due to inadequacy of the existing capital asset?	*See Appendix B*
g) If age of the existing capital asset is a factor, what is the estimate of future costs of continuing its use?	*See section 5.3 and supplemental information*
h) Have there been complaints from the public, or other stakeholders about the existing capital asset?	*See Appendix E*
i) Provide an estimate of the total capital costs associated with the proposed investment?	*See section 5.5*
j) How was the cost estimate derived? Entirely with BC Ferries' staff or was there an external review?	*See section 5.2*
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 6.1.1*

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 for the Island class vessels* *Salish class vessel – see sections 3.3.2 and 5.2.3*
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 as no suitable used vessels have been identified – see section 6.1.1*
n) Does the proposal include significant features that are innovative or untried?	*See section 3.3 and Appendix F*
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 5.2.7*
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 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.	*Project management responsibilities will rest with BC Ferries*
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?	*Custom tariffs do not apply to importation of newly constructed vessels, but would apply to the importation of a used vessel*
u) In the case of vessels, will BC Ferries require the contracting shipyard to bear the design and construction risk?	*See section 6.4.2 and 6.4.4*

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 6.2.3*
b)	Were potential builders, for example shipyards, contacted to determine if the proposed date is reasonable?	*See section 6.2.2*
c)	What are the consequences of a delay in the in-service or deployment date?	*See section 6.3 and Appendix B*

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 sections 2.3 and 6.3, and Appendix B*
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 condition of the assets being replaced and the need to ensure ongoing continuity of service on Routes 5, 19 and 23. See Appendix B and supplemental information.*
iii)	What sources of expertise and experience have been relied upon in deciding to proceed with this capital expenditure?	*In support of BC Ferries staff, the following key external experts have been engaged to provide advice in respect of the proposed project:* • *Lloyd's Register Canada (Vessel Condition Assessments)* • *Rennie Intelligence (Traffic Forecast Validation)* • *McElhanney (Traffic Simulation Modelling)*
iv)	Provide detail on completed and/or planned consultations, in particular with the provincial government or other stakeholders.	*See sections 2.4 and 2.5, and Appendix D*

v)	In the case of new vessels, has BC Ferries considered any alternative to building and owning the new vessels?	*There are no obvious alternatives* *See sections 5.2.5 and 5.5, and supplemental information*
vi)	Will a new or replacement vessel require any modifications to any terminals? If so, at what additional cost?	*See section 6.4.1*
vii)	What are the procurement cost risks and how will they be mitigated?	
viii)	What are the consequences or the alternatives if the application is rejected?	*There are no obvious alternatives to the three options presented in this Application. If all three of the options are rejected, BC Ferries may be unable to deliver the contractually-required service on Routes 5, 19 and 23*

Wise Use of Resources

i)	Can an existing vessel be reassigned instead?	*No. The Project already involves redeployment of current BC Ferries vessels and the Company does not have a spare vessel to reassign to avoid the need to replace the Bowen Queen. Mayne Queen or Powell River Queen*
ii)	For shorter routes, were non-vessel options considered, such as a fixed link?	*Yes, but there are no other obvious non-vessel options. A fixed link option is considered to be 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 roll-on/roll-off passenger ferries will be required for the foreseeable future. See section 4.3, Appendix G and supplemental information*
iv)	Has a used vessel option been considered?	*See section 6.1.1*
v)	How does the vessel align with the concept of standardization of the fleet?	*See section 3.3 and Appendix F*
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?	*See section 4.3.4*

Showing Due Consideration for the Future

i)	How does the proposed new vessel contribute to overall fleet flexibility?	*See section 3.3*
ii)	What new technologies or innovations will be incorporated, and why are they considered necessary?	*See Appendix F*
iii)	Will there be provision for a conversion to an alternative to marine diesel engines, such as LNG?	*See Appendix F*
iv)	Is dual-fuel capability planned and if so provide the rationale?	*See Appendix F*
v)	Will the new or replacement vessels be appropriate if the ratio of vehicle to foot passenger traffic changes in future?	*See section 5.2.4 and Appendix F*
vi)	Is vessel capacity sufficient to meet current and projected future demand?	*See section 4.3, Appendix G and supplemental information*
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 5.8*

Not Excessive

i)	What passenger amenities will be provided, and why are they considered appropriate for the intended use of this vessel?	*See section 3.3.2 and Appendix F*
ii)	Do any of the proposed passenger amenities require crewing levels to be higher than what is required by Transport Canada regulations?	*See Section 5.2.3*
iii)	Is the vessel the right size and how has the capacity requirement been determined?	*See section 4 and Appendix F*
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 F*
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 F*

vi)	What would have to be sacrificed to reduce total costs by 10%, and by 20%?	*See section 5.9*
vii)	Does vessel design or expected operating speed have any impact on labour costs?	*For the Salish class vessel, the design and minimum safe manning levels are already determined. For the Island class vessel, see section 6.4.5*
viii)	Are engines sized for efficient operations, fuel consumption and ability to recover schedule?	*See Appendix F*

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.	*See sections 4.2 and 5*
ii)	Has the business case been built on a full life cycle costing basis?	*Yes, see sections 5 and 6.4.1*
iii)	How fuel-efficient will the new vessels(s) be?	*The vessels are designed to be fuel efficient and to use lower-cost alternatives to diesel fuel. The Salish class vessel will have dual-fuel LNG/diesel propulsion, and the Island class vessels will have hybrid diesel-electric propulsion. BC Ferries' operational teams continuously monitor the fuel performance of its vessels to ensure they operate as efficiently as possible*
iv)	Will the new or replacement vessel have any impact on efficient use of labour?	*See section 6.4.5*
v)	Are the operating costs reasonable?	*See supplemental information*
vi)	How do the operating costs compare with the vessel being replaced?	*See supplemental information*
vii)	Is there any expected impact on revenue?	*See supplemental information*
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.*

Contract

i)	Is the proposed capital expenditure consistent with the current Contract?	*Yes, see sections 1,2, 3 and 4*

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?	*The Company understands the Province's vision for coastal ferry services is reflected in the service levels set out in the Contract The Project will ensure core service levels in the Contract continue to be met or exceeded.*